

20 November 2025

Refers to: SF17/3307

Mr Lloyd Eley-Smith
Locked Bag 5022
Parramatta NSW 2124
Via email: nick.hearfield@planning.nsw.gov.au

Dear Mr Eley-Smith

Thrumster Wastewater Scheme - Response to Submissions - Request for Additional Information

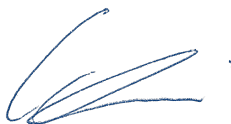
Thank you for your email dated 27 August 2025, detailing the Department's request for additional information following Council's response to submissions report dated 22 July 2025 for the Thrumster Wastewater Scheme.

Please find attached Council's responses to the various items raised in the request for additional information letter.

In consideration for overnight works in relation to pipe installation for the underbores, Council has included a variation request for working hours as part of Attachment C below.

If you require any additional information in relation to these responses or other related matters, please contact Cameron Sales on (02) 6581 8113 or cameron.sales@pmhc.nsw.gov.au

Yours sincerely



Cameron Hawkins
Group Manager Utilities Planning & Design

Attachment A - Request for Information - 27 August 2025

Our ref: Thrumster Wastewater Scheme (SSI-56980459)

Mr Cameron Sales
Project Manager

PORT MACQUARIE HASTINGS COUNCIL
17 BURRAWAN STREET
PORT MACQUARIE New South Wales 2444

27 August 2025

Subject: Request for Additional Information

Dear Mr Sales

I refer to Response to Submissions#2 for the Thrumster Wastewater Scheme (SSI-56980459). After careful consideration, the department is requesting that you provide additional information.

You are requested to submit the following additional information:

Partridge Creek

1. Please provide information in what scale of flood events discharges to Partridge Creek are likely to occur (ie X AEP event).
2. There is a property located where Partridge Creek passes beneath Fernbank Creek Road. In what flood events (ie X AEP event) would this property be likely to:
 - a. have its private open space inundated, and
 - b. have inundation from flooding occur within the house.
3. What measures would Council be prepared to undertake to assist in:
 - a. Preventing inundation of this property, and
 - b. If inundation of the property occurs, in cleaning the property.

If this information is also available within the existing EIA documentation (EIS, Amendment Report, RtSs' etc) please provide locations within documents (eg RtS#2 section X.X.X) in your response.

Noise and Vibration

Response to Submissions #1 states:

Construction noise:

Section 6 in the noise report provides all noise mitigation and management recommendations that would be adhered to during construction and operation to minimise impact upon nearby receivers. Management measures would include but not limited to:

- Construction will occur during standard daytime hours when possible, with noisy or vibrating work scheduled for less sensitive times. Standard construction hours are:
 - 7am to 6pm Monday to Friday
 - 7am to 1pm Saturday
 - No work on Sunday and Public holidays

Response to Submissions #2 states:

Works will be carried out in within the approved working times. Approved working times will be conditioned to the approval. The noise and vibration assessment defines standard construction hours as Mon to Fri 7:00 am to 6:00 pm and Saturdays from 8:00 am to 1:00 pm. No work on Sundays or public holidays.

Work generating noise with special audible characteristics and/or vibration levels will be scheduled during less sensitive time periods.

Note:

If works outside standard construction hours are proposed to be undertaken/or need to be undertaken, the works needs to be assessed, or alternatively (if the proposal is approved) a modification may need to be made to an approved project.

Query:

4. Please confirm how the large HDD underbores proposed from the WWTP beneath the surrounding protected land would be undertaken within the standard construction hours.
5. If 24 hour work is proposed (or needed) to undertake HDD bores, please provide a document that assess the potential noise impacts that would occur as a result of the proposed 24 hour works. Note, this should assess the impacts (ie likely sleep disturbance etc), not just provide a predicted noise level.

If this information is also available within the existing EIA documentation (EIS, Amendment Report, RtSs' etc) please provide locations within documents (eg RtS#2 section X.X.X) in your response.

Biodiversity

6. Please advise what Additional and Appropriate Measures (AMM) Council considers it may be able to take regarding potential Serious and Irreversible Impacts (SII) to the Giant Dragonfly.
7. Please provide the final agreed SII measures.

If any of the above information may be provided prior to the finalisation of 7 above, please provide this as an interim response.

You are requested to provide the information or notification that the information will not be provided, to the department by Fri 31 October 2025. If you cannot meet this deadline or do not intend to provide the additional information, please advise the department via the NSW planning portal.

The assessment period ceases to run between the date of this letter and the date you provide the additional information (or notification that the information will not be provided), in accordance with Part 4 Division 4 of the Environmental Planning and Assessment Regulation 2021.

If you have any questions, please contact Nick Hearfield via email at nick.hearfield@dpie.nsw.gov.au.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Lloyd Eley-Smith".

Lloyd Eley-Smith

Team Leader, Transport and Water Assessments

As nominee of the Planning Secretary

Attachment B - Partridge Creek Response - RFI Query 1, 2 and 3

Find enclosed RFI response and supporting technical memorandum "DPHI Storm Pond Assistance" in response to query 1, 2 and 3.

Thrumster Wastewater Scheme SSI 56980459 - Request for Additional Information - Partridge Creek & TWWTP Storm Pond Discharges

Requested Information

1. Please provide information in what scale flood events discharges to Partridge Creek are likely to occur (ie X AEP event).

Response

It is assumed that discharges are referring to emergency overflows from the proposed stormflow storage pond (storm pond) at the Thrumster Wastewater Treatment Plant. Discharges from the storm pond will be a result of rainfall across the wastewater network and associated stormwater entering the wastewater system and not flooding, as flooding (either of the Hastings River or Partridge Creek) results from rainfall and associated runoff across the river catchments, which are much larger areas than the wastewater network area. Annual Exceedance Probability (AEP) flooding events are typically defined as a river level or flow volume at a certain point along a river, while AEP rainfall events are typically defined as rainfall intensity over a duration, ranging from 1 minute to 168 hours, for a given frequency at a rain gauge location (referred to Intensity, frequency, duration, (IFD) values).

What are IFDs?

IFDs are Intensity–Frequency–Duration design rainfall intensities (mm/h) or design rainfall depths (mm) corresponding to selected standard probabilities, based on the statistical analysis of historical rainfall. <https://www.bom.gov.au/water/designRainfalls/#faq>

A 1% AEP rain event over the Thrumster wastewater network is not going to result in a 1% AEP Hastings River event. Analysing wastewater network rainfalls that corresponded with recent flood events shows this non-relationship. In March 2021 the Hastings River experienced a flood event that was approximately 200 to 300mm lower than a 1% AEP flood event, a rain gauge within the Thrumster wastewater network area received 460mm of rain over a 168hour period, which is only a 5% AEP rain event. Conversely in May 2025 the Hasting River experienced a 5% AEP flood event, whereas the same rain gauge in Thrumster wastewater network received approximately 530mm of rain in a 96hour period, which is just shy of a 1% AEP rain event. It should be noted that the rainfall analysis is limited to the rain gauge location and that different intensity rainfall may be experienced across the catchment area. Another key element that is going to influence the performance of a wastewater system is that amount of inflow and infiltration of stormwater and ground water into the system during and post rainfall events.

For these reasons it is very difficult to determine an accurate rainfall AEP event across a whole wastewater catchment that would result in a storm pond overflow. As it is not practical to develop a theoretical hydraulic model for the Thrumster wastewater catchment, as the majority of the catchment doesn't exist yet, historical inflow data for similar sized wastewater catchments has been used.

To assess the performance of the storm pond with the Thrumster Wastewater Treatment Plant operating at full capacity (40,000EP for stage 1 and 80,000EP for stage 2) a daily timestep model of inflows was produced using inflow data from the Port Macquarie and Coffs Harbour wastewater plants for the 2010 to 2025 period. This model identified that storm pond would have experienced six overflow events based on the Port Macquarie data and 27 using the Coffs Harbour data. For the 15-year period this equates to an annualised number of overflows ranging from 0.4 to 1.7 overflows per year. Therefore, it is assessed that the Thrumster Wastewater Treatment is likely to experience less than 2 overflow events per year on average.

Analysis of the rainfall data that corresponded to the overflow events indicated the highest frequency rainfall was less than the 63.2% AEP (being less than 1 in 1 year event), however the rainfall data is limited to only one rain gauge within the catchment and in most instances was limited to only the 24-hour duration data. Therefore, it is likely that there were higher intensity storm bursts in other parts of the catchment or occurring at durations in between the 24-hour data. Another likely factor that could contribute to higher inflows during relatively

higher frequent events is that the catchment may have been receiving rainfall for the months prior and therefore is already saturated with an elevated ground water level.

The detailed analysis is included within the enclosed technical memorandum prepared by Beca HunterH2O.

Review of storm overflows into Partridge Creek

Storm overflows from the Thrumster Wastewater Treatment Plant will be directed into the Partridge Creek wetlands upstream of the hydraulic weir that controls releases into the channel that flows to Fernbank Creek. The operation of the hydraulic weir is set to manage acid sulphate soils within the wetland area and has two set points. The default automatic set point for the weir is a height of 0.9m Australian Height Datum (AHD). Should the pH of the wetland waters drop below 5 then the weir height is raised to 1.4m AHD to ensure any acid sulphate soils remain submerged to reduce the risk of oxidation. The pH is automatically monitored via an online instrument with the weir height adjustment also automated within Council Supervisory Control and Data Acquisition (SCADA) system. Therefore, any overflows from the treatment plant into the wetlands will not increase the flows within the channel to Fernbank Creek as the weir will always control the release at a fixed volume from the wetland.

The height control of the hydraulic weir is shown below in Figure 1.

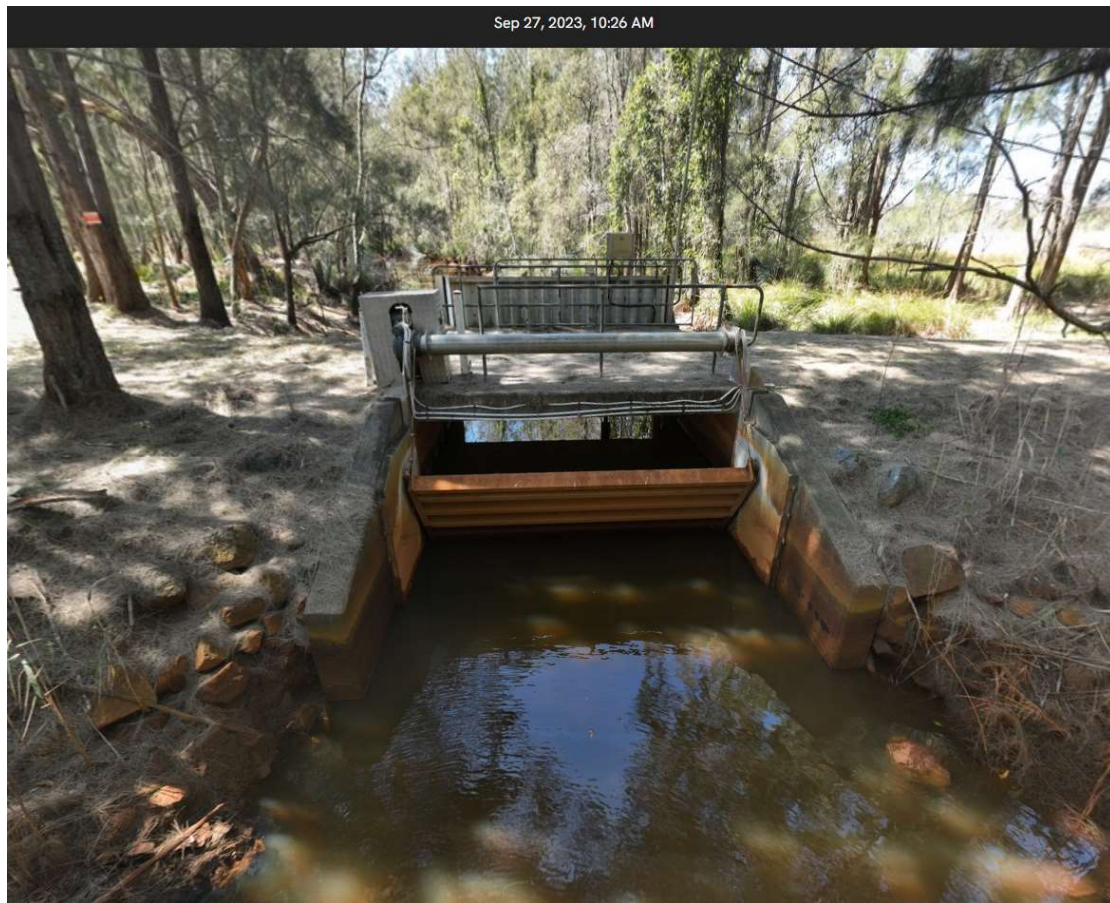


Figure 1: Downstream view of the Partridge Creek wetlands hydraulic weir. Top water level of the wetlands is set at 1.4m AHD (top of weir gate in image).

The wetland is bounded to the east by a constructed levee bank that is at or above the 1.5m AHD level, with a small natural low point weir that allows overflows in the adjacent Hibbard wetlands, shown below in Figure 2. This natural weir has a height of approximately 1.2m AHD. Should increased flows from Partridge Creek into the wetlands coincide with an overflow event from the treatment plant, this increased volume would be initially retained in the wetlands with any excess flowing into the Hibbard wetlands while also flowing over the

hydraulic weir. This flow control ensures that the release into the channel from the hydraulic weir is always consistent and therefore ensuring the channel and levee bank does not overtop onto the surrounding properties.

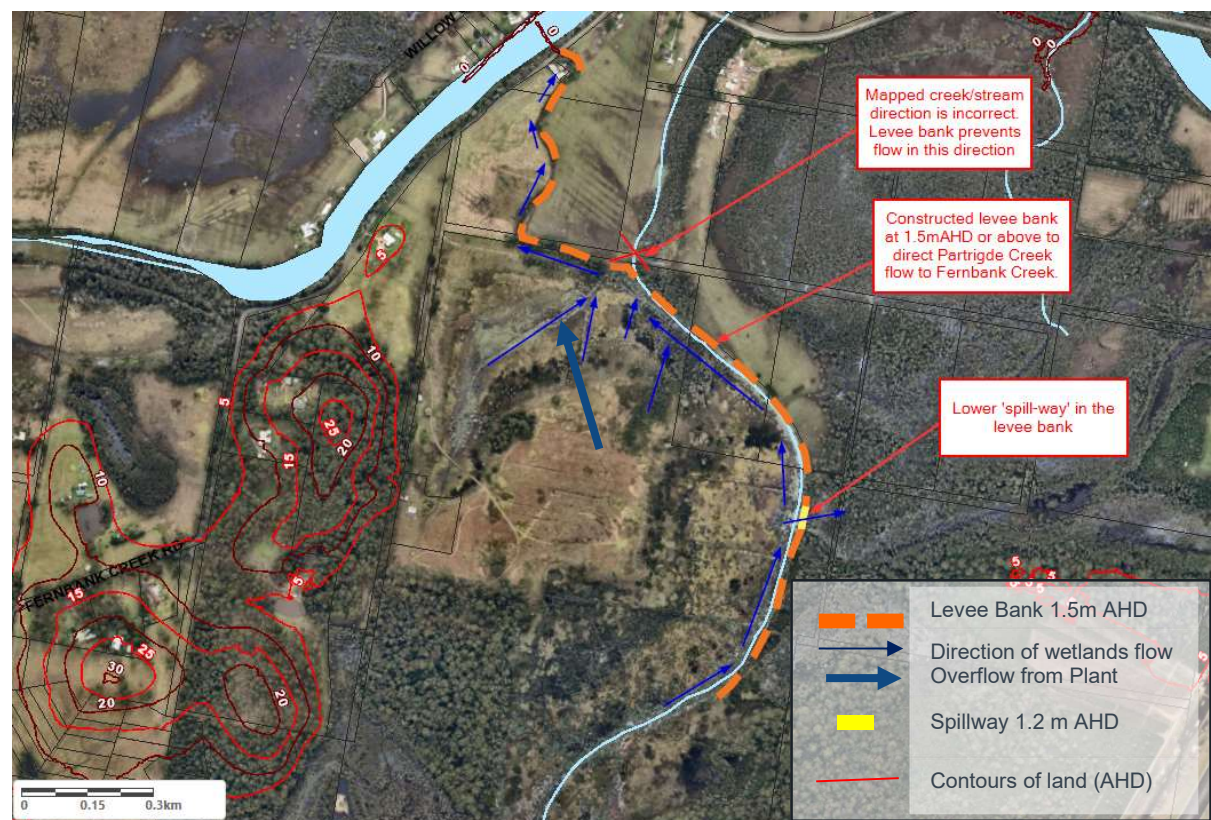


Figure 2: Levee bank system that contains the Partridge Creek Wetlands.

The channel downstream of the hydraulic weir is generally defined by 1.0m contour, indicated by the dark blue line in Figure 3 below, with the upper bank defined by the 1.5m contour, being the light blue line in Figure 3. As shown, there is a low-lying area to the west of the channel that would become a flow storage area should the 1.0m bank be overtopped.

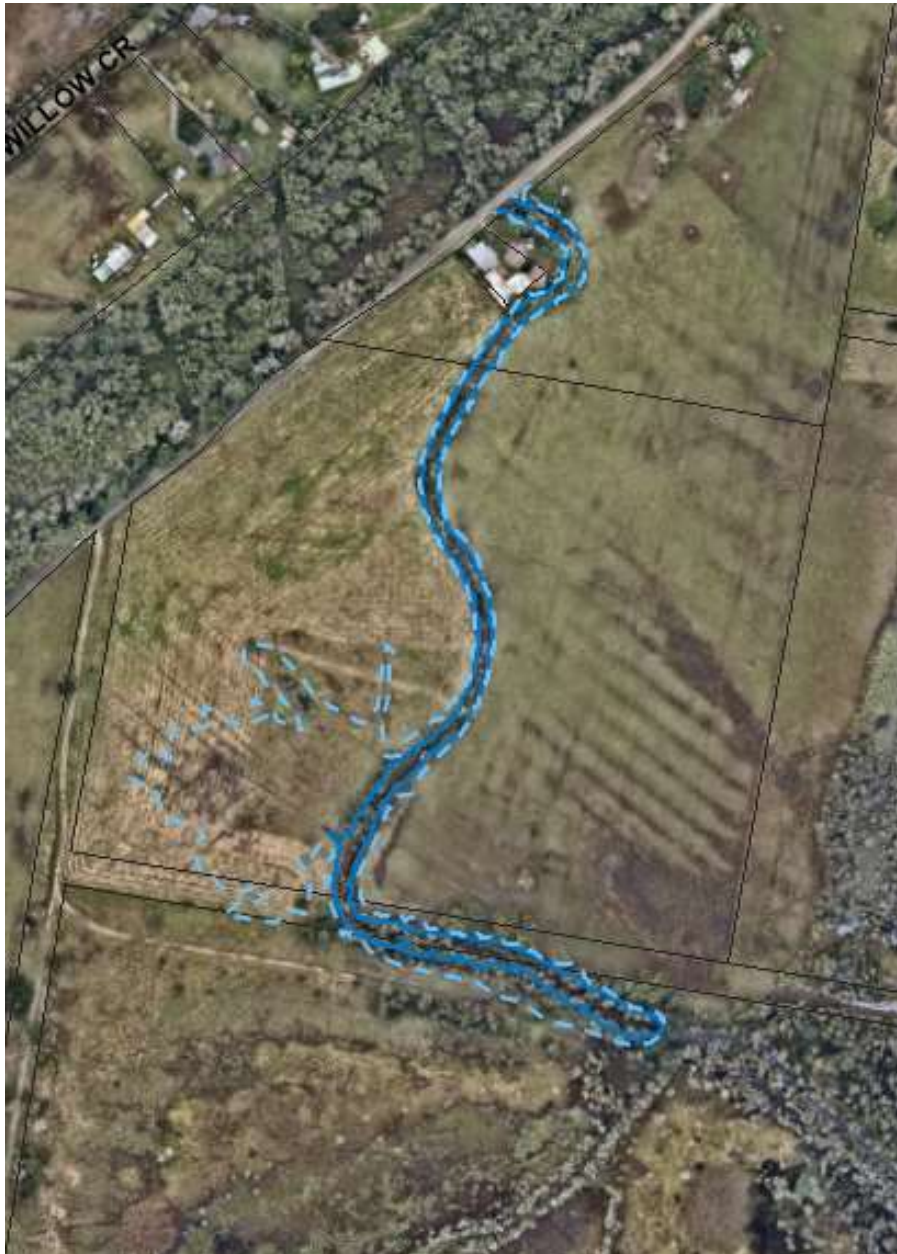


Figure 3: Partridge Creek channel between the hydraulic weir and Fernbank Creek. The channel is generally defined by the 1.0m contour (dark blue line), with the upper bank defined by the 1.5m contour (light blue dashed line).

Therefore, it is assessed that should an overflow occur from the Thrumster Wastewater Treatment Plant it is not going to have any adverse effect on the downstream properties with post-development flows within the channel likely to match the pre-development flows controlled via the hydraulic weir and contained within the channel flowing to Fernbank Creek.

Requested Information

2. *There is a property located where Partridge Creek passes beneath Fernbank Creek Road. In what flood event (ie X AEP event) would this property be likely to:*
 - a. *Have its private open space inundated, and*
 - b. *Have inundation from flooding occur within the house.*

Response

The property at 403 Fernbank Creek Road is generally above RL2.0m contour, as shown in Figure 4 below, with Council's GIS indicating the ground level of the property's open space being at approximately 2.3m. The Partridge Creek channel past the property is defined by 1.0m contour, shown by the blue lines in Figure 4.



Figure 4: 403 Fernbank Creek Road contour plan. The property is generally above the RL2.0m level with the open space surrounding the dwelling at approximately RL2.3m.

Using Council's currently adopted Hastings River flood modelling, flood levels at 403 Fernbank Creek Road at the 10%, 5% and 1% AEPs are:

- 10% - 2.00m
- 5% - 2.76m
- 1% - 3.47m

Analysing these flood event levels using a 2nd order polynomial trendline for a ground level of 2.3m corresponds to a flood event AEP of approximately 8%.

It is assessed that the open private space of 403 Fernbank Creek Road would experience flood inundation during an 8% AEP Hastings River flooding event.

The habitable floor of the house at 403 Fernbank Creek Road is approximately 0.6m above the ground level (three stairs to enter), being a RL of 2.9m.

Analysing the above flood event levels using a 2nd order polynomial trendline for a level of 2.9m corresponds to an AEP of approximately 4%.

It is assessed that a 4% AEP Hastings River flooding event would result in inundation occurring within the house at 403 Fernbank Creek Road.

This flood analysis correlates with the flood history at 403 Fernbank Creek Road.

The current resident of 403 Fernbank Creek Road has lived there since 1977. He advised that the property has only flooded three times since they have been there, in 2013, 2021 and 2025, with only the 2021 flood entering the house.

The May 2025 flood rose to the level of their back deck and inundated an enclosed deck 'sun' room but did not enter the main house.

Reviewing the historical flood levels for the Hastings River since 1977 shows the following floods:

Hastings River Level Gauges

Year	Wauchope Rail Bridge Gauge	Dennis Bridge Gauge	Settlement Point Gauge
March 1978	7.70m	-	1.74m
April 1989	5.85m	-	1.28m
February 1990	4.84m	-	1.22m
March 1995	6.00m	1.93m	1.73m
February 2009	4.73m	1.88m	1.40m
February 2013	7.2m	2.77m	1.72m
March 2021	8.72m	3.49m	2.48m
March 2022	2.98m	1.33m	1.20m
May 2025	7.35m	3.15m	2.09m
- Data unavailable			

Based on the historical flood levels and the reported incidents of flooding at 403 Fernbank Creek Road the property may have also flooded in 1978, although this event wasn't reported by the resident. The March 1995 flood event level at Settlement Point was similar to the February 2013 event level, however the Dennis Bridge and Wauchope Rail Bridge gauge levels were both below the 10% AEP levels, therefore it is unlikely that the property at 403 Fernbank Creek Road was impacted.

Current Hastings River Flood Study 10%, 5% and 1% AEP Levels:

AEP	Wauchope Rail Bridge Gauge	Dennis Bridge Gauge	Settlement Point Gauge
10%	6.10m	2.33m	1.05m
5%	7.10m	3.04m	2.33m
1%	8.87m	3.77m	2.74m

The flood level at 403 Fernbank Creek Road is generally 0.3m less than that recorded at the Dennis Bridge Gauge.

Analysing the Dennis Bridge flood gauge levels using a 2nd order polynomial trendline the historical floods were:

- March 2021 = 2.4% AEP
- May 2025 = 4.3% AEP
- February 2013 = 6.7% AEP

Reviewing the flood flow direction and velocity for the 5% AEP Hastings River flood model, shown below in Figure 5, indicates that flood waters flowing in an south-east direction with relatively low velocity. The arrows indicate direction with the size of the arrow representing the relative velocity. This shows that any storm overflows from the Thrumster Wastewater Treatment Plant that occur during a Hastings River flood event are not going to impact the property at 403 Fernbank Creek Road and instead be 'pushed' to the east into the Hibbard wetland area.



Figure 5: Flow direction and relative velocity indication for a 5% AEP Hastings River Flood event at 403 Fernbank Creek Road, with the arrows showing flow direction and size of arrow indicating relative flow velocity (longer the arrow tails the higher the velocity).

Requested Information

3. *What measures would Council be prepared to undertake to assist in:*
 - a. *Preventing inundation of this property, and*
 - b. *If inundation of the property occurs, in cleaning the property.*

Response

Council's role in flood prevention is primarily focused on strategic and community-wide initiatives. While direct intervention at individual properties is limited.

Council acknowledges the property owner's proactive efforts to improve flood resilience following the 2021 flood event. Notably, the installation of non-permeable flooring systems that can be removed and washed post-inundation.

In response to the specific queries:

a. Measures Council would be prepared to undertake to assist in preventing inundation of this property

In relation to the Thrumster Wastewater Scheme project as the works and operation of the plant does not contribute to the inundation of this property, as such no specific works are proposed to be undertaken at the property as part of the project.

Dependant on strategic flood planning for this area, Council (as the relevant authority for flood planning) may undertake or support the following:

- Floodplain Risk Management Planning: Council participates in the NSW Government's Floodplain Management Program, which enables the development of

flood mitigation infrastructure and strategic planning to reduce flood risk across the community, however this planning is not targeted at any individual property.

- Voluntary House Raising or Purchase: Port Macquarie-Hastings Council (PMHC) is currently considering initiating the process to join the NSW Government's Voluntary House Raising Scheme (VHRS). To progress this, Council must first update its Floodplain Risk Management Plan and undertake a scoping study to assess feasibility and identify potentially eligible properties.

In May 2025, PMHC publicly exhibited the VHRS proposal and received overwhelming public support, indicating strong community interest in the scheme. Should the program become available in the LGA, eligibility under the VHRS could be explored in consultation with the homeowner, subject to the outcomes of the scoping study and alignment with program criteria. However, this is not related to the Thrumster Wastewater Scheme project.

b. Measures Council would be prepared to undertake if inundation of the property occurs, in cleaning the property

Council does not typically provide direct cleaning services for private properties. This is usually undertaken by emergency services in the initial post event phase coordinated by the Local Emergency Management Controller. However, the following support may be available from Council following a declared flood event:

- Waste Management and Debris Removal: Council may coordinate with state agencies to provide flood waste collection services, including skip bins, kerbside collection, and access to waste disposal facilities.
- Community Recovery Coordination: Council may assist in coordinating recovery efforts, including referrals to relevant support services and agencies.
- Information and Safety Guidance: Council can disseminate public health and safety information regarding clean-up procedures, mould management, and structural safety.

Again, these actions are part of Council's response to natural disasters as the relevant local authority and not in relation to the Thrumster Wastewater Scheme project.

To:	Rana Kashif Project Manager Port Macquarie Hastings Council	From:	Damon Emerson Associate Process Engineer Beca HunterH2O
Copy to:	David Perry – Beca HunterH2O	Date:	20 October 2025
Subject:	DPHI Storm Pond Assistance – Technical Memorandum – Final Copy		

1 Background

1.1 Context

Beca HunterH2O (BHH2O) prepared a storm pond model for the Thrumster Wastewater Scheme options assessment and reference design. The existing model included data up to August 2022 which aligned to the initial storm pond assessment.

Port Macquarie Hastings Council (PMHC) received an RFI from the Department of Planning, Housing, and Infrastructure (DPHI) on 27 August 2025. The RFI requested additional information regarding discharges to Partridge Creek.

PMHC have asked BHH2O for assistance with the following RFI item:

“Please provide information in what scale of flood events discharges to Partridge Creek are likely to occur (i.e.. X AEP event).”

1.2 Objectives

The objective of this memo is to support PMHC in providing a response to the DPHI RFI dated 27 August 2025, namely the item outlined above.

In order to address the RFI, this memo outlines:

- **Updates to the storm pond model calculations** – Update inflow and rainfall data (up to September 2025).
- **Key findings** – Overflow events and discharges to Partridge Creek, including the scale of rainfall event expressed in terms of the Annual Exceedance Probability (AEP).
- **Verification** – Model results for one alternative site (Coffs Harbour, upon request from PMHC).

2 Methodology

This section outlines the methodology for addressing the RFI item outlined above including:

- The model structure
- Data sources and cleansing
- Required model updates

2.1 Model Structure

The Thrumster storm pond model uses inflow and rainfall data to model the filling and emptying of the storm pond with a set volume. The spreadsheet performs the following calculations:

- **Exclusion of rainfall events** – Five (5) day rain events are excluded to determine the Average Dry Weather Flow (ADWF) over time.

- **Median ADWF** – The three (3) year median ADWF is calculated for each point in the time series, avoiding skew from individual data points.
- **Normalised flow** – The inflow is divided by the median ADWF to obtain a normalised flow.
- **Flow projections** – Flow for a set future EP is determined by multiplying the normalised flow by the future EP and a set flow loading (230 L/EP/day).
- **Rain volume** – The volume of rain is determined by multiplying the storm pond area by the rainfall.
- **STP inflow** – The combined inflow to the STP was calculated by adding the rain volume to the projected flow.
- **Pond input** – The pond input is determined by the difference between the operational peak full treatment flow (PFTF) and STP inflow, where excess flow is directed to the ponds.
- **Removal** – The removal is determined using the STP inflow relative to the operational PFTF and utilised pond volume (below).
- **Pond** – The pond volume is determined by adding the pond input to the previous pond volume and subtracting the removal.
- **Spill** – The spill is calculated by the excess of the pond value compared to the set pond size. If the cumulative pond value exceeds the set pond size, a spill occurs.
- **Event** – The event column represents where a spill has occurred, whilst counting consecutive spills as a single event.

Section 2.2 outlines the data provided for the model update and Section 2.3 discusses the changes made to the model calculations in order to observe practical results for the updated data.

2.2 Data Sources and Cleaning

PMHC provided the following information for the completion of the storm pond model update:

- **Inflow data** – Daily inflow at PM WWTP in kL (2022 – 2025).
- **Rainfall data** – Rainfall data from Thrumster 3 SPS in five (5) minute intervals (2019 – 2025).
- **AEP converter** – A spreadsheet finds the corresponding AEP for a rainfall event.

2.3 Model Update

The model update included the following changes and assumptions:

- **Inflow data** – The provided inflow data was converted from kilolitres (kL) to megalitres (ML) and added to the model.
- **Rainfall data** – The provided rainfall data was condensed from 5 minute intervals to daily sum of rainfall to update the model.
- **Normalised flow** – The normalised flow was computed by dividing the inflow by a set ADWF of 13.3 ML/d. This change was made due to the three year median ADWF reaching 17.78 ML/d based on 2024 and 2025 data. This flow is not considered representative of the plant's average dry weather flow due to a jump in flow from 13.5 ML/d in 2022 to 19.6 ML/d in 2025. It is expected this is due to the high volume of rainfall and an elevated groundwater table. Thus, this was not used to calculate the normalised flow. Instead, the current population projections from the Port Macquarie WWTP Process Capacity Review completed by Beca HunterH2O in 2023 was adopted. A population of 59,500 EP and a flow loading of 224 L/EP/day determined an ADWF of 13.3 ML/d.
- **Pond area** – It was assumed that the area of the 50 ML storage pond was double the area provided in the existing model for the 25 ML storage pond. This assumption assumes the pond depth remains the same and was considered practical as well as conservative.

The following was completed to extract overflow information from the model:

- **Key dates** – The dates of all overflow events were recorded.

- **Rainfall data** – The five (5) minute interval rainfall data for the key dates was extracted from the data set provided by PMHC. Seven (7) days of rainfall data was extracted due to the computation of rolling averages in the AEP converter (discussed below).
- **AEP converter** – The five (5) minute interval rainfall data for seven (7) days including and prior to the key dates, was used to determine the AEP. The AEP converter was altered to determine rolling averages based on the five (5) minute interval data rather than one (1) minute intervals.
- **AEP** – The equivalent AEP for each key date was recorded as the lowest value from the range of AEP values computed for rolling averages ranging from five (5) minutes to seven (7) days.

3 Findings

This section outlines the findings from the additional modelling.

3.1 Thrumster WWTP Overflow Events Calculated Using Port Macquarie WWTP Inflow Data

Table 3-1 shows the number of overflow events forecasted for 40,000 EP (25 ML) and 80,000 EP (50 ML) with the updated model and current rainfall and inflow data. Over the 16 year period (2010 to 2025), a total of six (6) overflow events were observed, corresponding to an average of 0.4 overflow events per year.

Table 3-1. Summary of Overflow Events for Thrumster WWTP Using Port Macquarie WWTP Inflow Data (Updated Model)

	40,000 EP (25 ML Storage)	80,000 EP (50 ML Storage)
Year	Number of Overflow Events	
2010	0	0
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	1	1
2019	0	0
2020	0	0
2021	1	1
2022	2	2
2023	0	0
2024	1	1
2025	1	1
Total Overflow Events	6	6

The updated model resulted in the overflow events presented in Table 3-2. The equivalent AEP was determined using rainfall data which started within the seven (7) days prior to the overflow event. The period of the rainfall data used for the AEP calculation was selected based on the highest cumulative rainfall within this dataset. It is worth noting that the AEP calculation is variable based on the rainfall data input. The rainfall data utilised for the AEP calculation for each overflow event is summarised in Appendix A.

Table 3-2 compares the results of the updated model with the original predictions, verifying the altered model. It also includes the equivalent rainfall AEP determination.

Table 3-2. Comparison of Overflow Events for Thrumster Using Port Macquarie Inflow Data and Associated AEP Event (Original and Updated Models)

Date	Original Model Predictions – Spill (ML)		Updated Model Predictions– Spill (ML)		Equivalent AEP Details		
	40,000 EP 25 ML Storage	80,000 EP 50 ML Storage	40,000 EP 25 ML Storage	80,000 EP 50 ML Storage	AEP%	Period for AEP% (hrs)	Rainfall Total (mm)
03/05/2018 – 03/05/2018	5.9**	11.7**	0.47**	0.95**	<63.2*	24*	55*
19/03/2021 – 21/03/2021	26.2	51.3	26.5	53.1	2 – 5	120 – 168	516 ¹
26/03/2022 – 31/03/2022	92.3	182	93.0	186	10 – 20	168	357 ²
22/05/2022 – 22/05/2022	0.01	0.02	0.12	0.24	<63.2	All	62 ³
05/04/2024 – 05/04/2024			7.94	15.9	20 – 50	0.3 – 3 & 12 - 36	189 ⁴
19/05/2025 – 23/05/2025			105	210	2 – 5	96 – 120	452 ⁵

*The provided five (5) minute interval rainfall data ranged from 2019 to 2025 thus, the BOM AEP calculator was used to determine the AEP for the 2018 event. The rainfall data used started at 25/4/2018.

**The spills determined using the original and updated storm pond model were similar for all events excluding the 2018 overflow. This is a result of a higher adopted fixed ADWF rather than a lower rolling ADWF for the period between 2017 and 2021, this is a known dry weather period. This does not affect the event determination of the model.

¹The rainfall data used to determine AEP starts at 16/3/2021 at 21:25.

²The rainfall data used to determine AEP starts at 23/3/2022 at 20:00.

³The rainfall data used to determine AEP starts at 21/5/2022 at 22:20.

⁴The rainfall data used to determine AEP starts at 04/4/2024 at 11:40.

⁵The rainfall data used to determine AEP starts at 19/5/2025 at 07:35.

The observed AEP values ranged from '<63.2' (i.e. 1 exceedance per year) and '2 – 5' (i.e. 1 exceedance in 50 and 20 years, respectively), based on the categories defined in the rainfall to AEP converter provided by PMHC.

- The overflow events associated with the highest observed AEP of <63.2 (i.e. 1 exceedance per year) involved the lowest spills, ranging from 0.24 to 0.95 ML for 80,000 EP and 50 ML storage. The events where this occurs are associated with a very low discharge volume and the model results over a 15 year period confirm that overflows are less frequent than this. A likely explanation is that localised rainfall occurred somewhere else in the catchment and was not observed at the rain gauge provided.
- The largest spill, shown in 2025, had a low AEP of 2 – 5 (1 exceedance in 50 and 20 years, respectively). This indicates that the spill volumes are likely to increase depending on the storm severity.

Conclusion

This memorandum outlines the updated storm pond model outputs by including additional flow and rainfall data from Port Macquarie WWTP up to 2025. The following are noted:

- The data indicates additional overflows are predicted in 2024 and 2025.
- A total of six (6) overflows were predicted from 2010 to 2025, equating to an average of 0.4 overflows per year.
- The AEP rainfall intensity indicates that overflows occur during elevated rainfall conditions.

3.2 Thrumster WWTP Overflow Events Calculated Using Coffs Harbour WRP Inflow and Rainfall Data

The storm pond model was verified with an alternative data set. Inflow and rainfall data for Coffs Harbour WRP was used to predict the overflow events for Thrumster WWTP, upon request from PMHC. The previous model was used for the alternative (Coffs Harbour) rainfall and flow data set. No changes were made to the model.

Table 3-3 shows the number of overflow events forecasted for 40,000 EP (25 ML) and 80,000 EP (50 ML) with the updated model and rainfall and inflow data for Coffs Harbour from 2010 to 2024. Over the 16 year period (2010 to 2025), a total of 27 overflow events were observed, corresponding to an average of 1.7 overflow events per year.

Table 3-3. Summary of Overflow Events for Thrumster WWTP Using Coffs Harbour WRP Rainfall and Inflow Data (Original Model)

	40,000 EP (25 ML Storage)	80,000 EP (50 ML Storage)
Year	Number of Overflows	
2010	0	0
2011	1	1
2012	2	2
2013	3	3
2014	2	2
2015	4	4
2016	2	2
2017	3	3
2018	0	0
2019	0	0
2020	3	3
2021	3	3
2022	4	4
2023	0	0
2024	0	0
2025	0	0
Total Overflow Events	27	27

The overflow events shown by the storm pond model for the 2015 to 2025 Coffs Harbour data (19 overflows) are presented in Table 3-4. In lieu of the rainfall to AEP converter provided by PMHC, which required location specific IFD Rainfall Design Data, the AEP values for Coffs Harbour overflow events were determined using the Bureau of Meteorology (BOM) AEP calculator. It is worth noting that 24 hour rainfall data was used to calculate these AEPs, with inputs involving the cumulative rainfall within a seven (7) day from the event is shown in Appendix A.

Table 3-4. Overflow Events for Coffs Harbour and Associated AEP Events (Original Model)

Date	Original Model Predictions		Equivalent AEP Details		
	40,000 EP 25 ML Storage	80,000 EP 50 ML Storage	AEP%	Period for AEP% (hrs)	Rainfall Total (mm)
02/02/2015 – 02/02/2015	42.3	84.7	20 – 50	72	222.2
20/02/2015 – 22/02/2015	53.0	106	>63.2	All	214.4
13/03/2015 – 13/03/2015	6.34	12.7	20 – 50	24	183.4
01/05/2015 – 03/05/2015	61.3	123	20 – 50	120	263.2
04/06/2016 – 04/06/2016	14.2	28.4	20 – 50	48	259.0
03/08/2016 – 03/08/2016	0.17	0.35	>63.2	All	117.5
15/03/2017 – 18/03/2017	66.5	133	10 – 20	144	366.0
30/03/2017 – 30/03/2017	4.83	9.66	>63.2	All	117.0
12/06/2017 – 12/06/2017	5.61	11.2	20 – 50	120	275.0
09/02/2020 – 13/02/2020	87.6	175	5 – 10	168	460.5
24/02/2020 – 24/02/2020	0.38	0.76	>63.2	All	78.5
14/12/2020 – 17/12/2020	84.2	168	10 – 20	120	425.5
19/02/2021 – 19/02/2021	4.93	9.86	50 – 63.2	168	227.5
24/02/2021 – 25/02/2021	35.6	71.2	20 – 50	168	271.5
18/03/2021 – 23/03/2021	237	474	5 – 10	168	457.0
24/02/2022 – 01/03/2022	126	251	5 – 10	168	464.0
07/03/2022 – 07/03/2022	5.25	10.5	>63.2	All	134.5
27/03/2022 – 30/03/2022	137	274	5 – 10	168	445.0
05/07/2022 – 06/07/2022	23.7	47.3	20 – 50	24	206.0

The observed AEP values ranged from '>63.2' (i.e. 1 exceedance per year) and '5 – 10' (i.e. 1 exceedance in 20 and 10 years, respectively), based on the categories defined in the BOM AEP calculator. The following was noted:

- The AEP values for the 19 overflows from 2015 to 2025 had the following split in AEP categories: >63.2 (26%), 50 – 63.2 (5%), 20 – 50 (37%), 10 – 20 (11%), and 5 – 10 (21%).
- Of the five (5) events associated with an AEP of >63.2, two (2) involved small spills (< 1 ML), two (2) involved moderate spills (9.66 ML and 10.50 ML), and one (1) involved a large spill (106 ML).
- All other spills exceeding 100 ML were associated with lower AEP values; an AEP of 20 – 50 was observed for the 123 ML spill in 2015, whilst all other spills of this magnitude were associated with AEP values in the range between 5 – 20.

- The model results indicate that Coffs Harbour WRP is subject to higher infiltration than Port Macquarie (either due to catchment condition or catchment management) and is likely affected by infiltration from more frequent rainfall or higher intensity rainfall events than Port Macquarie. The intensity of the rainfall may not be fully captured for Coffs Harbour, due to the use of 24 hour rainfall data.

Conclusion

This memorandum outlines the updated storm pond model outputs by including additional flow and rainfall data from Coffs Harbour WRP up to 2025. The following are noted:

- The data indicates no additional overflows are predicted in 2024 and 2025.
- A total of 27 overflows were predicted from 2010 to 2025, equating to an average of 1.7 overflows per year.
- The AEP rainfall intensity indicates that overflows occur during elevated rainfall conditions.

3.3 Conclusion

Storm pond model update:

- The storm pond model required updates for the analysis of Thrumster WWTP overflows using Port Macquarie inflow data.
- The key change involved the adoption of a fixed ADWF of 13.3 ML/day, based on a 2023 capacity review completed by Beca HunterH2O. This replaced the computed ADWF which increased considerably in 2025.
- The increase in ADWF was believed to be due to high rainfall and an elevated groundwater table. The increase did not align with projected population growth. Thus, the computed ADWF was not considered representative of the plant and a fixed value was adopted.
- Comparison of results from the updated model with findings from the original model verified the changes to the model.
- The Coffs Harbour storm pond analysis was completed using the original model, as changes to the model were specific to Thrumster.

Data and modelling overview:

- The first data set was representative of the existing catchment at Port Macquarie, where part of the catchment will be redirected to Thrumster.
- The second data set was representative of a catchment that is likely more affected by infiltration (Coffs Harbour WRP).
- PMHC consider this to be an assessment of two extremes, providing insight to the range of overflows and AEP values which can be expected at their plants.

Key findings:

- The Thrumster data in the updated storm pond model indicates additional overflows are predicted in 2024 and 2025.
- No additional overflows were observed for the updated Coffs Harbour data.
- The AEP rainfall intensity indicates that overflows occur during elevated rainfall conditions.
- The annualised overflows for Thrumster and Coffs Harbour were 0.4 overflows per year and 1.7 overflows per year respectively.
- As this was considered an assessment of two extremes, 0.4 to 1.7 overflows per year represents the range of overflows that PMHC should expect to observe for Thrumster WWTP.

Appendix A. Cumulative Rainfall for AEP Calculation

Cumulative rainfall – Inputs for Port Macquarie AEP calculations:

Cumulative		overflow dates					
		3/05/2018	19/03/2021	26/03/2022	22/05/2022	5/04/2024	19/05/2025
days	hrs	3/05/2018	21/03/2021	31/03/2022	22/05/2022	5/04/2024	23/05/2025
1	24	55.0	157.2	104.2	51.4	134.2	197.2
2	48		249.0	148.2	59.2	165.8	285.6
3	72		303.0	214.8	60.0	183.4	361.4
4	96		394.2	240.0	60.2	183.4	446.6
5	120		474.4	249.2	61.4	183.6	451.6
6	144		499.6	290.8	61.6	188.8	452.0
7	168		516.4	357.4	61.8	188.8	452.0
Total		55.0	516.4	357.4	61.8	188.8	452.0
Rainfall (mm)							

Cumulative rainfall – Inputs for Coffs Harbour AEP calculations:

		overflow dates										12th back									
		2/02/2015	20/02/2015	13/03/2015	1/05/2015	4/06/2016	3/08/2016	15/03/2017	30/03/2017	12/06/2017	9/02/2020	24/02/2020	14/12/2020	19/02/2021	24/02/2021	18/03/2021	24/02/2022	7/03/2022	27/03/2022	5/07/2022	
days	hrs	2/02/2015	22/02/2015	13/03/2015	3/05/2015	4/06/2016	3/08/2016	18/03/2017	30/03/2017	12/06/2017	13/02/2020	24/02/2020	17/12/2020	19/02/2021	25/02/2021	23/03/2021	1/03/2022	7/03/2022	30/03/2022	6/07/2022	
1	24	21.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	125.0	0.0	131.0	28.5	34.0	36.0	32.0	10.5	39.0	0.0	
2	48	0.0	14.0	55.0	41.0	0.0	0.0	8.0	2.0	0.0	2.0	0.0	36.0	7.5	0.0	132.0	55.0	0.5	35.0	16.5	
3	72	0.0	21.0	0.0	16.2	0.0	0.0	48.0	0.0	2.0	117.0	0.0	20.0	25.5	20.5	24.0	56.0	5.5	81.0	3.5	
4	96	0.0	29.0	0.0	64.0	4.0	0.0	158.0	0.0	67.0	44.0	0.0	80.0	46.0	0.0	63.0	27.0	2.0	11.0	0.0	
5	120	4.2	70.6	0.0	106.0	0.0	0.0	0.0	0.0	108.0	3.5	9.5	121.0	67.0	53.5	110.0	18.0	2.0	28.0	0.0	
6	144	113.0	54.8	0.0	36.0	32.0	9.5	95.0	0.0	30.0	66.0	47.0	4.5	19.0	64.5	58.0	118.0	62.0	162.0	152.0	
7	168	105.0	25.0	183.4	0.0	227.0	108.0	57.0	117.0	68.0	103.0	22.0	33.0	34.0	99.0	34.0	158.0	52.0	89.0	54.0	
Total		243.2	214.4	238.4	263.2	263.0	117.5	366.0	123.0	275.0	460.5	78.5	425.5	227.5	271.5	457.0	464.0	134.5	445.0	226.0	
Rainfall (mm)																					
Cumulative		overflow dates										12th back									
		2/02/2015	20/02/2015	13/03/2015	1/05/2015	4/06/2016	3/08/2016	15/03/2017	30/03/2017	12/06/2017	9/02/2020	24/02/2020	14/12/2020	19/02/2021	24/02/2021	18/03/2021	24/02/2022	7/03/2022	27/03/2022	5/07/2022	
days	hrs	2/02/2015	22/02/2015	13/03/2015	3/05/2015	4/06/2016	3/08/2016	18/03/2017	30/03/2017	12/06/2017	13/02/2020	24/02/2020	17/12/2020	19/02/2021	25/02/2021	23/03/2021	1/03/2022	7/03/2022	30/03/2022	6/07/2022	
1	24	4.2	14.0	183.4	41.0	32.0	9.5	8.0	117.0	2.0	125.0	9.5	131.0	28.5	34.0	36.0	32.0	10.5	39.0	152.0	
2	48	117.2	35.0		57.2	259.0	117.5	56.0		69.0	127.0	56.5	167.0	36.0	34.0	168.0	87.0	11.0	74.0	206.0	
3	72	222.2	64.0		121.2			214.0		177.0	244.0	78.5	187.0	61.5	54.5	192.0	143.0	16.5	155.0		
4	96		134.6		227.2			214.0		207.0	288.0		267.0	107.5	54.5	255.0	170.0	18.5	166.0		
5	120		189.4		263.2			309.0		275.0	291.5		388.0	174.5	108.0	365.0	188.0	20.5	194.0		
6	144		214.4					366.0			357.5		392.5	193.5	172.5	423.0	306.0	82.5	356.0		
7	168										460.5		425.5	227.5	271.5	457.0	464.0	134.5	445.0		
Total		222.2	214.4	183.4	263.2	259.0	117.5	366.0	117.0	275.0	460.5	78.5	425.5	227.5	271.5	457.0	464.0	134.5	445.0	206.0	
Rainfall (mm)																					

Attachment C - Noise and Vibration Response - RFI Query 4 and 5

Variation Request for Working Hours

Out of Hours Approval Request Consideration - Potential Underbore Installation Durations

Based on advice from Council's underbore consultant, it is anticipated that trenchless pipe installations proposed from the TWWTP beneath the surrounding protected land will require works outside of the standard construction hours as follows:

- Partridge Creek HDD - Night time works is anticipated to be required for a maximum of 2 consecutive nights
- Recycled Water HDD - Night time works is anticipated to operate for a maximum of 10 consecutive nights

As such, a noise assessment has been undertaken for the underbore works to assess noise associated with works outside of standard working hours.

This risk for night works is less likely for the shorter Partridge Creek underbores.

Therefore, to allow for nightworks in relation to the pipe installation process for the abovementioned underbores, Council is seeking consideration of an 'Out of Hours' approval to the EIS determination to permit works outside the general daytime working hours as a pre-emptive risk mitigation measure for the Partridge Creek and Recycled Water underbore works.

Query 4 and 5

Find enclosed noise assessment report in response to query 4 and 5.



Trenchless Pipe Installation Noise Assessment

Thrumster Wastewater Scheme

Port Macquarie Hastings Council

14 November 2025

Project name		Thrumster WWS EIS					
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Appendices

Appendix A	Noise contour maps
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1. Introduction

Port Macquarie-Hastings Council (Council) is proposing to develop the Thrumster Wastewater Scheme including a new wastewater treatment plant (WWTP), associated pipelines and infrastructure at Port Macquarie on the NSW Mid North Coast (the project). The project has been declared as a State Significant Infrastructure (SSI) and is a priority project for Council to ensure communities have access to necessary resources in a safe and reliable manner.

During the assessment process, Department of Planning, Housing and Infrastructure (DPHI) has raised concerns regarding potential noise impacts from trenchless pipe installation methods. Specifically, the focus was on Horizontal Directional Drilling (HDD) and Micro tunnelling activities proposed as part of the wastewater scheme.

To respond to these concerns, GHD Pty Ltd (GHD) has been engaged by Council to undertake a detailed noise assessment of the various trenchless pipe installation locations. This assessment will evaluate the potential noise impacts on nearby sensitive receivers and inform appropriate mitigation strategies where required.

1.1 Purpose of this report

The purpose of this report is to inform Council of the findings of the detailed noise assessment undertaken for the trenchless pipe installations.

This report refers to the *Thrumster Wastewater Scheme Noise and Vibration Assessment* (GHD, 2024) and should be read in conjunction with that document.

1.2 Scope

The scope of work undertaken by GHD for this assessment is summarised below:

- Discussed and obtained trenchless pipe installation design details (location, layout, equipment, etc) from underbore consultant. The details covered:
 - Horizontal Directional Drilling (HDD) for Recycled Water Main
 - HDD for West Zone (Partridge Creek)
 - HDD for East Zone (Acacia Ave to Barton Cres)
 - HDD for South Zone (Oxley Hwy, near Port Macquarie Base Hospital)
 - Micro tunnelling for East Zone (Oxley Hwy, near Port Macquarie Race Club)
 - Micro tunnelling or South Zone (Wrights Rd, near Port Macquarie Base Hospital)
- Adopted the construction noise management levels previously established in the Noise and Vibration Assessment (GHD, 2024) for the project
- Undertook noise modelling to predict potential noise impacts, for each trenchless pipe installation locations, at nearby sensitive receivers for the aforementioned activities
- Provided reasonable and feasible in-principal noise mitigation and management measures to reduce noise impacts, if required
- Provided guidance on the effectiveness of noise mitigation measures such as temporary noise barriers

1.3 Limitations

This report has been prepared by GHD for Port Macquarie Hastings Council and may only be used and relied on by Port Macquarie Hastings Council for the purpose agreed between GHD and Port Macquarie Hastings Council as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Port Macquarie Hastings Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Port Macquarie Hastings Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.4 Assumptions

The following assumptions were relied upon in preparation of this noise assessment:

- Sensitive receivers were identified using aerial photography and land use planning and may not include all existing or future receivers in the project area but are considered representative at the time of the assessment.
- Assumptions outlined in *Thrumster Wastewater Scheme Noise and Vibration Assessment* (GHD, 2024) remain applicable.
- The ambient background noise level in the study area has not changed significantly since noise monitoring was last conducted (November 2023).
- Construction noise is assessed assuming that each piece of construction equipment is operating concurrently for each scenario.
- Each trenchless pipe installation site will not operate simultaneously with another trenchless pipe installation site.
- Due to the continuous operational nature of HDD rigs during pipe installation, it is assumed that the L_{max} level is equivalent to the L_{eq} value.
- Educational receivers are only operating within standard construction hours.
- For micro tunnelling operations, noise generated by above-ground equipment is expected to dominate over any noise produced by the tunnelling machine operating below ground.

Additional assumptions have been established throughout the document as appropriate.

2. Criteria

2.1 Construction noise

The noise criteria adopted for this assessment is based on the construction noise management levels (CNMLs) established in *Thrumster Wastewater Scheme – Noise and Vibration Assessment* (GHD, 2024). These were established in line with the Interim Construction Noise Guideline (ICNG) (DECC, 2009).

Table 2.1 Construction noise management levels

Receiver Type	Construction noise management levels, dB L _{Aeq} (15min)				
	Standard construction hours		Outside standard construction hours		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential – NCA 3 (CT_03)	49	75	44	41	41 ¹
Residential – NCA 5 (CT_05)	52	75	47	46	39
Residential – NCA 6 (CT_06)	45 ²	75	40	40	37
Commercial	70 (external) – when in use				
Industrial	75 (external) – when in use				
Active Recreational	65 (external) – when in use				
Educational Facility	55 (external) ³ or 45 (internal) – when in use				
Hospital Wards and Operating Theatres	55 (external) ³ or 45 (internal) – when in use				
Place of worship	55 (external) ³ or 45 (internal) – when in use				

Notes:

1. In determining project-specific construction noise criteria from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. The construction noise level criteria for night-time should be no greater than the construction noise level criteria for day or evening, as per NPI (Section 2.3).
2. The measured background noise levels were below minimum background noise levels recommended in the NPI, minimum RBLs have been adopted as per NPI (Section 2.3).
3. External noise management level is based on a 10 dB noise reduction through a partially open window.

2.2 Sleep disturbance

The ICNG acknowledges the need to consider sleep disturbance however does not provide any guidance on how to assess for the potential for sleep disturbance.

The Noise Policy for Industry (EPA, 2017) provide guidance on sleep disturbance noise levels and has been referred to. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages. Where the subject development/premises night-time noise levels at a residential location exceed:

- L_{Aeq,15min} 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater

a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy (RNP) (DECCW, 2011).

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- The distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development.
- Whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods).
- Current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

3. Receivers

The previous noise and vibration assessment (GHD, 2024) identified noise impacts across designated Noise Catchment Areas (NCAs). The trenchless pipe installation activities will be located within NCA 3, NCA 5 and NCA 6. To better understand the potential noise levels at nearby sensitive receivers, a selection of representative locations were identified to reflect those most likely to be impacted by the trenchless pipe installation activities. They are summarised in Table 3.1 and shown visually in Figure 3.1 to Figure 3.6.

Compliance at these identified locations is considered to result in compliance at other receivers located further away.

Table 3.1 *Trenchless pipe installation receivers*

Receiver ID	Type	NCA	Represents
Partridge Creek HDD			
Partridge_Receiver_R01	Residential	NCA6	Residential dwellings to the West of the entry and exit sites.
Partridge_Receiver_R02	Residential	NCA6	Residential dwellings to the North of the entry and exit sites.
Partridge_Receiver_R03	Residential	NCA5	Residential dwellings to the East of the entry and exit sites.
Partridge_Receiver_R03a	Active Recreational	NCA5	Sports fields to the East of the entry and exit sites.
Partridge_Receiver_R04	Residential	NCA3	Residential dwellings to the South of the entry and exit sites.
Recycled Water Main HDD			
RecycledWaterMain_Receiver_R01	Residential	NCA6	Residential dwellings to the West of the entry site.
RecycledWaterMain_Receiver_R02	Residential	NCA6	Residential dwellings to the North of the entry site.
RecycledWaterMain_Receiver_R03	Residential	NCA5	Residential dwellings to the East of the entry site.
RecycledWaterMain_Receiver_R03a	Active Recreational	NCA5	Sports fields to the East of the entry and exit sites.
RecycledWaterMain_Receiver_R04	Residential	NCA3	Industrial premises to the South-East of the exit site.
RecycledWaterMain_Receiver_R05	Residential	NCA3	Residential dwellings to the West of the exit site.
Acacia Avenue HDD			
Acacia_Receiver_R01	Industrial	NCA5	Industrial premise North to entry site.
Acacia_Receiver_R02	Residential	NCA5	Residential dwellings to the North of the entry site.
Acacia_Receiver_R03	Industrial	NCA5	Industrial premise South to entry site.
Acacia_Receiver_R04	Industrial	NCA5	Industrial premise West to entry site.
Acacia_Receiver_R05	Industrial	NCA5	Industrial premise South-East to exit site.
Acacia_Receiver_R06	Industrial	NCA5	Industrial premise South to exit site.
Acacia_Receiver_R07	Industrial	NCA5	Industrial premise West to exit site.
Acacia_Receiver_R08	Residential	NCA5	Residential dwellings to the North of the exit site.
Oxley Highway HDD			
OxleyHDD_Receiver_R01	Residential	NCA5	Residential dwellings to the North-East of the entry site.

Receiver ID	Type	NCA	Represents
OxleyHDD_Receiver_R02	Residential	NCA5	Residential dwellings to the North-East of the entry and exit site.
OxleyHDD_Receiver_R03	Hospital	NCA5	Hospital to the East of the entry and exit site
OxleyHDD_Receiver_R04	Residential	NCA5	Residential dwellings to the South of the entry and exit site.
OxleyHDD_Receiver_R05	Residential	NCA5	Residential dwellings to the South of the entry site.
OxleyHDD_Receiver_R06	Residential	NCA5	Residential dwellings to the North of the entry site.
Oxley Highway Micro Tunnelling			
OxleyMicro_Receiver_R01	Residential	NCA5	Residential dwellings to the North of the entry and exit site.
OxleyMicro_Receiver_R02	Residential	NCA5	Residential dwellings to the North-East of the entry and exit site.
OxleyMicro_Receiver_R03	Educational	NCA5	Childcare to the East of the entry and exit site.
OxleyMicro_Receiver_R04	Residential	NCA5	Residential dwellings to the South of the entry and exit site.
OxleyMicro_Receiver_R05	Residential	NCA5	Residential dwellings to the South-West of the entry and exit site.
Wrights Road Micro Tunnelling			
Wrights_Receiver_R01	Hospital	NCA5	Hospital to the North-East of the entry and exit site
Wrights_Receiver_R02	Residential	NCA5	Residential dwellings to the East of the entry and exit site.
Wrights_Receiver_R03	Residential	NCA5	Residential dwellings to the South of the entry and exit site.
Wrights_Receiver_R04	Commercial	NCA5	Commercial shops to the South-West of the entry and exit site.
Wrights_Receiver_R05	Residential	NCA5	Residential dwellings to the North-West of the entry and exit site.



Figure 3.1 Identified sensitive receivers for Partridge Creek HDD (Aerial: Nearmaps – taken 28/10/25)

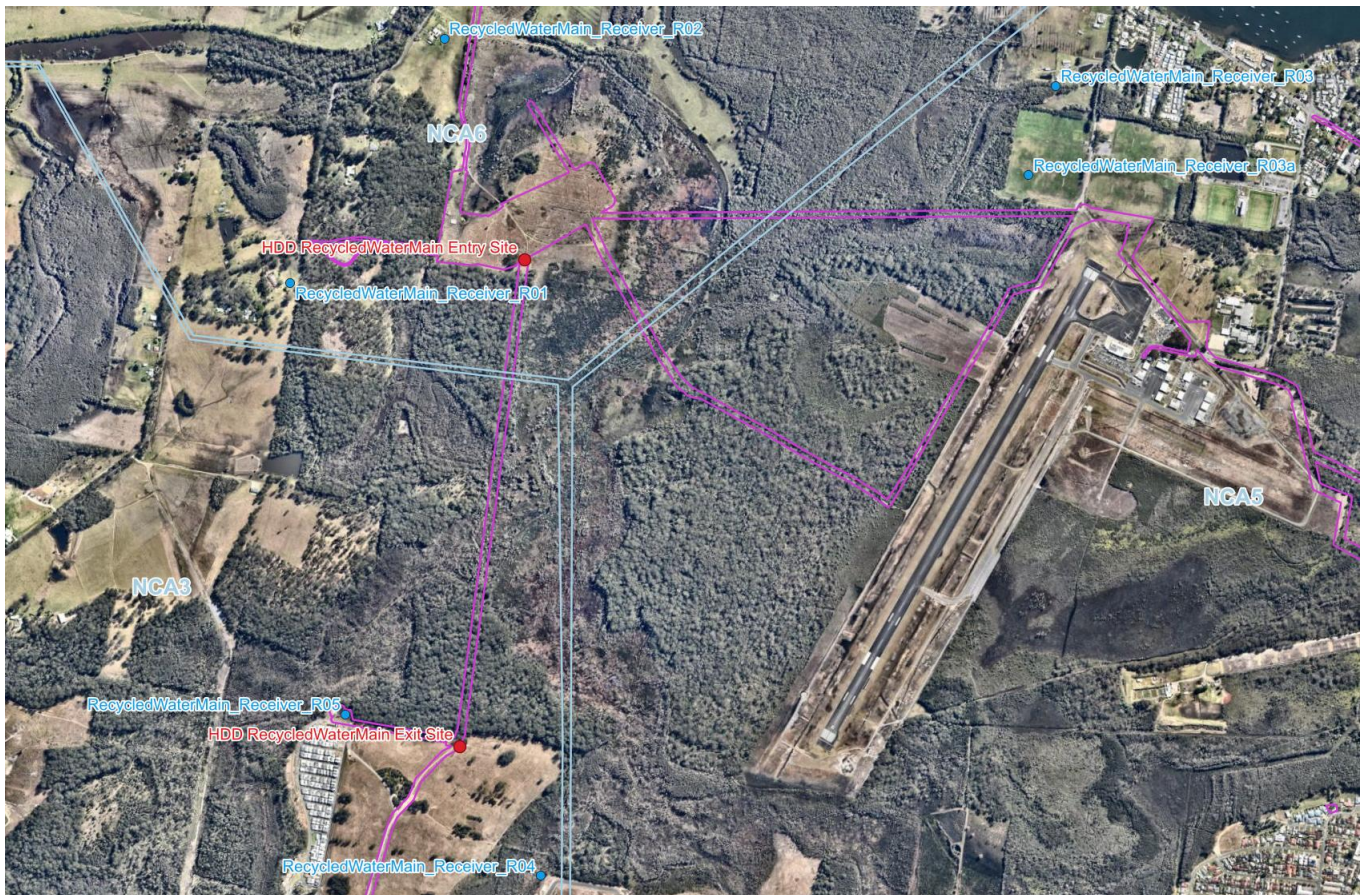


Figure 3.2 Identified sensitive receivers for Recycled Water Main HDD (Aerial: Nearmaps – taken 28/10/25)



Figure 3.3 Identified sensitive receivers for Acacia Avenue HDD (Aerial: Nearmaps – taken 28/10/25)



Figure 3.4 Identified sensitive receivers for Oxley Highway HDD (Aerial: Nearmaps – taken 28/10/25)



Figure 3.5 Identified sensitive receivers for Oxley Highway Micro Tunnelling (Aerial: Nearmaps – taken 28/10/25)



Figure 3.6 Identified sensitive receivers for Wrights Road Micro Tunnelling (Aerial: Nearmaps – taken 28/10/25)

4. Assessment of potential noise impacts

The noise impact associated with the trenchless pipe installation for the Thrumster Wastewater Scheme has been assessed quantitatively in line with ICNG (DECC NSW).

There are multiple places that require trenchless pipe installation. The trenchless pipe installation locations are:

- Partridge Creek HDD
- Recycled Water Main HDD
- Acacia Avenue HDD
- Oxley Highway HDD
- Oxley Highway Micro Tunnelling
- Wrights Road Micro Tunnelling

It is assumed that the trenchless pipe installations will not run simultaneously across the different sites and therefore each one has been assessed separately as detailed in this section.

4.1 Location and timing

The location of the trenchless pipe installations relative to the Thrumster Wastewater scheme is shown in Figure 4.1

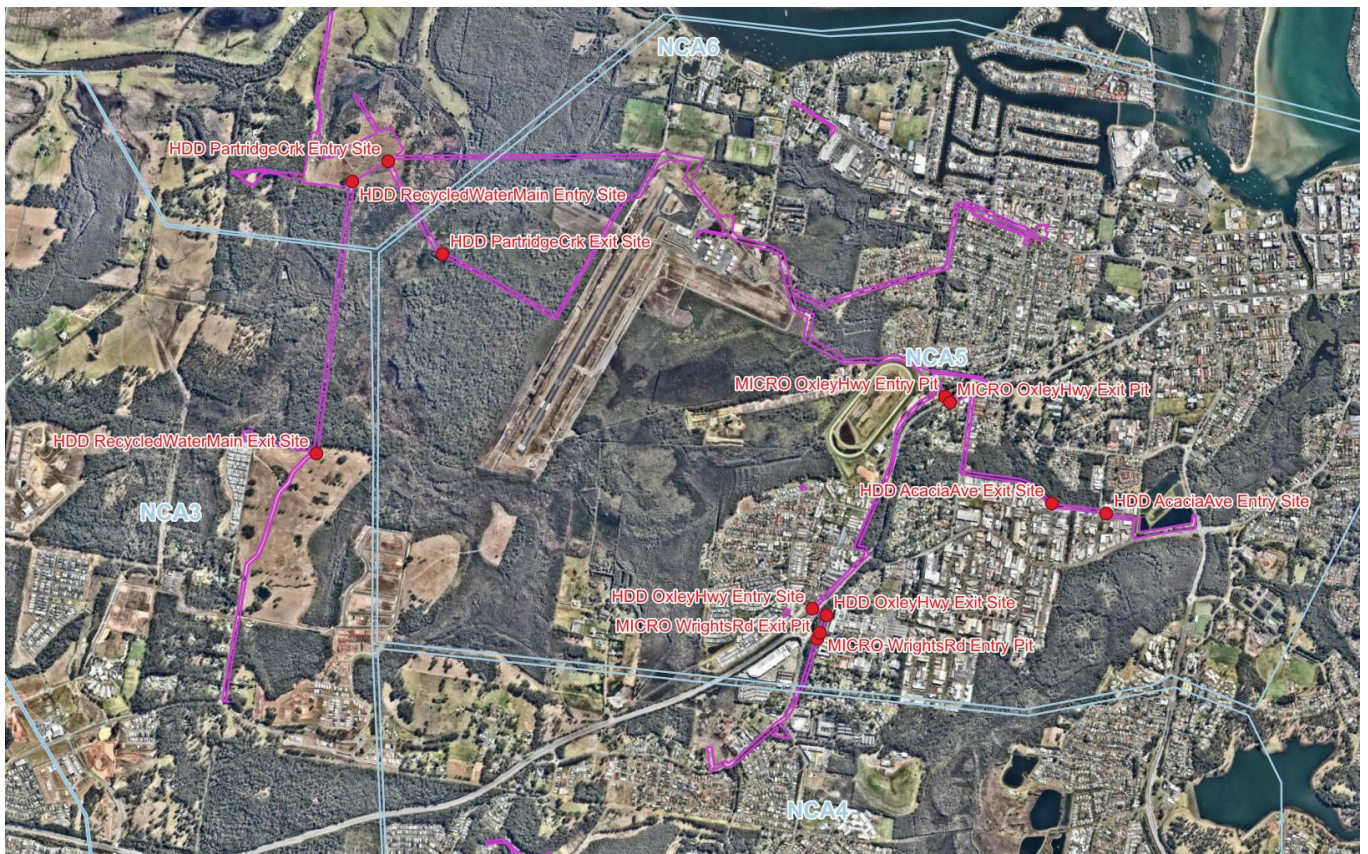


Figure 4.1 Overview of trenchless pipe installations (Aerial: Nearmaps – taken 28/10/25)

4.1.1 Partridge Creek HDD

The location of the HDD operations for the Partridge Creek, including an anticipated layout of the equipment is shown in Figure 4.2 and Figure 4.3. The anticipated construction stages and their durations are shown in Table 4.1.

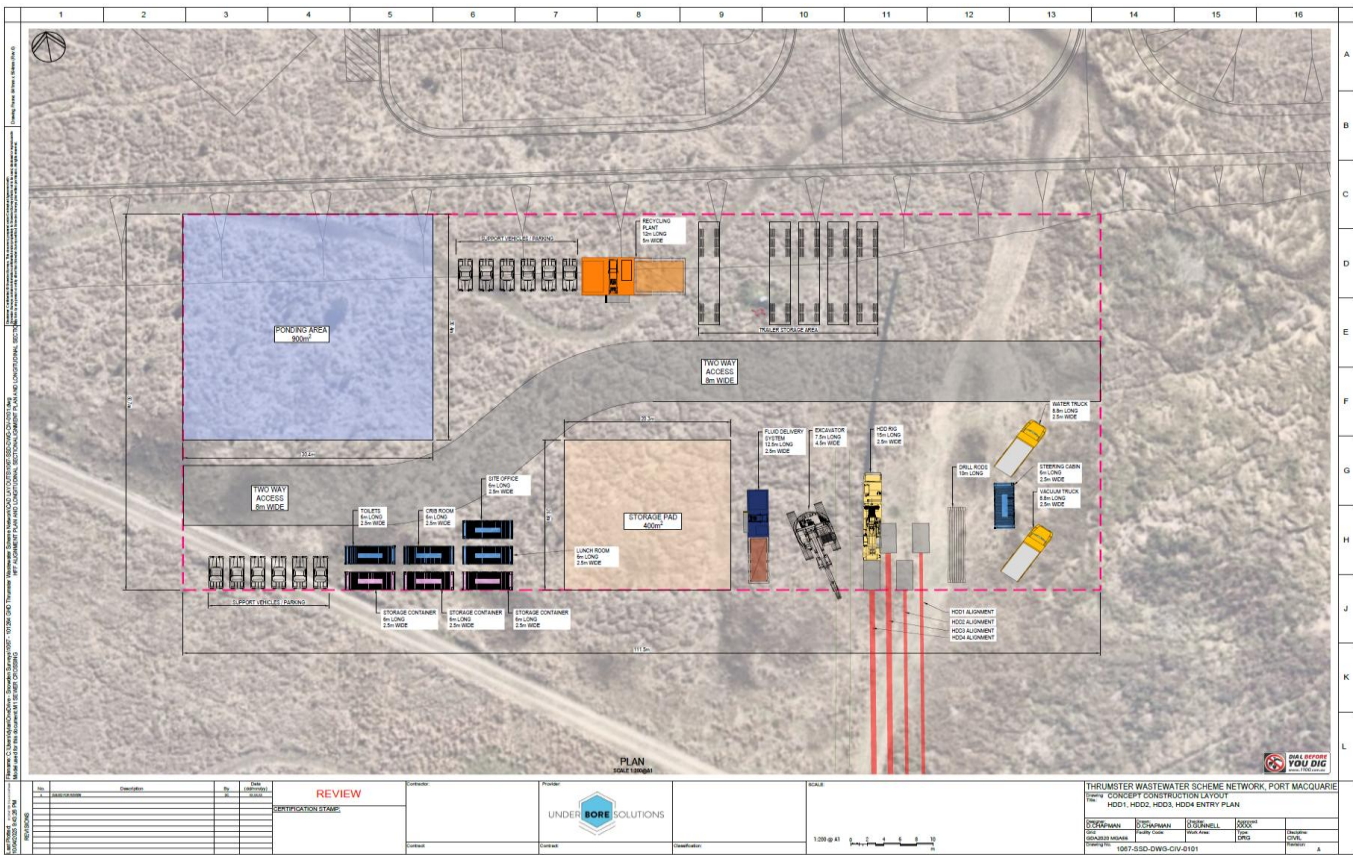


Figure 4.2 Anticipated Partridge Creek HDD Entry Site Location and Layout (Underbore Solutions, 2025)

4.1.2 Recycled Water Main HDD

The location of the HDD operations for Recycled Water Main, including an anticipated layout of the equipment is shown in Figure 4.4 and Figure 4.5. The anticipated construction stages and their durations are shown in Table 4.2.

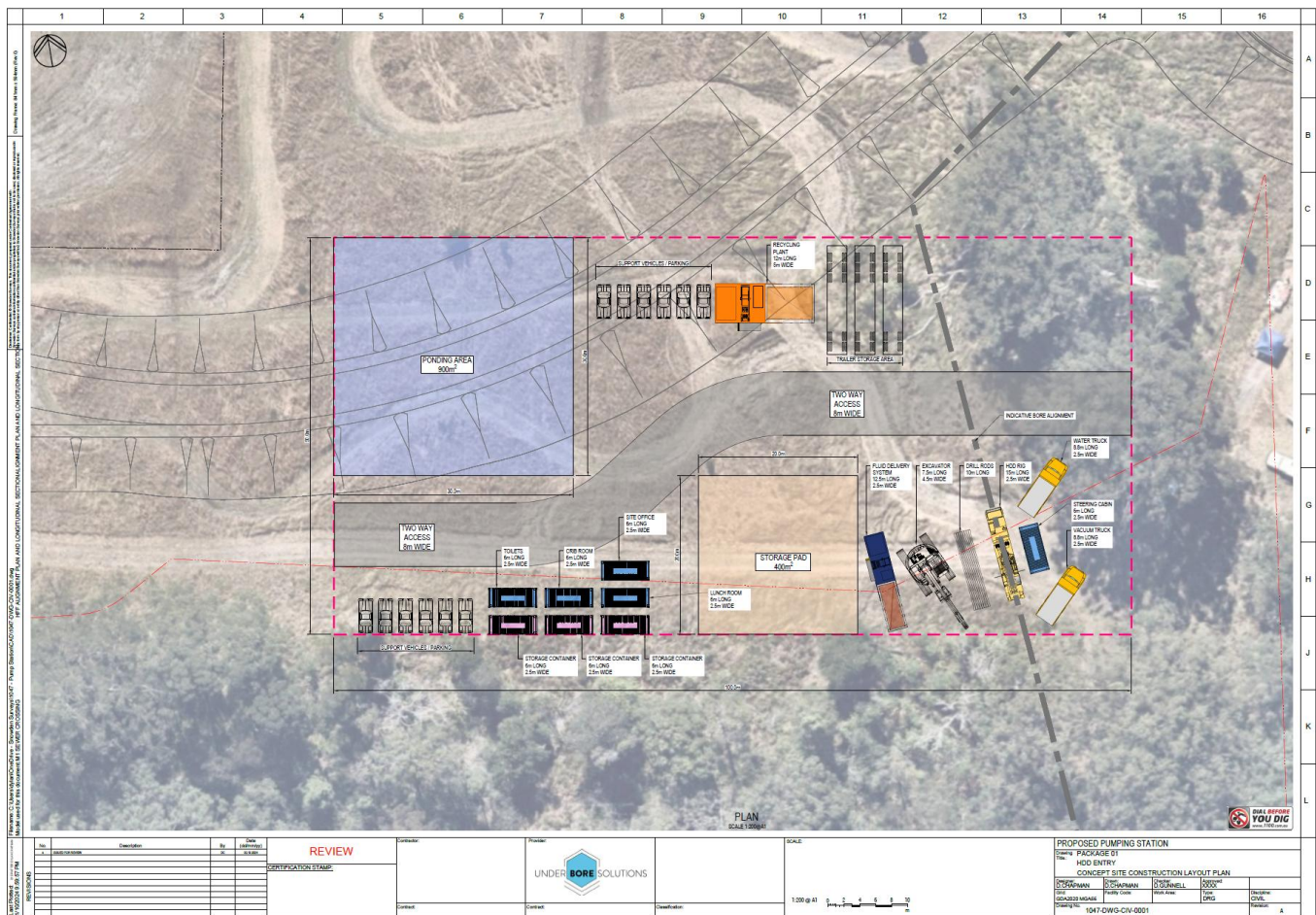


Figure 4.4 Anticipated Recycled Water Main HDD Entry Site Location and Layout (Underbore Solutions, 2025)

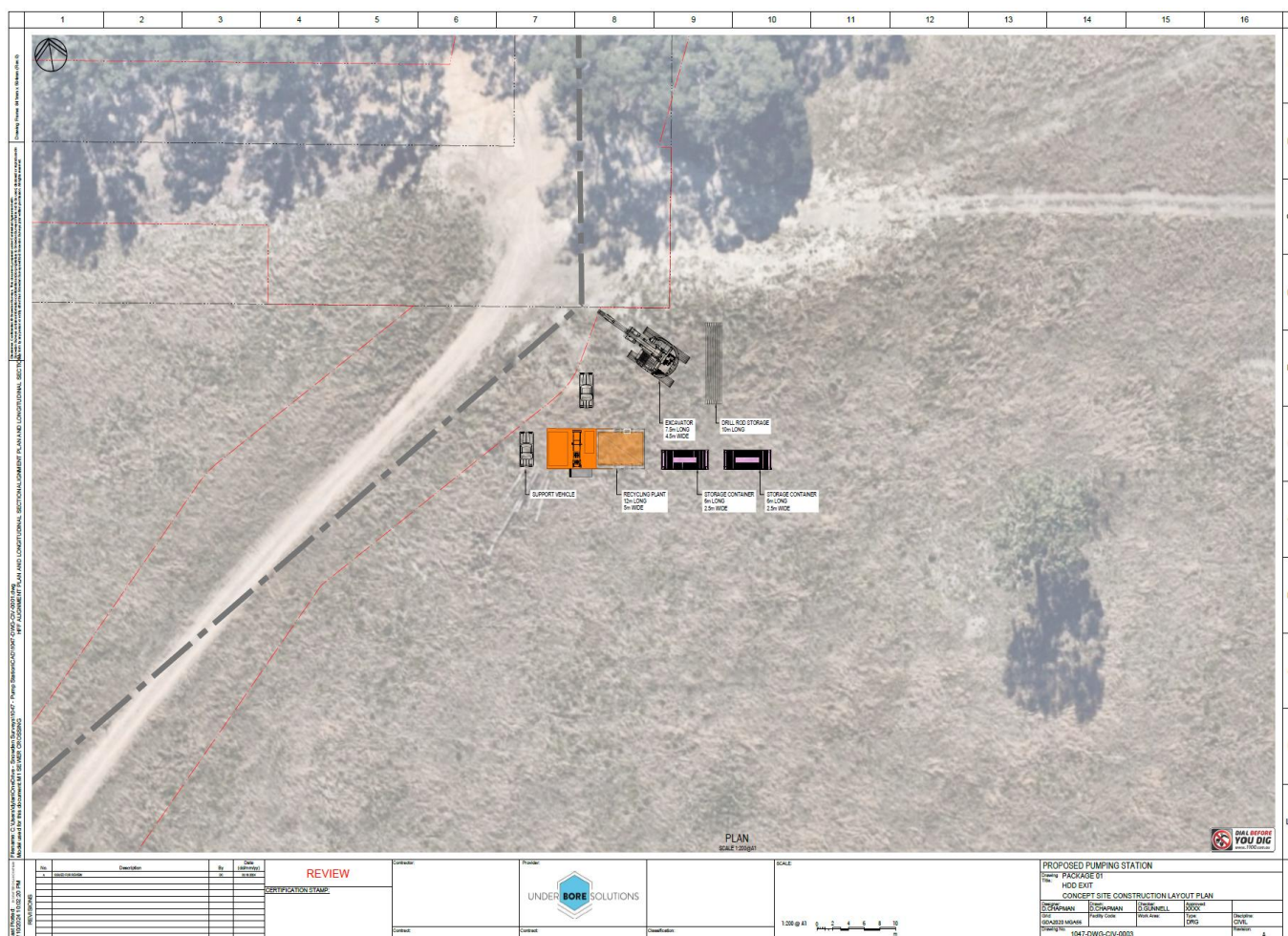


Figure 4.5 Anticipated Recycled Water Main HDD Exit Site Location and Layout (Underbore Solutions, 2025)

Table 4.2 Recycled Water Main HDD duration/timing

Underboring stage	Anticipated duration	Comments
Casing installation	16 days	Standard construction hours only
Pilot	32 days	Standard construction hours only
Reaming	130 days	Standard construction hours only
Pipe installation	10 days	24 hour operations

4.1.3 Acacia Avenue HDD

The location of the HDD operations for Acacia Avenue, including an anticipated layout of the equipment is shown in Figure 4.6 and Figure 4.7. The anticipated construction stages and their durations are shown in Table 4.3.

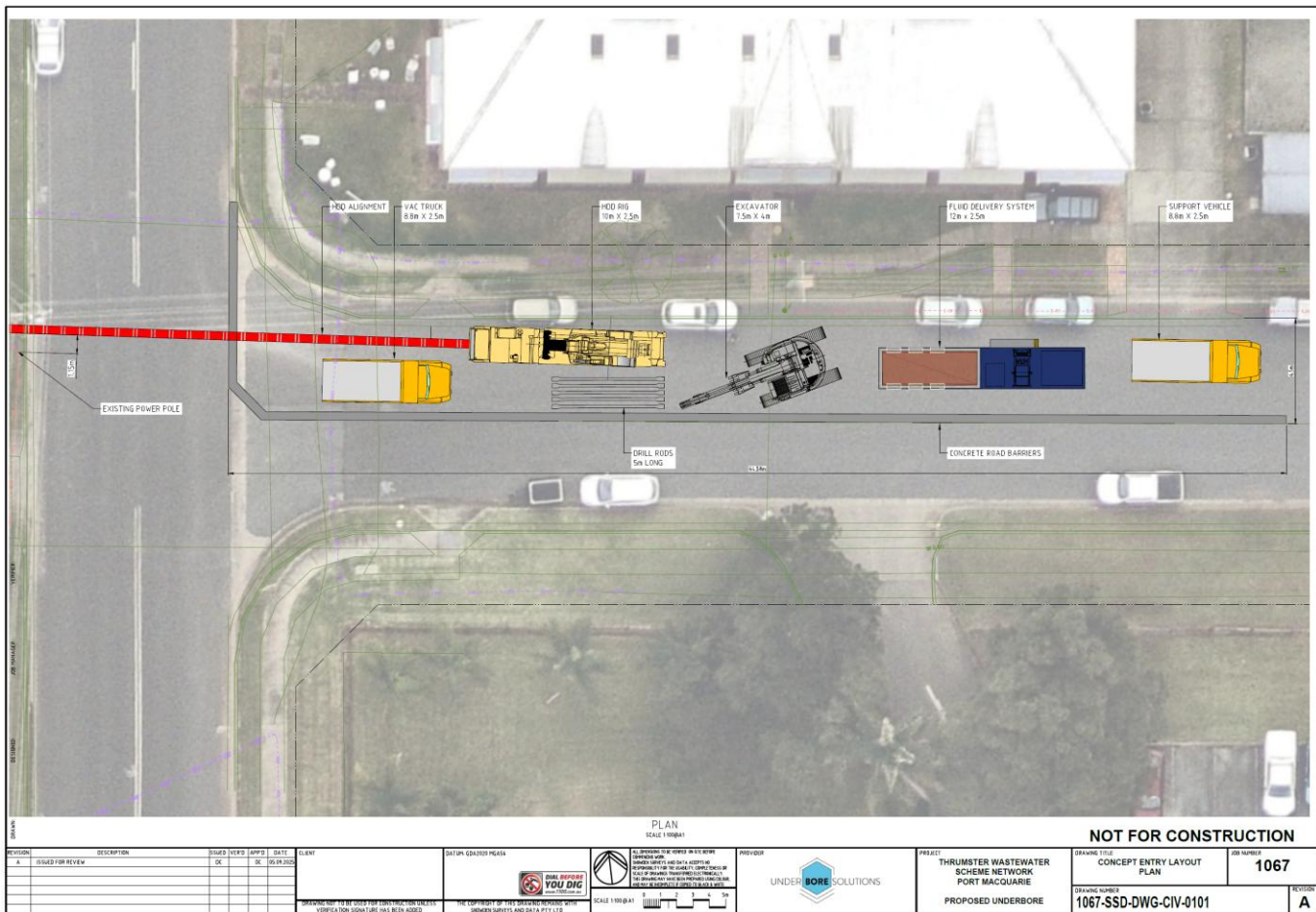


Figure 4.6 Anticipated Acacia Avenue HDD Entry Site Location and Layout (Underbore Solutions, 2025)

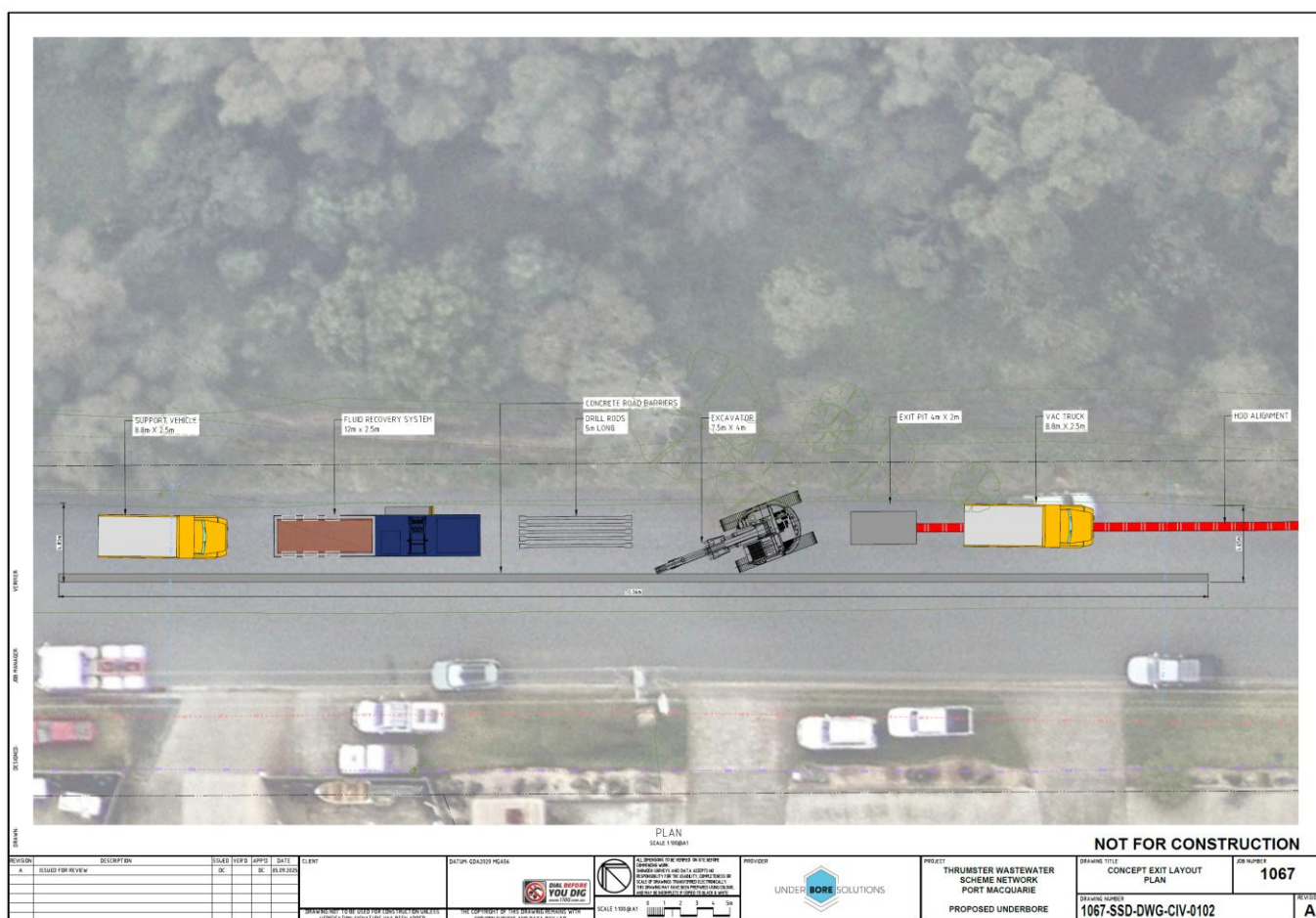


Figure 4.7 Anticipated Acacia Avenue HDD Exit Site Location and Layout (Underbore Solutions, 2025)

Table 4.3 Acacia Avenue HDD duration/timing

Underboring stage	Anticipated duration	Comments
Pilot	6 days	Standard construction hours only
Reaming	20 days	Standard construction hours only
Pipe installation	1 day	Standard construction hours only

4.1.4 Oxley Highway HDD

The location of the HDD operations for Oxley Highway, including an anticipated layout of the equipment is shown in Figure 4.8 and Figure 4.9. The anticipated construction stages and their durations are shown in Table 4.4.

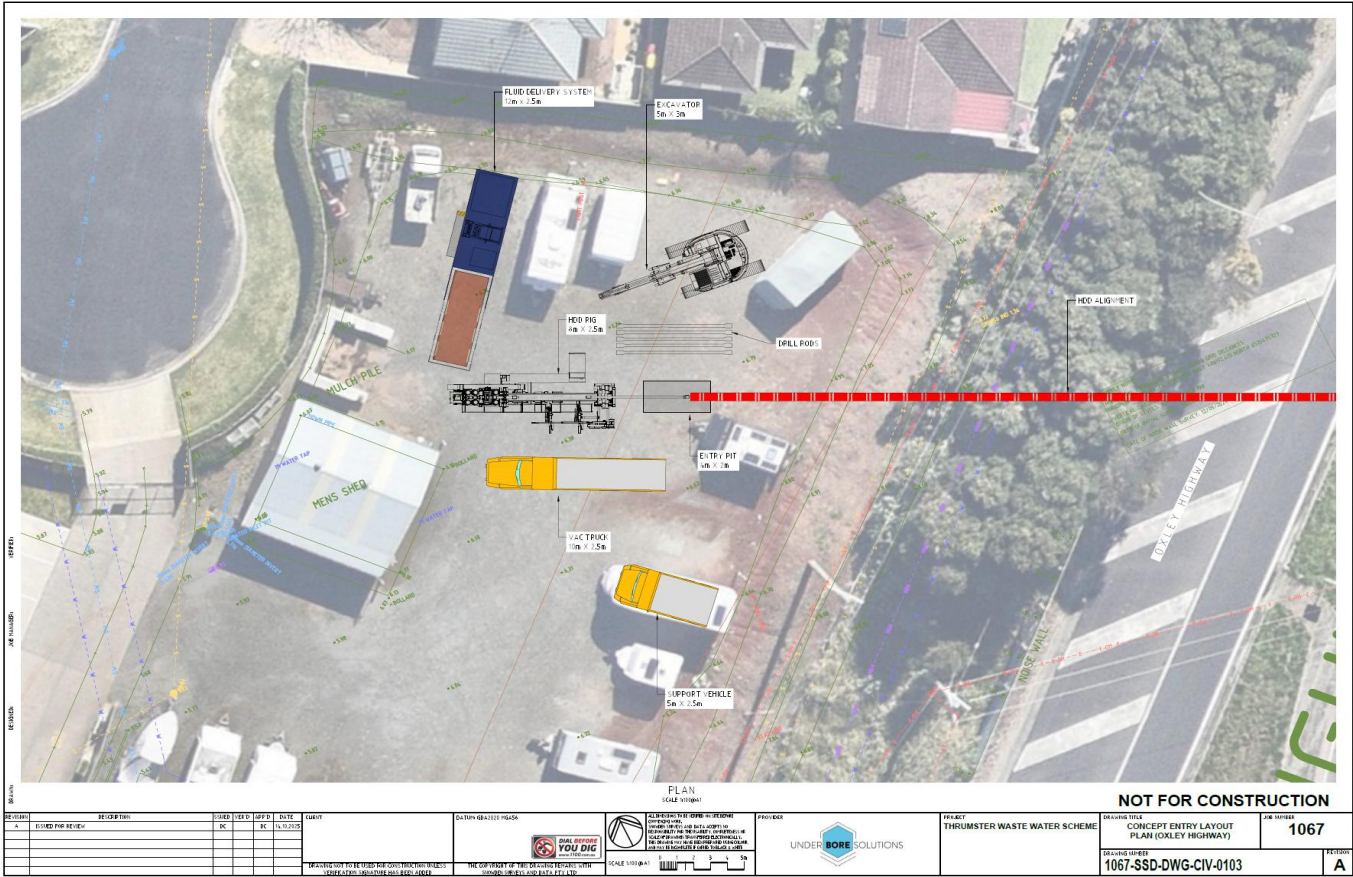


Figure 4.8 Anticipated Oxley Highway HDD Entry Site Location and Layout (Underbore Solutions, 2025)

4.1.5 Oxley Highway Micro Tunnelling

The location of the Micro Tunnelling operations for Oxley Highway, including an anticipated layout of the equipment is shown in Figure 4.10. The anticipated construction stages and their durations are shown in Table 4.5.

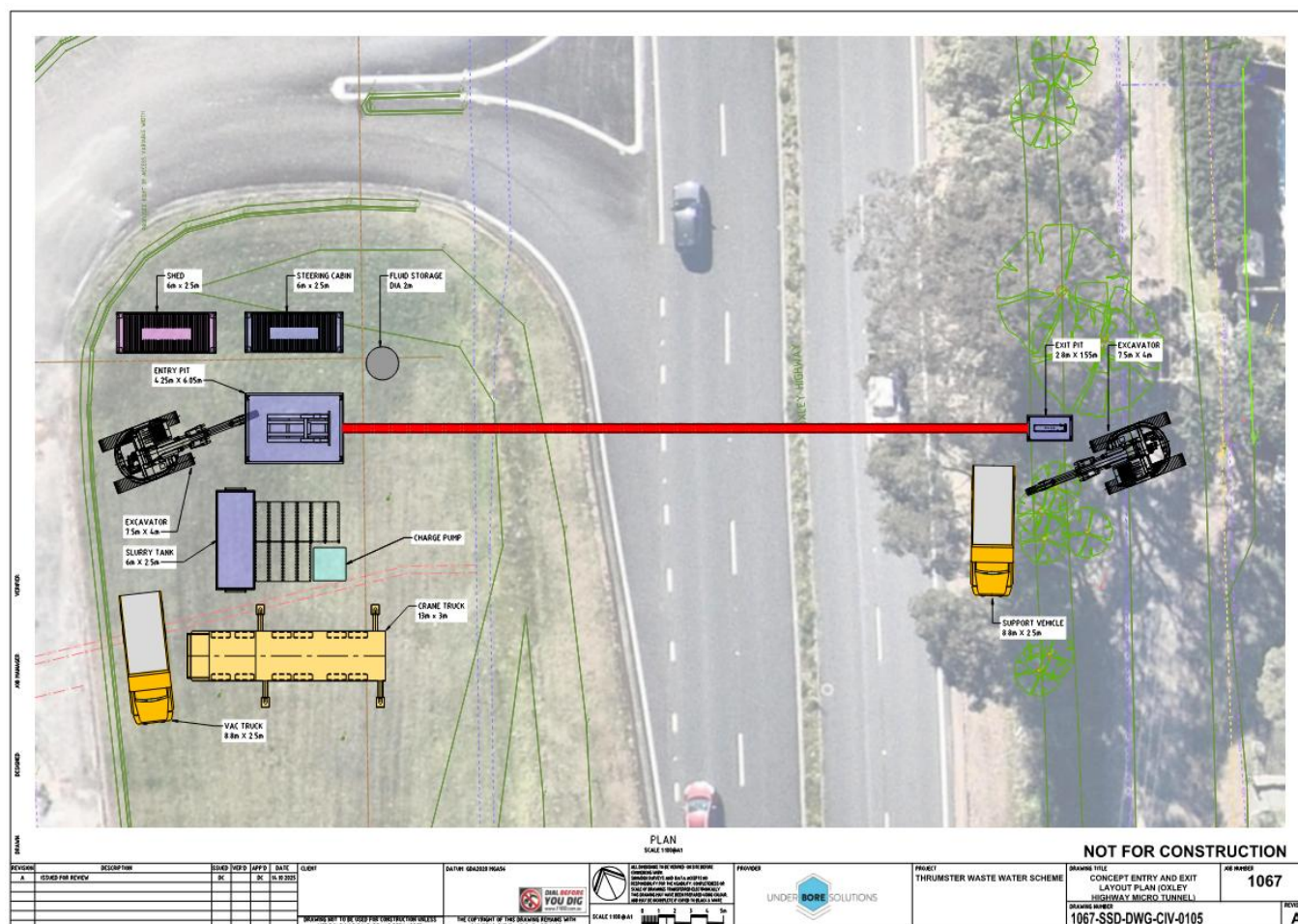


Figure 4.10 Anticipated Oxley Highway Micro Tunnelling Site Location and Layout (Underbore Solutions, 2025)

Table 4.5 Oxley Highway Micro Tunnelling duration/timing

Underboring stage	Anticipated duration	Comments
Pit Digging	3-4 days	Standard construction hours only
Micro Tunnelling	3-4 days	Standard construction hours only
Pipe Installation	2 days	Standard construction hours only
Grouting/Tidying	2 days	Standard construction hours only

4.1.6 Wrights Road Micro Tunnelling

The location of the Micro Tunnelling operations for Wrights Road, including an anticipated layout of the equipment is shown in Figure 4.11. The anticipated construction stages and their durations are shown in Table 4.6.

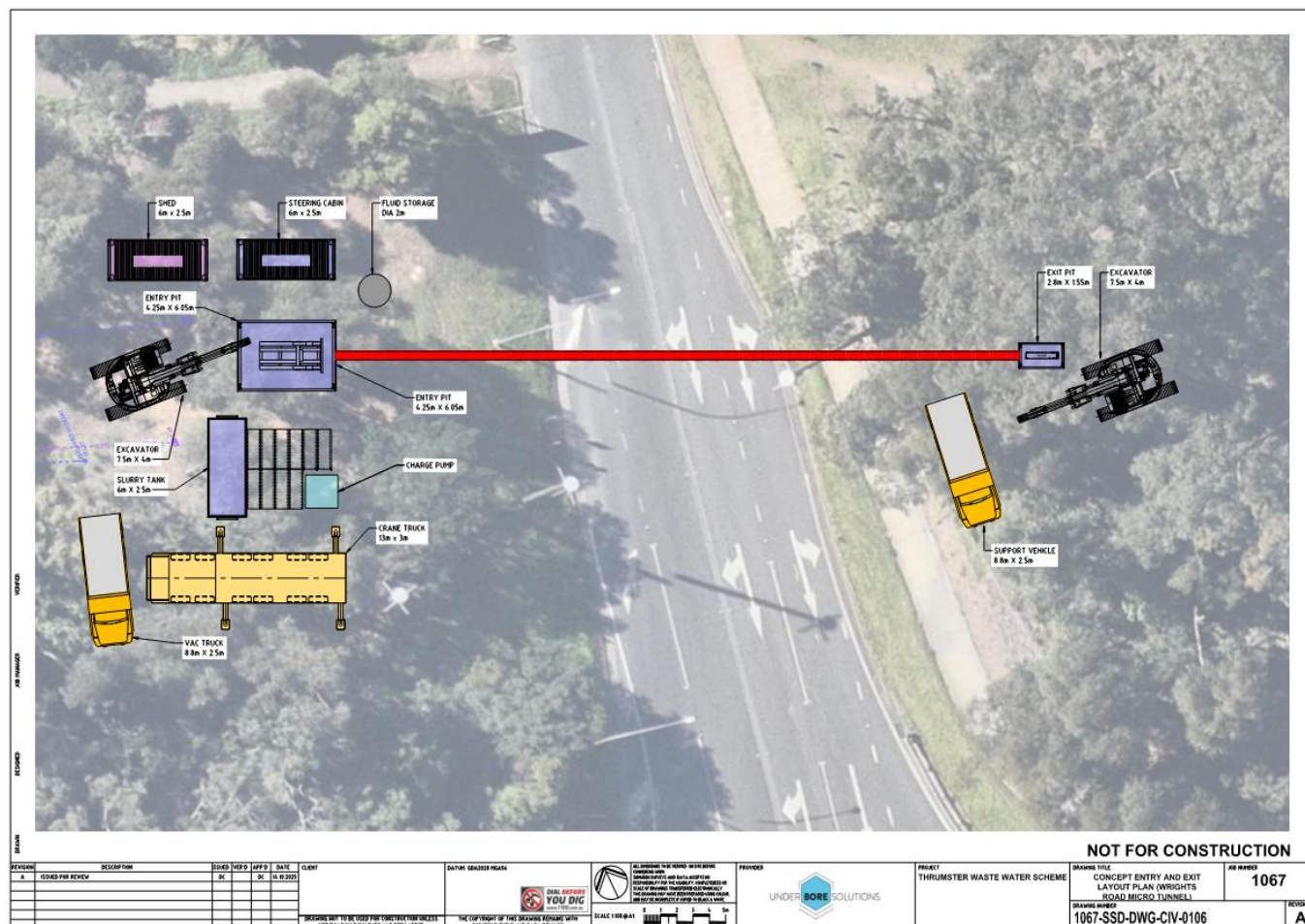


Figure 4.11 Anticipated Wrights Road Micro Tunnelling Site Location and Layout (Underbore Solutions, 2025)

Table 4.6 Wrights Road Micro Tunnelling duration/timing

Underboring stage	Anticipated duration	Comments
Pit Digging	3-4 days	Standard construction hours only
Micro Tunnelling	3-4 days	Standard construction hours only
Pipe Installation	2 days	Standard construction hours only
Grouting/Tidying	2 days	Standard construction hours only

4.2 Equipment

The equipment anticipated to be used for each scenario is summarised in Table 4.7. Refer to Figure 4.2 to Figure 4.11 for anticipated equipment layout for each site.

Table 4.7 Construction equipment sound power levels and heights

Equipment	Sound Power Level ¹ (dBA)	Source height (m)
Horizontal Directional Drilling		
Drill Rig	106	2
Drill Rig - Casing installation	115	2
Power Pack	103	2
Generator	103	2
Recycling Plant	102	1
Mud Pump	109	1
Vacuum Truck/Mud Removal Truck	103	1.5
Tracked Excavator	110	2
Light Truck	103	1
Light Vehicles	85	1
Micro Tunnelling		
Tracked Excavator	110	2
Vacuum Truck/Mud Removal Truck	103	1.5
Slurry Pump	109	1
Generator	103	2
Tunnelling Support Rig	106	2
Light Vehicles	85	1

¹ Equipment sound power levels are based on data provided for equipment in representative activities.

4.3 Scenarios

To provide a more detailed understanding of the potential noise impacts, the noise assessment has broken down each trenchless pipe installation site into the different stages based on the requirements of that site.

4.3.1 Partridge Creek HDD

The equipment anticipated to be used for each stage of the Partridge Creek HDD is shown in Table 4.8.

Table 4.8 Partridge Creek HDD stages and associated equipment

Equipment	Scenarios/HDD stages			
	Casing Installation	Mud Return / Pilot	Reaming	Pipe Installation
Entry Site				
Drill rig	YES	YES	YES	YES
Power pack	YES	YES	YES	YES
Generator	YES	YES	YES	YES
Recycling plant	YES	YES	YES	YES
Mud pump	NO	YES	YES	YES
Vacuum truck	NO	YES	YES	YES

Equipment	Scenarios/HDD stages			
	Casing Installation	Mud Return / Pilot	Reaming	Pipe Installation
Track excavator	YES	YES	YES	YES
Light trucks ¹	YES	YES	YES	YES
Light vehicles ²	YES	YES	YES	YES
Exit Site				
Drill rig	NO	NO	YES	NO
Generator	NO	NO	YES	NO
Recycling plant	NO	NO	YES	YES
Mud pump	NO	NO	YES	YES
Vacuum truck	NO	NO	YES	YES
Track excavator	NO	NO	YES	YES
Light truck ¹	NO	YES	YES	YES
Light vehicles ²	NO	YES	YES	YES

¹ One (1) truck movement in a 15 minute period.

² One (1) light vehicle movement in a 15 minute period.

4.3.2 Recycled Water Main HDD

The equipment anticipated to be used for each stage of the Recycled Water Main HDD is shown in Table 4.9.

Table 4.9 Recycled Water Main HDD stages and associated equipment

Equipment	Scenarios/HDD stages			
	Casing Installation	Mud Return / Pilot	Reaming	Pipe Installation
Entry Site				
Drill rig	YES	YES	YES	YES
Power pack	YES	YES	YES	YES
Generator	YES	YES	YES	YES
Recycling plant	YES	YES	YES	YES
Mud pump	NO	YES	YES	YES
Vacuum truck	NO	YES	YES	YES
Track excavator	YES	YES	YES	YES
Light truck ¹	YES	YES	YES	YES
Light vehicles ²	YES	YES	YES	YES
Exit Site				
Drill rig	NO	YES	YES	NO
Power pack	YES	YES	YES	YES
Generator	YES	YES	YES	YES
Recycling plant	NO	YES	YES	YES
Mud pump	NO	NO	YES	YES
Vacuum truck	YES	NO	YES	YES
Track excavator	YES	YES	YES	YES
Light truck ¹	YES	YES	YES	YES
Light vehicles ²	YES	YES	YES	YES

¹ One (1) truck movement in a 15 minute period.

² One (1) light vehicle movement in a 15 minute period.

4.3.3 Acacia Avenue HDD

The equipment anticipated to be used for each stage of the Acacia Avenue HDD is shown in Table 4.10.

Table 4.10 Acacia Avenue HDD stages and associated equipment

Equipment	Scenarios/HDD stages		
	Mud Return / Pilot	Reaming	Pipe Installation
Entry Site			
Drill rig	YES	YES	YES
Generator	YES	YES	YES
Power pack	NO	NO	NO
Recycling plant	YES	YES	NO
Vacuum truck	YES	YES	NO
Track excavator	YES	YES	NO
Light truck ¹	YES	YES	YES
Light vehicles ²	YES	YES	YES
Exit Site			
Drill rig	NO	YES	NO
Recycling plant	NO	YES	NO
Vacuum truck	YES	YES	NO
Track excavator	NO	YES	YES
Light truck ¹	YES	YES	YES
Light vehicles ²	YES	YES	YES

¹ One (1) truck movement in a 15 minute period.

² One (1) light vehicle movement in a 15 minute period.

4.3.4 Oxley Highway HDD

The equipment anticipated to be used for each stage of the Oxley Highway HDD is shown in Table 4.11.

Table 4.11 Oxley Highway HDD stages and associated equipment

Equipment	Scenarios/HDD stages		
	Mud Return / Pilot	Reaming	Pipe Installation
Entry Site			
Drill rig	YES	YES	YES
Generator	YES	YES	YES
Power pack	NO	NO	NO
Recycling plant	YES	YES	NO
Mud pump	YES	YES	NO
Vacuum truck	YES	YES	NO
Track excavator	YES	YES	NO
Light truck ¹	YES	YES	YES
Light vehicles ²	YES	YES	YES
Exit Site			
Recycling plant	NO	YES	NO
Vacuum truck	YES	YES	NO
Track excavator	NO	YES	YES
Light truck ¹	YES	YES	YES
Light vehicles ²	YES	YES	YES

¹ One (1) truck movement in a 15 minute period.

² One (1) light vehicle movement in a 15 minute period.

4.3.5 Oxley Highway Micro Tunnelling

The equipment anticipated to be used for each stage of the Oxley Highway micro tunnelling is shown in Table 4.12.

Table 4.12 Oxley Highway micro tunnelling stages and associated equipment

Equipment	Scenarios/Micro tunnelling stages			
	Casing Installation	Mud Return / Pilot	Reaming	Pipe Installation
Entry Pit				
Tracked excavator	YES	YES	YES	YES
Vacuum truck	YES	YES	YES	YES
Slurry pump	YES	YES	YES	YES
Generator	YES	YES	YES	YES
Tunnelling support rig	NO	YES	YES	NO
Light vehicle ¹	YES	YES	YES	YES
Exit Pit				
Tracked excavator	YES	YES	YES	YES
Light vehicle ¹	YES	YES	YES	YES

¹ One (1) light vehicle movement in a 15 minute period.

4.3.6 Wrights Road Micro Tunnelling

The equipment anticipated to be used for each stage of the Wright Road micro tunnelling is shown in Table 4.13.

Table 4.13 Wrights Road micro tunnelling stages and associated equipment

Equipment	Scenarios/Micro tunnelling stages			
	Casing Installation	Mud Return / Pilot	Reaming	Pipe Installation
Entry Pit				
Tracked excavator	YES	YES	YES	YES
Vacuum truck	YES	YES	YES	YES
Slurry pump	YES	YES	YES	YES
Generator	YES	YES	YES	YES
Tunnelling support rig	NO	YES	YES	NO
Light vehicle ¹	YES	YES	YES	YES
Exit Pit				
Tracked excavator	YES	YES	YES	YES
Light vehicle ¹	YES	YES	YES	YES

¹ One (1) light vehicle movement in a 15 minute period.

4.4 Predicted noise impact

Prediction of the construction noise impact to nearby noise sensitive receptors has been performed using SoundPLAN version 9.1. SoundPLAN is a computer program for the calculation, assessment and prognosis of noise propagation. Computer modelling has been undertaken according to the ISO 9613-2 (2024), Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation prediction algorithm, as implemented in SoundPLAN software. The noise model predicts sound pressure levels under meteorological conditions favourable to noise propagation (moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions) from sources of known sound emission.

The predicted values presented in this section are based on the assumptions that:

- There is no physical barriers (e.g. fences) between the underbore site and the nearest noise sensitive premises.
- The construction equipment will be operating continuously at full capacity for the full 15-minute evaluation period which is very unlikely in the actual construction site and represent typical worst case.
- A +5 dB adjustment is included in the results to account for annoying characteristics such as tonality, low frequency and intermittency.

Table 4.14 Partridge Creek HDD – Casing install results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	43	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	46	No Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	38	Yes Yes
Partridge_Receiver_R03a	65 (external)	40	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes

Table 4.15 Partridge Creek HDD – Pilot results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	40	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	44	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	35	Yes Yes
Partridge_Receiver_R03a	65 (external)	37	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes

Table 4.16 Partridge Creek HDD – Reaming results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	41	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	44	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes
Partridge_Receiver_R03a	65 (external)	39	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	36	Yes Yes

Table 4.17 Partridge Creek HDD – Pipe Installation results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results ¹ dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	40	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	44	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	36	Yes Yes

Receiver ID	Criteria dB LAeq (15min)	Results ¹ dB LAeq (15min)	Compliance
Partridge_Receiver_R03a	65 (external)	38	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	35	Yes Yes

Table 4.18 Partridge Creek HDD – Pipe Installation results – Outside standard construction hours

Receiver ID	Criteria ¹ dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Partridge_Receiver_R01	37	40	No
Partridge_Receiver_R02	37	44	No
Partridge_Receiver_R03	39	36	Yes
Partridge_Receiver_R03a	65	38	Yes
Partridge_Receiver_R04	41	35	Yes

¹ Criteria is based on night time period as it is the more stringent criteria.

Table 4.19 Partridge Creek HDD – Pipe Installation results – Sleep disturbance

Receiver ID	Criteria ¹ dB LAeq (15min)	Results ² dB LAeq (15min)	Compliance
Partridge_Receiver_R01	LAeq(15min) 45 LAFmax 52	40	Yes
Partridge_Receiver_R02	LAeq(15min) 45 LAFmax 52	44	Yes
Partridge_Receiver_R03	LAeq(15min) 45 LAFmax 52	36	Yes
Partridge_Receiver_R03a	N/A	38	N/A
Partridge_Receiver_R04	LAeq(15min) 45 LAFmax 52	35	Yes

¹ Criteria is based on night time period as it is the more stringent criteria.

² Pipe installation activity has been assumed to be relatively steady state and the L_{max} noise levels will be similar to the LAeq.

Table 4.20 Recycled Water Main HDD – Casing install results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	48	No Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	47	No Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	38	Yes
RecycledWaterMain_Receiver_R04	75 (external)	51	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	54	No Yes

Table 4.21 Recycled Water Main HDD – Pilot results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R04	75 (external)	47	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	50	No Yes

Table 4.22 Recycled Water Main HDD – Reaming results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes
RecycledWaterMain_Receiver_R04	75 (external)	48	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	51	No Yes

Table 4.23 Recycled Water Main HDD – Pipe Installation results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results ² dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes
RecycledWaterMain_Receiver_R04	75 (external)	48	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	51	No Yes

Table 4.24 Recycled Water Main HDD – Pipe Installation results – Outside standard construction hours

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	37	45	No
RecycledWaterMain_Receiver_R02	37	45	No
RecycledWaterMain_Receiver_R03	39	34	Yes
RecycledWaterMain_Receiver_R03a	65	35	Yes
RecycledWaterMain_Receiver_R04	75	48	Yes
RecycledWaterMain_Receiver_R05	41	51	No

¹ Criteria is based on night time period as it is the more stringent criteria.

Table 4.25 Recycled Water Main HDD – Pipe Installation results – Sleep disturbance

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results ² dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	L _{Aeq} (15min) 45 L _{AFmax} 52	45	Yes
RecycledWaterMain_Receiver_R02	L _{Aeq} (15min) 45 L _{AFmax} 52	45	Yes
RecycledWaterMain_Receiver_R03	L _{Aeq} (15min) 45 L _{AFmax} 52	34	Yes
RecycledWaterMain_Receiver_R03a	N/A	35	N/A
RecycledWaterMain_Receiver_R04	N/A	48	N/A
RecycledWaterMain_Receiver_R05	L _{Aeq} (15min) 45 L _{AFmax} 52	51	No

¹ Criteria is based on night time period as it is the more stringent criteria.

² Pipe installation activity has been assumed to be relatively steady state and the L_{max} noise levels will be similar to the L_{eq}.

Table 4.26 Acacia Avenue HDD – Pilot results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	89	No
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	62	No Yes
Acacia_Receiver_R03	75 (external)	82	No
Acacia_Receiver_R04	75 (external)	72	Yes
Acacia_Receiver_R05	75 (external)	55	Yes
Acacia_Receiver_R06	75 (external)	58	Yes
Acacia_Receiver_R07	75 (external)	57	Yes
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	57	No Yes

Table 4.27 Acacia Avenue HDD – Reaming results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	89	No
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	62	No Yes
Acacia_Receiver_R03	75 (external)	82	No
Acacia_Receiver_R04	75 (external)	72	Yes
Acacia_Receiver_R05	75 (external)	67	Yes
Acacia_Receiver_R06	75 (external)	82	No
Acacia_Receiver_R07	75 (external)	76	No
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	62	No Yes

Table 4.28 Acacia Avenue HDD – Pipe Installation results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	81	No
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	58	No Yes
Acacia_Receiver_R03	75 (external)	77	No
Acacia_Receiver_R04	75 (external)	68	Yes
Acacia_Receiver_R05	75 (external)	64	Yes

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Acacia_Receiver_R06	75 (external)	80	No
Acacia_Receiver_R07	75 (external)	74	Yes
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	60	No Yes

Table 4.29 Oxley Highway HDD – Pilot results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	85	No No
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	44	Yes Yes
OxleyHDD_Receiver_R03	55 (external)	62	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	61	No Yes
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	76	No No
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	75	No No

Table 4.30 Oxley Highway HDD – Reaming results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	85	No No
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	58	No Yes
OxleyHDD_Receiver_R03	55 (external)	74	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	76	No No
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	75	No No

Table 4.31 Oxley Highway HDD – Pipe Installation results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	77	No No
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	57	No Yes
OxleyHDD_Receiver_R03	55 (external)	73	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	62	No Yes
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes

Table 4.32 Oxley Highway Micro Tunnelling – Pit Digging results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R03	55 (external)	73	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	80	No No
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	79	No No

Table 4.33 Oxley Highway Micro Tunnelling – Micro Tunneling results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes
OxleyMicro_Receiver_R03	55 (external)	73	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	80	No No
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	79	No No

Table 4.34 Oxley Highway Micro Tunnelling – Pipe Installation results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes
OxleyMicro_Receiver_R03	55 (external)	73	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	80	No No
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	79	No No

Table 4.35 Oxley Highway Micro Tunnelling – Grouting/Tidying results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R03	55 (external)	73	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	80	No No
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	79	No No

Table 4.36 Wrights Road Micro Tunnelling – Pit Digging results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Wrights_Receiver_R01	55 (external)	77	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	77	No No
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	75	No Yes

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Wrights_Receiver_R04	70 (external) – when in use	68	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes

Table 4.37 *Wrights Road Micro Tunnelling – Micro Tunneling results – Standard construction hours*

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Wrights_Receiver_R01	55 (external)	78	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	78	No No
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	76	No No
Wrights_Receiver_R04	70 (external) – when in use	68	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes

Table 4.38 *Wrights Road Micro Tunnelling – Pipe Installation results – Standard construction hours*

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Wrights_Receiver_R01	55 (external)	78	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	78	No No
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	76	No No
Wrights_Receiver_R04	70 (external) – when in use	68	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes

Table 4.39 *Wrights Road Micro Tunnelling – Grouting/Tidying results – Standard construction hours*

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
Wrights_Receiver_R01	55 (external)	77	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	77	No No
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	75	No Yes
Wrights_Receiver_R04	70 (external) – when in use	68	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes

4.4.1 Summary

4.4.1.1 Partridge Creek HDD Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the ‘noise affected’ CNML at one of the representative residential receivers (Partridge_Receiver_R02) by 1 dB.
- Comply with the ‘highly noise affected’ CNML at all residential receivers during standard construction hours.
- The Pipe Installation stage of the Water Main HDD is the only stage that will require works outside of standard construction hours.
 - It is expected to exceed the ‘outside of standard construction hours’ CNML at two of the four representative residential receivers (Partridge_Receiver_R01 and Partridge_Receiver_R02)

- It is not predicted to cause sleep disturbance at any of the four representative residential receivers.
- Night time works is anticipated to operate for a maximum of two (2) consecutive nights and can potentially be managed with community engagement (refer to Section 5.3).

Noise mitigation and management measures should be considered where reasonable and feasible.

4.4.1.2 Recycled Water Main HDD Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the 'noise affected' CNML at three of the representative residential receivers (RecycledWaterMain_Receiver_R01, RecycledWaterMain_Receiver_R02 and RecycledWaterMain_Receiver_R05) by up to 5 dB.
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- The Pipe Installation stage is the only stage that will require works outside of standard construction hours.
 - It is expected to exceed the 'outside of standard construction hours' CNML at three of the four representative residential receivers (RecycledWaterMain_Receiver_R01, RecycledWaterMain_Receiver_R02 and RecycledWaterMain_Receiver_R05) by 8-10 dB.
 - It has a potential to cause sleep disturbance at one of the four representative residential receivers (RecycledWaterMain_Receiver_R05).
 - Night time works is anticipated to operate for a maximum of ten (10) consecutive nights. Temporary alternative accommodation for residents predicted to exceed the sleep disturbance criteria should be considered for the duration of the night time works, while other receptors can potentially be managed with community engagement (refer to Section 5.3).

Noise mitigation and management measures should be considered where reasonable and feasible.

4.4.1.3 Acacia Avenue HDD Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the 'noise affected' CNML at two of the representative residential receivers (Acacia_Receiver_R02 and Acacia_Receiver_R08).
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- Exceed the CNML for several of the industrial receivers (Acacia_Receiver_R01 and Acacia_Receiver_R03) for all stages of the underbore.

Noise mitigation and management measures should be considered where reasonable and feasible.

4.4.1.4 Oxley Highway HDD Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the 'noise affected' CNML and 'highly noise affected' CNML at three of the representative residential receivers (OxleyHDD_Receiver_R01, OxleyHDD_Receiver_R05 and OxleyHDD_Receiver_R06) during standard construction hours.
- Exceed the 'noise affected' CNML but comply with the 'highly noise affected' CNML at two of the representative residential receivers (Acacia_Receiver_R02 and Acacia_Receiver_R08) during standard construction hours.
- Exceed the CNML at the hospital for all stages (OxleyHDD_Receiver_R03) of the underbore.

Noise mitigation and management measures should be considered where reasonable and feasible.

4.4.1.5 Oxley Highway Micro Tunnelling Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the 'noise affected' CNML and 'highly noise affected' CNML at two of the representative residential receivers (OxleyMicro_Receiver_R04 and OxleyMicro_Receiver_R05) during standard construction hours.
- Exceed the 'noise affected' CNML but comply with the 'highly noise affected' CNML at two of the representative residential receivers (OxleyMicro_Receiver_R01 and OxleyMicro_Receiver_R02) during standard construction hours.
- Exceed the CNML at the childcare centre for all stages (OxleyMicro_Receiver_R03) of the underbore.

Noise mitigation and management measures should be considered where reasonable and feasible.

4.4.1.6 Wrights Road Micro Tunnelling Summary

Based on the noise model results shown above, the underbore activities are expected to:

- Exceed the 'noise affected' CNML and 'highly noise affected' CNML at two of the representative residential receivers (Wrights_Receiver_R02 and Wrights_Receiver_R03) during standard construction hours.
- Exceed the 'noise affected' CNML but comply with the 'highly noise affected' CNML at one of the representative residential receivers (Wrights_Receiver_R05) during standard construction hours.
- Exceed the CNML at the hospital for all stages (Wrights_Receiver_R01) of the underbore.
- Comply with the CNML at the commercial receptor for all stages (Wrights_Receiver_R04) of the underbore.

Noise mitigation and management measures should be considered where reasonable and feasible.

5. Noise mitigation and management measures

Although the majority of the underboring will take place during standard construction hours and will not exceed the 'highly noise affected' construction noise management level, it does exceed the 'noise affected' level, and therefore noise mitigation and management measures should be implemented where reasonable and feasible.

A Construction Noise and Vibration Management Plan (CNMVP) should be prepared prior to starting the underbore works and should include noise mitigation and management such as those covered in this section.

5.1 General noise mitigation and management measures

Construction noise impacts are predicted to exceed the 'noise affected' levels and therefore reasonable and feasible mitigation and management measures should be considered. Table 5.1 summarises mitigation and management measures that should be implemented.

Table 5.1 Construction mitigation and management measures

Action required	Mitigation measure
Staff training	All personnel working at the site would be made aware of their responsibilities in minimising noise and adhering to the specified work hours (i.e. 7:00 am to 6:00 pm Monday to Friday; 8:00 am to 4:00 pm Saturdays). When not in use, vehicles and machinery will be turned off. Where practical, machines will be operated at low speed or power. Haulage and delivery trucks to limit compression braking and heavy throttling in the area. They will be switched off during loading and unloading operations.
Equipment selection	Use quieter and less vibration emitting construction methods/equipment where reasonable and feasible. Minimise the use of tonal reversing beepers on mobile plant. It is recommended to use equipment installed with broadband reversing alarms instead. Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible.
Safe working distances	Place as much distance as possible between the plant or equipment and the receivers.
Community Engagement	Receivers up to 500 metres of the proposed works will be notified of the construction details of the project. This will occur at least two weeks prior to construction activities by letter box drop. Contact details for complaints and information will be provided. In the unlikely event that a noise or vibration complaint is received, it would be addressed within 24 hours. Complaints and response to complaints will be documented and documents kept for future reference.
Vehicle noise	Where practicable, ensure traffic movements, especially heavy vehicles, are limited to specified construction hours. Avoid the use of engine compression brakes where practicable. Advocate appropriate driver behaviour. Ensure the road surface is maintained to assist with minimising banging/bumping noise from vehicles as they travel to and from the site, particularly when they are unloaded. Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours. Avoid unnecessary vehicle movements in and out of the Entry and Exit Sites, especially for trucks.

For more information and other mitigation methods, see the ICNG (DECC - 2009) (Tables 4 – 10).

5.2 Temporary noise barriers

Due to the proximity of sensitive receivers and the overall duration of the works, it is recommended temporary noise barriers be installed around the Entry and Exit Sites of the underbore operations.

Noise modelling was conducted with a 3 m high temporary noise barrier positioned around the anticipated work site to investigate the noise reduction effectiveness and practicality of this mitigation measure. The barrier's alignment and height were selected to provide indicative insights into potential noise reductions achievable during underbore operations. Should this mitigation be implemented, the barrier design should be refined to suit site specific conditions. Detailed specifications including barrier alignment, height, and expected noise attenuation performance) should be included in any management plans (e.g. CNMP, CEMP, etc).

Noise contours of these results are included at the end of the report.

Table 5.2 *Partridge Creek HDD – Casing install with noise barrier results – Standard construction hours*

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	43	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	48	No Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	38	Yes Yes
Partridge_Receiver_R03a	65 (external)	39	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes

Table 5.3 *Partridge Creek HDD – Pilot with noise barrier results – Standard construction hours*

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	40	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	35	Yes Yes
Partridge_Receiver_R03a	65 (external)	36	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes

Table 5.4 *Partridge Creek HDD – Reaming with noise barrier results – Standard construction hours*

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	41	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes
Partridge_Receiver_R03a	65 (external)	39	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	36	Yes Yes

Table 5.5 Partridge Creek HDD – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	40	Yes Yes
Partridge_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
Partridge_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	36	Yes Yes
Partridge_Receiver_R03a	65 (external)	38	Yes
Partridge_Receiver_R04	49 (Noise Affected) 75 (Highly Noise Affected)	36	Yes Yes

Table 5.6 Partridge Creek HDD – Pipe Installation with noise barrier results – Outside standard construction hours

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	37	40	No
Partridge_Receiver_R02	37	45	No
Partridge_Receiver_R03	39	36	Yes
Partridge_Receiver_R03a	65	38	Yes
Partridge_Receiver_R04	41	36	Yes

¹ Criteria is based on night time period as it is the more stringent criteria.

Table 5.7 Partridge Creek HDD – Pipe Installation with noise barrier results – Sleep disturbance

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results ² dB L _{Aeq} (15min)	Compliance
Partridge_Receiver_R01	L _{Aeq} (15min) 45 L _{AFmax} 52	40	Yes
Partridge_Receiver_R02	L _{Aeq} (15min) 45 L _{AFmax} 52	45	Yes
Partridge_Receiver_R03	L _{Aeq} (15min) 45 L _{AFmax} 52	36	Yes
Partridge_Receiver_R03a	N/A	38	N/A
Partridge_Receiver_R04	L _{Aeq} (15min) 45 L _{AFmax} 52	36	Yes

¹ Pipe installation activity has been assumed to be relatively steady state and the L_{max} noise levels will be similar to the L_{eq}.

Table 5.8 Recycled Water Main HDD – Casing install with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	48	No Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	49	No Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	37	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	38	Yes
RecycledWaterMain_Receiver_R04	75 (external)	53	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	52	No Yes

Table 5.9 Recycled Water Main HDD – Pilot with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	46	No Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes
RecycledWaterMain_Receiver_R04	75 (external)	48	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	48	Yes Yes

Table 5.10 Recycled Water Main HDD – Reaming with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	46	No Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes
RecycledWaterMain_Receiver_R04	75 (external)	49	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	49	Yes Yes

Table 5.11 Recycled Water Main HDD – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	45 (Noise Affected) 75 (Highly Noise Affected)	45	Yes Yes
RecycledWaterMain_Receiver_R02	45 (Noise Affected) 75 (Highly Noise Affected)	46	No Yes
RecycledWaterMain_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	34	Yes Yes
RecycledWaterMain_Receiver_R03a	65 (external)	35	Yes
RecycledWaterMain_Receiver_R04	75 (external)	48	Yes
RecycledWaterMain_Receiver_R05	49 (Noise Affected) 75 (Highly Noise Affected)	48	Yes Yes

Table 5.12 Recycled Water Main HDD – Pipe Installation with noise barrier results – Outside standard construction hours

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	37	45	No
RecycledWaterMain_Receiver_R02	37	46	No
RecycledWaterMain_Receiver_R03	39	34	Yes

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R03a	65	35	Yes
RecycledWaterMain_Receiver_R04	65	48	Yes
RecycledWaterMain_Receiver_R05	41	48	No

¹ Criteria is based on night time period as it is the more stringent criteria.

Table 5.13 Recycled Water Main HDD – Pipe Installation with noise barrier results – Sleep disturbance

Receiver ID	Criteria ¹ dB L _{Aeq} (15min)	Results ² dB L _{Aeq} (15min)	Compliance
RecycledWaterMain_Receiver_R01	L _{Aeq} (15min) 45 L _{AFmax} 52	45	Yes
RecycledWaterMain_Receiver_R02	L _{Aeq} (15min) 45 L _{AFmax} 52	46	No
RecycledWaterMain_Receiver_R03	L _{Aeq} (15min) 45 L _{AFmax} 52	34	Yes
RecycledWaterMain_Receiver_R03a	N/A	35	N/A
RecycledWaterMain_Receiver_R04	N/A	48	N/A
RecycledWaterMain_Receiver_R05	L _{Aeq} (15min) 45 L _{AFmax} 54	48	No

¹ Pipe installation activity has been assumed to be relatively steady state and the L_{max} noise levels will be similar to the L_{eq}.

Table 5.14 Acacia Avenue HDD – Pilot with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	75	Yes
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	58	No Yes
Acacia_Receiver_R03	75 (external)	72	Yes
Acacia_Receiver_R04	75 (external)	66	Yes
Acacia_Receiver_R05	75 (external)	55	Yes
Acacia_Receiver_R06	75 (external)	51	Yes
Acacia_Receiver_R07	75 (external)	51	Yes
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	56	No Yes

Table 5.15 Acacia Avenue HDD – Reaming with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	75	Yes
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	58	No Yes
Acacia_Receiver_R03	75 (external)	72	Yes
Acacia_Receiver_R04	75 (external)	66	Yes
Acacia_Receiver_R05	75 (external)	63	Yes
Acacia_Receiver_R06	75 (external)	71	Yes
Acacia_Receiver_R07	75 (external)	68	Yes
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	58	No Yes

Table 5.16 Acacia Avenue HDD – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results ¹ dB L _{Aeq} (15min)	Compliance
Acacia_Receiver_R01	75 (external)	67	Yes
Acacia_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	54	No Yes
Acacia_Receiver_R03	75 (external)	67	Yes
Acacia_Receiver_R04	75 (external)	62	Yes
Acacia_Receiver_R05	75 (external)	61	Yes
Acacia_Receiver_R06	75 (external)	70	Yes
Acacia_Receiver_R07	75 (external)	67	Yes
Acacia_Receiver_R08	52 (Noise Affected) 75 (Highly Noise Affected)	55	No Yes

¹ Pipe installation activity has been assumed to be relatively steady state and the L_{max} noise levels will be similar to the L_{eq}.

Table 5.17 Oxley Highway HDD – Pilot with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	44	Yes Yes
OxleyHDD_Receiver_R03	55 (external)	56	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	56	No Yes
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	68	No Yes

Table 5.18 Oxley Highway HDD – Reaming with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	57	No Yes
OxleyHDD_Receiver_R03	55 (external)	65	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	57	No Yes
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	68	No Yes

Table 5.19 Oxley Highway HDD – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results ¹ dB L _{Aeq} (15min)	Compliance
OxleyHDD_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes
OxleyHDD_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	56	No Yes
OxleyHDD_Receiver_R03	55 (external)	65	No
OxleyHDD_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	53	No Yes

Receiver ID	Criteria dB LAeq (15min)	Results ¹ dB LAeq (15min)	Compliance
OxleyHDD_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	57	No Yes
OxleyHDD_Receiver_R06	52 (Noise Affected) 75 (Highly Noise Affected)	63	No Yes

Table 5.20 Oxley Highway Micro Tunnelling – Pit Digging with noise barrier results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	66	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes
OxleyMicro_Receiver_R03	55 (external)	65	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes

Table 5.21 Oxley Highway Micro Tunnelling – Micro Tunneling with noise barrier results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	66	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes
OxleyMicro_Receiver_R03	55 (external)	65	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes

Table 5.22 Oxley Highway Micro Tunnelling – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results ¹ dB LAeq (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	66	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes
OxleyMicro_Receiver_R03	55 (external)	65	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	70	No Yes

Table 5.23 Oxley Highway Micro Tunnelling – Grouting/Tidying with noise barrier results – Standard construction hours

Receiver ID	Criteria dB LAeq (15min)	Results dB LAeq (15min)	Compliance
OxleyMicro_Receiver_R01	52 (Noise Affected) 75 (Highly Noise Affected)	66	No Yes
OxleyMicro_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	64	No Yes
OxleyMicro_Receiver_R03	55 (external)	65	No
OxleyMicro_Receiver_R04	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes
OxleyMicro_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	69	No Yes

Table 5.24 Wrights Road Micro Tunnelling – Pit Digging with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Wrights_Receiver_R01	55 (external)	72	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	67	No Yes
Wrights_Receiver_R04	70 (external) – when in use	61	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	59	No Yes

Table 5.25 Wrights Road Micro Tunnelling – Micro Tunneling with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Wrights_Receiver_R01	55 (external)	73	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	72	No Yes
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	67	No Yes
Wrights_Receiver_R04	70 (external) – when in use	62	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	60	No Yes

Table 5.26 Wrights Road Micro Tunnelling – Pipe Installation with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results ¹ dB L _{Aeq} (15min)	Compliance
Wrights_Receiver_R01	55 (external)	73	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	72	No Yes
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	67	No Yes
Wrights_Receiver_R04	70 (external) – when in use	62	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	60	No Yes

Table 5.27 Wrights Road Micro Tunnelling – Grouting/Tidying with noise barrier results – Standard construction hours

Receiver ID	Criteria dB L _{Aeq} (15min)	Results dB L _{Aeq} (15min)	Compliance
Wrights_Receiver_R01	55 (external)	72	No
Wrights_Receiver_R02	52 (Noise Affected) 75 (Highly Noise Affected)	71	No Yes
Wrights_Receiver_R03	52 (Noise Affected) 75 (Highly Noise Affected)	67	No Yes
Wrights_Receiver_R04	70 (external) – when in use	61	Yes
Wrights_Receiver_R05	52 (Noise Affected) 75 (Highly Noise Affected)	59	No Yes

5.2.1 Summary

5.2.1.1 Partridge Creek HDD with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Comply with the 'noise affected' CNML at all representative residential receivers during standard construction hours, except for one of the representative residential receivers (Partridge_Receiver_R02) for the casing installation.
- Comply with the 'highly noise affected' CNML at all residential receivers for all HDD stages during standard construction hours.
- The Pipe Installation stage of the Partridge Creek HDD is the only stage that will require works outside of standard construction hours:
 - It is expected to exceed the 'outside of standard construction hours' CNML at two of the four representative residential receivers (Partridge_Receiver_R01 and Partridge_Receiver_R02).
 - It is predicted to comply with the sleep disturbance criteria at all representative residential receivers.
 - Night time works is anticipated to operate for a maximum of two (2) nights and can potentially be managed with community engagement (refer to Section 5.3).

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the 'noise affected' levels, it is nominally effective to reduce noise levels for some sensitive receivers (refer to Table 5.28), though also increases the noise levels at others.

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.28 Partridge Creek HDD – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
Partridge_Receiver_R01	0	The noise barrier modelled provides nominal shielding to receivers due to the distance of the barrier relative to the noise sources in the direction of the receivers. Practical design changes may increase effectiveness of temporary noise barrier (i.e. height, alignment).
Partridge_Receiver_R02	-1	
Partridge_Receiver_R03	0	
Partridge_Receiver_R03a	1	
Partridge_Receiver_R04	0	

5.2.1.2 Recycled Water Main HDD with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Exceed the 'noise affected' CNML at three of the representative residential receivers (RecycledWaterMain_Receiver_R01, RecycledWaterMain_Receiver_R02 and RecycledWaterMain_Receiver_R05) during standard construction hours
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- The Pipe Installation stage is the only stage that will require works outside of standard construction hours.
 - It is expected to exceed the 'outside of standard construction hours' CNML at three of the four representative residential receivers (RecycledWaterMain_Receiver_R01, RecycledWaterMain_Receiver_R02 and RecycledWaterMain_Receiver_R05).
 - It has a potential to cause sleep disturbance at two of the four representative residential receivers (RecycledWaterMain_Receiver_R02 and RecycledWaterMain_Receiver_R05).
 - Night time works is anticipated to operate for a maximum of ten (10) nights. Relocation of residents predicted to exceed the sleep disturbance criteria should be considered for the duration of the night time works, while other receptors can potentially be managed with community engagement (refer to Section 5.3).

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the 'noise affected' levels, it is nominally effective to reduce noise levels for some sensitive receivers (refer to Table 5.28), though also increases the noise levels at others.

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.29 Recycled Water Main HDD – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
RecycledWaterMain_Receiver_R01	0	The noise barrier modelled provides nominal shielding to receivers due to the distance of the barrier relative to the noise sources in the direction of the receivers. Practical design changes may increase effectiveness of temporary noise barrier (i.e. height, alignment).
RecycledWaterMain_Receiver_R02	-1	
RecycledWaterMain_Receiver_R03	0	
RecycledWaterMain_Receiver_R03a	0	
RecycledWaterMain_Receiver_R04	-1	
RecycledWaterMain_Receiver_R05	2	

5.2.1.3 Acacia Avenue HDD with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Exceed the 'noise affected' CNML at two of the representative residential receivers (Acacia_Receiver_R02 and Acacia_Receiver_R08) during standard construction hours.
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- Comply with the CNML for all of the industrial receivers for all stages of the underbore.

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the 'noise affected' levels, it is effective to reduce noise levels for some sensitive receivers (refer to Table 5.30).

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.30 Acacia Avenue HDD – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
Acacia_Receiver_R01	14	
Acacia_Receiver_R02	4	
Acacia_Receiver_R03	10	
Acacia_Receiver_R04	6	
Acacia_Receiver_R05	2	The noise barrier modelled provides nominal shielding to Acacia_Receiver_R05 for the Pilot activity due to the distance of the barrier relative to the noise sources in the direction of the receivers. Practical design changes may increase effectiveness of temporary noise barrier (i.e. height, alignment).
Acacia_Receiver_R06	9	
Acacia_Receiver_R07	7	
Acacia_Receiver_R08	3	The noise barrier modelled provides nominal shielding to Acacia_Receiver_R08 for the Pilot activity due to the distance of the barrier relative to the noise sources in the direction of the receivers. Practical design changes may increase effectiveness of temporary noise barrier (i.e. height, alignment).

5.2.1.4 Oxley Highway HDD with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Exceed the 'noise affected' CNML at four of the representative residential receivers (OxleyHDD_Receiver_R01, OxleyHDD_Receiver_R04, OxleyHDD_Receiver_R05 and OxleyHDD_Receiver_R06) during standard construction hours.
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- Exceed the CNML at the hospital for all stages (OxleyHDD_Receiver_R03) of the underbore.

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the 'noise affected' levels, it is effective to reduce noise levels for some sensitive receivers (refer to Table 5.31).

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.31 Oxley Highway HDD – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
OxleyHDD_Receiver_R01	15	
OxleyHDD_Receiver_R02	1	The noise barrier modelled provides nominal shielding to OxleyHDD_Receiver_R02 for the underbore activities due to the distance of the barrier relative to the noise sources in the direction of the receivers. Practical design changes may increase effectiveness of temporary noise barrier (i.e. height, alignment).
OxleyHDD_Receiver_R03	8	
OxleyHDD_Receiver_R04	7	
OxleyHDD_Receiver_R05	13	
OxleyHDD_Receiver_R06	7	.

5.2.1.5 Oxley Highway Micro Tunnelling with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Exceed the 'noise affected' CNML at four of the representative residential receivers (OxleyMicro_Receiver_R01, OxleyMicro_Receiver_R02, OxleyMicro_Receiver_R04 and OxleyMicro_Receiver_R05) during standard construction hours.
- Comply with the 'highly noise affected' CNML at all residential receivers during standard construction hours.
- Exceed the CNML at the childcare centre for all stages (OxleyMicro_Receiver_R03) of the underbore.

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the 'noise affected' levels, it is effective to reduce noise levels for some sensitive receivers (refer to Table 5.32).

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.32 Oxley Highway Micro Tunnelling – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
OxleyMicro_Receiver_R01	5	Practical design changes may increase the effectiveness of the temporary noise barrier
OxleyMicro_Receiver_R02	6	

Receiver ID	Average Reduction (dB)	Comments
OxleyMicro_Receiver_R03	8	
OxleyMicro_Receiver_R04	11	
OxleyMicro_Receiver_R05	10	

5.2.1.6 Wrights Road Micro Tunnelling with noise barriers Summary

Based on high-level acoustic modelling of a 3 m high temporary noise barrier, the underbore works are predicted to:

- Exceed the ‘noise affected’ CNML at three of the representative residential receivers (Wrights_Receiver_R02, Wrights_Receiver_R03 and Wrights_Receiver_R05) during standard construction hours.
- Comply with the ‘highly noise affected’ CNML at all residential receivers during standard construction hours.
- Exceed the CNML at the hospital for all stages (Wrights_Receiver_R01) of the underbore.
- Comply with the CNML at the commercial receptor for all stages (Wrights_Receiver_R04) of the underbore.

Although the installation of a 3 m temporary noise barrier around the underboring activities is predicted to still result in exceedances of the ‘noise affected’ levels, it is effective to reduce noise levels for some sensitive receivers (refer to Table 5.31).

Based on the proximity and duration of the works, it is recommended that temporary noise barriers be erected around the underbore sites along with other noise mitigation and management measures, where reasonable and feasible.

Table 5.33 Wrights Road Micro Tunnelling – 3 m high noise barrier - Average noise reduction

Receiver ID	Average Reduction (dB)	Comments
Wrights_Receiver_R01	5	Practical design changes may increase the effectiveness of the temporary noise barrier.
Wrights_Receiver_R02	6	
Wrights_Receiver_R03	9	
Wrights_Receiver_R04	7	
Wrights_Receiver_R05	4	

5.3 Additional mitigation measures

In many instances, impacts from construction noise are unavoidable and it is not feasible to achieve the construction noise objectives. TfNSW's Construction Noise and Vibration Guideline (Roads) (TfNSW, 2024) provides additional guidance for when implemented noise mitigation measures have been applied and the noise levels still exceed the established noise management levels (NMLs). Table C.1 in the aforementioned guideline suggests additional mitigation measures based on the exceedance levels after all reasonable and feasible mitigation have been implemented. This is shown in Table 5.34, along with the project specific trigger level, and should be incorporated as part of the CNVMP, where applicable.

Table 5.34 Triggers for additional mitigation measures – Airborne noise

Predicted airborne $L_{Aeq(15min)}$ noise level at receiver			Additional mitigation measures	
Perception	dBA above RBL	dBA above NML	Type ¹	Mitigation levels ²
All hours				
75 dBA or greater			N, V, PC, RO	HA
Standard hours: Mon-Fri (7:00 am-6:00 pm), Sat (8:00 am-1:00 pm), Sun/Public Holiday (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly audible	> 10 to 20	≤ 10	-	NML
Moderately intrusive	> 20 to 30	> 10 to 20	N, V	NML+10
Highly intrusive	> 30	> 20	N, V	NML+20

Predicted airborne $L_{Aeq(15min)}$ noise level at receiver			Additional mitigation measures	
OOHW Period 1: Mon-Fri (6:00 pm-10:00 pm), Sat (7:00 am-8:00 am & 1:00 pm-10:00 pm), Sun/Public Holidays (8: am-6:00 pm)				
Noticeable	5 to 10	≤ 5	-	NML
Clearly audible	> 10 to 20	> 5 to 15	N, R1, DR	NML+5
Moderately intrusive	> 20 to 30	> 15 to 25	V, N, R1, DR	NML+5
Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN	NML+25
OOHW Period 2: Mon-Fri (10:00 pm-7:00 am), Sat (10:00 pm-8:00 am), Sun/Public Holiday (6:00 pm-7:00 am)				
Noticeable	5 to 10	≤ 5	N	NML
Clearly audible	> 10 to 20	> 5 to 15	V, N, R2, DR	NML+5
Moderately intrusive	> 20 to 30	> 15 to 25	V, IB, N, PC, SN, R2, DR	NML+15
Highly intrusive	> 30	> 25	AA, V, IB, N, R2, DR, PC, SN	NML+25

¹ AA = Alternative Accommodation, V = Validation of predicted noise levels, IB = Individual Briefings, N = Notification box drops, PC = Phone Call, SN = Specific Notification, R1 = Respite period 1, R2 = Respite period 2, DR = Duration Respite, RO = Project specific respite offer, HA = Highly Affected.

² All affected receivers.

The definition of these mitigation measures is provided in Table 5.35 below.

Table 5.35 Additional management measures for construction activities out of standard hours

Action required	Details
Notification (letterbox drop or equivalent)	Advance warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of using variable message sign, letterbox drop (or equivalent), web site / social media or a combination to distribute information detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.
Specific notifications	Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than 5 working days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops. This form of communication is used to support periodic notifications, or to advertise unscheduled works.
Phone calls	Phone calls detailing relevant information made to identified/affected stakeholders, who have provided their contact details, within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.
Individual briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives should visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement should be used.
Respite offer	Respite offers should be considered where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers. The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis, and may not be applicable to all projects, or when duration respite has been agreed (see below).
Respite period 1	Out of hours construction noise in out of hours Period 1 (evenings) should be limited to no more than three consecutive evenings per week except where there is a Duration respite. For night work these periods of work should be separated by not less than one week and no more than 6 evenings per month.

Action required	Details
Respite period 2	Night time construction noise in out of hours Period 2 should be limited to two consecutive nights except for where there is a Duration respite. For night work, these periods of work should be separated by not less than one week and no more than 6 nights per month. Where possible, high noise generating works should be completed before 11:00 pm.
Duration respite	Respite offers and Respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration respite so that the project can be completed more quickly. Council staff should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.
Alternative accommodation	Alternative accommodation options may be offered (as a last resort) to residents living in close proximity to construction works that are likely to experience highly intrusive noise levels. The specifics of the offer will be identified on a project-by-project basis; however, an AA offer is unlikely to be made for maintenance works. Additional aspects for consideration should include whether the highly intrusive activities occur throughout the night or before midnight.
Verification	Verification may be required for building or asset condition where works are likely to cause vibration impact or for noise levels following reasonable complaints. See Appendix F of the <i>Construction Noise and Vibration Guideline (Roads)</i> (TfNSW, 2024) for more details.

6. Conclusion

GHD Pty Ltd (GHD) has been engaged by Council to undertake a detailed noise assessment of the trenchless pipe installation within the Thrumster Wastewater Scheme to inform Council of the potential noise impacts of underbore activities on nearby sensitive receivers.

Noise modelling was undertaken to assess the potential noise impacts of the underbore activities against the previously established construction noise targets. The results, summarised in Section 4.4.1, indicate multiple predicted exceedances of both the 'noise affected' CNML and 'highly noise affected' CNML at several residential receivers across different locations.

To address these impacts, noise mitigation and management measures should be considered where reasonable and feasible. A high-level assessment of a temporary noise barrier around the Entry and Exit Site was conducted to evaluate its potential effectiveness, as outlined in Section 5.2.1. Further investigation into the practical implementation of temporary noise barriers should be undertaken by the contractor. This includes refining the barrier's alignment, height and expected noise reduction performance, with full details to be incorporated into relevant noise management plans such as the Construction Noise and Vibration Management Plan (CNVMP).

Appendices

Appendix A

Noise contour maps



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
1

Partridge Creek HDD - Casing Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

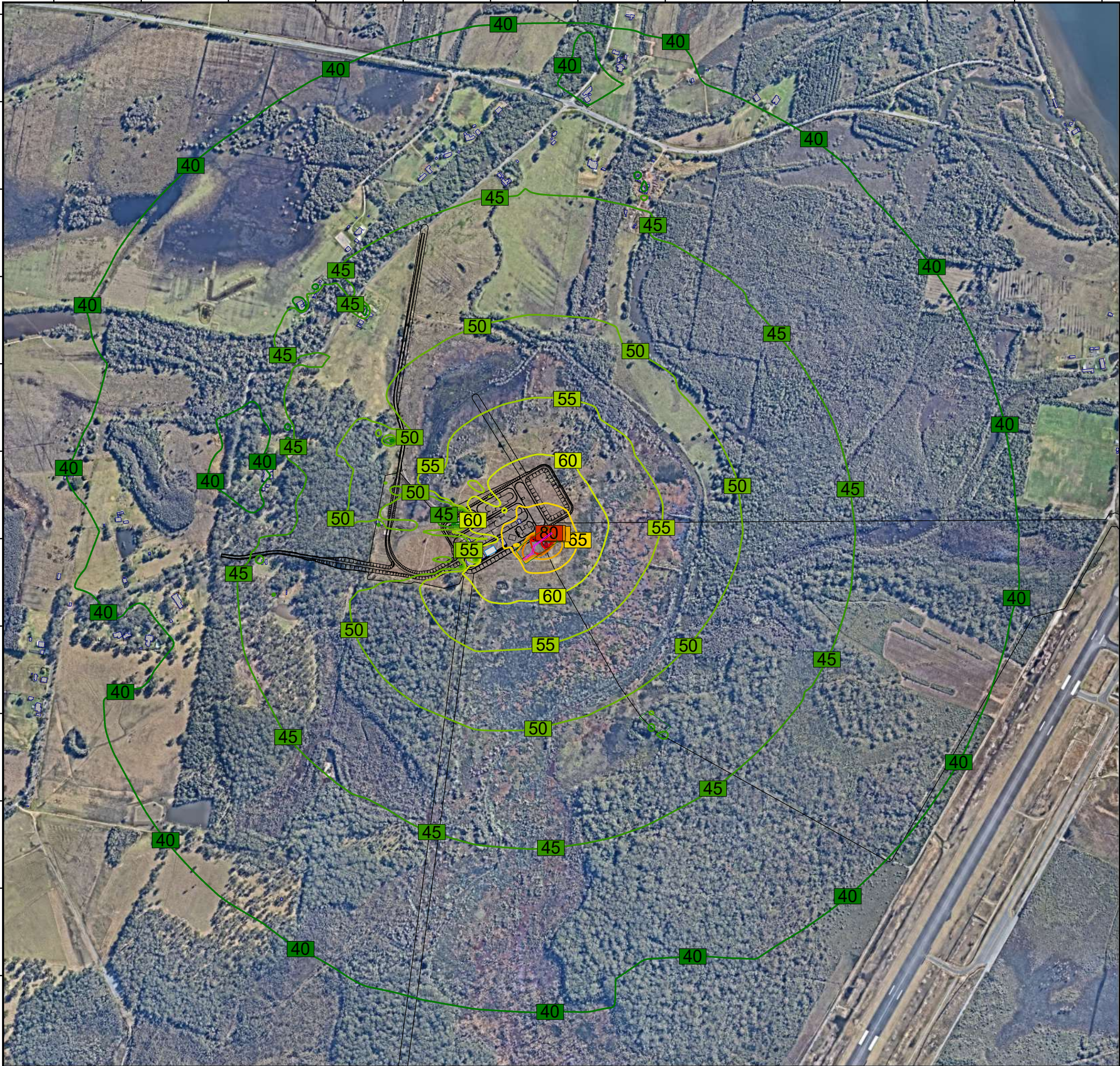
<= 40.0	<= 40.0
40.0 < <= 45.0	<= 45.0
45.0 < <= 50.0	<= 50.0
50.0 < <= 55.0	<= 55.0
55.0 < <= 60.0	<= 60.0
60.0 < <= 65.0	<= 65.0
65.0 < <= 70.0	<= 70.0
70.0 < <= 75.0	<= 75.0
75.0 < <= 80.0	<= 80.0
80.0 < <= 85.0	<= 85.0
85.0 < <= 90.0	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:11404

0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
1a

Partridge Creek HDD - Casing Install with 3m Barrier
Calculation in 1.5 m above ground

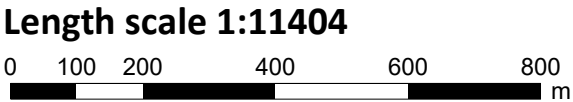
Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
2

Partridge Creek HDD - Pilot
Calculation in 1.5 m above ground

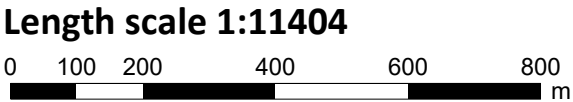
Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
2a

Partridge Creek HDD - Pilot with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

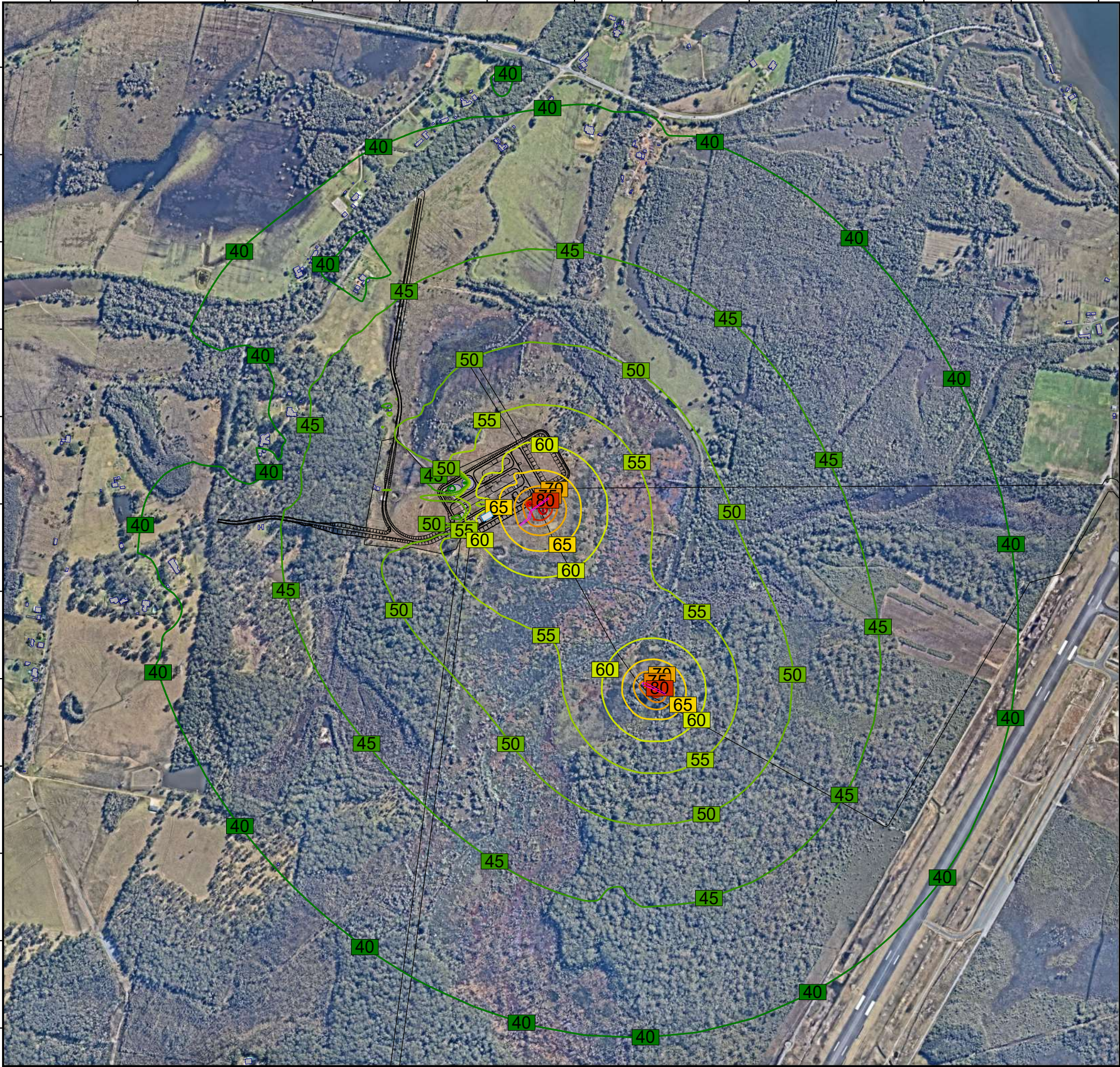
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45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:11404
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
3

Partridge Creek HDD - Reaming
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

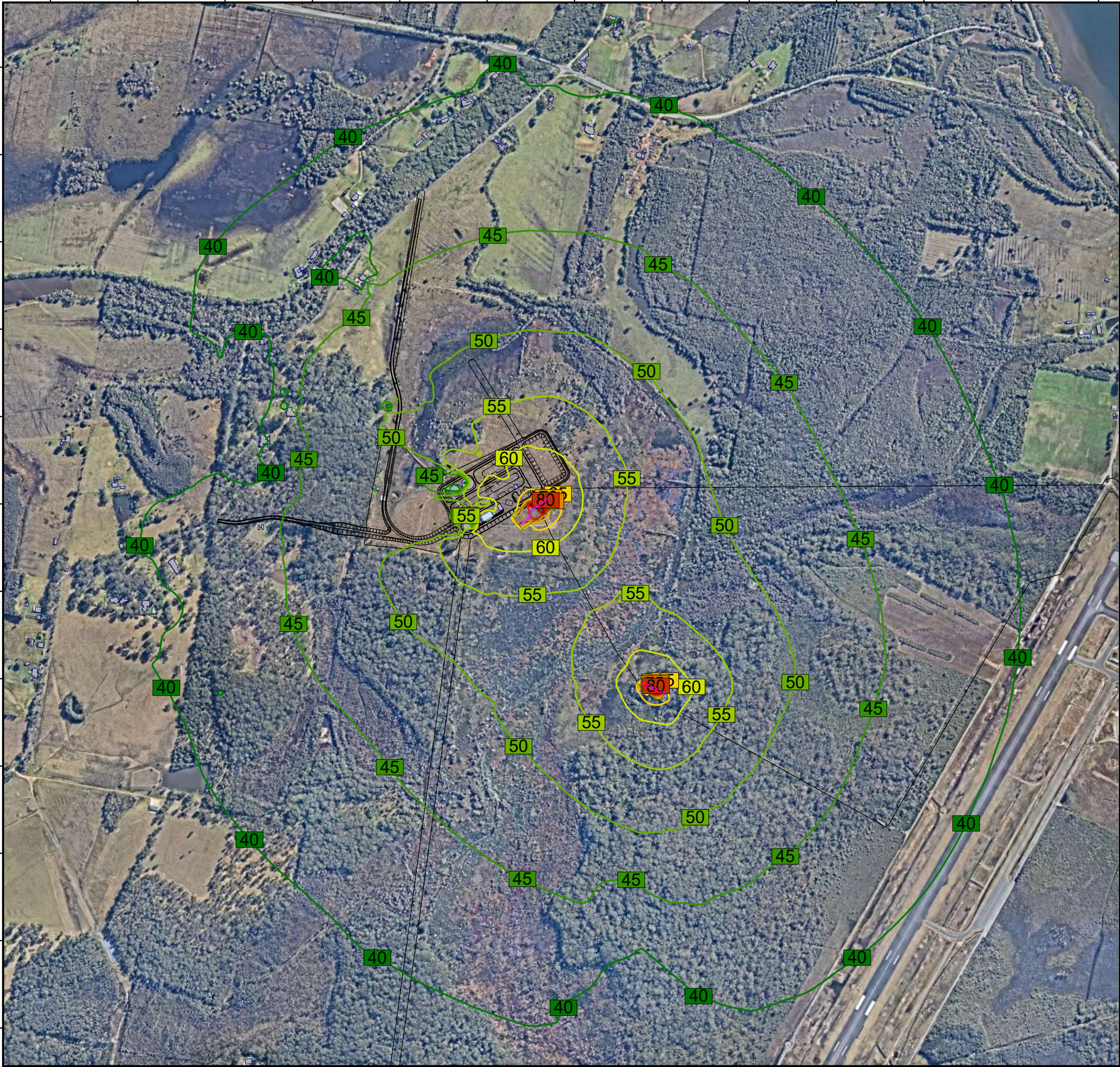
Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:11404





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
3a

Partridge Creek HDD - Reaming with 3m Barrier
Calculation in 1.5 m above ground

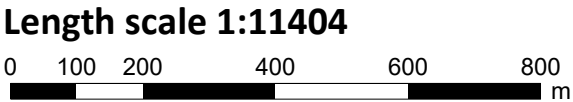
Processed with SoundPLAN 9.1, Update 17/02/2025

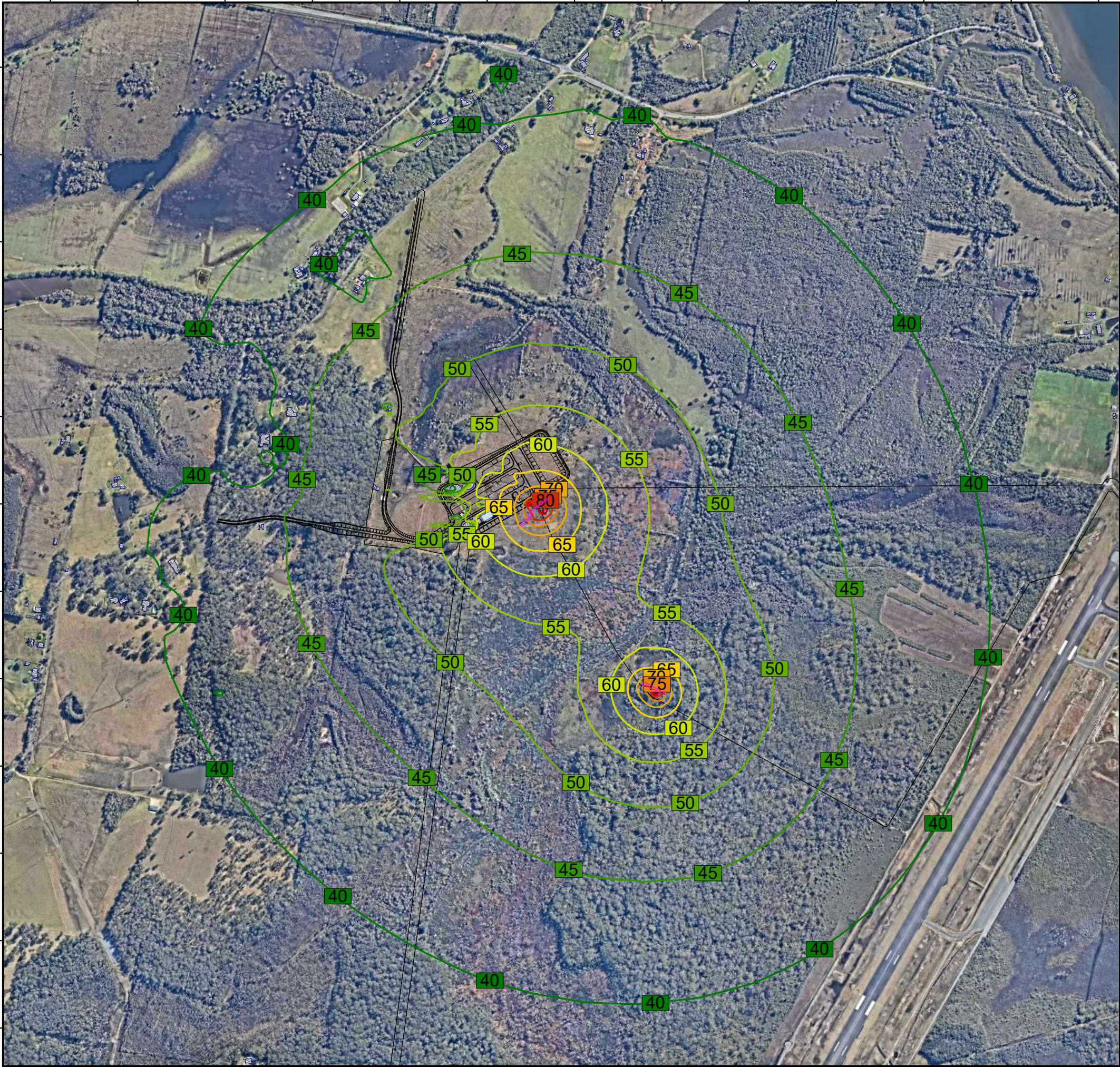
Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 < <= 45.0	<= 45.0
45.0 < <= 50.0	<= 50.0
50.0 < <= 55.0	<= 55.0
55.0 < <= 60.0	<= 60.0
60.0 < <= 65.0	<= 65.0
65.0 < <= 70.0	<= 70.0
70.0 < <= 75.0	<= 75.0
75.0 < <= 80.0	<= 80.0
80.0 < <= 85.0	<= 85.0
85.0 < <= 90.0	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
4

Partridge Creek HDD - Pipe Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

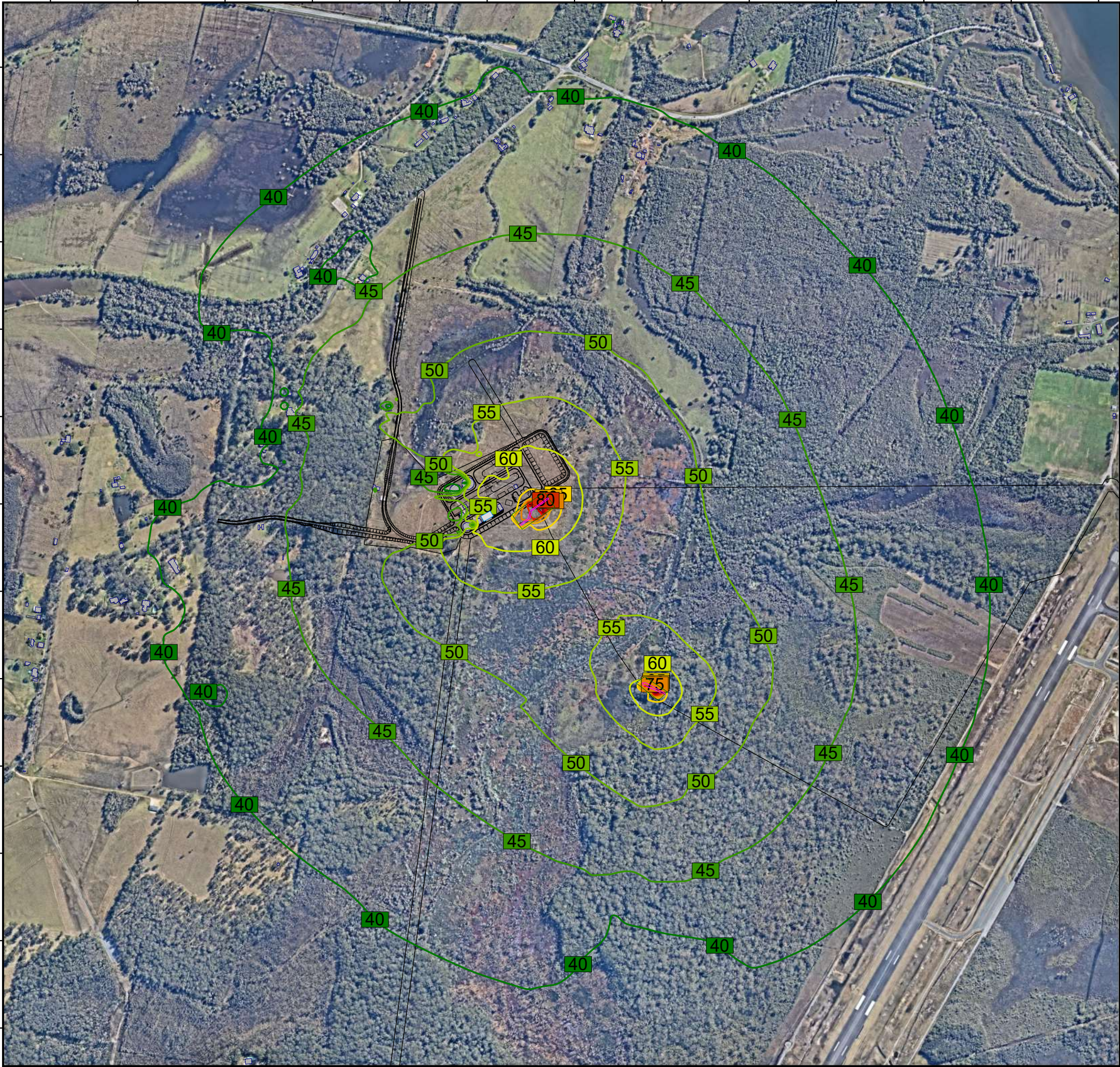
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:11404

0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
4a

Partridge Creek HDD - Pipe Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

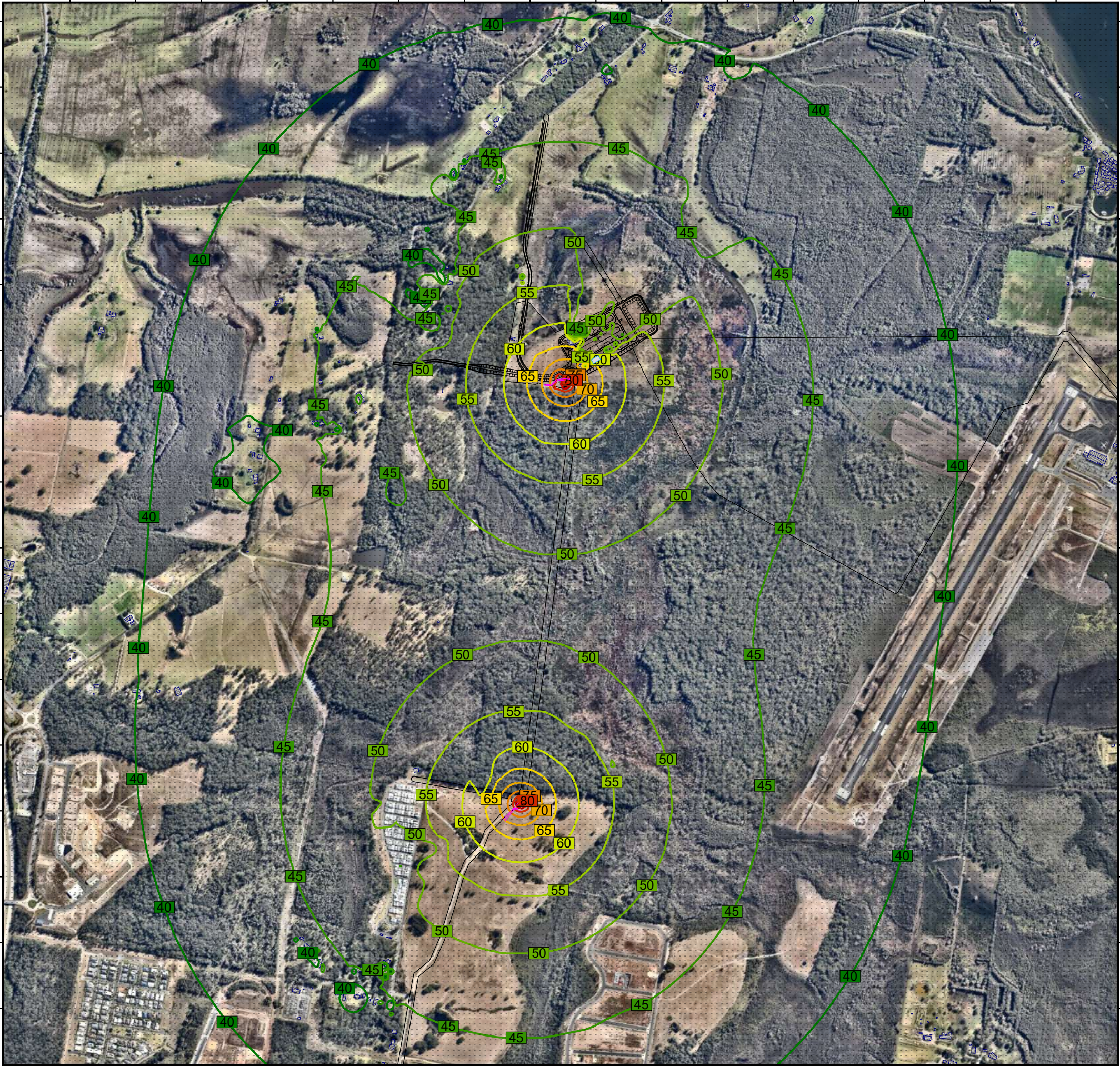
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:11404

0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
5

Recycled Water Main HDD - Casing Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:15128
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
5a

Recycled Water Main HDD - Casing Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 < <= 45.0	<= 45.0
45.0 < <= 50.0	<= 50.0
50.0 < <= 55.0	<= 55.0
55.0 < <= 60.0	<= 60.0
60.0 < <= 65.0	<= 65.0
65.0 < <= 70.0	<= 70.0
70.0 < <= 75.0	<= 75.0
75.0 < <= 80.0	<= 80.0
80.0 < <= 85.0	<= 85.0
85.0 < <= 90.0	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:15128
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
6

Recycled Water Main HDD - Pilot
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:15128

0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
6a

Recycled Water Main HDD - Pilot with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:15128
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
7

Recycled Water Main HDD - Reaming
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:15128





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
7a

Recycled Water Main HDD - Reaming with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:15128

0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
8

Recycled Water Main HDD - Pipe Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:15128
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
8a

Recycled Water Main HDD - Pipe Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

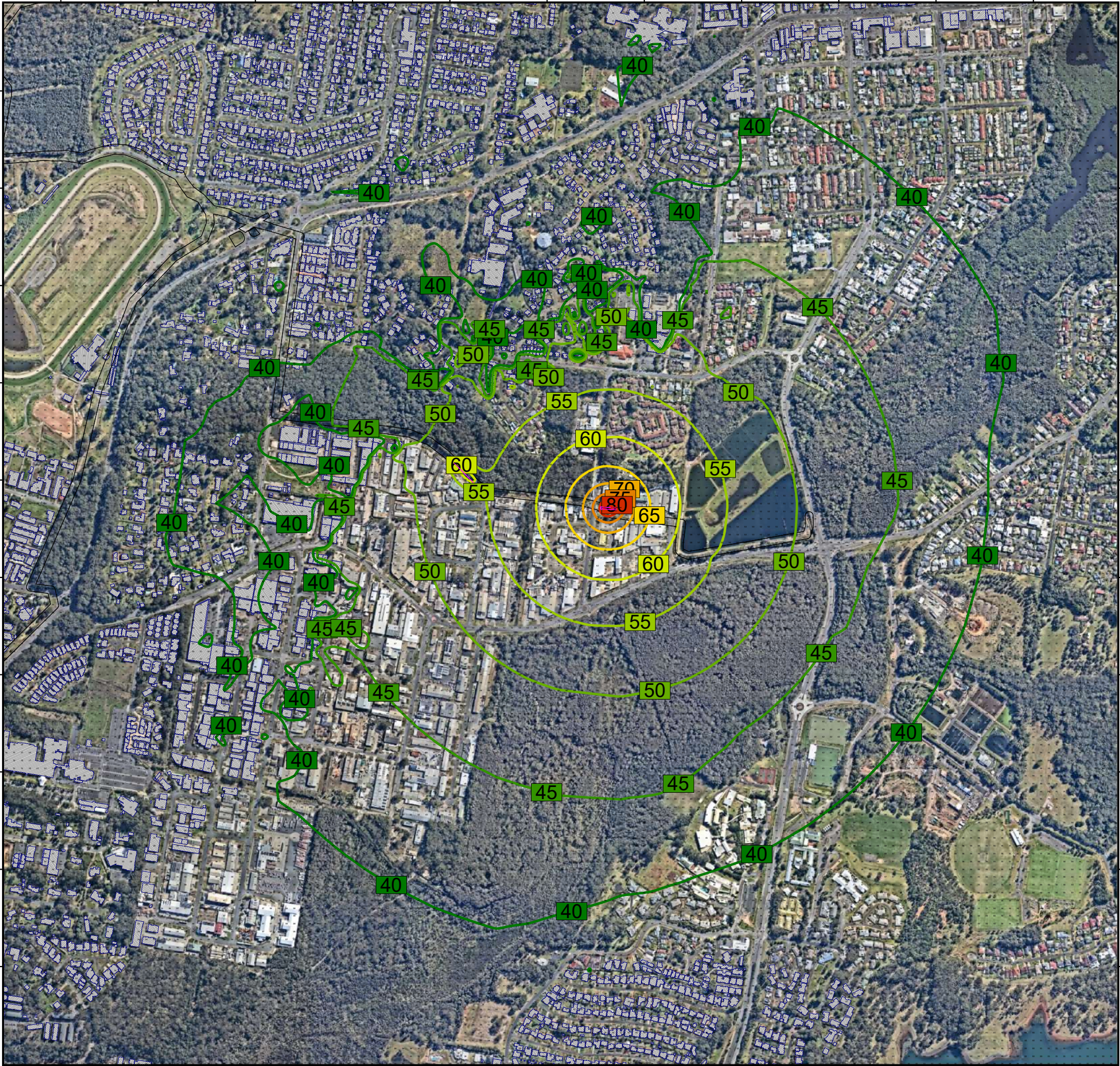
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40.0 <	<= 45.0
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50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:15128
0 100 200 400 600 800 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
9

Acacia Street HDD - Pilot
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

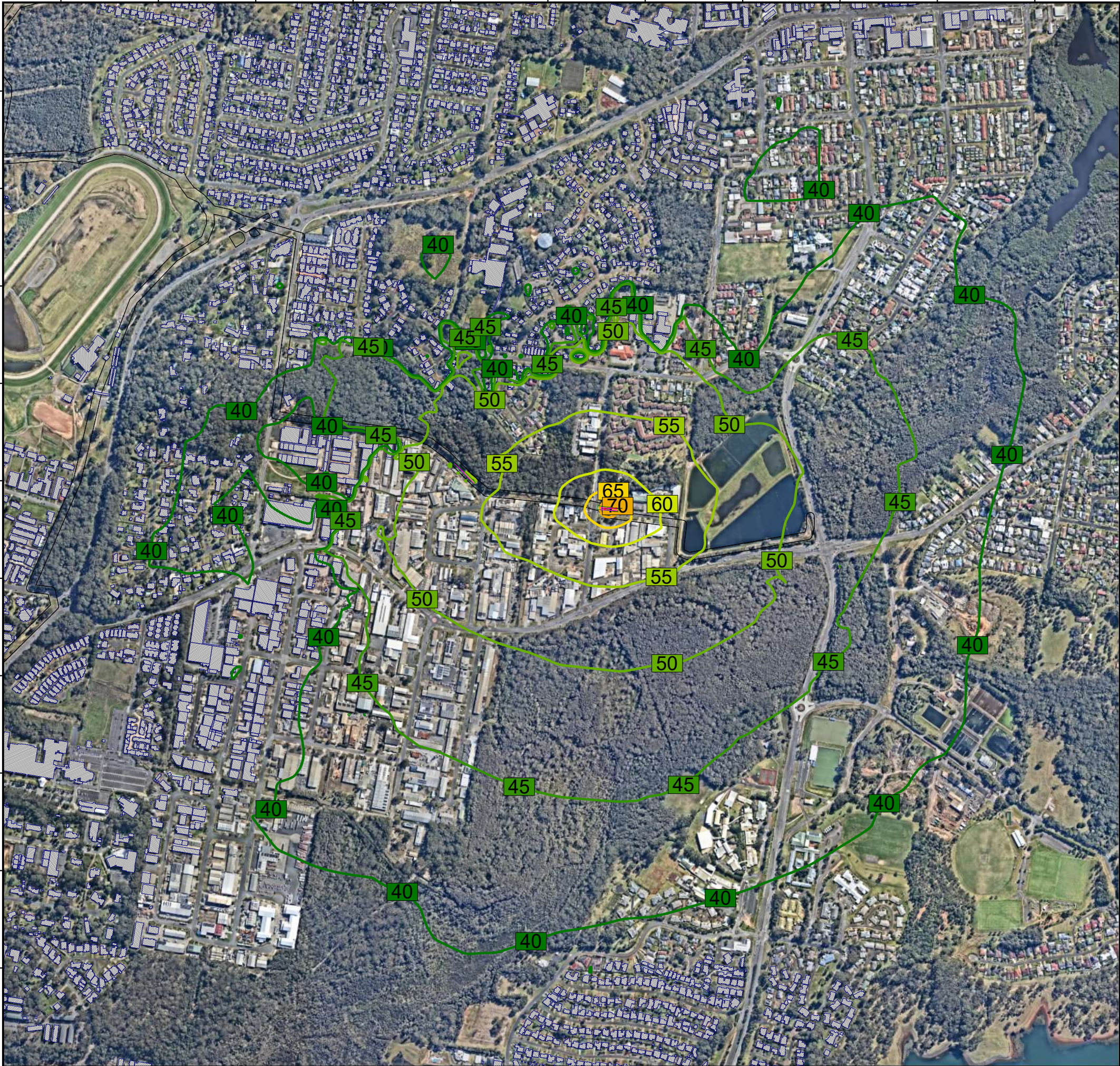
40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:10229
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
9a

Acacia Avenue HDD - Pilot with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

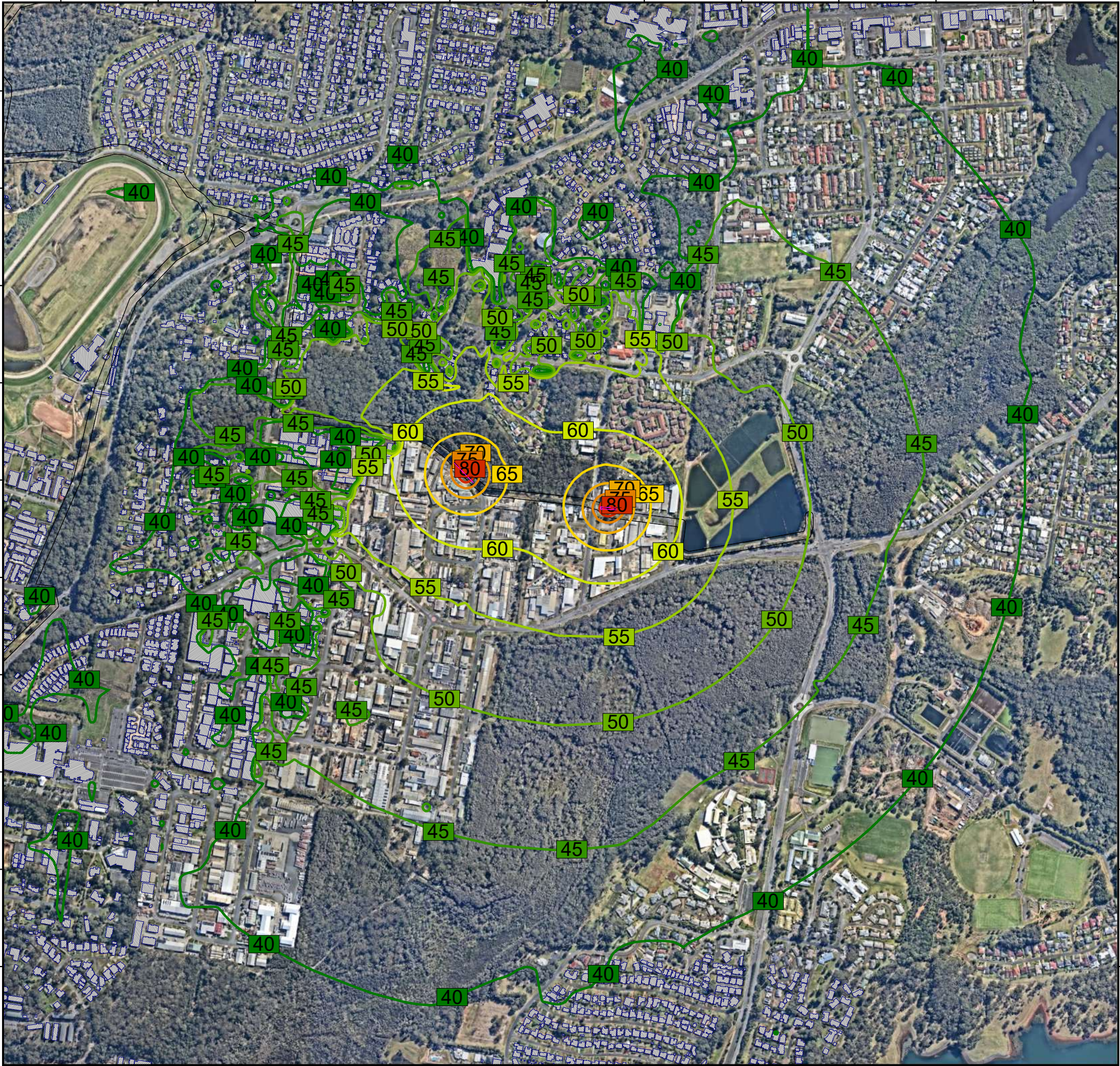
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:10229
0 50 100 200 300 400 m



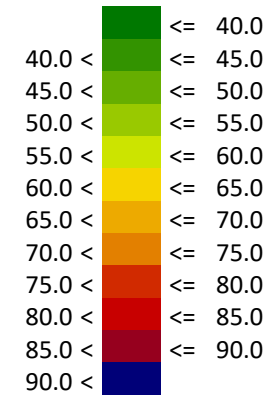
Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
10

Acacia Avenue HDD - Reaming
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

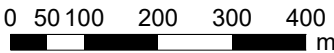


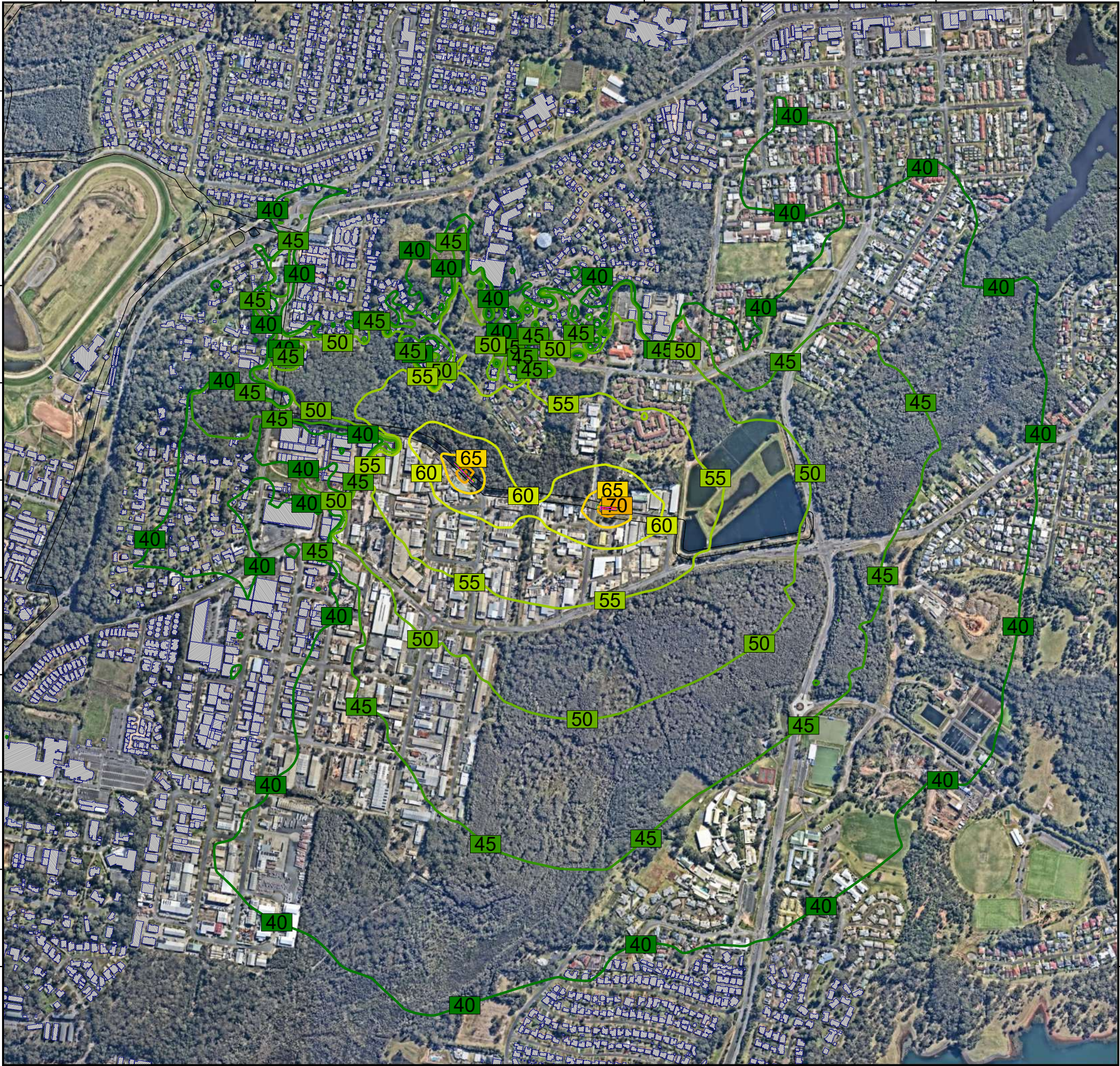
Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:10229





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
10a

Acacia Avenue HDD - Reaming with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

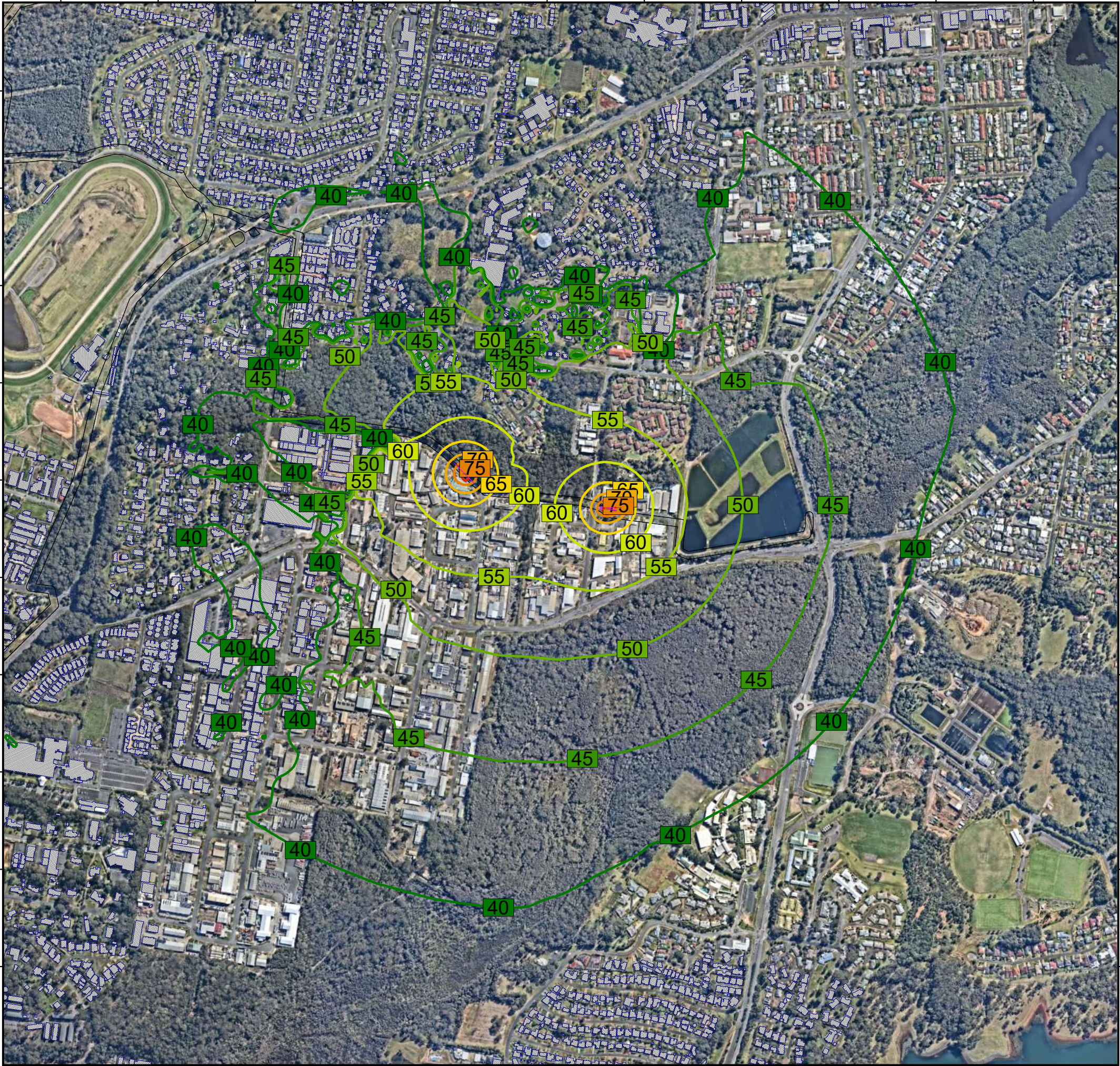
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:10229
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Acacia Avenue HDD - Pipe Install
Calculation in 1.5 m above ground

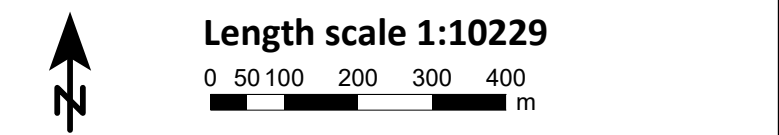
Processed with SoundPLAN 9.1, Update 17/02/2025

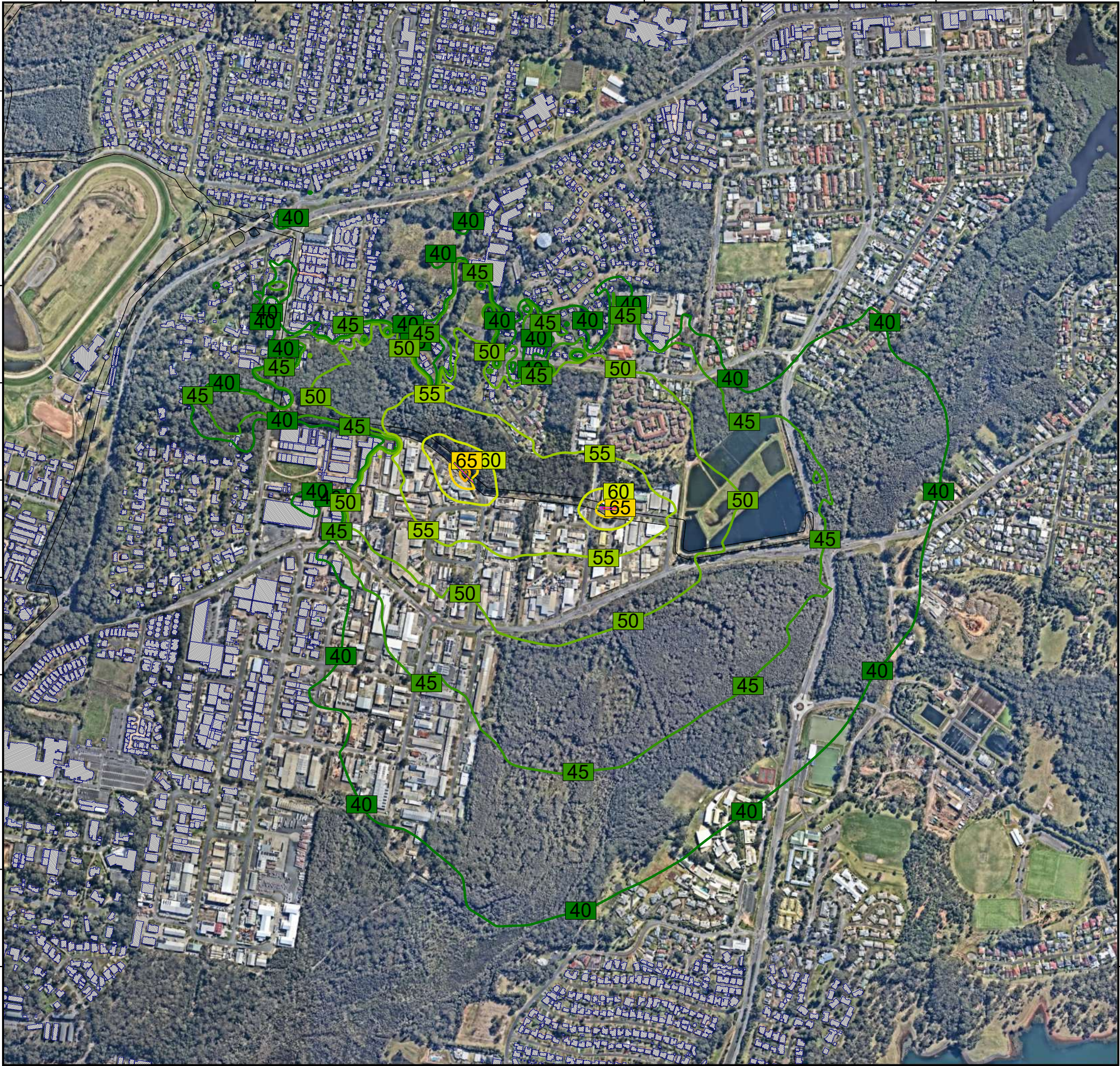
Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
11a

Acacia Avenue HDD - Pipe Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

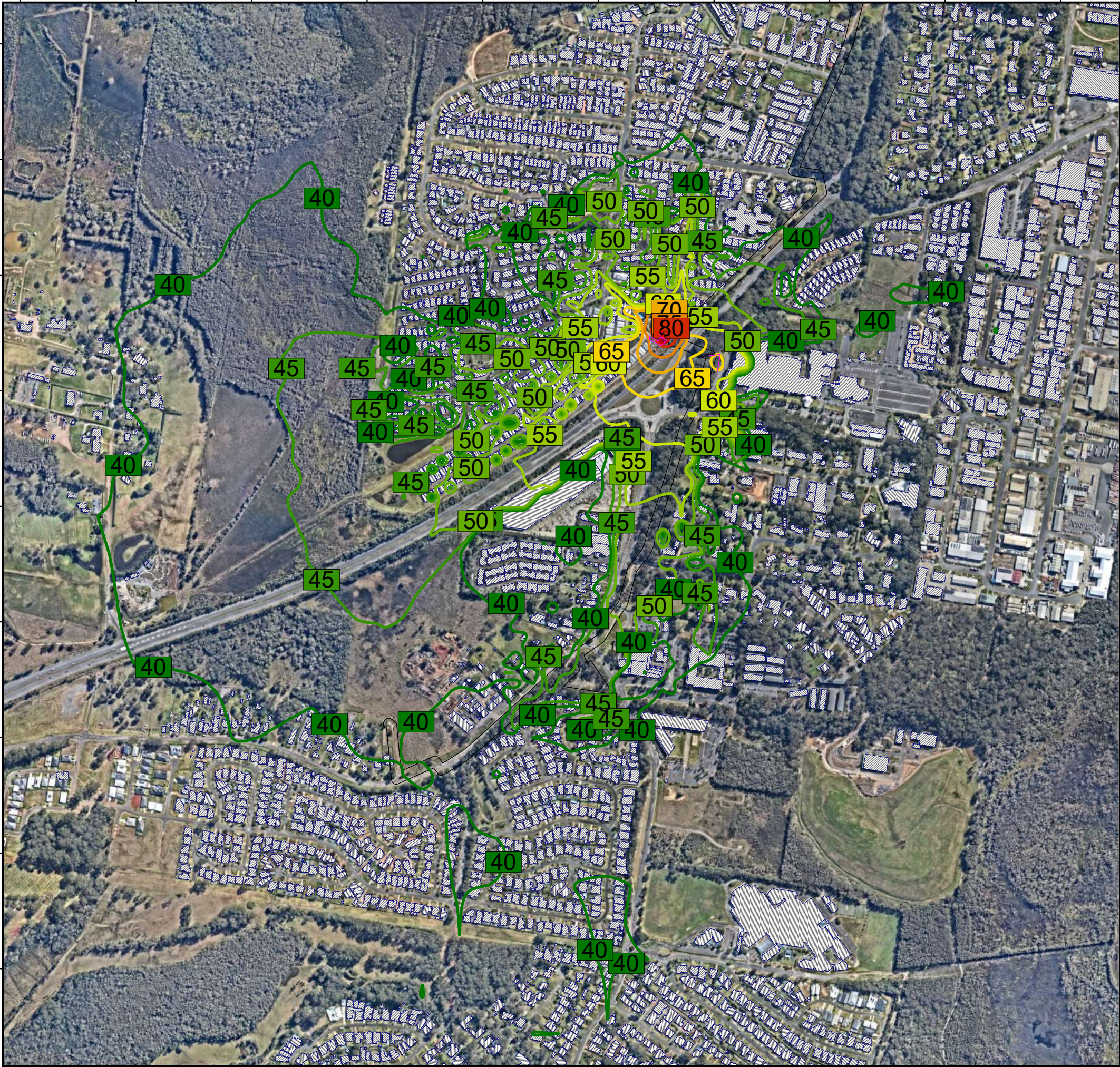
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:10229

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
12

Oxley Highway HDD - Pilot
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

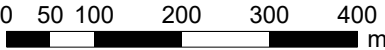
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

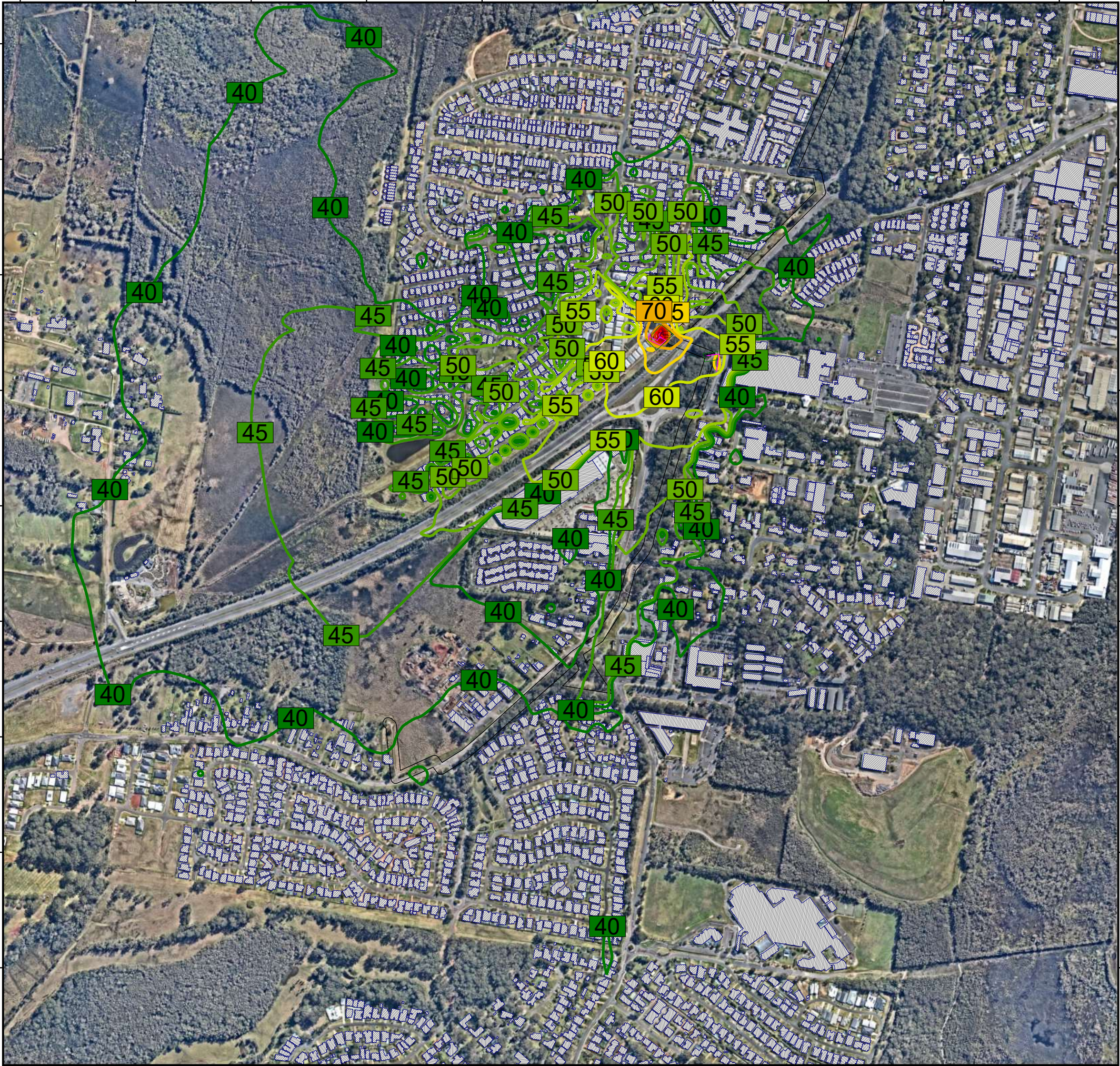
Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:8616





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
12a

Oxley Highway HDD - Pilot with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

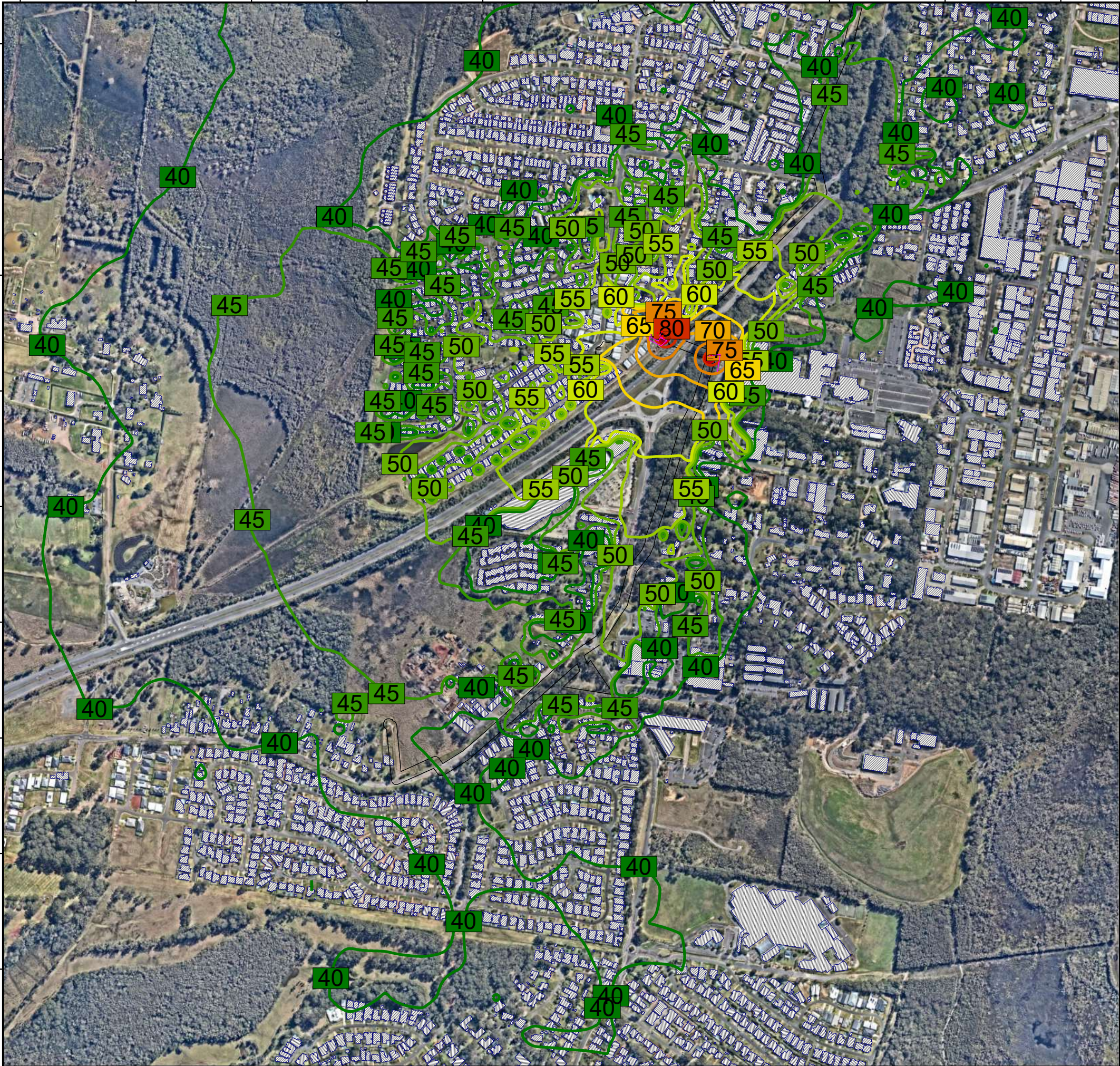
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:8616

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
13

Oxley Highway HDD - Reaming
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

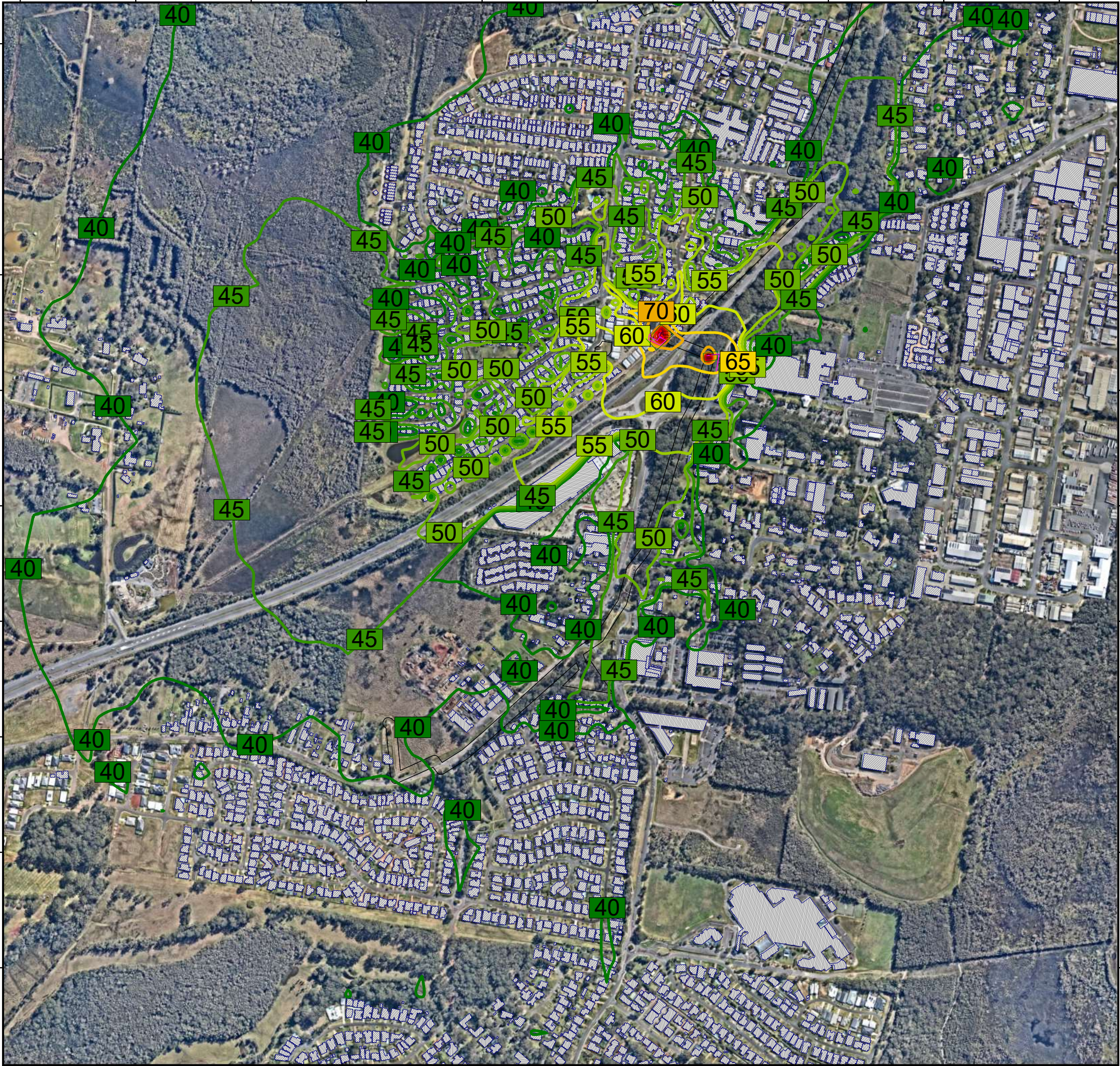
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:8616

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
13a

Oxley Highway HDD - Reaming with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

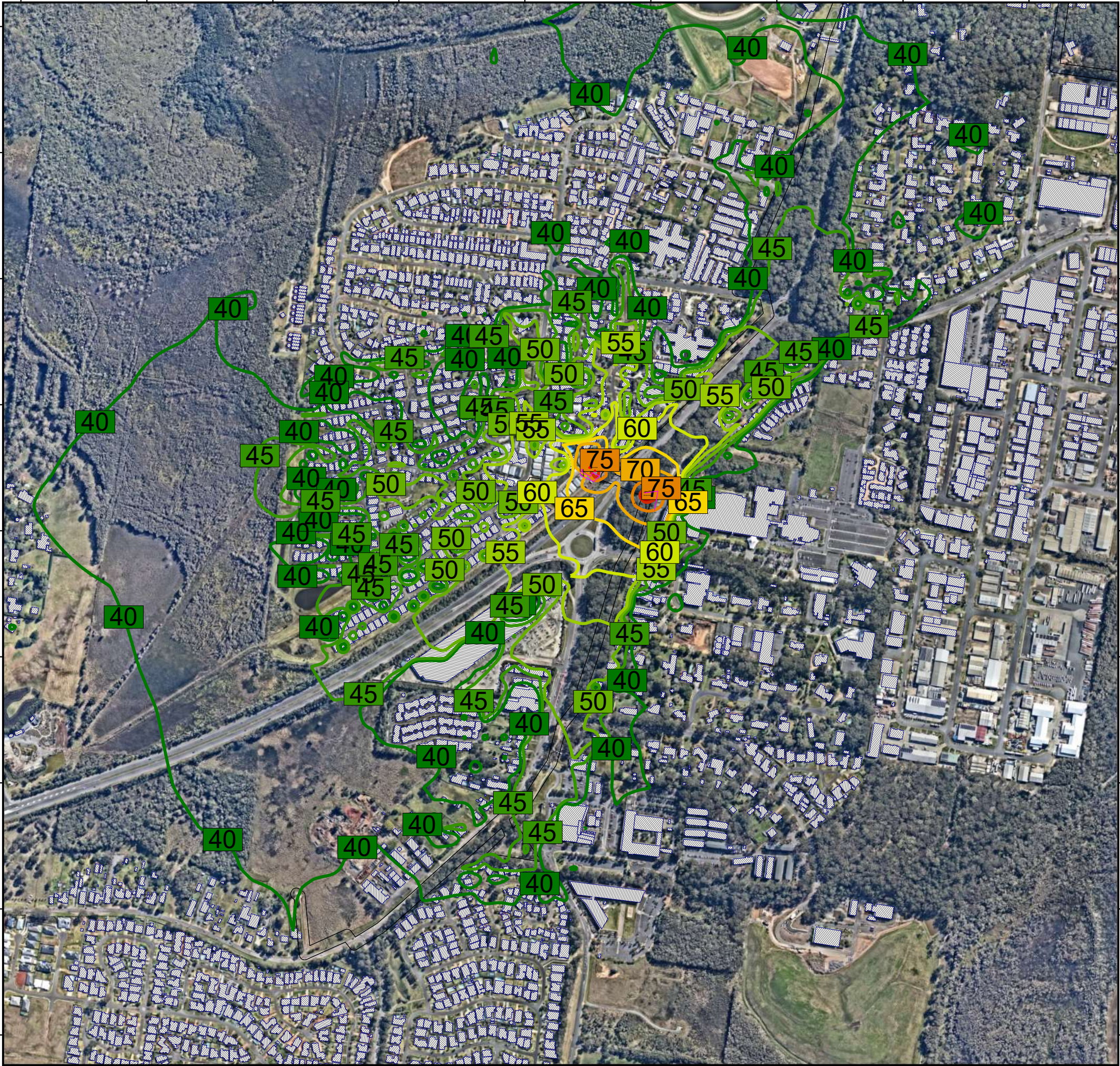
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:8616
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
14

Oxley Highway HDD - Pipe Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

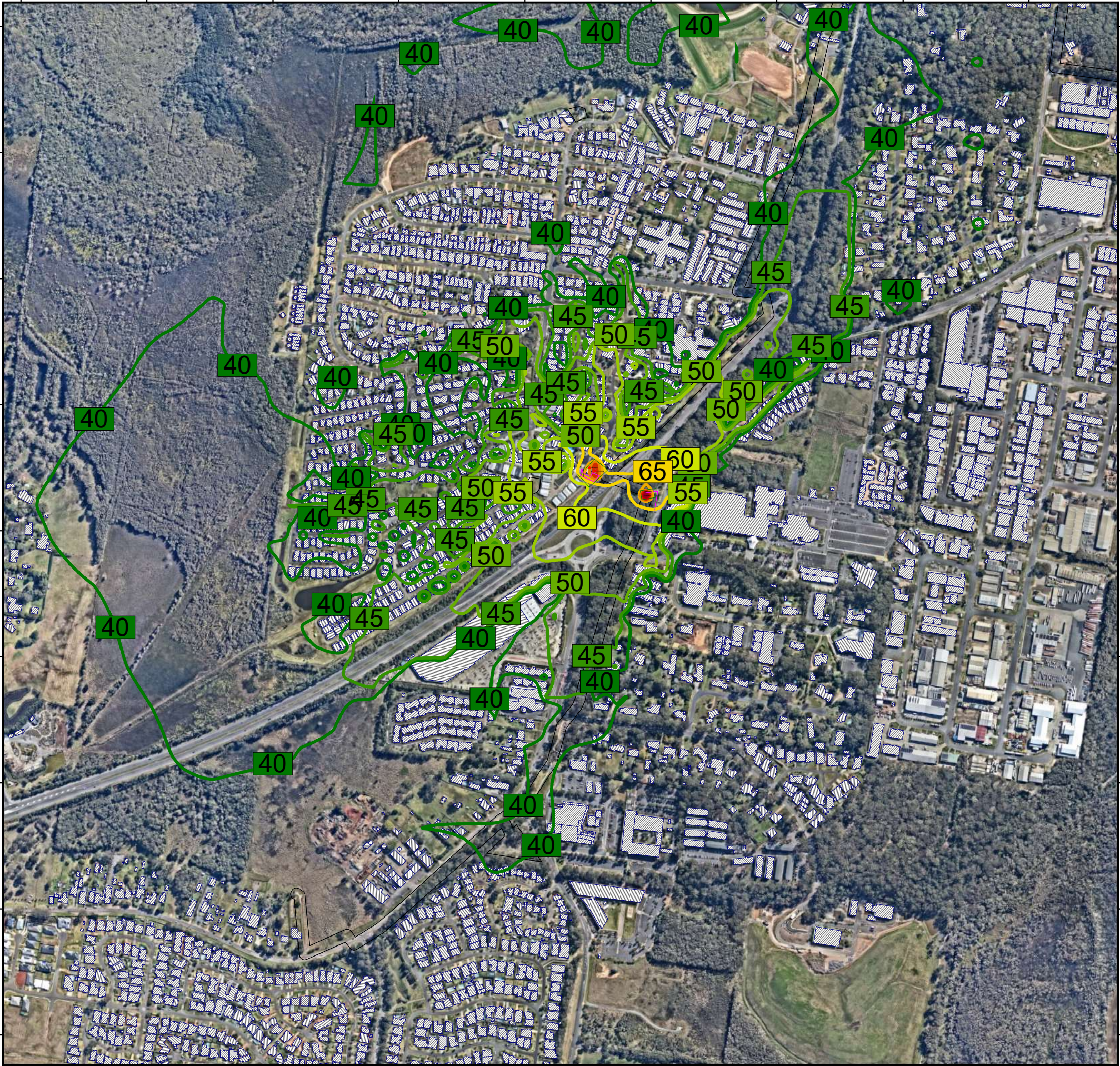
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:7894

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
14a

Oxley Highway HDD - Pipe Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

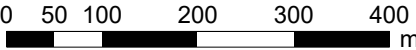
40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:7894





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
15

Oxley Highway Micro Tunnelling - Pit Dig
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

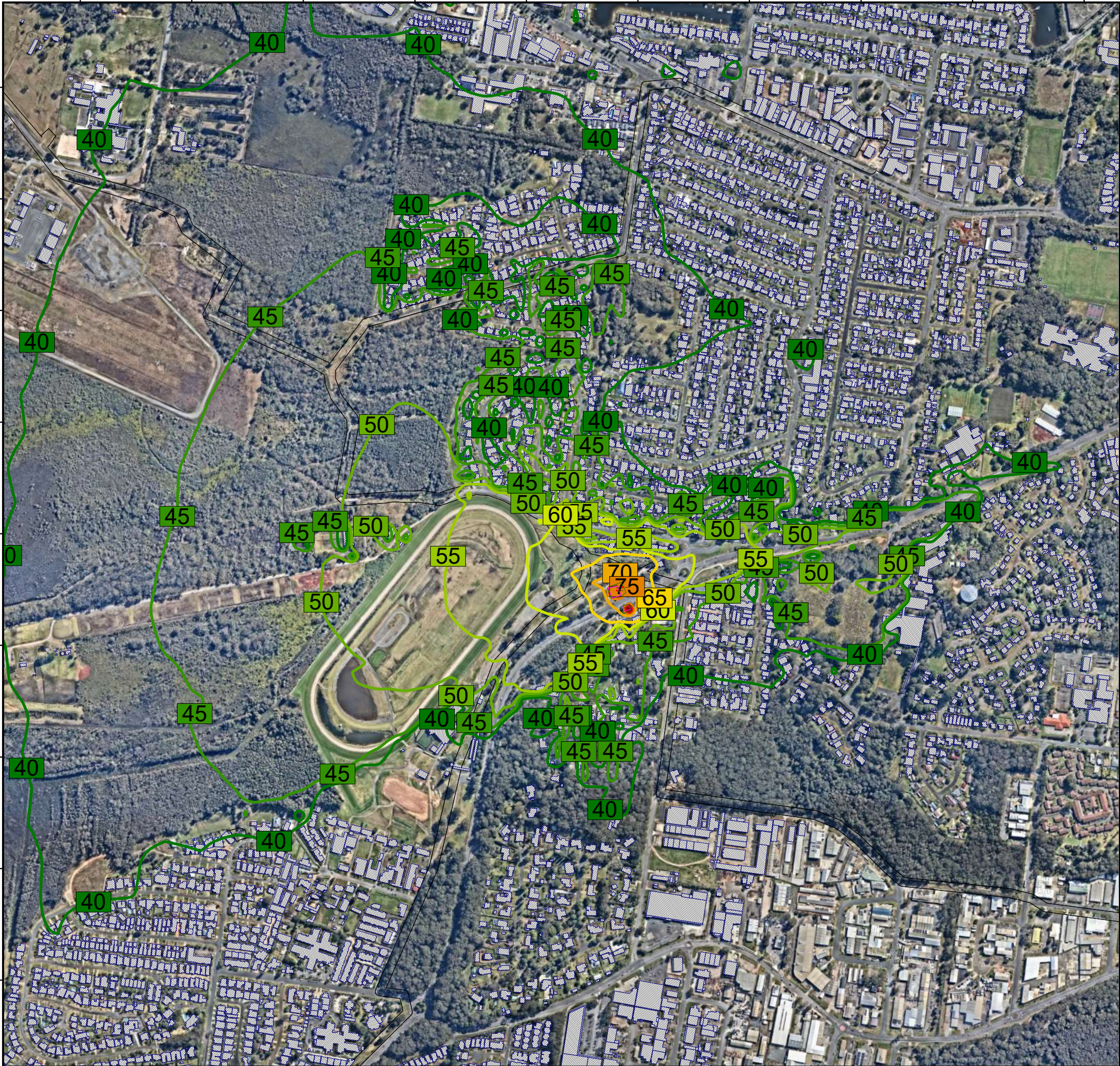
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:8930

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
15a

Oxley Highway Micro Tunnelling - Pit Dig with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

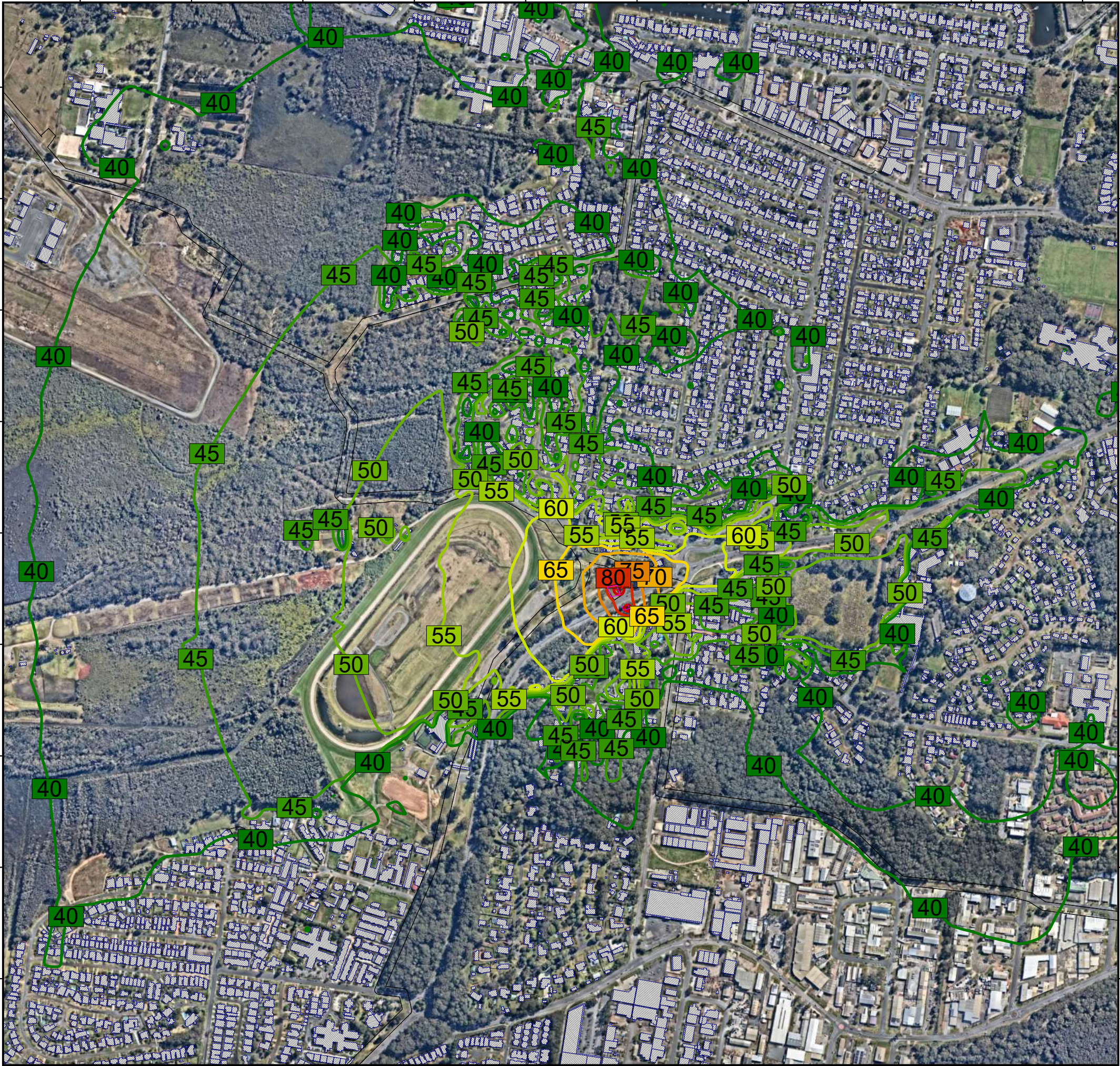
40.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
45.0 <	<= 55.0
50.0 <	<= 60.0
55.0 <	<= 65.0
60.0 <	<= 70.0
65.0 <	<= 75.0
70.0 <	<= 80.0
75.0 <	<= 85.0
80.0 <	<= 90.0
85.0 <	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:8930
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
16

Oxley Highway Micro Tunnelling - Micro Tunnelling
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

40.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
45.0 <	<= 55.0
50.0 <	<= 60.0
50.0 <	<= 65.0
55.0 <	<= 70.0
55.0 <	<= 75.0
60.0 <	<= 80.0
60.0 <	<= 85.0
65.0 <	<= 90.0
70.0 <	
75.0 <	
80.0 <	
85.0 <	
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:8930
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
16a

**Oxley Highway Micro Tunnelling - Micro
Tunnelling with 3m Barrier**
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

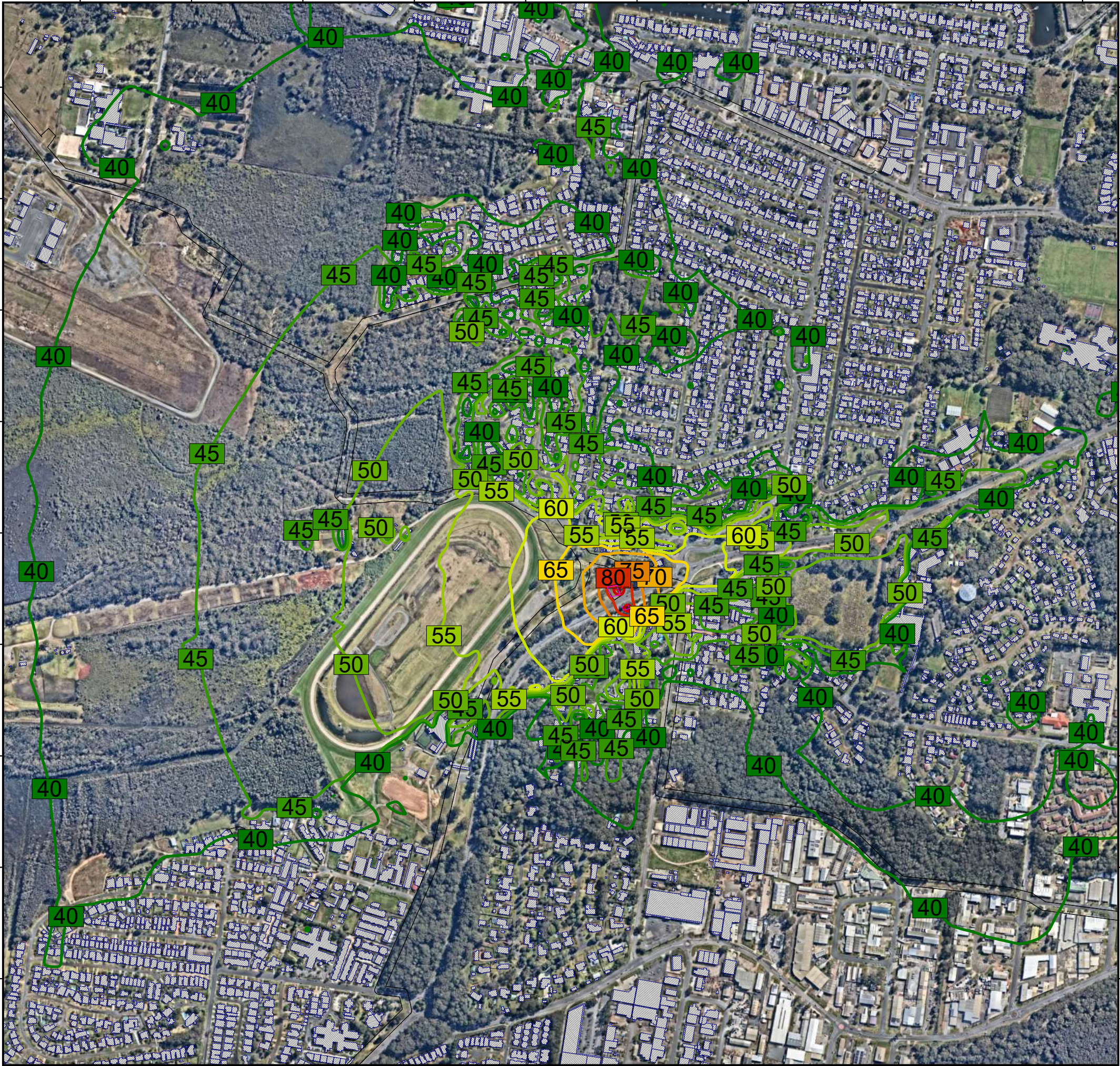
40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:8930

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
17

Oxley Highway Micro Tunnelling - Pipe Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:8930
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
17a

**Oxley Highway Micro Tunnelling - Pipe Install
with 3m Barrier**
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:8930
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
18

Oxley Highway Micro Tunnelling - Grouting/Tidying
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

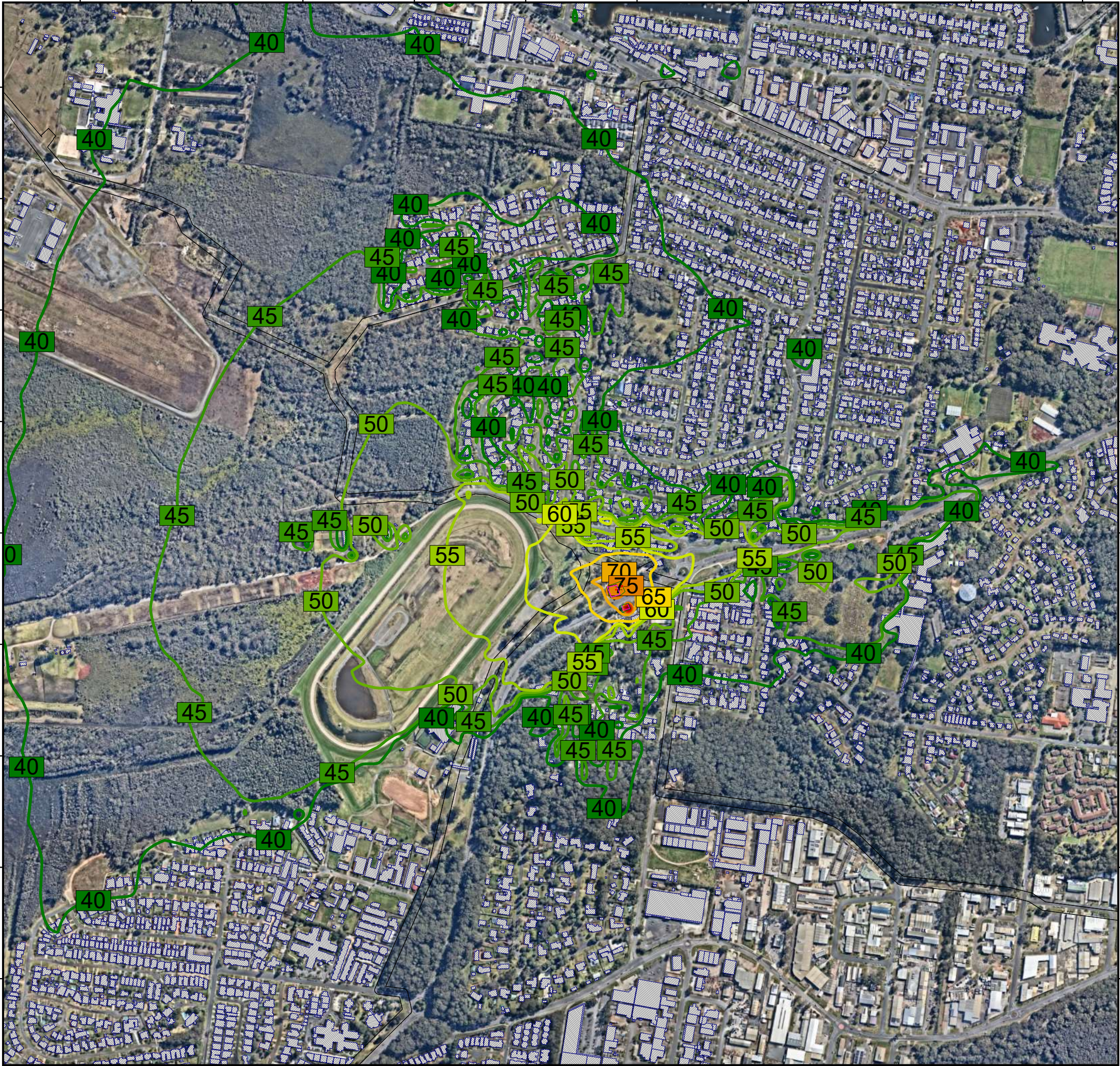
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:8930

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
18a

**Oxley Highway Micro Tunnelling -
Grouting/Tidying with 3m Barrier**
Calculation in 1.5 m above ground

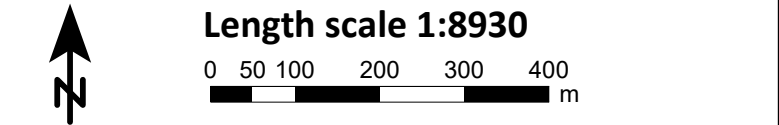
Processed with SoundPLAN 9.1, Update 17/02/2025

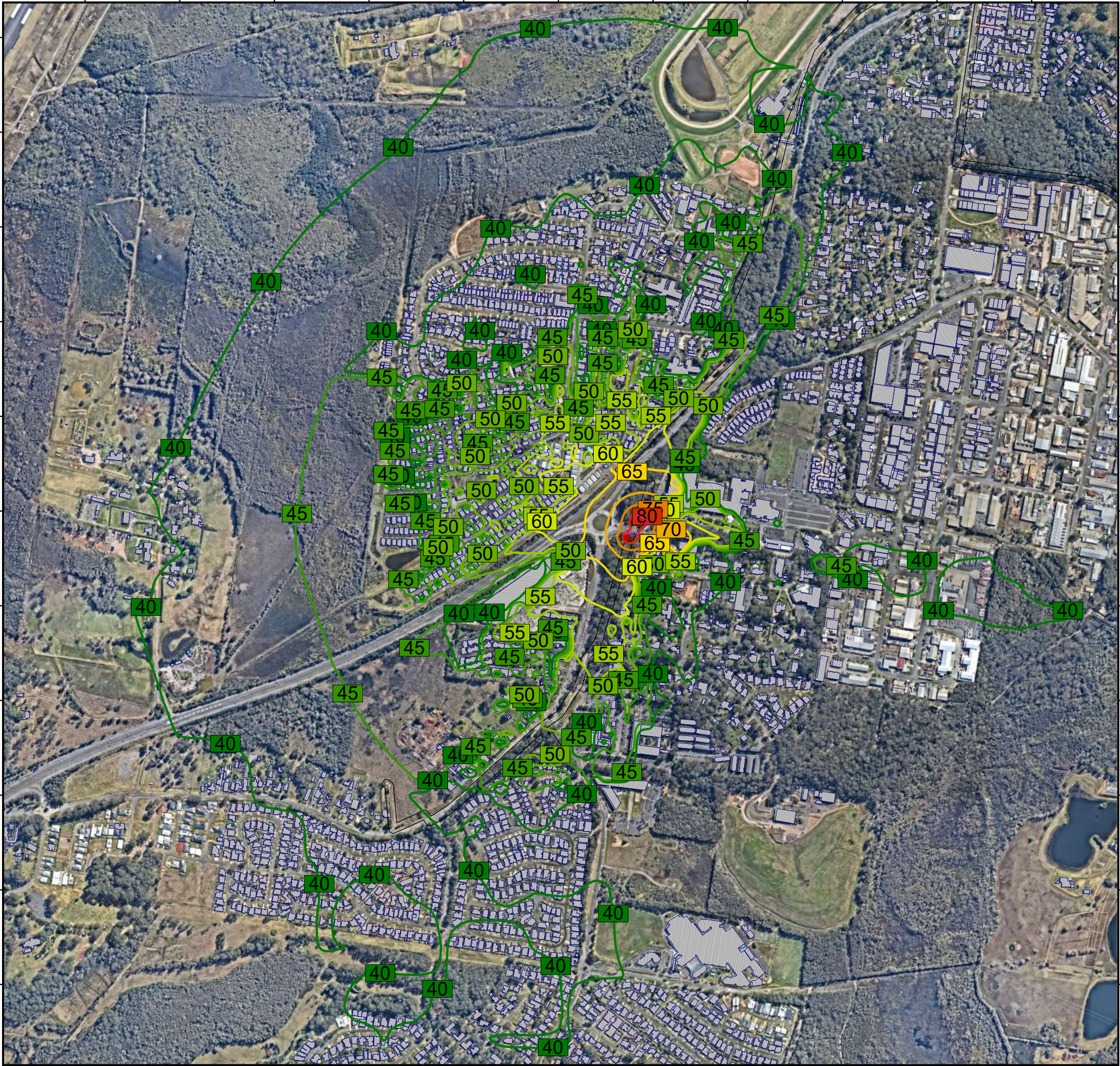
Levels Day
in dB(A)

40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall





Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
19

Wrights Road Micro Tunnelling - Pit Dig
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

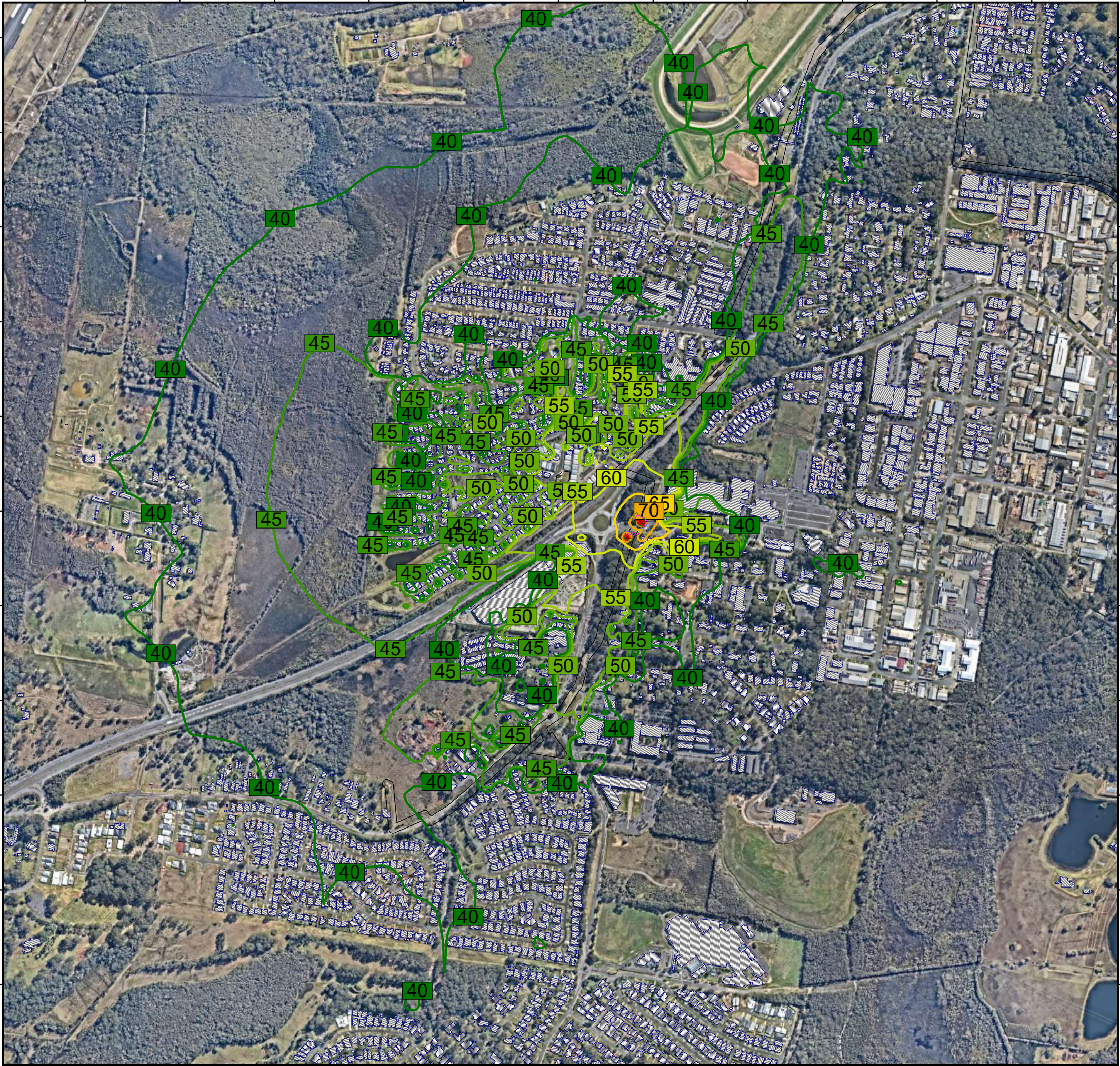
<= 40.0	<= 40.0
40.0 < <= 45.0	<= 45.0
45.0 < <= 50.0	<= 50.0
50.0 < <= 55.0	<= 55.0
55.0 < <= 60.0	<= 60.0
60.0 < <= 65.0	<= 65.0
65.0 < <= 70.0	<= 70.0
70.0 < <= 75.0	<= 75.0
75.0 < <= 80.0	<= 80.0
80.0 < <= 85.0	<= 85.0
85.0 < <= 90.0	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:10509

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
19a

Wright's Road Micro Tunnelling - Pit Dig with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

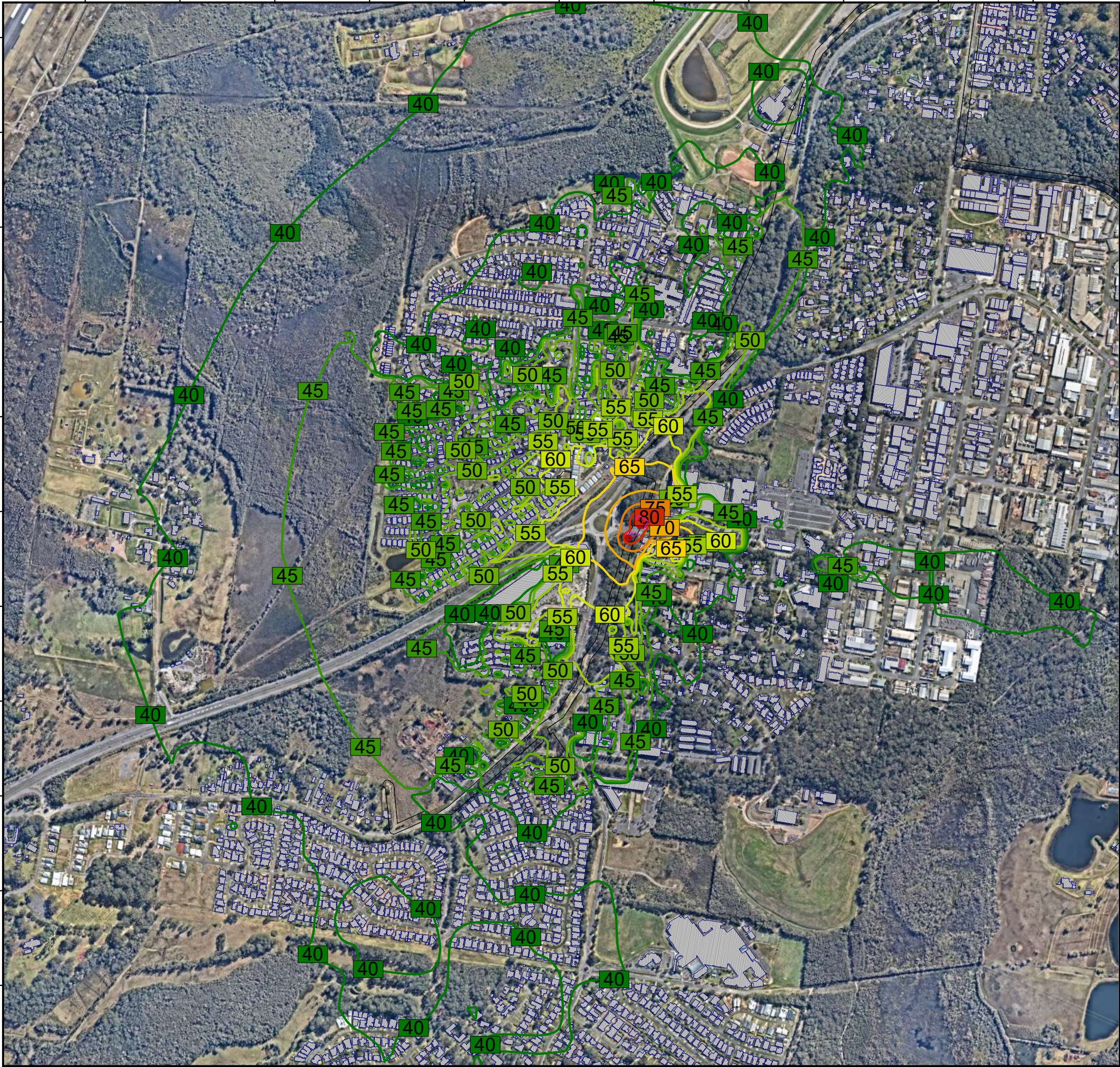
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:10509
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
20

Wrights Road Micro Tunnelling - Micro Tunnelling
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

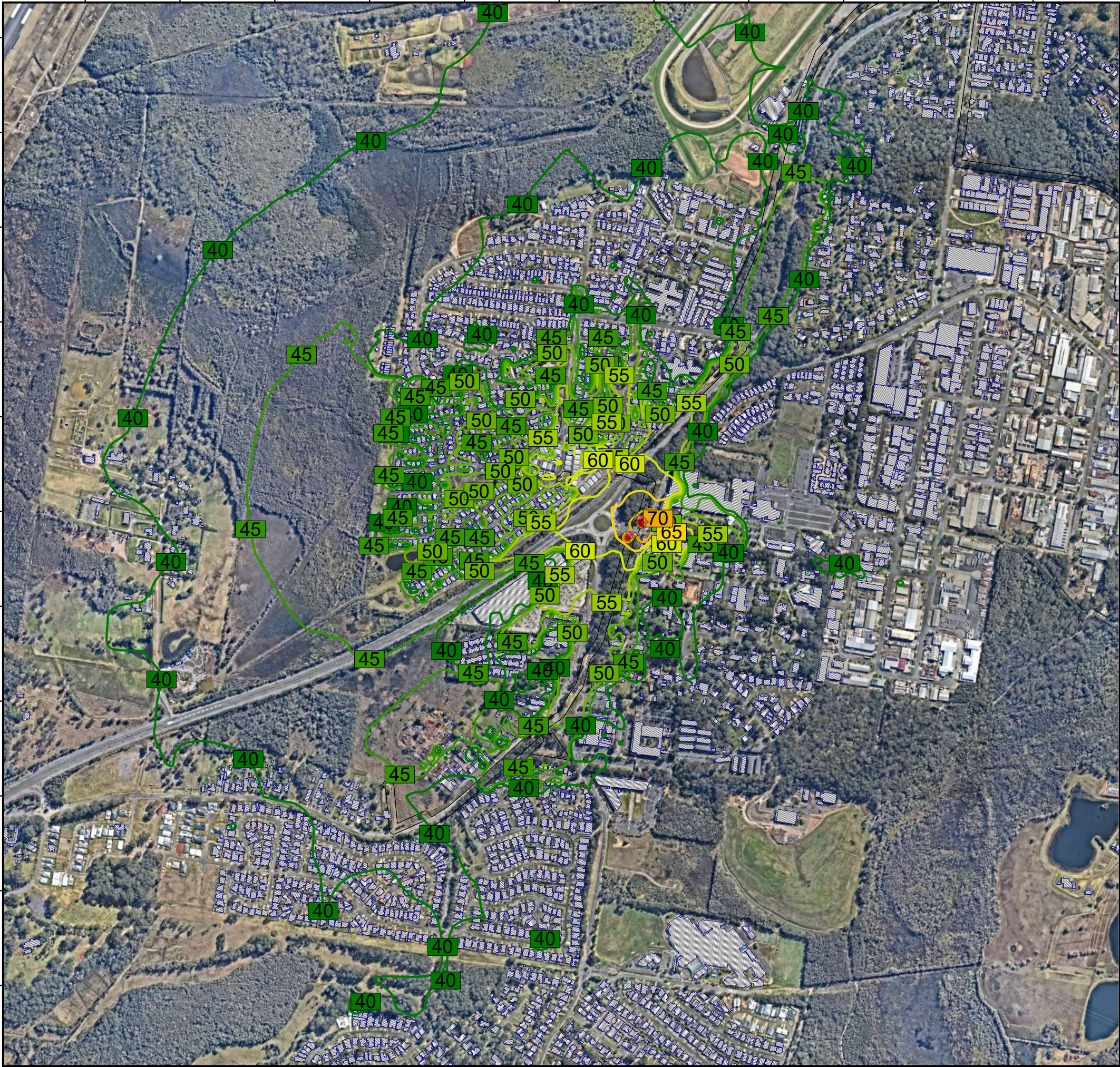
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:10509
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
20a

**Wrights Road Micro Tunnelling - Micro
Tunnelling with 3m Barrier**
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

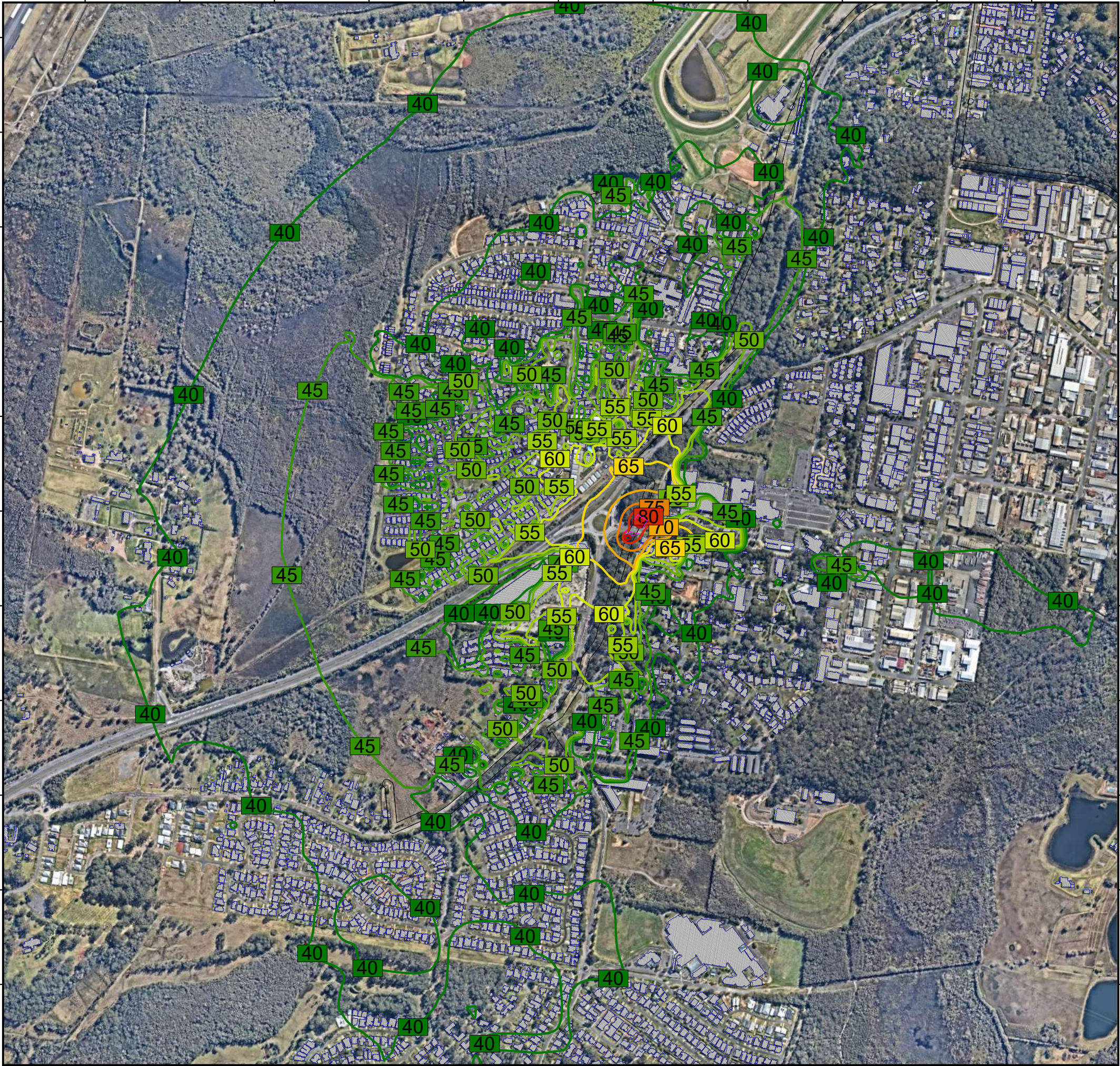
40.0 <=	40.0
40.0 <	45.0
45.0 <	50.0
50.0 <	55.0
55.0 <	60.0
60.0 <	65.0
65.0 <	70.0
70.0 <	75.0
75.0 <	80.0
80.0 <	85.0
85.0 <	90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall



Length scale 1:10509
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
21

Wright's Road Micro Tunnelling - Pipe Install
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

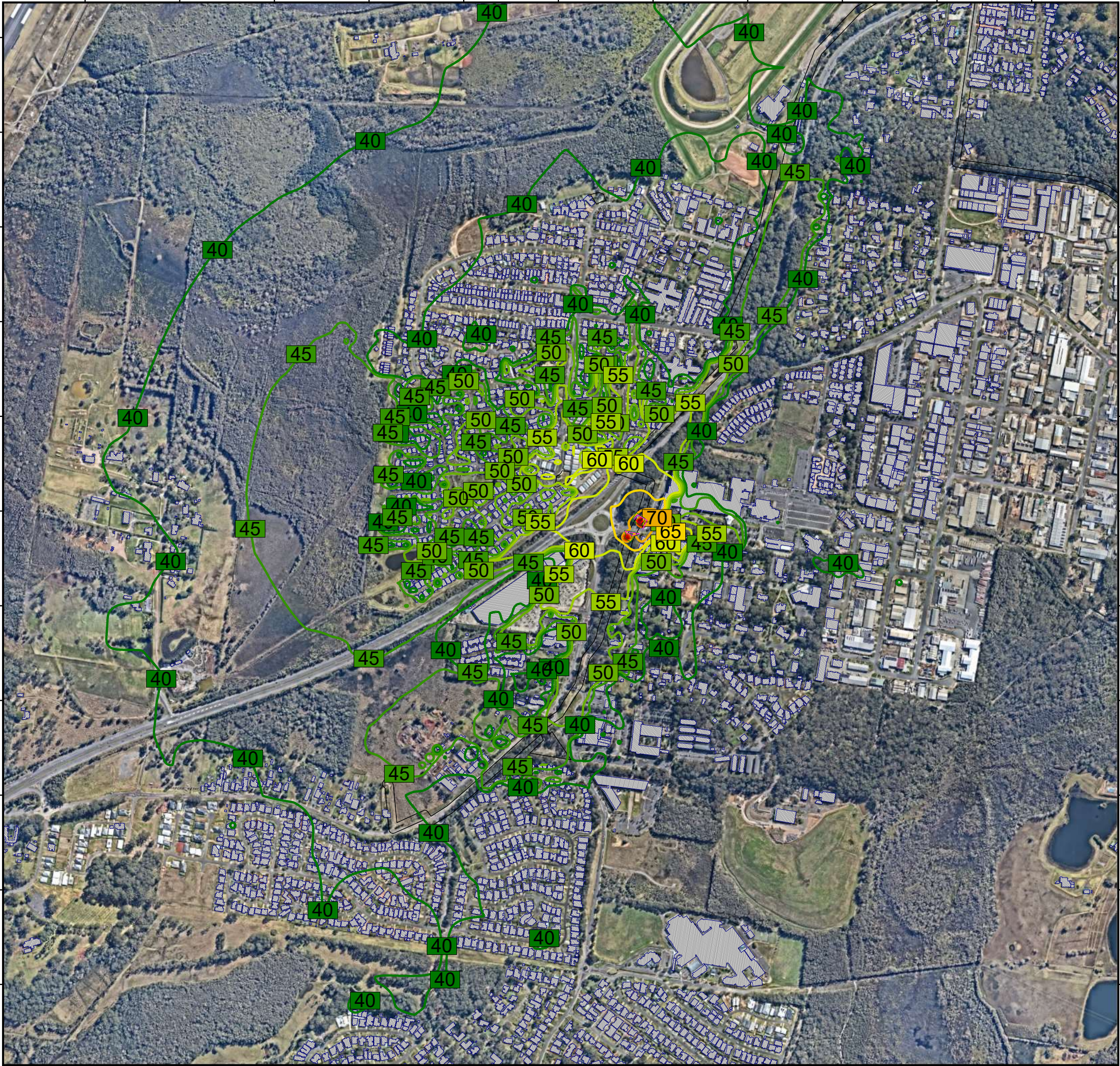
<= 40.0	<= 40.0
40.0 < 45.0	<= 45.0
45.0 < 50.0	<= 50.0
50.0 < 55.0	<= 55.0
55.0 < 60.0	<= 60.0
60.0 < 65.0	<= 65.0
65.0 < 70.0	<= 70.0
70.0 < 75.0	<= 75.0
75.0 < 80.0	<= 80.0
80.0 < 85.0	<= 85.0
85.0 < 90.0	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source

Length scale 1:10509

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
21a

Wrights Road Micro Tunnelling - Pipe Install with 3m Barrier
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

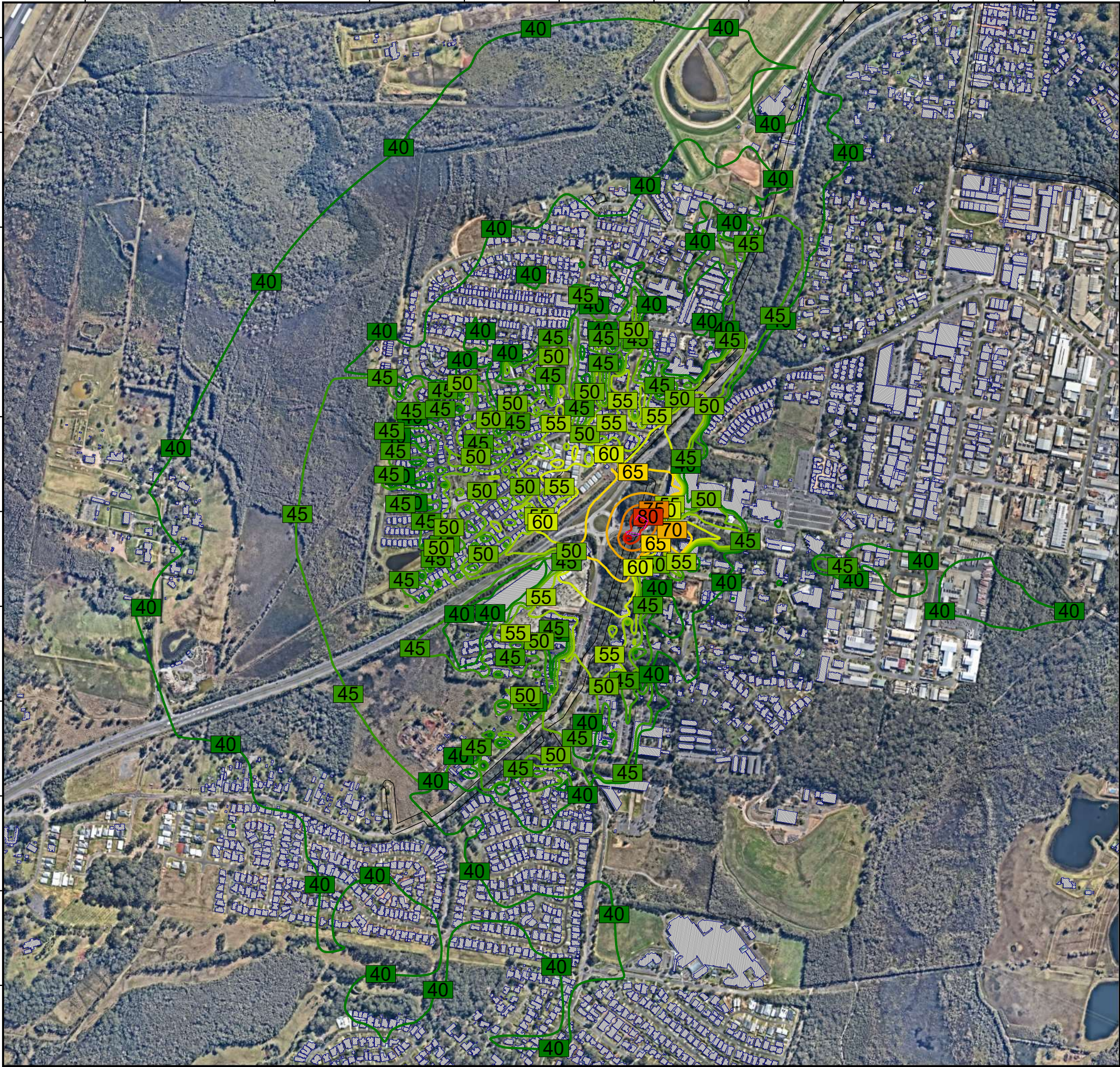
<= 40.0	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:10509

0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
22

Wrights Road Micro Tunnelling - Grouting/Tidying
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

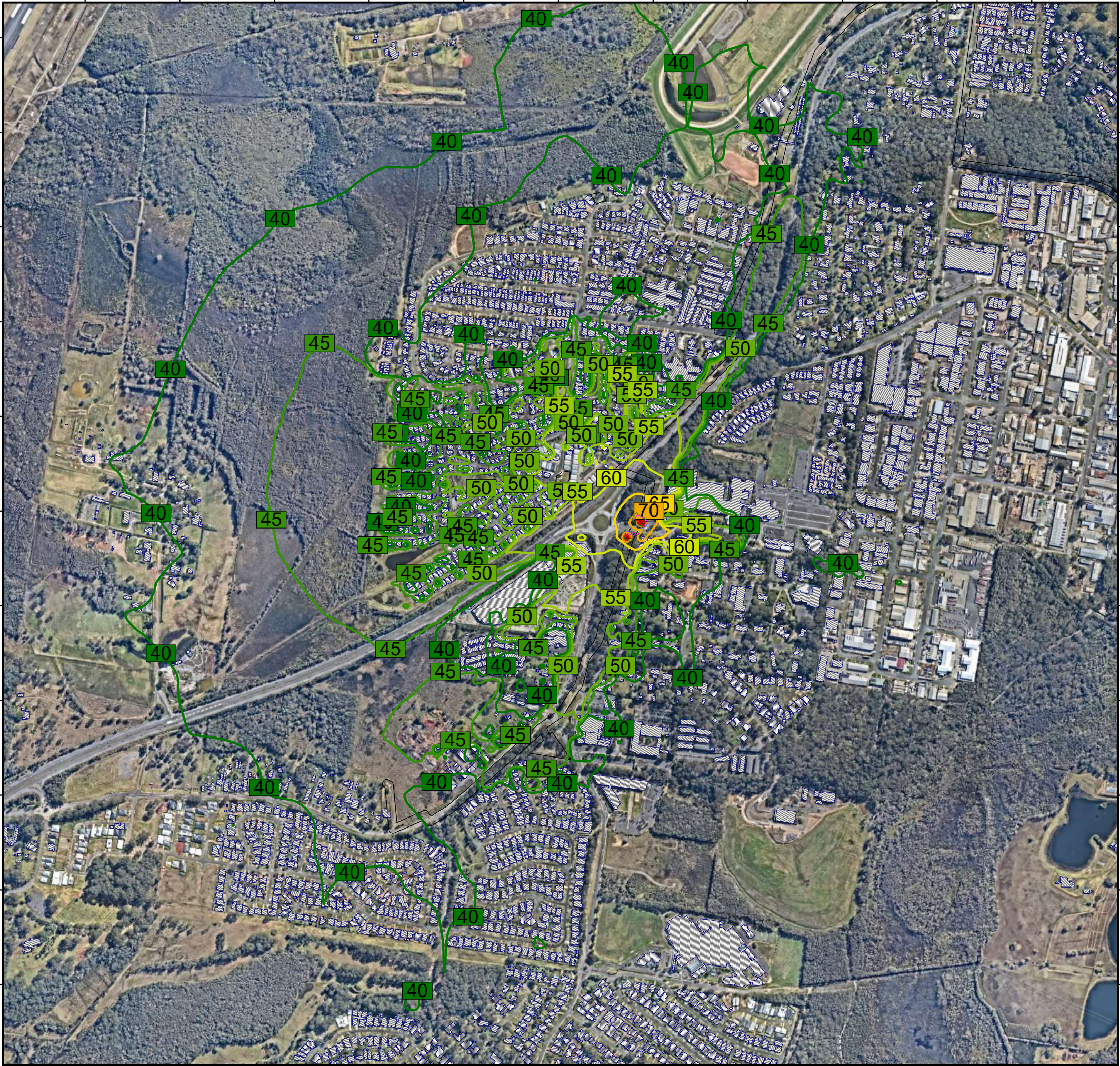
<= 40.0	<= 40.0
40.0 < <= 45.0	<= 45.0
45.0 < <= 50.0	<= 50.0
50.0 < <= 55.0	<= 55.0
55.0 < <= 60.0	<= 60.0
60.0 < <= 65.0	<= 65.0
65.0 < <= 70.0	<= 70.0
70.0 < <= 75.0	<= 75.0
75.0 < <= 80.0	<= 80.0
80.0 < <= 85.0	<= 85.0
85.0 < <= 90.0	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source



Length scale 1:10509
0 50 100 200 300 400 m



Customer:
Port Macquarie-Hastings Council
Project: Thrumster WWTP
Project-No. 12611129

Map
22a

**Wrights Road Micro Tunnelling -
Grouting/Tidying with 3m Barrier**
Calculation in 1.5 m above ground

Processed with SoundPLAN 9.1, Update 17/02/2025

Levels Day
in dB(A)

40.0 <	<= 40.0
40.0 <	<= 45.0
45.0 <	<= 50.0
50.0 <	<= 55.0
55.0 <	<= 60.0
60.0 <	<= 65.0
65.0 <	<= 70.0
70.0 <	<= 75.0
75.0 <	<= 80.0
80.0 <	<= 85.0
85.0 <	<= 90.0
90.0 <	<= 90.0

Signs and symbols

- Point source
- Line source
- Area source
- Wall
- Wall

Length scale 1:10509

0 50 100 200 300 400 m



ghd.com

→ **The Power of Commitment**

Attachment D - Biodiversity Response - Query 6 and 7

Find enclosed letter in response to query 6 and 7



16 October 2025

Our Ref: EC217

Cameron Sales
Project Manager – Thrumster Wastewater Network
Utilities Planning and Design
Port Macquarie Hastings Council
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www.dewittconsulting.com.au

Dear Cameron,

RE: Response to Community Submissions

Following an initial submission of this BDAR, dated 24/07/2024, de Witt Ecology provided a separate Response to Submissions and prepared an amended BDAR dated 16/04/2025. We have responded to further submissions on 24/06/2025.

The below addresses an additional submission from the Department of Planning, Housing and Infrastructure (DPHI) dated 27/08/2025.

THE-REQUEST-FOR-ADDITIONAL INFORMATION

The department has requested.

6. Please advise what Additional and Appropriate Measures (AAM) Council considers it may be able to take regarding potential Serious and Irreversible Impacts (SAIL) to the Giant Dragonfly
7. Please provide the final agreed SAIL measures

The term AMM is taken to have the same meaning as per s7.16 of the *Biodiversity Conservation Act 2016* in referencing measures that will minimise impacts if consent or approval is to be granted.

A meeting was held on 8/10/2025 with representatives of Port Macquarie Hastings Council, DPHI, members of the CPHR team (Conservation Programs, Heritage and Regulation), and de Witt Ecology. The meeting discussed actions that have already been considered, actions addressed in the BDAR and the further measures that could be implemented.

PROPOSED ADDITIONAL AND APPROPRIATE MEASURES

It is proposed that the area referred to as Wetland A in the BDAR is protected for the life of the Thrumster Wastewater Treatment Plant (WWTP) as part of a specific management plan. The management plan will focus on areas of habitat suitable for Giant Dragonfly (*Petalura gigantea*) within Wetland A and a buffer on the wetland areas. Specifically, the management plan will involve aspects similar to the adjacent Partridge Creek Biobank including,

- Restriction of use – site will be inaccessible to unauthorised personal and prevent grazing by cattle.
- Weed management – weeds will be managed with consideration for reducing erosion, ensuring that herbicide use is suitable for wetland areas and excluding potential insecticide use near the wetlands.
- Management of feral hard hooved animals – this will initially target deer but be adaptive to allow for other introduced hard hooved animals.
- Establishment of photo monitoring.
- Allow inspections of the site at the request of relevant authorities and for valid research purposes.
- Require a notification to CPHR of any major disturbance events or change of ownership.
- Allow for the updating of the management plan as required.

The proposed management plan will function to expand the substantial protections already offered to Giant Dragonfly in the surrounding landscape by the Partridge Creek BioBank, which is now fully operational. By protecting this area for Giant Dragonfly, this species will act as an umbrella species to protect habitat suitable for other species as well.

FINAL AGREED SAI MEASURES

The measures taken to avoid SAI for Giant Dragonfly include the items already identified in the BDAR as well as the above proposed AAM.

In summary, the final measures for the SAI within the BDAR include,

- The preparation of a Vegetation Management Plan (VMP). The VMP will,
 - Have a minimum five (5) year management duration.
 - Perform monitoring of prescribed impacts due to water drawdown at the WWTP.
 - Consider revegetation following disturbance by the project, including from dewatering of groundwater dependent ecosystems.
- Perform staged vegetation clearing in a manner that directs fauna away from further threats.
- Perform pre-clearance fauna surveys to ensure that mobile fauna is not within the clearing footprint.
- Ensure that a suitably qualified ecologist will be present during the clearance of native vegetation and fauna habitat
- Implement erosion and sediment control plans
 - Erosion and sediment control measures will be regularly inspected, particularly following rainfall events.
 - All stockpiled material will, where practical, be stored in bunded areas to avoid contamination of waterways.
- Spill kits will be available to manage accidental spills of hazardous materials.
- Adaptive management will be performed through adaptation of the VMP if needed for management of revegetation.
- If additional threatened species are found within the Subject Land (such as if a Giant Dragonfly is found), works should stop to ensure the safety of the species.

The above measures are detailed in full within the existing BDAR. In addition to the above measures outlined by the BDAR, the following AAM will also be performed

- Development of a Giant Dragonfly Management Plan for Wetland A that will be maintained for the life of the WWTP. The management plan will include,
 - Restriction of access.
 - Management of exotic vegetation.
 - Management of hard hooved animals.
 - Establishment of photo monitoring.
 - Allow inspection by relevant authorities and for valid research purposes.
 - Provide for the notification to CPHR of major disturbances or change of ownership.
 - Allow for update of the management plan as required.

Yours sincerely,

de Witt Ecology



Dr Robert Scanlon