Huon Aquaculture Group Pty Ltd

Parramatta Creek Fish Processing Facility

APPENDIX E

ODOUR MODELLING

HUON AQUACULTURE – PARRAMATTA CREEK FISH PROCESSING FACILITY

REVISED ODOUR IMPACT ASSESSMENT

DOCUMENT CONTROL

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1. INTRODUCTION

Airlabs Environmental was commissioned by Caloundra Environmental on behalf of HUON Aquaculture (HA) to undertake an odour impact assessment for HA's Parramatta Creek fish processing facility (the facility) at Lot 1, 7218 Bass Highway, Sassafras, Tasmania 7307.

The facility is located in an operational aquaculture site used for fish processing, on the eastern side of the Bass Highway at Sassafras. The purpose of developing this facility was to combine and centralise HA's fish processing activities into one site and to replace separate processing facilities located in Tasmania and South Australia.

Since commissioning, the facility has been capable of producing up to 14,000 tonnes per annum (tpa) of wet fish. According to information provided to Airlabs, the current production rate of the facility is approximately 25,000 tpa and HA are proposing to increase the production rates to approximately 33,000 tpa. Additionally, HA is proposing to construct a 75 ML winter storage dam on the facility to store treated wastewater prior to irrigation. HA is also proposing to expand the extent of current irrigation areas to include additional 124 ha irrigation land, owned by Mr. Troy Layton.

To estimate the increase in odour emissions resulting from the proposed expansion (25,000 tpa to 33,000 tpa), incorporation of a new winter storage dam, increase in irrigation area extents and to subsequently determine the impacts on the receiving environment, an odour impact assessment (the assessment) was required, which formed the scope of works for Airlabs.

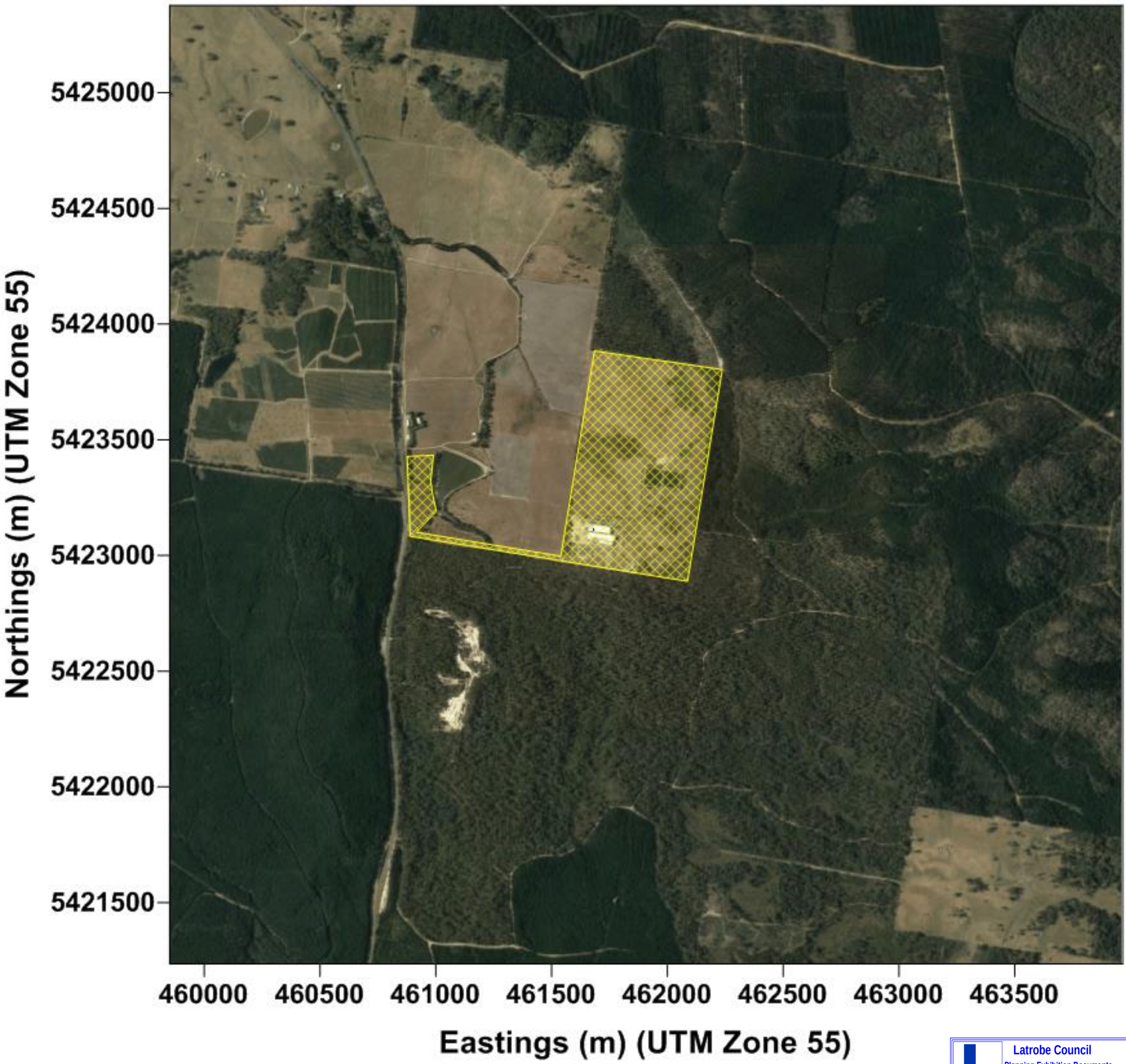
Caloundra Environmental are preparing a DPEMP for submission to the Environment Protection Authority – Tasmania (EPA) in relation to the proposed increase in fish production and this assessment would accompany the DPEMP.

As the facility is located in Tasmania, the assessment has been informed by the following guideline documents:

- Environment Protection Policy (Air Quality) 2004, Environment Protection Authority – Tasmania (hereafter 'Air Quality EPP')
- Draft Atmospheric Dispersion Modelling Guidelines, Environment Protection Authority – Tasmania – 2017 (hereafter 'EPA Modelling Guidelines')

An aerial overview of the facility boundary is shown in **Figure 1**.

Figure 1: Aerial Overview of Huon Aquaculture - Parramatta Creek Facility



2. ASSESSMENT OBJECTIVE

The objective of this assessment is to quantitatively determine odour emissions reflective of the increase in production rates to 33,000 tpa. Odour emissions were determined through site-specific odour sampling, details of which are presented in the later sections of this report. Literature information was used where site specific odour emission was not reliable or not available. The odour sampling program also provided a quantitative understanding / appreciation of the improvements done by HA mainly on the process wastewater treatment infrastructure.

Odour emissions were modelled using an appropriate air dispersion modelling package to predict the extent of odour impacts from the facility's operational activities on the surrounding environment. To determine the extent of odour impacts, modelled odour concentrations were compared against relevant odour assessment criteria specified in the Air Quality EPP.

3. ASSESSMENT METHODOLOGY AND APPROACH

To determine odour impacts from the facility, the following tasks were undertaken by Airlabs:

- Appreciation of the facility and its operations – including any upgrades completed and planned.
- Identifying key odour generating sources at the facility.
- Determination of relevant assessment criteria.
- Development of site-specific meteorology using the combination of TAPM/CALMET models.
- Determination of odour emissions through site-specific odour sampling and literature study.
- Identification of sensitive receptors and characterisation of the facility and the surrounding environment including topography and land-use.
- Dispersion modelling of the facility's odour emissions using the US-EPA CALPUFF dispersion model.
- Comparing predicted ground-level odour concentrations with assessment criteria to check for compliance.

The Project specific guidelines and corresponding comments are presented in **Table 1**.

Table 1: Project Specific Guidelines

Project Specific Guidelines (PSGs)	Sections of this Report Addressing the PSGs
6.1 Air Quality The DPEMP must:	
Identify, describe and mark the locations (on a site map) of all possible sources of emissions to air (i.e. materials, equipment and activities including fish smoking, waste management and maintenance) from the expanded facility and transport of material	All odour sources are presented in georeferenced map in **Figure 15** and **Figure 16**. Coordinates are listed in **Table 9**. Odour sources are listed in **Table 5**.
For each identified emission source (i.e. point or fugitive) describe the likely composition (i.e. types of constituents), quantities and rates of emissions to the atmosphere.	Described in the DPEMP and summarised in **Table 10** and **Table 11**.
Provide an assessment of the potential for emissions to air from the different stages of the production process at the expanded facility with respect to the likelihood of causing environmental nuisance or environmental harm. The assessment should cover both normal operating conditions and worst-case scenarios.	Described in the DPEMP and summarised in **Table 10, Table 11** and **Table 5**.
Undertake atmospheric dispersion modelling to assess the impacts of air emissions from the expanded facility relative to the requirements of the Environmental Protection Policy (Air Quality) 2004.	This Odour Assessment Report
Modelling should be conducted by a suitably qualified specialist in accordance with the EPA's Draft of the Atmospheric Dispersion Modelling	Modelling conducted in accordance with the EPA's Draft Atmospheric Dispersion Modelling Guidelines. Regular correspondence with TAS

Project Specific Guidelines (PSGs)	Sections of this Report Addressing the PSGs
Guidelines, a copy of which is included as Attachment 1 and is available from http://epa.tas.gov.au/epa/document?docid=1390. It is strongly recommended to discuss the scope and method of atmospheric dispersion modelling with the EPA's Air Modelling Officer prior to commencement. The meteorological data used in the model should be representative for the site.	EPA Air Quality specialist was conducted in preparation of this assessment.
Identify and discuss measures to be implemented to mitigate any impacts that may cause environmental nuisance or environmental harm. In addition to normal operations this should include management of potential impacts associated with supply and handling of the raw material as well as potential impacts associated with malfunction of the equipment used on the site.	Mitigation of the worst two odour sources (ranked by odour emission rates) is proposed by HA. Details presented in **Section 10.1**
Provide detailed information about the management of wastewater generated by the expanded facility in a context of a potential to create odour issues which could cause environmental nuisance or environmental harm in the area.	Described in the DPEMP and discussed in this report
6.5 Waste management In addition to the matters stipulated in Section 6.5 of the DPEMP General Guidelines the DPEMP must contain the following:	
A description of storage and handling and disposal procedures proposed to mitigate any potential odour and biosecurity impacts and to control pests.	Described in the DPEMP

4. FACILITY DESCRIPTION

4.1 Facility Location and Boundary

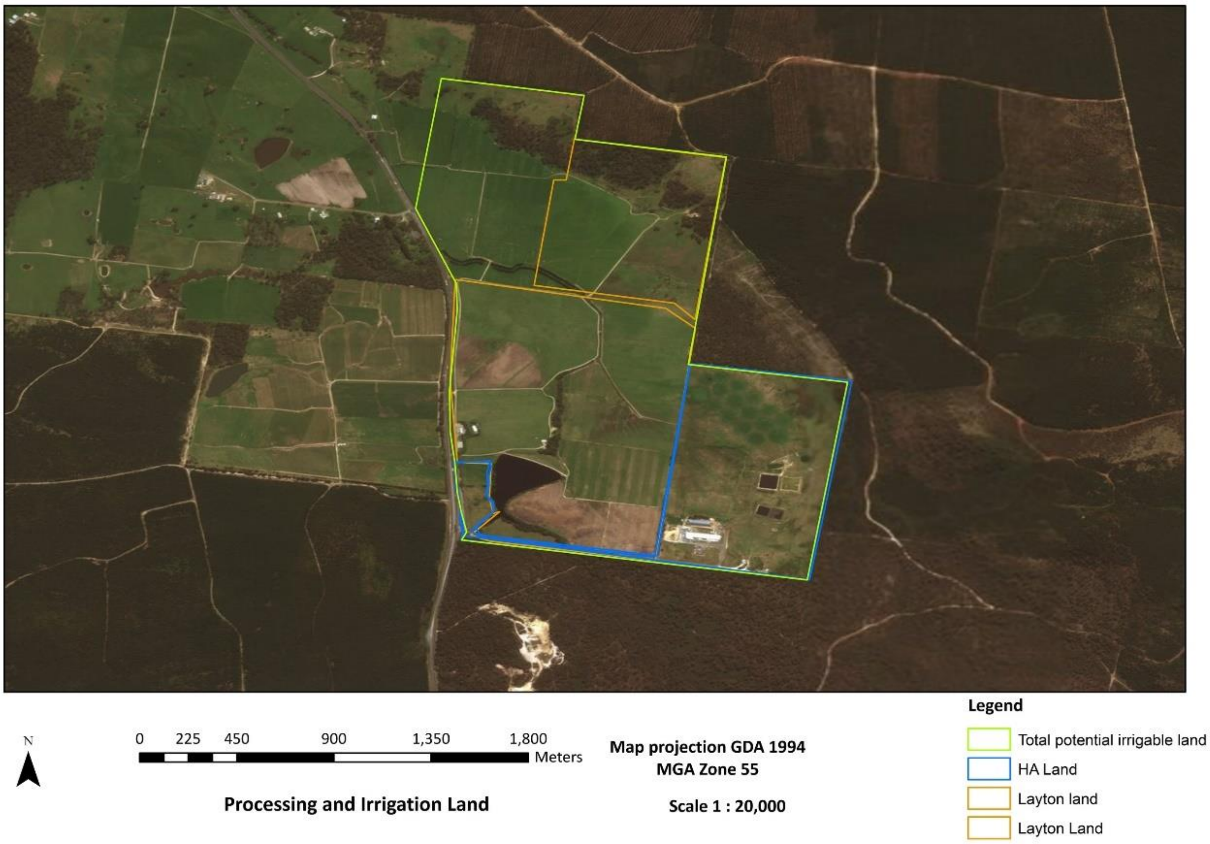
The Huon facility and the current irrigation land is located approximately 25km south-west of Devonport at Lot 1, 7216, Bass Highway, Sassafras, Tasmania. The processing site is located on 56 ha of land and is owned by HA.

In addition to the existing irrigable land, HA are planning to utilize land immediately adjacent to the facility being124-ha located at 7218 Bass Highway, Sassafras, which is owned by Mr. Troy Layton. Airlabs understand that HA has an agreement with Mr. Layton to irrigate treated wastewater on his land, once HA receives environmental approval.

The HA owned land and the proposed irrigation land owned by Mr. Layton comprise the total irrigable boundary, which is illustrated in **Figure 1**.

Figure 2 shows the land owned by Mr. Layton (as indicated by brown color), adjacent to the HA owned land (blue color) and the total irrigable land (green color), which constitutes the boundary of the facility.

Figure 2: Total Irrigable Land Boundary



Ref: Caloundra Environmental, December 2017

4.2 Operational Activities

4.2.1 Process Overview

The facility produces gutted and cleaned whole salmon and salmon fillets as well as hot and cold smoked salmon. Small quantities of salmon patties, caviar and pate are also produced.

The process commences at the fish farms in Huon River, Storm Bay and Macquarie Harbour where salmon and humanely harvested using the stunning and bleeding system developed by Seafood Innovations.

After harvesting, the fish are brought to the shore where they drop into purpose-built road tankers from the harvest line. The 30kL tankers contain approximately 10kL of chilled water to keep the fish below the required 5^0C during the drive to the facility.

There are essentially two stages of processing – wet processing and value adding, details of which are provided below.

As a part of this assessment, Airlabs undertook a site inspection of the facility's operations in November 2017. The operational activities mentioned below were verified by Airlabs personnel during the site inspection.

Stage 1 – Wet Processing:

Harvested fish arriving at the facility first undergo wet processing, which include

- *Fish unloading* – After arrival at the facility, the tankers are unloaded, and the fish are transferred to a receival tank which is chilled with fresh clean water. There is a return water

system to pump water from the receival tank back to the tanker to keep it pressurised until empty of fish. Once the tanker is empty it is taken to a CIP system for cleaning.

- *Grading* – After unloading, the fish are then sent into grading by a vacuum delivery system. An operator directs all higher quality fish to the *Baader* machines for gutting and lower quality fish to a handline.
- *Gutting* – Gutting is performed by two "*Baader 142*" machines and a handline. The "*Baader 142*" machines take fish via a conveyor for measurement. They are automatically split and the viscera are removed via a vacuum station system. The fish are then washed and offloaded onto an inspection conveyor for final inspection. Each machine operates a maximum rate of 16 fish per minute. The handline is a manual operation similar to the *Baader* operation. Fish are conveyed from the *Baader* machines and handline to a second grading station where they are inspected and graded again, checking for machine damage and other deformities. Rejects are sent to an insulated bin for further processing in the filleting area.
- *Further Grading* – This grader consists of six drop bins per side for different sizes and grades. One side of the grader is used to fill insulated bulk bins for further processing by the filleting department while the other side is used to fill polystyrene boxes for customers in the domestic and export market. Fish in the polystyrene boxes are conveyed from the grader to a weigh scale where they are identified, labelled and packaged with ice to dispatch for customers via refrigerated transport.
- *Filleting* – At the filleting station, fish are deheaded and sent through a filleting machine where they are split into fillets and the main carcass, with bones dropped into a waste bin. The fillets then go through a trimming machine. They are then inspected and put into polystyrene boxes. The boxes are labelled and packed with ice for dispatch to customers via refrigerated transport.

Stage 2 – Value Adding:

The value adding process currently involves the following activities – pin boning, skinning, portioning, hot smoking and further processing, cold smoking and further processing, mincing, caviar, burger room, pate room and packaging.

Smoking is currently carried out as a batch process. The smoke houses currently operate 12-14 hours per day, 5 days per week. The smokehouses were built to cope for additional capacity and as a consequence, can deliver sufficient product to meet the proposed production increase.

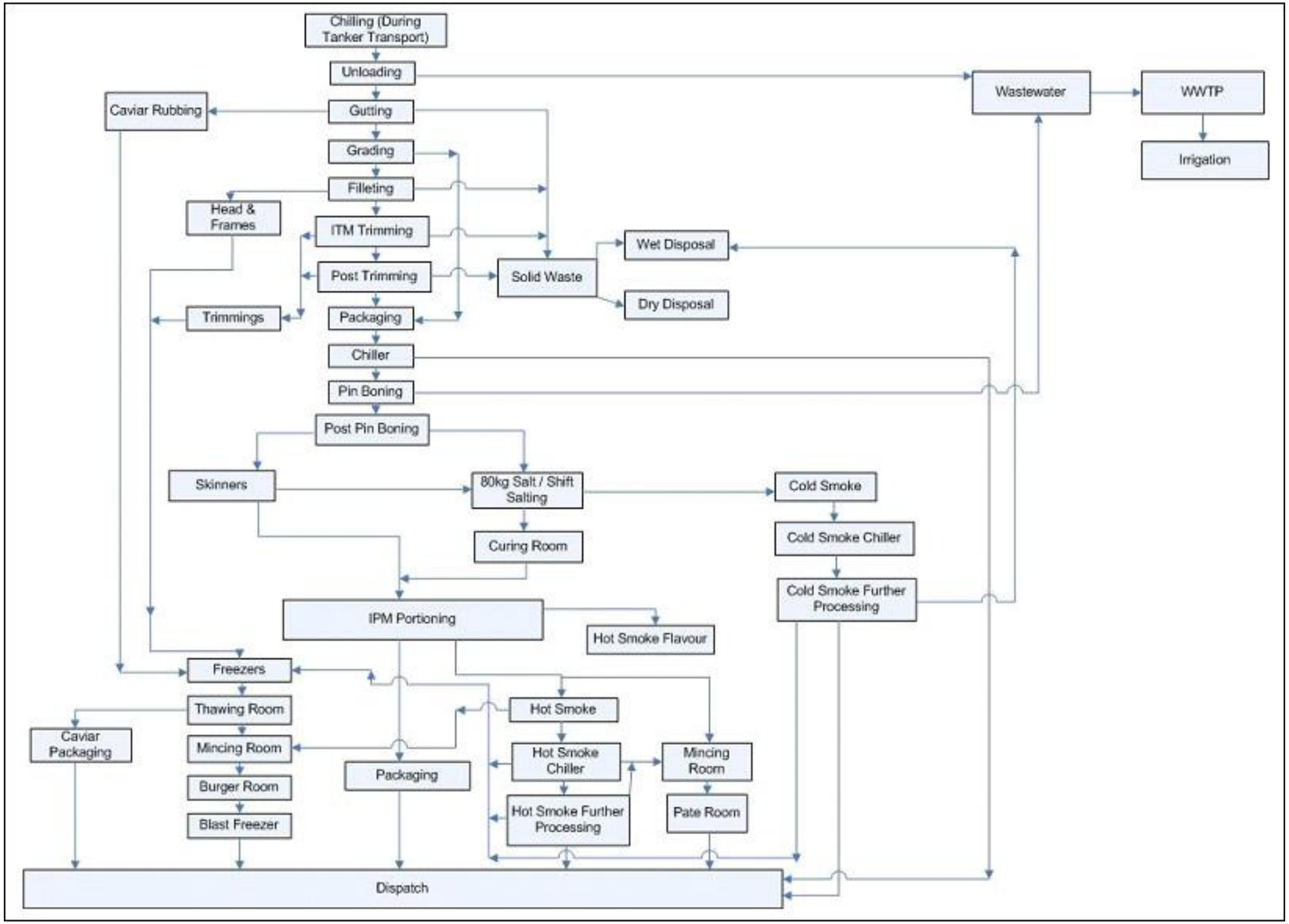
Stage 1 and Stage 2 operations are conducted in an enclosed building. General solid and semi-solid waste generated from Stage 1 and Stage 2 operations are placed in waste-bin with lids which are disposed of the facility regularly. Fish carcass (heads and frames) after filleting are sent to the freezer rooms and stored temporarily before dispatching them off site.

As majority of the operations are conducted indoors and considering that fresh meat is not highly odorous, it is very unlikely that there would be any adverse odours expected from the wet processing and value add operations.

All the liquid waste generated from the processing activities are directed to the wastewater treatment plant, details of which are presented in the following sections of this report.

A process flow diagram of the operations undertaken at the facility is illustrated in **Figure 3**.

Figure 3: Operations Process Flow Chart – Parramatta Creek Facility



Ref: Caloundra Environmental, December 2017

4.2.2 Wastewater Treatment

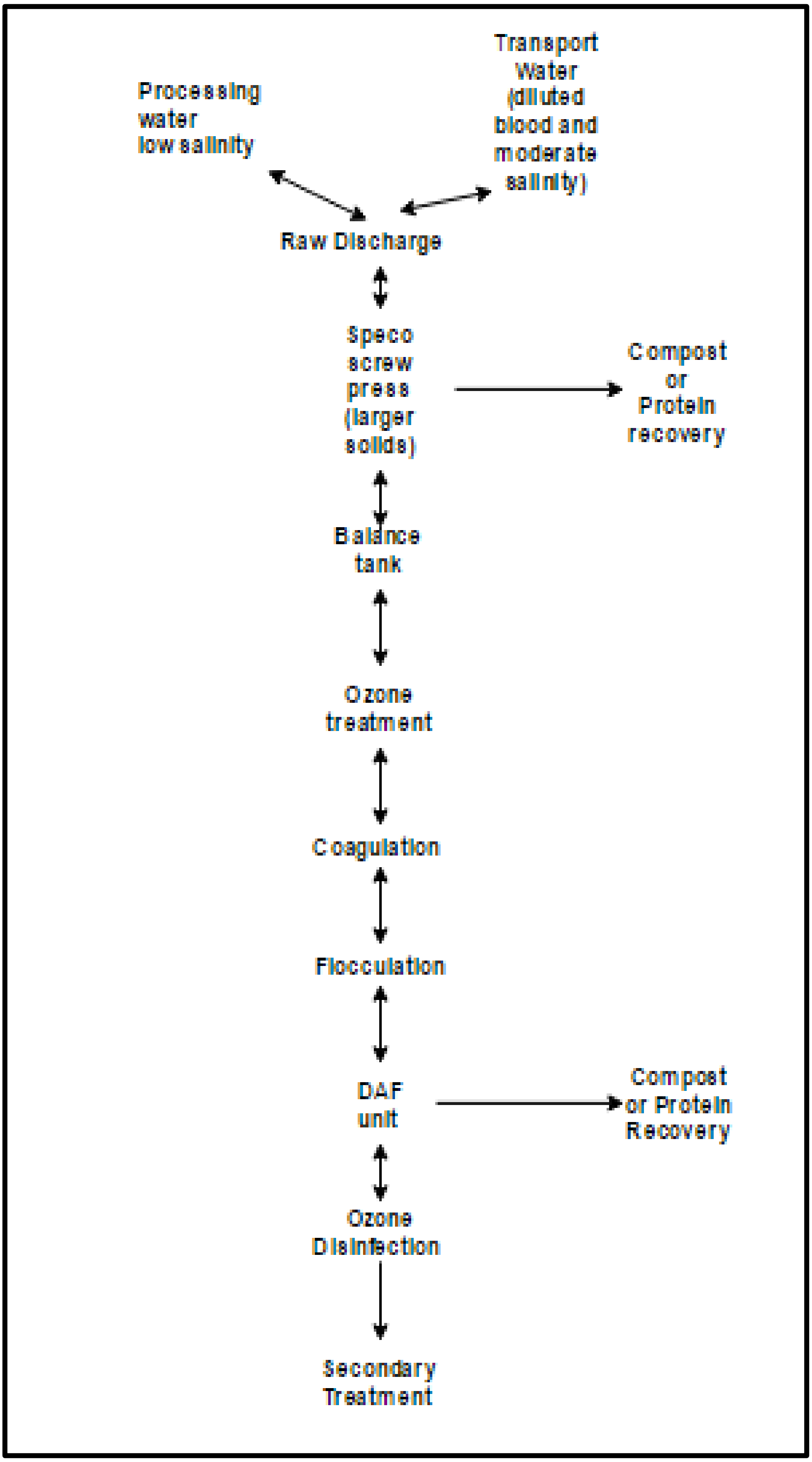
All the process wastewater from the facility is collected and drains to a sump at the on-site wastewater treatment plant (WWTP).

Airlabs have been informed that since 2009 there have been continual upgrades to the WWTP. The WWTP has a number of stages that serve different functions for achieving the required effluent quality. The stages in the order that they occur within the treatment system are:

- Screw Press
- Balance Tank
- Flocculation and Coagulation
- Dissolved Air Flotation (DAF)
- Aerated Ponds
- Non-Aerated Ponds
- Water Storage (including Winter storage); and
- Effluent Re-Use through Irrigation

A process flow of the WWTP is presented in **Figure 4**.

Figure 4: Process Flow Diagram – Wastewater Treatment Plant



Ref: Caloundra Environmental, December 2017

A brief overview of each of the principal components of the WWTP is presented below:

Screw Press:

The rotating trommel screen, used to remove fish scales from the wastewater system has been replaced by a screw press. The function of the screw press is to remove solids greater than 1mm from the processing water. This prevents solids from entering the water treatment plant including:

- Plastic that would not be effectively treated by the system.
- Hard material that may damage water treatment infrastructure.
- Larger organic material that would increase the organic load requiring treatment.

Removed solids from the screw press are reported to the organic solid waste management system. These solids are stored in lidded binds and removed off site daily by Veolia along with other wastes such as smokehouse ash and viscera.

Balance Tank:

As per information provided to Airlabs, the balance tank is made from a converted clarifier. The wastewater within the balance tank is aggressively mixed using a submersible agitator. The agitation assists in the prevention of odours. The effluent within the balance tank has a high biochemical oxygen demand (BOD) and is rich in organic material associated with fish waste such as fish blood. The agitation combined with frequently pumping the balance tank down to its base level, prevents significant bacterial loads building up and as a result reduces odour formation.

The balance tank also moderates the effluent load on the coagulation and flocculation and DAF units. The balance tank moderates the hydraulic load by storing effluent and providing a constant flow through the remaining treatment system units. The organic load is also modulated. Variations in concentrations are averaged across the entire volume of the balance tank due to rapid mixing.

Flocculation and Coagulation:

Flocculation and coagulation are effectively part of the Dissolved Air Flotation (DAF) system with proprietary chemicals used in the process. The dosing of coagulant and flocculant and the consequent flocculation occurs as the water passes from the balance tank to the DAF unit. The chemicals for this process are dosed as liquids using variable speed dosing pumps. This permits the dose to be varied as required to optimise the coagulation of fine solids and chemicals within the wastewater. The dose of flocculant can also be varied to improve the chemical entanglement of the particles formed by the coagulation into a form that can be readily removed from the solution.

Optimum flocculation and coagulation usually occur through gentle mixing. This is achieved by passing the dosed wastewater through a stack of pipes with bends.

Although, the total contaminant levels in the wastewater will not change substantively in the flocculation and coagulation process, the proportion of material in the form of larger solids that can be removed in the DAF unit will be significantly increased.

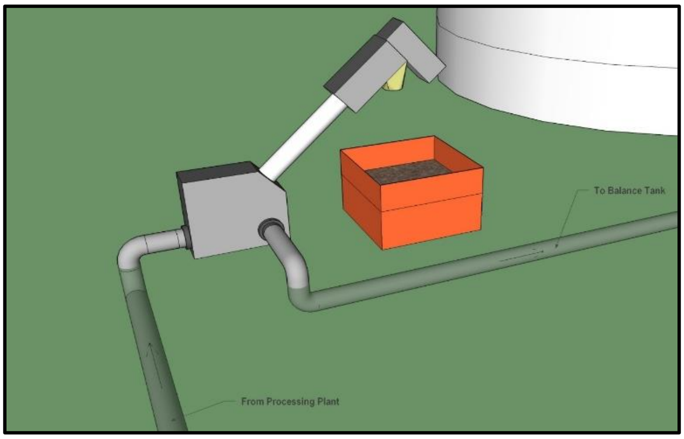
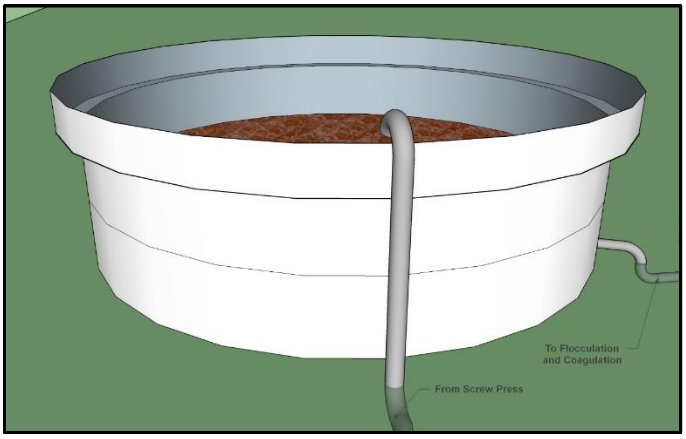
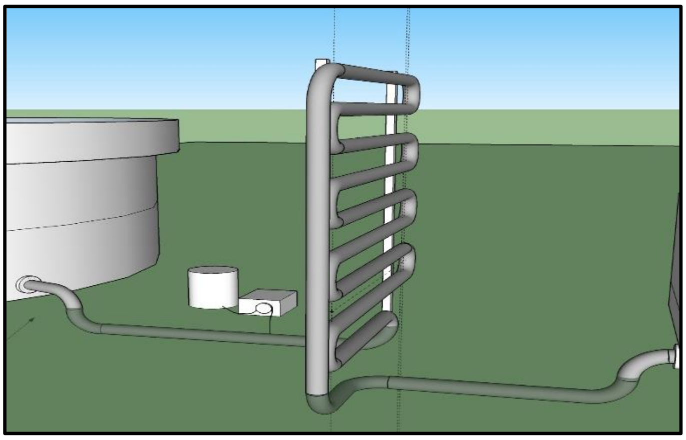
Dissolved Air Flotation (DAF):

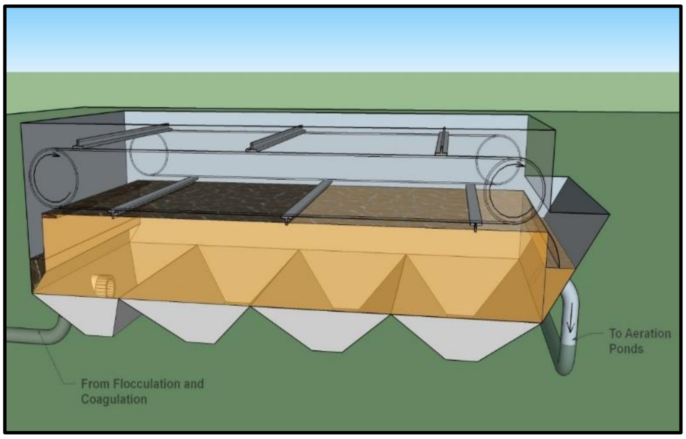
Wastewater from the flocculation and coagulation system passes into the base of the DAF unit. Recycled water supersaturated with air is then passed into the base of the DAF unit. Recycled water supersaturated with air is then passed into the cones as the base of the unit releasing extremely fine bubbles. The air bubbles entrain particulates and chemicals that have been drawn out of solution by coagulation process. The air bubbles with the collected material, rise to the surface of the DAF unit. The water surface is continually skimmed by blades that draw the material to a collection sump at the opposite end of the wastewater overflow. The wastewater passes along the entire length of the DAF unit to maximise the flow path for contact with the superfine air bubbles.

The DAF unit removes substantial quantities of particulate material including chemicals drawn out of solution through the coagulation process. The resultant water is lower in organics and nutrients, reducing the loads on the subsequent water treatment infrastructure.

3-D schematics of the screw press, balance tank, flocculation dosing and mixing pipage and the DAF unit are illustrated in **Figure 5**.

Figure 5: 3-D Schematics of the Principal Components of the WWTP

	Screw Press
	Balance Tank
	Flocculation and Coagulation

	Dissolved Air Flotation (DAF) unit

Ref: Caloundra Environmental, December 2017

Aerated Ponds, Facultative Ponds and Water Storage:

The facility ponding system includes two 2.6 ML aerated ponds and two 5.2 ML non-aerated lagoons.

Primary treated liquor discharging from the DAF unit is sent via gravity to the first of the two secondary treatment ponds.

The bulk of the organic reduction occurs in the first aeration pond. Supplementary aeration is also supplied by large splashers. Aerators are required in the aeration ponds because of the large organic loading, which is well over the 50-70 kg/ha recommended levels for Tasmanian Lagoons. If aerators are not employed, it would lead to anaerobic conditions which causes odours. Moreover, the later ponds would receive increased organic loading, reducing their overall performance.

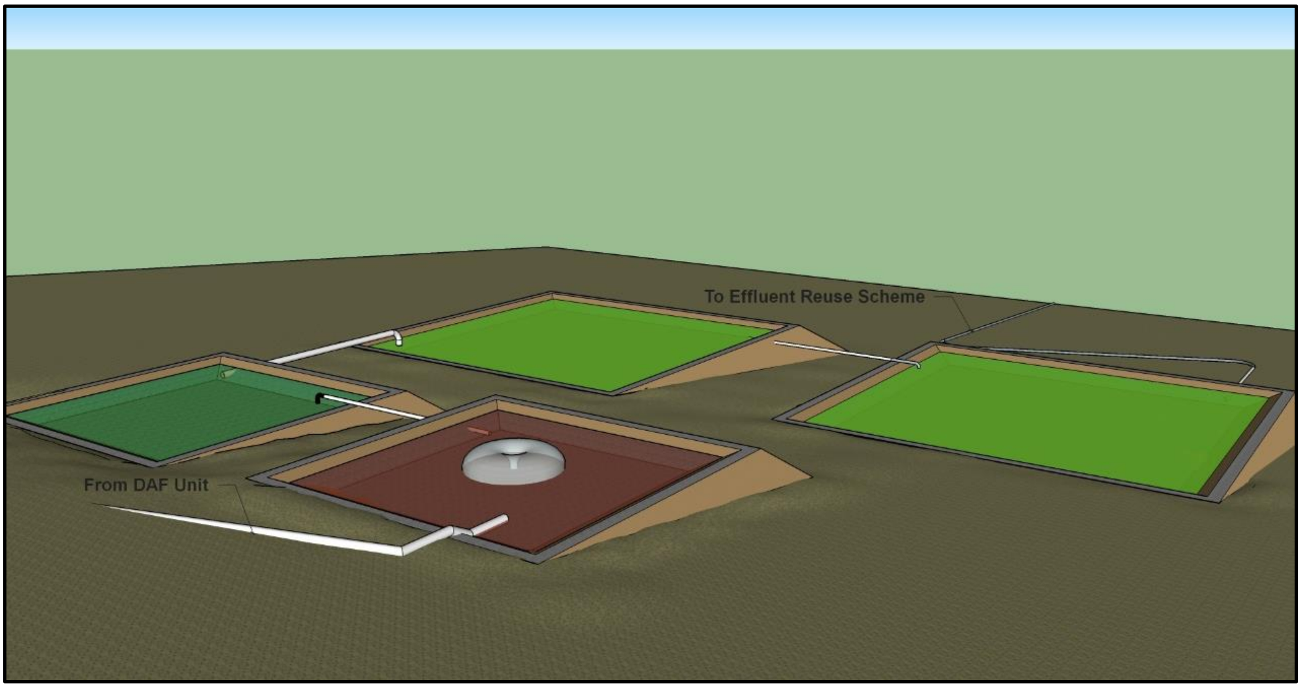
As per information from HA, the second pond also has an aerator that can be used if odours develop in that pond. The lagoons are effective disinfection systems, which work via extended oxidation and ultraviolet radiation from sun.

During the site inspection of the facility, the two aerated ponds were noted to be the main sources of odour across the WWTP.

Huon is also proposing to develop winter storage dam storing up to 75 ML of treated wastewater prior to irrigation.

A 3-D schematic of the ponding system at the facility is provided in **Figure 6**.

Figure 6: 3-D Schematics of the Ponding System



Ref: Caloundra Environmental, December 2017

Irrigation Area:

Proposed Irrigation sites were selected to maximise the use of the land best suited to irrigation as identified by the land suitability and capability assessments. The proposed system will irrigate land owned by Huon Aquaculture (current irrigation area) and the adjacent property owned by the Layton family and managed by Mr Troy Layton.

Buffers of 50m from the highway and 20m from streams were applied in the design process, and irrigators configured to not cross into these exclusion zones. The option of traversing these buffer areas and using individual sprinkler control to switch off irrigation application was considered, but ultimately ruled out on the basis of little additional area gain, and potential for loss of system reliability due to potential corrosion of control valves in the future.

The total irrigated area will be around 79.81ha, plus additional area if the end gun on the existing pivot (CP4) is utilised, bringing the total to close to 80ha.

The proposed irrigation concept site plan is detailed in **Figure 7** and includes three new centre pivot irrigators in addition to the existing centre pivot currently installed and operating on the Huon Aquaculture site. Details of all irrigators are provided in **Table 2**.

Table 2: Proposed Centre Pivot (CP) Irrigators

Irrigator ID	CP 1	CP 2	CP 3	CP 4 (existing)	CP 5	CP 6
Length (m)	430	301	225	168	196	174
Area (ha)	28.48	15.95	13.47	10.5 (+end gun)	6.01	5.4
Degree of Arc	176°	201°	304°	360°	180°	204°
Flow Rate @ 7mm per day (l/sec)	23	12.9	10.9	10	5.1	4.6

Figure 7: Proposed Irrigation Concept Plan

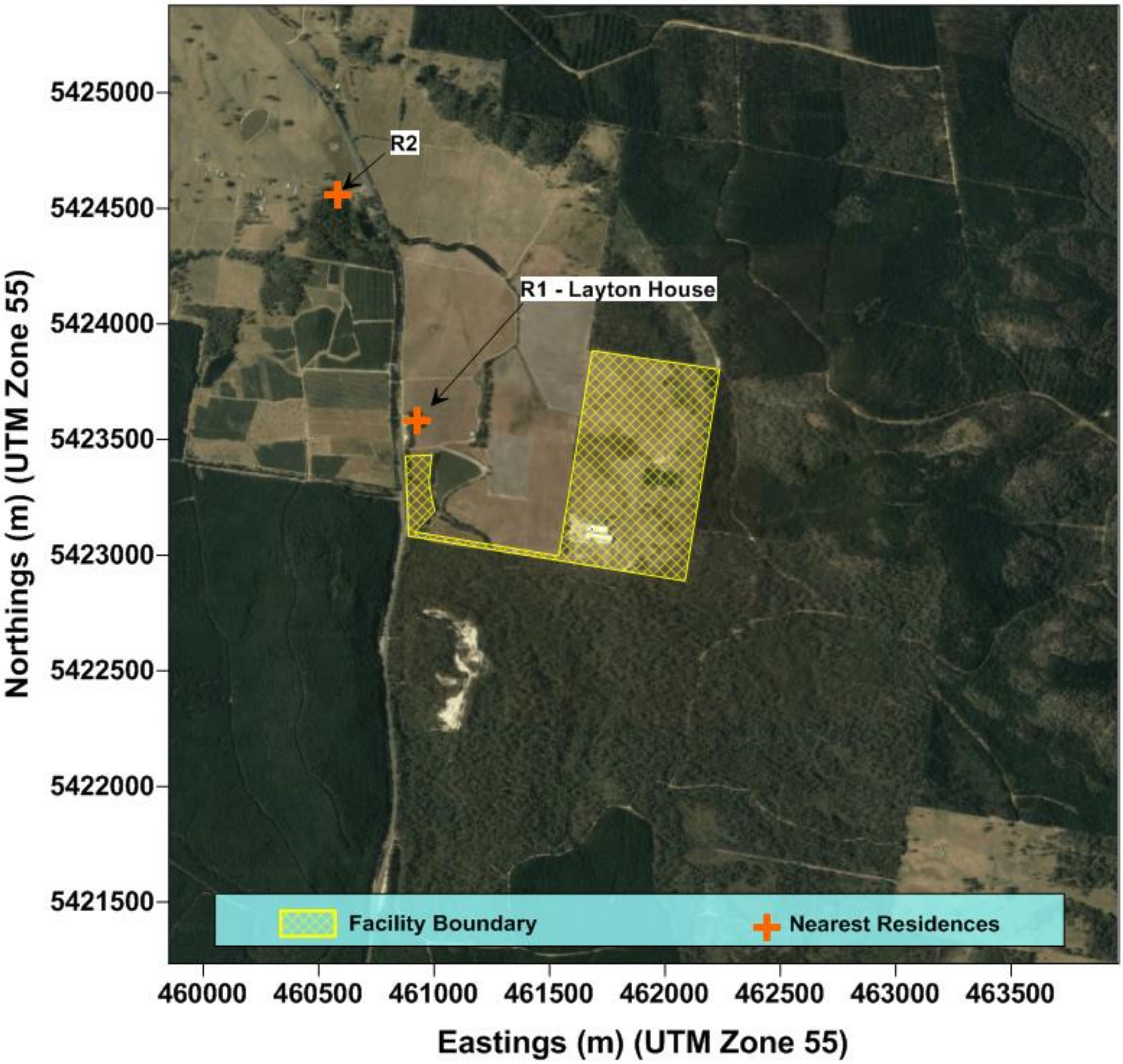
5. STUDY AREA AND SURROUNDS

The HA facility is located approximately 25km southeast of Devonport in Sassafras, Tasmania. Through aerial imagery and observations made during the site inspection, it is noted that there are two existing dwellings, in the nearby vicinity of the HA facility.

The nearest existing residential receptor (R1) is land owned by Mr. Layton. Second receptor (R2) is located more than 1 km northwest of the HA facility. The identified sensitive receptors (as shown in **Figure 8**) are the closest receptor to the facility amongst a set of scattered and sparse residential dwellings.

Based on discussions with Mr. Stephen Kent from Caloundra Environmental, it is very unlikely that there would be any future residential or commercial / industrial developments in the immediate surrounds, as the land-use is predominantly identified as either timber production or timber reserves. Consequently, no additional sensitive receptors have been identified for this assessment.

Figure 8: Identified Sensitive Receptor Closest to the Huon Parramatta Creek Facility



6. REGULATORY FRAMEWORK

The odour assessment is based on the following frameworks:

TASMANIA - Atmospheric Dispersion Modelling Guidelines Nov 2018

These guidelines provide the Environment Protection Authority (EPA), Tasmania's requirements for atmospheric dispersion modelling of emissions from existing and proposed industrial activities within the state of Tasmania.

TASMANIA - Environmental Management and Pollution Control Act 1994

The Environmental Management and Pollution Control Act 1994 (EMPCA) is the primary environment protection and pollution control legislation in Tasmania. The EMPCA was developed in the early 1990s to replace the Environment Protection Act 1973. There are a number of regulations made under EMPCA for environmental management and pollution control.

Environmental Protection Policies (EPPs) have been developed to give effect to the objectives of the EMPCA. The EPP for air quality – Environment Protection Policy (Air Quality) 2004 (hereafter 'Air Quality EPP') was commenced on 01 June 2005.

TASMANIA - Environment Protection Policy (Air Quality) 2004

The Air Quality EPP provides a framework for the management and regulation of both point and diffuse sources of emissions to air for pollutants with the potential to cause environmental harm.

According to the policy, the environmental values to be protected are:

(a) the life, health and well-being of other forms of life, including the present and future health, wellbeing and integrity of ecosystems and ecological processes;

(b) visual amenity; and

(c) the useful life and aesthetic appearance of buildings, structures, property and materials.

Section 13 of the Air Quality EPP (2004) provide regulatory framework relating to odour

1. If a regulatory authority is satisfied that an odour from an activity is causing or is likely to cause an environmental nuisance or environmental harm, the authority should require that the odour emission from the source not exceed the odour criteria specified in Schedule 3, at or beyond the boundary of the land on which the source is located.
2. If the activity that is the source of the odour is being carried out at the time that this Policy is made, the time frame for compliance with sub-clause (1) should be determined on a case-specific basis having regard to:
    (a) the environmental impact associated with the pollutant being emitted;
    (b) the economic cost of upgrading and the capacity of the relevant activity to support this cost; and
    (c) the practicability of reducing emissions.

Odour Assessment Criteria

The detectability (or odour threshold) refers to the minimum concentration of odorant stimulus necessary for detection in some specified percentage of the test population. The odour concentration of a sample can be characterised by the number of dilutions to reach this detection threshold.

That theoretical minimum concentration is referred to as the "odour threshold" and is also referred to as one (1) Odour Unit (OU). Therefore, an odour concentration of less than 1 OU would theoretically mean that there wouldn't be any odours perceived. Typically, the levels at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU, depending on several factors, commonly referred to as the FIDOL factors. These factors are to be considered when assessing the impacts of odours in the environment. The FIDOL factors include:

- the Frequency of the exposure

- the **I**ntensity of the odour
- the **D**uration of the odour episodes
- the **O**ffensiveness of the odour; and
- the **L**ocation of the source.

The odour assessment criteria for assessments in Tasmania is outlined in *Schedule 3 – Odour Criteria* of the Air Quality EPP.

For an unknown mixture, Table 1 of Schedule 3 of the Air Quality EPP specifies the following odour assessment criteria:

- *2 Odour Units (OU), 1-hour average, 99.5th percentile ground level concentration predicted at or beyond the site boundary,*

Schedule 3 of the Air Quality EPP states that for an unknown mixture, the 99.5th percentile model predicted concentrations can be presented where local high-quality and meteorological and emissions data are available.

Table 3: Odour Criteria Adopted for the Assessment

Pollutant	Averaging Period	Assessment Criteria (OU) Reported as 99.5th Percentile	Applicability of the Assessment Criteria
Odour (Unknown Mixture)	1-Hour	2.0 OU	At or beyond the facility site boundary

7. CHARACTERISTICS OF ODOUR SOURCES

Airlabs were commissioned by Caloundra Environmental on behalf of HA to measure odour concentrations and emission rates of sources with potential to generate odour at HA's Parramatta Creek fish processing facility (the facility) at Lot 1, 7218 Bass Highway, Sassafras, Tasmania 7307.

Based on a review of the process and observations made during the site inspection, the WWTP and its associated infrastructure were considered to be the key sources of odour generation at the facility.

Testing was conducted on 1st November 2017 by Airlabs to determine the following parameters:

- Concentration of odours
- Emission rate of odours

Odour sampling was undertaken at the following sources:

- Balance tank
- DAF unit
- Aerated lagoon 1
- Aerated lagoon 2
- Non aerated lagoon 3; and
- Non aerated lagoon 4.

All of the sampling and analysis were performed by Airlabs. Specific details of the odour sampling program have been presented in Report No. OCT17213_B.2, *Testing of Odour Emissions at HUON Aquaculture Parramatta Creek, Tasmania, Date of Sampling: 1st November 2017* (Airlabs, 2017).

A summary of the sampled odour sources and measured SOERs (reproduced from Airlabs, 2017) is presented in tables below.

Table 4: Plant Operational Data during Sampling and Sampled Sources

Pollutant	Averaging Period
Production rates	Production rates at the facility were ramped up resulting in daily average wastewater production at the time of sampling of approximately 302kL. This is equivalent to an annualised production rate of 32,000 tpa.
Odour sources not sampled	*Screw Press: Normal operations*. No discernible odours were noticed from the screw press and therefore no samples were collected. *Flocculation and Coagulation*: *Normal operations*. Pipes were properly sealed, and no leakage was noticed therefore, no samples were collected.
Odour sources samples	• Balance tank: Normal operations • DAF unit: Normal operations • Aerated lagoons: Normal operations • Non-Aerated lagoons: Normal operations

It was noted that the measured SOERs at non-aerated lagoons 3 & 4 were considered too low compared to literature data for wastewater treatment plants, and hence as per TAS EPA recommendation, adopted SOERs for non-aerated lagoons were assumed to be same as aerated lagoons.

The winter storage dam was still in design state at the time of odour sampling, hence the SOERs adopted for dispersion modelling were based on literature (Pitt & Sherry, 2016).

SOERs adopted for irrigation areas were based on the SOERs for winter storage dam. An SOER of 0.05 OU.m^3/m^2/sec was reported for the winter storage dam by Pitt & Sherry, 2016. As noted in previous sections, Huon has advised that the treated water from the storage dam will be diluted with freshwater (ratio of 1 wastewater: 2.5 freshwater). Based on the dilution ratio and the SOER of the winter storage dam, an SOER of 0.05/3.5 = 0.14 OU.m^3/m^2/sec was adopted for all irrigation areas. Furthermore, odour from irrigation was modelled for five summer months (November through to March). There would be no irrigation for the remaining seven months of the year.

SOERs for sludge handling operations were referenced from literature (Wodonga, 2017). Odour emission rates were measured at the Wodonga wastewater treatment plant in Victoria in 2010. Samples for odour analysis were collected using an equilibrium flux chamber in accordance with the Australian Standard for area source measurement AS 4323.4. Odour analysis was undertaken in a NATA accredited laboratory according to the Australian Standard for Dynamic Olfactometry AS 4323.3 by the forced-choice technique. Table 7.2 of the West Wodonga WWTP report suggests the sludge drying pans have SOER of 0.2 to 1.0.

To model accidental spills, it was assumed that a spill covering an area of 10 m^2 will occur from balance tank. Hence the SOERs of 1000 OU.m^3/m^2/sec (similar to that of balance tank) was adopted for the accidental spills.

No discernible odours were noticed from the screw press and therefore no samples were collected at this source. Similarly, no sampling was undertaken for the flocculation and coagulation system as the pipeages are completely enclosed. Other than the screw press and the flocculation and coagulation system, all other components of the WWTP were sampled and their SOERs were determined.

Similarly, no offensive odours were observed from the smoking process during the site inspection. As-such, these sources have been excluded from the assessment.

A list of all odour sources and adopted SOERs for the purpose of dispersion modelling are presented in **Table 5**.

Table 5: List of Odour Sources and Adopted SOER for Odour Dispersion Modelling

Source	Area (m^2)	New SOER ($OU.m^3/m^2/s$)	Source / Comments
Balance Tank	58	918	SOER adopted from on-site sampling conducted by Airlabs on 01 November 2017
DAF unit	21	1280	SOER adopted from on-site sampling conducted by Airlabs on 01 November 2017
Screw Press	Not modelled		During site inspection, it was determined that the odours from screw press were not significant. Considering the smaller surface area of the source and lower odour concentration, it is noted that excluding this source from modelling will have a trivial impact on the final modelling results.
Coagulation & flocculation	Not modelled		Enclosed Pipe Works. No odour emissions observed during site visit
Aerated Lagoon 1	1,570	0.685	SOER adopted from on-site sampling conducted by Airlabs on 01 November 2017
Aerated Lagoon 2	1,840	0.685	SOER adopted from on-site sampling conducted by Airlabs on 01 November 2017
Non-Aerated Lagoon 3	5,000	0.685	Conservatively assumed to be same as Aerated Lagoon 1 & 2
Non-Aerated Lagoon 4	4,590	0.685	Conservatively assumed to be same as Aerated Lagoon 1 & 2
Winter Storage Dam	19,400	0.05	The SOER have been referenced from literature and same value was used by Pit & Sherry report submitted to TAS EPA, dated 19th May 2016 (Huon Aquaculture Paramatta Creek Wastewater Treatment Plant – Odour Assessment)
Irrigation Areas	Approx. 80 hectares	0.014	SOER adopted from storage dam were scaled down by a factor of 3.5 Huon has advised that the treated water from storage dam will be diluted with freshwater (ratio of 1 wastewater: 2.5 freshwater). Based on the dilution ratio, SOER of 0.05/3.5 = 0.14 OU.m3/m2 Irrigation will only occur during five months of the year (November to March). Hence SOERs applied to those five months only.
Sludge Handling	Same as Non-Aerated Lagoon 4	1.0	Odour emission rates were measured at the Wodonga wastewater treatment plant in Victoria in 2010. Table 7.2 of West Wodonga WWTP report suggests the sludge drying pans have SOER of 0.2 to 1.0 OU.m3/m2/s (Wodonga, 2017)
Accidental Spills	10	1, 000	Assumed spill to occur from Balance tank hence applied similar SOER to Balance tank. Assumed spill over 10 m^2 area.

8. METEOROLOGICAL MODELLING

8.1 Assessment Methodology

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. The local meteorology at the site plays a significant role in understanding the pollutant transport and dispersion mechanisms, and in order to adequately characterise the local meteorological conditions, information is needed on key parameters such as prevailing wind regime, mixing depth, atmospheric stability, ambient temperatures, rainfall and relative humidity. The following sections outline the methodology for characterising the meteorological conditions at the facility.

Meteorological modelling was conducted using a combination of 'The Air Pollution Model (TAPM) (Version 4) and CALMET meteorological models. Meteorological modelling was conducted for year 2014 as per TAS EPA recommendations.

8.2 TAPM

For this modelling assessment, the meteorological model 'The Air Pollution Model (TAPM) (Version 4.0.5)' was used to generate the prognostic output. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which is used to predict three-dimensional meteorological data and air pollution concentrations. TAPM allows users to generate synthetic observations by referencing in-built databases (e.g. terrain information, synoptic scale meteorological observations, vegetation and soil type etc.) which are subsequently used in generating site-specific hourly meteorological data (Hurley P.J., 2008).

No local observations of wind speed and wind direction were assimilated into TAPM as the nearest available stations were located at a distance of more than 20 km from the facility.

Technical details of the model equations, parameterisations and numerical methods are described in the Hurley (2008)

Details of the TAPM model configuration are outlined in **Table 6**.

Table 6: TAPM Model Configuration

Parameter	Value
TAPM version	V4.0.5
Run dates	01/01/2014 to 31/12/2014
Number of grids	5 (30 km, 10km, 3 km, 1 km, 300m)
Grid Centre Coordinates (latitude, Longitude) (degree)	-41deg -20.5min, 146deg 32.5min
Grid Centre (cx, cy)	461653, 5423212 (m)
Grid Dimensions (nx, ny, nz)	31, 31, 30
Terrain and land use data	Default TAPM dataset
Data assimilation	No, as nearest met station is approximately 20km from the Project site
Additional run details extracted from TAPM list file	LOCAL HOUR IS GMT+ 9.800000 TIMESTEP SCALING FACTOR = 1.000000 VARY SYNOPTIC WITH 3-D SPACE AND TIME V4 LAND SURFACE SCHEME EXCLUDE NON-HYDROSTATIC EFFECTS INCLUDE PROGNOSTIC RAIN EQUATION EXCLUDE PROGNOSTIC SNOW EQUATION

8.3 CALMET

CALMET (version 6.4.0) was used to derive higher resolution meteorological fields at 200 m resolution over a 20km x 20km modelling domain centred over the facility. CALMET was run in no-observations (NOOBS=2) mode with prognostic output from TAPM (1 km Grid) used as an input to the CALMET model.

The CALMET model settings were in general accordance with the NSW - Environment Protection Agency (NSW-EPA) (formerly Office of Environment and Heritage – OEH) '*Generic Guidance and Optimum Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Australia*' (OEH, 2011).

Details of the CALMET model configuration are outlined in **Table 7**.

Table 7: CALMET Model Configuration

Parameter	Value
CALMET version	Version: 6.4.0
Run dates	01/1/2014 to 31/12/2014
Number of grids cells (NX, NY)	101, 101
Grid spacing (DGRIDKM)	0.2 km
Southwest corner of grid cell (1,1)	XORIGKM = 451.808, YORIGKM = 5413.206
Number of vertical layers	NZ = 12
Height of cell face (m)	*ZFACE = 0, 20, 40, 70, 100, 150, 200, 300, 450, 640, 1200, 2000, 3000*
No Observation Mode	NOOBS = 2 (No surface, overwater, or upper air observations Use MM4/MM5/3D for surface, overwater, and upper air data)
M3D dataset source	TAPM output (1 km grid) converted to M3D dataset using CALTAPM version 7.0.0
Other critical parameters	MCLOUD = 4 ICALM = 0 IPROG = 14 TERRAD = 5 km ZIMIN = ZIMINW = 50 m, ZIMAX = ZIMAXW = 3000 m
GEO.DAT file	Terrain data sourced from SRTM1 (30 m resolution) Land use data: USGS default land use

The geophysical dataset for CALMET contains terrain and land use information for the modelling domain. For this assessment, terrain data for the CALMET grid was extracted from 1- arc second (30m) spaced elevation data obtained via NASA's Shuttle Radar Topography Mission (SRTM) in 2000 (downloaded from USGS website). The land use or land cover data for the modelling domain was derived from USGS Global Land Cover Classification (GLCC). The geotechnical parameters for the land use classification were adopted from the default CALMET corresponding land use categories.

A 3-dimensional representation of the topographical features surrounding the facility over a 20-km x 20-km domain is illustrated in **Figure 9**. Terrain contours covering the CALMET modelling domain are presented in **Figure 10**.

Figure 9: CALMET Terrain – 3D

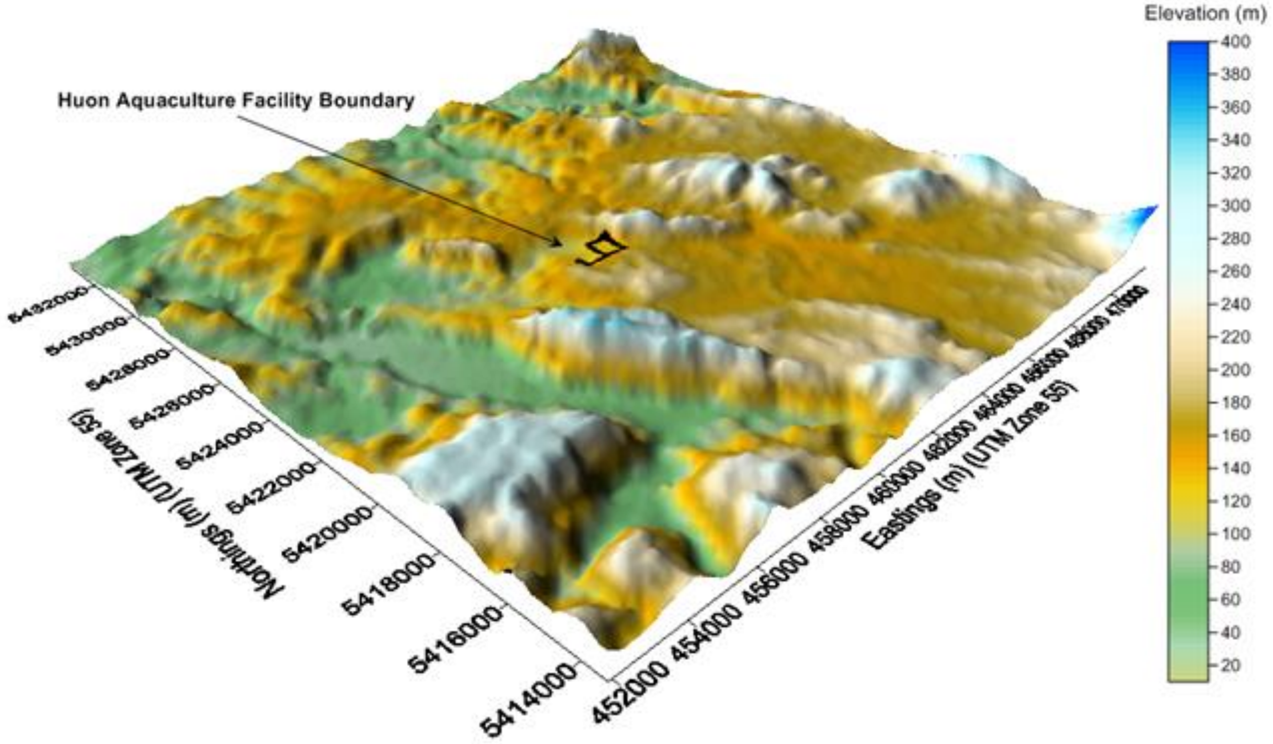
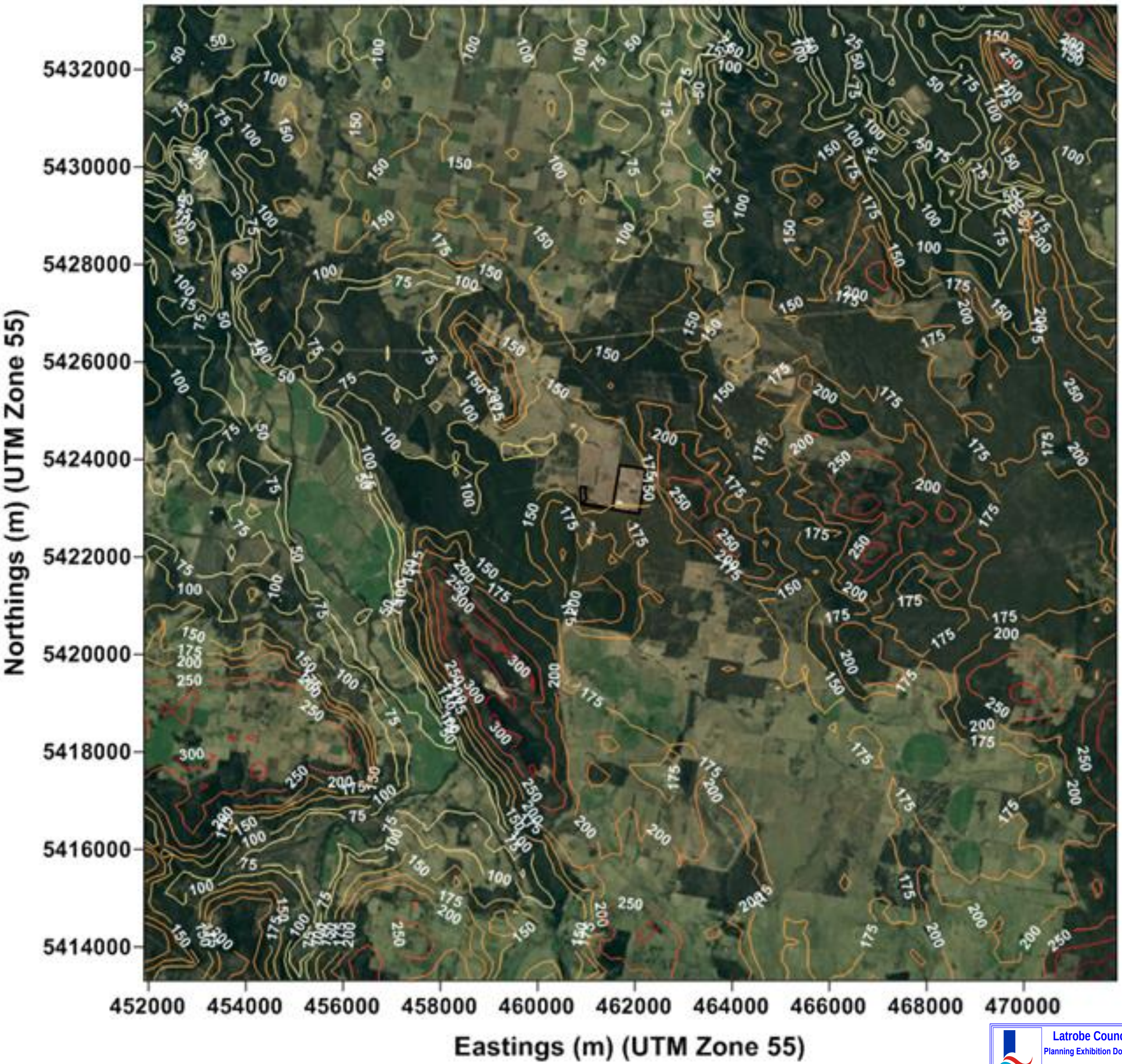


Figure 10: CALMET Terrain – Contours (elevation in meters)

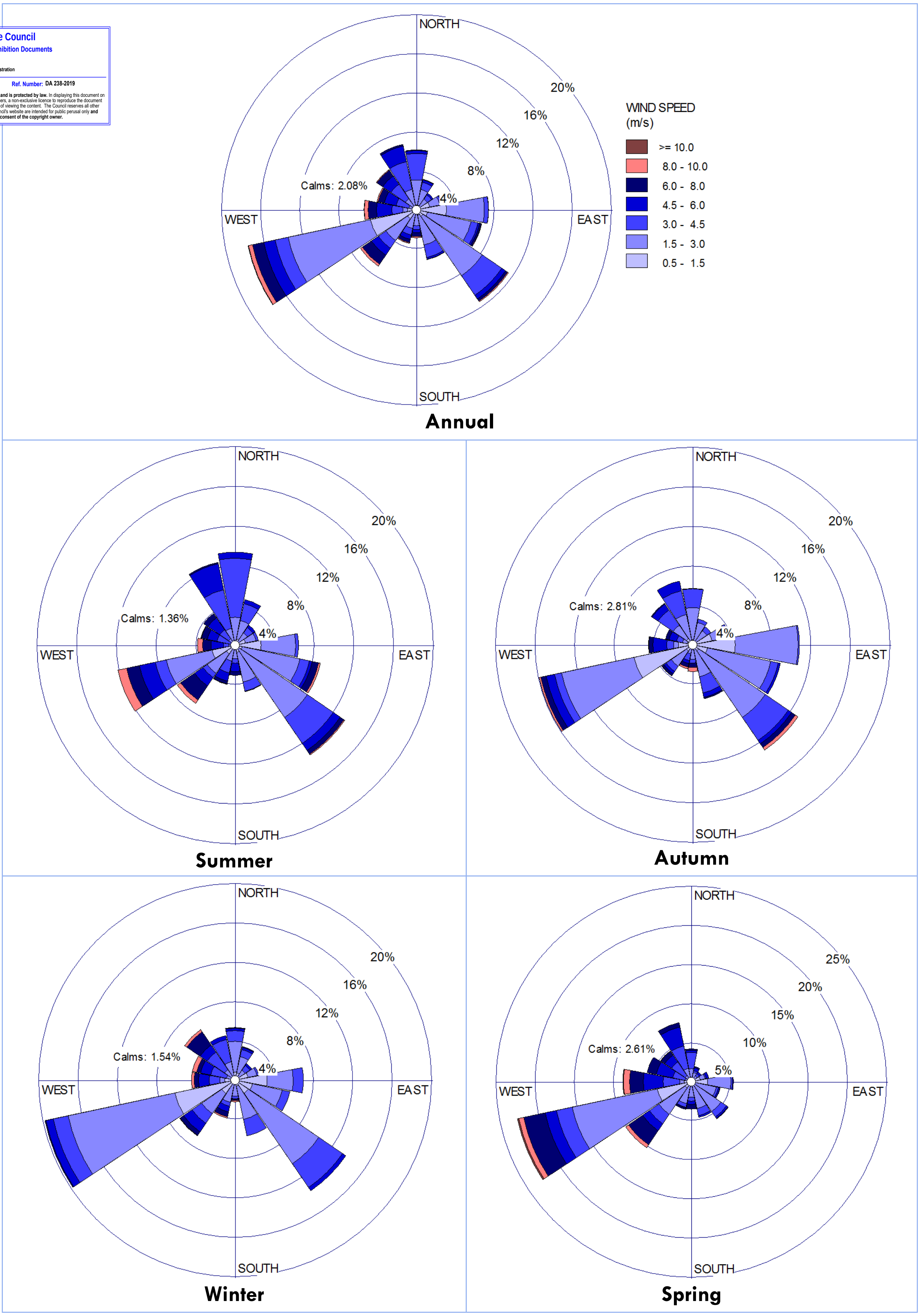


8.4 Modelled Meteorology

Hourly wind speeds and direction for calendar year 2014 were extracted from the CALMET output at the centre of the facility and are visually presented in the form of wind roses in **Figure 11**

Annual wind rose shows winds predominantly from west-southwest and southeast. Winds are usually in low (< 3m/s) to medium speed (3 to 6 m/s). Percentage of hourly calms over the year averages to 2.1%. Seasonal breakdown of wind shows that similarities are observed for the summer, autumn and winter season. Spring shows unusually low frequency of winds from southeast sector.

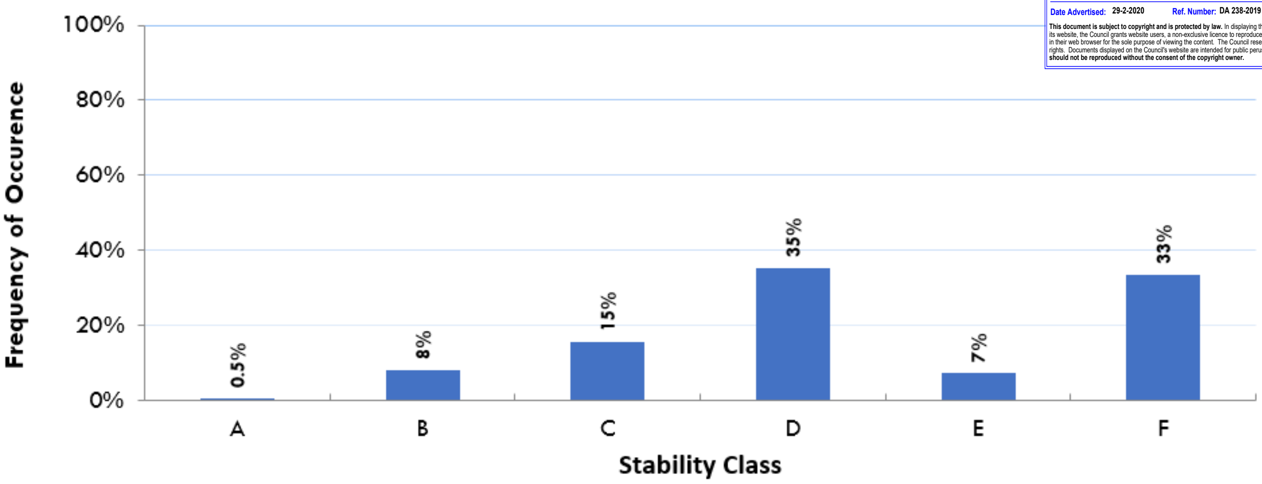
Figure 11: CALMET Predicted Wind Rose –2014



Stability of the atmosphere is determined by a combination of horizontal turbulence caused by the wind and vertical turbulence caused by the solar heating of the ground surface. Stability cannot be measured directly; instead, it must be inferred from available data, either measured or numerically simulated. The Pasquill-Gifford scale defines stability on a scale from A to G, with stability class A being the least stable, occurring during strong daytime sun and stability class G being the most stable condition, occurring during low wind speeds at night. For any given wind speed, the stability category may be characterised by two or three categories depending on the time of day and the amount of cloud present. In meteorological models such as CALMET, the stability classes F and G are combined.

A summary of the numerically simulated hourly stability class data using CALMET for calendar year 2014 is presented in **Figure 12**. A higher frequency of stability class D (35%) and stability class F (33%) was predicted by CALMET at the facility location.

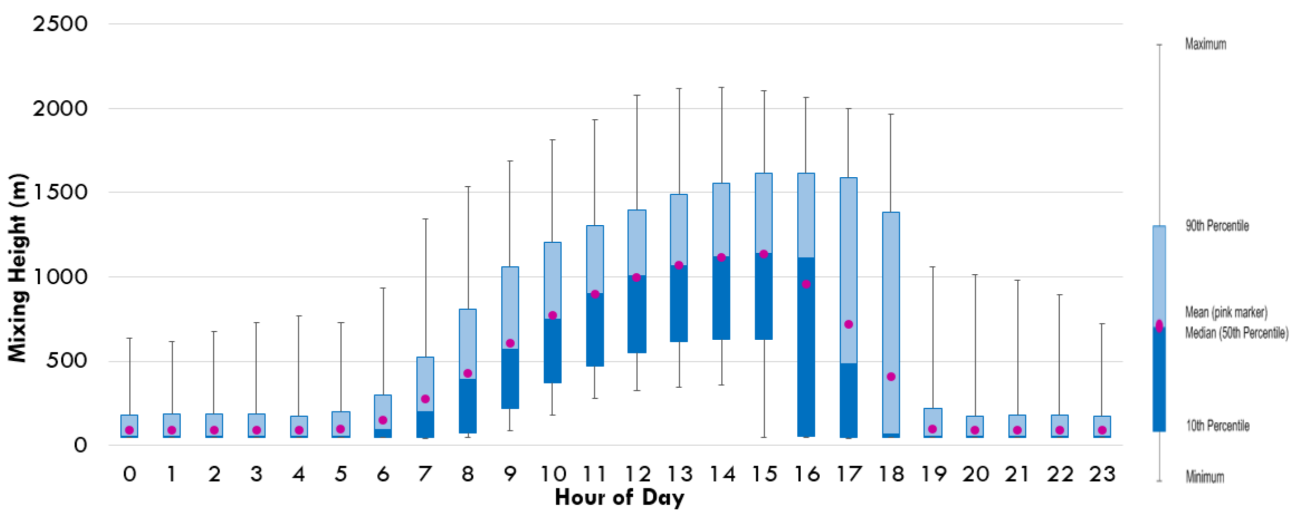
Figure 12: CALMET Predicted Frequency of Stability Class – 2014



The mixing height quantifies the vertical height of mixing in the atmosphere and is a modelled parameter that cannot be measured directly. The mixing height decreases in the late afternoon, particularly after sunset, due to the change from surface heating from the sun to a net heat loss overnight. Low mixing heights typically translate to stagnant air with little vertical motion, while high mixing heights allow vertical mixing and good dispersion of pollutants.

CALMET simulated hourly mixing height data are presented in **Figure 13** showing the mixing height as a function of the hour. The graph represents the typical growth of the boundary layer, whereby the mixing height is generally lowest during the night and into the early morning and highest during the late afternoon

Figure 13: CALMET Predicted Diurnal Variation in Mixing Heights –2014



9. ODOUR DISPERSION MODELLING

To model the odour emissions from the facility, dispersion modelling was undertaken for the calendar year 2014 using the US-EPA CALPUFF dispersion model.

CALPUFF is the dispersion model that calculates the dispersion of plumes within the three-dimensional (3D) meteorological field calculated by CALMET. CALPUFF is a non-steady state US-EPA approved dispersion model, which "advects" puffs of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so, it typically uses the wind fields generated by CALMET. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period (SRC, 2011).

9.1 CALPUFF Configuration

CALPUFF computational domain was set to 20 km by 20 km (full CALMET domain), while the sampling domain was set to be a 6 km x 6 km subset of the computational domain. It is expected that the predicted odour impacts will be contained within the sampling domain of 6 km x 6 km. To increase the accuracy of concentration isopleths, a nesting factor of 4 was used in CALPUFF to predict the odour impacts at 50 m resolution.

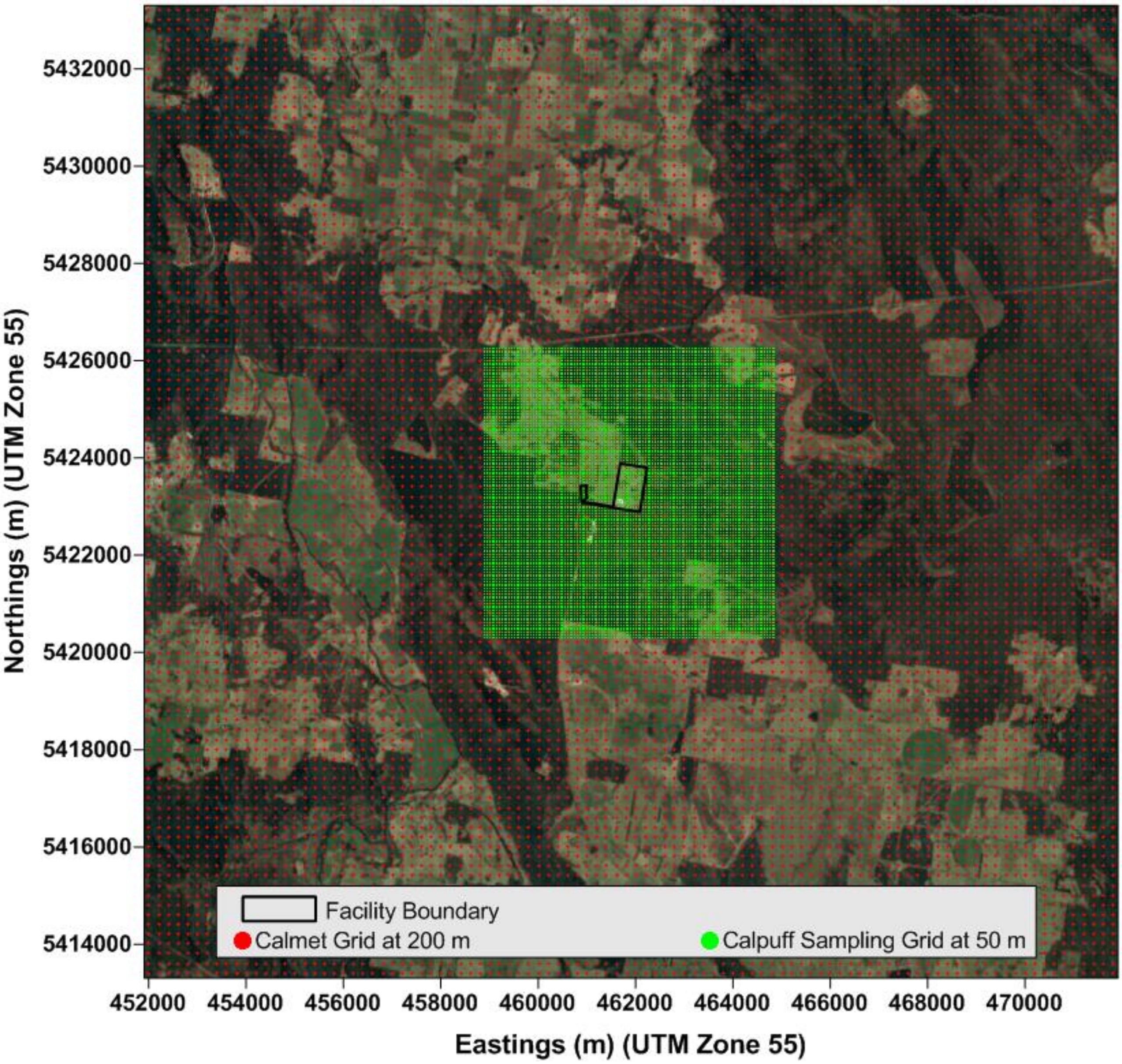
General run control parameters and technical options that were selected in the CALPUFF model are summarised in **Table 8**.

Table 8: CALPUFF Dispersion Model Configuration

Parameter	Value
Calpuff version	Version 6.42
Run dates	01/1/2014 to 01/01/2015
Met grid definition	See CALMET configuration
Computational grid	Full size of meteorological grid (IBCOMP & JBCOMP = 1, IECOMP & JECOMP = 101)
Sampling grid	A subset of computational grid, 6 km x 6 km, centred over Huon facility.
Nesting factor for sampling grid	4 (Sampling grid spacing set at 50 m)
Number of vertical layers	NZ = 12
Height of cell face (m)	*ZFACE = 0, 20, 40, 70, 100, 150, 200, 300, 450, 640, 1200, 2000, 3000*
Dry deposition	No (MDRY = 0)
Wet deposition	No (MWET = 0)
Method used to compute dispersion coefficients	Dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (MDISP = 2)
PDF used for dispersion under convective conditions	Yes (MPDF = 1)
Odour sources modelled as	Area sources

The extents of CALPUFF computational domain (same as CALMET domain) and the CALPUFF sampling domain in reference to the facility boundary are illustrated in **Figure 14**. The red dot represents 200 m grid resolution, whereas finer green dots represents 50 m sampling resolution.

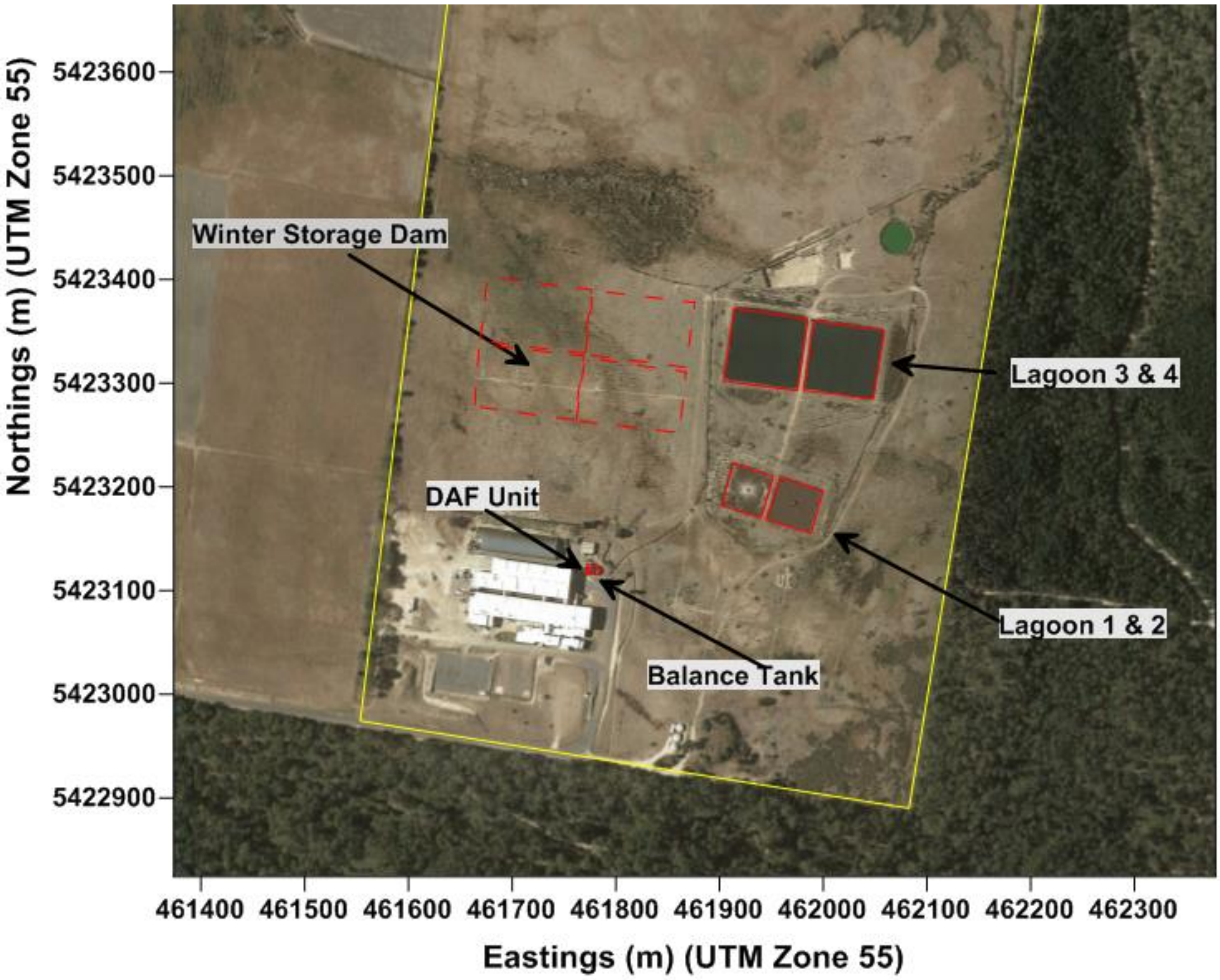
Figure 14: CALPUFF Computational and Sampling Domain



9.2 Source Location

Location of area sources as modelled in CALPUFF are illustrated in figures below. Balance tank, DAF unit, aerated lagoons 1 & 2, non-aerated lagoons 3 & 4 and winter storage dam are illustrated in **Figure 15**. A total of six irrigation areas were modelled as illustrated in **Figure 16**.

Figure 15: Source Location – Balance Tank, DAF Unit, Lagoons and Winter Storage Dam



Sources larger than CALMET resolution (200 m) were broken into multiple area sources to take advantage of the modelled 3-D meteorology. Dotted red outlines show sources that were broken into multiple areas – e.g. area source CP1 was modelled as 12 individual area sources as shown in **Figure 16**.

Area sources in CALPUFF are defined by four easting vertices and four northings vertices. The coordinates of the modelled sources are listed in **Table 9**.

Figure 16: Source Location – Irrigation Areas CP1 through to CP6

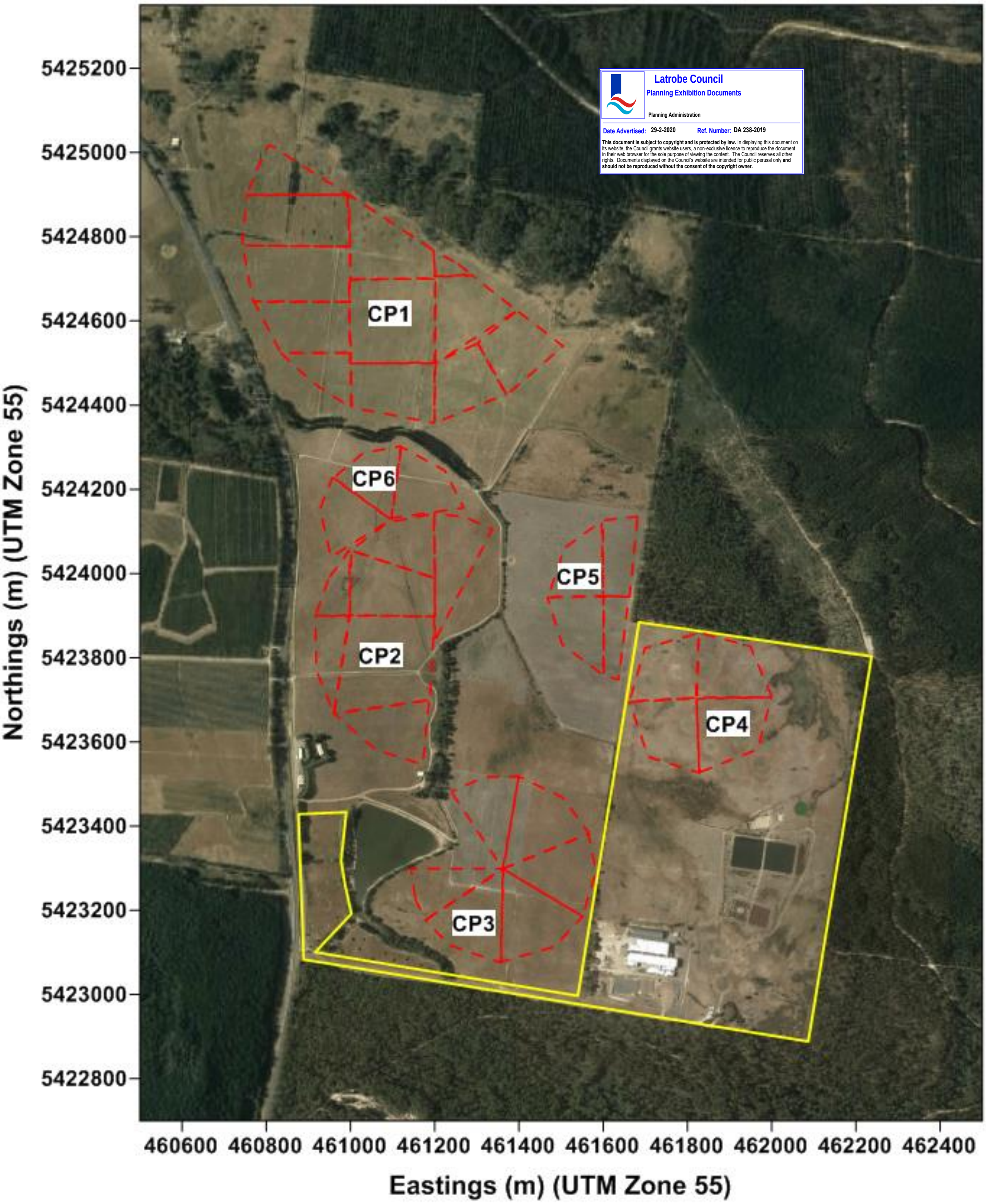


Table 9: Area Source Location – Coordinates of Four Vertices for the Modelled Sources

Source	X1	Y1	X2	Y2	X3	Y3	X4	Y4
Balance Tank	461777.1	5423123.9	461784.5	5423123.6	461784.1	5423115.8	461776.8	5423116.0
DAF unit	461770.6	5423115.7	461771.9	5423124.6	461774.3	5423124.3	461773.0	5423115.8
Aerated Lagoon 1	461903.0	5423183.0	461912.0	5423220.2	461951.0	5423210.0	461939.0	5423170.0
Aerated Lagoon 2	461945.3	5423168.3	461958.8	5423208.8	461999.6	5423195.7	461987.5	5423155.5
Non-Aerated Lagoon 3	461904.2	5423302.3	461914.3	5423372.3	461984.6	5423362.0	461975.1	5423293.0
Non-Aerated Lagoon 4	461980.7	5423293.2	461991.3	5423359.7	462059.4	5423351.1	462047.8	5423284.6
Winter dam	461686.6	5423389.6	461680.2	5423332.8	461767.9	5423324.2	461774.3	5423378.8
Winter dam	461775.8	5423378.5	461772.0	5423326.9	461863.6	5423317.4	461870.0	5423368.9
Winter dam	461769.3	5423324.2	461863.5	5423314.1	461857.7	5423260.9	461764.3	5423271.0
Winter dam	461764.3	5423271.0	461768.6	5423324.9	461680.9	5423332.8	461675.9	5423281.8
Irrigation Area CP1	460807.5	5425018.4	460994.3	5424900.0	460755.1	5424900.0	460775.6	5424954.7
Irrigation Area CP1	460752.8	5424897.7	460743.7	5424779.2	460998.8	5424777.0	460992.0	5424900.0
Irrigation Area CP1	460743.7	5424779.2	460768.7	5424647.1	460998.8	5424644.8	460998.8	5424777.0
Irrigation Area CP1	460771.0	5424644.8	460834.8	5424524.1	461001.1	5424524.1	460996.6	5424644.8
Irrigation Area CP1	460834.8	5424524.1	460910.0	5424453.4	461001.1	5424394.2	461001.1	5424524.1
Irrigation Area CP1	460996.6	5424900.0	461001.1	5424697.2	461201.6	5424701.8	461197.0	5424767.8
Irrigation Area CP1	460996.6	5424699.5	460998.8	5424499.0	461199.3	5424501.3	461201.6	5424699.5
Irrigation Area CP1	461001.1	5424499.0	461003.4	5424394.2	461199.3	5424357.8	461199.3	5424499.0
Irrigation Area CP1	461201.6	5424704.1	461288.2	5424708.6	461395.3	5424624.3	461201.6	5424499.0
Irrigation Area CP1	461201.6	5424501.3	461199.3	5424357.8	461370.2	5424426.1	461301.8	5424546.9
Irrigation Area CP1	461301.8	5424546.9	461370.2	5424423.8	461504.6	5424540.0	461395.3	5424624.3
Irrigation Area CP1	461198.4	5424766.5	461199.5	5424705.8	461288.3	5424710.3	461248.9	5424739.5
Irrigation Area CP2	461199.2	5424142.0	461268.9	5424135.1	461336.8	5424105.4	461200.9	5423842.4
Irrigation Area CP2	461197.4	5424142.0	461087.7	5424121.1	461000.6	5424054.9	461200.9	5423988.7
Irrigation Area CP2	461002.3	5424054.9	460998.8	5423899.9	461199.2	5423898.1	461200.9	5423988.7
Irrigation Area CP2	460916.9	5423899.9	460998.8	5423898.1	460997.1	5424054.9	460948.3	5423988.7
Irrigation Area CP2	460916.9	5423899.9	460918.7	5423770.9	460960.5	5423668.1	460998.8	5423899.9
Irrigation Area CP2	460997.1	5423901.6	461199.2	5423898.1	461188.7	5423699.5	460960.5	5423666.4
Irrigation Area CP2	460960.5	5423668.1	461058.0	5423582.8	461171.3	5423546.2	461187.0	5423699.5
Irrigation Area CP3	461361.2	5423298.8	461399.5	5423518.3	461317.6	5423516.6	461239.2	5423481.7
Irrigation Area CP3	461362.9	5423298.8	461566.8	5423382.4	461504.1	5423467.8	461399.5	5423518.3
Irrigation Area CP3	461361.2	5423298.8	461565.0	5423382.4	461582.5	5423291.8	461551.1	5423185.5
Irrigation Area CP3	461361.2	5423298.8	461551.1	5423185.5	461484.9	5423114.1	461357.7	5423077.5
Irrigation Area CP3	461362.9	5423300.5	461356.0	5423075.8	461234.0	5423117.6	461178.3	5423176.8
Irrigation Area CP3	461143.4	5423298.8	461364.7	5423298.8	461178.3	5423176.8	461153.9	5423227.4
Irrigation Area CP4	461827.8	5423858.7	461699.2	5423823.2	461662.6	5423696.7	461819.4	5423705.1
Irrigation Area CP4	461826.7	5423859.8	461949.0	5423827.4	462000.3	5423707.2	461822.5	5423705.1
Irrigation Area CP4	461821.5	5423701.9	461999.2	5423706.1	461966.8	5423582.8	461827.8	5423527.4
Irrigation Area CP4	461821.5	5423704.0	461828.8	5423526.3	461706.5	5423565.0	461662.6	5423694.6
Irrigation Area CP5	461662.6	5423945.2	461599.9	5423946.9	461599.9	5424126.4	461681.8	5424135.1
Irrigation Area CP5	461599.9	5423946.9	461469.2	5423943.4	461507.5	5424060.1	461596.4	5424124.6
Irrigation Area CP5	461601.6	5423945.2	461599.9	5423758.7	461502.3	5423831.9	461467.5	5423943.4
Irrigation Area CP5	461599.9	5423945.2	461660.9	5423945.2	461636.5	5423748.3	461601.6	5423758.7
Irrigation Area CP6	461098.1	5424131.6	461268.9	5424156.0	461223.6	5424244.8	461120.8	5424300.6
Irrigation Area CP6	461096.4	5424128.1	461119.0	5424302.3	461030.2	5424286.6	460960.5	5424227.4
Irrigation Area CP6	460957.0	5424227.4	460927.4	5424152.5	460953.5	5424039.2	461096.4	5424128.1
Sludge handling	461980.7	5423293.2	461991.3	5423359.7	462059.4	5423351.1	462047.8	5423284.6

Source	X1	Y1	X2	Y2	X3	Y3	X4	Y4
Accidental spills	461772.0	5423118.0	461772.0	5423123.0	461774.0	5423123.0	461774.0	5423118.0

9.3 Modelled Scenarios

To understand predicted odour impacts from the Huon facility on receiving environment, a total of five (5) scenarios were defined. A description of the five scenarios is presented in **Table 10**.

Table 10: Definition of Modelled Scenarios

Scenario	Description
Normal Operations	Representing normal operation of the facility. Does not take into account peak operating hours during Easter and Christmas period. Does not take into account upset conditions.
Worst Emissions and Peak Operating Hours	10% increase in SOER from normal operations to take into account any uncertainties/seasonal variabilities in the odour emission rates. The worst emission scenario also accounts for additional operating hours during the Easter and Christmas peak period
Upset Conditions – Sludge Handling	Normal Operations + Sludge handling operations. It is expected that, once every 10 to 15 years, sludge from each lagoon will be emptied. For the sake of conservatism in modelling, it was assumed that sludge handling will occur every hour of the year.
Upset Conditions – Accidental Spills	Normal Operations + Accidental spill. The occurrence of accidental spills happening is quite low. However, it cannot be ruled out entirely. For the sake of conservatism in modelling, it was assumed that an accidental spill from Balance tank, spread over an area of 10 m^2 occurs every hour of the year.
Mitigated Operations	Analysis of odour emission rate inventory indicated that the bulk of odour emissions were emanating from the DAF unit and the balance tank. Huon Aquaculture is proposing to cover these two sources thereby reducing emissions from these two sources by 25% during operating hours of the facility. It is expected that no emissions will be emitted from Balance Tank and DAF unit during non-operational hours. Emissions from other sources will be same as Normal operations.

A detailed description of adopted odour emission rates and modelled hours for each modelled five scenarios is presented in **Table 11**.

Table 11: Modelled SOERs and Operating Hours – All Modelled Scenarios

Scenario Name / Sources Modelled	Normal Operations	Worst Emissions and Peak Operating hours)	Upset - Sludge Handling	Upset - Accidental Spill	Mitigated Operations
Balance Tank	SOER of 918 OU.m³/m²/sec during operating hours (7 am to 3 pm). Half SOERs during non-operating hours	SOER 110% of Normal, Additional operating hours (21 extra hours before Easter and 43 extra hours during Christmas) when SOER will be 110% of Normal. For rest of the hours SOER will be half. This was fed through an hourly varying input file.	Same as Normal	Same as Normal	SOER 75% of Normal during operating hours (7 am to 3 pm). Zero SOERs during non-operating hours
DAF unit	SOER of 1280 OU.m³/m²/sec during operating hours (7 am to 3 pm). Half SOERs during non-operating hours	SOER 110% of Normal, Additional operating hours (21 extra hours before Easter and 43 extra hours during Christmas) when SOER will be 110% of Normal. For rest of the hours SOER will be half. This was fed through an hourly varying input file.	Same as Normal	Same as Normal	SOER 75% of Normal during operating hours (7 am to 3 pm). Zero SOERs during non-operating hours
Aerated Lagoon 1	SOER of 0.685 OU.m³/m²/sec, constant emissions throughout the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal
Aerated Lagoon 2	SOER of 0.685 OU.m³/m²/sec, constant emissions throughout the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal
Non-Aerated Lagoon 3	SOER of 0.685 OU.m³/m²/sec, constant emissions throughout the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal
Non-Aerated Lagoon 4	SOER of 0.685 OU.m³/m²/sec, constant emissions throughout the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal

Scenario Name / Sources Modelled	Normal Operations	Worst Emissions and Peak Operating hours)	Upset - Sludge Handling	Upset - Accidental Spill	Mitigated Operations
Winter Storage Dam	SOER of 0.05 OU.m³/m²/sec, constant emissions throughout the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal
Irrigation Areas	SOER of 0.014 OU.m³/m²/sec, continuous source, every hour of the day, for five summer months of November through to March. No emissions during rest of the year.	SOER 110% of Normal	Same as Normal	Same as Normal	Same as Normal
Sludge Handling	No emissions	No emissions	SOER of 1 OU.m³/m²/sec over an area of Lagoon 4, SOER to apply every hour of the year	No emissions	No emissions
Accidental Spills	No emissions	No emissions	No emissions	SOER of 1000 OU.m³/m2/sec to apply every hour of the year over an area of 10 m2 near Balance Tank.	No emissions

10. MODELLING RESULTS AND DISCUSSION

SOERs determined from the sampling program and literature studies for the key odour generating sources (refer **Table 5**) at the facility were modelled using the CALPUFF dispersion model. A total of five modelling scenarios (defined in **Table 10**) were modelled using CALPUFF modelling system.

The maximum (reported as 99.5th percentile) 1-hour average odour concentrations from the facility were predicted for the five modelled scenarios and are presented in **Table 12**. The predicted concentrations for the five modelled scenarios are visually presented in the form of a concentration isopleth in **Figure 17** through to **Figure 21**.

It is to be noted that no background odours were considered for this assessment, as there were no nearby sources identified outside the facility site boundary that released odour emissions similar to the odours expected from the assessed sources.

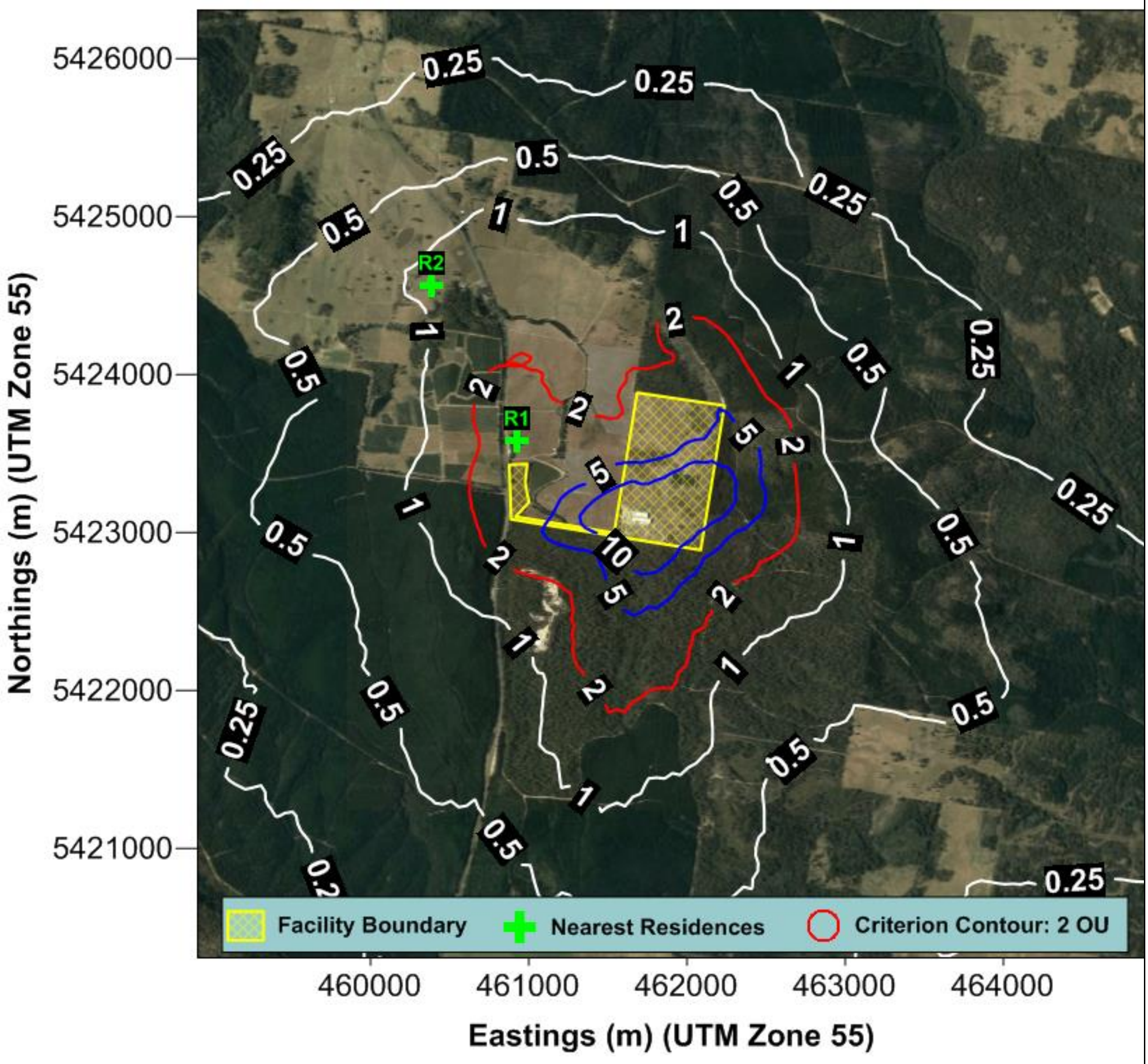
Table 12: Predicted 99.5th Percentile 1-Hour Average Ground Level Odour Concentrations

Scenario	Predicted 99.5th Percentile 1-Hour Average Odour Concentrations (OU)			
	Criterion	R1 (Layton House)	R2	At or Beyond Boundary
Normal Operations	2	3.5	1.1	25.2
Worst Emissions and Peak Operating Hours	2	5.7	1.6	58.7
Upset Conditions – Sludge Handling	2	3.7	1.2	25.7
Upset Conditions – Accidental Spills	2	4.2	1.2	31.9
Mitigated Operations	2	0.96	0.67	12.3

From the odour dispersion modelling results, the following observations can be made:

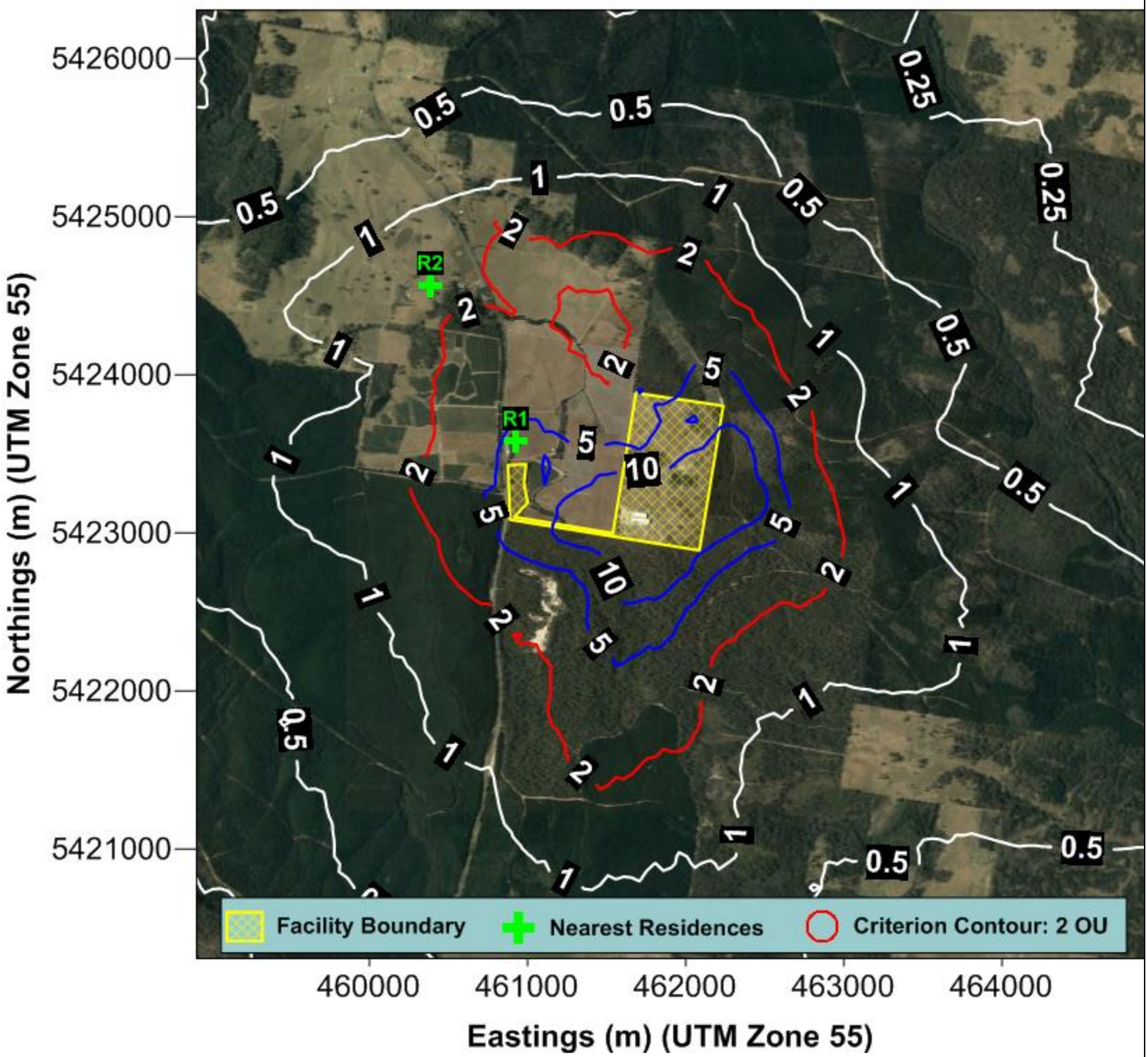
- For all five scenarios, maximum (99.5th percentile) 1-hour average odour concentrations predicted from the modelled SOERs indicate an exceedance of the odour assessment criteria, as the criteria contour of 2 OU is predicted outside the site boundary of the facility.
- For all five scenarios, upon a closer inspection of the concentration isopleth, it is observed that the majority of the 2 OU assessment criteria contour extent outside facility boundary is predicted on the Layton land, permanent timber production zones and private timber reserves.
- As the land-use is zoned for timber production and reserves and considering that there are no existing / proposed residential dwellings in that impacted area, it is very unlikely that the facility's operations would cause odour nuisance to any human beings outside the facility boundary, despite modelling suggesting the assessment criteria exceeding the site boundary.
- For the Mitigated Operations scenario, predicted 1-hour average odour concentrations at both sensitive receptors are below odour assessment criteria of 2 OU.

Figure 17: Normal Operations - Predicted Maximum 1-Hour Average Odour Concentrations



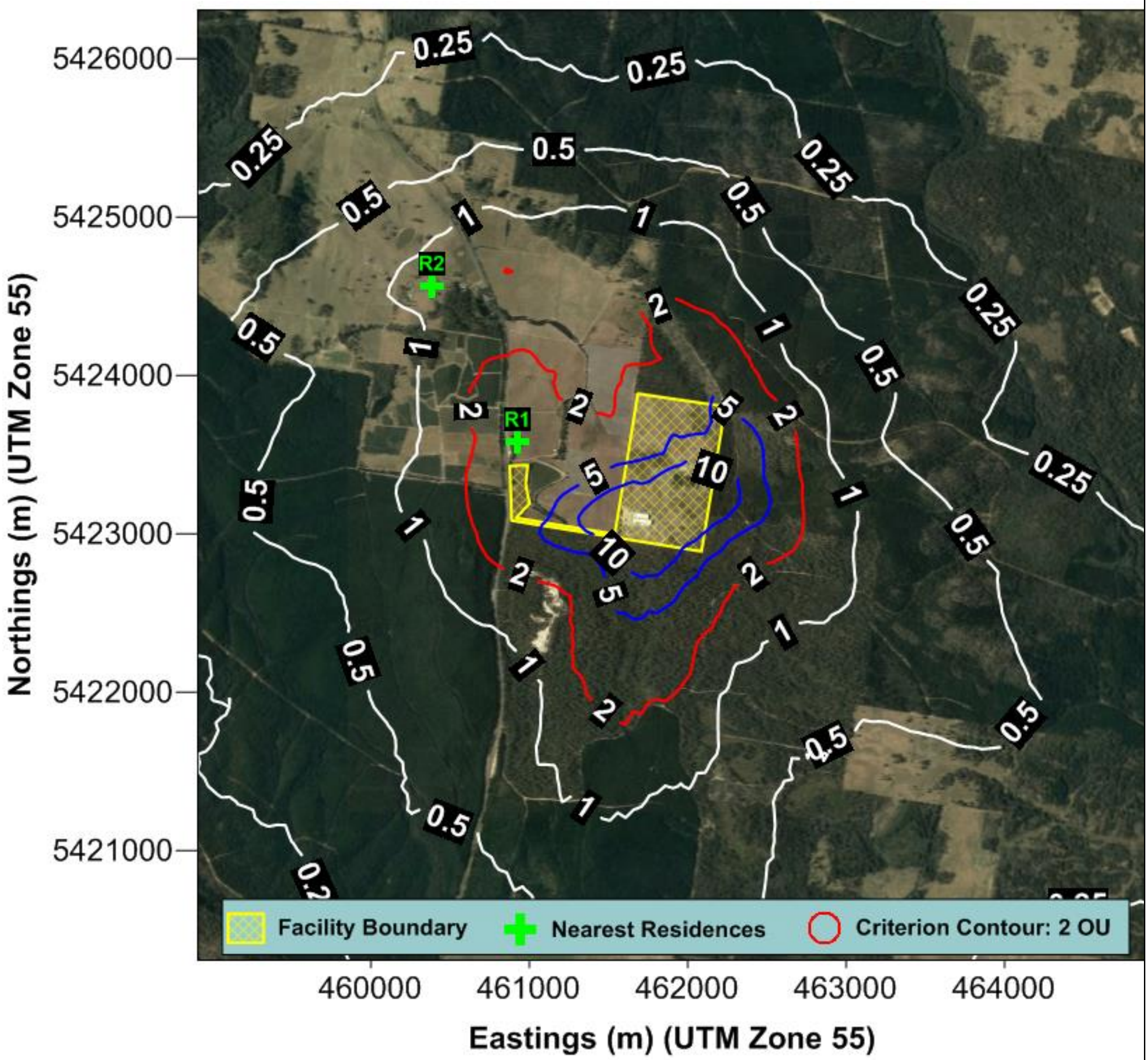
Scenario: Normal Operations	Site Boundary: Yellow Outline
Included Sources: Balance Tank, DAF, Aerated Lagoons 1 & 2, Non-Aerated Lagoons 3 &4, Winter Storage Dam, Irrigation areas	Included Receptor: 2, Green Markers
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Modelling Run Dates: 01/01/2014 to 31/12/2014
Computational Grid Resolution: 200 m	Sampling Grid Resolution: 50 m
Pollutant: Odour	Units: OU
Percentile Level: 99.5th Percentile	Averaging Period: 1- Hour
Criterion Contour: 2 OU (Red Contour)	Other Contours: Blue (> 2 OU), White (< 2 OU)
Maximum At or Beyond site Boundary: 25.2 OU	**Maximum Concentration at Receptor R1: 3.5 OU**

Figure 18: Worst Emissions & Peak Operating Hours - Predicted Maximum 1-Hour Average Odour Concentrations



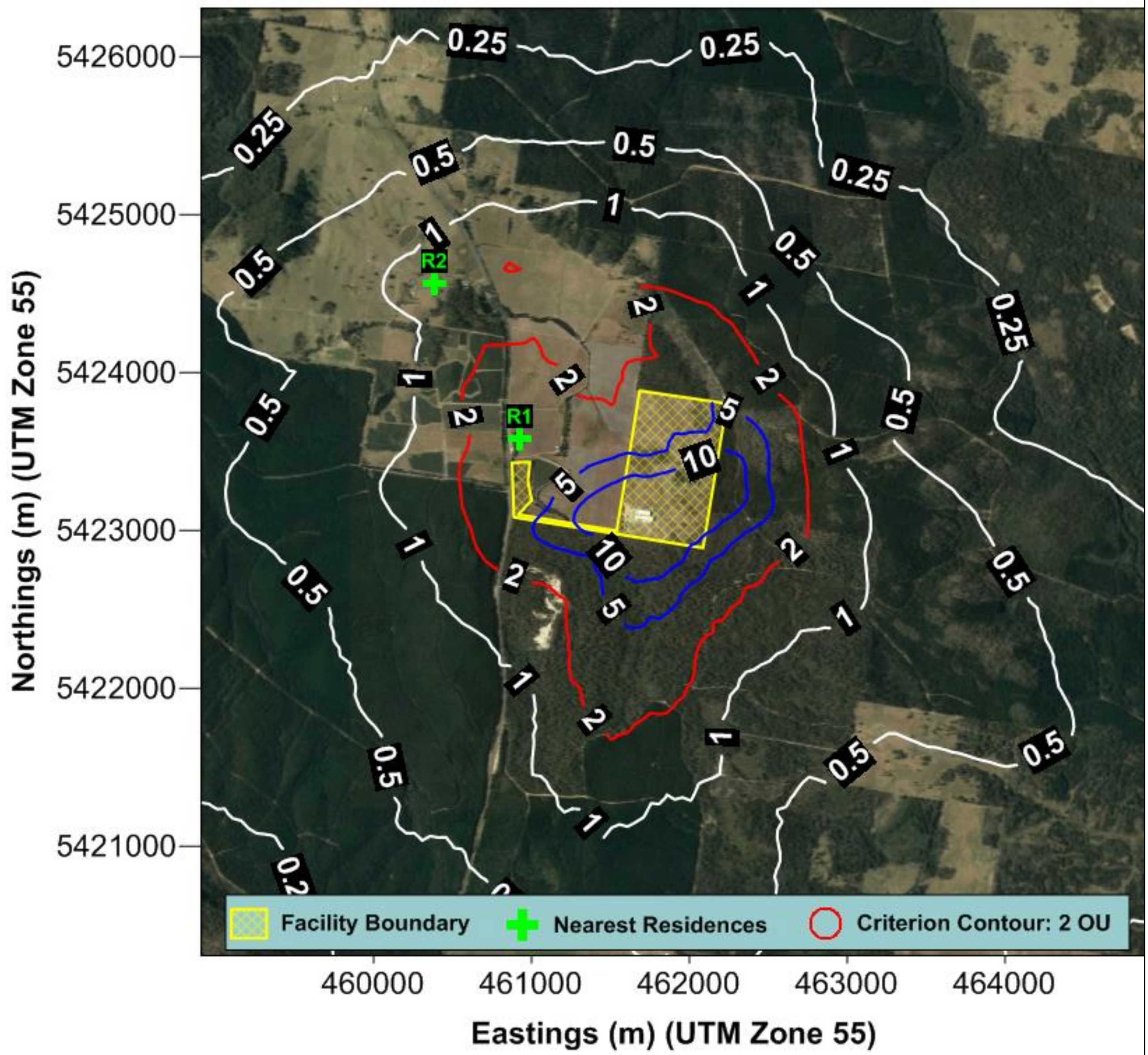
Scenario: Worst Emissions & Peak Operating Hours	Site Boundary: Yellow Outline
Included Sources: Balance Tank, DAF, Aerated Lagoons 1 & 2, Non-Aerated Lagoons 3 &4, Winter Storage Dam, Irrigation areas	Included Receptor: 2, Green Markers
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Modelling Run Dates: 01/01/2014 to 31/12/2014
Computational Grid Resolution: 200 m	Sampling Grid Resolution: 50 m
Pollutant: Odour	Units: OU
Percentile Level: 99.5th Percentile	Averaging Period: 1- Hour
Criterion Contour: 2 OU (Red Contour)	Other Contours: Blue (> 2 OU), White (< 2 OU)
Maximum At or Beyond site Boundary: 58.7 OU	**Maximum Concentration at Receptor R1: 5.7 OU**

Figure 19: Upset Conditions – Sludge Handling (Normal Operations + Sludge Handling) - Predicted Maximum 1-Hour Average Odour Concentrations



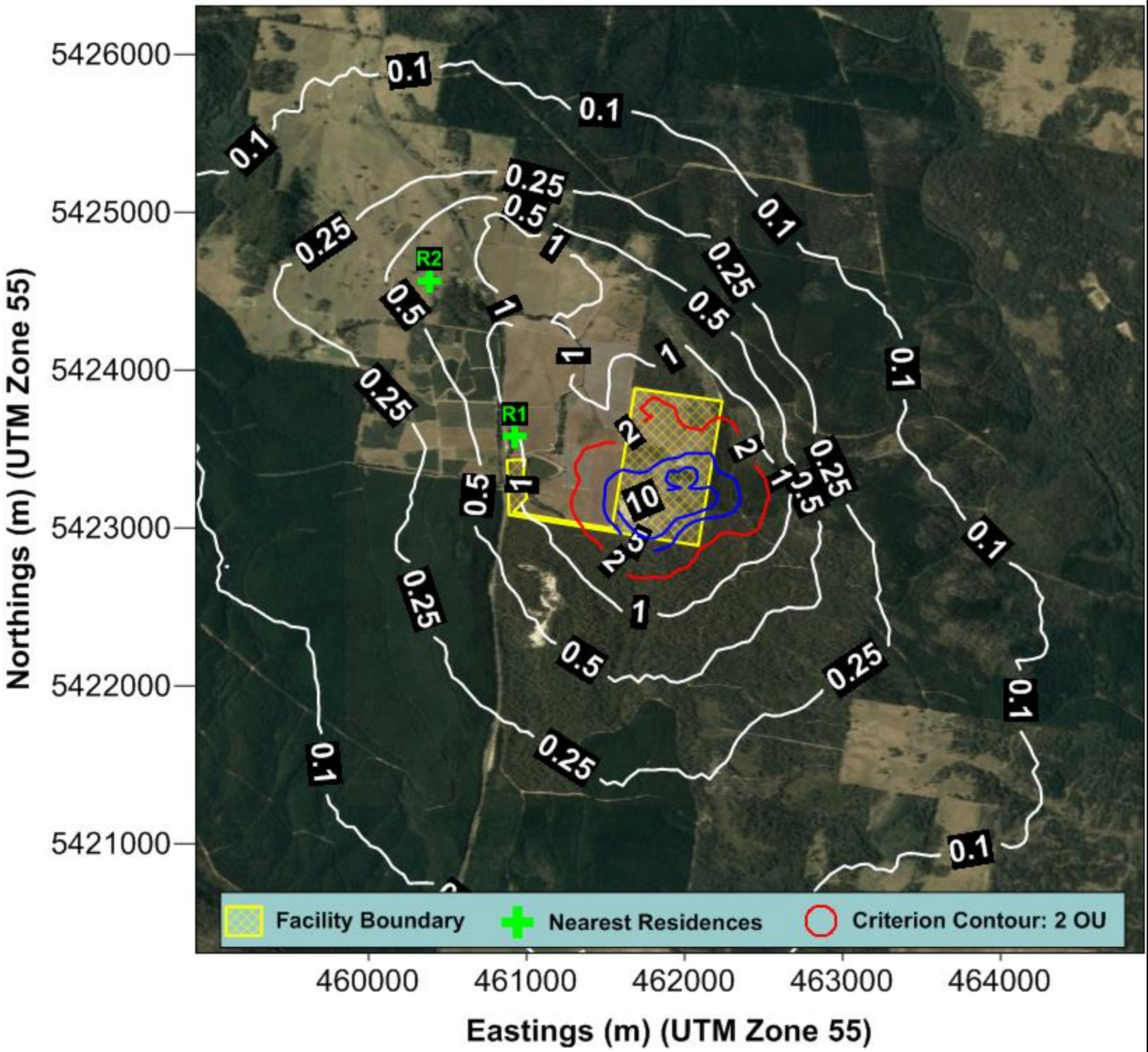
Scenario: Upset Conditions – Sludge Handling (Normal Operations + Sludge Handling)	Site Boundary: Yellow Outline
Included Sources: Balance Tank, DAF, Aerated Lagoons 1 & 2, Non-Aerated Lagoons 3 &4, Winter Storage Dam, Irrigation areas, Sludge Handling	Included Receptor: 2, Green Markers
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Modelling Run Dates: 01/01/2014 to 31/12/2014
Computational Grid Resolution: 200 m	Sampling Grid Resolution: 50 m
Pollutant: Odour	Units: OU
Percentile Level: 99.5th Percentile	Averaging Period: 1- Hour
Criterion Contour: 2 OU (Red Contour)	Other Contours: Blue (> 2 OU), White (< 2 OU)
Maximum At or Beyond site Boundary: 25.7 OU	**Maximum Concentration at Receptor R1: 3.7 OU**

Figure 20: Upset Conditions – Accidental Spills (Normal Operations + Accidental Spills) - Predicted Maximum 1-Hour Average Odour Concentrations



Scenario: Upset Conditions – Accidental Spills (Normal Operations + Accidental Spills)	Site Boundary: Yellow Outline
Included Sources: Balance Tank, DAF, Aerated Lagoons 1 & 2, Non-Aerated Lagoons 3 &4, Winter Storage Dam, Irrigation areas, Accidental spills	Included Receptor: 2, Green Markers
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Modelling Run Dates: 01/01/2014 to 31/12/2014
Computational Grid Resolution: 200 m	Sampling Grid Resolution: 50 m
Pollutant: Odour	Units: OU
Percentile Level: 99.5th Percentile	Averaging Period: 1- Hour
Criterion Contour: 2 OU (Red Contour)	Other Contours: Blue (> 2 OU), White (< 2 OU)
Maximum at or Beyond site Boundary: 31.9 OU	**Maximum Concentration at Receptor R1: 4.2 OU**

Figure 21: Mitigated Operations (Covered Balance Tank & DAF Unit) - Predicted Maximum 1-Hour Average Odour Concentrations



Scenario: Mitigated Operations (Covered Balance Tank & DAF Unit)	Site Boundary: Yellow Outline
Included Sources: Balance Tank, DAF, Aerated Lagoons 1 & 2, Non-Aerated Lagoons 3 &4, Winter Storage Dam, Irrigation areas	Included Receptor: 2, Green Markers
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Modelling Run Dates: 01/01/2014 to 31/12/2014
Computational Grid Resolution: 200 m	Sampling Grid Resolution: 50 m
Pollutant: Odour	Units: OU
Percentile Level: 99.5th Percentile	Averaging Period: 1- Hour
Criterion Contour: 2 OU (Red Contour)	Other Contours: Blue (> 2 OU), White (< 2 OU)
Maximum At or Beyond site Boundary: 12.3 OU	**Maximum Concentration at Receptor R1: 0.96 OU**

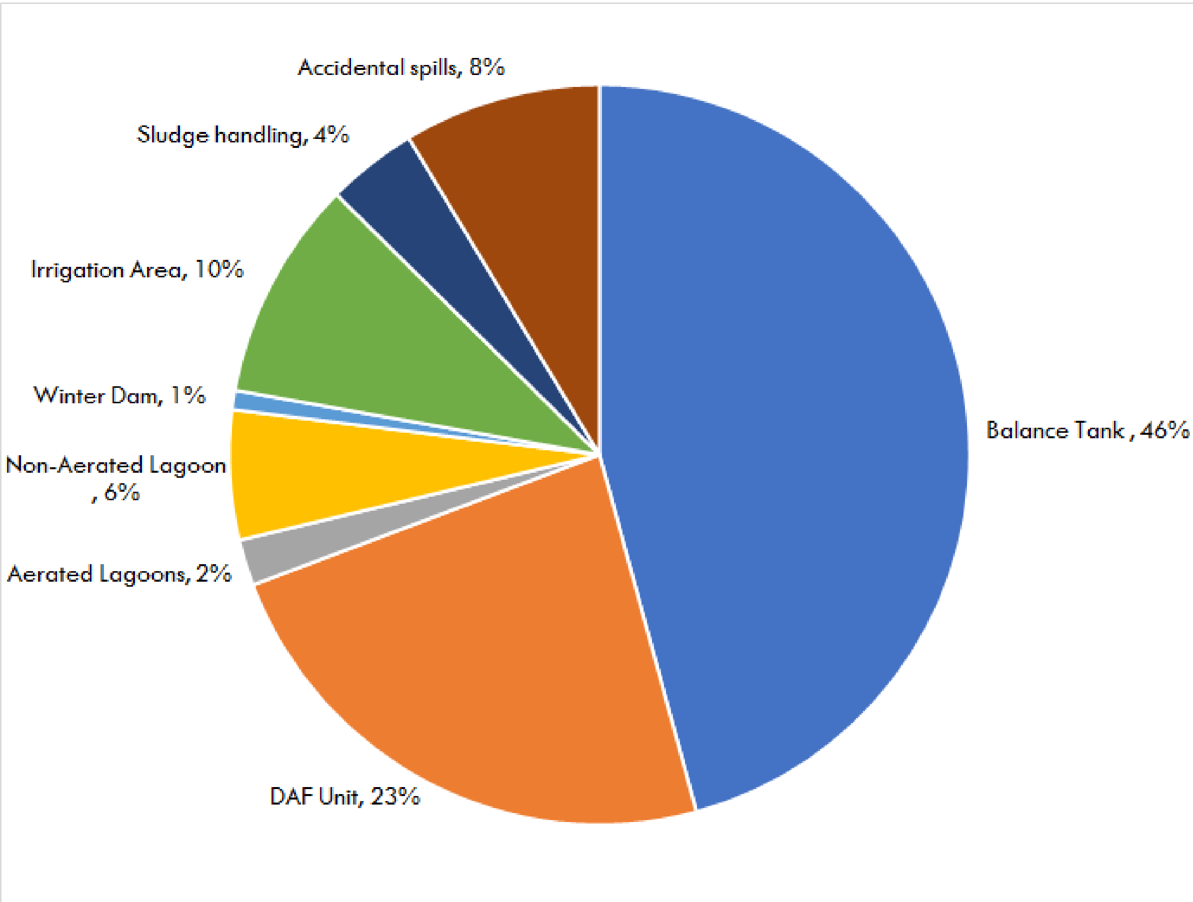
10.1 MITIGATION OF ODOUR IMPACTS

The four scenarios modelled (out of a total of five) are related to unmitigated emission rates from the facility. The fifth scenario (mitigated operations) relates to covering of the Balance tank and DAF unit.

The results of all five scenarios demonstrated non-compliance of the 2 OU criterion at or beyond facility boundary. HA is committed to minimise odour impacts from facility as much as possible (economically feasible) and as such, a business case was made to mitigate the worst offending sources.

A breakdown of the odour emissions from the facility (normal operations scenario) is shown in **Figure 22**. As can be seen, the Balance Tank and the DAF unit contribute to almost 70% of the total facility emissions. Mitigating odours emanating from these two units would lead to significant improvements in the odour impacts. Hence, HA is proposing to cover these two units to minimise the odour emissions.

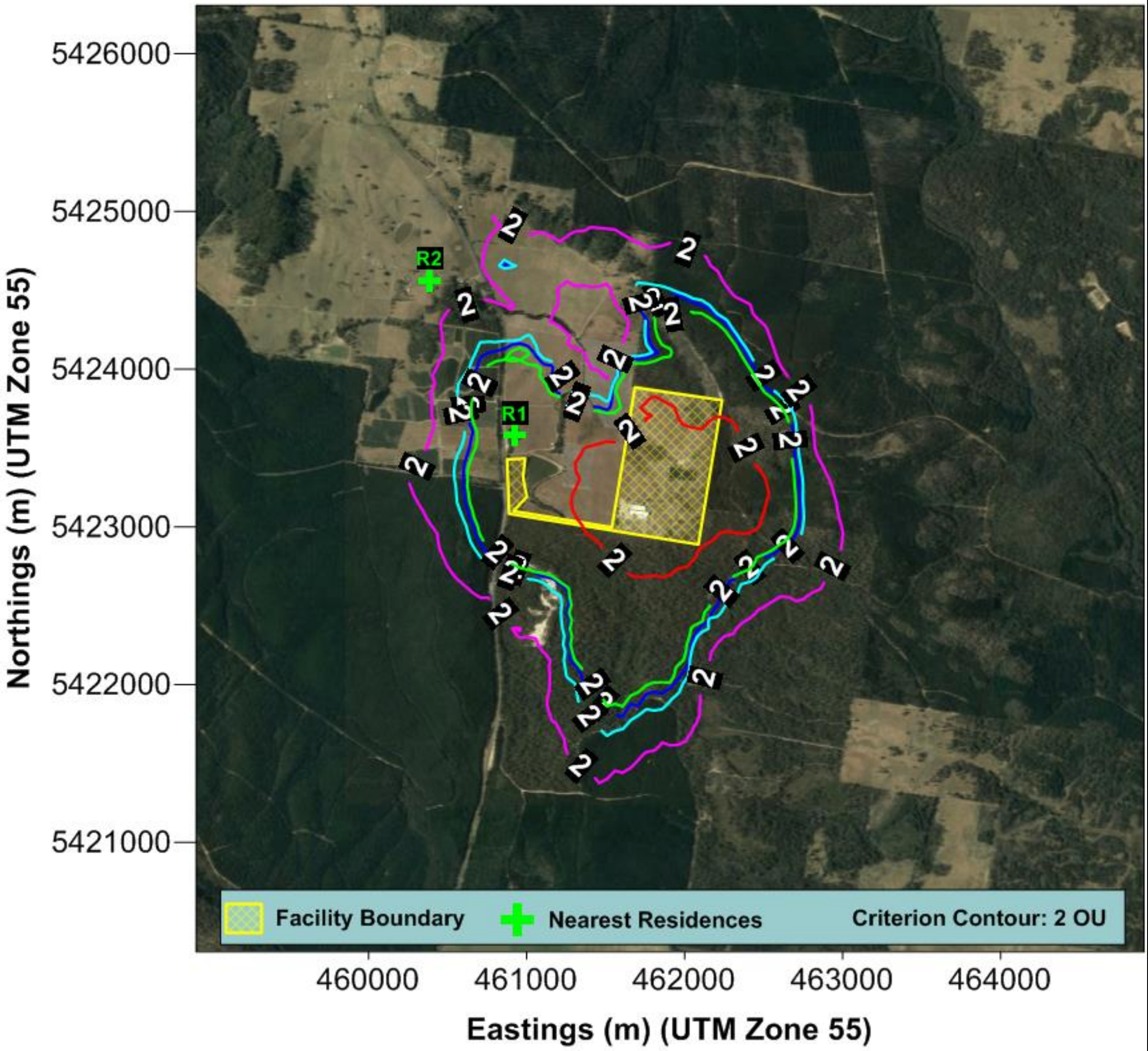
Figure 22: Individual Source Contribution – Breakdown of Total Odour Emissions from the Facility



The comparison of predicted impacts from the five modelled scenarios is visually illustrated in **Figure 23**. For the ease of visual comparison, only criterion contour 2 OU is presented. It can be seen that, for the mitigated operations scenario, the extent of exceedance outside facility boundary is significantly reduced to approximately 25 m outside facility boundary in south and to approximately 40 m outside facility boundary in east and west direction.

It is noted, that the improvements predicted by dispersion model for the fifth modelling scenario (mitigated operations) may be under-estimated as it was conservatively assumed that covering the Balance Tank and DAF unit will only lead to 25% reduction in emission rates during the operating hours of the facility (7 am to 3 pm).

Figure 23: Comparison of Predicted Impacts – All Five Modelled Scenarios



Scenarios Presented: • Normal Operations • Worst Emissions and Peak Operating Hours • Upset Conditions Sludge Handling • Upset Conditions Accidental Spills • Mitigated Operations	**Concentration Isopleth Presented: 2 OU Only (Varying colours)** • Normal Operations – **Green** • Worst Emissions and Peak Operating Hours - **Magenta** • Upset Conditions Sludge Handling - **Blue** • Upset Conditions Accidental Spills – **Cyan** • Mitigated Operations - **Red**
Model used: TAPM V4.0.5, CALMET 6.4.0, CALPUFF 6.42	Included Receptor: 2, Green Markers
Computational Grid Resolution: 200 m	Modelling Run Dates: 01/01/2014 to 31/12/2014
Odour Criteria: 2 OU	Sampling Grid Resolution: 50 m
Pollutant: Odour	Averaging Period: 1- Hour
Percentile Level: 99.5th Percentile	Site Boundary: Yellow Outline

11. CONCLUSION

Airlabs were commissioned by Caloundra Environmental on behalf of HA to undertake an odour impact assessment for HA's Parramatta Creek fish processing facility (the facility) at Lot 1, 7218 Bass Highway, Sassafras, Tasmania 7307.

The current production rate of the facility is approximately 25,000 tpa and HA are proposing to increase the production rates to approximately 33,000 tpa. Additionally, HA is proposing to construct a 75 ML winter storage dam on the facility to store treated wastewater prior to irrigation. HA is also proposing to expand the extent of current irrigation areas to include additional 124 ha irrigation land.

To determine odour impacts on the receiving environment from the proposed increase, an odour impact assessment was required which formed the scope of works for Airlabs. To determine odour impacts from the proposed increase in production, the following tasks were undertaken:

- Identifying key odour generating sources at the facility.
- Determination of relevant assessment criteria.
- Development of site-specific meteorology using the combination of TAPM/CALMET models.
- Determination of odour emissions through site-specific odour sampling and literature review.
- Identification of sensitive receptors and characterisation of the facility and the surrounding environment including topography and land-use.
- Dispersion modelling of the facility's odour emissions using the US-EPA CALPUFF dispersion model.
- Comparing predicted ground-level odour concentrations with assessment criteria to check for compliance.

Specific odour emission rates (SOERs) for the key odour generating sources (Balance tank, DAF unit, Aerated and Non aerated lagoons) at the facility were determined through site-specific odour sampling undertaken on 01 November 2017. The SOERs for the proposed winter storage dam and irrigation area were sourced from literature.

To determine odour impacts from the estimated SOERs, odour dispersion modelling was undertaken using the US-EPA CALPUFF dispersion model for the 2014 calendar year. Meteorological modelling was undertaken using a combination of the TAPM/CALMET models.

Four unmitigated scenarios (Normal operations, worst emissions combined with peak operating hours, and two upset scenarios related to accidental spills and sludge handling) and one mitigated scenario (covering the Balance tank and DAF unit) were modelled.

For all five modelled scenarios, the maximum predicted (99.5th percentile) 1-hour average odour concentrations demonstrate an exceedance of the odour assessment criteria, as the criteria contour of 2 OU is predicted outside the site boundary of the facility. However, a clear improvement in odour impacts was predicted for the mitigated scenario.

Upon a closer inspection of the concentration isopleths for the mitigated operation scenario, it is observed that the extent of exceedances of the 2 OU isopleth outside the facility boundary is limited to a maximum of 25 m in south direction and 40 m in east and west direction. No exceedance is expected in north direction as there is sufficient buffer distance between the source locations and the facility boundary.

As the land-use south and east of the Huon facility is zoned for timber production and reserves and considering that there are no existing / proposed residential dwellings in that impacted area, it is unlikely that the facility's operations would cause offensive odours especially for the mitigated operations scenario, despite modelling suggesting the assessment criteria exceeding the site boundary.

At the nearest identified sensitive receptor R1 (Layton house), the maximum predicted odour concentration ranges from 0.96 OU (mitigated operations scenario) to 5.7 OU (Worst emissions and peak hours scenario).

It is noted that the facility has not received any odour complaints despite being operational over a number of years.

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