MODIFICATION REPORT

# PROJECT APPROVAL 08_0129 ORICA KOORAGANG ISLAND: MODIFICATION APPLICATION - MOD 5

## PRILL TOWER AIR QUALITY IMPROVEMENT PROJECT

AUGUST 2021

# CONTENTS

# Certification

| | | |
|---|---|---|
| | Submission of Modification Report prepared under the Environmental Planning and Assessment Act 1979 Section 4.55 1A) | |
| EA prepared by: | | |
| **Name** | **Nathan Robinson** | |
| **Qualifications** | Bachelor of Chemical Engineering (Hons)<br>Senior Environment Specialist | |
| **Address** | Orica Kooragang Island<br>15 Greenleaf Road<br>Kooragang Island 2304 | |
| **In respect of** | Proposed Ammonium Nitrate Facility Expansion, Kooragang Island – MOD5 Prill Tower Scrubber Air Quality Improvement Project | |
| **Project application**<br>**Applicant name**<br>**Applicant address** | 08_0129 (MOD5)<br>Orica Australia Pty. Ltd<br>15 Greenleaf Road, Kooragang Island, NSW, 2304 | |
| **Land to be developed lot no., DP/MPS, vol/fol etc. Proposed project** | The proposed project is to be carried out on Lot 3 in Deposited Plan 234288. The proposed project involves the installation of auxiliary air scrubbing equipment on the existing Prill Tower | |
| **Environmental Assessment** | A modification report is attached | |
| **Certification** | I certify that I have prepared the contents of this Modification Report and to the best of my knowledge it is true in all material particulars and does not, by its presentation or omission of information, materially mislead | |
| **Signature** | | |
| **Name** | Nathan Robinson | |
| **Date** | 9 August 2021 | |

## GLOSSARY AND ABBREVIATIONS

| | |
|---|---|
| AN | Ammonium nitrate |
| ANSOL | Ammonium nitrate solution |
| AQMS | Air quality monitoring station |
| DA | Development Application |
| dBA | A-weighted decibels are an expression of the relative loudness of sounds in air as perceived by the human ear. |
| dBC | Unlike dBA, dBC measurements include low and high frequency sound levels |
| DCP | Development Control Plan |
| DoP | Department of Planning |
| DPIE | Department of Planning Industry and Environment |
| EA | Environmental Assessment |
| EPA | Environment Protection Authority |
| EP&A Act. | Environmental Planning & Assessment Act 1979 |
| EPBC Act | Environment Protection and Biodiversity Act |
| EPL | Environmental Protection Licence |
| FTE | Full time equivalent |
| ICNG | Interim Construction Noise Guideline |
| KI | Kooragang Island |
| kVA | Kilovolt ampere - Apparent Power |
| LEP | Local Environment Plan |
| mAGL | Metres above ground level |
| MOD | Development Consent Modification |
| MW | Megawatt or million watts |
| NES | National Environmental Significance |
| NSWLEC | NSW Land and Environment Court |
| Orica | Orica Australia Pty Ltd |
| PM10 | Particulate less than 10 micron |
| PM2.5 | Particulate less than 2.5 micron |
| POEO Act | Protection of the Environment Operations Act 1997 |
| PoN | Port of Newcastle |
| PRP | Pollution Reduction Program |
| SEARs | Secretary’s Environmental Assessment Requirements |
| SEPP | State Environmental Protection Policy |
| SSD | State Significant Development |
| TP | Total particulates |
| TPD | Tonnes per day |
| µm | Micron or micrometre |

# EXECUTIVE SUMMARY

## Background

Orica's Ammonium Nitrate Expansion Project (08_0129) was subject to an Environmental Assessment (EA) in June 2009 and was approved on 1 December 2009. Subsequent modifications to 08_0129 have also been approved for:

- Amendments to the layout of the Site, approved in July 2012; (MOD1)
- Changes to the size and location of the proposed nitric acid storage tank and the addition of ammonia flares, approved in December 2014 (MOD2);
- Administrative modification to increase the allowable annual production limit of ammonia at the site from 360,000t to 385,000t (MOD3), approved in December 2015; and
- Replacement of the existing Nitrates Effluent Pond with an above ground bunded tank (MOD4)

This project forms a further modification (MOD5) of development consent 08_0129 and will address particulate emissions from the No. 1 Ammonium Nitrate Plant Prill Tower (Prill Tower) and satisfy consent Condition 27 in addition to satisfying PRP 50 under the site's EPL (the **Project**).

## Project description

The project involves the installation of irrigated fibre-bed scrubbing (IFS) technology to the existing Prill Tower which includes the following:

- Air collection manifold and downcomer duct. An air collection manifold will be fitted beneath the existing prill tower fan room and supported from the tower while a stainless steel downcomer duct with free standing support structure will be installed to bring the unscrubbed gas into the scrubber.
- A stainless steel scrubber vessel approximately 7.4m wide x 10m deep x 18m high which contains filtration medium;
- 1.6MW scrubber fan with variable speed drive incorporating high voltage transformer; and
- 37.9m stainless steel self-supporting exhaust stack.

The project will involve a capital investment of approximately $39 million. The construction works associated with the project will employ approximately 40 people over an 18-month period (60 full time equivalent workers (FTE's)). Once operational no additional staff will be employed.

## Environmental Assessment

### Air Quality

A Level 2 Air Quality Impact Assessment (AQIA) was conducted to assess the air quality impacts associated with the addition of the irrigated fibre-bed scrubber (the Scrubber). The assessment was undertaken in accordance with the 'NSW Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (EPA 2017) (Approved Methods)' using the air dispersion model CALPUFF. Four dispersion modelling scenarios representing different possible operational regimes were examined to further understand the expected change in air pollutant concentrations following the addition of a scrubber to the Prill Tower.

Dispersion modelling showed that there was a significant drop in ground level pollutant concentrations at all locations for all pollutants modelled. Reductions in pollutant concentrations of greater than 98% were observed for the typical operational scenario, over 95% for the conservative operational scenario and over 87% for the maximum operational scenario following installation of the scrubber. All pollutant concentrations complied with their relevant air quality criteria and are expected to result in lower cumulative concentrations in the environment.

The predicted decrease in ground level concentrations following the construction of the scrubber is expected to make a significant improvement to the air quality in the environment immediately surrounding the Orica facility.

## Noise

A Noise Impact Assessment (NIA) was completed on the proposed Project. Under the existing consent, the NSW Department of Planning, Industry and Environment (DPIE) determined that noise generated through the inclusion of additional operating plant and infrastructure should not increase the noise impacts from the existing operations. To ensure projects at Orica's side did not contributed to increased noise levels at residential receivers DPIE required that any additional noise emitted must achieve a contribution at least 10dBA below pre-expansion development levels.

The NSW Environment Protection Authority (EPA) 'Noise Policy for Industry (2017)' (NPfI) refers to guidelines and procedures for assessing noise from existing industrial premises. Where a development proposal involves a discrete process, and premises–wide mitigation has or is to be considered outside the development proposal, a project noise trigger level from the new/modified component (not the whole site) of the operation may be set at 10dBA or more below the existing noise levels.

Six (6) reference assessment locations referenced in the Orica Noise Management Plan *(*NMP*)* were adopted for the purpose of assessing noise from the site. Three (3) locations are in the Stockton residential area and three (3) locations are adjacent to the Orica site on Kooragang Island. Due to the influence of transient ambient noise associated with local domestic activities and noise from neighbouring industrial sources on Kooragang Island, the three (3) Kooragang Island locations were selected to assist with monitoring near field noise emissions and trends influenced by Orica rather than the monitoring locations in Stockton*.*

Computer modelling for the Project considered normal operational noise conditions. The source noise data was developed from supplier and contractor technical reference information for the various noise generating plant associated with the project. Where supplier data was not available standard reference data was used. This information was used to inform the design process and the following noise mitigation measures were incorporated into the design:

- an in-duct acoustic splitter attenuator installed on the fan discharge and before the scrubber stack;
- external acoustic lagging of the scrubber fan casing; and
- the fan motor will be installed on a concrete pedestal.

Noise modelling results for the Project in isolation from existing site operations and under neutral meteorological conditions predict the noise contributions from the Project will be more than 10dBA lower than the target design noise goals. A low frequency noise assessment was also undertaken in accordance with EPA guidelines. The model predicted that the difference between the 'C-weighted' and 'A-weighted' levels will be within 15dB and an assessment of the one-third octave levels was not required to assess low frequency noise.

In summary, with the proposed noise mitigation measures incorporated into the Project, operational noise modelling for the Project predicts compliance with DPIE and the EPA's noise requirements. A full copy of the NIA is provided in Section 9.3.4.

## Visual Amenity

A visual amenity assessment was undertaken to assess the impact of the proposal from the Stockton residential area to the east. The impact of the proposal is minimised by the retrofitted nature of the project to the existing Prill Tower. In the context of the industrial nature of the existing plant, and the fact that the Project is smaller in scale and immediately adjacent to the existing Prill Tower, the impact to visual amenity is considered minor. A visual representation of the Project is supplied in section 9.3.3 of the EA.

## Justification

The proposed development would provide local direct and indirect employment opportunities. The 12 month construction phase is expected to require a construction workforce peaking at 40 personnel. The proposed development is, therefore, considered to be justifiable from an economic perspective, however it should be noted this project is environment and community driven and there are no financial benefits associated with it. The assessments presented in this EA regarding visual amenity, air quality, noise, hazard and risk, heritage and traffic indicate that the proposed Project would have an overall positive impact on socio-cultural issues. The Project is therefore justifiable on social grounds.

Orica is proposing to install ancillary pollution control equipment on the existing Prill Tower to reduce particulate air emissions. The project design will meet the overall site noise objectives and represents a minor impact on visual amenity. The proposed development will be substantially the same as the Development currently approved, and as such is consistent with minor modification under Section 4.55 1A) of the EP&A Act. As outlined in detail in the body of the assessment, it is considered that the Project will benefit the environment and the community by reducing particulate loads in the local airshed and reducing nitrogen loads on the Hunter River Estuary.

# 1. INTRODUCTION

Orica Australia Pty Ltd (Orica) is seeking approval for the install of irrigated fibre-bed scrubbing (IFS) technology on the existing No. 1 Ammonium Nitrate Prill Tower (Prill Tower) at the Kooragang Island (KI) facility (the site). **Figure 1** shows the site location. **Figure 2** shows the location of the existing Prill Tower and the proposed scrubber (the Project).


***Figure 1 - Site Location***

# 2. BACKGROUND

Orica's Ammonium Nitrate Expansion Project (08_0129) was subject to an Environmental Assessment (EA) prepared by AECOM. The project application was submitted to the Department of Planning (DoP), now Department of Planning, Industry and Environment (DPIE), in June 2009 and was approved on 1 December 2009.

Subsequent modifications to project approval 08_0129 have also been approved for:

- Amendments to the layout of the Site, approved in July 2012; (MOD1)
- Changes to the size and location of the proposed nitric acid storage tank and the addition of ammonia flares, approved in December 2014 (MOD2);

- Administrative modification to increase the allowable annual production limit of ammonia at the site from 360,000t to 385,000t (MOD3), approved in December 2015; and
- Replacement of the existing Nitrates Effluent Pond with an above ground bunded tank (MOD4).

This project forms a further modification (MOD5) of development consent 08_0129.

In the air quality assessment completed for the 2009 EA it was identified that concentrations of particulate matter of less than 10 micron in size (PM10) were in excess of assessment criteria at two receptor locations in Stockton.

Conditions were included in the Ammonium Nitrate Expansion Project (08_0129) development consent requiring:

1. Installation of a scrubber No. 3 ammonium nitrate plant's prill tower (AN3) (Condition 21(c)).
2. Annual reporting on progress to reduce PM10 emissions and include a timeframe for implementation of emission controls (Condition 27)

In addition, the site's Environment Protection Licence (EPL 828) includes a Pollution Reduction Program, PRP 50, which requires installation of air pollution control equipment on the Prill Tower by January 2024.

This project will address particulate emissions from the Prill Tower and will enable Condition 27 of the development consent to be removed and satisfy PRP 50 under the site's EPL.

# 3. SITE DESCRIPTION

Orica's Kooragang Island site is located approximately 3 km north of the Newcastle Central Business District, at 15 Greenleaf Road, Kooragang Island and covers an area of approximately 25 hectares and incorporates land parcels Lot 2 and 3 in DP234288.

The site operates on a 24 hour per day, 7 day per week basis with approximately 160 direct employees, and more than 80 contractors and consists of:

- An ammonia plant;
- Three nitric acid plants (NAP) being NAP1, NAP2 and NAP3 (nitric acid is used in the production of ammonium nitrate);
- Two ammonium nitrate (AN) plants, namely ANP1 which manufactures Nitropril (a porous prilled ammonium nitrate product) and AN2 which manufactures an ammonium nitrate solution;
- Bagging and bulk dispatch facilities for anhydrous ammonia, aqueous ammonia, solid ammonium nitrate, AN solution and nitric acid;
- Shipping/wharf related operations;
- Ancillary/site services such as demineralised water production, instrument/factory air generation, laboratory and workshop facilities, and
- Offices and amenities located adjacent to Greenleaf Road on the eastern side of the plant.

The location of the operating areas of the facility and the Project location are shown in **Figure 2.**


*Figure 2 - Location of plant facilities and Project*

Under the development consent 08-0129 and subsequent modifications, the site is approved to manufacture up to:

- Ammonia – 385,000 tonnes per annum (tpa)
- Nitric acid – 605,000 tpa
- Ammonium nitrate – 750,000 tpa

The main raw materials used in production are natural gas, electricity and water.

# 4. PROJECT DESCRIPTION

The Site produces two ammonium nitrate (AN) products consisting of a liquid solution and a dry bulk product produced via a prilling process in Prill Tower.

The Prill Tower commenced operation in 1969 and consists of an approximately 52 metre high square-section tower. Ambient air flows counter-current to a shower of hot liquid AN solution, forming prills (small beads) as the AN stream cools and solidifies. Process air exits the Prill Tower via 12 fan discharge outlets located below the Prill Tower Headhouse. The Headhouse is at the top of the Prill Tower and is where the hot liquid AN solution enters the tower shaft via the Prill Head.

The project involves the installation of ancillary equipment, namely Scrubber technology to the existing Prill Tower.

Figure 3 represents the proposed configuration of the Scrubber, which comprises the following main equipment. Note the final dimensions and details are subject to completion of detailed design:

- Air collection manifold and downcomer duct. An air collection manifold will be fitted beneath the existing prill tower fan room and supported from the tower while a stainless steel downcomer duct with free standing support structure will be installed to bring the unscrubbed gas into the scrubber;
- A stainless steel scrubber vessel approximately 7.4m wide x 10m deep x 18m high which contains filtration medium;
- 1.6MW scrubber fan with variable speed drive incorporating high voltage transformer; and
- 37.9m stainless steel self-supporting exhaust stack.

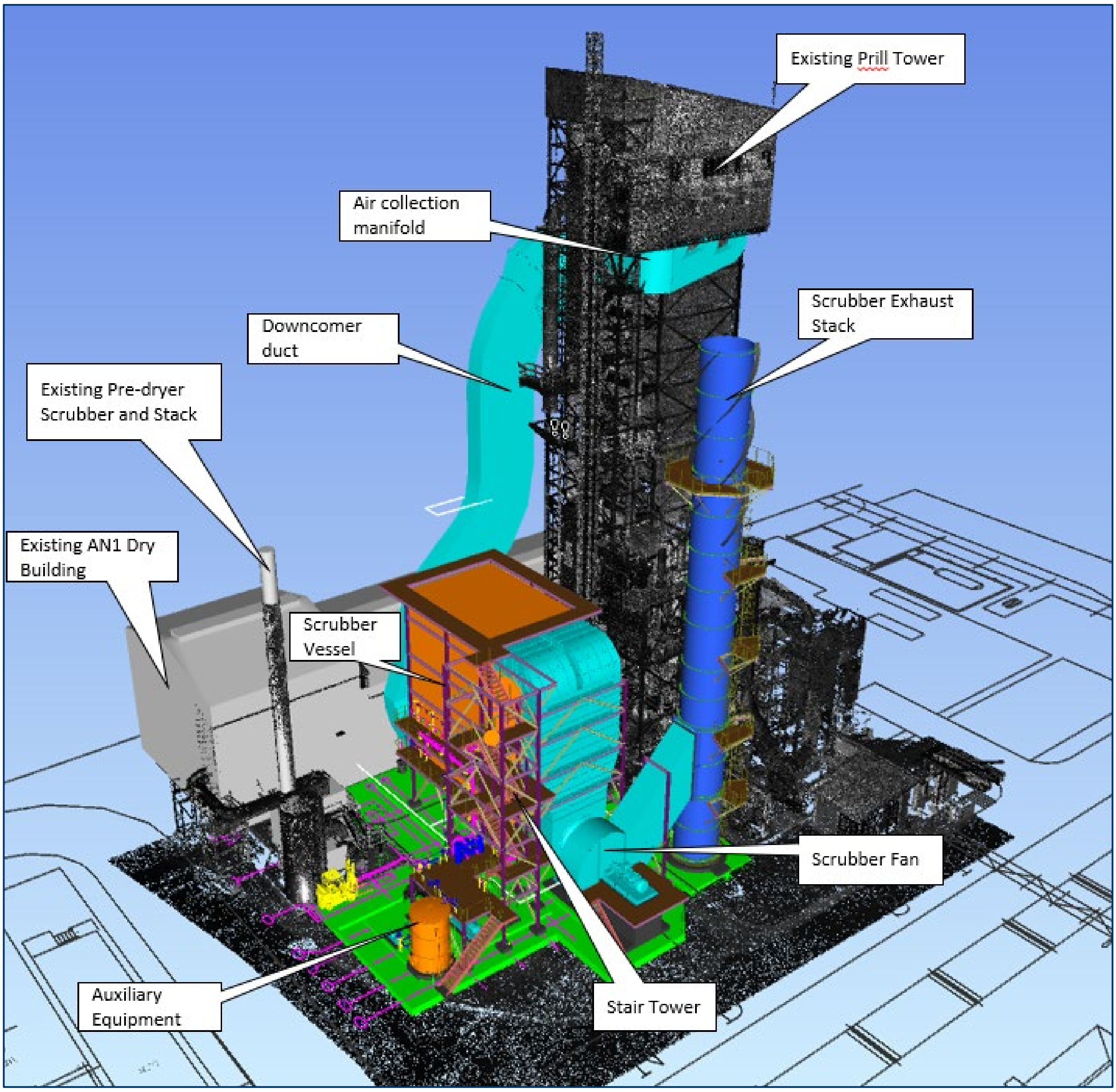


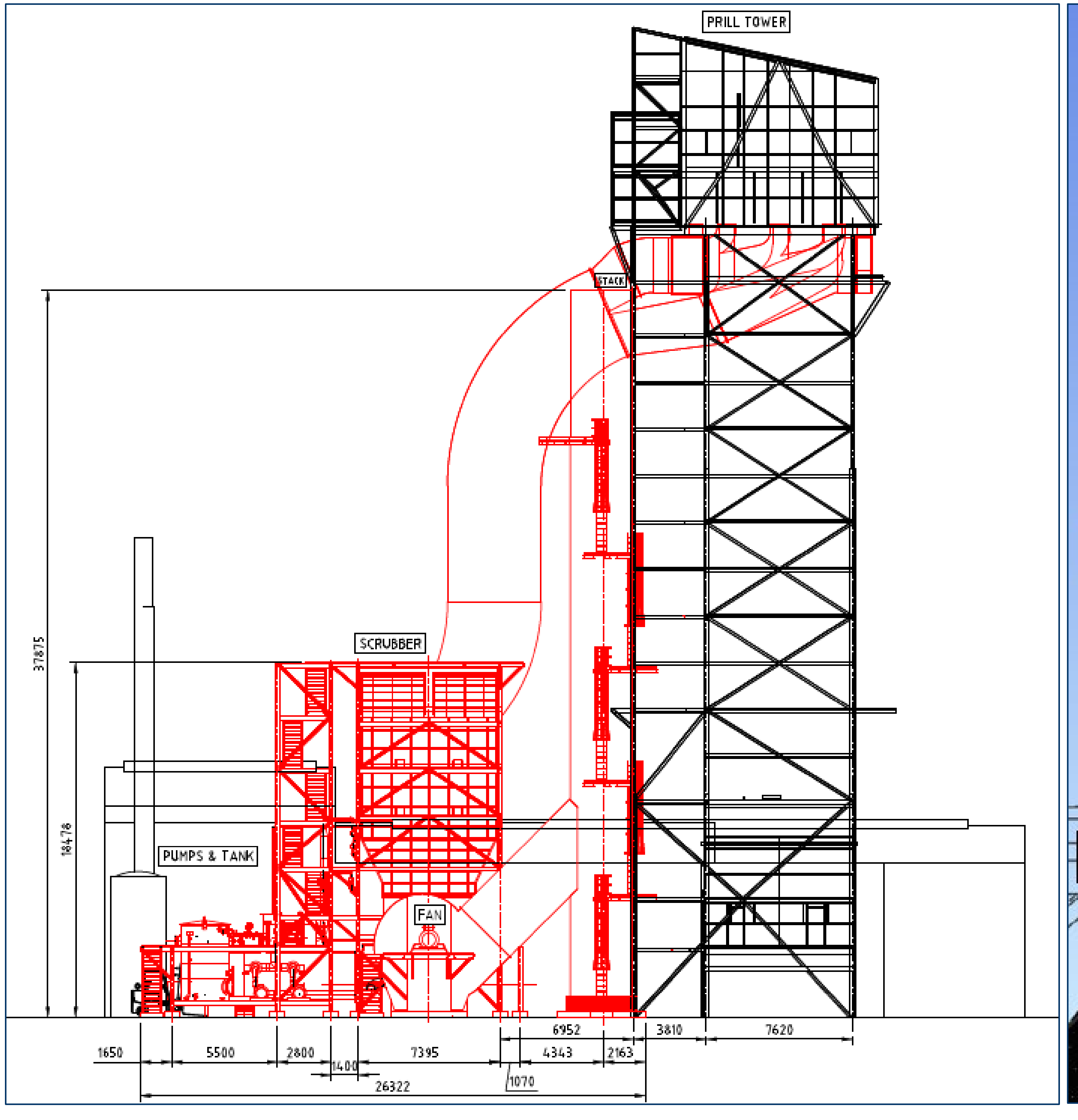

*Figure 3 - Layout of proposed Prill Tower Scrubber*

Under the proposal, exhaust air from the 12 fans installed below the Headhouse would be collected from the top of the Prill Tower and ducted into the base of the scrubber. The unfiltered air would pass through a bank of mesh pads which remove the coarser AN particulate (>3 μm diameter) from the airflow. After passing through the mesh pads the air would flow through a bank of candle filters (fibre bed elements), which capture finer particulates (mostly the particles less than 2.5 micron in size (PM2.5)), before passing through the fan and discharging via the scrubber exhaust stack.

The candle filters are periodically wetted to dissolve the collected ammonium nitrate and this solution drains to the sump in the base of the scrubber. A recirculating flow from the sump is used to wash the mesh pads. The wash water is dosed with nitric acid from existing site tanks to aid the removal of free ammonia gas from the airflow. The concentration of AN builds up in the wash water, and a portion of this solution is discharged from the scubber and recycled in the ANP1 Plant.

The project will involve a capital investment of approximately $39M. The construction works associated with the project will employ approximately 40 people over an 18-month period (60 full-time equivalents). Once operational no additional staff will be employed.

A general arrangement of the project is supplied in Figures 3 with two dimensional and three dimensional model elevations supplied in Figures 4 and 5. All views show the Project elements in colour and the existing structure in black and/or greyscale. An overall scrubber layout drawing is provided in Appendix D.



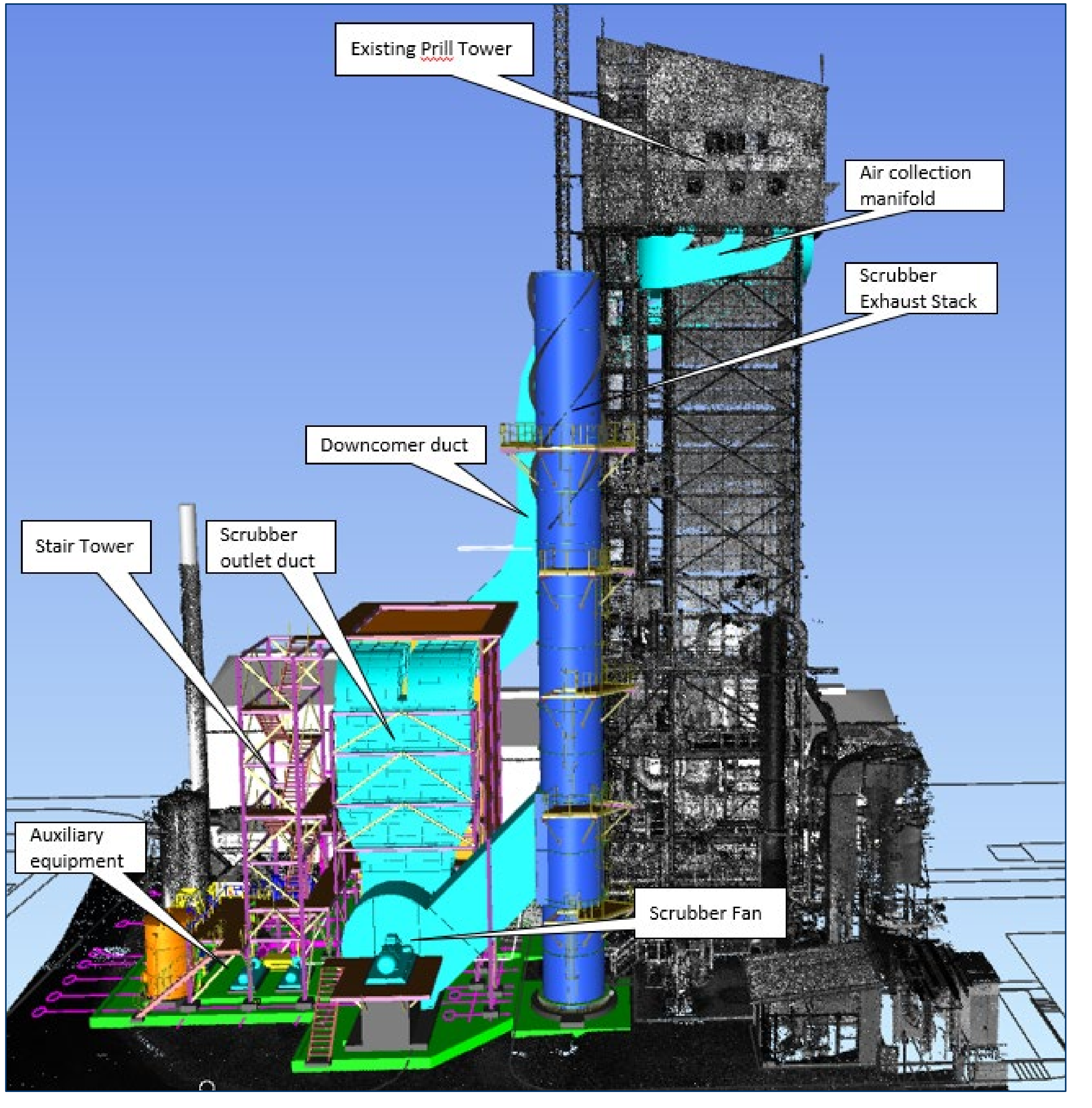




*Figure 4 - East Elevation - Prill Tower Scrubber – 2D drawing (extract from Appendix D) and 3D model views (all dimensions in mm)*

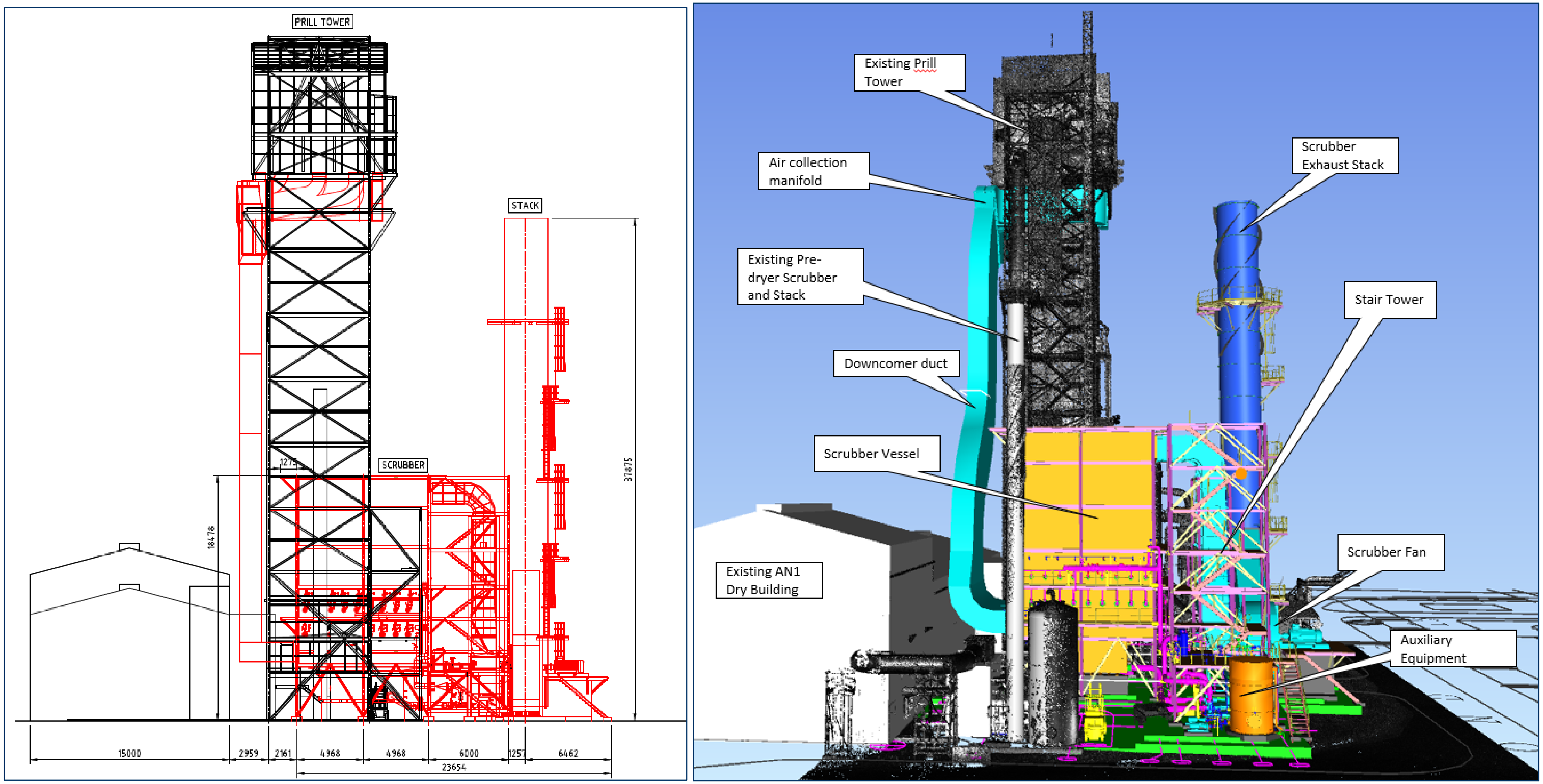



***Figure 5 - South elevation - Prill Tower Scrubber – 2D drawing (extract from Appendix D) and 3D model views (all dimensions in mm)***

# 5. STATUTORY CONTEXT

On 20 November 2020, Orica met with DPIE to discuss the use of Condition 7F of Project Approval 08_0129 for the addition of ancillary equipment, a Prill Tower Scrubber, to the existing ANP1 Prill Tower. DPIE indicated a statutory modification of the approval under Section 4.55 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) would be required.

A further discussion was held with DPIE on the 12 March 2021, where this approval pathway was confirmed, and DPIE requested submission of a scoping review to assist with determining whether a modification application under Section 4.55 1A) or 4.55 2) of the EP&A Act was appropriate.

A Scoping Report for the project was approved by DPIE on 28 April 2021, and it was confirmed that Section 4.55 1A) of the EP&A Act was applicable to the project.

## 5.1 ENVIRONMENTAL PLANNING & ASSESSMENT (EP&A) ACT

### 5.1.1 SECTION 4.55(1A) EP&A ACT

Section 4.55(1A) of the EP&A Act reads:

*4.55 Modification of consents—generally (formerly Section 96 1A)*

*(1A)* ***Modifications involving minimal environmental impact.*** *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if;*

> *(a) it is satisfied that the proposed modification is of minimal environmental impact, and*
> *(b) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all), and*
> *(c) it has notified the application in accordance with—*
>> *(i) the regulations, if the regulations so require, or*
>> *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
>
> *(d) it has considered any submissions made concerning the proposed modification within any period prescribed by the regulations or provided by the development control plan, as the case may be.*

*Subsections (1), (2) and (5) do not apply to such a modification.*

An application made under Section 4.55(1A) must demonstrate that *"the proposed modification will have minimal environmental impact; and the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified".*

The assessment needs to appreciate both the qualitative and quantitative aspects of the development being compared in its proper context as described by Bignold J at paragraphs 54 to 56 in *Moto Projects (No.2) Pty Ltd v North Sydney* Council *[1999] NSWLEC 280*. This judgment included the following comments:

> *54. The relevant satisfaction required by* ***s 96(2)(a) [now Section 4.55 (2)]*** *to be found to exist in order that the modification power be available involves an ultimate finding of fact based upon the primary facts found. I must be satisfied that the modified development is substantially the same as the originally approved development.*

*55. The requisite factual finding obviously requires a comparison between the development, as currently approved, and the development as proposed to be modified. The result of the comparison must be a finding that the modified development is "essentially or materially" the same as the (currently) approved development.*

*56. The comparative task does not merely involve a comparison of the physical features or components of the development as currently approved and modified where that comparative exercise is undertaken in some type of sterile vacuum. Rather, the comparison involves an appreciation, qualitative, as well as quantitative, of the developments being compared in their proper contexts (including the circumstances in which the development consent was granted).*

The *Modifying an Approved Project* draft guidelines produced as part of the *Draft Environmental Impact Assessment Guidance Serie*s by the NSW Department of Planning and Environment in June 2017, provides some guidance when assessing modifications of State Significant Development (SSD):

*For SSD, a proponent must demonstrate that the change, if carried out, would result in a development that would be substantially the same development as the original development. In order to draw this conclusion, a proponent must have regard to the following considerations, which have been established through decisions of the NSWLEC:*

- *''Substantially'' means ''essentially or materially'' or ''having the same essence.''*
- *A development can still be substantially the same even if the development as modified involves land that was not the subject of the original consent (provided that the consent authority is satisfied that the proposal is substantially the same).*
- *If the development as modified, involves an ''additional and distinct land use'', it is not substantially the same development.*
- *Notwithstanding the above, development as modified would not necessarily be substantially the same solely because it was for precisely the same use as that for which consent was originally granted.*
- *To determine whether something is ''substantially the same'' requires a comparative task between the whole development as originally approved and the development as proposed to be modified. In order for the proposal to be ''substantially the same'', the comparative task must:*
    - *result in a finding that the modified development is ''essentially or materially'' the same*
    - *appreciate the qualitative and quantitative differences in their proper context*
    - *in addition to the physical difference, consider the environmental impacts of proposed Modification Applications to approved developments.*

An assessment of the Project against each of the considerations is detailed below:

**1. *'Substantially'' means ''essentially or materially'' or ''having the same essence.''***

**Assessment:**

It is considered the modification proposal for the installation of the Scrubber will be substantially the same as that approved and is development that could be considered "*materially the same as that previously approved".* Furthermore, it is considered that the modifications proposed are of the same '*essence'* as the approved development given that:

- the proposal maintains the current approved land use and does not seek to alter the character of development;
- the proposal is not associated with a change to production limits;
- the proposed built form will be substantially the same as that already approved, in that development is retrofitted to an existing structure on the site and is located within the general confines of the site;
- The proposed modifications do not represent an expansion of the overall plant footprint;
- The proposal reduces the environmental impact of the existing Prill Tower and

- The proposal is consistent with the intent of the following existing conditions in the Ammonium Nitrate Expansion Project (08_0129) development consent:
  - A scrubber needed to be included on the second proposed prill tower (AN3-unconstructed) (Condition 21(c)).
  - Orica needed to report annually on progress to reduce PM10 emissions and include a timeframe for implementation of emission controls (Condition 27)

2. ***A development can still be substantially the same even if the development as modified involves land that was not the subject of the original consent (provided that the consent authority is satisfied that the proposal is substantially the same).***

   **Assessment:**
   The proposal does not involve land that was not the subject of the approval.

3. ***If the development as modified, involves an ''additional and distinct land use'', it is not substantially the same development.***

   **Assessment:**
   The proposal does not involve an *''additional and distinct land use'.*

4. ***Notwithstanding the above, the development as modified would not necessarily be substantially the same solely because it was for precisely the same use as that for which consent was originally granted.***

   **Assessment:**
   This Modification Application seeks to modify elements of the process that have already been approved and will not change the scale or nature of those processes.

5. ***To determine whether something is ''substantially the same'' requires a comparative task between the whole development as originally approved and the development as proposed to be modified. In order for the proposal to be ''substantially the same'', the comparative task must:***

   o ***result in a finding that the modified development is ''essentially or materially'' the same***
   o ***appreciate the qualitative and quantitative differences in their proper context***
   o ***in addition to the physical difference, consider the environmental impacts of proposed Modification Applications to approved developments.***

   **Assessment:**
   The proposal represents a reduction in environmental impact of an existing process via the addition of ancillary air pollution control equipment to existing operations. The proposal will be located within the approved footprint of the Nitrates Plant. The proposed development will have a limited visual impact. The bulk, character and scale of the structure associated with this modification application will be consistent with the existing Prill Tower and sited in the existing plant area.

On the basis of the above, the development will be substantially the same as the approved development and this modification report has been submitted for consideration under Section 4.55(1A) of the EP&A Act.

## 5.2 ENVIRONMENTAL PLANNING INSTRUMENTS

### 5.2.1 NEWCASTLE LOCAL ENVIRONMENTAL PLAN 2012

The Site is located within the Newcastle City Local Government Area where the relevant Local Environmental Planning instrument is the Newcastle Local Environmental Plan 2012 (LEP 2012). However, the proposed Site is within the boundary of the Three Ports Site as shown on the Newcastle Port Site – Land Zoning Map – LZN 001 and thus falls under the provisions of the *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP). By virtue of Part 20(4) of Schedule 3 Major Development SEPP, environmental planning instruments other than State Environmental Planning Policies do not apply to the Site as it is located within Three Ports land. Therefore the provisions of the LEP 2012 do not apply to the Site.

### 5.2.2 NEWCASTLE DEVELOPMENT CONTROL PLAN

The planning controls within the Newcastle Development Control Plan (DCP) have been reviewed as they relate to the proposed development. Due to the nature of the proposed modification, no specific controls from the DCP apply to the proposal.

### 5.2.3 STATE ENVIRONMENTAL PLANNING POLICY (MAJOR DEVELOPMENT) 2005

The Major Development SEPP was used to identify developments that were Major Developments under the EP&A Act before the EP&A Act was amended to remove this definition. Orica approved transitioning of project approval 08_0129 to a Part 4 State Significant Development so that a modification application can be lodged under Section 4.55 of the Environmental Planning & Assessment Act 1979. This transition order was gazetted on 22 January 2021. This SEPP no longer applies to the site.

### 5.2.4 STATE ENVIRONMENTAL PLANNING POLICY 33 – HAZARDOUS AND OFFENSIVE DEVELOPMENT (SEPP 33)

SEPP 33 was designed to ensure that sufficient information is provided to consent authorities to determine whether a development is hazardous or offensive. Conditions can then be imposed on the development to reduce or minimise adverse impacts. Any development application for a potentially hazardous development must be supported by a Preliminary Hazard Analysis (PHA).

As the proposed modification will not introduce any new materials or processes to the site and will be undertaken in a manner which includes appropriate safety systems, it does not constitute an additional hazardous or offensive development that would require further consideration under SEPP 33. Further consideration of project specific hazards and risk is provided in **Section 9**.

## 5.3 COMMONWEALTH MATTERS

### 5.3.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

In addition to State-based approvals, actions that may significantly affect matters of National Environmental Significance (NES) require assessment and/or approval from the Commonwealth under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The EPBC Act lists eight matters of NES that must be addressed when assessing the environmental impacts of a proposal.

A review of the potential for the proposed modification to impact on NES matters was undertaken. Due to the proposed location of the scrubbing technology within the boundaries of the already highly modified plant area, it is considered no NES matters would be impacted by the proposed modification. No referral to the Commonwealth Department of Environment is considered necessary.

## 5.4 OTHER REGULATORY INSTRUMENTS

### 5.4.1 DEVELOPMENT CONSENT

Development consent 08_0129 includes a number of conditions that will require the updating and submission of documentation to DPIE, including:

- Project Staging Plan revision to reflect the Phase 8 works which will require approval from DPIE (Condition 7Cb))
- Pre-construction revisions where required to Fire Safety Studies, HAZOPs, FHA's and CSS's where required with approval of DPIE (Condition 14)
- Pre-commissioning requirements for revision (where required) and approval of the site's Emergency Plan and Safety Management System by DPIE (Condition 15)
- Compliance reports for "Pre-Start Up" and "Post-start Up" phases of the project (Condition 16)
- Preparation of a project CEMP (Condition 49A)

In addition, there will be post project obligations, for example:

- Compliance reports required for the "Post start Up" phase of the project (Condition 17)
- Air Quality Verification Study requirements (Condition 23)
- Revision of the site's EMP where required (Condition 49B)

### 5.4.2 ENVIRONMENT PROTECTION LICENCE

Orica's Kooragang Island facility currently operates under Orica's existing Environmental Protection Licence (EPL) No. 828.

Pollution Reduction Program 50 (PRP 50) under the EPL requires the installation of the scrubber to be completed before 1 November 2023. Prior to commissioning of the project and transition of the existing sampling point to the new stack sampling point, the licence will be varied in consultation with the EPA.

Orica has completed several Pollution Reduction Programs[1] related to the project in the site'sEPL. Details of the current Pollution Reduction Program (PRP 50) are as follows:

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[1] Historically several PRPs have been listed under EPL 828 aimed at reducing particulate emissions from the Prill Tower and include:

> *PRP 21 - AN1 Prill Tower Emission Investigation The licensee must characterise particulate emissions from the AN1 Prill Tower; review options to reduce emissions; and evaluate feasible options to reduce emissions. Completed in December 2013*
>
> *PRP 46 - $PM_{2.5}$ Characterisation Study Analysis of 2015-2016 Stockton Air Quality Monitor PM2.5 samples; and, a review of feasibleoptions to reduce $PM_{2.5}$ ammonium nitrate particle emissions from significant sources. Completed in February 2018*
>
> *PRP 47 - Feasibility Assessment of Irrigated Fibre-Bed Scrubbing Technology to Reduce $PM_{2.5}$ Emissions from the Prill Tower.Completed in December 2019*

### *U3 Pollution Reduction Program (PRP) 50 - Installation of new Pollution Controls at the Prill Tower*

***U3.1 Background***

*The Lower Hunter Particle Characterisation Study (2015) found that a portion of the $PM_{2.5}$ detected at the Stockton ambient air quality monitoring station was composed of primary ammonium nitrate. Primary ammonium nitrate was subsequently found to make up about 40% of the $PM_{2.5}$ detected at the Stockton ambient air monitoring station in winter; a time when the monitor is often downwind of the Prill Tower.*

*The licensee has completed Pollution Reduction Program (PRP) 46 and PRP 47, which were investigations into feasible options to reduce $PM_{2.5}$ emissions from the Prill Tower. The licenseehas identified that irrigated fibre bed scrubber technology is an appropriate pollution control for the Prill Tower air emissions. This PRP is the next step, being formalisation of the installation of new pollution controls to address $PM_{2.5}$ emissions from the Prill Tower.*

**Deliverables**

*U3.2 The licensee must install an irrigated fibre bed scrubber at the Prill Tower (Point 16) to minimise PM2.5 ammonium nitrate emissions from the premises. The licensee must carry outthe project as follows:*

*a) By 1 February 2021, the licensee must complete all geotechnical and structural engineeringinvestigations associated with the current Prill Tower (including but not limited to intrusive structural investigations of the Prill Tower foundations) and prepare a stakeholder engagement and a regulatory approvals plan for the project;*

*b) By 1 October 2021, the licensee must complete all necessary final engineering designs forthe project to allow for the procurement tendering process to commence for long lead time items;*

*c) By 1 April 2022, the licensee must finalise orders for all long lead-time items for the project;*

*d) By 1 April 2023, the licensee must complete all necessary pre-works for the project (includingearthworks, civil, electrical, structural and mechanical works) and receive the scrubber at the premises;*

*e) By 1 November 2023, the licensee must achieve practical completion of the project;*

*f) By 31 January 2024, th license must achieve final completion of the project.*

# 6 CONSULTATION

Orica has commenced consultation with key stakeholders to provide information regarding the prill tower scrubber, including timing of construction. The consultation will continue as the project progresses and utilises existing communication avenues and relationships, including:

- The NSW EPA;
- The Orica Community Reference Group (CRG);
- Newcastle Community Consultative Committee for the Environment (NCCCE); and
- Industrial neighbour briefings.

A Stakeholder Engagement Plan (Appendix C) has been developed as part of PRP 50 and details the engagement and consultation processes being undertaken in relation to the project.

# 7. CONSTRUCTION METHODOLOGY

## 7.1 CONSTRUCTION PERIOD AND WORKING HOURS

The entire construction period is anticipated to span approximately 12 months, subject to weather and plant operation impacts. Early works would begin in August 2022 and installation and commissioning of the new scrubbing system would be completed in approximately September 2023.

The proposed construction hours would comply with the standard working hours as recommended by the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) and Condition 33 of the existing project approval which are as follows:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sundays and public holidays: no work.

## 7.2 CONSTRUCTION EQUIPMENT AND STAFF

The following plant and equipment would be used as required during the construction period.  :

- Up to 750 tonne cranes
- Up to 135 foot knuckle boom lifts
- 20t excavators
- 22t loaders
- 10t rollers
- Piling rig
- Flat-bed trucks
- Concrete trucks
- Hydrovac trucks
- Tip trucks

The construction crew would consist of existing Orica site employees, as well as up to an additional 50 contractors for the duration of the construction period.

## 7.3 CONSTRUCTION METHODOLOGY

The installation of the scrubber is anticipated to occur in the following stages.  It should be noted the exact staging of construction is subject to completion of the detailed design and constructability review stages of the project.

### 7.3.1 RETROFITTING EXHAUST MANIFOLD TO EXISTING PRILL TOWER

Completion of structural reinforcement/upgrade of the existing Prill Tower structure to support the weight of the exhaust manifold. Modification and re-routing of existing pipework and electrical cables to allow the installation of the exhaust manifold. Mounting and attachment of the exhaust manifold to the existing Prill Tower, followed by construction of the inlet duct downcomer and supporting frame.

### 7.3.2 CIVIL WORKS

Installation of the concrete foundations and bunding for the scrubber system including scrubber vessel, scrubber stack and associated stair tower, and ancillaries such as the scrubber fan and other ground level equipment.

### 7.3.3 SCRUBBER SYSTEM INSTALLATION

Installation of the scrubber system itself, including inlet duct work from the inlet duct downcomer to the scrubber vessel, and outlet duct work from the scrubber vessel to the fan and scrubber stack. Associated support structures such as access stair towers for the scrubber vessel and stack (for monitoring and maintenance access) would also be constructed. Auxiliary equipment to be installed includes a process condensate storage tank, two circulation pumps, two scrubber spray circulation pumps and associated pipework.

### 7.3.4 TIE INS AND ANCILLARIES

Connection of theinlet duct downcomer to the exhaust manifold, and tie-ins of pipework, services and utilities to existing plant. Key tie ins will include:

- Process condensate – for scrubber liquor makeup and to top of tower for air manifold internal washing;
- Potable water supply for safety showers;
- Fire service water;
- Demineralised water for decontamination/washdown;
- Compressed air;
- Nitric acid for scrubber filter washing;
- Weak AN effluent/bleed of scrubber liquor as feedstock to existing plants;
- 33 kV power and 33 kV/690 VAC transformer supply;
- 3.3/6.6 kV power;
- 240VAC GPO power;
- 24VDC instrument power;
- Data cabling for connection to existing DCS/SCADA systems; and
- Tie in of the exhaust manifold to the current floor of the axial fan room in the existing prill tower.

### 7.3.5 CUTOVER

Remove axial fans and seal fan openings after scrubber commissioning.

## 7.4 SCRUBBER OPERATION

Consistent with existing site and plant operations as approved in Project Approval 08_0129, the scrubber would operate whenever the ANP1 plant itself is operational, up to 24 hours per day, 7 days per week, 365 days per annum excluding 24 hours shutdowns at nominally 3-week intervals.

# 8. ISSUE PRIORITISATION

## 8.1 PRIORITISATION OF ISSUES

A risk analysis was completed to rank environmental risks associated with the proposed Project.

## 8.2 RISK MATRIX

The prioritisation of issues for the proposed Project was based on the need to recognise that a higher degree of assessment is required for the issues with the highest severity and greatest possible consequences. **Table 1** shows the Issues Prioritisation Matrix used to identify priorities.

Each issue was given a ranking for both consequence and likelihood in accordance with the Issues Prioritisation Matrix shown in Table 1 below. These two numbers provide a numerical ranking for the issue that was used to categorise each issue into high, medium, low or very low priorities.

### Table 1 - Issues Prioritisation Matrix

| | Likelihood of adverse impact | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Potential Consequence | | A – Almost Certain | B - Likely | C - Possible | D - Unlikely | E - Rare |
| | 1 – Broad scale | High | High | Medium | Low | Very Low |
| | 2 - Regional | High | High | Medium | Low | Very Low |
| | 3 - Local | Medium | Medium | Medium | Low | Very Low |
| | 4 - Minor | Low | Low | Low | Low | Very Low |
| | 5 - Insignificant | Very Low | Very Low | Very Low | Very Low | Very Low |

## 8.3 PRIORITY ASSESSMENT

The prioritisation of environmental issues related to the proposed Project is provided in **Table 2**. This environmental risk analysis prioritises environmental issues in the absence of appropriate safeguard measures to manage environmental effects. This analysis was then used to inform the environmental assessment and the engineering and environmental design of the Project and in the identification of appropriate safeguards.

### Table 2 - Prioritisation of Environmental Issues

| Issue | Potential Environmental Issue | Consequence | Likelihood | Priority |
| --- | --- | --- | --- | --- |
| Air Quality and Odour | Dust and vehicle emissions during construction. Odours and emissions during operation. | 3 | B | Medium |
| Visual | Visual impacts of the proposal | 3 | C | Medium |
| Noise and Vibration | Construction and operational noise and vibration impacts. | 4 | B | Medium |
| Hazards and Risk | Leaks/spills and interaction with materials and equipment. | 4 | C | Low |

| | | | | |
|---|---|---|---|---|
| Soils and water | Erosion, sedimentation and contamination during construction and contamination during operation. | 4 | C | Low |
| Transport | Construction traffic generation | 4 | C | Low |
| Waste | Waste generated by the construction | 4 | B | Low |
| Greenhouse Gas | Emissions during construction due to plant operation. Ongoing operational emissions. | 4 | A | Low |
| Flora and fauna | Vegetation or wildlife in project footprint | 5 | E | Very Low |
| Heritage | Impacts to unidentified indigenous or non-indigenous heritage items. | 5 | E | Very Low |

## 8.4 KEY ENVIRONMENTAL ISSUES

In summary, the final prioritisation of issues identified for the proposed Project is:

Medium:

- Air Quality and Odour
- Visual
- Noise and Vibration

Low:

- Soil and water
- Hazard and Risk
- Waste
- Transport
- Greenhouse Gas

Very Low:

- Flora and fauna
- Heritage

Three issues with medium risk prioritisation requiring detailed studies were identified by the risk assessment. Further assessment is detailed in Section 9.

# 9. ASSESSMENT & MITIGATION

## 9.1 MANAGEMENT SYSTEMS

Under Condition 49B of Project Approval 08_0129, Orica maintains an operational environmental management plan (OEMP), titled internally as the "Orica Kooragang Island EMS Manual" (EMS Manual).

The EMS Manual outlines the processes and practices within Orica's Safety, Health, Environment and Security (SHES) Management System for Kooragang Island to manage environmental aspects relating to operations, namely ammonia, nitric acid and ammonium nitrate production, storage, handling and transport. The EMS Manual also includes processes for management of construction and project related activities.

The EMS Manual integrates with broader quality and SHES management systems for the site including:

- Quality Management System, and in particular the 'QMS Overview' that provides a description of the QMS.
- Emergency Management System including the Orica Kooragang Island Emergency Plan.
- Safety Management System including the Major Hazard Facility Safety Case.

A key component of the EMS Manual is the site's construction environmental management plan utilised for project related activities.

## 9.2 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Orica Kooragang Island has developed a Construction Environmental Management Plan (CEMP template) to ensure that environmental hazards relating to construction activities are effectively identified and managed.

This CEMP forms one element of the site's comprehensive SHES management system and is implemented in conjunction with the requirements of the SHES Management System.

CEMP's are prepared for construction projects at the site to assess and mitigate the following impacts during construction;

- Air
- Water
- Land
- Waste
- Security
- Heritage
- Aviation
- Visual amenity
- Noise
- Transport
- Lighting
- Weed management

A project specific CEMP will be developed for the proposal and supplied to DPIE for approval in accordance with Condition 49A of the project approval prior to commencement of works.

## 9.3 ENVIRONMENTAL ASSESSMENT

### 9.3.1 AIR QUALITY

#### SCOPE AND OBJECTIVES

The Air Quality Impact Assessment (AQIA) provided information on the findings of the dispersion modelling undertaken to evaluate the benefits associated with the installation of the Prill Tower scrubber. The assessment was undertaken by AECOM. Benefits were examined in terms of the relative change in concentration before and after the scrubber installation along with the change in pollution concentrations relative to the established NSW EPA air quality assessment criteria. Pollutant concentrations were evaluated at ground level at or beyond the facility boundary and at on-site locations to examine concentrations from an Orica personnel exposure perspective.

The Level 2 AQIA was conducted in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2017) (Approved Methods) using the air dispersion model CALPUFF. A summary of the AQIA is provided below. A full copy of the AQIA is available in Appendix A.

#### AIR POLLUTANTS OF CONCERN

The Prill Tower is a well understood process on the Orica facility, operating since site operations commenced in 1969. Emissions are exhausted via twelve horizontally oriented fan vents. Emissions from the Prill Tower consist of the following pollutants as listed below:

Solid ammonium nitrate as:

- Total Suspended Particulate Matter (TSP)
- Particulate Matter less than or equal to 10 microns in diameter (PM10)
- Particulate Matter less than or equal to 2.5 microns in diameter (PM2.5); and

Gaseous fume as:

- Ammonia.

#### ASSESSMENT CRITERIA

In NSW the Protection of the Environment Operations Act 1997 (NSW) (POEO Act) provides the statutory framework for managing air emissions. Under the POEO Act the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW) (Clean Air Regulation) provides regulatory measures to control air emissions.

Part 5 of the Clean Air Regulation refers to the Approved Methods that lists the statutory methods for the modelling and assessment of air emissions from stationary sources in NSW. The Approved Methods for Modelling include assessment criteria against which emissions from a site or activity are assessed, with the particulate (TSP, PM10 and PM2.5) and ammonia criteria provided in Table 3.

Predicted pollutant concentrations were assessed against the NSW EPA criteria either as a maximum concentration (100th percentile) or as a lower percentile (99.9th percentile for ammonia). Given the mix of pollutants in Table 3, predicted concentrations were assessed at both the boundary of the site and beyond along with at several representative receptor locations beyond the boundary of the site.

## Table 3 - NSW EPA Assessment Criteria

| Pollutant | Assessment Criterion (µg/m³) | Averaging Period | Percentile | Reportable Location |
|---|---|---|---|---|
| TSP | 90 | Annual | 100th | At the nearest sensitive receptor |
| PM10 | 50 | 24 hour | 100th | At the nearest sensitive receptor |
| | 25 | Annual | 100th | At the nearest sensitive receptor |
| PM2.5 | 25 | 24 hour | 100th | At the nearest sensitive receptor |
| | 8 | Annual | 100th | At the nearest sensitive receptor |
| Ammonia | 330 | 1 hour | 99.9th | At or beyond the boundary |

The advisory standards adopted for the assessment of PM2.5 exposure for onsite workers and the total particulate standard are shown in **Table 4.**

## Table 4 - Adopted Occupational Assessment Criteria

| Pollutant | Assessment Criterion (µg/m³) | Averaging Period | Percentile | Reportable Location |
|---|---|---|---|---|
| TSP | 10,000 | 8 hour | 100th | At Worker Exposure Locations |
| Ammonia | 24,000 | 8 hour | 100th | At Worker Exposure Locations |
| Ammonia | 17,000 | 15 min | 100th | At Worker Exposure Locations |

### MONITORING DATA

DPIE, under the Environment, Energy and Science (EES) sector operate a comprehensive ambient air quality monitoring network in NSW. The following subsections provide a summary of five years of PM10 and PM2.5 and ammonia monitoring data from the nearest monitoring station from 2015 to 2019.

### PARTICULATE MATTER

The nearest EES ambient monitoring station to the Orica facility is the Stockton station, approximately 750m southeast of the site across the north arm of the Hunter River. The EES monitoring station at Stockton records hourly PM10, PM2.5 and ammonia concentrations. 24 Hour average and annual average concentration for the PM10 and PM2.5 data were calculated for the 2015 to 2019 period along with a determination of the number of exceedances that occurred during that time. Stockton monitoring station concentrations for 2015 to 2019 are shown in **Table 5**.

**Table 5** shows that the 24-hour maximum and annual average particulate concentrations recorded at the Stockton EES monitoring station for 2015 to 2019 were all well above the EPA criteria for both short and long-term averaging periods. This is due to the proximity of the monitoring station to the ocean and the contribution of sea salt to the maximum concentrations. Further analysis has been undertaken into the particulate source below.

## Table 5 - 2015-2019 24 Hour Maximum and Annual Average PM10 and PM2.5 Concentrations at Stockton (EES 2021)

| Pollutant | Year | 24 Hour Maximum (μg/m³) | Exceedances of EPA Criteria | Annual Average (μg/m³) |
|---|---|---|---|---|
| PM10 | 2015 | 101.4 | 69 | 35.8 |
| | 2016 | 108.1 | 62 | 35.2 |
| | 2017 | 96.7 | 62 | 36.1 |
| | 2018 | 196.6 | 65 | 38.7 |
| | 2019 | 169.5 | 104 | 43.6 |
| **EPA PM10 Criterion** | | **50** | **0** | **25** |
| PM2.5 | 2015 | 30.9 | 3 | 9.5 |
| | 2016 | 66.4 | 1 | 9.7 |
| | 2017 | 32.0 | 1 | 9.8 |
| | 2018 | 26.9 | 1 | 10.0 |
| | 2019 | 98.6 | 27 | 12.9 |
| **EPA PM2.5 Criterion** | | **25** | **0** | **8** |

### PM10

PM10 data at the Stockton monitoring station was generally much higher than the Newcastle regional airshed concentrations with proximity to the ocean considered to be the primary reason for the difference. The highest average concentrations occurred during periods with light winds from the east during summer, suggesting a large contribution of the overall average PM10 concentrations can be attributed to sea salt from the ocean. These findings were also supported by the Lower Hunter Particle Characterisation Study (Hibberd et al. 2016) that found that the concentration of coarse particles (between 2.5 and 10 microns in diameter) was 2.5 times higher at Stockton than in Mayfield. This was mainly due to a much higher contribution of fresh sea salt particles at Stockton.

### PM2.5

PM2.5 concentration data at Stockton shows levels of pollution closer to the Newcastle regional airshed concentrations. While the proximity to the ocean is considered to be the primary reason for the elevated PM10 fraction of particulates at Stockton, PM2.5 concentrations have a different trend, with higher concentration predominantly occurring to the northwest, suggesting contributions from the Hunter Valley and the Kooragang Island area. While the Orica site contributes to the background PM2.5 concentration, given the similarities between the Mayfield, Carrington and Stockton PM2.5 concentrations (and exceedances), the majority of the PM2.5 particulates are expected to be from either non-local sources (regional sources such as the Liddell and Bayswater power stations and the Hunter Valley coal mines) or non-anthropogenic sources (sea salt). Given the similarities between Stockton and other Lower Hunter PM2.5 concentrations, the Orica Site is expected to have limited influence on overall background concentrations.

### AMMONIA

The ESS monitoring station at Stockton monitors hourly ammonia gas concentrations. Over the five-year period between 2015 and 2019 the maximum recorded hourly background concentration at Stockton was

265.2μg/m³ and the highest hourly 99.9th percentile concentration recorded was 207.8 μg/m³. The 5-year maximum hourly concentration is below the EPA criterion of 330 μg/m³ (99.9th percentile).

### MODELLING SCENARIOS

Several modelling scenarios were investigated to enable the assessment of the existing emissions from the Prill Tower at the proposed stack height. A description of each modelled scenario is provided below in **Table 6**. The proposed 37.9m stack height is the minimum required to satisfy the upstream and downstream disturbance requirements outlined in AS4323 for stack sampling port position.

## Table 6 - Description of Modelled Scenarios

| Scenario ID | Description |
|---|---|
| **Scenario 1** | Existing Prill Tower emissions |
| **Scenario 2A** | 37.9m Stack Height, typical emissions |
| **Scenario 2B** | 37.9m Stack Height, conservative emissions |
| **Scenario 2C** | 37.9m Stack Height, maximum emissions |

The assumed particulate and ammonia emission rates for each modelled scenario are summarised in **Table 7**. Additional information on the calculation of these emission rates is provided in the full report provided in **Appendix A**.

## Table 7 - Modelled Scenario Pollutant Emission Rates (g/s)

| Scenario ID | TSP Emission Rates | PM10 Emission Rates | PM2.5 Emission Rates | Ammonia Emission Rates |
|---|---|---|---|---|
| **Scenario 1** | 7.74 | 2.32 | 2.32 | 0.23 |
| **Scenario 2A** | 0.060 | 0.060 | 0.060 | 0.0020 |
| **Scenario 2B** | 0.20 | 0.20 | 0.20 | 0.0027 |
| **Scenario 2C** | 0.68 | 0.68 | 0.68 | 0.0068 |

### EMISSIONS INVENTORY

The Prill Tower for the purposes of the dispersion modelling investigation has been conservatively assumed to be operating continuously. Based on indicative real time data for outlet concentrations to the Prill Tower Scrubber, the inlet concentrations are anticipated to be below 20mg/Nm³ approximately 99% of the time, and below 50mg/Nm³ 99.9% of the time. The scrubber is anticipated to have a performance guarantee from the technology vendor of 5mg/Nm³ for inlet concentrations of less than 100mg/Nm³. Given these performance characteristics, the following scenarios were considered:

- Scenario 2A - Assumption of typical inlet scrubber concentration of 20mg/Nm³ total particulates (TP) (Ammonium nitrate-solid) (wet), 15mg/Nm³ (wet) (Ammonium nitrate-solid) PM10/PM2.5 and 3.0mg/Nm³ ammonia (gas)
- Scenario 2B - Assumption of conservative inlet scrubber concentration of 50mg/Nm³ TP (Ammonium nitrate-solid) (wet), 15mg/Nm³ (wet) (Ammonium nitrate-solid) PM10/PM2.5 and 3.0mg/Nm³ ammonia (gas)

- Scenario 2C - Assumption of reasonable worst case inlet scrubber concentration of 100mg/Nm$^3$ (Ammonium nitrate-solid) TP (wet), 30mg/Nm$^3$ (Ammonium nitrate-solid) (wet) PM10/PM2.5 and 10.0mg/Nm$^3$ ammonia (gas)

Stack emissions parameters for each source are provided in Table 8 and are based on information supplied by the technology vendor predicting the performance of the system at various inlet concentrations as shown below. Based on available process data, it is anticipated that input concentrations to the scrubber will be typically below 20mg/m$^3$ (Scenario 2A) 99% of the time, and typically below 50mg/m$^3$ (Scenario 2B) 99.9% of the time. The existing Prill Tower was also modelled with emission rates being based around historically modelled emission rates and the sources consisted of horizontal vents at the top of the Prill Tower itself.

## Table 8 - Stack Parameters

| Stack parameter | Units | Scenario 1 (existing) | Scenario 2A (typical) | Scenario 2B (conservative) | Scenario 2C (maximum) |
|---|---|---|---|---|---|
| Discharge Height | mAGL | 45 | 37.9 | 37.9 | 37.9 |
| Stack discharge air flowrate | Nm$^3$/h (dry) | 278,640 | 357,000 | 490,000 | 490,000 |
| Stack exit diameter | mm | NA | 3250 | 3250 | 3250 |
| Stack discharge velocity | m/s | NA | 14.6 | 19.2 | 20.7 |
| Stack discharge air temperature | °C | NA | 40 | 40 | 48 |
| Total Particulate (TP) | mg/Nm$^3$ | 100 | 0.6 | 1.5 | 5.0 |
| | g/s | 7.74 | 0.060 | 0.204 | 0.681 |
| Particulate Matter Less than 10 Microns (PM10)[1] | mg/Nm$^3$ | 30.0 | 0.6 | 1.5 | 5.0 |
| | g/s | 2.32 | 0.060 | 0.204 | 0.681 |
| Particulate Matter Less than 2.5 Microns (PM2.5) | mg/Nm$^3$ | 30.0 | 0.6 | 1.5 | 5.0 |
| | g/s | 2.32 | 0.060 | 0.204 | 0.681 |
| Ammonia | mg/Nm$^3$ | 3.0 | 0.020 | 0.020 | 0.050 |
| | g/s | 0.23 | 0.002 | 0.003 | 0.007 |

[1] PM10 concentrations were not specified by Worley. Assumed to be the same as PM2.5

**Typical Scenario (2A)** – Assumed typical inlet scrubber concentration of 20mg/Nm$^3$ TP (Ammonium nitrate-solid) (wet), 15mg/Nm$^3$ (wet) Ammonium nitrate-solid) PM10/PM2.5 and 3.0mg/Nm$^3$ ammonia (gas)

**Conservative Scenario (2B)** – Assumed conservative inlet scrubber concentration of 50mg/Nm$^3$ TP (Ammonium nitrate-solid) (wet), 15mg/Nm$^3$ (wet) (Ammonium nitrate-solid) PM10/PM2.5 and 3.0mg/Nm$^3$ ammonia (gas)

**Reasonable Worst Case Scenario (2C)** – Assumed Reasonable Worst Case inlet scrubber concentration of 100mg/Nm$^3$ (Ammonium nitrate-solid) TP (wet), 30mg/Nm$^3$ (Ammonium nitrate-solid) (wet) PM10/PM2.5 and 10.0mg/Nm$^3$ ammonia (gas)

## MODELLING RESULTS

This section presents the predicted pollutant concentrations and provides an analysis of those concentrations for each modelled scenario and makes a comparison against relevant criteria. Dispersion modelling results for the scrubber stack emissions are tabulated in **Table 9**, with dispersion contours shown in the full report in **Appendix A**. Results in **Table 9** include the following data:

- Predicted pollutant concentrations at the EES Monitoring Station at Stockton to enable a comparison with measured particulate and ammonia concentrations;
- Predicted maximum concentrations at ground level at or beyond the Orica boundary.

- Predicted maximum concentrations at ground level at sensitive receptor locations; and
- Predicted maximum concentrations within the Orica site.

The above predicted pollutant concentrations have been assessed against the criteria outlined in **Table 3** and **4**.

## Table 9 - Predicted Pollutant Concentrations as a result of Orica's operations: Onsite and Off-site Receptors

| Pollutant | Averaging Period | Description | Predicted Concentrations (µg/m³) | | | | Criteria (µg/m³) |
|---|---|---|---|---|---|---|---|
| | | | Scenario 1 | Scenario 2A | Scenario 2B | Scenario 2C | |
| TSP | Annual | EPA Station – Stockton | 5.75 | 0.02 | 0.05 | 0.12 | 90 |
| | | At or Beyond the Boundary | 16.47 | 0.04 | 0.11 | 0.31 | |
| | 8 Hour Average | Onsite Workers | 377.2 | 4.4 | 10.4 | 32.6 | 10,000 |
| PM10 | 24 Hour Average | EPA Station – Stockton | 9.30 | 0.13 | 0.33 | 0.83 | 50 |
| | | At or Beyond the Boundary | 20.33 | 0.32 | 0.86 | 2.57 | |
| | | Discrete Receptors | 15.95 | 0.21 | 0.53 | 1.43 | |
| | Annual | EPA Station – Stockton | 1.75 | 0.02 | 0.05 | 0.12 | 25 |
| | | At or Beyond the Boundary | 4.95 | 0.04 | 0.11 | 0.31 | |
| | | Discrete Receptors | 1.83 | 0.02 | 0.05 | 0.14 | |
| PM2.5 | 24 Hour Average | EPA Station – Stockton | 9.30 | 0.13 | 0.33 | 0.83 | 25 |
| | | At or Beyond the Boundary | 20.33 | 0.32 | 0.86 | 2.57 | |
| | | Discrete Receptors | 15.95 | 0.21 | 0.53 | 1.43 | |
| | Annual | EPA Station – Stockton | 1.75 | 0.02 | 0.05 | 0.12 | 8 |
| | | At or Beyond the Boundary | 4.95 | 0.04 | 0.11 | 0.31 | |
| | | Discrete Receptors | 1.83 | 0.02 | 0.05 | 0.14 | |
| Ammonia | 99.9th Percentile Hour Average | EPA Station – Stockton | 2.44 | 0.010 | 0.012 | 0.024 | 330 |
| | | At or Beyond the Boundary | 11.5 | 0.019 | 0.018 | 0.04 | |
| | 8 Hour Average (TWA) | Onsite Workers | 11.2 | 0.02 | 0.07 | 0.07 | 17,000 |
| | 15 minute Average (STEL) | Onsite Workers | 69.3 | 0.31 | 0.34 | 0.44 | 24,000 |
| **Bold** text denotes exceedance of relevant criteria | | | | | | | |

Analysis of the dispersion modelling results showed the following:

- Predicted ground level concentrations were found to decrease significantly due to the operation of the scrubber. This decrease was evident across all pollutants and across all averaging times.
- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Typical" Prill Tower scrubber operations (Scenario 2) were all greater than 98%.
- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Conservative" expected Prill Tower scrubber operations (Scenario 3) were all greater than 95%

- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Maximum" expected Prill Tower scrubber operations (Scenario 3) were all greater than 87%
- All predicted pollutant concentrations "at or beyond" the boundary for the scrubber operational scenarios (Scenarios 2 and 3) were well below NSW EPA criteria. Although the predictions are presented in isolation from the background, the future emissions due to the scrubber only represent a small percentage of the NSW EPA criteria (less than 11% for all pollutants) and would result in a significant decrease in cumulative concentrations from the Prill Tower. The decrease from the existing emission concentrations are expected to have a significant net positive effect on the environment.
- Worker exposure concentrations were well below Safe Work Australia Workplace Exposure Standards.

On the basis of the findings above, the installation and operation of the Prill Tower Scrubber is expected to result in a significant decrease in the ground level concentrations both on-site and offsite of ammonium nitrate particulate and is expected to have a positive effect on the pollutant concentrations in the surrounding environment.

#### CONCLUSION

A Level 2 AQIA was conducted in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2017) (Approved Methods). The CALPUFF air dispersion model along with local meteorology was used for the assessment. Four dispersion modelling scenarios were examined to examine the expected change in air pollutant concentrations following the addition of a scrubber to the Prill Tower.

Based on available process data, it is anticipated that input concentrations to the scrubber will be typically below 20mg/m$^3$ (Scenario 2A) 99% of the time, and typically below 50mg/m$^3$ (Scenario 2B) 99.9% of the time.

Dispersion modelling results showed that there is predicted to be a significant drop in ground level pollutant concentrations at all locations for all pollutants modelled. Reductions of over 98% were predicted for the typical operational scenario (Scenario 2A), over 95% reduction for the conservative operational scenario (Scenario 2B) and over 87% reduction for the reasonable worst case operational scenario (Scenario 2C) post construction of the scrubber.

The expected decreases in ground level concentrations of ammonium nitrate particulate following the addition of the scrubber are expected to make a significant improvement to the air quality in the environment surrounding Orica. Refer to **Appendix A** for a full copy of the AQIA.

### 9.3.2 GREENHOUSE GAS

No Scope 1 greenhouse gas emissions are associated with the project. Additional electricity consumption (Scope 2 emissions) would be associated with the scrubber fan and pumps, however as noted in Section 9.3.8 this additional load is not significant in the context of the site's existing electricity usage or in the context of the greenhouse gas emissions considered in the 2009 EA that supported Consent 08_0129.

### 9.3.3 VISUAL AMENITY

As noted in the 2009 EA, Kooragang Island ('the Island') is essentially flat and low-lying. It has an industrial character which features large tanks, stacks, pipe work, buildings and port facilities. Scattered vegetation and the rock revetment walls define and protect the site and Kooragang Island generally.

These features are visually insignificant compared to the overall industrial appearance of the Island. The southern section of the Island can be seen from residential areas such as Stockton to the east and south-east, Carrington to the south-west and Newcastle to the south. The site is also visible from the heavily industrialised areas directly to the north and to the west across the Hunter River. The overall character of the vicinity of the proposed development is industrial, with neighbouring properties also containing industrial or commercial operations. The closest sensitive receivers are located at Stockton, which is over 800m east of the site.

The new scrubber stack and downcomer/ support structure will be adjacent to and consistent with the existing bulk and scale of the existing Prill Tower structure to which it will be retrofitted. Other tall structures such as the existing nitric acid plants also surround the proposed location.

Views across to the Island from Stockton would remain as views of an industrialised landscape. Overall, the proposed development would be consistent with the industrial character of the Island and would be similar in scale to the industrial infrastructure already existing at the Orica site. Figure 6 below shows the viewpoint from Stockton boat ramp used to represent the view of the Project from Stockton residential area.


*Figure 6 – Viewpoint of Project Proposal from Stockton shown in photo in Figure 7*

The approximated view illustrating the impact on visual amenity of the Project is shown in Figure 7 below.


***View of proposed Project from Stockton***

***Note - the image shows bulk and scale only and is not indicative of the actual colour – the scrubber will be constructed of stainless steel with a grey finish consistent with surrounding buildings on site***

Based on the above analysis, the Project is believed to have a limited and acceptable impact on visual amenity.

### 9.3.4 NOISE AND VIBRATION

#### CONSTRUCTION

There would be some noise generation as a result of construction activities such as additional vehicle movements as described in **Section 9.3.6** and installation of the new scrubber. Construction activities would be carried out in standard work hours in accordance with the ICNG (refer to **Section 4.0**) and Condition 33 of the existing approval. The proposed construction hours in accordance with the ICNG have been opted for over the construction hours as assessed in the EA (Monday to Saturday between the hours of 7:00am – 5:00pm) to be consistent with current guidelines and the existing approval.

The closest residential receivers to the site are approximately 800m east, in the suburb of Stockton. However, other industrial premises are adjacent to each boundary of the site.

A Noise Impact Assessment (NIA) was prepared by Atkins Acoustics to support development application 08_0129 in 2009. This assessment included a construction noise and vibration assessment, as well as an operational noise assessment.

Additional noise mitigation measures for the construction project would be incorporated in the CEMP and implemented during the construction period.

## STATUTORY CONTEXT

### DEVELOPMENT CONSENT

The Department of Planning (Department), now DPIE, determined that noise generated through the inclusion of additional operating plants and infrastructure, should not increase the noise impacts from the existing operations. To ensure no discernible increase in noise levels at the Stockton residential receivers from Orica, the Department concluded that any additional noise emitted from the site must achieve a contribution at least 10dBA below pre-development levels. To support this requirement a noise verification program determined baseline noise levels and reference noise monitoring locations. Noise data obtained during the noise verification process provided the basis for developing an ongoing Noise Management Plan for the site. Operational noise emissions associated with the scrubber would be assessed as part of the ongoing Noise Management Plan for the site.

The Departments noise conditions for the site are documented in Schedule 3 'Specific Environmental Conditions' of project approval 08_0129 dated 1 December 2009. Orica's Development Condition 30 is shown below:

| |
|---|
| **Condition 30:**<br>The Proponent shall ensure that noise levels from the operation of the Project are at least 10dB(A) below noise levels from Orica's Existing Operations as specified by conditions 31 & 32 below. |

### EPA NOISE POLICY FOR INDUSTRY

The EPA Noise Policy for Industry (NPfI) refers to guidelines and procedures for assessing noise from existing industrial premises. Where a development proposal involves a discrete process, and the premises–wide mitigation has or is to be considered outside the development proposal, a project noise trigger level for noise from the new/modified component (not the whole site) of the operation may be set at 10dBA or more below existing site noise levels or requirements.

Orica's EPL 828 does not contain noise limits for the site nor requirements to monitor noise emissions from the site. EPL 828 included a number of PRP's with the aim of reducing noise emissions from the site. Works associated with those PRP's have been implemented and completed to the EPA's requirements.

### REFERENCE NOISE ASSESSMENT LOCATIONS

Six (6) reference assessment locations referenced in the Orica Noise Management Plan (NMP) were adopted for the purpose of assessing noise from the site. Three (3) locations, representing the Stockton residential area and three (3) near field locations on Kooragang Island (**Figure** 6). Due to the influence of transient ambient noise associated with local domestic activities and noise from neighbouring industrial sources on Kooragang Island, the three (3) Kooragang Island locations were selected to assist with monitoring near field noise emissions and trends influenced by Orica.


*Figure 8 - Referenced Noise Monitoring Locations*

NOTES:
R1 - 284 Fullerton Street, Stockton.
R2 - 218 Fullerton Street, Stockton.
R3 - 184 Fullerton Street, Stockton.
R4 - Roadside (south) opposite Ammonium Nitrate Area
R5 - Riverside (central) opposite Administration Building.
R6 - Roadside (north) opposite Ammonia Plant.

## DISCUSSION

Night-time attended audits reported for the reference monitoring locations on Kooragang Island (2011) demonstrated that operational noise from Orica is steady state with minimal influence from other industrial sources. At the three (3) near field locations it was reported there was minimal variation between the measured LA90 and LAeq levels.

For assessing noise contributions from new plant and operations, the project approval Condition 30 and the NPfI refer to noise target levels at least 10dBA below levels from Orica's existing plant. **Table 10** presents a summary of the baseline background levels and target noise assessment levels assessed for neutral weather conditions.

## Table 10: Project Target Noise Criteria

| Reference Assessment Location | Baseline Background Sound Pressure Levels dBA | Target Noise Assessment Levels dBA |
|---|---|---|
| R1 | 50 | 40 |
| R2 | 53 | 43 |
| R3 | 51 | 41 |
| R4 | 62 | 52 |
| R5 | 57 | 47 |
| R6 | 56 | 46 |

*Note - dBA re: 20 x $10^{-6}$ Pa*

### ASSESSMENT OF NOISE TRENDS

For assessing Orica's noise emission trends, the NMP recommended future noise monitoring on Kooragang Island (R4, R5 and R6) be considered. Baseline RBL's established for the Kooragang Island monitoring locations are referenced in Atkins Acoustic (September 2012).

Initially noise audit monitoring locations were selected to provide for reliable site access to install instrumentation and security. The locations identified as R4 and R6 due to access arrangements and instrumentation security were relocated from the riverside to roadside positions. Similarly, due to access restrictions monitoring location R1 (294 Fullerton Street) was changed to 284 Fullerton Street and R3 (186 Fullerton Road) to 184 Fullerton Road. The night-time range of measured and median sound pressure levels summarised in Table 3 show that levels for R6 resulting from the repositioning of the monitoring location are 6-7dBA higher than referenced in **Table 11**.

## Table 11. Baseline RBL Noise Trends

| Reference Assessment Location | Ambient Rating Background Level RBL's | |
|---|---|---|
| | Range | Median |
| R4 - Roadside (South) | 55.6 to 63.0 | 59.4 |
| R5 - Riverside (Central) | 49.3 to 60.7 | 55.8 |
| R6 - Roadside (North) | 60.1 to 65.4 | 62.7 |

*Note:: dBA 20 x $10^{-6}$ Pa*

### NOISE MITIGATION

The Project involves decommissioning twelve (12) ventilation fans installed at the top of the Prill Tower and commissioning of a new scrubber and associated fan, pumps and stack. Reviewing field noise data referenced for the 2009 project an effective sound power level for the Prill Tower fans was Lw113dBA. Modelling has demonstrated with the removal of the existing Prill Tower fans site noise emissions reduce by 0.6-0.8dBA. Referring to the NPfI Section 4.1, the significance of increases or decreases in cumulative industrial noise levels ≤2 dBA is considered negligible.

## LOW FREQUENCY NOISE

The NPfI provides guidance for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15dB or more between ‘C-weighted’ and ‘A-weighted’ noise emissions identify potential for an unbalanced spectrum and potential increased annoyance. Where a difference of 15dB or more between the ‘C-weighted’ and ‘A-weighted’ emission levels from a site is identified, an assessment of the one-third octave levels is recommended to assess if a modifying factor correction is to be applied.

## NOISE MODELLING SOURCE DATA

Computer modelling for the Project considered normal operational noise conditions. A summary of the significant noise sources identified the Project and adopted for modelling is presented in **Table 12**. The source noise data was developed from suppliers and contractors technical reference information. Where this was not available for the fan motor octave band sound power data was obtained from the Edison Electric Institute (EEI).

### Table 12 - Plant Sound Power Levels

| Plant Description | Sound Power Levels at nominated frequencies LAeq ref $10^{-12}$ Watts | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 62 | 125 | 250 | 500 | 1K | 2K | 4K | 8K | dBA | dBC |
| Transition Duct | 113 | 102 | 91 | 83 | 75 | 68 | 59 | 47 | 91 | 113 |
| Stack Top (S1) | 87 | 72 | 50 | 46 | 35 | 33 | 38 | 34 | 62 | 86 |
| Stack Bottom (S2) | 97 | 82 | 60 | 38 | 27 | 43 | 48 | 44 | 72 | 96 |
| Stack Discharge | 117 | 102 | 80 | 64 | 59 | 63 | 74 | 76 | 92 | 116 |
| Fan | 104 | 99 | 85 | 77 | 74 | 64 | 53 | 63 | 85 | 105 |
| Fan Motor EEI(1978)* | 85 | 87 | 88 | 88 | 93 | 87 | 78 | 71 | 95 | 97 |
| Fan intake Manifold | 110 | 99 | 88 | 80 | 71 | 65 | 56 | 44 | 88 | 110 |

* Reference Edison Electric Institute (1978) Motor speed 720rpm and lower - reference $10^{-12}$ Watts

## OPERATIONAL NOISE MODELLING AND ASSESSMENT

Noise modelling for the Project was developed with the Environmental Noise Model (ENM) computer model. The model considers attenuation factors including distance, shielding from structures, ground absorption, atmospheric absorption, topographical features of the area and the site.

The model was calibrated with site attended audit noise measurement data. Near field audit measurements were consistent with predicted levels and therefore it was considered that the model provided a realistic representation of the site noise emissions.

Preliminary modelling identified the stack discharge as the main source controlling the noise emissions and contributions for the referenced assessment locations. Further engineering investigations recommended that an inline attenuator be investigated for the discharge side of the fan. The recommended design insertion loss performance of the attenuator was 10dBA. Additional noise mitigation incorporated into the model included external acoustic lagging of the scrubber fan casing and installation of the fan motor on a concrete plinth.

A low frequency noise assessment was undertaken in accordance with EPA guidelines. The findings demonstrated the difference between the 'C-weighted' and 'A-weighted' levels are within 15dB and an assessment of the one-third octave levels is not required to assess low frequency noise.

Indicative noise modelling results for the Project in isolation from the existing site operation are presented in **Table 13**. The predicted levels for neutral meteorological conditions demonstrate the noise contributions from the Project are more than 10dBA lower than the target design noise goals.

## Table 13 - Predicted Baseline and Project Noise Contributions

| Operating Plant Conditions | Predicted Sound Pressure Level dBA Ref: *20 x $10^{-6}$ Pa* | | | | | |
|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R5 | R6 |
| Project Noise Design Goals | 40 | 43 | 41 | 52 | 47 | 60 |
| Predicted Prill Tower Project Contributions | 25 | 27 | 26 | 47 | 31 | 30 |

*re: dBA 20 x $10^{-6}$ Pa*

Indicative noise contours produced from the ENM modelling are presented in Figure 9.


***Figure 9 - Indicative noise contours for Project***

### CONCLUSION

Operational noise modelling for the Project shown in Table 13 and as indicative noise contours in Attachment 1 demonstrate compliance with the Departments criteria. In addition to plant selection, noise mitigation measures incorporated into the project design for the Project include.

- an in-duct acoustic splitter attenuator installed on the fan discharge and before the scrubber stack;
- external acoustic lagging of the scrubber ID fan casing; and
- the fan motor will be installed on concrete pedestal

These recommendations have been incorporated into the project design. Verification of the predicted noise performance of the project will occur post commissioning as part of the annual noise assessment process conducted for the site and disclosed as part of the Annual Environmental Management Report to DPIE.

### 9.3.5 HAZARD AND RISK

Development application 08_0129 was for the purpose of increasing the allowable ammonium nitrate production at the site through the provision of an additional nitric acid plant and ammonium nitrate plant and upgrading the ammonia plant capacity. A Preliminary Hazard Analysis (PHA) identified that the new plant and equipment risks associated with the additional nitric acid plant and ammonium nitrate (as well as other supporting infrastructure) complied with Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning (HIPAP 4 (DoP 1992/2002). Further, the operation of the new plant and equipment in addition to normal operations was assessed against HIPAP4 criteria for intensification of hazardous activities on an existing site. This was also compliant with HIPAP4 criteria.

The scrubber vessel will contain AN solution at a concentration of <40%. Weak ammonium nitrate solution ie. <80%) is not classified as hazardous and is not specified in the NOHSC List of Designated Hazardous Substances [NOHSC:10005(1999)] and as such the PHA does not require revision due to the proposal.

There is not expected to be any changes to the risk profile of the site or any additional hazards introduced as a result of the addition of the pollution control equipment.

### 9.3.6 TRAFFIC

During the 12-month construction period, there would be up to an additional 50 light vehicle movements on the public road network from the 50 additional contractors travelling to and from the site each day. Parking for the additional 50 personnel would be accommodated in the on-street parking on Greenleaf Road or in the existing Orica carpark. It is anticipated that the 50 light vehicle movements per day would equate to 250 light vehicle movements per month when based on a 5-day working week.

Additional heavy vehicle movements would also be required for deliveries and for the disposal of soil, concrete and steel of up to 40 vehicles per month. All vehicles entering the site are required to enter via the security gatehouse and would follow the site’s traffic management plan. An indicative number of additional heavy and light vehicle movements per month as well as total additional vehicle movements per month is provided in **Table 14**.

During construction, earthworks and traffic involved with the installation of the new scrubber tank may liberate sediments and dust. The CEMP for the project will include measures for control of civil works and traffic related dust.

## Table 14 - Indicative additional vehicle movements per month during the construction period

| Month | Additional heavy vehicles movements per month | Additional light vehicle movements per month | Total additional vehicle movements per month |
|---|---|---|---|
| September 2022 | 40 | 250 | 290 |
| October 2022 | 40 | 250 | 290 |
| November 2022 | 40 | 250 | 290 |
| December 2022 | 40 | 250 | 290 |
| January 2023 | 40 | 250 | 290 |
| February 2023 | 40 | 250 | 290 |
| March 2023 | 40 | 250 | 290 |
| April 2023 | 40 | 250 | 290 |
| May 2023 | 40 | 250 | 290 |
| June 2023 | 40 | 250 | 290 |
| July 2023 | 40 | 250 | 290 |
| August 2023 | 40 | 250 | 290 |

At the peak of the construction period, the 2009 EA assessed the impact of an additional 250 construction personnel on site per day, which when considering movements to and from the site, this would equate to about 13,000 light vehicle movements per month (based on a six day working week). The heavy vehicle contribution was assessed at up to 30 heavy vehicles per day, and in terms of movements, this would produce 1,560 heavy vehicle movements per month during the peak construction period (based on a six day working week). The peak light, heavy and total vehicle movements per month as assessed in the 2009 EA are summarised below in **Table 3**. It is noted that these numbers are conservative and have been extrapolated from the numbers presented in the 2009 EA for comparative purposes.

## Table 15 - Peak vehicle movements as assessed in the 2009 EA

| Month | Peak additional heavy vehicles movements per month | Peak additional light vehicle movements per month | Total additional vehicle movements per month (during construction peak) |
|---|---|---|---|
| | 1560 | 13000 | 14560 |

Based on the scheduling of the project, additional vehicle movements would be fairly consistent over the 12-month period at 290 total vehicle movements per month. This is significantly less than the 14,560 additional vehicle movements per month predicted to occur during the peak construction period in the 2009 EA. Further, the construction period of the project is only about 12 months, whereas the construction period for the 2009 EA was 28 months in duration. Potential construction traffic impacts for the project will therefore be well below those assessed in the 2009 EA, given the total additional vehicle movements per month are much smaller and would be of a shorter duration.

Greenleaf Road is a private road and is built to industrial road standard with an overall width of about 15m to accommodate heavy vehicles. As construction traffic volumes required for the Prill Tower Scrubber would be much less than those considered acceptable in the 2009 EA and would only occur for about 12 months, construction traffic impacts are minimal in comparison to the 2009 EA, and would not strain the existing road network. For construction traffic management within the site, a traffic management plan would be developed for access to the construction area and would be included within the CEMP. Operation of the new scrubber would not contribute to any increase in operational traffic.

### 9.3.7 SURFACE WATER QUALITY

#### STORMWATER

As noted in the 2009 EA, the site is divided into seven separate catchment areas which discharge to the Hunter River, as follows:

- Catchments 1, 2 and 3 include the ammonia plant and existing cooling towers, as well as open space with grassed areas;
- Catchment 4 contains much of the existing Nitrates manufacturing facilities including the ammonium nitrate plants and nitric acid plants;
- Catchment 5 has a relatively low-level of activity and contains part of the Bulk Store, with some hardstand areas as well as open grassed areas.
- Catchment 6 contains the Bag Store and some hardstand areas as well as open grassed areas.
- Catchment 7 contains a container storage area, with the remainder predominantly a greenfield area. This catchment is not serviced by any collection infrastructure and stormwater only infiltrates through the greenfield area.

The proposed project is located within stormwater catchment 4 at the site. Catchments 4 has a ‘first flush’ catchment system designed to capture the first 10mm of runoff generated from roof areas, hardstand and other operational areas connected to the stormwater drainage system, in accordance with EPA guidance on first flush systems. The stormwater runoff is diverted to a 110kL tank. Once the tank is full, any continuing stormwater flow is diverted past the tank to stormwater outlets discharging to the Hunter River. Stormwater stored in the ‘first flush’ tanks is pumped to either the site effluent system or an effluent holding pond depending upon the quality of the stormwater. Once combined with the site effluent, it is tested in accordance with the site’s EPL, including total suspended solids (TSS), pH, ammonia, nitrate and other potential contaminants, prior to discharge to the Hunter River.

During construction, earthworks involved with the installation of the new scrubber and associated civil works may liberate sediments and dust. Appropriate erosion and sediment control mitigation measures as provided in the CEMP would be employed during the construction period to manage potential impacts.

Once operational the new scrubber would reduce the particulate fallout within Catchment 4 and therefore improve stormwater quality. The scrubber vessel and associate pipework/pumps will be located in a bunded area connected to the effluent system in the event of losses of containment.

#### EFFLUENT

As noted in the 2009 EA, existing effluent volume discharged from the site is typically approximately 2,000kL per day, with maximum daily discharges typically of approximately 3,000kL. The effluent consists of:

- ‘Blowdown’ water from cooling towers and boilers;
- Process wastes from plant operations; and
- Some stormwater (collected in the flush systems).

Where possible, liquid streams are recycled on site in various processes to increase the plant water efficiency and reduce the effluent volumes and contaminant loads.  Liquids that cannot be recycled within the existing operations are collected, managed and discharged to the site effluent system where the quality is suitable or collected for disposal offsite to licensed waste facilities. The system consists of a network of effluent pipes from all areas of the plant that direct waste-water that meets the discharge criteria to the effluent discharge system. The effluent is discharged to the north arm of the Hunter River via a diffuser system to ensure rapid mixing with the river water.

The site has three main hold points where effluent that does not meet the discharge requirements can be diverted for treatment or management prior to release to the site effluent system. These are:

- Nitrates Effluent Pond – holds effluent that has elevated nitrogen levels or high/low pH, to control discharge from the pond at a rate allowing for overall acceptable specifications;
- Demineralisation Treatment Plant – holds and treats waste liquid from the demineralisation process (high/low pH); and
- Effluent Diversion Pond – additional temporary storage capacity for off-specification effluent prior to transfer to the Demineralisation Treatment Plant for pH adjustment or disposal offsite using appropriately licensed liquid waste contractors.

Effluent quality is subject to a range of concentration limits detailed within the EPL for temperature, pH, total nitrogen, zinc, arsenic, hexavalent chromium and oil and grease. The site undertakes effluent monitoring on a continuous, composite and grab sample basis to assess compliance.

The site's current EPL includes a load limit requiring annual nitrogen discharge from the site to be below 200 tonnes per annum.  Process condensate generated in the ammonium nitrate plants (0.5% ammonium nitrate) is utilised for washing of the filter candles and makes up evaporative losses from the scrubber. Make up rates will vary significantly with weather conditions, however a minimum supply is required to maintain filter irrigation.

This process condensate will combine with sump recirculation liquor and be cycled up to a concentration >40% ammonium nitrate solution before being bled into the existing AN plant for recycling via the existing weak ammonium nitrate system.

This additional use of process condensate is anticipated to significantly reduce the load on the Nitrates reverse osmosis plant, which is currently used to treat process condensate prior to its discharge to the effluent system. As a consequence, the existing annual nitrogen loads in effluent discharged to the Hunter River are anticipated to reduce by approximately 60-70% from the current typical range of 140 – 160 tonnes per annum (tpa) to 40 - 60tpa.

## 9.3.8 RESOURCE IMPLICATIONS AND INTERFACES

### ELECTRICITY

Electricity demand will increase due to operation of the 1.6MW scrubber fan and a number of smaller pumps associated with operation, however this does not require additional high voltage power supply infrastructure.  Site loads are typically approximately 13,000kVA.  Electricity consumption is anticipated to increase by approximately 12% based on an estimated full project assembly load of 1600kVA consisting of the following:

- New scrubber fan will increase loading by approximately 1490kVA
- Addition of 1 x 90 kW pump (second pump in standby);
- Addition of 1 x 22kW pump (second pump in standby);
- Allocation of 100A for general light and power on the new structure;
- Removal of 66kW of load when the existing 12 x prill tower fans are decommissioned.

The main fan for the project will be fitted with a variable speed drive to match fan operation to process demand and minimize electricity use.

#### WATER

Water consumption will not change as a consequence of the project. All liquid makeup to the scrubber will be from existing process condensate streams.

#### GAS

No additional gas consumption is associated with the project.

#### MATERIALS

Materials required to build the new foundations and bund would be sourced locally where possible and is not expected to place an unreasonable demand on the source. The scrubber technology package is likely to be manufactured and imported from overseas by the technology vendor.

### 9.3.9 SOIL AND GROUNDWATER QUALITY

#### CONSTRUCTION

The EA identified three key potential soil and groundwater contaminants/ constraints at the site including arsenic, nutrients and acid sulfate soils.

Historic arsenic contamination was identified to be in the north-western portion of the site, in the former sludge disposal pit. The plume was delineated to occur in a north-west direction towards the Hunter River and therefore away from the proposed footprint of the project. Arsenic contamination impacted both groundwater and soil.

Orica was granted consent for State Significant Development (SDD) application SSD_7831 on 10 December 2018 for a cap and containment remediation system for the arsenic contamination. The remediation work was completed in August 2019.

Elevated nutrient levels were identified to occur in groundwater onsite from the discharge of solution from the Ammonia Storage Scrubber also in the north of the site. Source control activities have been carried out onsite to stop discharges from the Ammonia Storage Scrubber and ongoing monitoring is undertaken as part of the site EPL.

None of the above areas of contamination affect the footprint of the project, however given the project location there is anticipated to be some nutrient (nitrogen) contamination in groundwater.

All earthworks are anticipated to be above the water table, however if dewatering is required during construction a management plan would be developed as part of the CEMP for the project.

During the construction period, potential impacts to soil would be generally the same as assessed in the EA and would relate to encountering potentially contaminated soil during earthworks.

The CEMP will include provisions for unexpected finds including contaminants. However, if dewatering is required a dewatering management plan will be developed as part of the CEMP for the project and appropriate approvals obtained.

#### OPERATION

The scrubber vessel and associated tanks and pumps will be installed inside a bunded area connected to the existing effluent systems on the plant to contain spills or leaks and prevent soil and groundwater contamination.

### 9.3.10 FLORA AND FAUNA

No vegetation is present within the footprint of the project. Given no vegetation would be removed to accommodate the new scrubber, no impact to terrestrial biodiversity will be associated with the project.

Impacts to aquatic biodiversity in the Hunter River via accidental spills or from increased sediment load during construction would be prevented by the existing first flush system and control measures outlined in the CEMP.' During operation, the higher process condensate reuse required for makeup of the scrubber liquor will reduce nitrogen loads to the River, improving water quality.

### 9.3.11 HERITAGE

As noted in the 2009 EA, the site does not hold non-Aboriginal heritage significance and is formed on reclaimed land, therefore there is a very low likelihood that items of non-Aboriginal heritage significance would be encountered.

The EA also determined that no specific Aboriginal cultural values have been identified at the site and it is considered to be of low archaeological potential. Consistent with the EA, both non-Aboriginal and Aboriginal heritage is not considered a constraint for the project. A protocol for unexpected finds, including non-Aboriginal and Aboriginal heritage items will form part of the CEMP.

### 9.3.12 CLIMATE CHANGE

The 2009 EA notes aspects such as sea level rise, temperature, water availability and bushfire risk as key issues associated with climate change. Given the proposed scrubber system will be retrofitted to an existing operating plant in an existing location, there is limited scope for consideration of these issues. It is worth noting however that since the 2009 EA the site has connected to a recycled water supply and now uses approximately 75% less potable water, reducing the risk of a lack of water availability to the site as a whole.

### 9.3.13 AVIATION SAFETY

The scrubber stack (37.9m) is the highest point of the project and is immediately adjacent to a structure of greater height (ie. Prill Tower @ 51.5m), so will not present a new aviation hazard. However, the necessary approvals/notifications have been obtained from Williamtown RAAF base in accordance with Condition 48B of the Existing Approval. Being under 100m in height, the proposed stack does not require obstacle lighting under CASA 139 Manual of Standards.

### 9.3.14 WASTE

#### CONSTRUCTION

The sources of construction waste for the project are likely to include surplus construction materials (scrap metal, asphalt, timber, fencing, concrete and used erosion and sedimentation control materials), waste oil from construction equipment maintenance, office waste (paper, ink cartridges, toner, cardboard), batteries, light globes, domestic waste from construction personnel, packaging waste associated with equipment and materials (plastics, timber pallets, metal wire and cardboard), and possible waste from the demolition of plant. In addition, there may be some liquid wastes generated during cleaning activities associated with preparing equipment for commissioning of the plant.

It should be noted that lead based paint has been used on the structural members of the existing Prill Tower. If disposal of lead-based paint affected waste is required, the CEMP for the project will detail the associated controls.

### OPERATION

Operational waste will be limited to waste associated repairs and maintenance of the scrubber and ancillaries. All effluents from the scrubber are recycled through the existing AN plant. As noted previously, process condensate will be utilised to make up evaporative losses from the scrubber. Process condensate supply will be required as make up but flowrates are likely to vary significantly with weather conditions. This process condensate will combine with sump recirculation liquor and be recycled as a ~40% AN solution to the existing AN plant.

## 9.4 SOCIO-ECONOMIC IMPACTS

The proposed development would provide local direct and indirect employment opportunities. The 12-month construction phase is expected to require a construction workforce peaking at 40 personnel. The proposed development is, therefore, considered to be justifiable from an economic perspective, however it should be noted this project is environment and community driven and there are no financial benefits associated with it.

The assessments presented in this modification report regarding visual amenity, air quality, noise, hazard and risk, heritage and traffic indicate that the proposed Project would have an overall positive impact on socio-cultural issues. The Project is therefore justifiable on social grounds.

### DEVELOPMENT CONTRIBUTIONS

Condition 13 of the Project Approval (MP_0066) dated December 2009 required Orica prior to operation to pay a monetary contribution of $272,000 to Council (now City of Newcastle) in accordance with the former Newcastle Section 94A Development Contributions Plan 2006. The current plan is CN's Section 7.12 Newcastle Local Infrastructure Contributions Plan 2019 (Update Dec 2020).

To assist the Department to make an informed decision as to whether to change the infrastructure contribution required under condition 13, it is Orica's understanding that Section 7.12 contributions (formerly Section 94) are to assist council in maintaining adequate public infrastructure, as a result of increased demand associated with a development. During negotiations between Orica and Newcastle City Council in 2009 it was acknowledged that it was difficult to apply a conventional Section 94 contribution calculation to the Expansion Project (08_0129), as there was no clear correlation between the expansion of the Kooragang Island site and increased demand on local public infrastructure. While Orica contributed to a local community project to the value of $272,000, there was a valid argument that no development contribution payment should be required for the project.

In the case of this proposed modification, it will also create no additional demand on public services, and therefore Orica believe a renegotiation of the expansion project's original Section 94 contribution of $272,000 is not warranted. This is consistent with the Department's determinations in relation to previous modifications of 08_0129.

Furthermore, the proposed modification:

1. Does not intensify, enlarge or expand the development, and

2. Is in essence in its entirety a retrofitting or refurbishment project providing an ancillary service to the existing Prill Tower to improve environmental performance

As such Clause 3g) of 25J Section 7.12 levy - determination of proposed cost of development applies to the project costs, which states the following development costs are to be excluded:

(g) the costs of fittings and furnishings, including any refitting or refurbishing, associated with the development (except where the development involves an enlargement, expansion or intensification of a current use of land),

It should also be noted that Port of Newcastle own and maintain the infrastructure on Walsh Point, Kooragang Island where the site is located, not the City of Newcastle.

Finally, Orica Kooragang Island prides itself on being a part of the local community and makes considerable effort to fulfil its role as a corporate citizen. Since 2009, Orica has donated in excess of $2M to local community and sporting groups for a range of events, equipment and facilities, particularly in the Stockton area as part of its Community Investment Program and will this year donate approximately $316,000 as part of the ongoing program.

# 10. EVALUATION AND CONCLUSION

Orica is proposing to install ancillary pollution control equipment on the existing Prill Tower to reduce particulate air emissions. The project design will meet the overall site noise objectives and represents a minor impact on visual amenity. The proposed development will be substantially the same as the development currently approved, and as such is consistent with minor modification under Section 4.55 1A) of the EP&A Act.

As outlined in detail in the body of the assessment, it is considered that the Project will benefit the environment and the community by reducing particulate loads in the local airshed and reducing nitrogen loads on the Hunter River Estuary.

# APPENDIX A – AIR QUALITY IMPACT ASSESSMENT

# Prill Tower Scrubber

## Air Quality Impact Assessment

Revision 2 – 27-Jul-2021
Prepared for – Orica Australia (Kooragang Island) Pty Ltd – ABN: 99 004 117 828

# Prill Tower Scrubber

Air Quality Impact Assessment

Client: Orica Australia (Kooragang Island) Pty Ltd

ABN: 99 004 117 828

Prepared by

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27-Jul-2021

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AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

# Quality Information

Document Prill Tower Scrubber

Ref 60578946
I:\orica projects\prill tower scrubber modelling\deliverables\final\orica_prill_tower_aqia_final_27jul2021.docx

Date 27-Jul-2021

Prepared by David Rollings

Reviewed by Kristen Clarke

Revision History

| Rev | Revision Date | Details | Authorised | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| 1 | 10-6-2021 | Draft Report for Review | David Rollings<br>Associated Director - Air Quality | |
| 2 | 02-Jun-2021 | Final Report for Issue | David Rollings<br>Associated Director - Air Quality | |

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# Executive Summary

Orica is currently undertaking the investigation and design activities associated with the collection and scrubbing of particulate emissions from the Prill Tower, located on the southern portion (Nitrates Plant) of the Orica Kooragang Island site.

In accordance with requirements stipulated by NSW EPA on the Orica Environmental Protection licence, Orica has completed several Pollution Reduction Programs in relation to the Prill Tower. Condition U3 outlines the requirements for the installation of pollution control at the Prill Tower.

This Level 2 AQIA was conducted to assess the impact associated with the addition of the scrubber as part of the Environmental Assessment for the project. The assessment was undertaken in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2017) (Approved Methods) using the air dispersion model CALPUFF. Four dispersion modelling scenarios representing different possible operational regimes were examined to further understand the expected change in air pollutant concentrations following the addition of a scrubber to the Prill Tower.

Dispersion modelling results showed that there was a significant drop in ground level pollutant concentrations at all locations for all pollutants modelled. Reductions of over 98% were observed for the typical operational scenario, over 95% for the conservative operational scenario and over 87% for the maximum operational scenario post construction of the scrubber. All pollutant concentrations complied with their relevant air quality criteria and are expected to result in lower cumulative concentrations in the environment.

The expected decrease in ground level concentrations following the addition of the scrubber are expected to make a significant improvement to the air quality in the environment immediately surrounding the Orica facility.

# 1.0 Introduction

## 1.1 Background

Orica Pty Limited (Orica) is currently undertaking the investigation and design activities associated with the collection and scrubbing of particulate emissions from the Prill Tower, located on the southern portion (Nitrates Plant) of the Orica Kooragang Island site.

Orica has completed several Pollution Reduction Programs[1] related to the Prill Tower project. Details of the current Pollution Reduction Program (PRP 50) are outlined in the site's current Environmental Protection Licence (EPL 828) as follows:

> ***U3 Pollution Reduction Program (PRP) 50 - Installation of new Pollution Controls at the Prill Tower***
>
> ***U3.1 Background***
>
> *The Lower Hunter Particle Characterisation Study (2015) found that a portion of the $PM_{2.5}$ detected at the Stockton ambient air quality monitoring station was composed of primary ammonium nitrate. Primary ammonium nitrate was subsequently found to make up about 40%of the $PM_{2.5}$ detected at the Stockton ambient air monitoring station in winter; a time when the monitor is often downwind of the Prill Tower.*
>
> *The licensee has completed Pollution Reduction Program (PRP) 46 and PRP 47, which were investigations into feasible options to reduce $PM_{2.}$5 emissions from the Prill Tower. The licensee has identified that irrigated fibre bed scrubber technology is an appropriate pollution control for the Prill Tower air emissions. This PRP is the next step, being formalisation of the installation of new pollution controls to address $PM_{2.5}$ emissions from the Prill Tower.*
>
> **Deliverables**
>
> *U3.2 The licensee must install an irrigated fibre bed scrubber at the Prill Tower (Point 16) to minimise PM2.5 ammonium nitrate emissions from the premises. The licensee must carry out the project as follows:*
>
> *a) By 1 February 2021, the licensee must complete all geotechnical and structural engineeringinvestigations associated with the current Prill Tower (including but not limited to intrusive structural investigations of the Prill Tower foundations) and prepare a stakeholder engagementand a regulatory approvals plan for the project;*
>
> *b) By 1 October 2021, the licensee must complete all necessary final engineering designs forthe project to allow for the procurement tendering process to commence for long lead time items;*
>
> *c) By 1 April 2022, the licensee must finalise orders for all long lead-time items for the project;*
>
> *d) By 1 April 2023, the licensee must complete all necessary pre-works for the project (includingearthworks, civil, electrical, structural and mechanical works) and receive the scrubber at the premises;*
>
> *e) By 1 November 2023, the licensee must achieve practical completion of the project;*

---

[1] Historically several PRPs have been listed under EPL 828 aimed at reducing particulate emissions from the Prill Tower and include:

PRP 21 - AN1 Prill Tower Emission Investigation The licensee must characterise particulate emissions from the AN1 Prill Tower; review options to reduce emissions; and evaluate feasible options to reduce emissions. Completed in December 2013

PRP 46 - $PM_{2.5}$ Characterisation Study Analysis of 2015-2016 Stockton Air Quality Monitor $PM_{2.5}$ samples; and, a review of feasible options to reduce $PM_{2.5}$ ammonium nitrate particle emissions from significant sources. Completed in February 2018

PRP 47 - Feasibility Assessment of Irrigated Fibre-Bed Scrubbing Technology to Reduce $PM_{2.5}$ Emissions from the Prill Tower. Completed in December 2019 *f) By 31 January 2024, the licensee must achieve final completion of the project.*

*Note: This PRP has been added to the licence during the COVID-19 pandemic in mid-2020. COVID has resulted in delays, particularly for items that need to be imported from abroad. The EPA recognises that there might need to be some refinement to the above dates depending upon how the COVID pandemic plays out.*

*U3.3 The licensee must submit to the EPA's Director Metro North a progress report within sixty days of each of the dates given in the condition above. Each progress report must include, but need not be limited to:*

*a) an overview of the project;*

*b) a description of the project activities and works completed during the period;*

*c) a description of the project activities and works proposed for the next period;*

*d) a summary of any significant deviation(s) from the engineering design or the milestones givenin the condition above, along with their cause.*

*U3.4 The licensee must notify the EPA's Director Metro North within thirty days of becoming aware of any significant deviation from the engineering design or the milestones and their cause.*

The following scope and project objectives have been developed to enable the assessment of the change in pollutant concentrations following the installation of a scrubbing system for the Prill Tower emissions.

## 1.2 Scope and Objectives

The purpose of this report is to provide information on the findings of the dispersion modelling undertaken to evaluate the benefits associated with the installation of the Prill Tower scrubber. Benefits have been examined in terms of the relative change in concentration before and after the scrubber installation along with the change in pollution concentrations relative to the established NSW EPA criteria. Pollutant concentrations have been evaluated at ground level at or beyond the facility boundary and at on-site locations to examine concentrations from an Orica personnel exposure perspective.

A Level 2 AQIA was conducted in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2017) (Approved Methods) using the air dispersion model CALPUFF. The project scope included:

- A description of the proposed stack configuration (refer **Section 2.0**);
- Identification of ambient air quality assessment criteria relevant to this investigation, both in terms of off-site and onsite criteria (refer **Section 3.0**)
- A discussion on local meteorological and ambient air quality monitoring data (refer **Section 4.0** and **Section 5.4**)
- Development of an emissions inventory (EI) for the proposed Prill Tower Scrubber stack (refer **Section 5.8**). The EI included emission rates based on the following operational modes:
  - Typical emissions levels (expected normal operational emissions); and
  - Conservative emissions levels (periodic high operational emissions); and
  - Reasonable worst-case emission levels (maximum expected stack emission rates).
- Description of the modelling methodology (refer **Section 5.0**);
- Assessment of potential air quality impacts (refer **Section 6.0**); and
- Conclusions (refer **Section 7.0**).

# 2.0 Project Description

## 2.1 Project Location

The location of Orica's Kooragang Island site along with the relative location of the Prill Tower and associated scrubber infrastructure modelled in this assessment are shown in **Figure 1** and **Figure 2**. Cadastral boundaries have also been overlaid onto the site map in **Figure 1** to show the site boundary.

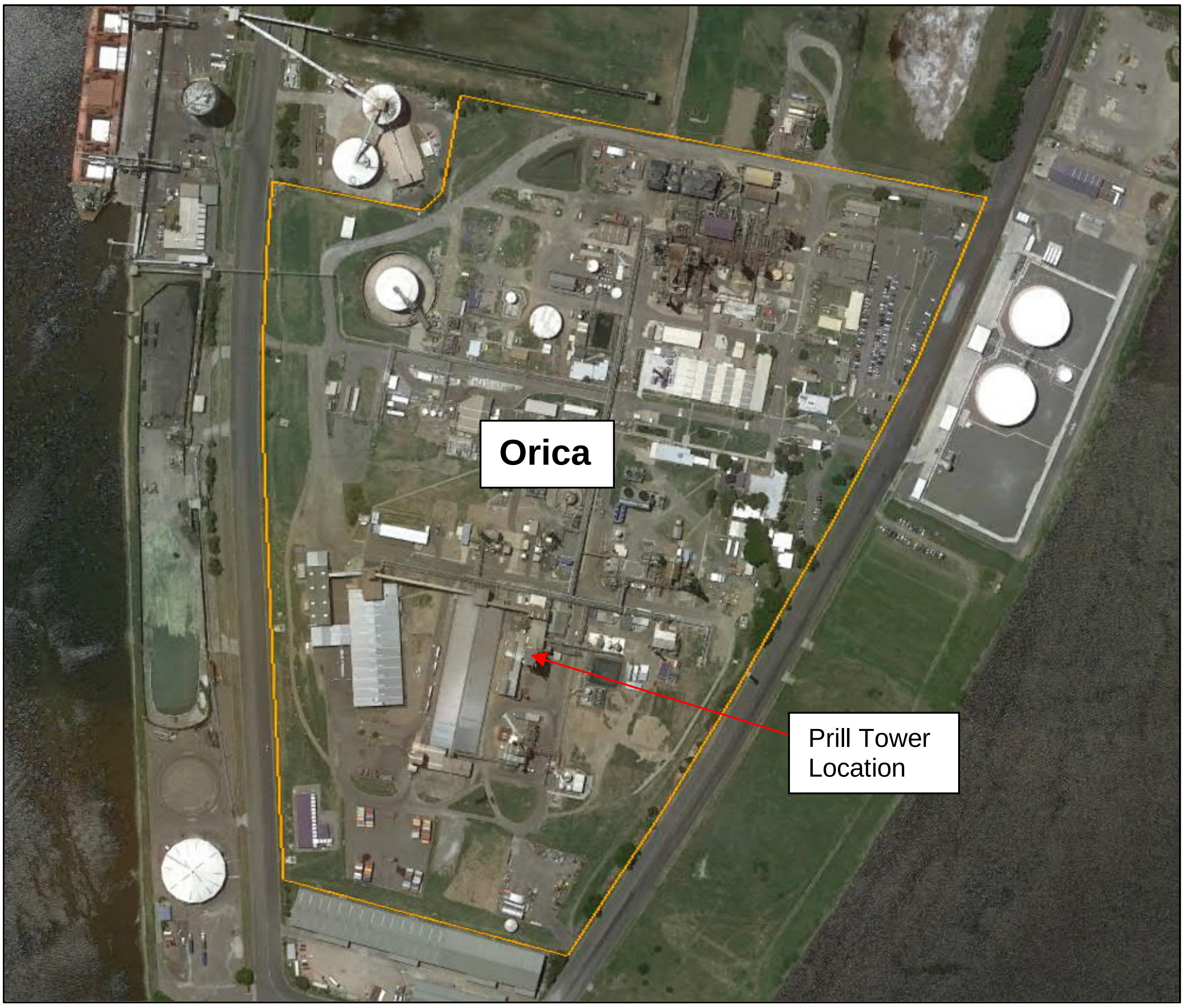


**Figure 1 Location of Orica, Kooragang Island.**

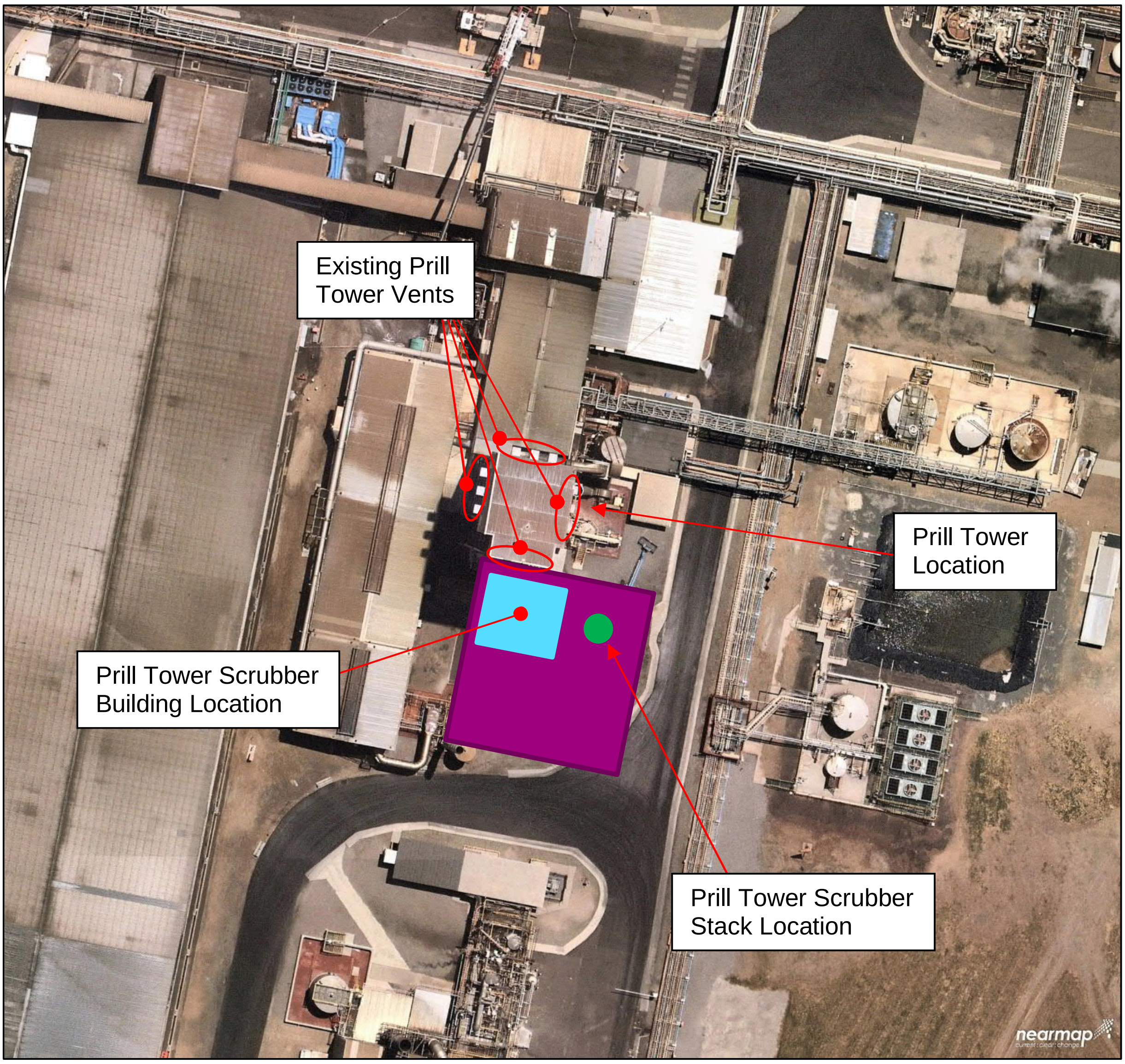


**Figure 2** **Approximate Location of Existing Prill Tower and Proposed Scrubber and Stack**

## 2.2 Prill Tower Emissions capture and Scrubber Project

Worley were engaged by Orica to complete a Feasibility Level engineering report of an Emission Reduction System (the Scrubber) to mitigate particulate emissions of ammonium nitrate (AN) from the Ammonium Nitrate Plant No. 1 (AN1) Prill Tower. The Scrubber would be designed and integrated into the existing AN1 plant with a stack situated adjacent to the scrubber infrastructure. The layout of the Scrubber relative to the Prill Tower, as determined at the end of the Prefeasibility engineering phase of the project is shown in **Figure 3**.

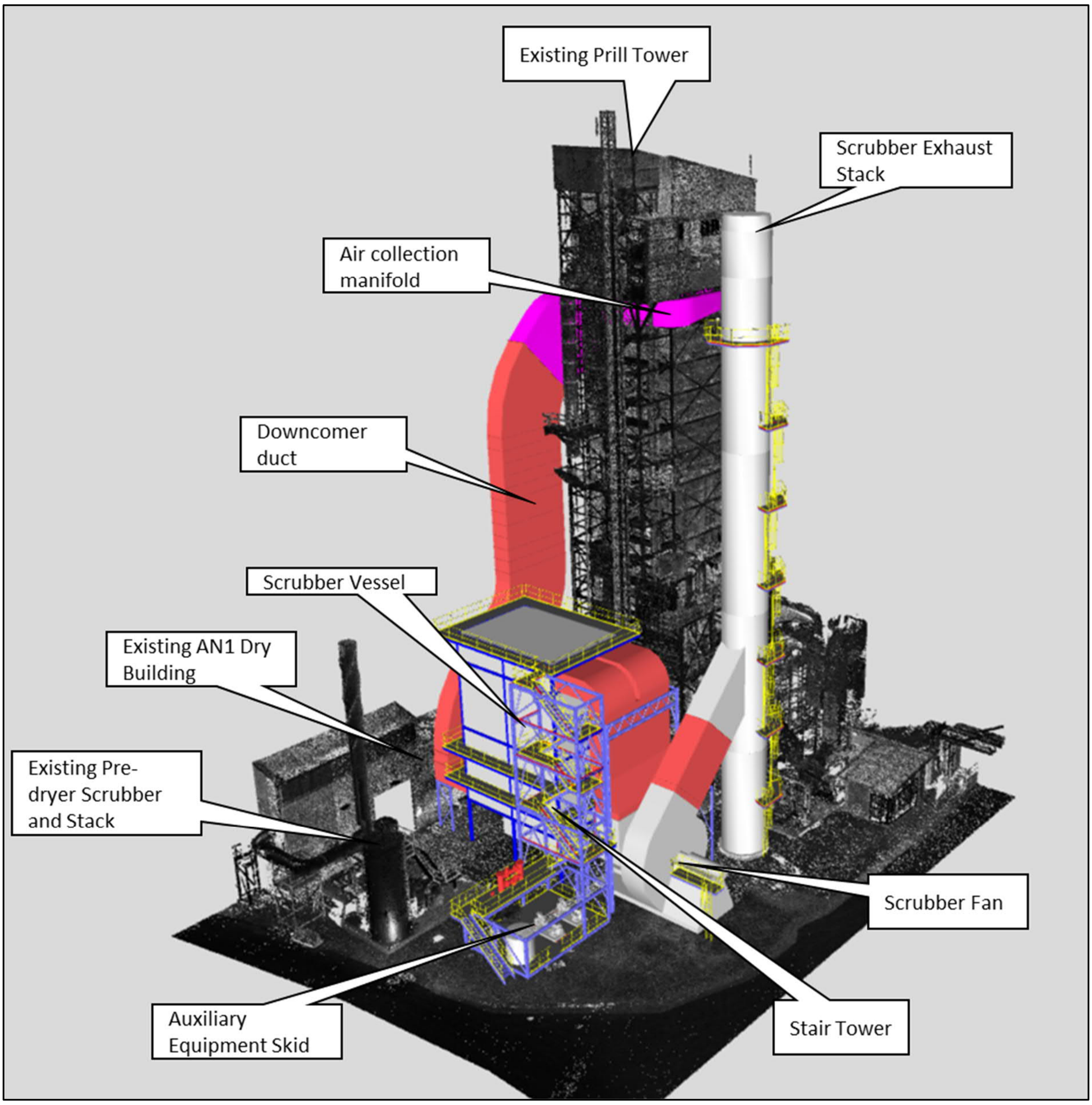


**Figure 3 Location of the Prill Tower Scrubber and Stack Location (Source: Worley, 2021)**

## 2.3 Air Pollutants of Concern

The Prill Tower is a well understood process on the Orica facility, operating since site operations commenced in 1969. Emissions are exhausted via twelve horizontally oriented fan vents. Emissions from the Tower consist of the following pollutants as listed below:

Solid ammonium nitrate as:

- Total Suspended Particulate Matter (TSP)
- Particulate Matter less than or equal to 10 microns in diameter ($PM_{10}$)
- Particulate Matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$); and

Gaseous fume as:

- Ammonia ($NH_3$).

Design concentrations and emissions rates have been provided by Orica/Worley for the Prill tower design which have been outlined in **Section 5.8**.

# 3.0 Assessment Criteria

In NSW the Protection of the Environment Operations Act 1997 (NSW) (POEO Act) provides the statutory framework for managing air emissions. Under the POEO Act the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW) (Clean Air Regulation) provides regulatory measures to control air emissions.

Part 5 of the Clean Air Regulation refers to the Approved Methods that lists the statutory methods for the modelling and assessment of air emissions from stationary sources in NSW. The Approved Methods for Modelling include assessment criteria against which emissions from a site or activity are assessed, with the Particulate (TSP, $PM_{10}$ and $PM_{2.5}$) and Ammonia ($NH_3$) criteria provided in **Table 1**.

Predicted pollutant concentrations were assessed against the NSW EPA criteria either as a maximum concentration (100th percentile) or as a lower percentile (99.9th percentile for Ammonia). Given the mix of pollutants in **Table 1**, predicted concentrations were assessed at both the boundary of the site and beyond along with at several representative receptor locations beyond the boundary of the site.

**Table 1 NSW EPA Assessment Criteria**

| Pollutant | Assessment Criterion (µg/m³) | Averaging Period | Percentile | Reportable Location |
|---|---|---|---|---|
| TSP | 90 | Annual | 100th | At the nearest sensitive receptor |
| $PM_{10}$ | 50 | 24 hour | 100th | At the nearest sensitive receptor |
| | 25 | Annual | 100th | At the nearest sensitive receptor |
| $PM_{2.5}$ | 25 | 24 hour | 100th | At the nearest sensitive receptor |
| | 8 | Annual | 100th | At the nearest sensitive receptor |
| Ammonia ($NH_3$) | 330 | 1 hour | 99.9th | At or beyond the boundary |

In addition to the NSW EPA criteria, onsite predicted pollutant concentrations were also assessed against standards developed for occupational health and safety at the Orica Kooragang Island. Standards for an occupational setting are provided in Workplace Exposure Standards for Airborne Contaminants (Worksafe Australia, 2019).

In the context of the Worksafe Australia exposure standards document, dust of interest is referred to as respirable dust and the focus is more on the composition of the dust (e.g. asbestos, synthetic mineral fibres or silica) rather than the size fraction and aerodynamic diameter. In the absence of man-made mineral fibres or silica, the particulate criteria recommended is the nuisance dust exposure standard of 10,000µg/m³ (averaged over an 8-hour period, also known as a Time Weighted Average, or TWA). TSP concentrations have been assessed against this standard.

The exposure standard adopted for the assessment of TSP and Ammonia exposure for onsite workers is shown in **Table 2**.

**Table 2 Adopted Occupational Assessment Criteria**

| Pollutant | Assessment Criterion (µg/m³) | Averaging Period | Percentile | Reportable Location |
|---|---|---|---|---|
| TSP | 10,000 | 8 Hour | 100th | At Worker Exposure Locations |
| $NH_3$ | 24,000 | 15 Minute | 100th | At Worker Exposure Locations |
| | 17,000 | 8 Hour | 100th | At Worker Exposure Locations |

# 4.0 Monitoring Data

The NSW Department of Planning, Industry and Environment (DPIE) under the Environment, Energy and Science (EES) sector operate a comprehensive ambient air quality monitoring network in NSW. The following subsections provide a summary of five years of $PM_{10}$ and $PM_{2.5}$ and $NH_3$ monitoring data from the nearest monitoring station from 2015 to 2019.

## 4.1 Particulate Matter

The nearest EES ambient monitoring station to the Orica facility is the Stockton station, approximately 750m southeast of the site across the north arm of the Hunter River. The EES monitoring station at Stockton records hourly $PM_{10}$, $PM_{2.5}$ and Ammonia Concentrations. 24 Hour average and annual average concentration for the $PM_{10}$ and PM2.5 data were calculated for the 2015 to 2019 period along with a determination of the number of exceedances that occurred during that time. Stockton monitoring station concentrations for 2015 to 2019 are shown in **Table 3**.

**Table 3** shows that the 24-hour maximum and annual average particulate concentrations recorded at the Stockton EES monitoring stations for 2015 to 2019 were all well above the EPA criteria for both short and long-term averaging periods. This is due to the proximity of the monitoring station to the ocean and the contribution of sea salt to the maximum concentrations. Further analysis has been undertaken into the particulate source below.

**Table 3 2015-2019 24 Hour Maximum and Annual Average $PM_{10}$ and $PM_{2.5}$ Concentrations at Stockton (EES 2021)**

| Pollutant | Year | 24 Hour Maximum (µg/m³) | Exceedances of EPA Criteria | Annual Average (µg/m³) |
|---|---|---|---|---|
| $PM_{10}$ | 2015 | 101.4 | 69 | 35.8 |
| | 2016 | 108.1 | 62 | 35.2 |
| | 2017 | 96.7 | 62 | 36.1 |
| | 2018 | 196.6 | 65 | 38.7 |
| | 2019 | 169.5 | 104 | 43.6 |
| **EPA $PM_{10}$ Criterion** | | **50** | **0** | **25** |
| $PM_{2.5}$ | 2015 | 30.9 | 3 | 9.5 |
| | 2016 | 66.4 | 1 | 9.7 |
| | 2017 | 32.0 | 1 | 9.8 |
| | 2018 | 26.9 | 1 | 10.0 |
| | 2019 | 98.6 | 27 | 12.9 |
| **EPA $PM_{2.5}$ Criterion** | | **25** | **0** | **8** |

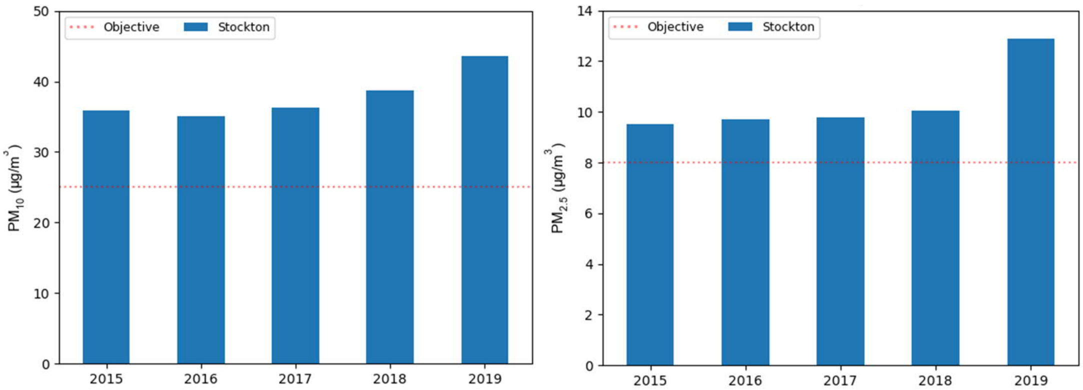


**Figure 4 Stockton EES Station Annual Average $PM_{10}$ and $PM_{2.5}$ Concentration 2015 to 2019**

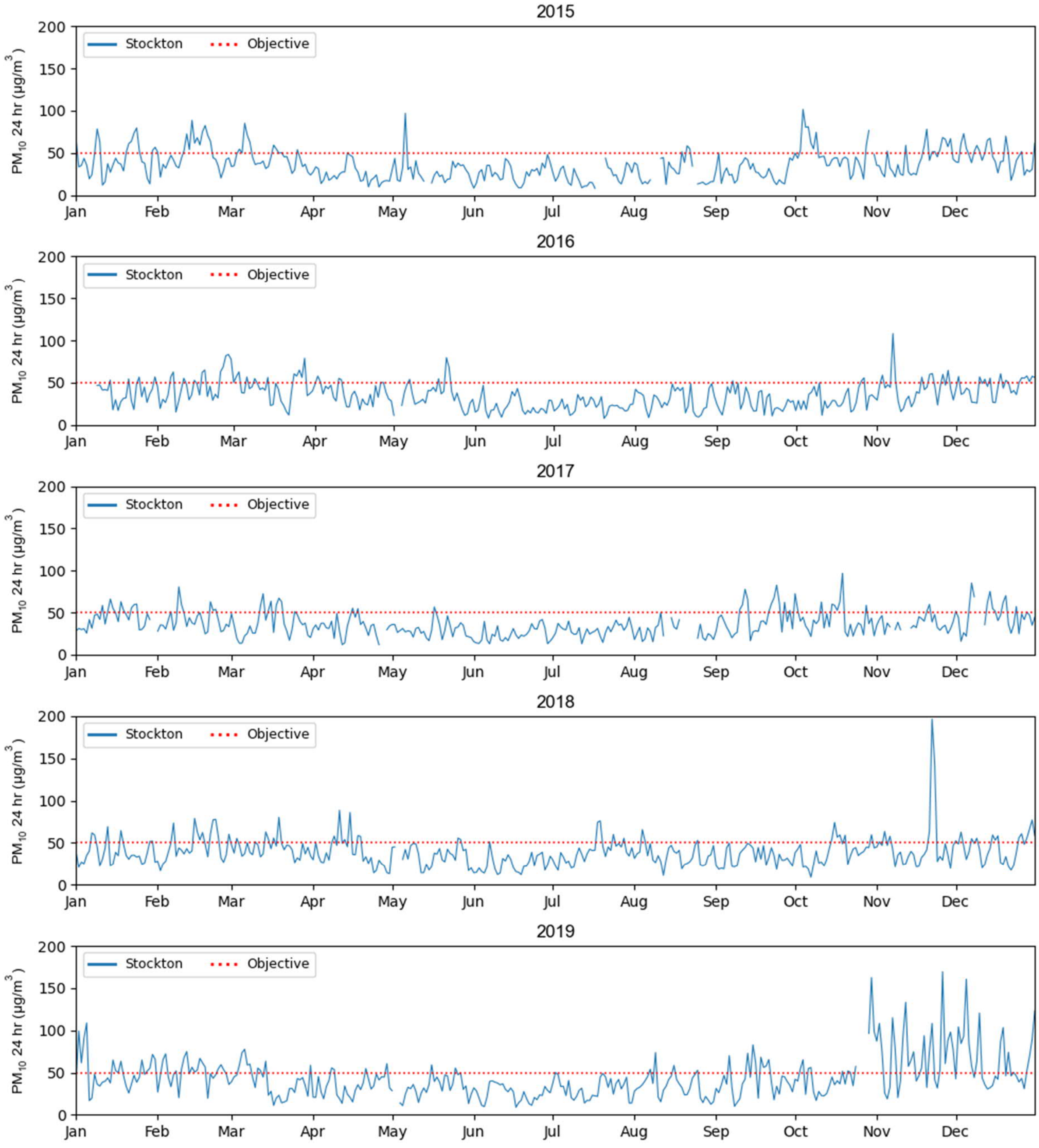


**Figure 5 Stockton EES Station $PM_{10}$ 24 Hour Average Concentration 2015 to 2019**

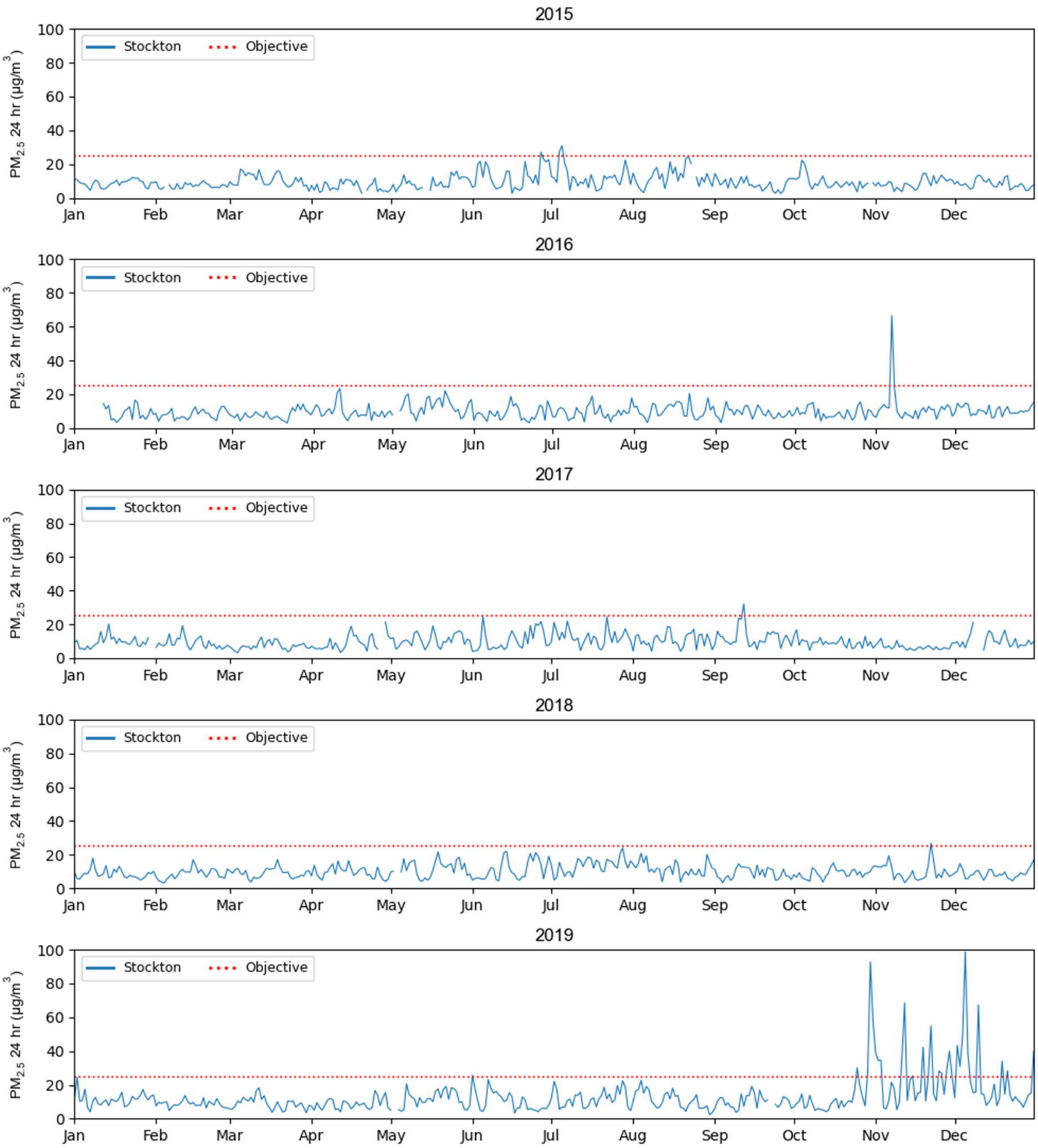


**Figure 6 Stockton EES Station 24 Hour Average $PM_{2.5}$ Concentration 2015 to 2019**

As discussed above, the particulate concentrations at Stockton were above the criteria for both $PM_{10}$ and $PM_{2.5}$ for all years between 2015 to 2019.

The $PM_{10}$ data at the Stockton monitoring station is generally much higher than the Newcastle regional airshed concentrations (as shown in a comparison between Mayfield, Carrington and Stockton $PM_{10}$ data in **Table 4**) with proximity to the ocean considered to be the primary reason for the difference between $PM_{10}$ concentrations at Carrington and Mayfield. The distances between the three stations and the ocean (which is a primary source of sea salt) are 5.95km, 2.51km and 0.44km. An analysis was undertaken to examine the average $PM_{10}$ concentrations for different wind speeds and directions around the Stockton EES station. Results of the analysis are shown in **Figure 7** along with wind roses showing the predominant wind direction for the different seasons. This figure clearly shows a significant contribution from the northeast to southeast across all seasons. The highest average concentrations occurred during periods with light winds from the east during winter, suggesting a large contribution of the overall average $PM_{10}$ concentrations can be attributed to sea salt from the ocean. These findings are also supported by the Lower Hunter Particle Characterisation Study (Hibberd et al. 2016) that found that the concentration of coarse particles (between 2.5 and 10 microns in diameter) were 2.5 times higher at Stockton than in Mayfield. This was mainly due to a much higher contribution of fresh sea salt particles at Stockton.

**Table 4 $PM_{2.5}$ Concentrations at Mayfield, Carrington, and Stockton**

| Year | 24 Hour Maximum (µg/m³) | | | Exceedances of EPA Criteria | | | Annual Average (µg/m³) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Stock | May | Carr | Stock | May | Carr | Stock | May | Carr |
| **2015** | 101.4 | 84.7 | 80.6 | 67 | 4 | 4 | 35.9 | 21.7 | 22.8 |
| **2016** | 108.1 | 84.1 | 95.4 | 60 | 1 | 2 | 35.1 | 22.6 | 23.5 |
| **2017** | 96.7 | 70.6 | 64.0 | 60 | 3 | 10 | 36.2 | 24.3 | 24.4 |
| **2018** | 196.6 | 135.6 | 155.2 | 65 | 11 | 12 | 38.7 | 26.9 | 27.3 |
| **2019** | 169.5 | 153.0 | 136.4 | 102 | 36 | 33 | 43.6 | 30.8 | 31.1 |

Stock – refers to the Stockton EES Station
May – refers to the Mayfield EES Station
Carr – refers to the Carrington EES Station

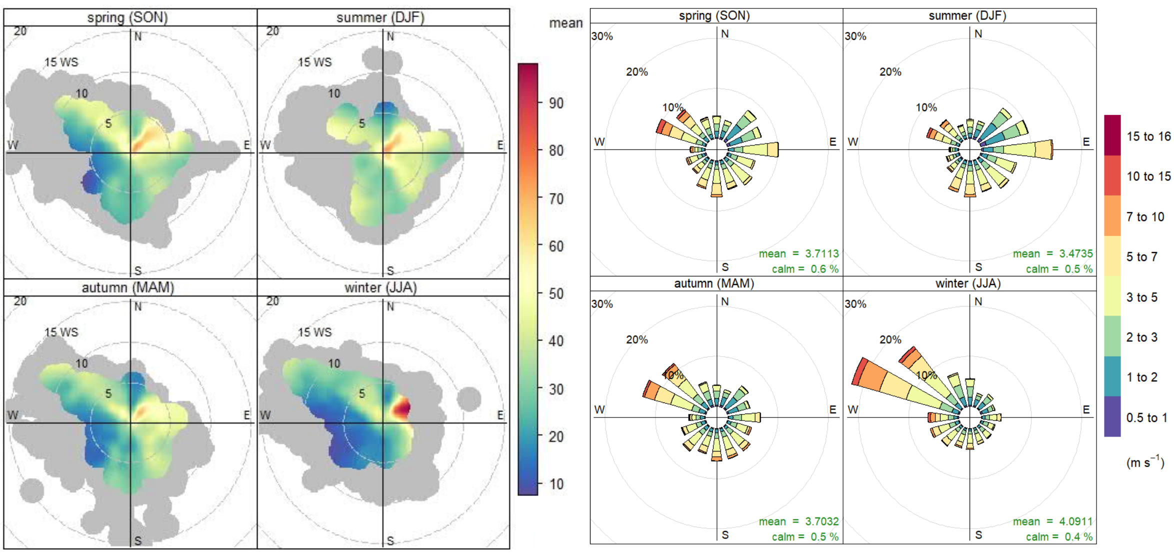


**Figure 7 Correlation of Wind Speed, Wind Direction and $PM_{10}$ Data for the Stockton EES Station**

The $PM_{2.5}$ concentration data at Stockton showed levels of pollution closer to the Newcastle regional airshed concentrations (as shown in a comparison between Mayfield, Carrington and Stockton $PM_{2.5}$ data in **Table 5**). While the proximity to the ocean is considered to be the primary reason for the elevated $PM_{10}$ fraction of particulates at Stockton, $PM_{2.5}$ concentrations have a different trend, with higher concentration predominantly occurring to the northwest, suggesting contributions from the Hunter Valley and the Kooragang Island area. While the Orica site may contribute to the background $PM_{2.5}$ concentration, given the similarities between the Mayfield, Carrington and Stockton $PM_{2.5}$ concentrations (and exceedances), the majority of the $PM_{2.5}$ particulates are expected to be from either non-local sources (regional sources such as the Liddell and Bayswater power stations and the Hunter Valley coal mines) or non-anthropogenic sources (sea salt). Given the similarities between Stockton and other Lower Hunter $PM_{2.5}$ concentrations, the Orica Site is expected to have limited influence on background concentrations.

**Table 5 PM2.5 Concentrations at Mayfield, Carrington, and Stockton**

| Year | 24 Hour Maximum (µg/m³) | | | Exceedances of EPA Criteria | | | Annual Average (µg/m³) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Stock | May | Carr | Stock | May | Carr | Stock | May | Carr |
| **2015** | 30.9 | 30.2 | 30.7 | 3 | 2 | 1 | 9.5 | 7.4 | 8.2 |
| **2016** | 66.4 | 57.9 | 70.0 | 1 | 1 | 1 | 9.7 | 7.5 | 8.5 |
| **2017** | 32.0 | 18.9 | 20.7 | 1 | 0 | 0 | 9.8 | 7.5 | 8.5 |
| **2018** | 26.9 | 21.3 | 20.8 | 1 | 0 | 0 | 10.0 | 8.4 | 8.2 |
| **2019** | 98.6 | 103.2 | 92.1 | 27 | 22 | 23 | 12.9 | 11.2 | 11.0 |

Stock – refers to the Stockton EES Station
May – refers to the Mayfield EES Station
Carr – refers to the Carrington EES Station

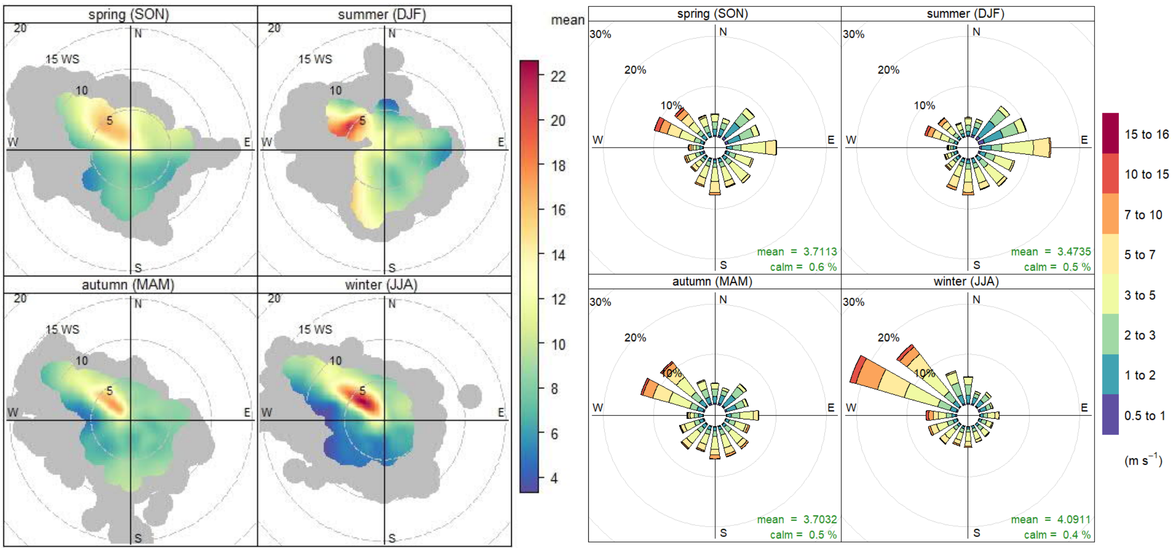


**Figure 8 Correlation of Wind Speed, Wind Direction and PM2.5 Data for the Stockton EES Station**

## 4.2 Ammonia

The ESS monitoring station at Stockton monitors hourly ammonia gas concentrations. Ammonia data for 2015 to 2019 has also be presented in **Table 6**. Over the five-year period the maximum recorded hourly background concentration at Stockton was 265.2µg/m³ and the highest hourly 99.9th percentile concentration recorded was 207.8 µg/m³. The 5-year maximum hourly concentration is below the EPA criterion of 330 µg/m³ (99.9th percentile).

**Table 6 2015 – 2019 1 Hour Maximum 99.9th Percentile $NH_3$ Concentrations at Stockton**

| Pollutant | Year | 1 Hour Maximum (µg/m³) | 99.9th Percentile (µg/m³) | Exceedances of EPA Criteria |
|---|---|---|---|---|
| **$NH_3$** | 2015 | 265.2 | 207.8 | 0 |
| | 2016 | 174.0 | 123.1 | 0 |
| | 2017 | 271.3 | 141.2 | 0 |
| | 2018 | 206.7 | 180.2 | 0 |
| | 2019 | 154.3 | 125.4 | 0 |
| **EPA $NH_3$ Criterion** | | **-** | **330** | **0** |

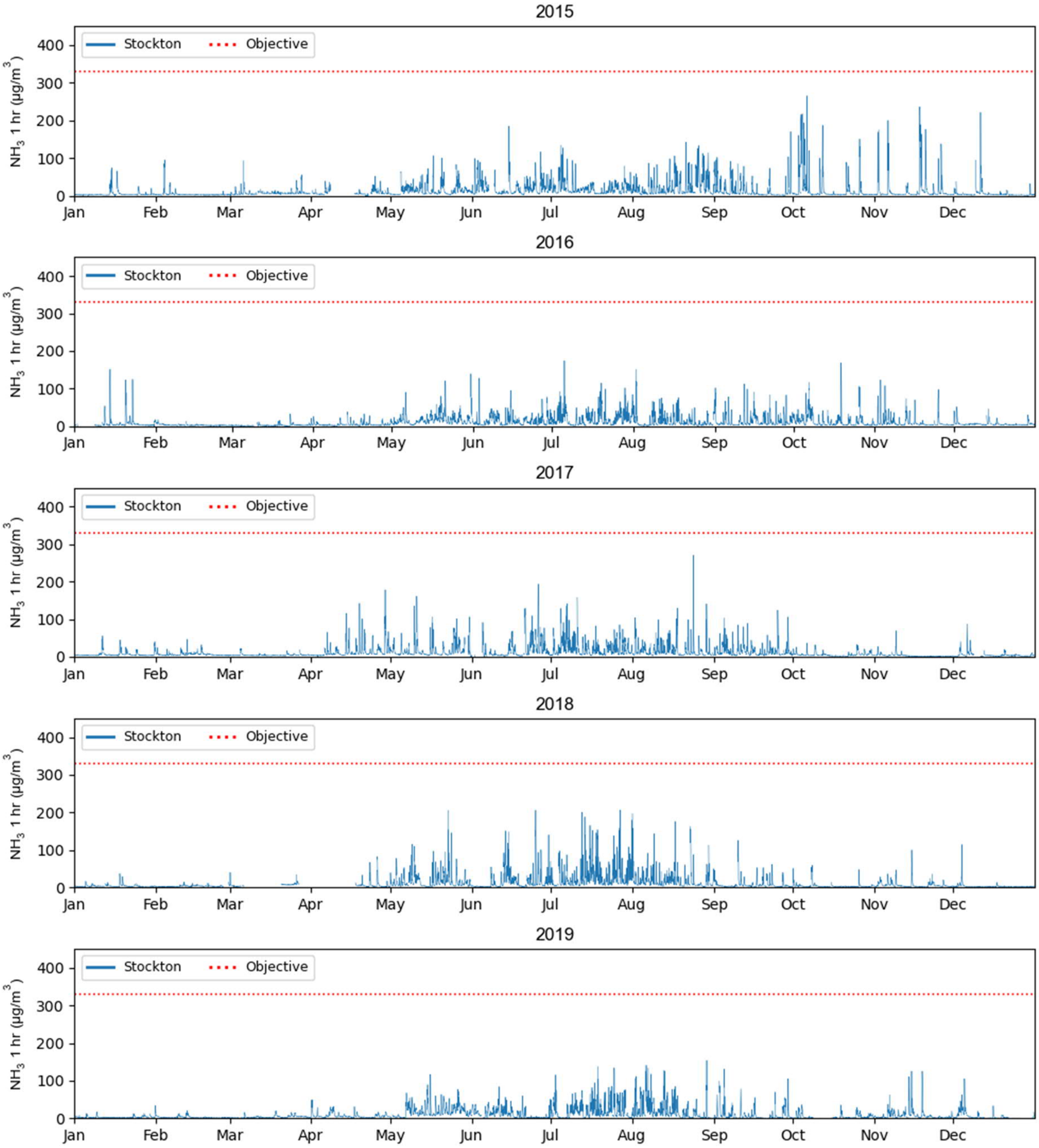


**Figure 9 Stockton EES Station NH3 Concentration 2015 to 2019**

As with $PM_{10}$ and $PM_{2.5}$, an analysis was undertaken of the concentration at different wind speeds and directions. Ammonia concentrations at the Stockton monitoring location show that the $NH_3$ gas concentration is almost completely from the North West quadrant with wind speeds between 2-10 m/s. Given the location of the Orica site (located to the North West of the Stockton Monitoring station) and given that there are not any other large $NH_3$ sources in the area, the source of the $NH_3$ gas is considered likely to be Orica.

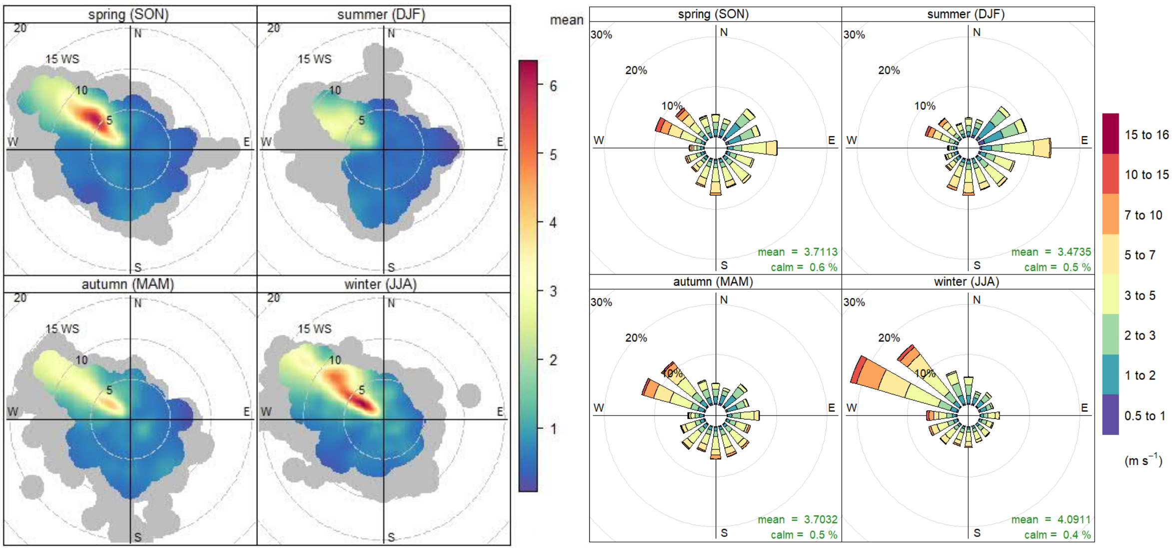


**Figure 10 Correlation of Wind Speed, Wind Direction and $NH_3$ Data for the Stockton EES Station**

# 5.0 Modelling Methodology

## 5.1 Overview

The air dispersion modelling conducted for this assessment was undertaken using the CALPUFF modelling suite with prognostic meteorological data derived from The Air Pollution Model (TAPM). The data available for this project and a discussion of the methodologies required to implement CALPUFF are discussed in the following sections.

The flow diagram in **Figure 11** shows the general process of programs used and the input data required for the dispersion model.

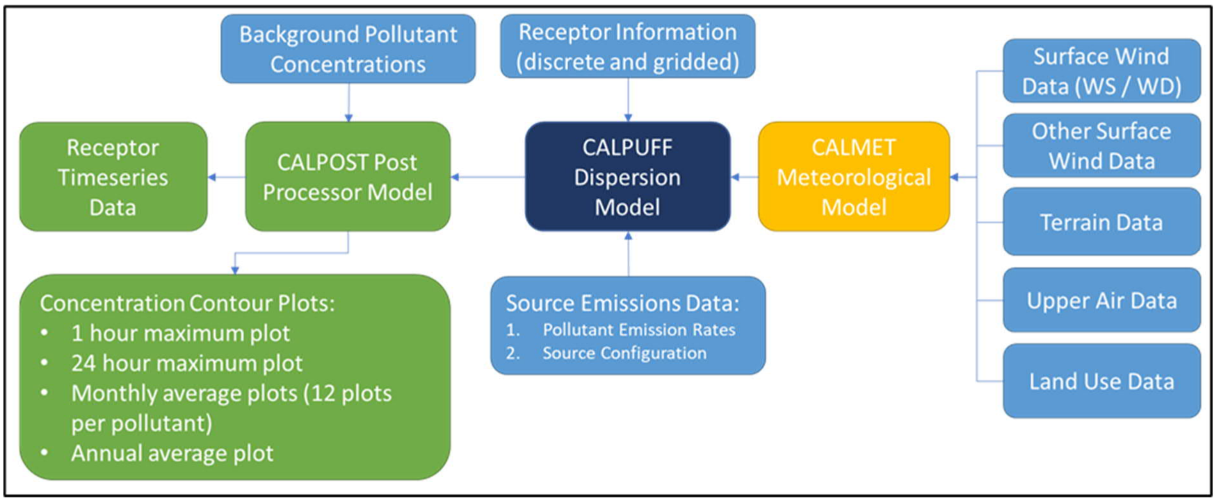


**Figure 11 Dispersion Model Flow Chart**

## 5.2 Modelling Approach

The selection of the dispersion modelling for this assessment was undertaken in accordance with the guidelines published in the NSW EPA publication Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, (NSW EPA, 2017). Details of the modelling inputs and assumptions are provided in the following sections.

### 5.2.1 TAPM

TAPM predicts three-dimensional meteorology, including terrain-induced circulations. TAPM is a PC-based interface that is connected to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic-scale meteorological analyses for various regions around the world. TAPM is used to predict meteorological parameters at both ground level and at heights of up to 8,000 m above the surface; these data are required by the CALPUFF model. The TAPM output file requires processing through a program such as CALTAPM to generate a file that is used within CALMET to generate the three-dimensional wind fields required by the CALPUFF dispersion model.

The settings used for the TAPM program are provided in **Table 7**. The settings are in accordance with the Site Model.

**Table 7 TAPM Settings**

| Parameter | Setting |
|---|---|
| TAPM Version | 4.0.5 |
| Grid centre coordinates | 32 º 53’ E |
| | 151º 44’ S |
| Date parameters | 2016 full calendar year |

| | |
|---|---|
| Number of grid points | nx = 40 |
| | ny = 40 |
| Outer grid spacing | dx1 = 30000 m |
| | dy1 = 30000 m |
| Number of grid domains | 4 |
| Grid spacing for CALTAPM | Inner most grid (t010a) = 1000m |
| Number of vertical grid levels | nz = 30 |
| Observation file | Not used |

### 5.2.2 CALPUFF Model Package

CALPUFF is the NSW EPA model of choice for areas that are affected by coastal breezes, coastal fumigation, or complex terrain. The Orica facility is situated within a coastal area and, hence, the CALPUFF model was the most appropriate model for the assessment of the dispersion of pollutants emitted on the Site.

The CALPUFF modelling system consists of three main components and a set of pre-processing and post-processing programs. The main components of the modelling system are CALMET (a diagnostic three-dimensional meteorological model), CALPUFF (an air quality dispersion model), and CALPOST (a post-processing package). The three main CALPUFF software package programs are described in the following sections.

### 5.2.3 CALMET

CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. CALMET produces a meteorological file that is used within the CALPUFF model to predict the movement of pollution.

The settings in **Table 8** were specifically selected to run CALMET in the 'hybrid' mode discussed in Barclay and Scire (2011). Only those parameters that deviate from the program default values or are significant to the AQIA are provided. The settings are in accordance with the Site Model.

**Table 8 CALMET Settings**

| Parameter | Setting |
|---|---|
| CALMET version | 6.5.0 |
| Grid Spacing | 0.200 km |
| Grid Size | 30km x 30km |
| # Cells NX | 200 |
| # Cells NY | 200 |
| Source of Land Use Data | Site-specific creation based on USGS data system |
| Geo Processer Used | Used external data in the Geophysical Processer program |
| Surface and Overwater | Surface stations:<br>- NSW EES Newcastle meteorological stations<br>- NSW BoM Williamtown and Nobbys meteorological station:<br>Overwater data:<br>- TAPM Prognostic Data. |

| | |
|---|---|
| Upper Air | Upper air data processed from Williamtown BOM data and TAPM upper air data |
| Convective mixing height method | Maul-Carson for land and water |
| Overwater surface flux method | COARSE with no wave parameterisation |
| Use 3D temperature from | Surface and upper air |
| Surface temperature | Compute internally from 2-D spatially varying |
| Surface wind vertical extrapolation | Extrapolate using similarity theory and exclude upper air observations from level 1 |
| Wind field guess | Compute internally |
| Cloud cover data options | Cloud data generated from Surface Observations |
| Seven Critical CALMET Parameters | TERRAD = 4<br>RMAX1 = 2.5<br>RMAX2 = 10<br>R1 = 6<br>R2 = 2<br>IEXTRP = -4<br>BIAS = -1, 0, 0, 0, 0, 0.5, 0.8, 1, 1, 1,<br>These values have been considered based on the local terrain characteristics of the area, which is mildly undulating with the coastline to the east, and another water body within the meteorological domain. These values are generally in line with the recommendations in the Barclay and Scire (2011) CALPUFF Guidelines for flat terrain, where there are minimal influences from the terrain on the wind vectors. |

### 5.2.4 CALPUFF

CALPUFF is a non-steady-state three-dimensional Gaussian puff model developed for the US Environmental Protection Agency (US EPA) and approved by the NSW EPA for use in situations where basic Gaussian plume models are not effective, such as areas with complex meteorological or topographical conditions, including coastal areas with re-circulating sea breezes. The CALPUFF model substantially overcomes the basic limitations of the steady-state Gaussian plume models, and as such, was chosen as the most suitable dispersion model for the AQIA and Site Model. Some examples of applications for which CALPUFF may be suitable include:

- Near-field impacts in complex flow or dispersion situations:
  - complex terrain;
  - stagnation, inversion, recirculation, and fumigation conditions;
  - overwater transport and coastal conditions;
  - light wind speed and calm wind conditions.
- Long range transport;
- Visibility assessments and Class I area impact studies;
- Criteria pollutant modelling, including application to development applications;
- Secondary pollutant formation and particulate matter modelling; and
- Buoyant area and line sources (e.g. forest fires and aluminium reduction facilities).

Those parameters that deviate from the program default values or are significant to the AQIA are provided in **Table 9**. The settings are in accordance with the Site Model.

**Table 9 CALPUFF Settings**

| Parameter | Setting |
|---|---|
| CALPUFF version | 7.2.1 |
| Sampling Grid | 6km x 8 km |
| Calculation type | Concentration |
| Chemical transformation method | Not modelled |
| Dispersion Option | Dispersion coefficient uses turbulence computed from micrometeorology |
| Use PDF method for Sigma-z in the convective BL | On |
| Puff splitting | No puff splitting |
| Plume rise method | Briggs |
| Transitional plume rise | On |
| Stack tip downwash | On |
| Partial plume penetration | On |
| Partial plume penetration (buoyant) | On |
| Terrain adjustment method | Partial plume path adjustment |
| Building wake calculation | PRIME algorithm |

### 5.2.5 CALPOST

The CALPOST program is used to process the outputs of the CALPUFF program into a format defined by the user. Results can be tabulated for selected options including percentiles, selected days, gridded results, or discrete locations and can be adjusted to account for chemical transformation and background values.

The program default settings were used for the CALPOST program, (NSW EPA, 2017). CALPOST version 7.1.0 was used in the assessment.

## 5.3 Modelling Scenarios

Several modelling scenarios were investigated to enable the assessment of the existing emissions from the Prill Tower at the proposed stack height. A description of each modelled scenario is provided below in **Table 10**. The proposed 37.9m stack height is the minimum required to satisfy the upstream and downstream disturbance requirements outlined in AS4323 for stack sampling port position as shown below in **Figure 12**.

**Table 10 Description of Modelled Scenarios**

| Scenario ID | Description |
|---|---|
| **Scenario 1** | Existing Prill Tower Emissions |
| **Scenario 2A** | 37.9m Stack Height, Typical Emissions |
| **Scenario 2B** | 37.9m Stack Height, Conservative Emissions |
| **Scenario 2C** | 37.9m Stack Height, Maximum Emissions |

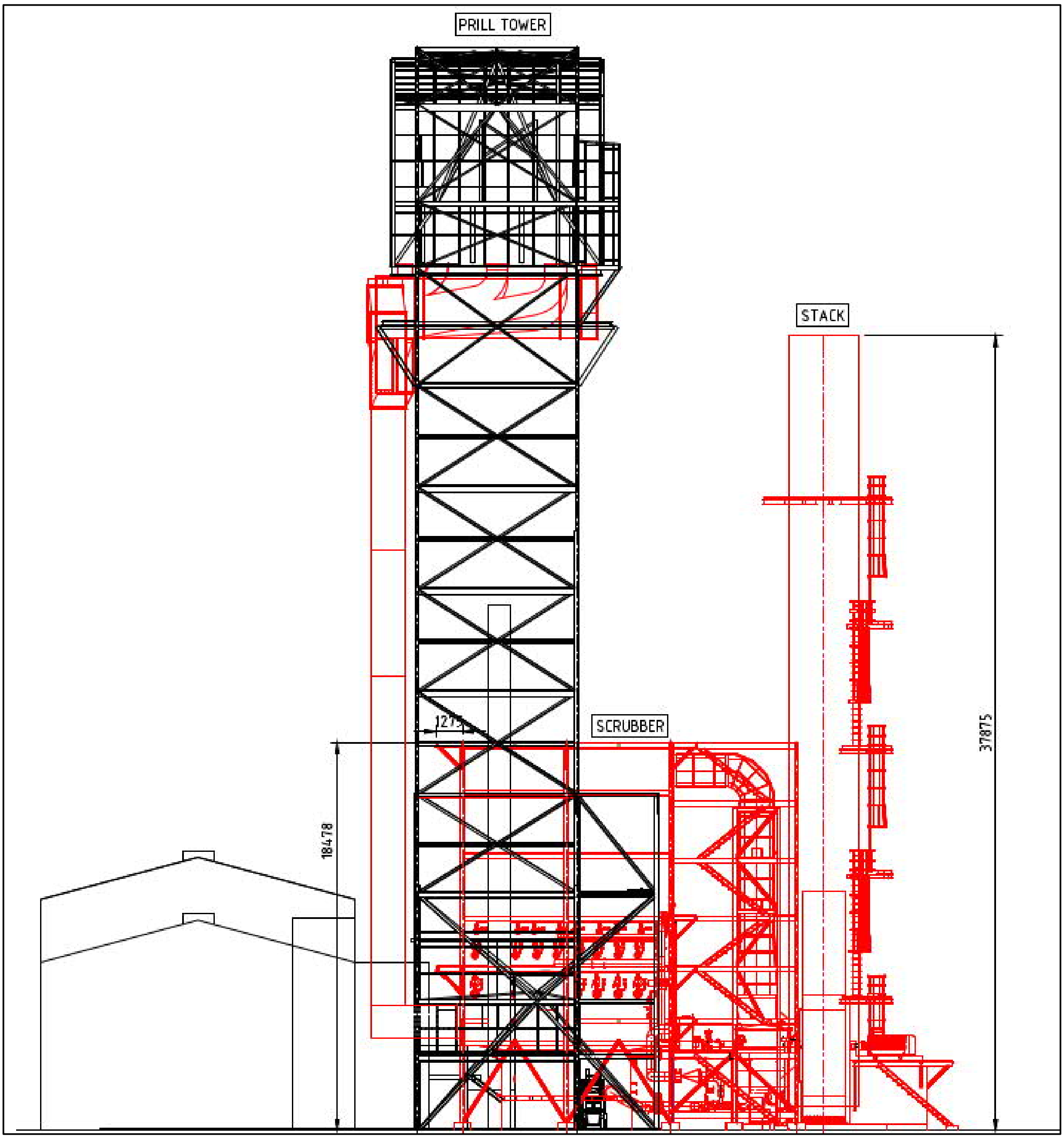


**Figure 12 Stack Dimensions**

The assumed particulate and ammonia emission rates for each modelled scenario are summarised in **Table 11**. Additional information on the calculation of these emission rates is provided in **Section 5.8**.

**Table 11 Modelled Scenario Pollutant Emission Rates (g/s)**

| Scenario ID | TSP Emission Rates | $PM_{10}$ Emission Rates | $PM_{2.5}$ Emission Rates | $NH_3$ Emission Rates |
|---|---|---|---|---|
| **Scenario 1** | 7.74 | 2.32 | 2.32 | 0.23 |
| **Scenario 2A** | 0.060 | 0.060 | 0.060 | 0.0020 |
| **Scenario 2B** | 0.20 | 0.20 | 0.20 | 0.0027 |
| **Scenario 2C** | 0.68 | 0.68 | 0.68 | 0.0068 |

## 5.4 Meteorology

A full year of hourly averaged meteorology has been used by the model to simulate dispersion of particulates and $NH_3$ emissions from the Prill Tower stack at the Orica facility. The meteorological data are used by the model in different ways to estimate the dispersion of air pollutants:

- Ambient temperature is used to incorporate thermal buoyancy effects when calculating the rise and dispersion of pollutant plumes;
- Wind direction determines the direction in which pollutants would be carried;
- Wind speed influences the dilution and entrainment of the plume into the air continuum;
- Atmospheric stability class is a measure of atmospheric turbulence and the dispersive properties of the atmosphere. Most dispersion models utilise six stability classes, ranging from A (very unstable) to F (stable/very stable); and
- Vertical mixing height is the height at which vertical mixing occurs in the atmosphere.

The AQIA used meteorological data from the following Bureau of Meteorology and NSW EES monitoring stations:

- Williamtown BOM Station (12.0km to the northeast of the Orica facility)
- Nobbys lighthouse BOM station (2.9km to the southeast of the Orica facility)
- Mayfield EES Station (4.6km to the west northwest of the Orica facility)
- Carrington EES Station (1.5km to the southwest of the Orica facility)
- Beresfield EES Station (15.3km to the northwest of the Orica facility); and
- Stockton EES Station (0.7km to the southeast of the Orica facility)

The above stations meet the relevant Australian Standards for siting and measurement of meteorological conditions. The stations monitor a combination of wind speed, wind direction, precipitation, pressure, relative humidity, and temperature.

A minimum of one year of meteorological data is required for entry into the dispersion model. Selection of the most appropriate year is needed with a demonstration that the selected year is representative of long-term meteorological conditions. In addition, it needs to be shown that the selected meteorological year does not exhibit critical dispersion parameters that may result in more favourable dispersion conditions e.g. low levels of calms.

Selection of the most appropriate year for entry into the dispersion model was based on the following criteria:

- Intra-year data availability (greater than 90% availability was used as a broad criteria)
- Date of installation for the stations (BOM stations were available for long periods of time while the EES stations were only available since 2014)
- Visual analysis of the data to identify whether there were any outliers in the data that may influence the statistics
- Analysis of the statistics of the meteorology to identify whether any year was not appropriate for use in the dispersion modelling.
- Analysis of the wind roses for the different historical meteorological years.

All dispersion modelling results are based on the 2016 meteorology developed from the CALMET model using inputs from the above stations. The modelled concentrations generated represent the worst-case ground level concentrations for the modelled year of meteorological conditions.

Meteorological data used for the modelling has been presented as wind roses in **Figure 13**. Data for the 2016 calendar year along with seasonal meteorology and long-term meteorology have been presented. This data set is the same data used for recent investigation undertaken in the Lower

Hunter for Orica and other industries and has been accepted for use by NSW EPA. To ensure consistency with previous investigations, this meteorology has been used for this assessment.

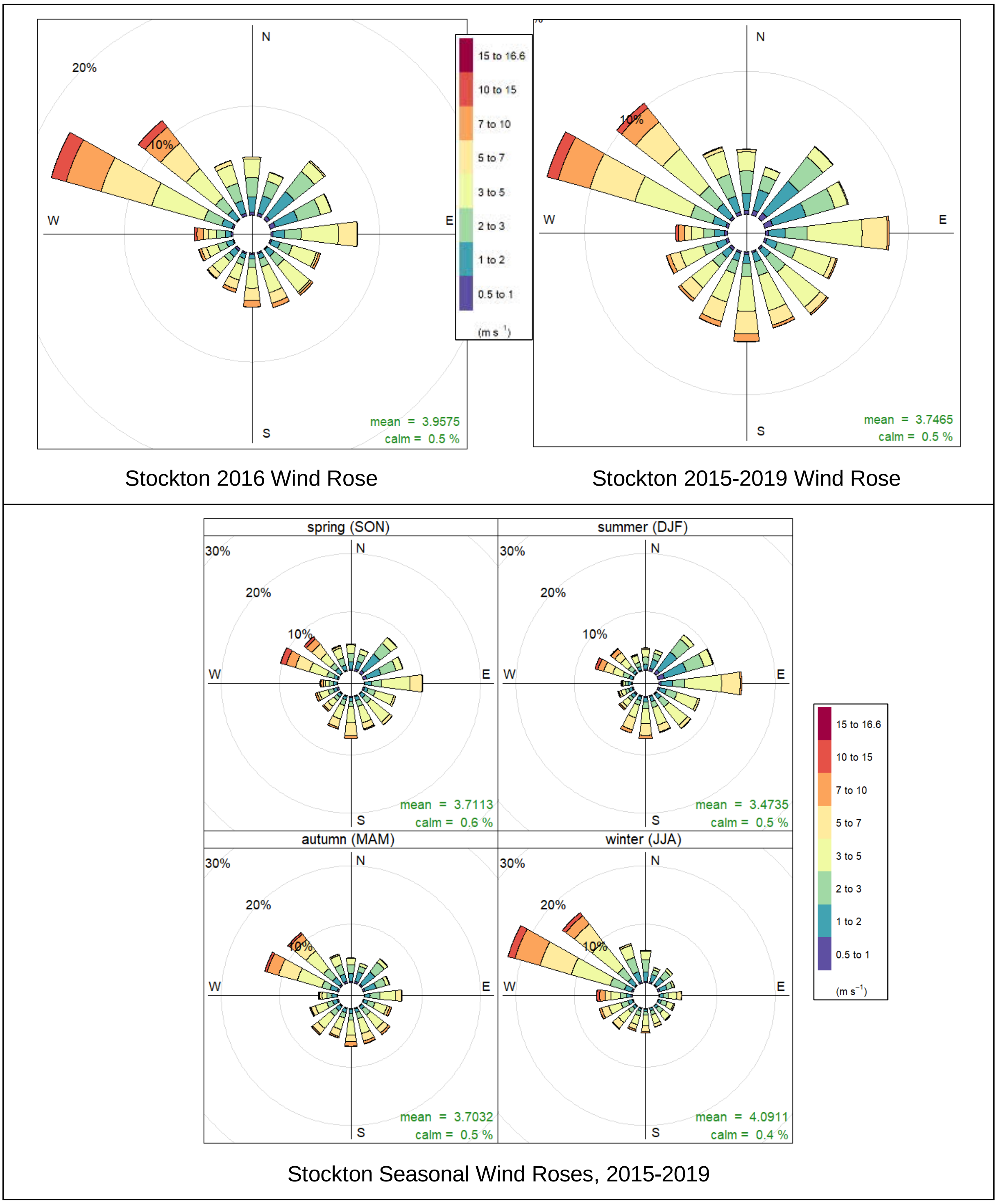


**Figure 13 Modelled Meteorology Wind Roses**

## 5.5 Sensitive Receptor Locations

The NSW EPA defines sensitive receptors to be areas where people are likely to either live or work or engage in recreational activities or may be reasonably expected to do so in the future (NSW EPA, 2016). Receptors have been entered into the model as either discrete receptors (at exact receptor locations within the domain) or as gridded receptors which consist of an arbitrary grid of receptors spread across the modelling domain.

A receptor grid was spread over an area of 4km x 5km centred on the Orica Site. Gridded receptors were positioned with a spacing between receptors of 50m. In addition to the gridded receptors, discrete receptors were placed at locations of interest across the modelling domain. This included receptors located at the site boundary, sensitive receptor locations (residential areas and commercial operations) and at the Stockton EES monitoring location (to enable a direct analysis of concentrations at the monitoring station location). Location of boundary and sensitive receptors that have been used to assess predicted ground level pollutant concentrations against the relevant EPA ambient are quality criteria are shown in **Figure 14**. Receptors have been separated into on-site receptors and receptors "at or beyond the boundary".

**Figure 14 Discrete Receptor Location**

Onsite impacts from the Prill Tower were assessed using results from the arbitrarily spaced grid receptors that fell within the boundary of the Orca facility.

## 5.6 Terrain Data

Terrain data for the modelling grid has been extracted from the NSW Land and Property information (LPI) 10m resolution dataset, which comprises gridded elevation data at a horizontal resolution of 10m measured using a C3 LiDAR (Light Detection and Ranging) from an ALS50 (Airborne Laser Scanner). This data has an accuracy of 2.0m vertical and 5.0m horizontal. These data were incorporated into the CALPUFF input files via CALMET.

Terrain in the lower Hunter around the Orica site is predominantly flat and terrain is not expected to be a major factor in the dispersion modelling.

## 5.7 Building Wake Effects

Building wakes generally decrease the distance downwind at which pollutant plumes encounter the ground. This may result in higher ground level pollutant concentrations closer to the source of emission. Building wake effects were included in the modelling via the BPIP program. Main structures at the Orica Kooragang Island Plant incorporated into the BPIP are shown in **Figure 15**.

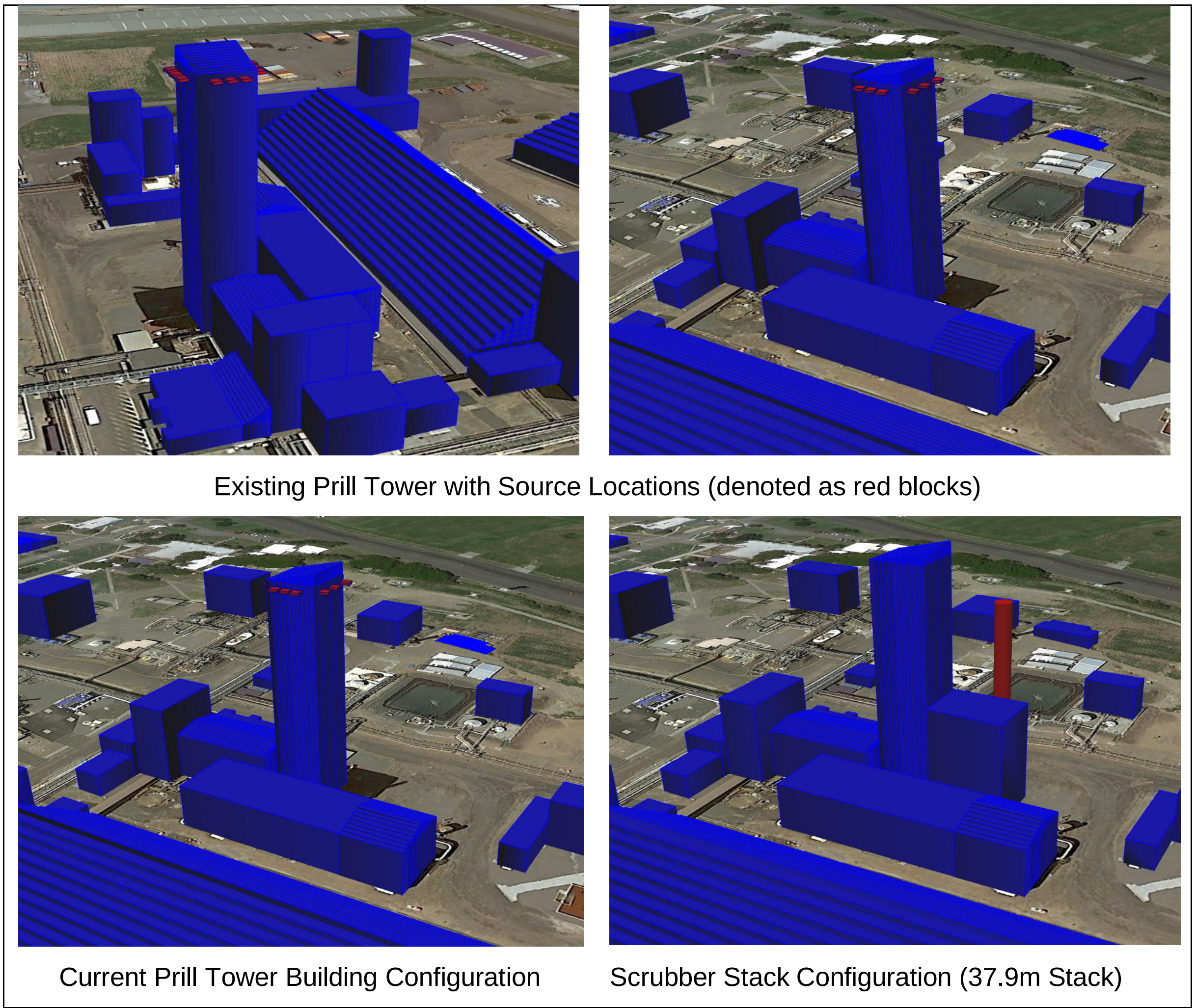


**Figure 15 Buildings included in the dispersion modelling drawings**

## 5.8 Emissions Inventory

The Prill Tower for the purposes of the dispersion modelling investigation has been conservatively assumed to be operating continuously. Based on indicative real time data for outlet concentrations to the Prill Tower Scrubber, the inlet concentrations are anticipated to be below 20mg/Nm$^3$ approximately 99% of the time, and below 50mg/Nm$^3$ 99.9% of the time. The scrubber is anticipated to have a performance guarantee from the technology vendor of 5mg/Nm$^3$ for inlet concentrations of less than 100mg/Nm$^3$. Given these performance characteristics, the following scenarios were considered:

- Scenario 2A - Assumption of typical inlet scrubber concentration of 20mg/Nm$^3$ TP ($NH_4NO_3$-solid) (wet), 15mg/Nm$^3$ (wet) ($NH_4NO_3$-solid) $PM_{10}/PM_{2.5}$ and 3.0mg/Nm$^3$ $NH_3$ (gas)
- Scenario 2B - Assumption of conservative inlet scrubber concentration of 50mg/Nm$^3$ TP ($NH_4NO^3$-solid) (wet), 15mg/Nm$^3$ (wet) ($NH_4NO_3$-solid) $PM_{10}/PM_{2.5}$ and 3.0mg/Nm$^3$ $NH_3$ (gas)
- Scenario 2C - Assumption of reasonable worst-case inlet scrubber concentration of 100mg/Nm$^3$ ($NH_4NO_3$-solid) TP (wet), 30mg/Nm$^3$ ($NH_4NO_3$-solid) (wet) $PM_{10}/PM_{2.5}$ and 10.0mg/Nm$^3$ $NH_3$ (gas)

Stack emissions parameters for each source have been included in **Table 12** and are based on information supplied by the technology vendor predicting the performance of the system at various inlet concentrations as shown below.

Based on available process data, it is anticipated that input concentrations to the scrubber will be typically below 20mg/m$^3$ (Scenario 2A) 99% of the time, and typically below 50mg/m$^3$ (Scenario 2B) 99.9% of the time.

The existing Prill Tower was also modelled with emission rates being based around historically modelled emission rates and the sources consisted of horizontal vents at the top of the Prill Tower itself.

**Table 12 Stack Parameters**

| Stack parameter | Units | Scenario 1 (existing) | Scenario 2A (typical) | Scenario 2B (conservative) | Scenario 2C (maximum) |
|---|---|---|---|---|---|
| Discharge Height | mAGL | 45 | 37.9 | 37.9 | 37.9 |
| Stack discharge air flowrate | Nm$^3$/h (dry) | 278,640 | 357,000 | 490,000 | 490,000 |
| Stack exit diameter | mm | NA | 3250 | 3250 | 3250 |
| Stack discharge velocity | m/s | NA | 14.6 | 19.2 | 20.7 |
| Stack discharge air temperature | °C | NA | 40 | 40 | 48 |
| Total Particulate (TP) | mg/Nm$^3$ | 100 | 0.6 | 1.5 | 5.0 |
| | g/s | 7.74 | 0.060 | 0.204 | 0.681 |
| Particulate Matter Less than 10 Microns ($PM_{10}$)[1] | mg/Nm$^3$ | 30.0 | 0.6 | 1.5 | 5.0 |
| | g/s | 2.32 | 0.060 | 0.204 | 0.681 |
| Particulate Matter Less than 2.5 Microns ($PM_{2.5}$) | mg/Nm$^3$ | 30.0 | 0.6 | 1.5 | 5.0 |
| | g/s | 2.32 | 0.060 | 0.204 | 0.681 |
| Ammonia ($NH_3$) | mg/Nm$^3$ | 3.0 | 0.020 | 0.020 | 0.050 |
| | g/s | 0.23 | 0.002 | 0.003 | 0.007 |

[1] $PM_{10}$ concentrations were not specified by Worley. Assumed to be the same as $PM_{2.5}$

**Typical Scenario** – Assumed typical inlet scrubber concentration of 20mg/Nm$^3$ TP ($NH_4NO_3$-solid) (wet), 15mg/Nm$^3$ (wet) ($NH_4NO_3$-solid) $PM_{10}$/$PM_{2.5}$ and 3.0mg/Nm$^3$ $NH_3$ (gas)

**Conservative Scenario** – Assumed conservative inlet scrubber concentration of 50mg/Nm$^3$ TP ($NH_4NO_3$-solid) (wet), 15mg/Nm$^3$ (wet) ($NH_4NO_3$-solid) $PM_{10}$/$PM_{2.5}$ and 3.0mg/Nm$^3$ $NH_3$ (gas)

**Reasonable Worst-Case Scenario** – Assumed Reasonable Worst-Case inlet scrubber concentration of 100mg/Nm$^3$ ($NH_4NO_3$-solid) TP (wet), 30mg/Nm$^3$ ($NH_4NO_3$-solid) (wet) $PM_{10}$/$PM_{2.5}$ and 10.0mg/Nm$^3$ $NH_3$ (gas)

# 6.0 Modelling Results

This section presents the predicted pollutant concentrations and provides an analysis of those concentrations for each modelled scenario and makes a comparison against relevant criteria.

Dispersion modelling results for the scrubber stack emissions are tabulated in **Table 13**, with dispersion contours shown in **Figure 16** to **Figure 43**. Results in **Table 13** include the following data:

- Predicted pollutant concentrations at the EES Monitoring Station at Stockton to enable a comparison with measured particulate and ammonia concentrations;
- Predicted maximum concentrations at ground level at or beyond the Orica boundary.
- Predicted maximum concentrations at ground level at sensitive receptor locations; and
- Predicted maximum concentrations within the Orica site.

The above predicted pollutant concentrations have been assessed against the criteria outlined in **Table 1** and **Table 2**.

**Table 13 Predicted Pollutant Concentrations – Onsite and Off-site Receptor Locations**

| Pollutant | Averaging Period | Description | Predicted Concentrations (µg/m³) | | | | Criteria (µg/m³) |
|---|---|---|---|---|---|---|---|
| | | | Scenario1 | Scenario 2A | Scenario 2B | Scenario 2C | |
| TSP | Annual | EPA Station – Stockton | 5.75 | 0.02 | 0.05 | 0.12 | 90 |
| | | At or Beyond the Boundary | 16.47 | 0.04 | 0.11 | 0.31 | |
| | 8 Hour Average | Onsite Workers | 377.2 | 4.4 | 10.4 | 32.6 | 10,000 |
| $PM_{10}$ | 24 Hour Average | EPA Station – Stockton | 9.30 | 0.13 | 0.33 | 0.83 | 50 |
| | | At or Beyond the Boundary | 20.33 | 0.32 | 0.86 | 2.57 | |
| | | Discrete Receptors | 15.95 | 0.21 | 0.53 | 1.43 | |
| | Annual | EPA Station – Stockton | 1.75 | 0.02 | 0.05 | 0.12 | 25 |
| | | At or Beyond the Boundary | 4.95 | 0.04 | 0.11 | 0.31 | |
| | | Discrete Receptors | 1.83 | 0.02 | 0.05 | 0.14 | |
| $PM_{2.5}$ | 24 Hour Average | EPA Station – Stockton | 9.30 | 0.13 | 0.33 | 0.83 | 25 |
| | | At or Beyond the Boundary | 20.33 | 0.32 | 0.86 | 2.57 | |
| | | Discrete Receptors | 15.95 | 0.21 | 0.53 | 1.43 | |
| | Annual | EPA Station – Stockton | 1.75 | 0.02 | 0.05 | 0.12 | 8 |
| | | At or Beyond the Boundary | 4.95 | 0.04 | 0.11 | 0.31 | |
| | | Discrete Receptors | 1.83 | 0.02 | 0.05 | 0.14 | |
| $NH_3$ | 99.9th Percentile Hour Average | EPA Station – Stockton | 2.44 | 0.010 | 0.012 | 0.024 | 330 |
| | | At or Beyond the Boundary | 11.5 | 0.019 | 0.018 | 0.04 | |
| | 8 Hour Average (TWA) | Onsite Workers | 11.2 | 0.02 | 0.07 | 0.07 | 17,000 |
| | 15-minute Average (STEL) | Onsite Workers | 69.3 | 0.31 | 0.34 | 0.44 | 24,000 |
| **Bold** text denotes exceedance of relevant criteria | | | | | | | |

Analysis of the dispersion modelling results show the following:

- Predicted ground level concentrations were found to decrease significantly due to the operation of the scrubber. This decrease was evident across all pollutants and across all averaging times.
- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Typical" Prill Tower scrubber operations (Scenario 2) were all greater than 98%.
- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Conservative" expected Prill Tower scrubber operations (Scenario 3) were all greater than 95%
- The percentage decrease in pollutant concentrations between the existing operations (Scenario 1) and the "Maximum" expected Prill Tower scrubber operations (Scenario 3) were all greater than 87%
- All predicted pollutant concentrations "at or beyond" the boundary for the scrubber operational scenarios (Scenarios 2 and 3) were well below NSW EPA criteria. Although the predictions are presented in isolation from the background, the future emissions due to the scrubber only represent a small percentage of the NSW EPA criteria (less than 11% for all pollutants) and would result in a significant decrease in cumulative concentrations from the Prill Tower. The decrease from the existing emission concentrations are expected to have a significant net positive effect on the environment.
- Worker exposure concentrations were well below relevant Worksafe standards.

On the basis of the findings above, the installation and operation of the Prill Tower Scrubber is expected to result in a significant decrease in the ground level concentrations both on-site and offsite and is expected to have a positive effect on the pollutant concentrations in the surrounding environment.

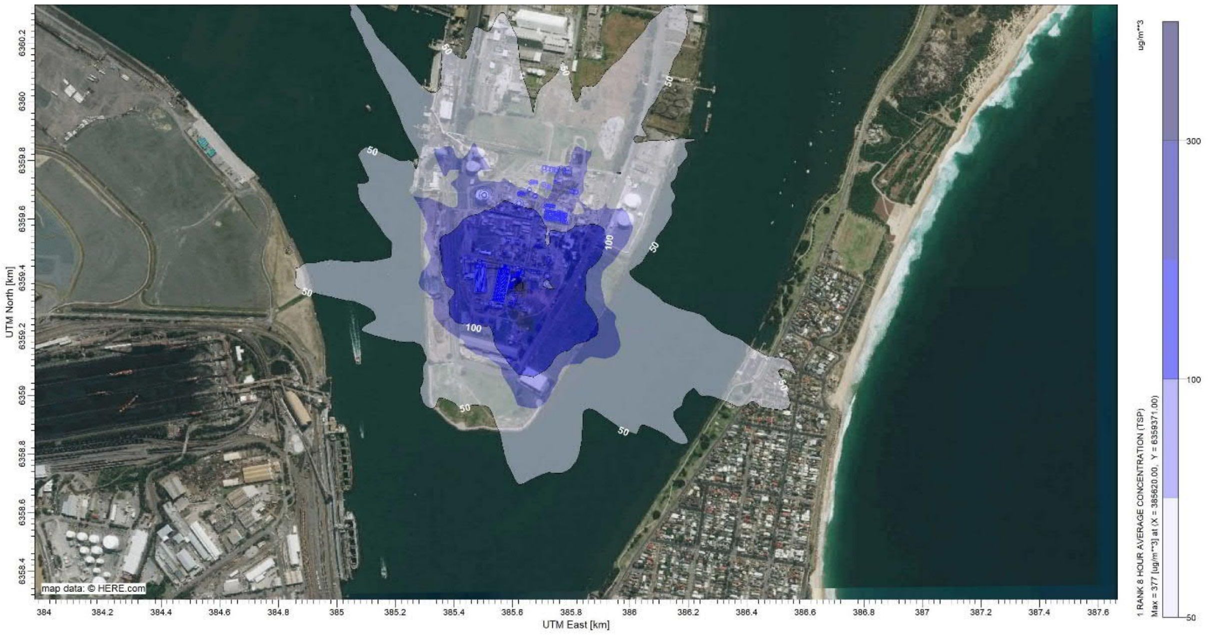


**Figure 16 Scenario 1: Incremental Contribution 8 Hour Maximum TSP Concentrations**


**Figure 17 Scenario 2A: Incremental Contribution 8 Hour Maximum TSP Concentrations**


**Figure 18 Scenario 2B: Incremental Contribution 8 Hour Maximum TSP Concentrations**

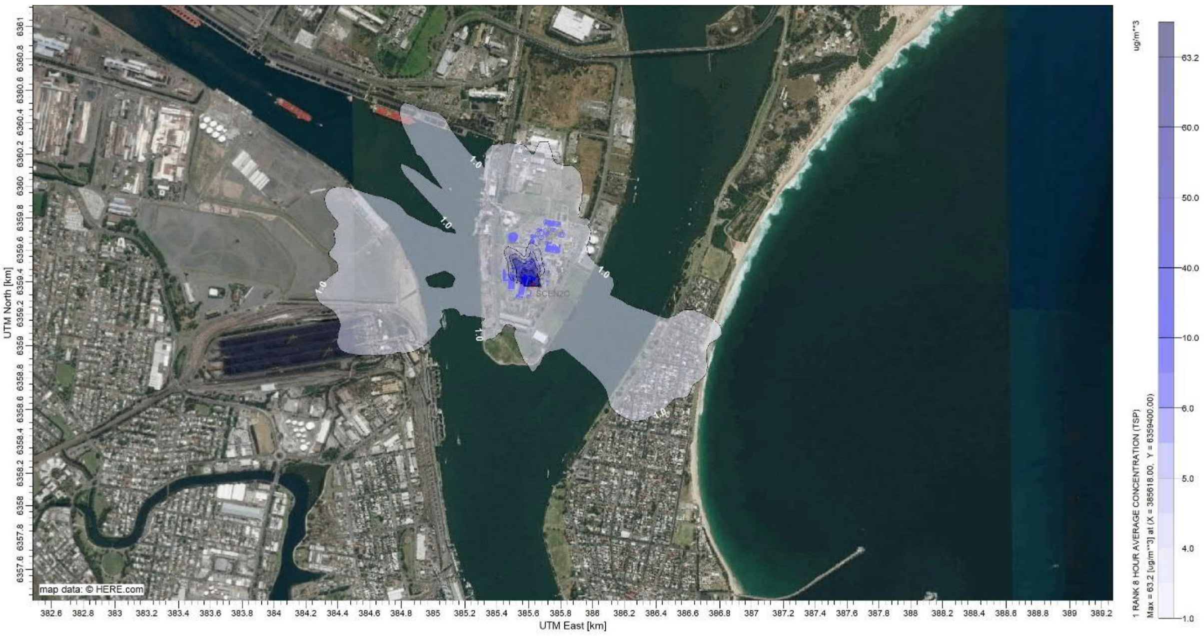


**Figure 19 Scenario 2C: Incremental Contribution 8 Hour Maximum TSP Concentrations**

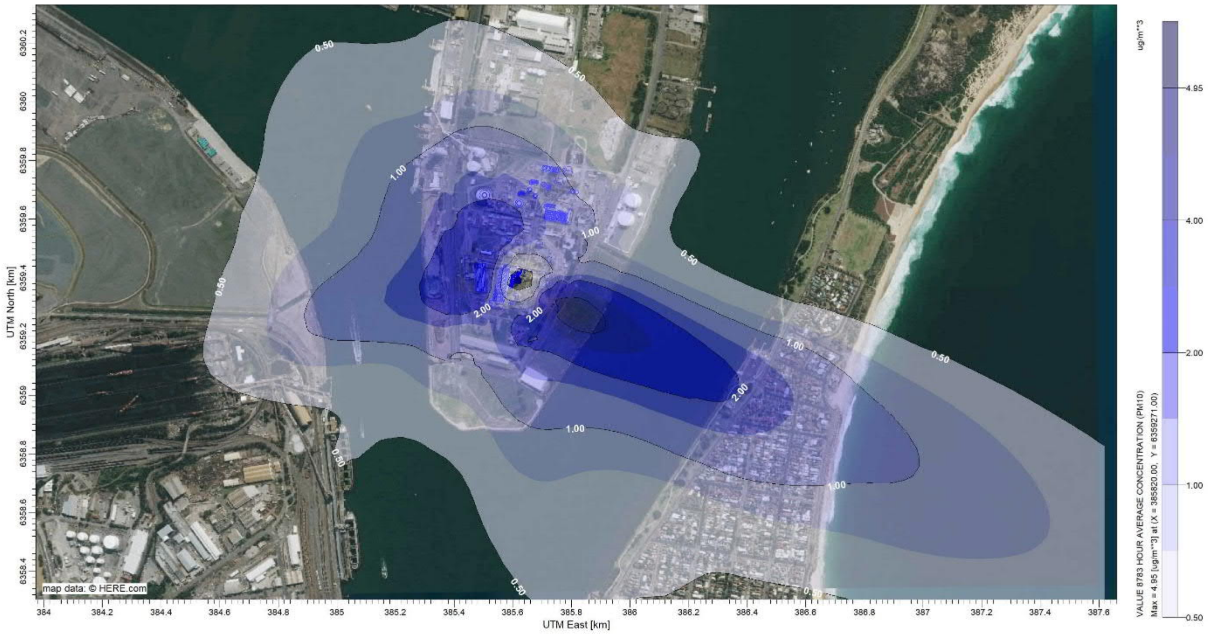


**Figure 20 Scenario 1: Incremental Contribution Annual Average TSP Concentrations**


**Figure 21 Scenario 2A: Incremental Contribution Annual Average TSP Concentrations**


**Figure 22 Scenario 2B: Incremental Contribution Annual Average TSP Concentrations**


**Figure 23 Scenario 2C: Incremental Contribution Annual Average TSP Concentrations**

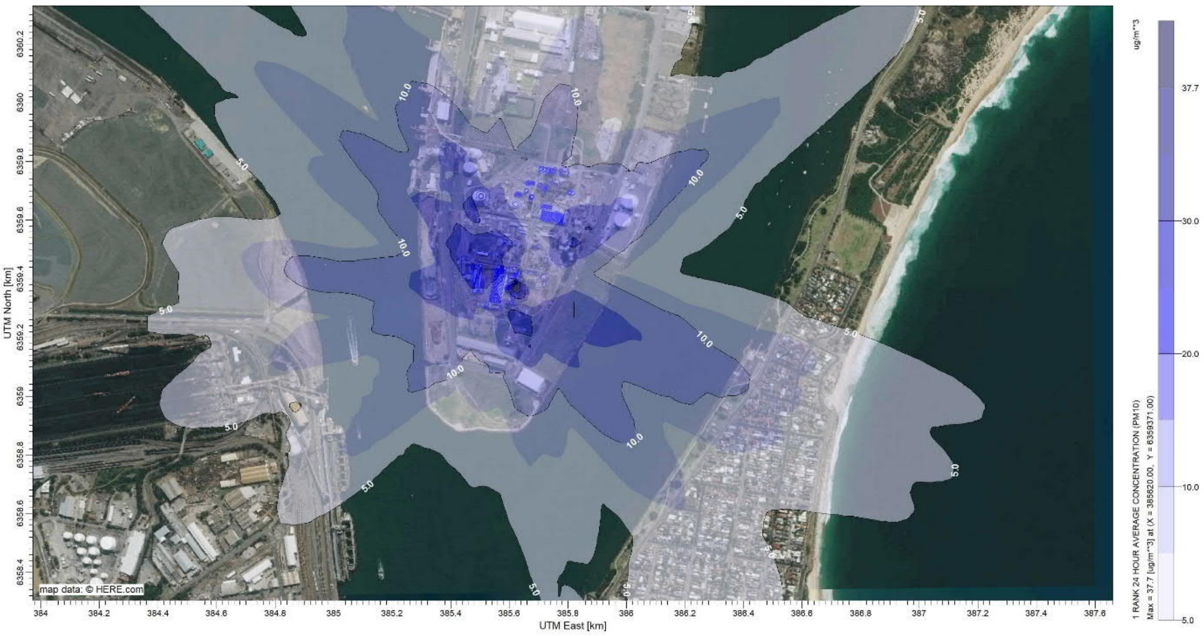

Figure 24 Scenario 1: Incremental Contribution 24 Hour Maximum $PM_{10}$ Concentrations

Figure 25 Scenario 2A: Incremental Contribution 24 Hour Maximum $PM_{10}$ Concentrations


**Figure 26 Scenario 2B: Incremental Contribution 24 Hour Maximum $PM_{10}$ Concentrations**


**Figure 27 Scenario 2C: Incremental Contribution 24 Hour Maximum $PM_{10}$ Concentrations**


**Figure 28 Scenario 1: Incremental Contribution Annual Average $PM_{10}$ Concentrations**


**Figure 29 Scenario 2A: Incremental Contribution Annual Average $PM_{10}$ Concentrations**


**Figure 30 Scenario 2B: Incremental Contribution Annual Average $PM_{10}$ Concentrations**


**Figure 31 Scenario 2C: Incremental Contribution Annual Average $PM_{10}$ Concentrations**

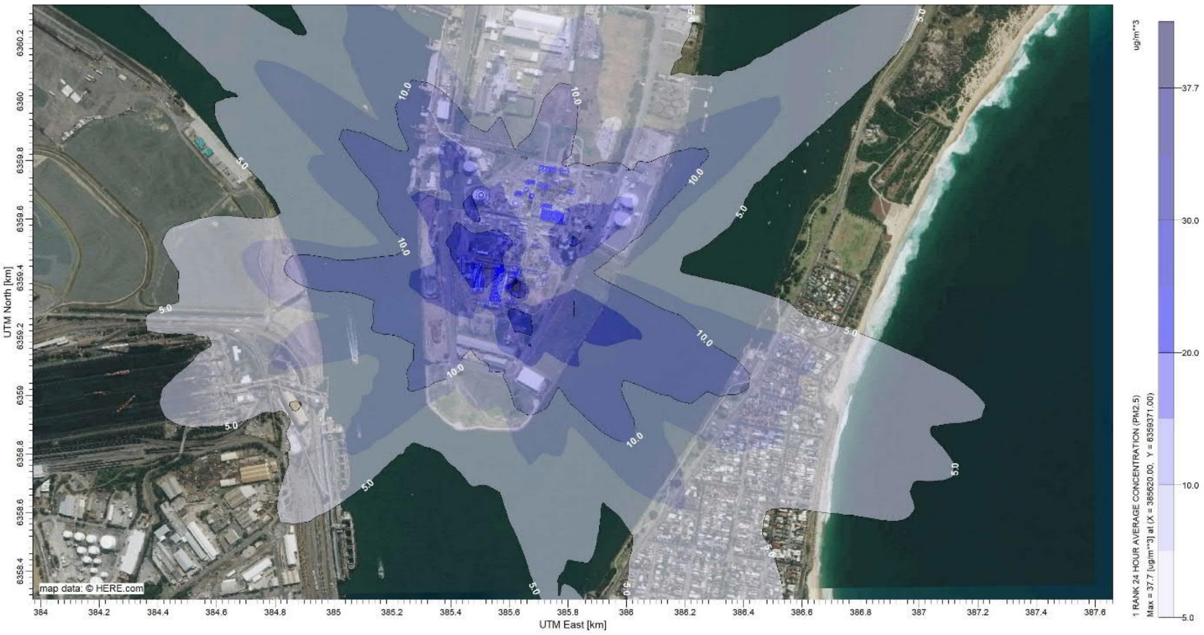

**Figure 32 Scenario 1: Incremental Contribution 24-hour Maximum $PM_{2.5}$ Concentrations**

**Figure 33 Scenario 2A: Incremental Contribution 24-hour Maximum $PM_{2.5}$ Concentrations**

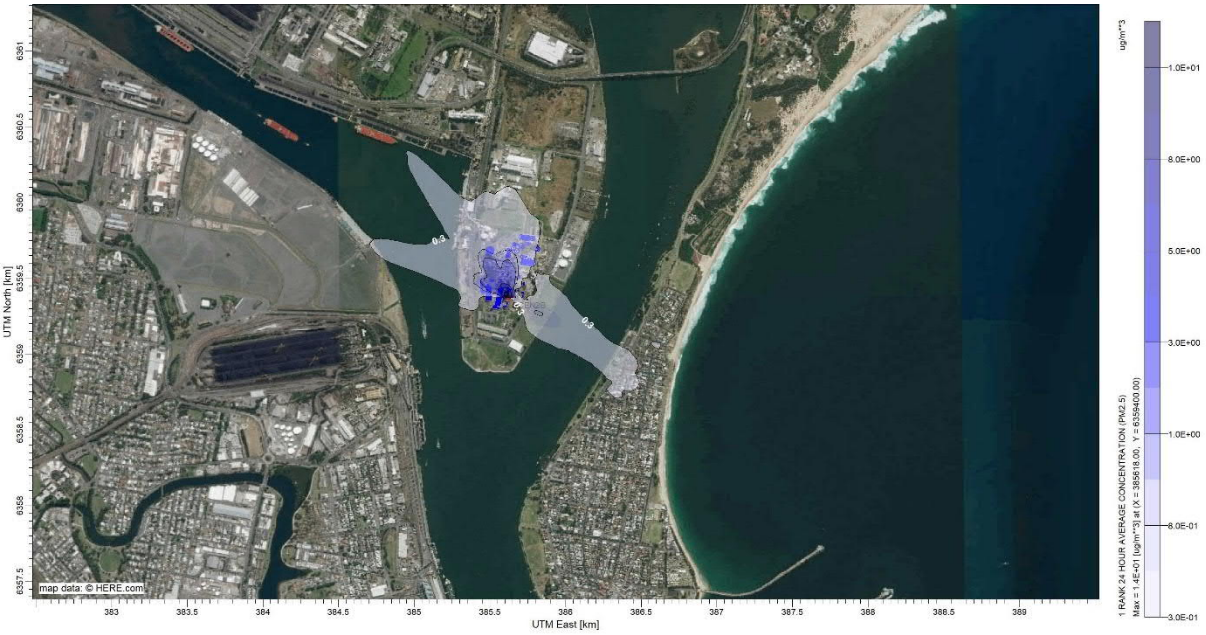


**Figure 34 Scenario 2B: Incremental Contribution 24-hour Maximum $PM_{2.5}$ Concentrations**


**Figure 35 Scenario 2C: Incremental Contribution 24-hour Maximum $PM_{2.5}$ Concentrations**

**Figure 36 Scenario 1: Incremental Contribution Annual Average $PM_{2.5}$ Concentrations**

**Figure 37 Scenario 2A: Incremental Contribution Annual Average $PM_{2.5}$ Concentrations**


**Figure 38 Scenario 2B: Incremental Contribution Annual Average $PM_{2.5}$ Concentrations**

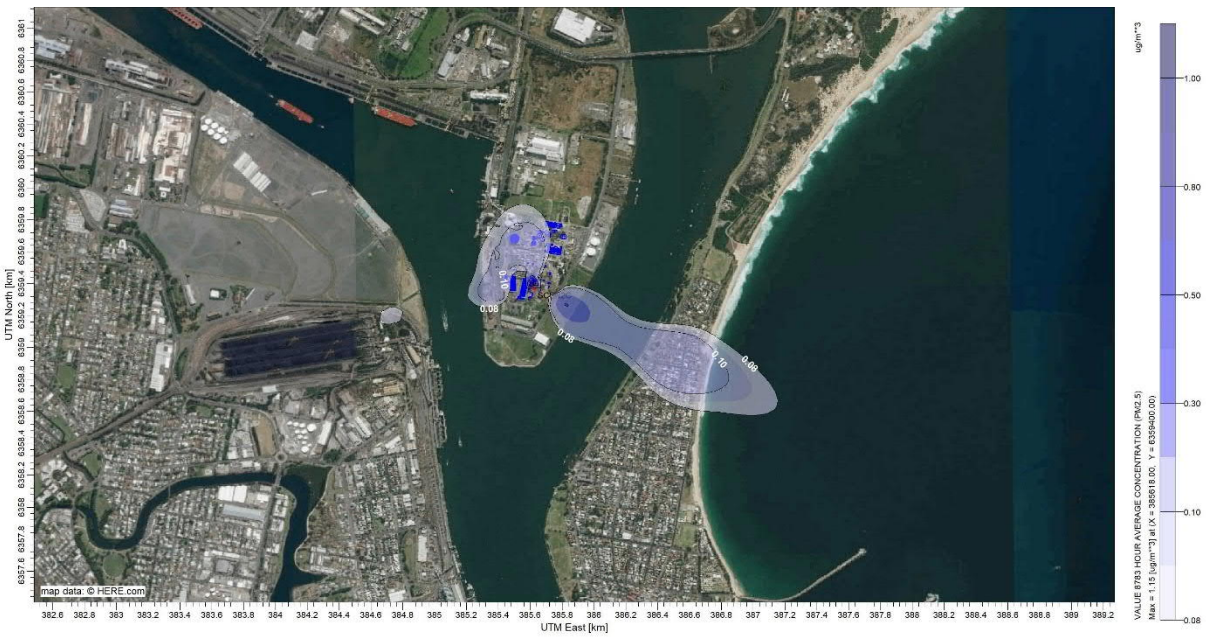


**Figure 39 Scenario 2C: Incremental Contribution Annual Average $PM_{2.5}$ Concentrations**

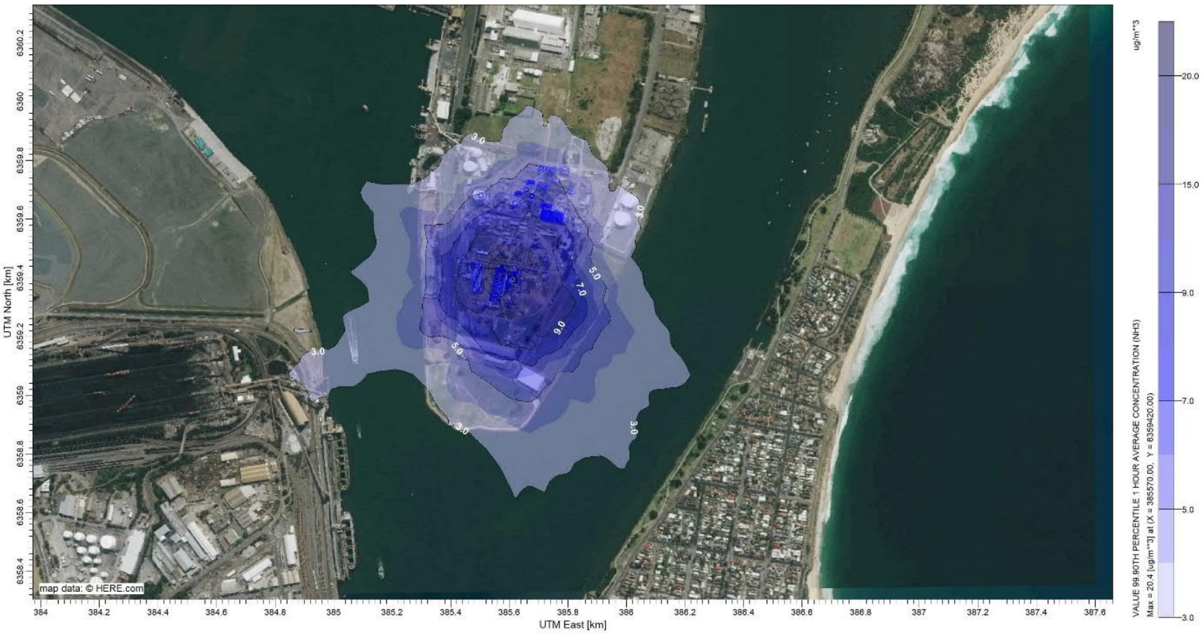


**Figure 40 Scenario 1: Incremental Contribution 99.9th Percentile $NH_3$ Concentrations**


**Figure 41 Scenario 2A: Incremental Contribution 99.9th Percentile $NH_3$ Concentrations**


**Figure 42 Scenario 2B: Incremental Contribution 99.9th Percentile $NH_3$ Concentrations**

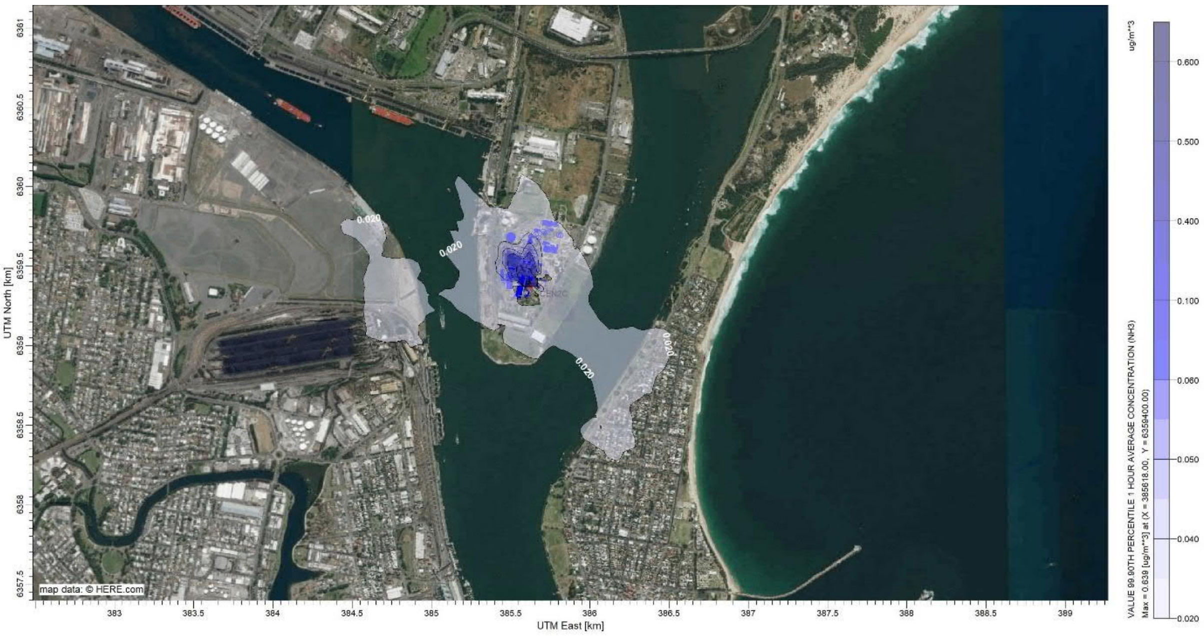


**Figure 43 Scenario 2C: Incremental Contribution 99.9th Percentile $NH_3$ Concentrations**

# 7.0 Conclusion

A Level 2 AQIA was conducted in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2017) (Approved Methods). The CALPUFF air dispersion model along with local meteorology was used for the assessment. Four dispersion modelling scenarios were examined to examine the expected change in air pollutant concentrations following the addition of a scrubber to the Prill Tower.

Based on available process data, it is anticipated that input concentrations to the scrubber will be typically below 20mg/m$^3$ (Scenario 2A) 99% of the time, and typically below 50mg/m$^3$ (Scenario 2B) 99.9% of the time.

Dispersion modelling results showed that there was a significant drop in ground level pollutant concentrations at all locations for all pollutants modelled. Reductions of over 98% were observed for the typical operational scenario (Scenario 2A), over 95% for the conservative operational scenario (Scenario 2B) and over 87% for the reasonable worst-case operational scenario (Scenario 2C) post construction of the scrubber.

The expected decrease in ground level concentrations following the addition of the scrubber are expected to make a significant improvement to the air quality in the environment surrounding Orica.

# APPENDIX B – NOISE IMPACT ASSESSMENT

ATKINS ACOUSTICS

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**Atkins Acoustics and Associates Pty Ltd.**
Consulting Acoustical & Vibration Engineers

# ORICA AUSTRALIA PTY LTD.
# KOORAGANG ISLAND
# NOISE ASSESSMENT
# PRILL TOWER SCRUBBER

51.7233.R1:GA/DT/2021

**Prepared for:** Orica Australia Pty Ltd
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July 2021

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# ATTACHMENTS

# Executive Summary

Orica Australia Pty Ltd *(Orica)* is seeking development consent to install a scrubber existing Prill Tower *(the Project)*. *The Project* will be retrofitted to the existing Prill Tower.

As part of the Orica Australia Pty Ltd *(Orica)* Environmental Protection Licence (Number 828), Pollution Reduction Program (PRP) 50 involves the decommissioning of twelve (12) ventilation fans servicing the existing Tower and the installation of a new scrubber system.

The NSW Minister for Planning granted *Orica* approval for the expansion of the ammonium nitrate plant on Kooragang Island, 1 December 2009 (08_0129) *(the Approval)*.

The Department of Planning *(Department)* determined that noise generated through the inclusion of additional operating plants and infrastructure, should not increase the noise impacts from the existing operations. To ensure no discernible increase in noise levels at the Stockton residential receivers from *Orica*, the *Department* concluded thatany additional noise emitted must achieve a contribution at least 10dBA below pre-development levels.

The EPA, Noise Policy for Industry *(NPfI)* (Section 6.1) refers to guidelines and procedures for assessing noise from existing industrial premises. Where a development proposal involves a discrete process, and the premises–wide mitigation has or is to be considered outside the development proposal, a project noise trigger level for noise from the new/modified component (not the whole site) of the operation may be set at 10dBA or more below existing site noise levels or requirements.

Reviewing field noise data referenced for the 2009 project an effective sound power level established for the Prill Tower fans was Lw113dBA. Modelling has demonstrated with the removal of the existing Prill Tower fans site noise emissions reduce by 0.6-0.8dBA. Referring to the *NPfI* Section 4.1, the significance of increases or decreases in cumulative industrial noise levels ≤2 dBA is considered negligible.

Computer modelling for *the Project* considered normal operational noise conditions. A summary of the significant noise sources identified *the Project* and adopted for modelling is presented in *Table 4.* The source noise data was developed from suppliers and contractors technical reference information. Where this was not available for the fan motor octave band sound power data was obtained from EEI*

Indicative noise modelling results for *the Project* in isolation from the existing site operation are presented in *Table 5.* The predicted levels for neutral meteorological conditions demonstrate the noise contributions from *the Project* are more than 10dBA lower than the target design noise goals. Indicative noise contours produced from the

ENM modelling are presented in *Attachment 1.*

A low frequency noise assessment was undertaken in accordance with EPA guidelines. The findings demonstrated the difference between the ‘C-weighted’ and ‘A-weighted’ levels is within 15dB and an assessment of the one-third octave levels is not required to assess low frequency noise.

Operational noise modelling for *the Project* shown in *Table 5* and as indicative noise contours in *Attachment 1,* demonstrate compliance with the *Departments* noise requirements.

# 1.0 Introduction

Orica Australia Pty Ltd *(Orica)* is seeking development consent to install a scrubber for the existing Prill Tower *(the Project)*. *The Project* will be retrofitted to the existing Prill Tower infrastructure..

*Atkins Acoustics* was retained by *Orica* to conduct an environmental noise assessment for *the Project.* This report presents results and findings of the assessment of operational noise from *the Project*.

As part of the Orica Australia Pty Ltd *(Orica)* Environmental Protection Licence (Number 828), Pollution Reduction Program (PRP) 50 involves the decommissioning of twelve (12) ventilation fans servicing the existing Prill Tower and the installation of a new scrubbing system. The primary objectives of PRP 50 *(the* P*roject)* are to:

- reduce total particulate and in particular PM2.5 emissions from the Prill Tower, and
- manage operational noise from *the Project* in accordance with Department of Planning *(Department)* Approval Conditions and set out in the Orica Kooragang Noise Management Plan.

Previous site works commissioned by *Orica* are described in Environmental Noise Audit Report dated November 2012, include a new Ammonia Plant Process air compressor, cooling tower cells and pumps to service the Ammonia Plant; steam power generator 183L; and de-commissioning two (2) process air compressors (102J and 122J). In addition to works associated with Ammonia Plant, *Orica* implemented a site noise reduction program *(SNRP).* Details of those works are summarised in the *Atkins Acoustics* Environmental Noise Audit report dated March 2013. Recent site works implemented during 2020 included the decommissioning of the off-site boiler, commissioning of a new site boiler and relocation of the $CO_2$ vent with an inline discharge attenuator.

# 2.0 Background

The NSW Minister for Planning granted *Orica* approval for the expansion of the ammonium nitrate plant on Kooragang Island, 1 December 2009 (08_0129) *(the Approval)*.

The Department of Planning *(Department)* determined that noise generated through the inclusion of additional operating plants and infrastructure, should not increase the noise impacts from the existing operations. To ensure no discernible increase in noise levels at the Stockton residential receivers from *Orica*, the *Department* concluded thatany additional noise emitted from the site must achieve a contribution at least 10dBA below pre-development levels. To support this requirement a noise verification program determined baseline noise levels and reference noise monitoring locations. Noise data obtained during the noise verification process provided the basis fordeveloping a Noise Management Plan, as required under Orica's Development Consent.

## 2.1 EPA. Noise Policy for Industry

The EPA, Noise Policy for Industry *(NPfI)* (Section 6.1) refers to guidelines and procedures for assessing noise from existing industrial premises. Where a development proposal involves a discrete process, and the premises–wide mitigation has or is to be considered outside the development proposal, a project noise trigger level for noise from the new/modified component (not the whole site) of the operation may be set at 10dBA or more below existing site noise levels or requirements.

## 2.2 Overview

Previous works described in *Orica* Environmental Noise Audit Report dated November 2012, included a new Ammonia Plant Process air compressor, cooling tower cells and pumps to service the Ammonia Plant; a steam power generator 183L; and de-commissioning two (2) process air compressors (102J and 122J). In addition, *Orica* implemented a site noise reduction program *(SNRP).* Details of those works are summarised in the *Atkins Acoustics* Environmental Noise Audit report (March 2013). Recent site improvement works implemented during 2020 included the decommissioning of the off-site boiler, commissioning of a new site boiler and relocation of the $CO_2$ vent with an inline discharge attenuator.

# 3.0 Noise Assessment Goals

## 3.1 EPA Environmental Protection Licence

*Orica's*, Environmental Protection Licence (EPL) 828 does not contain noise limits for the site nor requirements to monitor noise emissions from the site. EPL 828 included a number of PRP's with the aim of reducing noise emissions from the site. Works associated with those PRP's have been implemented and completed to the EPA's requirements.

## 3.2 Orica's Noise Development Condition

The *Departments* noise conditions for the site are documented in Schedule 3 'Specific Environmental Conditions' of Project Approval (08_0129) dated 1 December 2009. *Orica's* Development Condition 30 *(Table 1).*

### Table 1. Development Consent Noise Conditions of Approval

| |
|---|
| **Condition 30**: |
| The Proponent shall ensure that noise levels from the operation of the Project are at least 10dB(A) below noise levels from Orica's Existing Operations as specified by conditions 31 & 32 below. |

## 3.3 Reference Noise Assessment Locations

Six (6) reference assessment locations referenced in the Orica Noise Management Plan *(NMP)* were adopted for the purpose of assessing noise from the site. Three (3) locations, representing the Stockton residential area and three (3) near field locations on Kooragang Island *(Figure 1)*. Resulting from the influence of transient ambient noise associated with local domestic activities and noise from neighbouring industrial sources on Kooragang Island, the three (3) Kooragang Island locations were selected to assist with monitoring near field noise emissions and trends influenced by *Orica.*

## Figure 1- Referenced Noise Monitoring Locations


NOTES:

- R1 - 284 Fullerton Street, Stockton.
- R2 - 218 Fullerton Street, Stockton.
- R3 - 184 Fullerton Street, Stockton.
- R4 - Roadside (south) opposite Ammonium Nitrate Area
- R5 - Riverside (central) opposite Administration Building.
- R6 - Roadside (north) opposite Ammonia Plant.

## 3.4 Discussion

Night-time attended audits reported for the reference monitoring locations on Kooragang Island (2011) demonstrated that operational noise from *Orica* is steady state with minimal influence from other industrial sources. At the three (3) near field locations it was reported there was minimal variation between the measured $L_{A90}$ and $L_{Aeq}$ levels.

For assessing noise contributions from new plant and operations, the *Departments* Condition 30 and the *NPfI* refer to noise target levels at least 10dBA below levels from *Orica's* existing plant. *Table 2* presents a summary of the baseline background levels and target noise assessment levels assessed for neutral weather conditions.

## Table 2: Project Target Noise Criteria

*dBA re: 20 x $10^{-6}$ Pa*

| Reference Assessment Location | Baseline Background Sound Pressure Levels dBA | Target Noise Assessment Levels dBA |
|---|---|---|
| R1 | 50 | 40 |
| R2 | 53 | 43 |
| R3 | 51 | 41 |
| R4 | 62 | 52 |
| R5 | 57 | 47 |
| R6 | 56 | 46 |

## 3.5 Assessment of Noise Trends

For assessing *Orica's* noise emission trends, the NMP recommended future noise monitoring on Kooragang Island (R4, R5 and R6) be considered. Baseline RBL's established for the Kooragang Island monitoring locations are referenced in Atkins Acoustic (September 2012).

Initially noise audit monitoring locations were selected to provide for reliable site access to install instrumentation and security. The locations identified as R4 and R6 due to access arrangements and instrumentation security were relocated from the riverside to roadside positions. Similarly, due to access restrictions monitoring location R1 (294 Fullerton Street) was changed to 284 Fullerton Street and R3 (186 Fullerton Road) to 184 Fullerton Road. The night-time range of measured and median sound pressure levels summarised in *Table 3* show that levels for R6 resultingfrom the repositioning of the monitoring location are 6-7dBA higher than referenced in *Table 2*.

## Table 3. Baseline RBL Noise Trends

*re: dBA 20 x $10^{-6}$ Pa*

| Reference Assessment Location | Ambient Rating Background Level RBL's | |
|---|---|---|
| | Range | Median |
| R4 - Roadside (South) | 55.6 to 63.0 | 59.4 |
| R5 - Riverside (Central) | 49.3 to 60.7 | 55.8 |
| R6 - Roadside (North) | 60.1 to 65.4 | 62.7 |

## 3.6 Prill Tower Noise Reduction

*The Project* involves decommissioning twelve (12) ventilation fans installed at the top of the Prill Tower and commissioning of a new scrubber and associated fans, pumps and stack. Reviewing field noise data referenced for the 2009 project an effective sound power level for the Prill Tower fans was Lw113dBA. Modelling has demonstrated with the removal of the existing Prill Tower fans site noise emissions reduce by 0.6-0.8dBA. Referring to the *NPfI* Section 4.1, the significance of increases or decreases in cumulative industrial noise levels ≤2 dBA is considered negligible.

## 3.7 Low Frequency Noise

The *NPfI* provides guidance for applying modifying factor corrections to account for low frequency noise emissions. The *NPfI* specifies that a difference of 15dB or more between 'C-weighted' and 'A-weighted' noise emissions identify potential for an unbalanced spectrum and potential increased annoyance. Where a difference of 15dB or more between the 'C-weighted' and 'A-weighted' emission levels from a site is identified, an assessment of the one-third octave levels is recommended to assess if a modifying factor correction is to be applied.

# 4.0 Noise Modelling Source Data

Computer modelling for *the Project* considered normal operational noise conditions. A summary of the significant noise sources identified *the Project* and adopted for modelling is presented in *Table 4.* The source noise data was developed from suppliers and contractors technical reference information. Where this was not available for the fan motor octave band sound power data was obtained from EEI*

## Table 4. Plant Sound Power Levels

Reference $10^{-12}$ Watts

| Plant Description | Sound Power Levels LAeq ref $10^{-12}$ Watts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 125 | 250 | 500 | 1K | 2K | 4K | 8K | dBA | dBC |
| Transition Duct | 113 | 102 | 91 | 83 | 75 | 68 | 59 | 47 | 91 | 113 |
| Stack Top (S1) | 87 | 72 | 50 | 46 | 35 | 33 | 38 | 34 | 62 | 86 |
| Stack Bottom (S2) | 97 | 82 | 60 | 38 | 27 | 43 | 48 | 44 | 72 | 96 |
| Stack Discharge | 117 | 102 | 80 | 64 | 59 | 63 | 74 | 76 | 92 | 116 |
| Fan | 104 | 99 | 85 | 77 | 74 | 64 | 53 | 63 | 85 | 105 |
| Fan Motor EEI(1978)* | 85 | 87 | 88 | 88 | 93 | 87 | 78 | 71 | 95 | 97 |
| Fan intake Manifold | 110 | 99 | 88 | 80 | 71 | 65 | 56 | 44 | 88 | 110 |

* Reference Edison Electric Institute (1978) Motor speed 720rpm and lower

# 5.0 Operational Noise Modelling and Assessment

Noise modelling for *the Project* was developed with the *Environmental Noise Model (ENM)* computer model. The model considers attenuation factors including distance, shielding from structures, ground absorption, atmospheric absorption, topographical features of the area and the site.

The model was calibrated with site attended audit noise measurement data. Near field audit measurements were consistent with predicted levels and therefore considered the model provided a realistic representation of the site noise emissions.

Preliminary modelling identified the stack discharge as the main source controlling the noise emissions and contributions for the referenced assessment locations. Further engineering investigations recommended that an inline attenuator be investigated for the discharge side of the fan. The recommended design insertion loss performance of the attenuator was 10dBA.

Indicative noise modelling results for *the Project* in isolation from the existing site operation are presented in *Table 5.* The predicted levels for neutral meteorological conditions demonstrate the noise contributions from *the Project* are more than 10dBA lower than the target design noise goals. Indicative noise contours produced from the ENM modelling are presented in *Attachment 1*

**Table 5. Predicted Baseline and Project Noise Contributions**
*re: dBA 20 x $10^{-6}$ Pa*

| Operating Plant Conditions | Predicted Sound Pressure Level dBA Ref: *20 x $10^{-6}$ Pa* | | | | | |
|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R5 | R6 |
| Project Noise Design Goals | 40 | 43 | 41 | 52 | 47 | 60 |
| Predicted Prill Tower Project Contributions | 25 | 27 | 26 | 47 | 31 | 30 |

## 5.1 Low Frequency Noise

A low frequency noise assessment was undertaken in accordance with EPA guidelines. The findings demonstrated the difference between the 'C-weighted' and 'A-weighted' levels are within 15dB and an assessment of the one-third octave levels is not required to assess low frequency noise.

## 5.2 Assessment

Operational noise modelling for *The Project* shown in *Table 5* and as indicative noise contours in *Attachment 1* demonstrate compliance with the *Departments* criteria.

## 5.3 Noise Mitigation Strategies

In addition to plant selection, noise mitigation measures recommended for *the Project* include.

- an in-duct splitter attenuator installed on the fan discharge and before the scrubber stack;
- external lagging of the scrubber ID fan casing; and
- the fan motor installed on concrete pedestal

These recommendations have been incorporated into the project design. Verification of the predicted noise performance of the project will occur post commissioning as part of the annual noise assessment process conducted for the site and disclosed as part of the Annual Environmental Management Report to the Department of Planning.

# ATTACHMENT 1: INDICATIVE NOISE CONTOUR PLOTS

# APPENDIX C – STAKEHOLDER ENGAGEMENT PLAN

# ORICA KOORAGANG ISLAND

## STAKEHOLDER ENGAGEMENT PLAN

## PRP50 – PRILL TOWER SCRUBBER

**Document Control Table**

| Date | Rev No. | Details | Prepared by | Authorised by |
|---|---|---|---|---|
| 1/2/21 | 0 | Plan for submission to EPA | Nicole Masson (Media and Stakeholders Relations) | Nathan Robinson (Senior Specialist Environment) |
| | | | | |
| | | | | |
| | | | | |

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# BACKGROUND

Orica Australia Pty Ltd (Orica) has agreed to a Pollution Reduction Program under EPL 828 with the NSW Environment Protection Authority (EPA) in relation to the installation of a scrubber on the existing Prill Tower on the KI site.

The objective of the project is to reduce particulate emission of ammonium nitrate, and in particular PM2.5 (ie. particles less than 2.5 microns). Condition U3.2 a) of PRP requires that Orica submit a stakeholder engagement plan.

# OBJECTIVES

The objectives of this Stakeholder Engagement Plan are to ensure stakeholders are:

- informed of the project,
- regularly updated on the progress of works,

# KEY MILESTONES

The key milestones for the project under PRP50 are as follows:

*a) By 1 February 2021, the licensee must complete all geotechnical and structural engineering investigations associated with the current Prill Tower (including but not limited to intrusive structural investigations of the Prill Tower foundations) and prepare a stakeholder engagement and a regulatory approvals plan for the project;*
*b) By 1 October 2021, the licensee must complete all necessary final engineering designs for the project to allow for the procurement tendering process to commence for long lead time items;*
*c) By 1 April 2022, the licensee must finalise orders for all long lead-time items for the project;*
*d) By 1 April 2023, the licensee must complete all necessary pre-works for the project (including earthworks, civil, electrical, structural and mechanical works) and receive the scrubber at the premises;*
*e) By 1 November 2023, the licensee must achieve practical completion of the project;*
*f) By 31 January 2024, the licensee must achieve final completion of the project.*

# KEY STAKEHOLDERS

The key stakeholders will be reviewed from time to time. Currently the key stakeholders, as listed below, include:

***Community***

- Orica KI's Community Reference Group (CRG)
- Neighbouring communities of Stockton, Fern Bay, Carrington, Tighes Hill and Mayfield East (as per Appendix A: Community Newsletter distribution area)
- Newcastle Community Consultative Committee on the Environment (NCCCE)

***Industrial neighbours***

- Incitec Pivot Limited
- Port Authority of NSW
- Port of Newcastle
- Kooragang Bulk Facilities Pty Ltd (K3 Berth Lessee)
- Cement Australia Pty Ltd (K2 Berth Lessee)
- Vue Cement Pty Ltd
- Australian Rail Track Corporation
- Cargill Australia Ltd
- QUBE

***Utilities***

- Hunter Water
- Ausgrid
- Telstra
- Jemena

***Other***

- NSW Environment Protection Authority (EPA)
- Newcastle City Council

# IMPLEMENTATION PLAN

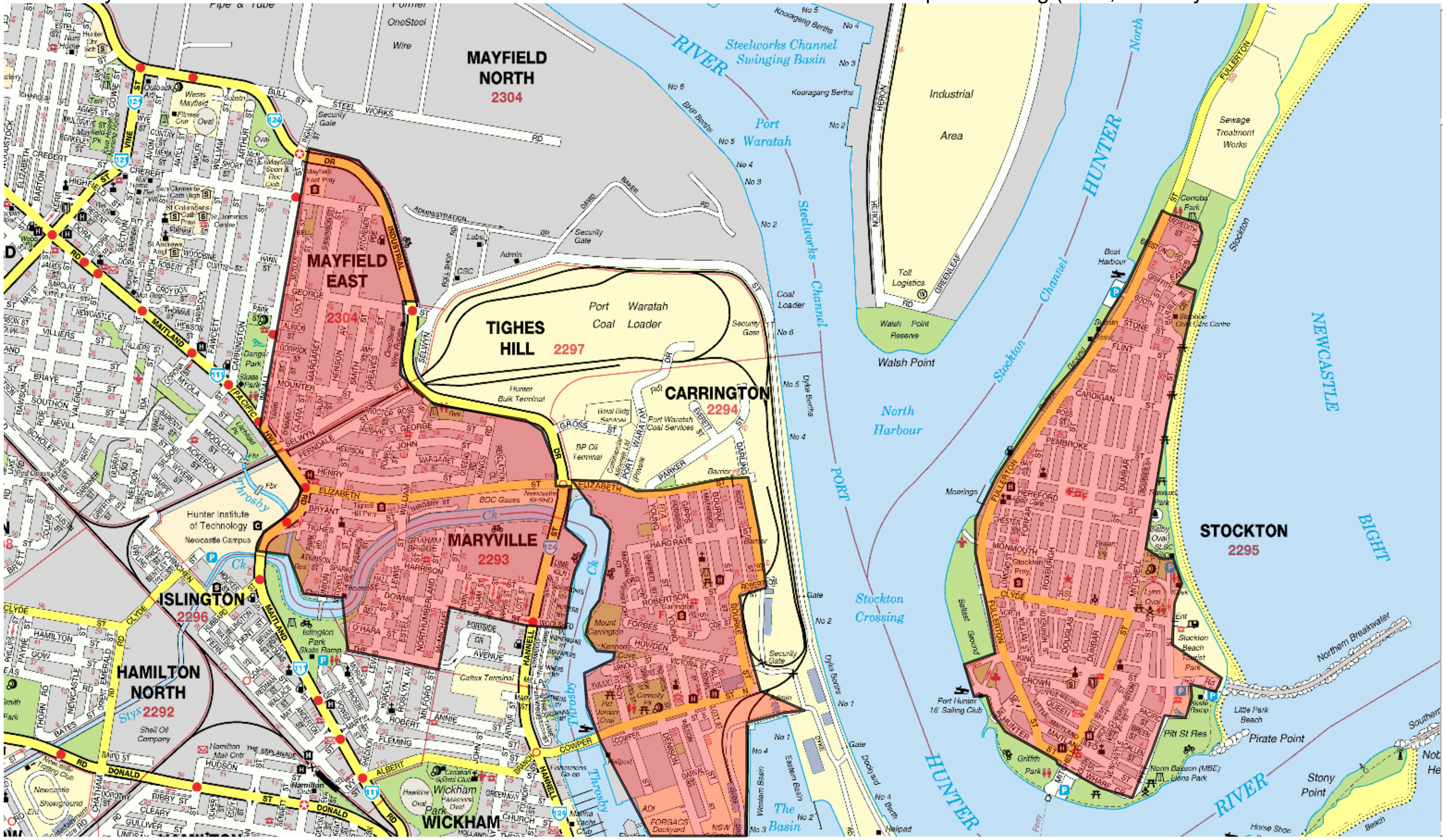
| Activity/Tool | Start Date | Stakeholder(s) | Frequency | Comments |
|---|---|---|---|---|
| Community Reference Group (CRG) Meetings | October 2020 | CRG<br>Neighbouring communities<br>Newcastle City Council | Quarterly | Progress on project to be an agenda item at completion of key milestones |
| Website | March 2015 | All | As required at the completion of key milestones | Include a page on the project and update at the completion of key milestones |
| Community Newsletter | March 2021 | Neighbouring communities, as per the distribution areas detailed in Appendix A. | As required at the completion of key milestones or at least annually | Include information upon the completion of key milestones |
| Industrial Neighbour Briefings | July 2021 | Industrial neighbours | Annually | Meeting held at site or on Teams annually |
| Letter | March 2021 | Industrial neighbours<br>Utilities | Annually | To be sent with neighbour letter/presentation on an annual basis |
| Newcastle Community Consultative Committee on the Environment (NCCCE) Meetings | April 2021 | NCCCE<br>EPA<br>Newcastle City Council | As required at the completion of key milestones | Updates on the progress of works to be provided at key milestones |
| Progress Updates | Feb 2021 | EPA | As required at key milestones | Regular verbal communication with EPA on progress of project activities. |

# STAKEHOLDER ENGAGEMENT PLAN REVIEW

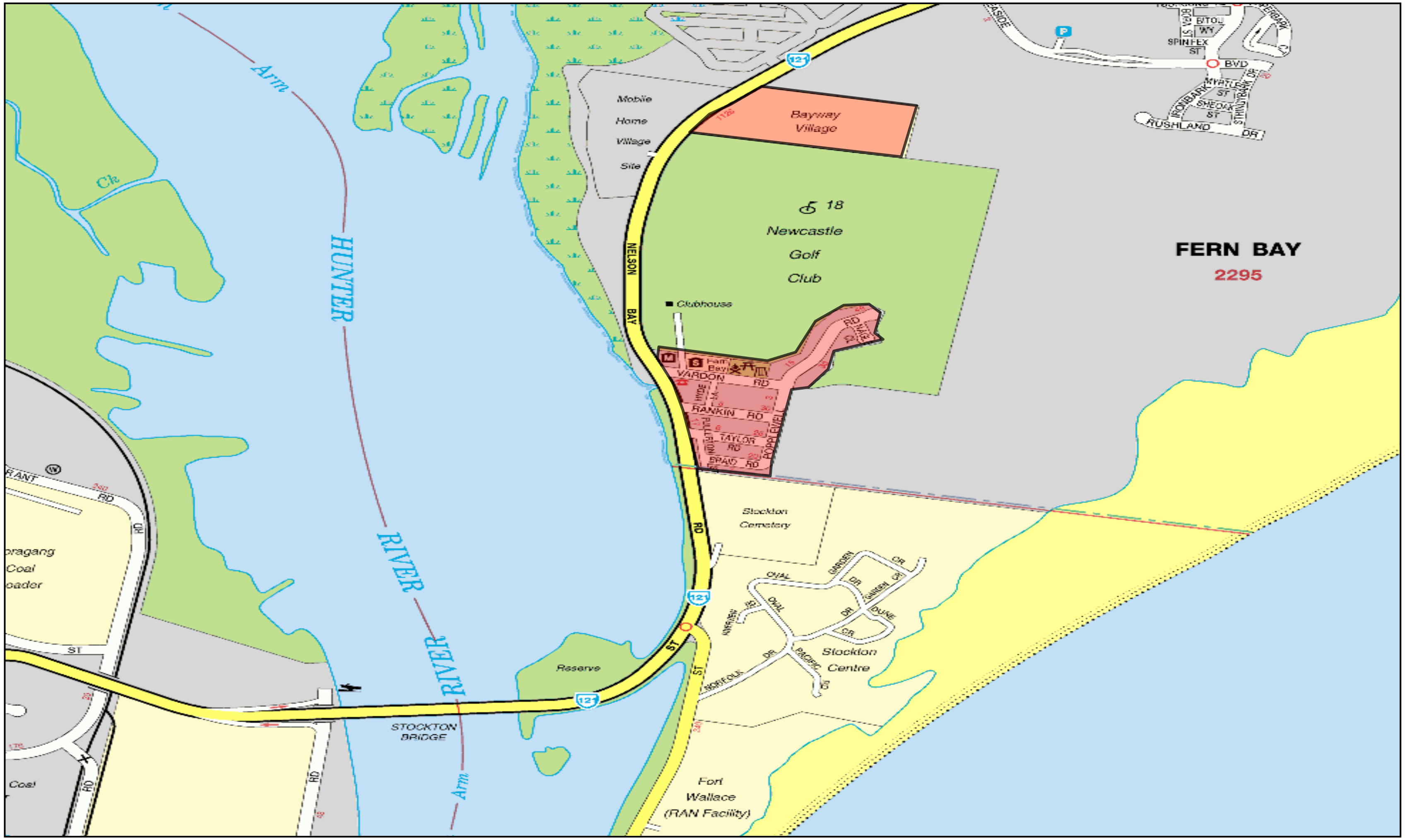
The stakeholder engagement plan will be reviewed on an annual basis or as required to identify whether any updates to the plan, such as key stakeholders and the communication activities, are required.  The stakeholder engagement plan will be available for the duration of the project at request.

## Appendix A – Orica Community Newsletter Distribution Area

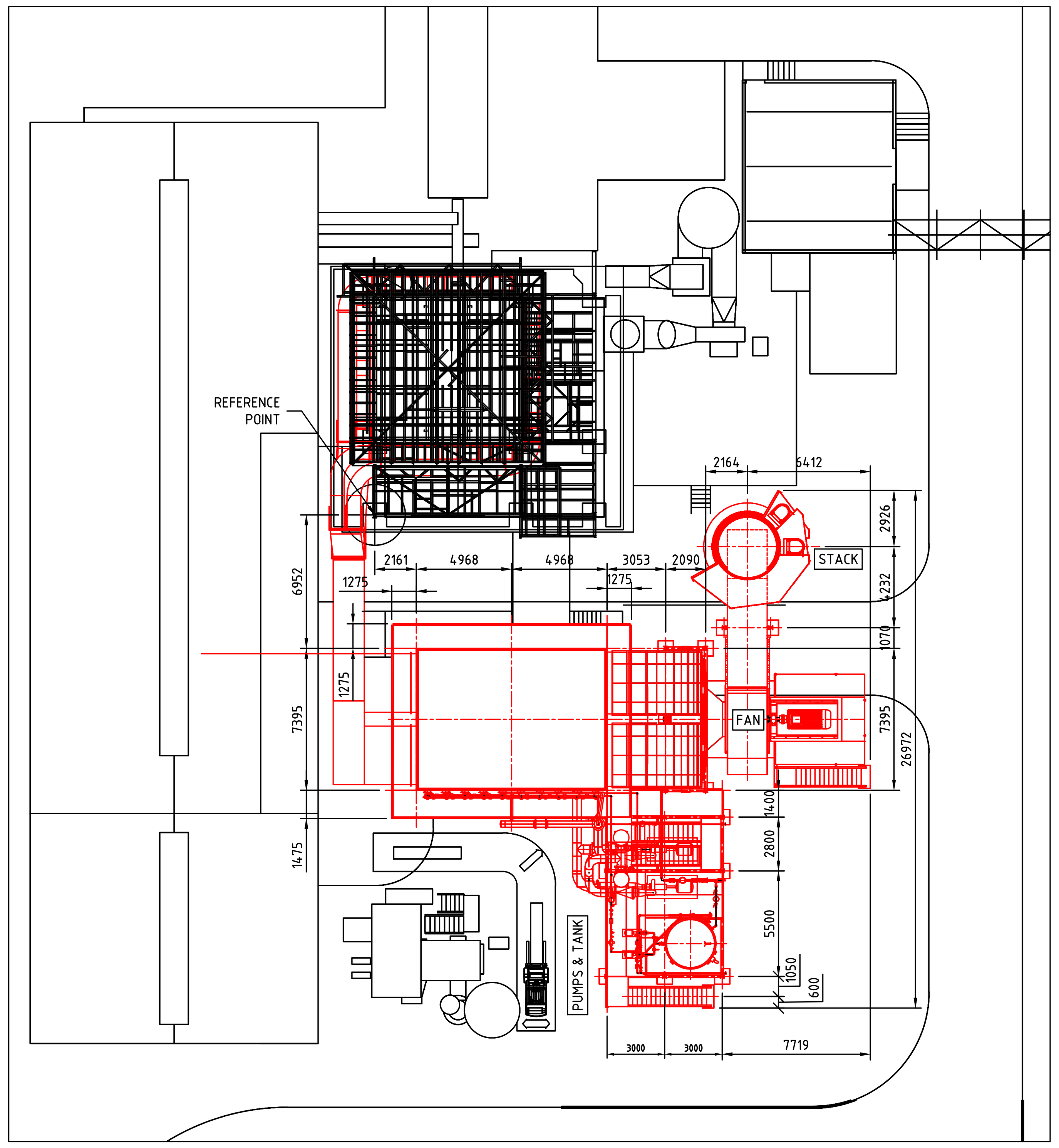
Community newsletter distribution areas to the east and west of the Orica KI site as marked in pink shading (Note, this may be varied from time to time).



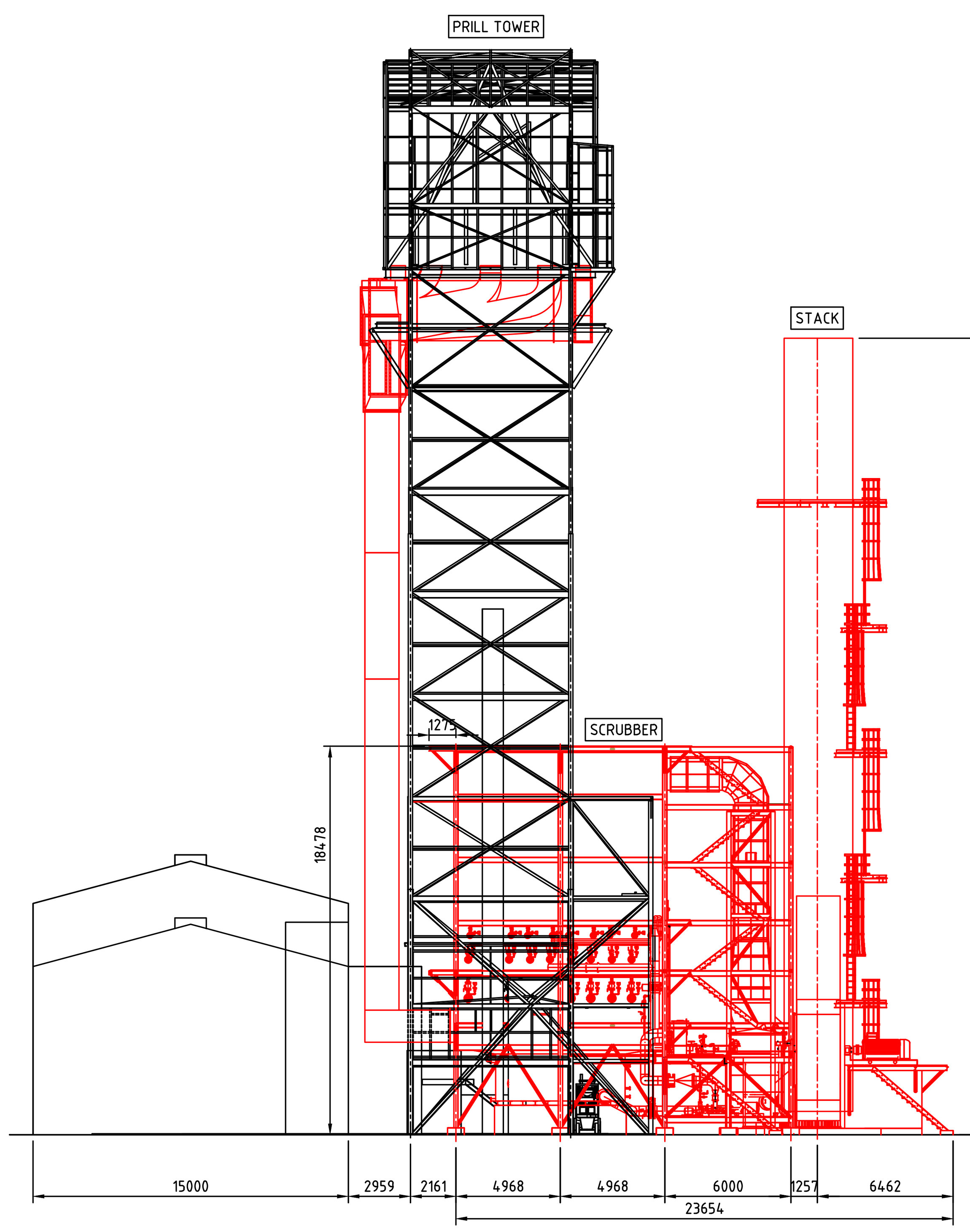
Community newsletter distribution areas to the north of the Orica KI site as marked in pink shading (Note, this may be varied from time to time).



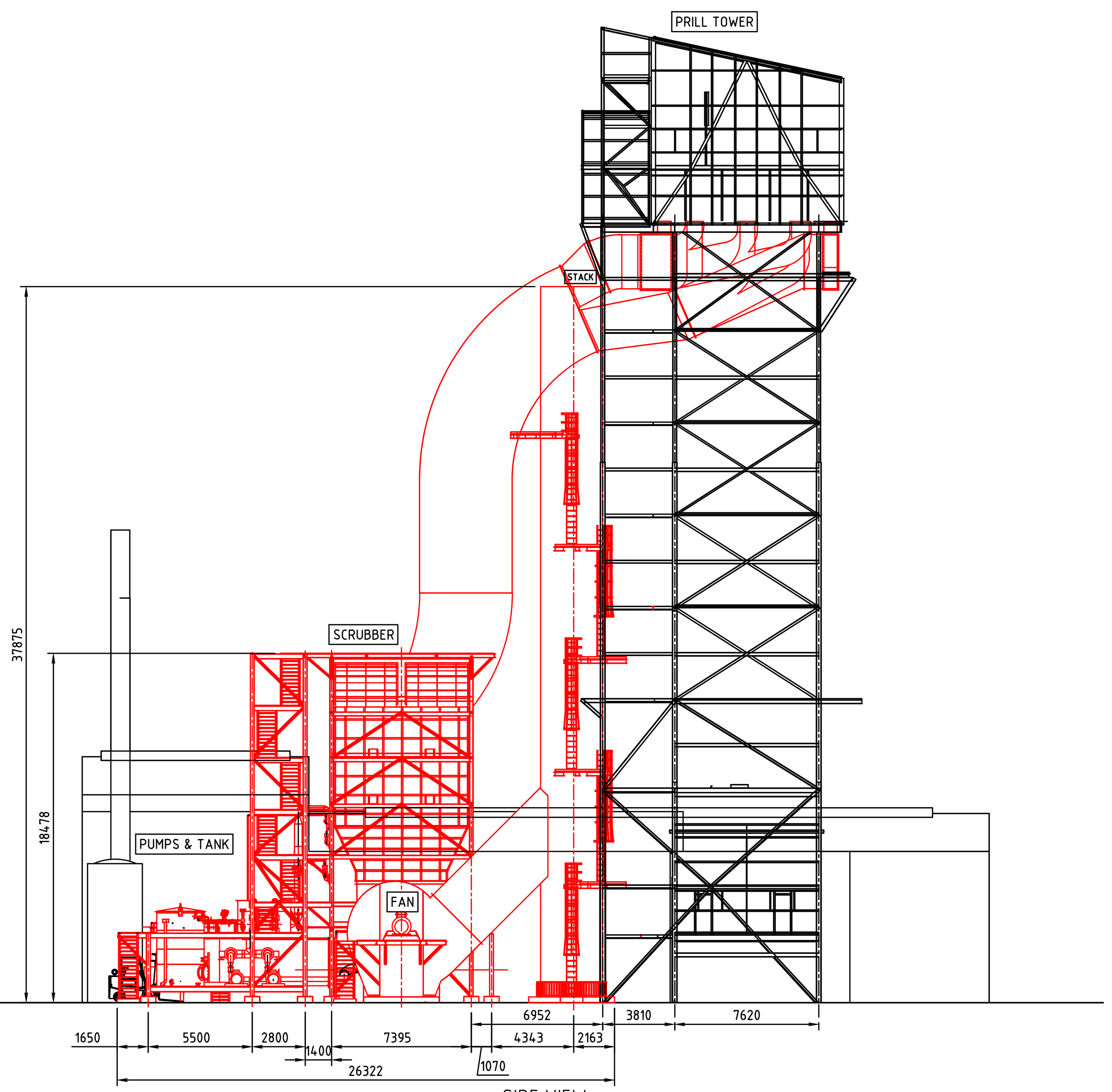
# APPENDIX D – OVERALL SCRUBBER LAYOUT DRAWING




PLAN




ELEVATION




SIDE VIEW

| | | | | | |
|---|---|---|---|---|---|
| DRAWN: JORD | DATE | SITE KOORAGANG ISLAND | ORICA | | Kooragang Island N.S.W. Australia |
| CHECKED: | DATE | PLANT No.1 AMMONIUM NITRATE | TITLE PRILLING PRILL TOWER SCRUBBING OVERALL PLANT LAYOUT | | |
| PASSED–1: | DATE | SECTION GENERAL | | | |
| PASSED–2: | DATE | PROJECT – WO No C.006149 | SHEET SIZE A1 841 x 594 | DWG No – – – | REV 01 |
| APPROVED: | DATE | SCALE | | STATUS | INDEX 14.02.07.00 |

| REFERENCE DOCS. | |
|---|---|
| DOCUMENT NUMBER | DOCUMENT TITLE |

| REVISION | | | | | | |
|---|---|---|---|---|---|---|
| A | ISSUED FOR INFORMATION | JJP | SV | SV | RPK | 11.06.2021 |
| Rev | DESCRIPTION | DRN | CHK | ENG | APP | DATE |

U.N.O Units: mm
Scale: 1:1
A1
JH ENABLED

CLIENT
ORICA

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PROJECT ANP1 PRILL TOWER EMISSIONS ABATEMENT IRRIGATED FIBER BED SCRUBBER

TITLE OVERALL PLANT LAYOUT

DRG NO. C7711-000-OV-SK-00-0001

SHEET 1 of 1

REV A