Tooheys Brewery
Wastewater Treatment Plant
Environmental Assessment

221580

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Contents

Appendices

Glossary of terms and abbreviations

ALARP	As low as reasonably practical
ARI	Average recurrence interval (measured in years) is a term used to describe flood frequency. It is the long-term average number of years between floods of a certain magnitude. For example, a 100-year ARI flood is a flood that occurs or is exceeded on average once every 100 years.
BOD_5	Biochemical Oxygen Demand is a measure of the quantity of oxygen used by microorganisms such as aerobic bacteria in the oxidation of organic content present in the wastewater. The subscript '5' indicated the measure is taken for a period of 5 days
BOM	Bureau of Meteorology
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalents is a measure of all global warming gases converted to carbon dioxide based on global warming potential
CH_4	Methane
COD	Chemical Oxygen Demand is a measure of the total amount oxygen from both organisms and inorganic matter present in the wastewater. It is a measure of the total quantity of oxygen required to oxidise all organic material into carbon dioxide and water
dB	Decibel, a logarithmic unit of sound intensity.
dB(A)	A-weighted sound pressure level in decibels. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds.
DP&I	NSW Department of Planning and Infrastructure (former Department of Planning).
EA	Enviromental Assessment
EPL	Environmental Protection Licence issued under S. 308 of the Protection of the Environment Operations Act 1997.
GJ	Gigajoule
HAZOP	Hazard and operability study
HIPAP	Hazardous Industry Planning Advisory Papers
kL	kilo litres
LAeq	Equivalent continuous level. When a noise varies over time, the Leq is the equivalent continuous sound that would contain the same sound energy as the time varying sound.
MWh	Megawatt hour
N_2O	Nitrous oxide (a global warming gas)
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
OEH	NSW Office of Environment and Heritage (former Department of Environment and Climate Change and Water).
pH	A measure of acidity or basicity
PM_{10}	Particulate matter (diameter less than 10μm)
Scope 1 GHG emissions	Direct emissions of greenhouse gases on site

Scope 2 GHG emissions	Indirect greenhouse gas emissions associated with consumption of electricity
SPS	Sewage Pumping Station
TJ	Terajoule
Wort	The liquid extracted from the mashing process during the brewing of beer
WWTP	Wastewater Treatment Plant

Executive summary

In July 2006, Tooheys Brewery received single site wide planning approval from the NSW Department of Planning under Part 3A of the Environmental Planning and Assessment Act, 1979. The approval was granted for the major upgrade of the brewery known as Project Key as well as site wide approval for ongoing operations at the brewery.

Tooheys are now seeking a modification to the existing approval, under Section 75W of the Environmental Planning and Assessment Act to install a wastewater treatment plant at the site.

Sydney Water has directed Tooheys to improve the quality of its liquid trade waste under a new trade waste agreement which will likely be in force from August 2014.

In order to improve the liquid wastewater quality, Tooheys propose to install a wastewater treatment plant on site designed to treat an average flow of 2,400 kL of wastewater per day with a maximum daily peak of 3,240 kL. The plant will treat raw wastewater via a two stage process to improve prior water quality to discharge to Sydney Water's trade waste system.

The proposed process is divided into two stages:

- Stage 1 – Primary treatment (Anaerobic)
- Stage 2 – Secondary treatment (Aerobic)

Within Stage 2 there are two potential treatment methods:

- Membrane bioreactor; or
- Dissolved air flotation.

The decision to adopt membrane bioreactor or dissolved air flotation technology will depend upon the outcomes of the final feasibility stage. Both options have been considered within this assessment.

In addition the WWTP will produce approximately 4,400 m^3 of biogas per day which is proposed to be combusted within an existing boiler on site. The use of the biogas will supply approximately 12% of the site's thermal energy requirements, significantly reducing the need to import natural gas

An assessment of potential environmental impacts has been undertaken including consideration of:

- Water quality
- Traffic
- Flooding
- Noise
- Air quality
- Hazard and risk

- Odour
- Resource consumption (energy and water)
- Greenhouse gas emissions
- Waste

All impacts were found to be insignificant, low or moderate with the exception of energy and greenhouse gas which were found to have a net benefit. Low and moderate risks were found to be within acceptable limits and able to be further mitigated with the implementation of management measure.

1 Introduction

Tooheys Pty Ltd is part of the Lion Nathan group which operates breweries in Brisbane, Adelaide, Perth and New Zealand.

The Tooheys Brewery at Lidcombe has been in operation since 1955 and was initially used as a packaging facility. Brewing commenced at the site in 1978. The brewery has undergone several small scale upgrades during this time, and a major plant upgrade in 2007.

Tooheys now proposes to install a wastewater treatment plant (WWTP) and new cooling tower at the site, which is not currently covered by the site wide approval granted from the then NSW Department of Planning (DoP) under Part 3A of the Environmental Planning and Assessment Act, 1979.

1.1 Overview of project

Tooheys generates approximately 2,000 kL per day of wastewater which is currently discharged into Sydney Water's sewer system under a Sydney Water Trade Waste Agreement.

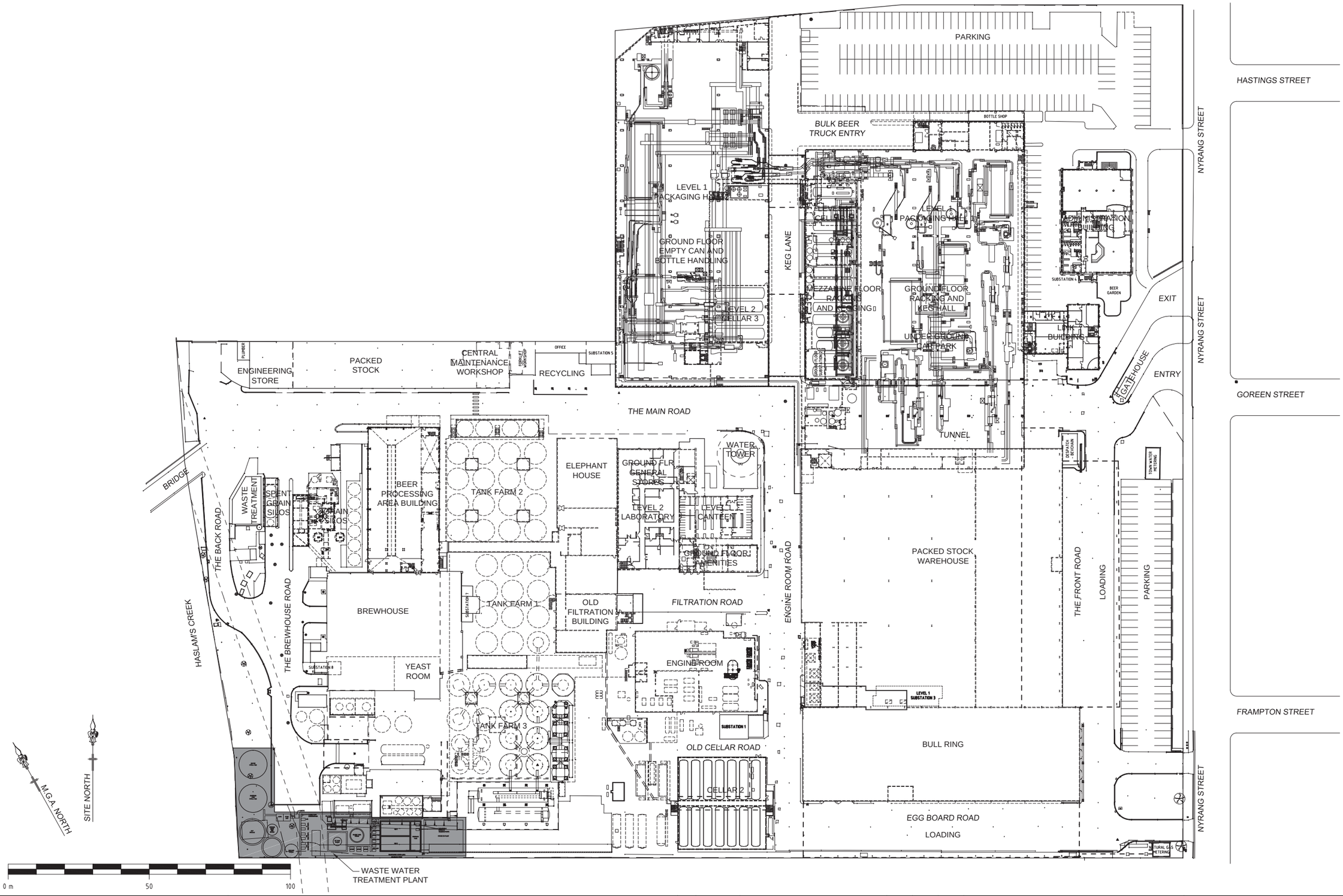
In 2009 Sydney Water undertook an investigation for its Sewage Pumping Station (SPS) No 67 Catchment into which Tooheys discharges. As a result of this investigation, Sydney Water declared the sewerage system upstream of SPS 67 to be corrosion impacted. Tooheys (and other trade waste customers within the SPS 67 catchment) have to meet more stringent standards for effluent quality discharged into Sydney Water's sewerage system.

In order to meet these standards, Tooheys proposes to install a WWTP, to be located on the rear boundary in the rear corner of the site adjacent to Haslams Creek and industrial neighbours as shown in Figure 1 below. The WWTP will be designed to treat an average of 2,400kL per day and a peak flow of 3,240kL per day.

1.2 Legislative context

In July 2007, Tooheys Brewery received single site wide planning approval from the then NSW Department of Planning under Part 3A of the Environmental Planning and Assessment Act, 1979 for the Project Key upgrade as well as ongoing operations at the brewery.

Approval for the installation of a new WWTP and cooling tower was sought from the Department of Planning and Infrastructure (DP&I) under Section 75W of the Environmental Planning and Assessment Act, 1979. Upon consultation with DP&I, the recommendations Arup put forward in the Preliminary Environmental Assessment have been accepted in place of the Director General Requirements for this Environmental Assessment. These recommendations are included in full as Appendix A.



REFERENCE DRAWINGS	
DRAWING No.	TITLE

GENERAL NOTES

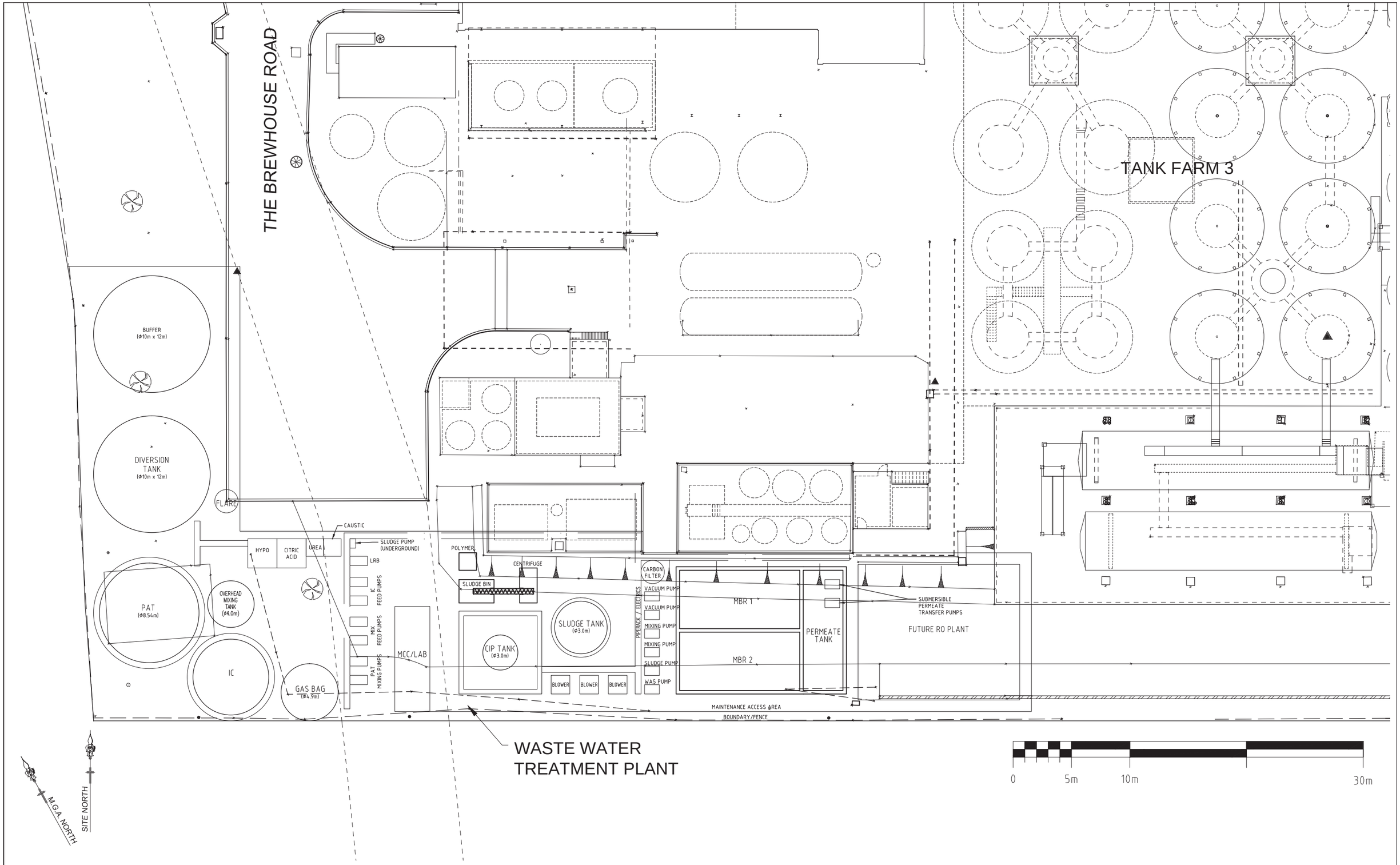
1. THIS SITE PLAN WAS RE-DRAFTED BASED ON BRUNSKILL McCLENAHAN & ASSOCIATES PTY LTD SITE SURVEY CONDUCTED 11/03/2011 (BMA REF. 10081-SC).
2. CRITICAL FEATURES ON THIS PLAN MUST BE VERIFIED BY THE USER AS TO THE ACCURACY REQUIRED FOR THE INTENDED PURPOSE.

No.	DATE	REVISION	DRN	CHK	APP.
B	05.09.2011	WWTP SHADED FOR CLARITY	RPZ	SK	-
A	22.08.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

MASTER SITE PLAN
WASTE WATER TREATMENT PLANT
SHEET 1

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
1:650 (A1)	AUBURN BREWERY	–	374-SK-001	B



REFERENCE DRAWINGS	
DRAWING No.	TITLE
374-SK-001	MASTER SITE PLAN - SHEET 1

GENERAL NOTES

1. THIS SITE PLAN WAS RE-DRAFTED BASED ON BRUNSKILL McCLENAHAN & ASSOCIATES PTY LTD SITE SURVEY CONDUCTED 11/03/2011 (BMA REF. 10081-SC).
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No.	DATE	REVISION	DRN	CHK	APP.
A	05.09.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

WASTE WATER TREATMENT PLANT
GENERAL ARRANGEMENT
SHEET 1

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
1:150 (A1)	AUBURN BREWERY	–	374-SK-005	A

2 Project description

2.1 Location and context

The Tooheys Brewery forms part of an industrial cluster in the suburb of Lidcombe. The industrial premises are amassed within a large, rectangular shaped block bound by Parramatta Road to the north, Boorea Street to the south and Nyrang and Percy Streets to the east and west respectively.

The brewery site lies at the easterly end of the industrial area, with its largest frontage along Nyrang Street. The site is surrounded by industrial, residential and recreational land uses, as shown in Figure 3 below.

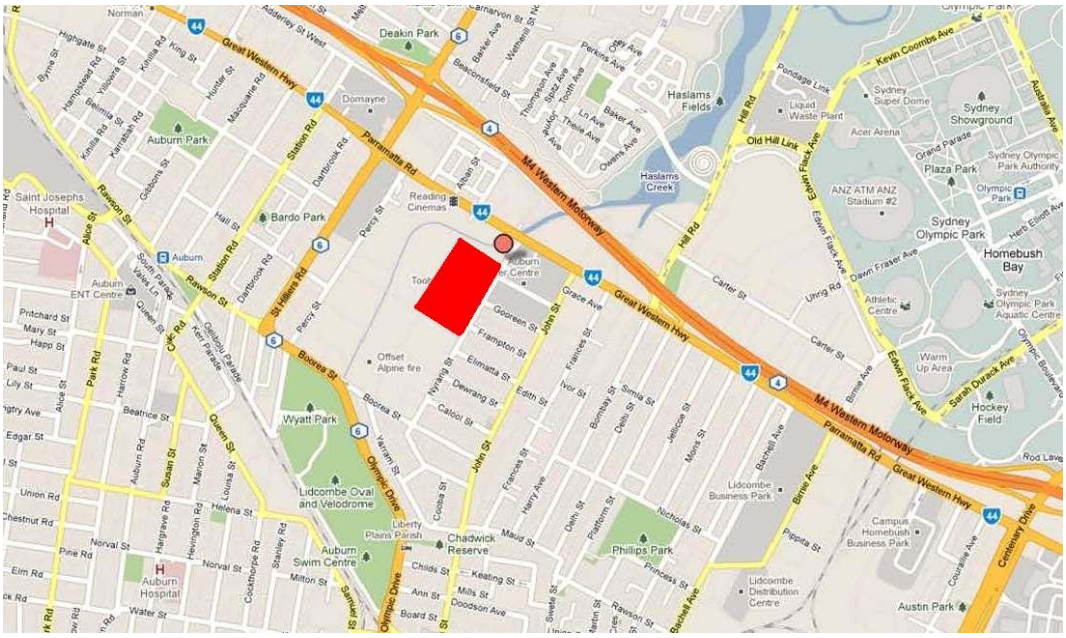


Figure 3 Site Location

The residential area to the east has a regular grid of streets of blocks containing detached residential dwellings on large allotments from the post-war period. To the south of the industrial area is similar detached housing from the mid 20th century. Redevelopment of some of these allotments has taken place over the last decade with larger double storey dwellings replacing the more austere cottages.

Immediately to the west of the site is a continuance of the industrial area. The majority of these premises contain late 20th century large industrial buildings set back from the street edge, which tend to be dominated by hardstand.

Redevelopment in the immediate area has been concentrated along Parramatta Road. The subdivision pattern to the north of the site is largely based on rectangular lots; however the size of each allotment varies. Retail, entertainment and recreation facilities have recently been added to the industrial and commercial streetscape.

Haslams Creek has been canalised where it is adjacent to the brewery site. North-east of the industrial area, the creek passes through a wetland area, before discharging to Homebush Bay.

2.2 Project details

In 2009 Sydney Water undertook an investigation for its Sewage Pumping Station (SPS) No 67 Catchment (into which Tooheys currently discharges trade waste) to assess factors contributing to the accelerated corrosion of sewer assets.

As a consequence of this investigation, Tooheys (and other trade waste customers within the SPS 67 catchment) have to meet more stringent standards for effluent quality discharged into Sydney Water's sewerage system, as follows:

- An acceptance standard for total BOD_5 of less than 600mg/L and soluble BOD_5 of less than 100mg/L;
- pH of a wastewater sample should remain within the range of pH > 7.0 and < 10.0 for 12 hours after sample collection.

Tooheys currently discharge wastewater with a BOD_5 concentration of 3,000mg/L and at a temperature of 38°C.

Sydney Water issued a requirement for Tooheys to develop an Effluent Improvement Plan. The Effluent Improvement Plan identified that the effluent quality standards could be met by onsite wastewater treatment in the form of a WWTP and cooling tower (see Figure 1). The WWTP would be located on the rear boundary in the west corner of the site adjacent to Haslams Creek and industrial neighbours. The process would be a two stage anaerobic and aerobic treatment.

Tooheys also propose to divert the biogas generated from the anaerobic digestion process to the existing boilers for energy generation. While it is currently not considered viable to further treat the water for on-site re-use applications, the plant design will allow for future reverse osmosis or other advanced treatment technology to be installed in the future.

Tooheys now propose to implement the Effluent Improvement Plan to meet the discharge limits under a new trade waste agreement with Sydney Water which will come into effect in August 2014.

2.3 Existing conditions

2.3.1 Existing process

Tooheys currently consumes approximately four litres of potable water per litre of beer produced. The excess water not utilised in the product is used by a number of process operations and eventually becomes wastewater. The wastewater generating processes include:

- Brew house and fermentation operations;
- Beer filtration;
- Packaging (e.g. filling bottles, cans and kegs);
- Boiler and cooling tower makeup; and
- Clean in place (CIP) operations.

Wastewater from the brewery flows to various pits and gravitates to Junction Pit T4. Effluent then gravitates to pH Balance Pit T5 where effluent is pumped into the Wastewater Equalisation Tank (see Figure 4). This equalisation tank is covered and mixed and has continuous level monitoring. The effluent from the Wastewater Equalisation Tank has continuous pH monitoring, and there are facilities to dose either caustic or acid, depending on the pH of the effluent, to meet the pH targets for discharge into the Sydney Water sewer.

After pH correction, effluent from the Wastewater Equalisation Tank returns to a bell mouth in Junction Pit T4 where it is discharged through a series of pits to the Sydney Water sewer. Further pH monitoring occurs in the downstream pits.

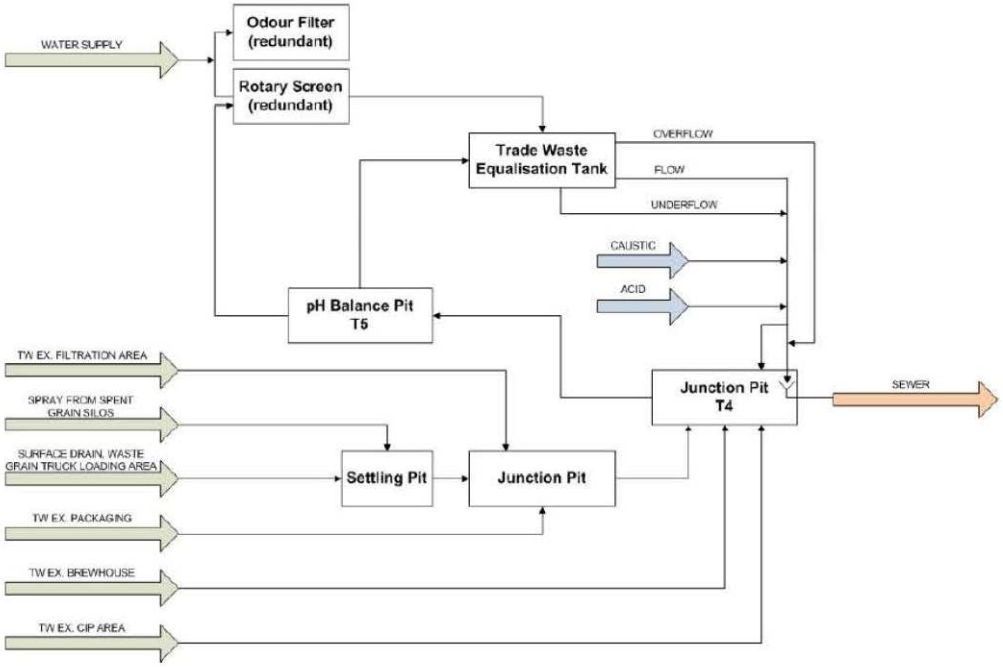


Figure 4 Existing wastewater treatment process flow diagram

2.3.2 Existing wastewater quality

Existing wastewater quality parameters and comparison to the proposed Sydney Water Licence condition is presented in Table 1.

Table 1 Existing wastewater quality parameters

Parameter	Wastewater quality	Sydney Water licence condition
BOD_5	3,045 mg/L	<600 mg/L
COD	5,695 mg/L	N/A
SS[2]	438 mg/L	30 mg/L
TDS[3]	2,030 mg/L	N/A

The existing wastewater has a Biological Oxygen Demand (BOD_5) of around 3,000mg/L which is well above the new standard of 600mg/L to be imposed by Sydney Water. The high BOD_5 is derived from the organic content in wort (the liquid extracted from the mashing process during the brewing of beer) and beer losses within the process.

BOD is a measure of the quantity of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter. High BOD levels can result in impacts to aquatic ecosystems where oxygen consumed in the decomposition process reduces the availability of oxygen for other aquatic organisms.

The COD to BOD_5 ratio indicates the extent to which the organic components within the wastewater are biodegradable and is an important consideration in determining the effectiveness of wastewater treatment technology. The ratio of Chemical Oxygen Demand (COD) to BOD_5 is about 1.6, indicating that it is readily biodegradable. This suggests that the COD can be reduced significantly through biological systems such as anaerobic and aerobic treatment processes.

Suspended solids (SS) are also reasonably high, which can be attributed to the small percentage of yeast and protein material that is not recovered from the brewing process and is allowed to infiltrate the wastewater system. Suspended solids may be removed in primary treatment processes.

The total dissolved solids (TDS) concentrations are quite high and are attributed to the contribution of water from the clean in place processes and demineralisation plant. The TDS concentrations would need to be significantly reduced in order for the water to be reused.

2.4 Detailed project description

Tooheys proposes to utilise a two stage process to improve its waste water quality prior to discharge to Sydney Water's sewerage system.

The process is divided into two stages:

- Stage 1 – Primary treatment (anaerobic); and
- Stage 2 – Secondary treatment (aerobic).

Within Stage 2 there are two potential treatment methods:

- Membrane bioreactor; or
- Dissolved air flotation.

The decision to adopt membrane bioreactor or dissolved air flotation technology will depend upon the outcomes of the final feasibility stage. Both options have been considered within this assessment.

The proposed treatment process is described below with process flow diagrams included in Appendix B.

2.4.1 Stage 1 Primary treatment (anaerobic)

The major process units for the project include:

- Screening;
- Diversion tank;
- Balance tank;
- Transfer pipeline;

- Preacidification tank;
- Heat exchanger;
- Mix tank;
- High rate anaerobic reactor;
- Anaerobic sludge storage tank; and
- Biogas capture and reuse system.

Wastewater collection

Wastewater from the site would be collected as per existing arrangements, in the pH balance pit T5 (Figure 4). From here, it would be pumped with the existing pumps, through a new screen and to the existing wastewater equalisation tank.

Screening

A self-cleaning fine screen would be required to remove coarse solids which are mostly spent grains. The separated solids would be collected in a fully enclosed container, which would be connected to the off-gas treatment system to avoid having odours created by the screenings. The screenings would be regularly removed depending on the amount of solids created. Any liquid from the screenings bin would drain back to the pH balance pit T5.

It is anticipated that the existing screenings structure (platform) would be used with a new rotating self-cleaning drum screen on the top. A chute would be connected to where the screenings are collected to deliver the screenings to the container, which would be located at ground level.

Diversion tank

The diversion tank would allow for improved process performance, by temporarily storing any high strength wastewater with wastewater quality parameters outside of the design specifications of the system. This wastewater can then be slowly fed back into the treatment system to minimise the shock loading on the process. In a brewery these shock loads generally consist of off-spec beer, wort or cleaning chemicals.

Balance tank (existing wastewater equalisation tank)

The existing balance tank would be used to receive the screened wastewater and to balance the peaks in temperature, COD and other wastewater constituents. An additional new balance tank will be provided to provide additional capacity to adjust any out of specification wastewater .

Transfer pipeline to wastewater treatment plant

The wastewater would be transferred from the balance tank at the site of the existing wastewater equalisation tank located in the north-west of the site to the proposed site of the WWTP in the south west corner. The wastewater would be transferred via an underground pipeline located within existing services areas.

New pumps would need to be added at the WWTP site. Ventilation and off-gas treatment systems would be utilised to avoid having accumulation of potentially odorous gases.

New balance /buffer tank

An additional new balance tank will be provided to provide additional capacity to adjust any out of specification wastewater prior to preacidification.

Preacidification tank

The wastewater would be pumped into a preacidification tank, which is the first stage of the anaerobic process. During this process, the organic material in the wastewater would be converted into short chain fatty acids, namely volatile fatty acids which is the ideal food for the bacteria in the anaerobic methanogenic reactor.

In the preacidification tank, the pH is automatically controlled by the addition of caustic or citric acid, to provide the correct conditions for the acidifying bacteria. The content of the tank is mixed by means of an external mixing pump.

Off-gas from the preacidification tank would be removed for treatment through an activated carbon unit.

Heat exchanger

A heat exchanger to cool or heat the raw wastewater to the optimum temperature of 35˚C would be incorporated within the process and would provide protection against overheating the bacteria in the high rate anaerobic reactor.

The cooling unit would be integrated with the recirculation mixing pump on the preacidification tank. The cooling liquid for the heat exchanger would be chilled with cooling tower water from the new cooling tower.

Mix tank

The preacidification tank effluent would be pumped into a mix tank which also receives effluent from the anaerobic reactor in order to minimise the caustic or citric acid requirement for pH control.

The brewery wastewater is likely to be low in ammonia, and as such it is anticipated that urea dosing may be required to be added to the mix tank to adjust the nitrogen to phosphorous ratio for further treatment.

High rate anaerobic reactor

The high rate anaerobic reactor is designed to convert the majority of the dissolved organic material into biogas, utilising a range of bacteria including methanogenic bacteria. Typical removal rates of high rate anaerobic reactors for brewery wastewater are 75-80%. The system will be a fully enclosed reactor.

Anaerobic sludge storage tank

The anaerobic process produces a granular anaerobic sludge, which can be stored for significant amounts of time. After some days of storage, the bacteria within the sludge become dormant. When reintroduced to warm wastewater with biodegradable components the bacteria become active again.

The methanogenic bacteria in the anaerobic reactor are the most sensitive in the entire system and therefore one full reseed volume would be maintained on site in an anaerobic sludge storage tank. A full reseed volume is typically half the volume of the anaerobic reactor volume. The contents of the anaerobic tank would need to be vented as the sludge coming from the anaerobic reactor would still continue to produce biogas for several hours.

Biogas capture and reuse

The anaerobic processes is expected to produce an average amount of biogas of 4,400 m^3/day up to 8,100m^3/day at maximum loading. The biogas from the anaerobic reactor would be collected in a gas buffer system which evens out peaks and troughs in gas production, and then transferred via pipeline to the engine room for combustion within the existing boilers.

The biogas composition depends on the wastewater. Currently measured COD and sulphate concentrations in the wastewater, indicate that the biogas would contain a nominal 75-80% methane, 20-25% carbon dioxide and less than 0.1% hydrogen sulphide. The biogas will be directly used in the boiler.

2.4.2 Stage 2 Secondary treatment (aerobic)

The major process units for the project include:

- Dissolved air flotation OR membrane bioreactor;
- Sludge dewatering;

Option 2A: Dissolved air flotation

The main purpose of the dissolved air flotation process is to clarify the suspended solids which are left over from the wastewater. Dissolved air flotation technology uses fine air bubbles to float attached solids particles to the surface of a flotation cell for removal.

Option 2B: Membrane bioreactor

The membrane bioreactor option involves a suspended growth activated sludge process that utilises micro-porous membranes for separation of the liquids and solids. The use of a membrane instead of a clarifier allows the process to be operated at very high mixed liquor concentrations. The membrane bioreactor also produces very high quality effluent which would require less treatment than the dissolved air flotation option as feed water for a potential future reverse osmosis plant.

Sludge dewatering

The plant would create waste solids, consisting of residual solids from the brewery and excess biomass.

This sludge would be collected in a sludge tank and can be dewatered in a centrifuge with the aid of a polyelectrolyte. The content of the sludge tank needs to be mixed in order to avoid settling of solids in the tank. This is proposed to be done with air mixing. This would also keep the sludge from becoming septic. The centrifuge will be contained within a small building for noise containment and odour control.

The dewatered sludge is expected to be greater than 17% in dry solids concentration and is collected in a fully enclosed container, which would be connected to a dedicated off-gas treatment system.

2.5 Plant and equipment size

Indicative sizes of the most significant (in terms of size) plant and equipment are presented in Table 2 for the dissolved air flotation option and Table 3 for the membrane bioreactor option below.

Table 2 Dissolved air flotation option: Plant and Equipment Size

Treatment Unit	Indicative Size		
	Volume	Height	Diameter
Spill Diversion Tank	1000m^3	10m	12m
Buffer tank	1,000m^3	10m	12m
Preacidification Tank	700m^3	24m	6m
Mix Tank	50m3	4m	4m
High Rate Anaerobic Reactor	1,406m^3	28m	8m
Gas Bag (Gas buffer system)	70m^3	4.1m	5.5m
Anaerobic sludge tank	680m^3	28m	6m
Attached growth aerobic reactor	170m^3	8.5m	2.5m
DAF	135m^3	3.5m	11m × 3.5m (rectangular base)
Cooling tower	N/A	4.5m	3.8m x 3.2m (rectangular base)

Table 3 Membrane bioreactor option: Plant and equipment size

Treatment Unit	Indicative Size		
	Volume	Height	Diameter
Spill Diversion Tank	1000m^3	10m	12m
Buffer tank	1,000m^3	10m	12m
Pre-Acidification Tank	650m^3	12m	8.5m
Mix Tank	50m3	4m	4m

High Rate Anaerobic Reactor	800m^3	24m	6.5m
Gas Bag (Gas buffer system)	70m^3	4.1m	5.5m
Anaerobic sludge tank	300m^3	11m	3m
Pre- Aeration Tank	1160m^3	5.5m	16m
Membrane Tank x2	240m^3 x 2	4.3m	10.3 x 5.5m
Cooling tower	N/A	4.5m	3.8m x 3.2m (rectangular base)

2.6 Operating hours

It is proposed that the WWTP is operational 24 hours a day, 7 days a week; consistent with the approved operating hours for the rest of the brewery.

2.7 Construction

Construction would occur over a 24 month period and would involve the following:

- Site establishment (1 week)
- Demolition of existing slabs and removal of sugar tanks (2 weeks)
- Civil works and piling (4 weeks)
- Concrete foundations (4 weeks)
- Process equipment installation (16 months)
- Trial and commissioning (5 months)

2.8 Timing

To meet Sydney Water's timeframes, Tooheys require construction to commence by July 2012. The plant is anticipated to be fully operational by August 2014.

2.9 Capital expenditure

The total capital expenditure for WWTP is estimated at approximately $20M.

3 Strategic context

3.1 Commonwealth Government

3.1.1 Environment Protection and Biodiversity Conservation Act, 1999

The Environmental Protection and Biodiversity Conservation Act. 1999 provides protection to matters of National Environmental Significance which include:

- World heritage properties;
- Ramsar wetlands of international importance;
- Nationally threatened species and communities;
- Migratory species protected under international agreements;
- Nuclear actions;
- Commonwealth marine environment; and
- Any additional matters specified by regulation.

The proposed development would not affect any matters of National Environmental Significance and therefore referral to the Commonwealth Department of Environment, Water, Population and Communities is not required.

3.2 State Government

3.2.1 Environmental Planning and Assessment Act, 1979

In July 2007, Tooheys Brewery received single site wide planning approval from the then NSW Department of Planning under Part 3A of the Environmental Planning & Assessment Act, 1979 for the Project Key upgrade as well as ongoing operations at the brewery.

Any work which is inconsistent with this approval must be assessed as a modification of the Minister's approval under Section 75W of the Environmental Planning and Assessment Act, requiring the preparation of an Environmental Assessment.

Upon consultation with the Department of Planning and Infrastructure (DP&I), the recommendations Arup put forward in the Preliminary Environmental Assessment have been accepted in place of the Director General Requirements for this Environmental Assessment. These recommendations are included as Appendix A.

3.2.2 Protection of the Environment and Operations Act 1997

The Protection of the Environment and Operations Act, 1997 establishes a system of environment protection licensing for 'scheduled' activities with the potential to have a significant impact on the environment. Schedule 1 of the Act lists the activities requiring an Environment Protection Licence (EPL) including:

Breweries or distilleries that produce alcohol or alcoholic products and that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.

Tooheys Brewery produces in excess of 10,000 tonnes per annum and therefore qualifies as a scheduled activity, and as such is subject to an Environment Protection Licence (EPL Number 1167) issued by the NSW Office of Environment and Heritage. As part of the approvals process the Office of Environment and Heritage will be given the opportunity to provide comment on the proposal including recommendations for mitigation and/or monitoring requirements. The EPL would be accordingly modified to reflect these requirements.

4 Consultation

Following the submission of the Preliminary Environmental Assessment, the Department of Planning and Infrastructure consulted with both Sydney Water and the NSW Office of Environment and Heritage. Their responses are included in Appendix C. In addition, a letter was sent to Auburn Council advising of the plans and seeking their comments. No comments have been received to date. Copies of all consultation are presented in Appendix C.

Consultation with the industrial facility to the south of the proposed WWTP will be undertaken prior to commencement of construction.

5 Project justification

5.1 Project drivers

The main driver for this project is a result of Sydney Water's SPS 67 Catchment Investigation. A series of structural sewer failures in the SPS 67 catchment (which the Brewery discharges trade waste into) and downstream catchments, prompted Sydney Water to conduct investigations into factors contributing to the accelerated corrosion of sewer assets. Trade waste discharges were assessed as part of investigations into SPS 67 catchment in October 2009, and the brewery was one of the trade waste dischargers selected for wastewater discharge improvement. Consequently, the brewery has been issued an Effluent Improvement Program to improve effluent quality. This project is Tooheys response to meet the new criteria for effluent quality.

5.2 Project benefits

The project will improve the quality of the wastewater discharged into Sydney Water catchment. Following treatment, the brewery's wastewater will meet the following Effluent Improvement Program conditions:

- Total BOD_5 of less than 600mg/L and soluble BOD_5 of less than 100mg/L; and
- pH of a wastewater sample to remain within the range of pH greater than 7.0 and < 10.0 for 12 hours after sample collection.

5.3 Consideration of alternatives / do nothing

Consideration has been given to different options, including alternative locations and treatment processes.

5.3.1 Do nothing option

The do nothing option would result in Tooheys not meeting the revised trade waste license conditions issued by Sydney Water and has therefore not been considered.

5.3.2 Alternative WWTP locations

Although the brewery site is largely occupied by buildings and facilities, three locations for the WWTP have been given consideration:

- the area occupied by the Central Maintenance Workshop on the northern corner of the site;
- the area near the existing Trade Waste Equalisation Tank on the northwest boundary of the site adjacent Haslams Creek; and
- the area where the Liquid Sugar Tanks are currently located in the western corner of the site.

The selected location at the western corner was chosen due to the existing site constraints and proposed future works, in particular the plan to construct a Bright Beer Cellar in the Central Maintenance Workshop.

5.3.3 Treatment process alternatives

Three options for the wastewater treatment process have been investigated:

- Primary stage anaerobic treatment with secondary stage (dissolved air flotation) aerobic treatment;
- Primary stage anaerobic treatment with secondary stage (membrane bioreactor) aerobic treatment; and
- Either of the above options with reverse osmosis water recycling plant.

Both the membrane bioreactor and dissolved air flotation options option allows compliance with Sydney Water's revised discharge requirements. The membrane bioreactor option will provide a higher quality wastewater which will require less treatment should the reverse osmosis water recycling plant be installed in the future. The dissolved air flotation option can still support future water recycling but will require additional treatment compared to the membrane bioreactor option. Both options are currently being considered by Tooheys and are therefore assessed here.

The WWTP may be connected to a reverse osmosis process to further improve wastewater quality to allow for on-site recycling of the wastewater. The main advantage of this option is the opportunity to reduce the sites reticulated potable water consumption. The recycling option is subject to ongoing investigation but is not considered viable at this stage.

6 Environmental assessment

Table 4 presents a summary of the potential environmental impacts associated with all relevant issues associated with the WWTP. The table also assigns a level of significance to the issue based on the extent and likelihood of:

- Potential impact with consideration of mitigation or management measures; and
- Potential community or regulatory concern.

The three levels of significance are:

High environmental significance:	A high likelihood of adverse environmental impact or the potential environmental impact is of a severe nature. These issues are key decision making factors, and require detailed and specific investigations to adequately characterise the nature of the impact and to determine appropriate mitigation or management measures which may still result in significant residual impact.
Moderate environmental significance:	Some likelihood of adverse environmental impact however the potential environmental impact is predicted to be of a manageable nature. These issues are likely to be important decision making factors, and may require investigations to characterise the nature of the impact. Non-standard mitigation and management measures, or special tailoring of standard measures, are likely to be required to ensure impacts are minimised to acceptable levels.
Low environmental significance:	Low likelihood of adverse environmental impact and the potential environmental impact is negligible or of a manageable nature. These issues are not likely to be key decision making factors, and are unlikely to require investigations. Standard mitigation and management measures may be applied.

No issues of high environmental significance have been identified. This reflects the fact that the proposed WWTP is a minor change to an existing development and the project would not increase the overall production volume of the brewery.

Table 4 Impact Assessment Summary

Issue	Potential Impact	Further Assessment
Water Quality	The key objective and outcome of the project is to improve wastewater quality discharged to Sydney Water sewerage system. The project will result in an improvement in wastewater quality that is discharged to sewer. **Environmental benefit.**	**More detail provided in Section 6.1**
Flooding	The Project Key EA noted that the northwest corner of the site is the worst location in terms of flood risk as it is within the 100 year Annual Recurrence Interval (ARI) flood plain levels for the Haslams Creek catchment. The proposed location of the WWTP is in the west corner of the site and as a result a flood risk assessment was undertaken. In the event of a flood, a minimum floor level of 7.4mAHD will not only reduce damage to the wastewater treatment plant but it will also reduce the risk of environmental impacts on the surrounding areas from industrial waste contamination. Given the proximity of the Tooheys Brewery site to the adjacent creek, it is highly likely that the site will be affected by flooding in future. However the extents of the development in comparison to the size of the flood extents are small and therefore, the impact of the development on surrounding flood levels is expected to be minimal. **Moderate environmental significance.**	**More detail provided in Section 6.2** **Full Flood Assessment provided in Appendix D**
Traffic	No significant increase in traffic generation or staffing levels is anticipated as a result of the operation of the proposed WWTP. Some additional deliveries of wastewater treatment chemicals will be required as well as removal of sludge, but will be insignificant in terms of overall traffic volumes. Construction traffic will be mainly associated with civil stages of the project. Considering the existing number of truck movements on the site, the brewery location (in a high traffic industrial area close to the Western Motorway) and the proposed management measures, it is considered that the additional construction truck movements over the 4/5 month civil stage of the construction period will be of low significance. **Low environmental significance.**	**More detail provided in Section 6.3**

Issue	Potential Impact	Further Assessment
Noise	The most stringent noise criterion for the Tooheys site is the 50 dB(A) EPL criterion applying at the site boundary of nearby noise-sensitive receivers, which applies to all noise from Tooheys operations, not just the WWTP. Noise from the WWTP will be designed to be sufficiently low that it does not add to the noise level at the residential property boundary. Sources of noise will include blowers, pumps, treatment vessels, exhaust flues, water discharge. These will be contained within buildings where possible to mitigate against noise impacts. Technical noise assessment was undertaken to model the noise impacts of the various components of the WWTP at the nearest sensitive receivers on Nyrang Street, and assess compliance of the WWTP with the licence noise criteria for the Tooheys brewery. The noise assessment showed predicted noise levels at residential receivers within the noise objective of 40 dBA with mitigated source noise levels provided that plant were mitigated. Noise levels are predicted to remain within the maximum noise objective of 75 dBA at the nearest industrial boundary. Should maximum allowable noise emission levels be unachievable via appropriate selection of plant items, alternative engineering methods such as acoustic enclosures and/or barriers may need to be explored in order to ensure the acoustic amenity of nearby receivers is maintained. This will need to be reviewed during detailed design once more information is available. The type of works associated with construction of the WWTP in the context of the significant distances to nearby residential receivers in Nyrang Street is not considered to be a significant issue provided works are conducted during standard hours as defined in the Interim Construction Noise Guideline (ICNG). **Low environmental significance.**	**More detail provided in Section 6.4** **Full Noise Assessment provided in Appendix E.**
Air Quality	There is likely to be a change in the emissions profile of the site as a result of combustion of biogas in one existing boiler and some flaring. Changes in emissions of NO_2 and SO_2 have been assessed to determine the impact on local air quality. Changes in total emissions of NOx have also been assessed from a regional air quality perspective. The impact to local air quality is likely to be low with concentrations of NO_2 and SO_2 within NSW DECCW Impact Assessment Criteria at all sensitive receptors. There is likely to be a change in total NOx emissions with a maximum increase of 8% . The actual increase is likely to be less due to the reduced NOx emission rate for biogas compared to natural gas. **Moderate Environmental Significance**	**More detail provided in Section 6.5** **Air Quality Technical Assessment provided in Appendix F**
Hazards and Risk	Change in hazard risk on the site as a result of: • Storage and use of wastewater treatment chemicals • Storage transfer and combustion of biogas on site. Preliminary hazards assessment has been undertaken in accordance with *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazardous Analysis* **Moderate environmental significance.**	**More detail provided in Section 6.6** **Full Preliminary Hazards Assessment provided in Appendix G.**

Issue	Potential Impact	Further Assessment
Contamination	Due to the industrial nature of the site there is potential for contamination to be present within sub surface soil. The WWTP will be installed on hardstand and therefore there is negligible risk of exposure to contamination during operation. Some subsurface works will be conducted during installation of pipelines and piling for foundations for the WWTP. There is therefore potential risk of construction workers being exposed to potential contaminated soil. This will be managed through construction management plan to ensure that: • On site personnel are be trained to recognise unexpected contamination and danger signs • Any signs of unexpected contamination are to be immediately reported following the appropriate incident reporting procedures and work in the immediate vicinity is to be stopped • Areas where unexpected contamination is observed and reported are to be isolated with a physical barrier and assumed to be contaminated until an assessment proves otherwise **Low environmental significance**	**No Further Assessment.** Construction management plan to address risk of exposure of construction workers to potentially contaminated soil.
Visual Amenity and Landscape	The proposed works are within the operational part of the existing brewery and are away from sensitive receivers. The height of the new tanks and cooling tower are comparable to the heights of other nearby process equipment and will not be visible from residential areas on Nyrang Street. **Low environmental significance**	**No Further Assessment.** No management measures proposed.
Odour	The process of anaerobic digestion is odorous producing small quantities of hydrogen sulfide depending on the sulfur content of the wastewater. The process equipment proposed include a number of odour mitigation measures including enclosed vessels, off-gas treatment and activated carbon scrubbers consistent with best management practice and using the best available control technology. Notwithstanding there are likely to be fugitive odour emissions and odours from the outlet points of the carbon scrubbers. The WWTP is located at the rear of the site away from residential areas (approximately 275m to nearest residential receptors). A 'Level 1' technical odour assessment was carried out in accordance with the DECCW *Technical Framework and Technical Notes for the Assessment and Management of Odour from Stationary Sources in NSW*, 2006 The odour impacts from the proposed WWTP are assessed to be acceptable where the odour monitoring and management measures are implemented. The WWTP is designed to be enclosed and reduce emissions to air and under normal operations the odour impacts are expected to be negligible. Post commissioning testing for odour and the operation of an odour complaints system will establish if odour generation occurs, and remedial measures would be required to be undertaken. **Moderate environmental significance.**	**More detail provided in Section 6.7** **Full Odour Assessment provided in Appendix H.**

Issue	Potential Impact	Further Assessment
Heritage (Aboriginal and Non-Aboriginal)	The Wangal clan of the Eora Aboriginal tribe were the original inhabitants of the Auburn area. The site has, however, been significantly modified and it is unlikely for Indigenous artefacts to remain. The brewery site forms part of a site occupied by the Sydney Meat Preserving Company between 1869 and 1955. The *Auburn Heritage Study* (Schwager, 1996) identified the meat preserving works site as being of archaeological significance, however, the buildings and structures have been removed and the ground surface disturbed. The site is not identified in Auburn Council's register of archaeological sites and potential archaeological sites. The canalisation of Haslams Creek, running along the western boundary of the site, is a non-Indigenous heritage item of local significance, listed in Schedule 2 of the Auburn LEP. None of the works would physically impact upon the canalisation of Haslams Creek. **Low environmental significance**	**No Further Assessment.** No management measures proposed.
Flora and Fauna	A search of the NSW Government's BioNet database was carried out in September 2006 as part of the Toohey's Upgrade EA (Arup 2007). There are no previous recordings of any threatened species on the site, although a range of species have been recorded in the local area. The Tooheys brewery is a highly modified site with negligible potential for containing threatened species. The proposed works is within the operational part of the brewery and would not involve any impact to the vegetated areas. **Low environmental significance**	**No Further Assessment.** No management measures proposed.
Resource Consumption	The project will result in an overall increase in electricity consumption on site. However the project will also allow Tooheys to reduce consumption of natural gas by reusing biogas. Therefore, on balance, there is likely to be a net benefit in terms of overall energy consumption and an overall reduction in greenhouse gas emissions. The WWTP will not significantly alter the water consumption of the brewery. **Low environmental significance**	**More detail provided in Section 6.8, 6.9 and 6.10**
Waste Management	The project will not alter the current volumes of wastewater discharged from site. The WWTP will generate waste solids, consisting of residual solids from the brewery and excess biomass (sludge). The residual solids will be disposed of offsite and the dewatered sludge will be sold or disposed of offsite. **Low environmental significance**	**More detail provided in Section 6.11**
Socio-Economic	The proposed WWTP contributes to the on-going viability of brewery, with associated benefit to the wider economy. It also contributes to the ongoing viability of Sydney Water infrastructure. **Low environmental significance (potential benefit)**	**No Further Assessment.** No management measures proposed.

6.1 Water quality

6.1.1 Existing condition

Tooheys currently discharge their wastewater into the sewer under a trade waste agreement with Sydney Water.

Existing wastewater quality parameters and comparison to the proposed Sydney Water Licence condition is presented in Table 1.

Table 5 Existing wastewater quality parameters

Parameter	Wastewater quality	Sydney Water licence condition
BOD_5	3,045 mg/L	<600 mg/L
COD	5,695 mg/L	N/A
SS[2]	438 mg/L	30 mg/L
TDS[3]	2,030 mg/L	N/A

The existing wastewater has a Biological Oxygen Demand (BOD_5) of around 3,000mg/L which is well above the new standard of 600mg/L to be imposed by Sydney Water. The high BOD_5 is derived from the organic content in wort (the liquid extracted from the mashing process during the brewing of beer) and beer losses within the process.

BOD is a measure of the quantity of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter. High BOD levels can result in impacts to aquatic ecosystems where oxygen consumed in the decomposition process reduces the availability of oxygen for other aquatic organisms.

The COD to BOD_5 ratio indicates the extent to which the organic components within the wastewater are biodegradable and is an important consideration in determining the effectiveness of wastewater treatment technology. The ratio of Chemical Oxygen Demand (COD) to BOD_5 is about 1.6, indicating that it is readily biodegradable. This suggests that the COD can be reduced significantly through biological systems such as anaerobic and aerobic treatment processes.

Suspended solids are also reasonably high, which can be attributed to the small percentage of yeast and protein material that is not recovered from the brewing process and is allowed to infiltrate the wastewater system. Suspended solids may be removed in primary treatment processes.

The total dissolved solids concentrations are quite high and are attributed to the contribution of water from the clean in place processes and demineralisation plant. The total dissolved solids concentrations would need to be significantly reduced in order for the water to be reused.

6.1.2 Potential impacts

The proposed WWTP (both dissolved air flotation and membrane bioreactor options) has been designed to achieve the standards for effluent quality discharged into Sydney Water's sewerage system, as follows:

- An acceptance standard for total BOD_5 of less than 600mg/L and soluble BOD_5 of less than 100mg/L; and
- pH of a wastewater sample should remain within the range of pH greater than 7.0 and less than 10.0 for 12 hours after sample collection.

This will result in an improvement in the water quality being discharged into the sewerage system and result in an environmental benefit in terms of water quality and contribute to the longevity of Sydney Water infrastructure.

6.1.3 Management measures

Management and maintenance of the WWTP will be part of the operational stage of the WWTP. No other management measures are proposed.

6.2 Flooding

A desktop flood study has been carried out to assess the flood risk to the site and provide details of any mitigation measures which should be incorporated into the proposed development to minimise the impact of future flooding. The full report is provided in Appendix B

The flood assessment is applicable for both the dissolved air flotation and membrane bioreactor option.

6.2.1 Existing condition

The Tooheys Brewery site is bounded by Haslams Creek to the northwest of the site as shown below in Figure 5. This creek is in close proximity to the site on both the northwest and northeast sides of the site. The St Hilliers Road Branch channel connects into Haslams Creek near the west corner of the Tooheys Brewery site. These channels both influence the flooding on the site.

Figure 5 Tooheys Brewery site

The site is covered by an Auburn Council commissioned flood study *'Haslams Creek Floodplain Risk Management Study and Plan'* undertaken by Bewsher Consulting Pty Ltd in January 2003. The results of the flood study indicate that some flooding is expected on the site in the 100 year Average Recurrence Interval (ARI) flood event. The report also confirms that the majority of the site lies within the extent of the Probable Maximum Flood event thus in this major event, the majority of the Tooheys Brewery site is expected to be inundated. The varying flood levels on the site for the 100 year ARI flood event results in parts of the site being classed as a medium flood risk precinct while the remainder is classed as a low flood risk precinct.

6.2.2 Potential impacts

In the vicinity of Tooheys Brewery, the Bewsher Consulting (2003) study recommends a design level of 7.4mAHD for the 100 year ARI flood event which includes an allowance for freeboard of approximately 0.7m. The existing ground levels in the proposed location of the wastewater treatment plant vary between approximately 7mAHD and 8mAHD and are therefore subject to flooding impacts.

Tooheys would therefore ensure that a top of slab floor level of 7.4mAHD is adopted for the WWTP. In the event of a flood, a minimum floor level of 7.4mAHD will not only reduce damage to the WWTP but it will also reduce the risk of environmental impacts on the surrounding areas from industrial waste contamination.

Given the proximity of the Tooheys Brewery site to the adjacent creek, it is highly likely that the site will be affected by flooding in future. However the extents of the development in comparison to the size of the flood extents are small and therefore, the impact of the development on surrounding flood levels is expected to be minimal.

The proposed WWTP is set back from the creek bank and is not expected to significantly impact flood storage volumes.

6.2.3 Management measures

The proposed floor level of the WWTP at the Tooheys Brewery would be designed to be above 7.4mAHD. This is the design level for the 100 year ARI flood event which includes an allowance for freeboard.

To achieve the evacuation standards required by the Auburn Council Development Control Plan, the consideration of reliable access for pedestrians or vehicles from the wastewater treatment plant to an area of refuge above the probable mean flood level would be incorporated in detailed design.

6.3 Traffic

6.3.1 Existing condition

The Tooheys brewery at Lidcombe is a high generator of traffic movements due to its constant beverage production. Approximately 345 vehicles access the site daily. These include B-Doubles, semitrailers and rigid trucks, with heavy vehicles making up approximately 95 per cent of vehicles accessing the site.

Heavy vehicles currently access the site via the main gate on Nyrang Street, or the secure entrance on Percy Street. Nyrang Street is bounded on one side by residential dwellings whereas Percy Street is entirely within the industrial estate.

A large car parking facility is provided on the site in its north eastern corner with 385 parking spaces for employees and contractors, to cater for approximately 200 employees, as well as 37 parking spaces for visitors. No increase in staffing levels is anticipated.

6.3.2 Potential impacts

Construction traffic

Construction traffic will be mainly associated with delivery of equipment and raw materials to the site, along with specialist vehicles and machinery.

It is anticipated that the civil stage of the project (earthworks and concrete pour) will be the peak period for traffic movement – this is a 4-5 month period over the entire 19 month construction program. The increase of traffic to the site during the civil stage is expected to total approximately 40 truck movements with up to 5 truck movements a day during certain stages of the works (such as during the concrete pour).

It is anticipated that the construction of the facility would include the following vehicle and machinery movements;

Site establishment (approximately 1 week)

- General light vehicles (3 vehicles to and from site each day)
- Bin truck (to and from site on 2 days)

Demolition period (2 weeks)

- Truck movement - tray type 2/5 tons (2 vehicles to and from site each day)
- General light vehicles (3 vehicles to and from site each day)
- Small excavator (to and from site on 2 days)

Civil / piling period (4 weeks - 2 weeks peak)

- Piling unit (to and from site on 5 days)
- Excavator 22 ton unit (to and from site on 5 days)
- Tipper / bogey truck (3 vehicles to and from site on 3days)
- General light vehicles (3 vehicles to and from site each day)
- Concrete trucks (6 vehicles to and from site on 5 days)
- Concrete pump (2 vehicles to and from site on 5 days)
- Tipper / bogey truck (to and from site on 6 days)
- General light vehicles (4 vehicles to and from site each day)

Concrete Foundations (8 weeks)

- Concrete trucks (20 vehicles to and from site on 2 days)
- Concrete pump (2 vehicles to and from site on 2 days)
- Tipper / bogey truck (7 vehicles to and from site on 6 days)
- General light vehicles (4 vehicles to and from site each day)
- Truck movement - tray type 2/5 tons (2 vehicles to and from site on 6 days)

Total vehicle movements for the construction period are;

Light vehicles – Approximately 352 (to and from site)

Heavy vehicles – Approximately 207 (to and from site)

Truck movements will be managed on site through provision of short term parking of trucks and construction staff, as outlined in Section 6.3.3.

Considering the existing number of truck movements on the site, the brewery location (in a high traffic industrial area close to the Western Motorway) and the proposed management measures, it is considered that the additional truck movements over the 4 to 5 month civil stage construction period will be of low significance.

Operational traffic

The operation of the WWTP will generate some additional truck movements to and from the site. These additional movements will include deliveries of wastewater treatment chemicals and the removal of waste water sludge and sediment.

These truck movements are estimated to be in the order of two movements per week (sludge removal) and two movements per week for delivery of wastewater treatment chemicals. It is anticipated that there will not be any significant increase in traffic generation or staffing levels as a result of the operation of the proposed WWTP, as such the potential traffic impact during operation is expected to be low.

6.3.3 Management measures

Construction

Management measures for minimising construction traffic impacts are;

- A dedicated site compound area will be established. The site compound is to be clearly demarked and its location included on site plans. The site compound is required to accommodate;
    - Up to five heavy vehicles (concrete truck equivalent) and an area for short term parking (deliveries);
    - Storage of construction plant and machinery;
    - Storage of construction materials.
- Use of temporary construction traffic measures on the site (witches hats, traffic controllers, etc) to be implemented as required.
- Parking for staff associated with the construction works will be provided at the main staff car park on the site. This is to allow for maximum space in the vicinity of the WWTP construction area for heavy vehicles and deliveries, plant and equipment and construction materials.
- Staff facilities for construction personnel, such as toilets, lunchroom and site office are to be located within the main Tooheys Brewery facility.
- Construction traffic will be required to use Nyrang Street to directly access Parramatta Road or Olympic Drive via Booreal Road. No other local roads will be used during construction.

Operation

Existing traffic management measures at the brewery site will be implemented to minimise traffic impacts during the WWTP operation including:

- Public traffic access to and from Nyrang Street will be maintained at all times;
- Operational traffic will use existing entry and exit points from the site and existing authorisation procedures;
- All deliveries and removal of material via truck transport to and from the WWTP will be covered;
- Parking for staff associated with the WWTP will be at the existing staff car park at the site.

6.4 Noise

A full noise assessment is provided as Appendix C

6.4.1 Assessment criteria

Environmental Protection License

The Tooheys Brewery at Lidcombe currently operates under noise criteria set by the Department of Environment and Climate Change (DECC) under Environmental Protection License L1167 (March 2011).

> *L6 Noise Limits*
>
> *L6.1 Noise generated at the premises must not exceed the noise limits presented in the table below:*
>
> *Noise Limits (dB (A))*

Location	At All Times $L_{Aeq(15\ minute)}$
Boundary of 24 Nyrang Street (opposite site entrance)	50

> *Noise from the premises is to be measured at the boundary of 24 Nyrang Street opposite site entrance to determine compliance with the LAeq(15 minute), noise limits in condition L6.1. Note: 5dB (A) must be added to the measured level if noise is substantially tonal or impulsive in character.*

It should be noted with respect to the receiver location that the quoted address is not actually located opposite the site entrance. Further, for the purpose of this study, it is assumed that the criteria apply to all nearby residential receivers.

Noise emission criteria apply to all noise from Tooheys operations, not just the proposed WWTP. In order to comply with the overall site criteria, noise from the WWTP must not exceed 40 dBA at the nearest residential site boundary. This level represents the level (10 dB below the noise criterion) at which noise emission from the WWTP will not contribute to the overall noise levels generated by the site as a whole.

Industrial Noise Policy

Further to the noise emission objectives derived under the current site specific licence, the Office of Environment and Heritage (OEH) also sets industrial noise emission criteria for industrial receivers in the Industrial Noise Policy (INP). These noise criteria are summarised in Table 6.

Table 6 INP Industrial Noise Emission Criteria for Industrial Receivers

Type of Receiver	Time of Day	Recommended LAeq Noise Level (dBA)	
		Acceptable	Recommended Maximum
Industrial premises	When in use	70	75

6.4.2 Operational noise

6.4.3 Noise Sources

Given the early stage in project development, specific plant selection has not been finalised. It is understood that two options are being considered for the 'aerobic' treatment stage, namely:

- Dissolved Air Flotation (DAF)
- Membrane Bioreactor (MBR)

All other components of processing are understood to be common to both options (i.e. anaerobic, sludge dewatering, chemical, RE, control). The main noise generating equipment in both systems are identified as being the pumps and blowers.

6.4.4 Noise Modelling and Assessment Methodology

Assessment of WWTP noise impacts was conducted using the CONCAWE[1] noise propagation algorithms contained within the SoundPLAN noise modelling software suite.

Resultant noise levels were calculated via the use of single point receiver locations aligning Nyrang Street residential boundaries as well as on the industrial boundary immediately to the south of the proposed WWTP.

A table of predicted noise levels at receiver locations is provided in Table 7. Noise levels are based on unmitigated source spectra and have been calculated for both DAF and MBR technologies. Receiver locations are organised from north to south along Nyrang Street.

Table 7 Resultant Noise Levels at Nearby Receivers – Unmitigated

Receiver Location	**Resultant Noise Level (dBA)**	
	DAF	**MBR**
Nyrang Street between Gooreen and Hastings Streets	34	34
Corner of Nyrang and Gooreen Streets (North)	33	33
Corner of Nyrang and Gooreen Streets (South)	33	33
Nyrang Street between Gooreen and Frampton Streets	33	33
Corner of Nyrang and Frampton Streets (North)	39	36
Corner of Nyrang and Frampton Streets (South)	**42**	39
Nyrang Street between Frampton and Elimatta Streets	**48**	**48**
Corner of Nyrang and Elimatta Streets	38	38
Industrial boundary to south of WWTP	**79**	**79**

[1] Manning, CJ (1981) – The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Conservation of Clean Air, Water and the Environment (CONCAWE).

The data presented in Table 7 shows that noise objectives are exceeded for both technology options at both residential and industrial receivers. The worst affected residential receiver location is identified as Nyrang Street between Frampton and Elimatta Streets.

The most significant noise propagation path to this receiver location is via the gap between the Tooheys Brewery site and the neighbouring industrial site to the south.

It should be noted that, due to the source sound data being empirically derived, predicted noise levels are likely to be overly conservative. It is therefore envisaged that quieter plant selections should be readily available in line with the recommendations of this report.

SoundPLAN modelling has therefore been undertaken of quieter items of plant selection. Tooheys will require contractors to meet these overall noise levels in order to achieve these reduced noise levels.

In light of the predicted exceedances, SoundPLAN modelling has been undertaken of mitigated items of plant. Table 8 summarises predicted noise levels with the following overall source sound pressure levels:

- Blowers - 75 dBA @ 1m
- Pumps - 70 dBA @ 1m

Table 8 Resultant Noise Levels at Nearby Receivers – Mitigated

Receiver Location	**Resultant Noise Level (dBA)**	
	DAF	**MBR**
Nyrang Street between Gooreen and Hastings Streets	26	26
Corner of Nyrang and Gooreen Streets (North)	25	25
Corner of Nyrang and Gooreen Streets (South)	25	25
Nyrang Street between Gooreen and Frampton Streets	25	25
Corner of Nyrang and Frampton Streets (North)	31	28
Corner of Nyrang and Frampton Streets (South)	34	31
Nyrang Street between Frampton and Elimatta Streets	40	40
Corner of Nyrang and Elimatta Streets	30	30
Industrial boundary to south of WWTP	71	71

Predicted noise levels at residential receivers are calculated to remain within the noise objective of 40 dBA with mitigated source noise levels. Noise levels are predicted to remain within the maximum noise objective of 75 dBA at the nearest industrial boundary.

Should maximum allowable noise emission levels be unachievable via appropriate selection of plant items, alternative engineering methods such as acoustic enclosures and/or barriers may need to be explored in order to ensure the acoustic amenity of nearby receivers is maintained. This will need to be reviewed during detailed design once more information is available.

6.4.5 Construction noise

The construction period is estimated at approximately 19 months with a further six month trial and commissioning phase.

The type of works associated with construction of the WWTP in the context of the significant distances to nearby residential receivers in Nyrang Street is not considered to be a significant issue provided works are conducted during standard hours as defined in the Interim Construction Noise Guideline (ICNG).

Despite the expected negligible noise impact from construction related noise and vibration on the closest residences at Nyrang Street, steps to minimise noise and vibration and maintain good practice should still be applied as provided in Section 6.4.6.

6.4.6 Management measures

Management measures are recommended for the construction period:

- Contractor(s) would be required to meet noise levels as specified through the selection of appropriate equipment, use of appropriate enclosures and/or other mitigation methods;
- Works would be conducted during standard hours as defined in the Interim Construction Noise Guideline (ICNG);
- Acoustic monitoring would be undertaken if complaints are received
- Acoustic test certificates for machinery, noisy plant and machinery brought on to the site would be obtained where appropriate;
- Working hours would be controlled such that there is no work audible at nearby residences on Sundays, public holidays, or during the night time or evening periods;
- Silencers would be fitted to the exhausts of noisy items of plant, including residential grade mufflers
- Regular maintenance of plant would be undertaken to prevent plant noise levels increasing due to poor maintenance, such as blowing exhausts and loose and rattling component , etc.
- Machinery would be turned off when not in use, and machine enclosures are kept closed.
- Regular communication with neighbours would be undertaken including notification of any changes to the works.

6.5 Air quality

6.5.1 Existing condition

Local air quality

The brewery currently consumes natural gas within the site's boilers and cogeneration unit. As a result of this local air pollutants are produced including:

- Nitrogen dioxide (NO_2);
- Carbon monoxide (CO); and
- Particulate matter (PM_{10}).

The impact of these pollutants at the nearest sensitive receptors has been previously assessed and are within assessment criteria. The results for the 2007 air quality assessment are presented below.

Table 9 Results of 2007 air quality assessment for PM_{10}, NO_2 and CO

Pollutant	Averaging Period	Predicted Max Ground Level Concentration at Sensitive Receiver (µg/m³)	Criteria (µg/m³)	% of Criteria
PM_{10}	24 hours	0.25	50	0.50%
NO_2	1 hour	16.4	246	6.67%
CO	15 minutes	14.7	100,000	0.01%
	1 hour	13.8	30,000	0.05%
	8 hours	5.77	10,000	0.06%

From these results it can be seen that concentrations are an order of magnitude less than the criteria.

The results of the 2009 assessment for cogeneration found that there would be no significant change in NO_2 or CO emissions and that PM_{10} would be likely to decrease due to the relatively low PM_{10} emission factor for natural gas fired engines compared to boilers.

Regional air quality

In terms of regional air quality, the main concern is the generation of nitrogen oxide (NO_x) emissions as the precursor to ozone generation. Ozone is formed in summer by reactions between NO_x and volatile organic compounds produced which may be produced anywhere in the regional air shed. Ozone is a respiratory irritant under high exposure levels. During periods of high ozone concentration, hospital admissions for asthma and respiratory conditions increase.

The Sydney Illawarra air shed has a particular issue with ozone, regularly exceeding health based guidelines for ambient concentration of ozone since 1995.

6.5.2 Potential impacts

Local air quality

It is proposed that the biogas produced by the WWTP is utilised within the one dedicated boiler up to 100% biogas. Under this scenario it is estimated that 95% of the biogas produced can be used in the boiler with the remaining 5% to be flared. The combustion of biogas would likely lead to an increase in sulfur dioxide (SO_2) emissions due to the sulfur content of the biogas. Nitrogen dioxide (NO_2) emissions were also modelled as they were the closest to the criterion level in the previous assessment.

Dispersion modelling was undertaken to assess the impacts of the biogas combustion on local air quality in terms of NO_2 an SO_2 and compared to the criteria prescribed by the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005). A summary of the results at the nearest sensitive receptor are presented in Table 10 below.

Table 10 Summary of results

Averaging Period	Maximum NOx Ground Level Concentration (µg/m^3)		Maximum SO_2 Ground Level Concentration (µg/m^3)	
	Nearest sensitive receptor	Criterion	Nearest sensitive receptor	Criterion
10min	NA	NA	21.6	712
1 hour	20.9	246	15.2	570
24 hour	NA	NA	6.87	228
Annual	1.25	62	0.844	60

These show that the ground level concentrations are below the criterion for both pollutants across all averaging periods over the entire year with the shortest averaging periods being the most critical.

When combined with the background maximum hourly average value as shown in Table 11 below the results are still below the criterion.

Table 11 Summary of results with background concentrations

Maximum hourly concentration	NOx Ground Level Concentration (µg/m^3)	SO_2 Ground Level Concentration (µg/m^3)
Background	116.9	82.7
Modelled at nearest receptor	20.9	15.2
Total	137.8	97.9
Criterion	246	570

Regional air quality

In terms of regional air quality, impacts are considered for annual average conditions to determine whether the total NOx loading is likely to increase on an annual average basis. This will depend upon the increase in fuel consumption.

Currently the brewery consumes approximately 315.8 TJ of natural gas per year. The WWTP is likely to produce 39.9 TJ of biogas. Assuming 5% of this is flared, 12% of the brewery's energy requirements would be supplied from biogas on an energy basis.

However, due to the reduced energy density of biogas compared to natural gas there would be an increase in the total volume of gas combustion as presented in Table 12 below.

Table 12 Total natural gas and biogas consumption

Scenario		Annual Average Consumption	
		TJ	m^3
Existing (without WWTP)	Natural Gas (Boiler and Cogen)	315.8	8,036,000
Proposal (with WWTP)	Natural Gas (Boiler and Cogen)	277.9	7,071,000
	Biogas (Boiler)	37.9	1,516,000
	Biogas (Flare)	2	80,000
	Total	315.8	8,667,000

NOx emission rates are linked to volumetric flow rate and there is therefore potential for an increase in total NOx emissions of up to 8% as a result of the proposal.

However, there is evidence to suggest that NOx formation may be reduced during biogas combustion as a result of a lower methane content and lower combustion temperature[23]. This will depend upon the actual configuration of the boiler, but will likely reduce the rate of increase in annual average NOx emissions to below 8%.

It should further be noted that the onsite treatment of Tooheys waste water replaces the current Sydney Water treatment processes to some extent. The trend towards decentralisation of industrial wastewater treatment is likely to continue as trade waste requirements become more onerous. In theory, the outcome of this trend will likely result in no net change in the regional impacts of treating waste water (including the potential generation of NOx in combustion of biogas) depending on the differences in technologies adopted. That is, the source of regional impacts will shift to a number of decentralised sources rather than one centralised plant.

[2] Wopera, A.,Wagnerova, E., Formation of Air Pollutants at Bio Gas Firing, Hungarian Electronic Journal of Sciences, Széchenyi István University.

[3] Alternative Fuel, Biomass Waste as a Renewable Source of Biogas Production – Experiments, Adrian Eugen Cioabla and Ioana Ionel, Alternative Fuel, August 2011, Intech http://www.intechopen.com/books/show/title/alternative-fuel

6.5.3 Management measures

Operation

The following measures would be adopted:

- Maximising use of biogas in the boiler to reduce natural gas combustion;
- Utilisation of gas buffer system to allow biogas to be stored to some degree when boilers are not operating;
- Consideration of blending of biogas and natural gas to reduce SO_2 emissions over short averaging periods; and
- Review of upstream processes to identify opportunities to remove sulfur compounds from the wastewater.

Construction

Management measures to reduce air quality impacts during construction would include:

- Assigning access and haul roads to permanent paved areas;
- Watering of exposed soil;
- Minimising the duration of exposed soil by construction programming;
- Ensuring vehicles, plant and equipment are adequately maintained so as to minimise air
- Quality impacts from exhaust; and
- Ensuring vehicle or items of plant or equipment generating excessive exhaust (smoke) are not permitted on site.

6.6 Hazard and risk

Due to the hazardous substances and potential hazards present in the proposed concept design, the WWTP is to be reviewed under the provisions of the NSW Department of Planning and Infrastructure, State Environment Planning Policy No.33 – Hazardous and Offensive Development (SEPP 33).

The brewery site is considered to be a 'Potentially Hazardous Industry', and under SEPP 33, a Preliminary Hazard Analysis is required to be performed to prove the proposed WWTP is not hazardous.

A Preliminary Hazard Analysis for the proposed WWTP has been undertaken and is summarised in the following sections. The full Preliminary Hazard Analysis report is presented as Appendix E.

6.6.1 Methodology

The Preliminary Hazard Analysis risk workshop was based on a Hazard Identification Study (HAZID), using site layouts/surveys, process flow diagrams and information about the proposed hazardous substances and processes involved.

The proposed WWTP was broken into sub-systems and analysed methodically, using a list of potentially hazardous events and a list of guide words or prompts to help formulate scenarios and causes for the hazardous events to occur. Existing safeguards and safeguards that are assumed to be part of the design of the new WWTP were identified for each of the causes of the identified hazardous events.

A primarily qualitative risk analysis was performed on each of the consequences of the hazardous events. Due to the difficulty of quantifying the consequences and likelihoods of the hazardous events, a qualitative assessment was made utilising the Tooheys risk matrix policy as a first pass for identifying any intolerable risks.

Recommendations have been made against each of the identified risks, to ensure that the residual risks will be *As Low As Reasonably Practicable* (ALARP).

There are no recommendations that would be considered major recommendations, or major changes to the proposed WWTP concept design.

The majority of the recommendations are either design tasks/investigations that would be expected to be part of the detailed design phase or are modifications to existing administrative systems and procedures employed by Tooheys at their Lidcombe site.

A summary of risks identified with consequences occurring outside the site boundary and their associated recommendations can be found in Table 13.

Table 13 Summary of risks and recommended management measures

Risk	Recommendation
Biogas Leak	Consider vehicle impact protection for biogas equipment in design, consider confined spaces in design, identify low points for H2S to accumulate (i.e. storm drains) in design, consultation with neighbours about risks (i.e. identify a leak by smell, evacuation plans).
Flame failure of biogas flare or boilers	Consider confined spaces in design, identify low points for H2S to accumulate (i.e. storm drains) in design, consultation with neighbours (i.e. identify a leak by smell, evacuation plans)
Incomplete combustion in biogas flare or boilers	Consider confined spaces in design, identify low points for hydrogen sulfide to accumulate (i.e. storm drains) in design, consultation with neighbours (i.e. identify a leak by smell, evacuation plans)
Sludge, waste water or biogas condensate leak via tank overflow, pipe leak or sludge disposal vehicle accident on-site	Review and update Spill Containment Action Plan
Toxic release during powdered chemical handling	Investigate alternative liquid or solid prill chemical delivery to minimise dust, investigate use of dust extraction/containment equipment in design
Hazardous chemical pipe leak or tank overflow	Review Spill Containment Action Plan
Traffic accident involving hazardous chemical or waste transport vehicle on or off site	Use only licensed transport contractor/supplier, review Spill Containment Action Plan for new chemicals on-site
Backflow from chemical or waste water systems or cooling tower	Additional backflow protection on individual chemical system water connections
Biogas fire/explosion inside vapour space of sludge disposal tanker via biogas and static discharge	Hazardous area classification and selection of suitably rated equipment during design including waste removal truck, choose appropriate licensed contractor for waste removal, investigate the need for a fixed earth point for the disposal vehicle on-site
Solid waste spill off-site	Choose appropriate licensed contractor for waste removal, ensure skip bins/tanks are fit for purpose in design phase, ensure skip bins/tanks are adequately covered/sealed prior to leaving site via waste management plan
Lack of maintenance and poor management of new cooling tower leading to contaminated water	Ensure new cooling tower/s are included into existing legionella prevention program
Biocide or saline water release from cooling towers	Review Spill Containment Action Plan

6.6.2 Management measures

A number of design measures would be incorporated in detailed design stage to ensure that the WWTP aligns with the general principles of NSW DP&I's Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning (HIPAP 4). These are given below:

- Noise and odour sources would be minimised and kept as far away from the site boundary as possible, odour exhaust outlets would be at a high level;
- Chemical storage capacities would be minimised and located as far away from the site boundary as possible without creating other hazards;
- The biogas system capacity would be minimised as far as practical, and the high pressure biogas pipeline diameter and pressure should be minimised as far as practical;
- Major components of the biogas system, including the waste gas flare and any relief valve outlets would be kept as far away from the site boundary as possible without creating other hazards; and
- Chemical deliveries and waste disposal vehicle frequencies would be minimised

The off-site effects due to fire or explosion of biogas, and the potential off-site toxic effects from biogas are considered to be highly unlikely. These effects would be investigated further through the detailed design phase, HAZOP workshop to confirm the assumptions of this Preliminary Hazards Analysis.

6.7 Odour

As part of the Environmental Assessment process, a Level 1 Odour Assessment has been undertaken to determine the potential impacts of the proposal and is included as Appendix H . A Level 1 Odour Assessment is a screening-level technique based on generic parameters for the type of activity and the site. It may be used to assess site suitability and odour mitigation measures for new or modified activities but excludes detailed dispersion modelling or monitoring of odour emissions. This level of assessment has been chosen as a first approach to identify whether the site is suitable or further assessment of odour impact is necessary.

6.7.1 Existing condition

Generally, odours from breweries are associated with volatile organic compound released during the heating stages of the process prior to fermentation. Odours during the post-fermentation operations include ethanol and small quantities of other total volatile organic compounds including ethyl acetate.

From a review of the Tooheys brewery process and facilities, sources of potential odour have been identified as:

- direct emissions from wort boiling;
- direct emissions from the maturation and fermentation vessels;
- brewery waste water;
- potential leaks from the ammonia cooling plant;
- ventilation of beer cellars and packaging lines;
- leaks and spills from valves and pipelines; and
- storage of spent grains.

The largest current potential source of odour from the existing brewery operations is the evaporation of volatile organic compounds derived from wort boiling. Wort boiling occurs in brew kettles, within the brewhouse, during which the boil vapour is recompressed and reused before being condensed, cooled and disposed of as a liquid effluent.

The fermentation and maturation stage of the process produces volatile organic compounds including ethanol and ethyl acetate. However, the gases from the fermentation and maturation process are collected to recover carbon dioxide. During this process, the carbon dioxide is purified, so that it may be reused in further stages of the beer making process. In this process, the fermentation gas is passed through a gas scrubber, where it is cleaned by counterflow of water removing the water soluble impurities and a gas purifier, removing further substances influencing odour and taste of the beer.

Existing waste water diverted to trade waste has the potential for odour emissions where brewery effluent and spills are transported off site via an onsite drainage network. The onsite trade waste system is well contained within grated underground drainage channels.

In 2002, Tooheys implemented an odour reduction programme as part of the Environmental Protection Licence which has reduced odour impacts from the site. The project key upgrade completed in 2008 further reduced odour emissions with one odour complaint registered since this time in June 2009.

It is therefore considered that background odour concentrations are likely to be low.

6.7.2 Potential impacts

The onsite wastewater treatment process will potentially result in increase holding time of wastewater on site instead of immediate discharge to trade waste. This will potentially increase the duration of brewery related odour emissions. These emissions will occur during the stages prior to anaerobic digestion and are considered relatively insignificant given that the same quantity of wastewater is already treated on site and that the odour characteristics will be generally the same as the existing site.

However, the proposed WWTP has the potential to generate new sources of odour compared to the existing condition due to the introduction of anaerobic digestion processes with the potential for release of hydrogen sulfide compounds and other odorous compounds. Odour emissions may potentially be released as fugitive emissions from tanks or from the outlet point of carbon filters.

However, odour controls adopted are likely to significantly reduce emissions including:

- Critical odour areas are covered and under negative pressure
- Odorous air is either directed to boilers for destruction or treated in one of two carbon filters which reduce odorous emissions in the order of 99.9%

Notwithstanding, odour dispersion modelling was undertaken for these sources to determine the odour concentration likely to be experienced at the nearest sensitive receiver and compared to the criteria prescribed by the *Technical Framework: Assessment and Management of Odour from Stationary Sources* in NSW (NSW DEC, 2006).

The results of this modelling are presented in Table 14.

Table 14 Odour assessment results

Option	Predicted Maximum Ground Level Concentration (OU)		Background Concentration (OU)	Criteria (µg/m^3)
	Maximum outside site boundary[1]	At Sensitive Receiver[2]		
DAF	1.69	0.092	NA	NA
MBR	2.2	0.155	NA	2

1 Odour level modelled at closest neighbouring industrial boundary adjacent to Haslams Creek

2 At Nyrang Street, approximately 275 m to the east of the WWTP

While the background concentration for odour at the site and for sensitive receivers is not known, the results for odour emissions from the proposed WWTP options have resulted in odour levels at sensitive receivers which are approximately 8% of the criteria. Therefore it is likely that the WWTP under either option is unlikely to raise the criteria above acceptable levels.

6.7.3 Management measures

Management measures for odour to be applied on the site would include;

- An odour monitoring plan would be prepared and implemented in accordance with the *Approved Methods for the Sampling and Analysis for Air Pollutants in New South Wales* (NSW DEC, 2006);
- Regular inspection and testing of the pre-acidification tank and mix tank would be undertaken to ensure optimum acidic conditions are present;
- Odour sampling and analysis would to be undertaken as part of post-commissioning performance testing. Minimum testing required to be undertaken is for sulphurous compounds including hydrogen sulfide and volatile organic compounds at the plant and at the site boundary;
- All potential odour sources related to the wastewater and biogas system would be adequately contained and regularly inspected and tested;
- The existing gas boilers and flaring system would combust the biogas completely without unintended or unburnt emissions;
- Where possible any odour generating events such as tank cleaning would be undertaken under favourable atmospheric conditions (such as an easterly breeze);
- The installation of a screen (such as stands of trees and shrubs) at the western boundary of the site would be considered if required to reduce potential effects to surrounding industrial neighbours;
- Loading of sludge to removal vehicles would be undertaken so as to minimise odours from sludge escaping to the environment;
- Chemical storage facilities are to be kept as far away from sensitive receivers as possible;
- All chemicals to be stored on site would be handled and stored in accordance with proper hazard management procedures;
- Activated carbon filters would be regularly inspected and maintained to an optimum standard of operation. The malfunction of carbon filters due to poor maintenance is a key potential odour emission source.

6.8 Resource consumption - Energy

6.8.1 Existing conditions

Toohey's Brewery installed a 2MW$_e$ cogeneration system in mid 2010 and commissioned in September 2010. This has altered the energy mix supplied to the site with gas consumption increasing and electricity consumption decreasing significantly. This means that a full year of consumption data is not yet available so existing conditions for energy consumption are slightly uncertain.

Average monthly energy consumption for the Toohey's Brewery site before and after the commissioning of the cogeneration system is shown below in Table 10.

Table 10 Monthly average energy consumption pre and post commissioning of the cogeneration system

Energy type	**Pre cogeneration (January 2007 – August 2010)**	**Post Cogeneration (September 2010 – April 2011)**
Average monthly electricity consumption (MWh)	2,813	1,891
Average monthly natural gas consumption (GJ)	19,489	26,316

For the purposes of estimated existing consumption the average monthly energy consumed has been used to estimate annual and daily consumption. These estimates are:

- 322,095 GJ a year of energy or 865 GJ per day;
- 22,691 MWh a year of electricity or 62 MWh per day; and
- 315,792 GJ a year of natural gas or 864 GJ per day.

6.8.2 Potential impacts

The WWTP will result in an increase in electricity use and a reduction in natural gas consumption through the use of biogas in a boiler.

The WWTP will use approximately 4.8 MWh per day of electricity. This will increase electricity consumption by 1,753 MWh per year to a total of 24,444 MWh per year. This represents an increase of around 8%.

The WWTP is estimated to produce 4,400 Nm^3 of biogas per day with an energy value of 110 GJ. It is assumed that 95% of this biogas is utilised in a boiler, offsetting 104.5 GJ of natural gas consumption, and that the remainder is flared. The balance of gas consumption before and after WWTP is shown in Table 11 below.

Table 11 Annual natural gas and biogas consumption

Scenario	Natural Gas		Biogas		Total	
	GJ	Nm^3	GJ	Nm^3	GJ	Nm^3
Existing	315,792	8,035	NA	NA	315,792	8,035
With WWTP	277,623	7,064	40,178	1,607	317,801	8,671
% change	-12%	-12%	NA	NA	1%	8%

Table 12 below summarises the annual energy consumption now and that estimated once the WWTP project is implemented.

Table 12 Current and future annual energy consumption

Energy type	Existing annual consumption	Predicted annual consumption	Percentage change
Electricity (MWh)	22,691	24,444	8%
Natural Gas (GJ)	315,792	277,623	-12%

The rise in electricity consumption will be mitigated by the reduction in natural gas consumption. However this is based on the assumption that 95% of the biogas is utilised to offset natural gas consumption. Measures that enable this amount of biogas to be utilised include:

- Optimising the maintenance regimes for the boiler that will use the biogas to ensure that maximum biogas is utilised; and
- Providing temporary biogas storage of between $70m^3$ to $100m^3$ to compensate for times when the biogas boiler is not in operation.

6.9 Greenhouse gas emissions

6.9.1 Existing conditions

Greenhouse gas emissions from the brewery are considered in terms of Scope 1 emissions (direct release from the site) and Scope 2 emissions (emissions released elsewhere as a result of consumption of energy on site i.e. electricity). Based on the energy consumption estimated in Section 6.8.1, the Scope 1 greenhouse gas emissions from natural gas consumption at the brewery site is 44.4 tCO_2e per day and Scope 2 emissions associated with electricity consumption is 55.3 tCO_2e per day.

Annual Scope 1 and Scope 2 greenhouse gas emissions from energy consumption are shown in Table 13 below.

Table 13 Greenhouse gas emissions associated with current energy consumption

Parameters	Existing annual consumption	Emissions factor (tCO_2e/ unit)	Annual greenhouse gas emissions (tCO_2e)
Electricity (MWh)	22,691	0.89	20,195
Natural gas (GJ)	315,792	0.05133	16,210

The overall annual greenhouse gas emissions from the consumption of electricity and combustion of natural gas are estimated to be 36.4 $ktCO_2$-e.

6.9.2 Potential impacts

The carbon dioxide emitted from the combustion of biogas is treated as renewable and neutral in terms of global warming potential. The methane and nitrous oxide emissions associated with the combustion of biogas are considered to have a global warming potential. This means that biogas has a much smaller GHG emissions factor than natural gas and that the WWTP project would result in an overall reduction in greenhouse gas emissions associated with the Tooheys Brewery.

The balance of greenhouse gas emission associated with the project is shown below in Table 14.

Table 14 Greenhouse gas emissions existing and with WWTP

Parameter	Existing consumption	Consumption with WWTP	Emission factor (tCO_2e/unit)	Current emissions (tCO_2e)	Future emissions (tCO_2e)
Electricity	22,691 MWh	24,444 MWh	0.89	20,195	21,755
Natural gas	315,792 GJ	277,623 GJ	0.05133	16,210	14,250
Biogas	0 GJ	40,178 GJ	0.00483	0	194
Total	NA	NA	NA	36,405	36,200

The greenhouse gas emissions reductions associated with biogas combustion and the offset of natural gas consumption is 5.37 tCO_2e per day. Overall, this represents a reduction of 4.83 tCO_2e a day or 1,765 tCO_2e per year.

However, increased electricity consumption means that the proposal would result in an overall reduction of greenhouse gas emissions of only 0.56 tCO_2-e per day, or 205 tCO_2-e per year. This represents a 0.6% decrease in annual Scope 1 and Scope 2 greenhouse gas emissions.

It is estimated that if the utilisation of biogas reduced to below 85% of biogas produced, reducing the amount of natural gas offset, there would be no greenhouse gas benefit.

6.9.3 Management measures

The rise in electricity consumption will be mitigated by the reduction in gas consumption. However this is based on the assumption that 95% of the biogas is utilised to offset natural gas consumption. Measures that enable this amount of biogas to be utilised would include:

- Optimising the maintenance regimes for the boiler that will use the biogas to ensure that the maximum biogas is utilised; and
- Providing temporary biogas storage of between 70m^3 to 100m^3 to compensate for times when the biogas boiler is not in operation.

6.10 Resource consumption - Water

6.10.1 Existing conditions

The average daily water consumption between May 2010 and April 2011 was 3,000 kL.

6.10.2 Potential impacts

The WWTP would not significantly alter the water consumption of the brewery. Small quantities of water may be used for cleaning and cooling of the WWTP.

6.10.3 Management measures

While there are no specific management measure related to water consumption, the project represents the first stage into a potential water reuse plant which would significantly reduce the site's potable water consumption. The feasibility of a reverse osmosis plant to further treat wastewater to reuse standards is subject to an ongoing feasibility study.

6.11 Waste

6.11.1 Existing conditions

Currently the brewery discharges an average 2,000kL of wastewater daily to Sydney Water's sewerage system.

6.11.2 Potential impacts

Whether dissolved air flotation or a membrane bioreactor is used, the WWTP will not change the volumes of wastewater discharged, although it will improve its quality, as described in Section 6.1. The average effluent volume is predicted to remain the same, 2,000kL a day.

The WWTP will also produce waste solids, consisting of residual solids from the brewery and excess biomass (sludge). The residual solids are expected to be removed through dissolved air flotation and will be disposed of offsite. The sludge will be collected and dewatered, leaving approximately 4.5m^3 of dewatered sludge to be sold or disposed of daily.

It should be noted that further assessment would be required to quantify the solid waste from the WWTP if a membrane bioreactor was used.

6.11.3 Management measures

The sludge produced will be tested for its suitability for land application under the *Australian Guidelines for sewerage system: Bio-solid management, 2004*. It is expected that most of the sludge will be sold for reuse.

6.12 Cumulative impacts

An assessment of cumulative environmental impacts considers the potential impact of a proposal in the context of existing developments and future developments to ensure that any potential environmental impacts are not considered in isolation. The extent of cumulative impacts to be considered depends upon the nature of the environmental issue.

The WWTP is not considered to make a significant contribution to cumulative impacts associated with wider strategic policy such as greenhouse, resource consumption and waste disposal. The improved efficiencies that will occur as a result of the WWTP will reduce the brewery's load on natural resource consumption resulting in a reduction in cumulative impact to wider environmental systems.

In the context of local cumulative impacts, including noise, odour, air quality, visual and traffic, the impact of the brewery WWTP is to be considered in combination with:

- the surrounding industrial developments;
- future developments including the proposed distribution centre to the west of the site;
- the nearby Parramatta Road and M4 Freeway; and
- the existing brewery operations.

For the most part, the impacts of these developments have already been incorporated as baseline conditions in the environmental risk assessment presented in Section 6.

The Preliminary Hazard Assessment, presented in Appendix C, considered and assessed potential cumulative hazards and risks associated with the proposed WWTP, existing operations on the Tooheys site and the surrounding industrial areas.

7 Draft statement of commitments

Environmental management of the proposed WWTP will be undertaken in accordance with the existing approved Construction Management Plan and Operational Management Plans for Project Key as well as the site's Environmental Protection License.

Additional management measures will be adopted for the WWTP project as summarised below.

Table 15 Summary of environmental management and mitigation measures

Environmental management or mitigation measure		Phase
1	**Scope and compliance**	
1.1	Tooheys will carry out the project in general accordance with this Environmental Assessment, including the Statement of Commitments	All
1.2	Tooheys will, in writing, provide a Statement of Compliance to the Director-General of the Department of Planning and Infrastructure one week prior to the start of construction activities at the site. The Statement of Compliance will include: • Details of how the Commitments required to be addressed before construction were complied with • The time when each relevant Commitment was complied with including dates of submissions of any required reports and/or approval dates	Pre-construction
2	**Environmental management**	
2.1	Tooheys will update the current Construction Management Plan for the site with approval to be obtained by the Director General	Pre-construction
3	**Communication and consultation**	
3.1	Tooheys will continue to be responsive to the community's expectations and requests. In particular, Tooheys will: • Continue to maintain a complaints register for the site • Consult with industrial neighbours to the immediate south west of the site with respect to the WWTP project	All
4	**Flooding**	
4.1	The proposed floor level (top of slab) of the wastewater treatment plant at the Tooheys Brewery will be designed to be above 7.4mAHD	Pre-construction
4.2	The detailed design of the WWTP will consider reliable access for pedestrians or vehicles from the wastewater treatment plant to an area of refuge above the probable mean flood level	Pre-construction

5	**Traffic**	
5.1	A dedicated site compound area will be established, clearly demarked and its location included on site plans.	Construction
5.2	Use of temporary construction traffic measures on the site (witches hats, traffic controllers, etc) will be implemented as required	Construction
5.3	Parking for staff associated with the construction works will be provided at the main staff car park on the site	Construction
5.4	Public traffic access to and from Nyrang Street will be maintained at all times	Operation
5.5	Operational traffic will use existing entry and exit points from the site and existing authorisation procedures	Operation
5.6	All deliveries and removal of material via truck transport to and from the WWTP will be covered	Operation
6	**Noise**	
6.1	Contractor(s) ' detailed design will be required to meet noise levels as specified through the use of appropriate enclosures and/or other mitigation methods	Pre-construction
6.2	Acoustic monitoring will be undertaken as per Tooheys EPL and if complaints are received	
6.3	Acoustic test certificates will be obtained where appropriate for machinery, noisy plant and machinery brought on to the site	Pre-construction
6.4	Working hours will be controlled so that there is no work audible at nearby residences on Sundays, public holidays, or during the night time or evening periods	Construction
6.5	Silencers will be fitted to plant including residential grade mufflers to the exhausts of noisy items of plant	Construction
6.6	Regular maintenance will be undertaken of plant to prevent plant noise levels increasing	Construction
6.7	Machinery will be turned off when not in use, and machine enclosures are kept closed	Construction
7	**Air quality**	
7.1	Review of upstream processes to identify opportunities to remove sulfur compounds from the wastewater	Pre-construction
7.2	Access and haul roads will be assigned to permanent paved areas	Construction
7.3	Exposed soil will be watered	Construction
7.4	The duration of exposed soil will be minimised by construction programming	Construction
7.5	Vehicles, plant and equipment will be adequately maintained so as to minimise air quality impacts from exhaust	Construction
7.6	Vehicle or items of plant or equipment generating excessive exhaust (smoke) will not be permitted on site.	Construction
7.7	The use of biogas in the boiler will be maximised to reduce natural gas combustion	Operation

7.8	The gas buffer system will be utilised to allow biogas to be stored to some degree when boilers are not operating	Operation
7.9	Consideration will be given to blending of biogas and natural gas to reduce SO_2 emissions over short averaging periods	Operation
8	**Hazard and risk**	
8.1	Vehicle impact protection for biogas equipment will be considered in detailed design	Pre-construction
8.2	Confined spaces will be considered in detailed design to identify low points for hydrogen sulfide to accumulate (i.e. storm drains	Pre-construction
8.3	The Spill Containment Action Plan will be reviewed and updated and submitted to the Director General for approval	Pre-construction
8.4	Hazardous area classification and selection of suitably rated equipment will be undertaken during detailed design	Pre-construction
9	**Odour**	
9.1	An odour monitoring plan will be prepared and submitted to the Director General in accordance with the *Approved Methods for the Sampling and Analysis for Air Pollutants in New South Wales* DECC	Pre-operation
9.2	The pre-acidification tank and mix tank will be regular inspected and tested to ensure optimum acidic conditions are present	Operation
9.3	Odour sampling and analysis will be undertaken as part of post- commissioning performance testing.	Operation
9.4	All potential odour sources related to the wastewater and biogas system will be adequately contained and regularly inspected and tested	Operation
9.5	The existing gas boilers and flaring system will combust the biogas completely without unintended or unburnt emissions	Operation
9.6	Where possible any odour generating events such as tank cleaning will be undertaken under favourable atmospheric conditions (such as an easterly breeze).	Operation
9.7	The installation of a screen (such as stands of trees and shrubs) at the western boundary of the site will be considered if required to reduce potential effects to surrounding industrial neighbours	Pre-operation
9.8	Loading of sludge to removal vehicles will be undertaken so as to minimise odours from sludge escaping to the environment	Operation
9.9	Chemical storage facilities will be kept as far away from sensitive receivers as possible	Operation
9.10	All chemicals stored on site will be handled and stored in accordance with proper hazard management procedures	Operation
9.11	Activated carbon filters will be regularly inspected and maintained to an optimum standard of operation	Operation

Appendix A

PEA recommendations

Issue	Potential Impact	Recommendation for further assessment.
Water Quality	The key objective of the project is to improve wastewater quality discharged to Sydney Water sewerage system. **Environmental benefit.**	Assessment of the improvement in wastewater quality to be discharged to sewer as a result of the project.
Flooding	The north west corner of the site has the highest flood risk as it is likely to be within the 1 in 100 year flood levels for the Haslams Creek catchment. **Moderate environmental significance.**	Qualitative assessment of the potential impact from flooding and flood behaviour of Haslams Creek catchment, specifically in relation to: • obstruction of flood flows, • flow storage volumes, and • risks to the WWTP itself.
Traffic	No significant increase in traffic generation or staffing levels is anticipated as a result of the operation of the proposed WWTP. Some additional deliveries of wastewater treatment chemicals will be required and removal of sludge, but will be insignificant in terms of overall traffic volumes. Construction traffic will be mainly associated with delivery of equipment and concrete pour. **Low environmental significance.**	Quantitative assessment of increased vehicle numbers during construction and operation
Noise	The most stringent noise criterion for the Tooheys site is the 50 dB(A) EPL criterion applying at the site boundary of nearby noise-sensitive receivers, which applies to all noise from Tooheys operations, not just the WWTP. Noise from the WWTP will be designed to be sufficiently low that it does not add to the noise level at the residential property boundary. Sources of noise will include pumps, treatment vessels, exhaust flues, water discharge. These will be contained within buildings where possible to mitigate against noise impacts. **Low environmental significance.**	Technical noise assessment to model the noise impacts of the various components of the WWTP at the nearest sensitive receivers on Nyrang Street, and assess compliance of the WWTP with the licence noise criteria for the Tooheys brewery. A qualitative discussion of construction noise impacts based on the assumption that the construction period will be 19 months and involve minimal traffic movements.

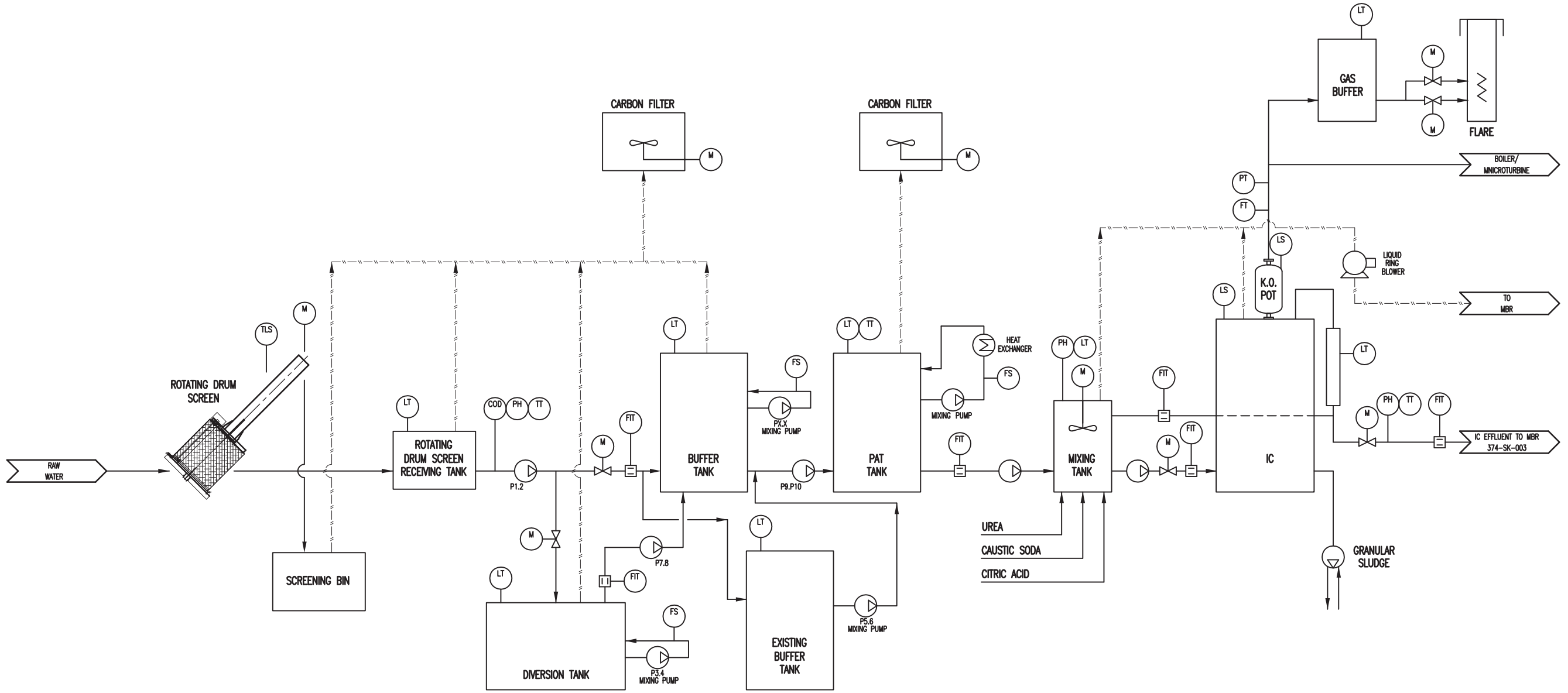
Issue	Potential Impact	Recommendation for further assessment.
Air Quality	There will be no additional impacts to air quality as a result of the operation of the wastewater treatment with the exception of odour emissions (see below). The biogas generated will replace natural gas in the boilers which may have an altered combustion profile due to the additional impurities in biogas However, biogas combustion will only represent a small proportion of the total natural gas consumption at the site. (<10%) **Low environmental significance.**	Assessment of the impact to air quality as a result of replacing a portion of the natural gas feed to the boilers with biogas. Inclusion of a revision of previous air quality assessment submitted specifically addressing changes in emissions to air as a result of: • any change in combustion efficiency of the unit as a result of change of fuel mix; and • changes in pollutant concentrations resulting from change in fuel mix. No additional dispersion modelling is recommended due to small percentage of biogas compared to overall natural gas consumption.
Hazards and Risk	Change in hazard risk on the site as a result of: • Storage and use of wastewater treatment chemicals • Storage transfer and combustion of biogas on site. **Moderate environmental significance.**	Preliminary hazards assessment (PHA) in accordance with *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazardous Analysis*
Contamination	No subsurface works and therefore limited risk of encountering contamination during construction. All chemicals used for operation will be stored in hardstand dedicated storage areas limiting risk of introducing contamination during operation. **Insignificant**	No further assessment is recommended.
Visual Amenity and Landscape	The proposed works are focused within the operational part of the existing brewery and are away from sensitive receivers. The height of the new tanks and cooling tower are comparable to the heights of other nearby process equipment and will not be visible from residential areas on Nyrang Street. **Insignificant**	No further assessment is recommended.
Odour	The process of anaerobic digestion is odorous producing hydrogen sulphide. The process equipment proposed include a number of odour mitigation measures including enclosed vessels, offgas treatment and activated carbon scrubbers consistent with best	A 'Level 1' technical odour assessment carried out in accordance with the DECCW *Technical Framework and Technical Notes for the Assessment and Management of Odour from Stationary Sources in NSW*, 2006 including the following information:

Issue	Potential Impact	Recommendation for further assessment.
	management practice and using the best available control technology. Notwithstanding there are likely to be minor fugitive odour emissions. The WWTP is located at the rear of the site away from residential areas (approximately 200m to nearest residential receptors). **Low environmental significance.**	• Description of the source and frequency of odour emissions and the identification of the nearest affected receptor; • Review of published odour emission rates for similar facilities to provide quantification of likely emission rates (OUV per second); • Discussion on acceptable level of odour concentration at affected receptors in the affected community; • Review of local topography and presence of buildings; • Discussion of worst-case meteorology; • Avoidance and mitigation strategies
Heritage (Aboriginal and Non-Aboriginal)	The Wangal clan of the Eora Aboriginal tribe were the original inhabitants of the Auburn area. The site has, however, been significantly modified and it is unlikely for Indigenous artefacts to remain. The brewery site forms part of a site occupied by the Sydney Meat Preserving Company between 1869 and 1955. The *Auburn Heritage Study* (Schwager, 1996) identified the meat preserving works site as being of archaeological significance, however, the buildings and structures have been removed and the ground surface disturbed. The site is not identified in Auburn Council's register of archaeological sites and potential archaeological sites. The canalisation of Haslams Creek, running along the western boundary of the site, is a non-Indigenous heritage item of local significance, listed in Schedule 2 of the Auburn LEP. None of the works would physically impact upon the canalisation of Haslams Creek. **Insignificant.**	No further assessment is recommended. .
Flora and Fauna	Proposed upgrade within the operational part of the brewery. No impact to the vegetated areas. **Insignificant**	No further assessment is recommended.

Issue	Potential Impact	Recommendation for further assessment.
Resource Consumption	The project will result in an overall increase in energy consumption on site. Further the project will allow Tooheys to reduce consumption of natural gas by reusing biogas. Therefore, on balance, there is likely to be a net benefit or at worst a neutral outcome in terms of overall energy consumption. **Low environmental significance**	A summary of the net increase or decrease in resource consumption at the site, addressing: • Energy; • Electricity; • Natural gas (likely decrease where biogas can be diverted to cogeneration unit); • Greenhouse gas emissions (potential decrease if sufficient quantities of biogas are generated); and • Water
Waste Management	The project will result in the generation of waste solids, consisting of residual solids from the brewery, excess biomass (sludge) and ferric phosphate flocs.	Summary of waste volumes and proposed on site storage, and end treatment for each waste type.
Socio-Economic	On-going viability of brewery, with associated benefit to the wider economy. Ongoing viability of Sydney Water infrastructure **Insignificant (potential benefit)**	No further assessment.

Appendix B

Process flow diagrams



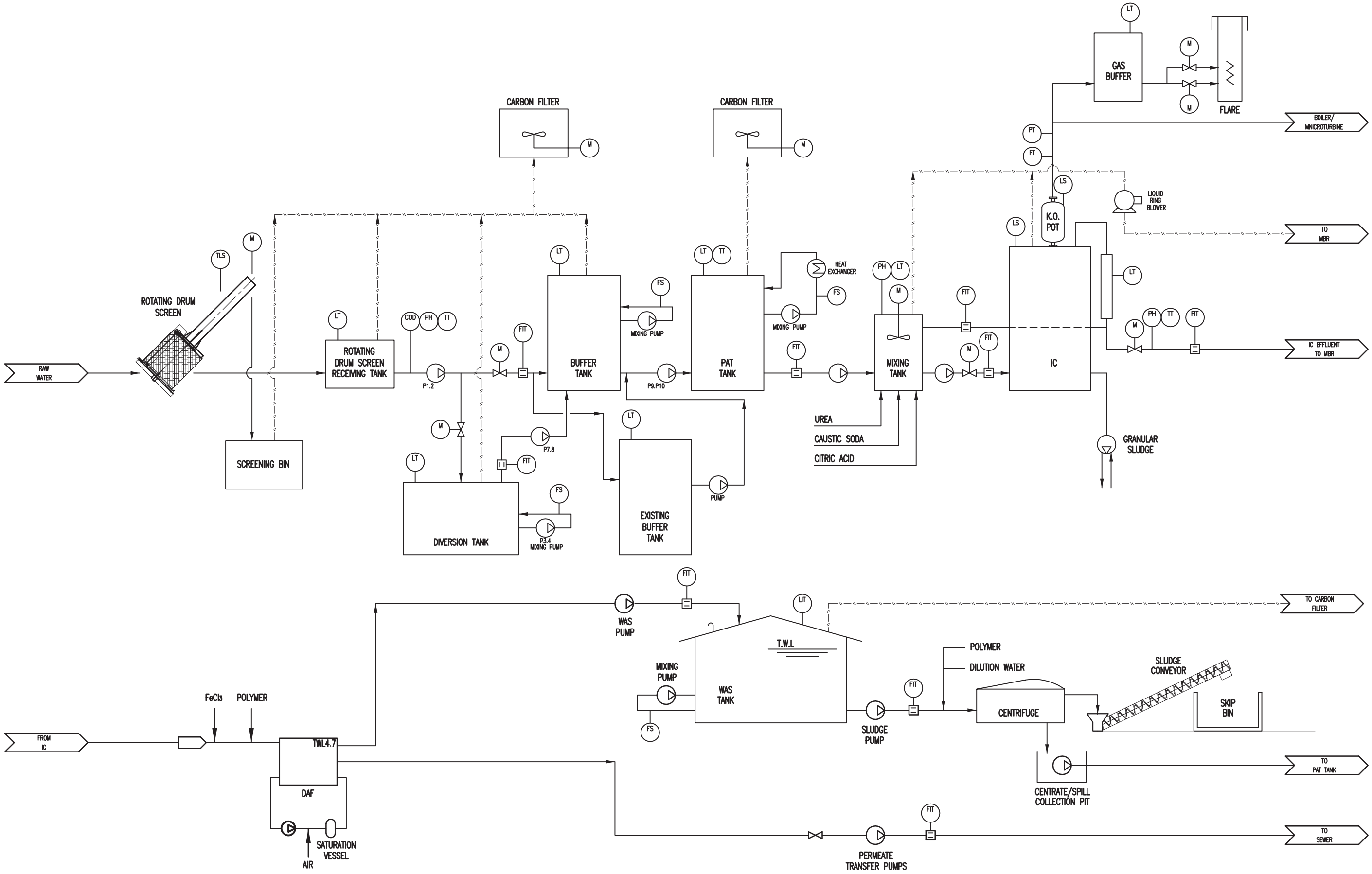
REFERENCE DRAWINGS	
DRAWING No.	TITLE
374-SK-003	WWTP - ANAEROBIC & MEMBRANE PFD

No.	DATE	REVISION	DRN	CHK	APP.
A	22.08.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

LION NATHAN AUSTRALIA PTY LTD
WASTE WATER TREATMENT PLANT
ANAEROBIC & MEMBRANE PFD

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
NTS	AUBURN BREWERY	–	374–SK–002	A



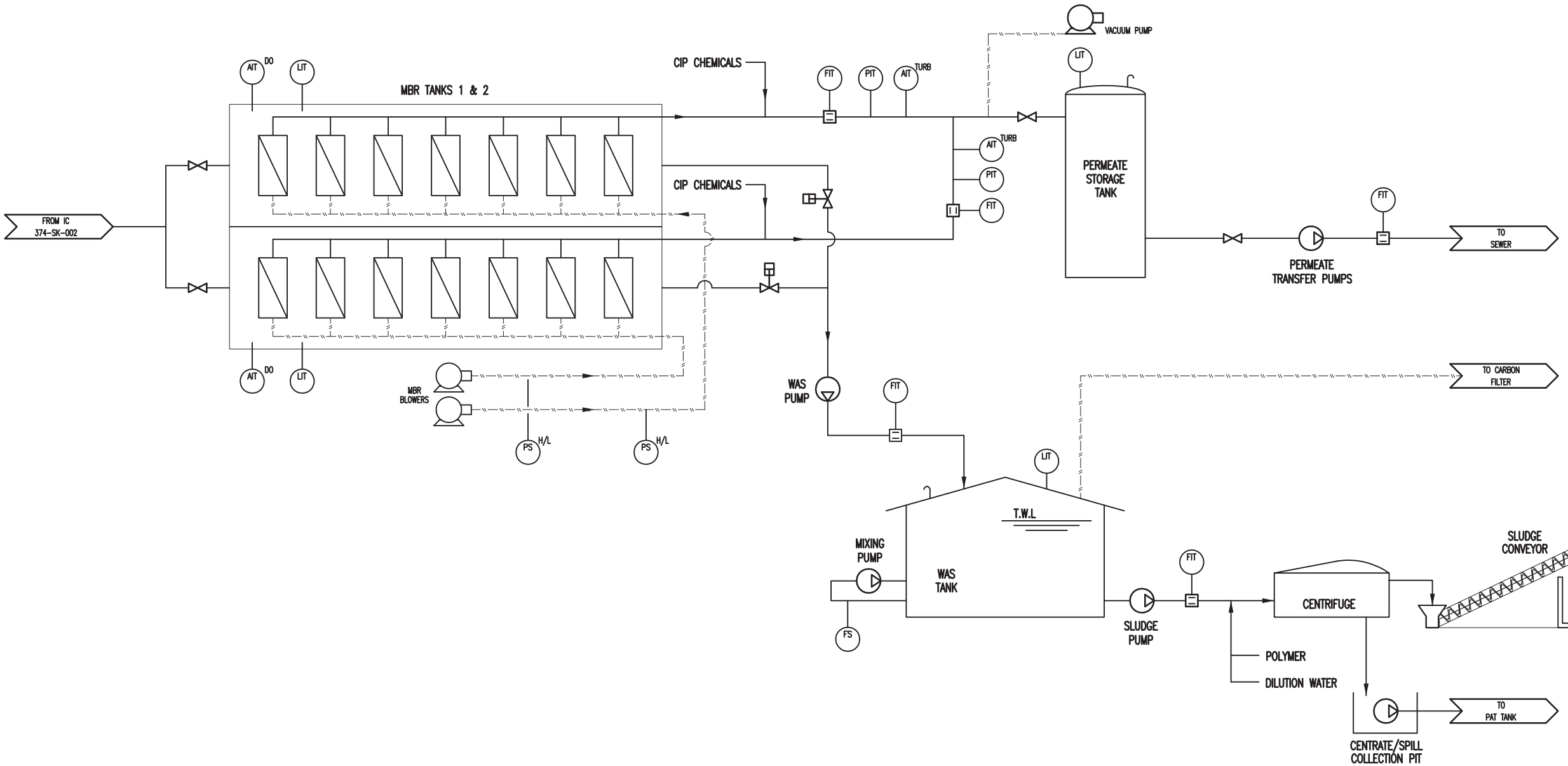
REFERENCE DRAWINGS	
DRAWING No.	TITLE

No.	DATE	REVISION	DRN	CHK	APP.
A	22.08.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

LION NATHAN AUSTRALIA PTY LTD
WASTE WATER TREATMENT PLANT
ANAEROBIC & DAF PFD

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
NTS	AUBURN BREWERY	–	374–SK–004	A



REFERENCE DRAWINGS	
DRAWING No.	TITLE
374-SK-002	WWTP - ANAEROBIC & MEMBRANE PFD

No.	DATE	REVISION	DRN	CHK	APP.
A	22.08.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

LION NATHAN AUSTRALIA PTY LTD
WASTE WATER TREATMENT PLANT
ANAEROBIC & MEMBRANE PFD

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
NTS	AUBURN BREWERY	–	374–SK–003	A

Appendix C

Consultation

Our ref 221580/FSR

ARUP

By Email & Post

Karl O'Korn
Team Leader - Development Assessment
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PO Box 118
AUBURN NSW 1835

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Sydney
NSW 2000
Australia

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d +61 2 9320 9339
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melanie.koerner@arup.com
www.arup.com

4 April 2011

Dear Karl

Proposal to Install a Wastewater Treatment Plant
Tooheys Brewery, Lidcombe, Auburn LGA

This letter is to inform you of the Tooheys Brewery proposal to install a wastewater treatment plant at the existing brewery site, located at 29 Nyrang Street Lidcombe within the Auburn LGA. Arup has been commissioned by Tooheys to undertake the Environmental Assessment for the proposal. The proposal is to be assessed under Part 3A of the NSW EP&A Act by the NSW Department of Planning and therefore requires no action on your behalf. However, we would welcome any Council comments and concerns at this stage so that we can ensure that they are addressed within the Environmental Assessment document.

Background

In July 2006, Tooheys Brewery received single site wide planning approval from the NSW Department of Planning (DoP) under Part 3A of the Environmental Planning and Assessment (EP&A) Act, 1979. The approval was granted for the major upgrade of the brewery known as Project Key as well as a site wide approval for ongoing operations at the brewery. Tooheys now proposes to install a wastewater treatment plant at the site which is not currently covered by the site wide approval.

Project Proposal

In order to improve the liquid waste water quality, Tooheys propose to install a wastewater treatment plant (WWTP) on site to treat up to 3,500 kL of wastewater per day. Currently, the proposed treatment process comprises of high rate anaerobic digestion (AD) followed by aerobic digestion prior to discharge to the sewerage system. The plant is to be located on the rear boundary in the South West corner of the site adjacent to Haslams Creek and industrial neighbours. Tooheys also propose to divert the biogas generated from the AD process to the existing boilers for energy generation offering a renewable replacement for the natural gas fuel currently used and reducing the carbon footprint of the site.

The EA will assess the range of potential impacts of the plant including air quality, odour, noise, flooding, hazard and risk and resource consumption. You will also be provided with an opportunity to comment on the EA which is due to be completed in October 2011.

Please send any comments or questions to Melanie Koerner by 18th April 2011 so that these can be specifically addressed in the Environmental Assessment process.

Yours sincerely

Melanie Koerner
Senior Engineer

From: "BEAN, JOHN" <John.Bean@sydneywater.com.au>
To: 'Christine Chapman' <Christine.Chapman@planning.nsw.gov.au>
Date: 5/12/2011 9:05 am
Subject: RE: Tooheys Brewery, Lidcombe - Modification Application

Hi Christine
I have reviewed the EA and it confirms the details provided to me as part of their effluent improvement program.
The only points I would like to add is what are the consequences of WWTP Operational stoppages or malfunction and containment of wastewater processing and storage vessels and pre-treatment equipment in line with DECCW bunding requirements.
Feel free to contact me if you require any further detail
Regards
John Bean
Business Customer Representative
Business Customer Services

Gate 0, 33-73 Links Road
St Marys NSW 2760
TEL: 88055550
FAX: 88055588
M: 0419400723

From: Christine Chapman [mailto:Christine.Chapman@planning.nsw.gov.au]
Sent: Monday, 9 May 2011 4:41 PM
To: BEAN, JOHN
Subject: Tooheys Brewery, Lidcombe - Modification Application

Good afternoon John
Apologies for not speaking with you directly, I was unable to contact you by phone.
The Department recently received a modification application from Tooheys (PA 06_0303) to install a wastewater treatment plant and new cooling tower at the site. A copy the Preliminary Environmental Assessment is attached for your review.
It would be appreciated if you could review the attached and advise on any requirements for the EA in additional to those outlined in Table 2 of the attached.
If you could provide me with your comments/requirements by Thursday 12 May, it would be greatly appreciated.
Please feel free to give me call if you would like to discuss.
Kind regards

Christine Chapman
Senior Planner, Major Projects Assessment
NSW Department of Planning & Infrastructure | GPO Box 39 | Sydney NSW 2001
T: 02 9228 6537 F: 02 9228 6466
christine.chapman@planning.nsw.gov.au<mailto:christine.chapman@planning.nsw.gov.au>

Dams + Recycling + Desalination + Water efficiency = Water 4 Life.

NORTH POINT LOCATION INDICATIVE ONLY

EQUALISATION TANKS

EXISTING TRADE WASTE CONNECTION

PROPOSED TRADE WASTE PIPELINE

PROPOSED TRADE WASTE CONNECTION

PROPOSED BIOGAS PIPELINE

PROPOSED WASTE WATER TREATMENT PLANT SITE AREA

Proposed Bright Beer Cellar
Sub
CIP Plant
Path
Bridge
Plumbers
Racking Cellar
Underground Carpark
Tech. Office
Gatehouse Monitor
Tunnel
Water Tower
Tank Farm Slab No.1
Spent Grain Silos
Waste Treatment
Grain Silos
Beer Processing Building
Fabrication
Laboratory Complex
Beer Recovery
Yeast Loading
Packed Stock
Filtration Road
Filtration
Tank Farm Slab No.2
Brewhouse
The Back Road
Yeastroom
DAW Tank
Engine Room
Carbon Filter
Pump house
Lactic Acid
Hot Liquid Tanks
Tank Farm Slab No.3
Sub-Station No.1
Husdon's Creek
NWSSDB Easement
B'house Liquid Tanks
Liquid Sugar Tanks
Unloading Area
Oxygen Tank
Acid Tanks
Old Cellar Road
Cooling Tower
Condens.
Maturation
Cellar
CO2
Recovery
Loading
Egg Board Road
The Front Road

0 10 20 30 40 50
SCALE 1:500m

Issue	Date	By	Chkd	Appd

Client

Job Title
TOOHEYS
EFFLUENT IMPROVEMENT
PROGRAM

Scale at A1 1:500

Discipline

ARUP
Level 10, 201 Kent street
Sydney, NSW, 2000
Tel +31 (02) 9360 9360
www.arup.com

CONSULT AUSTRALIA
Member Firm
Arup Pty Ltd
ABN 18 000 966 165

Drawing Title
PROPOSED TRADE WASTE
TREATMENT LAYOUT

Drawing Status
FOR INFORMATION

Job No	Drawing No	Issue
221580	**SK001**	**A**

Do not scale

From: Melanie Meatheringham <Melanie.Meatheringham@environment.nsw.gov.au>
To: Christine Chapman <Christine.Chapman@planning.nsw.gov.au>
Date: 5/5/2011 9:55 am
Subject: RE: Tooheys Brewery Modification 06_0303 Mod 3

HI Christine,

I have reviewed the Preliminary Environmental Assessment and table 2 appears to have covered all of the Office of Environment and Heritage (OEH) areas of interest. Please call me on 9995 6858 if you would like to discuss further.

Kind Regards,

Melanie Meatheringham
Regional Operations Officer
Metropolitan Regulatory Projects & Programs Unit, EPRG
TEL: 9995 6858 Fax: 9995 6902

_____
From: Christine Chapman [mailto:Christine.Chapman@planning.nsw.gov.au]
Sent: Tuesday, 3 May 2011 3:34 PM
To: Meatheringham Melanie
Cc: Goodwin James
Subject: Tooheys Brewery Modification 06_0303 Mod 3

Good afternoon Melanie,
I have just been speaking with Mr Stuart Clark regarding the Toohey's Brewery, Lidcombe site. He advised me that you would be the appropriate contact regarding the site now.
Tooheys have written to the Department requesting the DGR's for a proposed modification to PA 06_0303, to install a wastewater treatment plant and new cooling tower at the site. A copy the Preliminary Environmental Assessment is attached for your review.
It would be appreciated if you could review the attached and advise on any requirements for the EA additional to those outlined in Table 2 of the attached.
If you could provide me with your comments/requirements no later than Monday 9 May, it would be greatly appreciated.
Please feel free to give me call if you would like to discuss.
Kind regards

Christine Chapman
Senior Planner, Major Projects Assessment
NSW Department of Planning & Infrastructure | GPO Box 39 | Sydney NSW 2001
T: 02 9228 6537 F: 02 9228 6466
christine.chapman@planning.nsw.gov.au<mailto:christine.chapman@planning.nsw.gov.au>

From: "MURPHY, STEVE" <STEVE.MURPHY@sydneywater.com.au>
To: "'Christine.Chapman@planning.nsw.gov.au'" <Christine.Chapman@planning.ns...
Date: 5/12/2011 7:52 am
Subject: Response to Tooheys PEA

Hi Christine
Sydney Water supports Tooheys in their response to our requirement for them to improve the quality of their trade wastewater discharge, primarily aimed at reducing odour and corrosion in the receiving sewer downstream.

The preliminary environmental assessment provides an appropriate summary of the proposed WWTP and associated environmental impacts.

Items that warrant further consideration in the EA include;

* impacts on current stormwater management arrangements.

* Consequences of Wastewater treatment malfunction.

* Containment of additional wastewater processing and storage vessels.

* adequate bunding of the treatment tanks and bulk reagent storage.

* holistic first flush arrangements for the entire site.

regards

Steve Murphy | Manager Delivery
Business Customer Services | Sydney Water
L1 Minnamurra Building 51 Hermitage Rd West Ryde NSW 2114
T 9800 6552
M 0419 018 862
DX 2517W

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Appendix D

Technical assessment - Flooding

Tooheys Brewery

Tooheys WWTP EA

Flood Risk Assessment

221580

Issue | September 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

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Level 10
201 Kent Street
Sydney
NSW 2000
Australia
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Job number 221580

ARUP

Contents

Appendices

Executive Summary

Arup has been commissioned to undertake an Environmental Assessment (EA) for planning approval modification for the proposed wastewater treatment plant at Tooheys Brewery. The proposed wastewater treatment plant will treat an average daily flow rate of 2,400kL of industrial waste produced onsite. As part of the EA, a flood risk assessment has been carried out and is outlined in the following report.

The original EA noted that the northwest corner of the site is the worst location in terms of flood risk as it is within the 100 year Annual Recurrence Interval (ARI) flood plain levels for the Haslams Creek catchment. The proposed location of the wastewater treatment plant is in the west corner of the site and as a result a flood risk assessment is required to determine:

- The design flood levels from the Auburn Development Control Plan;
- The potential impact of the development on flood storage volumes;
- The potential impact of flooding on the development.

A review of available information found that Auburn Council commissioned a flood study, *'Haslams Creek Floodplain Risk Management Study and Plan'* in January 2003. In the vicinity of Tooheys Brewery, the study recommends a design level of 7.4mAHD for the 100 year ARI flood event which includes an allowance for freeboard. It is therefore recommended that a minimum floor level of 7.4mAHD is adopted for the proposed wastewater treatment plant.

In the event of a flood, a minimum floor level of 7.4mAHD will not only reduce damage to the wastewater treatment plant but it will also reduce the risk of environmental impacts on the surrounding areas from industrial waste contamination.

Given the proximity of the Tooheys Brewery site to the adjacent creek, it is highly likely that the site will be affected by flooding in future. However the extents of the development in comparison to the size of the flood extents are small and therefore, the impact of the development on surrounding flood levels is expected to be minimal.

1 Introduction

Tooheys is proposing to redevelop their current brewery site located at 29 Nyrang Street, Lidcombe to include a wastewater treatment plant to treat industrial waste produced onsite. Arup has been commissioned to undertake an Environmental Assessment (EA) on the proposed development. As part of the EA, a desktop flood study has been carried out to assess the flood risk to the site and provide details of any mitigation measures which should be incorporated into the proposed development to minimise the impact of future flooding.

2 Background Information

2.1 Location of Site

Tooheys Brewery is located at 29 Nyrang Street, Lidcombe. The site is bounded by Haslams Creek to the northwest of the site, Nyrang Street to the southeast and other industrial properties to the northeast and southwest as shown below in Figure 1. The Haslams Creek only forms the boundary for Tooheys Brewery on one side of the site. However, this creek is in close proximity to the site on both the northwest and northeast sides of the site. The St Hilliers Road Branch channel connects into Haslams Creek near the west corner of the Tooheys Brewery site. These channels both influence the flooding on the site of the brewery. The proposed development at Tooheys Brewery in Lidcombe is situated within the Haslams Creek Catchment which ultimately drains into Homebush Bay.

Figure 1: Tooheys Brewery site

2.2 Description of the Proposed Works

The wastewater generated from the Tooheys Brewery site is currently discharged directly to Sydney Water's sewerage system under a Sydney Water Trade Waste agreement. However, Sydney Water has directed Tooheys to improve the quality of its liquid trade waste. In order to improve the liquid waste water quality, Tooheys propose to install a wastewater treatment plant on site to treat an average flow rate of 2,400kL of wastewater per day.

The final design and location of the wastewater treatment plant within the site are still being developed. The proposed layout is shown below in Figure 2 and has the wastewater treatment plant located in the west corner of the Tooheys Brewery site.

THE BREWHOUSE ROAD

TANK FARM 3

BUFFER
(Ø10m x 12m)

DIVERSION
TANK
(Ø10m x 12m)

FLARE

CAUSTIC

HYPO

CITRIC
ACID

UREA

SLUDGE PUMP
(UNDERGROUND)

LRB

IC FEED PUMPS

MIX FEED PUMPS

PAT MIXING PUMPS

PAT
(Ø8.54m)

OVERHEAD
MIXING
TANK
(Ø4.0m)

IC

GAS BAG
(Ø4.9m)

MCC/LAB

POLYMER

CENTRIFUGE

SLUDGE BIN

CIP TANK
(Ø3.0m)

SLUDGE TANK
(Ø3.0m)

CARBON
FILTER

PIPERACK / ELECTRICAL

VACUUM PUMP

VACUUM PUMP

MIXING PUMP

MIXING PUMP

SLUDGE PUMP

WAS PUMP

BLOWER

BLOWER

BLOWER

MBR 1

MBR 2

PERMEATE
TANK

SUBMERSIBLE
PERMEATE
TRANSFER PUMPS

FUTURE RO PLANT

MAINTENANCE ACCESS AREA

BOUNDARY/FENCE

WASTE WATER
TREATMENT PLANT

M.G.A. NORTH

SITE NORTH

0 5m 10m 30m

REFERENCE DRAWINGS	
DRAWING No.	TITLE
374-SK-001	MASTER SITE PLAN - SHEET 1

GENERAL NOTES

1. THIS SITE PLAN WAS RE-DRAFTED BASED ON BRUNSKILL McCLENAHAN & ASSOCIATES PTY LTD SITE SURVEY CONDUCTED 11/03/2011 (BMA REF. 10081-SC).
2. CRITICAL FEATURES ON THIS PLAN MUST BE VERIFIED BY THE USER AS TO THE ACCURACY REQUIRED FOR THE INTENDED PURPOSE.

No.	DATE	REVISION	DRN	CHK	APP.
A	05.09.2011	ISSUED FOR DA APPROVAL	RPZ	SK	-

TOOHEYS LIMITED

WASTE WATER TREATMENT PLANT
GENERAL ARRANGEMENT
SHEET 1

SCALE	LOCATION	PLOT DATE	DRAWING No.	REV.
1:150 (A1)	AUBURN BREWERY	–	374-SK-005	A

3 Review of Existing Information

3.1 Auburn Council Involvement

Arup wrote to Auburn Council on 19 April 2011 to involve them in a consultation process for the flood risk assessment and to request the most recent flooding information and design standards. This was followed up with a visit to the Auburn Council office on 3 May 2011 where more flood modelling data was obtained.

3.2 Existing Flood Studies

The site is covered by an Auburn Council commissioned flood study *'Haslams Creek Floodplain Risk Management Study and Plan'* undertaken by Bewsher Consulting Pty Ltd in January 2003. Bewsher Consulting Pty Ltd undertook flood modelling in HECRAS, a one dimensional model. The results of the flood study as shown in *'Figure 4.2 100 year and probable maximum flood extents along open channel systems'* indicate that some flooding is expected on the site in the 100 year Average Recurrence Interval (ARI) flood event. The report also confirms that the majority of the site lies within the extent of the Probable Maximum Flood (PMF) event thus in this major event, the majority of the Tooheys Brewery site is expected to be inundated. As *'Figure 4.4 Flood risk precincts along open channel systems'* indicates, the varying flood levels on the site for the 100 year ARI flood event results in parts of the site being classed as a medium flood risk precinct while the remainder is classed as a low flood risk precinct. These figures can be found in Appendix A. For design purposes the proposed wastewater treatment plant should be considered as being within the medium flood risk precinct.

Buckton Lysenko Consulting Engineers undertook a smaller study in August 2006, *'Flood Study for 17 to 19 Percy Street'*. On behalf of Buckton Lysenko Consulting Engineers, DHI Water and Environment Pty Ltd undertook two dimensional flood modelling in Mike 11. The resulting flood levels are lower than the previous modelling as a result of improved accuracy in the type of modelling.

3.3 Flood Levels

The 100 year ARI flood event planning level nearest to the proposed location of the wastewater treatment plant is shown as 7.4mAHD according to *'Table 4.2 Water levels and planning levels'* in the *'Haslams Creek Floodplain Risk Management Study and Plan'*. This planning level is the result of the 100 year ARI flood level plus an allowance for freeboard. For the purposes of flood modelling Bewsher Consulting Pty Ltd adopted a freeboard of 0.5m for subcritical flow and 1.0m for supercritical flow. During major flood events the flow in Haslams Creek is expected to oscillate between subcritical and supercritical flow conditions. This is the case in the vicinity of the Tooheys Brewery as is shown in the design profile in Figure 3 below. The Tooheys Brewery site lies within sections 1033 to 1093 of the flood model.

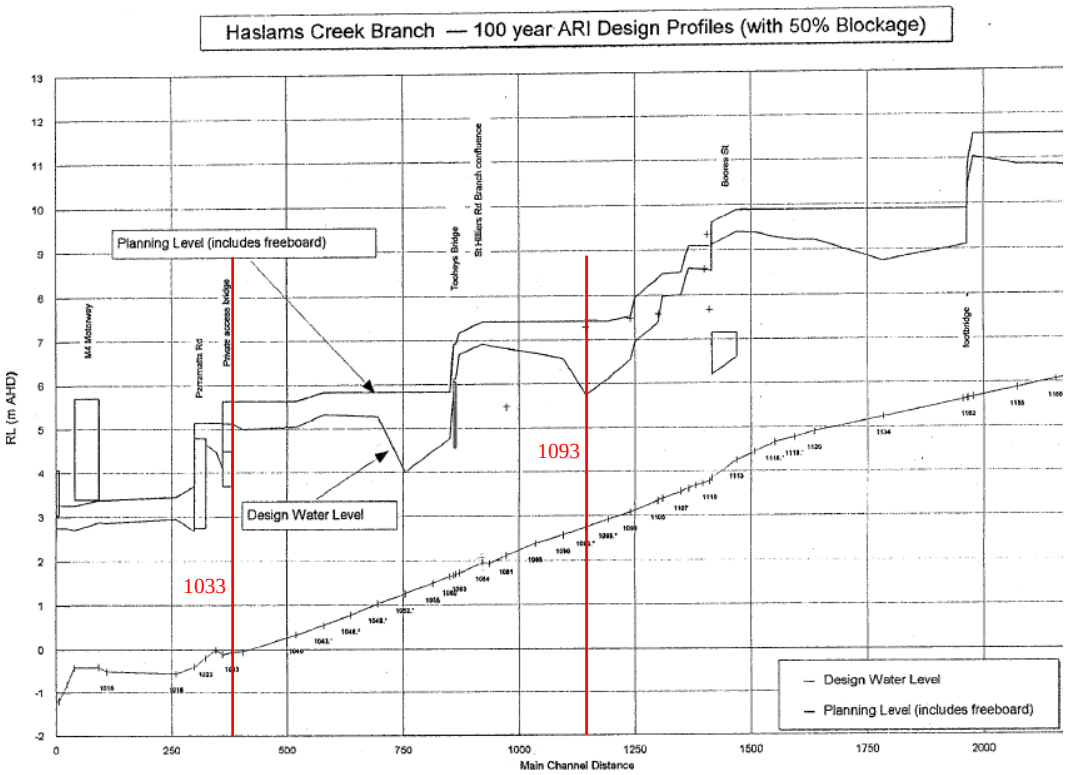

Figure 3: 100 year ARI Design Profile for Haslams Creek Branch with 50% blockage

Reproduced from 'Haslams Creek Floodplain Risk Management Study and Plan – Appendices to Final Report'

The planning level of 7.4mAHD is based on 50% blockage of structures. As a result, Figure 3 indicates that the Tooheys bridge has a significant impact on flood behaviour. Due to the blockage caused by the bridge in high rainfall events it is important that the flood levels are not increased as a result of the proposed development to prevent making the existing problem any worse.

4 Planning Considerations

4.1 Development Control Plan

Any new development within the Auburn Council region must comply with the Development Control Plan. For the purposes of this flood risk assessment Section 18 *'Stormwater Drainage'* of the Auburn Development Control Plan 2010 is applicable. Within this document Section 6.0 *'Flood risk management'* lists the controls that a new development must comply with for the proposed land use category within a specific floodplain.

The proposed development is within the Haslams Creek floodplain and the land use falls within the commercial and industrial category. Based on a medium flood risk there are significant planning considerations to be taken into account which are outlined in the following sections.

4.1.1 Floor Levels

When considering floor levels the development control plan states:

- *Floor levels of open car parking areas to be equal to or greater than the 20 year ARI flood plus freeboard.*
- *Habitable floor levels to be equal to or greater than the 100 year ARI flood plus freeboard.*

The freeboard height in the Haslams Creek floodplain is variable primarily due to the implications of subcritical and supercritical flows caused by obstructions to the flowpath of flood waters. The freeboard can be determined by reference to a map and tables produced as part of the *'Haslams Creek Floodplain Risk Management Study and Plan'*. In the vicinity of the proposed wastewater treatment plant the freeboard is approximately 0.7m.

4.1.2 Building Components

When considering building components the development control plan states:

- *All structures to have flood compatible building components below or at the 100 year ARI flood level.*

4.1.3 Structural Soundness

When considering structural soundness the development control plan states:

- *Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year ARI flood.*

4.1.4 Flood Affectation

When considering flood affectation the development control plan states:

- *The impact of the development on flooding elsewhere to be considered.*

4.1.5 Evacuation

When considering evacuation the development control plan states:

- *Reliable access for pedestrians or vehicles is required from the dwelling, commencing at a minimum flood level equal to the lowest habitable floor level to an area of refuge above the PMF level, either onsite of offsite.*
- *Applicant to demonstrate that the development is to be consistent with any relevant DISPLAN or flood evacuation strategy.*

4.1.6 Management and Design

When considering management and design the development control plan states:

- *Site Emergency Response Flood plan required (except for single-dwelling houses) where floor levels are below the design floor level.*

- *Applicant to demonstrate that area is available to store goods above the 100 year ARI flood plus 0.5m (freeboard).*
- *No external storage of materials below design floor level which may cause pollution or be potentially hazardous during any flood.*

4.2 Local Environmental Plan

The Auburn Local Environmental Plan 2010 needs to be taken into consideration when a new development is proposed. The Auburn Local Environmental Plan 2010 Flood Planning Map indicates that the Tooheys Brewery is within the flood planning area. The relevant flood planning map can be found in Appendix B.

As a result of being located within the flood planning area there are particular requirements that must be addressed. To obtain development consent the consent authority must be satisfied that the development:

(a) is compatible with the flood hazard of the land, and

(b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and

(c) incorporates appropriate measures to manage risk to life from flood, and

(d) is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

The Auburn Local Environmental Plan 2010 Foreshore Building Line Map indicates that the Tooheys Brewery is not within the foreshore building line area and therefore this provides no additional limitations to the proposed wastewater treatment plant. The relevant foreshore building line map can be found in Appendix B.

It is noted that Don Fox Planning undertook a report on planning issues as part of the appendices for the *'Haslams Creek Floodplain Risk Management Study and Plan'*. Don Fox Planning recommended that Auburn Council adopt a foreshore building line that is not less than 10m from the top of the creek bank for all the open channel systems. Based on this recommendation part of the proposed location of the wastewater treatment plant is within Don Fox Planning's recommended foreshore building line. However no record was found that Auburn Council have adopted this recommendation and therefore the development is located outside the foreshore building line and no extra limitations are imposed.

5 Impacts of the Development on Flooding

In the 100 year ARI flood event the cross section of Haslams Creek is expected to be approximately 240m wide in the vicinity of the proposed wastewater treatment plant. The wastewater treatment plant is expected to encroach on this width by approximately 17m. The extents of the development in comparison to the size of the flood extents are small and therefore, the impact of the development on surrounding flood levels is expected to be minimal. Given the proximity of the Tooheys Brewery site to the adjacent creek, it is highly likely that the site will be affected by flooding in future. However, the proposed wastewater treatment plant is set back from the creek bank and is not expected to significantly impact flood storage volumes.

6 Mitigation of Flood Impacts

The risk of serious consequences from a flood on the Tooheys Brewery site can be mitigated by designing the new development to be resilient to flooding. It is believed that the following recommendations for the wastewater treatment plant will result in minimal impact on future flooding on the Tooheys Brewery site and surrounding properties. The following recommendations also take into consideration the Auburn Council Development Control Plan and the Local Environmental Plan.

The Auburn Council Development Control Plan require the design floor levels for the proposed wastewater treatment plant to be above the 20 year flood level with an allowance for freeboard as well. Due to the likeliness that the site will be flood affected in future, it is recommended that the proposed floor level of the wastewater treatment plant at the Tooheys Brewery is designed to be above 7.4mAHD. This is the design level for the 100 year ARI flood event which includes an allowance for freeboard of approximately 0.7m. The existing ground levels in the proposed location of the wastewater treatment plant vary between approximately 7mAHD and 8mAHD. It is therefore reasonable to have a minimum floor level of 7.4mAHD.

If the 100 year ARI flood level is adopted as a minimum floor level the wastewater treatment plant will be more resilient to flooding in the future. In the event of a flood, not only will it reduce damage to the wastewater treatment plant but it will also reduce the risk of environmental impact from the wastewater treatment plant on the surrounding area. A minimum floor level of 7.4mAHD means there is less chance of industrial waste contamination. This is hugely beneficial for the surrounding environment and future sustainability.

The *'Flood Study for 17 to 19 Percy Street'* undertaken by Buckton Lysenko in August 2006 states that the flood modelling carried out by Bewsher Consulting in 2003, from which the design level of 7.4mAHD was derived from, was done in HECRAS, a one dimensional model. In 2006, DHI Water and Environment Pty Ltd undertook two dimensional flood modelling in Mike 11 on behalf of Buckton Lysenko in the vicinity of Tooheys Brewery. They determined that the previous modelling of Haslams Creek had overestimated the peak water levels on the site by approximately 0.6m. Based on this, adopting a design floor level of 7.4mAHD for the proposed wastewater treatment plant is a conservative approach to

minimise the impact on of the wastewater treatment plant on future flooding in the vicinity.

It is worth noting that the design floor level of 7.4mAHD does not include an allowance for climate change. It is likely that the *'Haslams Creek Floodplain Risk Management Study and Plan'* undertaken in January 2003 predates any formal climate change allowances. To further future proof the wastewater treatment plant a higher floor level could be considered.

The Auburn Development Control Plan requires that where it is not possible for the proposed wastewater treatment plant to be above 7.4mAHD, the building must be flood compatible. To achieve flood compatibility for foundations below the 100 year ARI flood level, concrete slab-on-ground monolith construction or suspension reinforced concrete slabs for flooring and sub-floor structure can be used. For the wastewater treatment plant to be resilient to flooding, it is also recommended that sensitive receptors are raised above floor level and located on the side of the building furthest from the Haslams Creek.

Locating the wastewater treatment plant above the 100 year ARI flood level will significantly reduce the impacts upon the wastewater treatment plant structure in the event of a flood. To achieve the structural soundness required by the Auburn Council Development Control Plan an assessment will be required by a structural engineer if the floor level of the wastewater treatment plant is to be below the 100 year ARI flood level of 7.4mAHD. In this case, the assessment will need to demonstrate the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI flood. For these assessments it is worth noting the results of the two dimensional flood modelling undertaken by DHI Water and Environment Pty Ltd. *'Figure 6 Existing Case – 1:100 year AEP Flood – Speed Map'* from Appendix A1 of *'Flood Study for 17 to 19 Percy Street'* indicates that the velocity of Haslams Creek is to be greater than 2m/s in the 100 year Annual Exceedance Probability flood event. This can be found in Appendix C.

To achieve the evacuation standards required by the Auburn Council Development Control Plan it is recommended that the detailed design of the wastewater treatment plant considers reliable access for pedestrians or vehicles from the wastewater treatment plant to an area of refuge above the PMF level.

A Site Emergency Response Flood plan may also be required in the event that the floor level of the wastewater treatment plant is below the design floor level.

Appendix A

Haslams Creek Floodplain Risk Management Study and Plan

Figure 4.2 100 year and probable maximum flood extents along open channel systems
Figure 4.4 Flood risk precincts along open channel systems

FIGURE 4.2
100 YEAR AND PROBABLE MAXIMUM FLOOD EXTENTS ALONG OPEN CHANNEL SYSTEMS

OLYMPIC PARK

LIDCOMBE

AUBURN

ROOKWOOD CEMETERY

LEGEND

- Probable Maximum Flood (PMF)
- 100 year ARI floodway
- Existing Open Channel
- Existing Major Pipe System

IMPORTANT NOTE REGARDING THE ACCURACY OF THIS PLAN

This map is approximate and provides only an indication of the areas likely to be affected by flooding along the open channel systems. The map's accuracy is dependent on the limited ground survey and contour information that is currently available. Before the map is adopted and used, Council intends to undertake more detailed ground survey to accurately map the various flood extents shown on this plan.

FLOODPLAIN MANAGEMENT CONSULTANT

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Plot file date: 28/07/2003
Plot scale: 1:10,000 (A3)
Date of plot: 1 Jan 2003

HASLAMS CREEK FLOOD PLAIN RISK MANAGEMENT STUDY AND PLAN

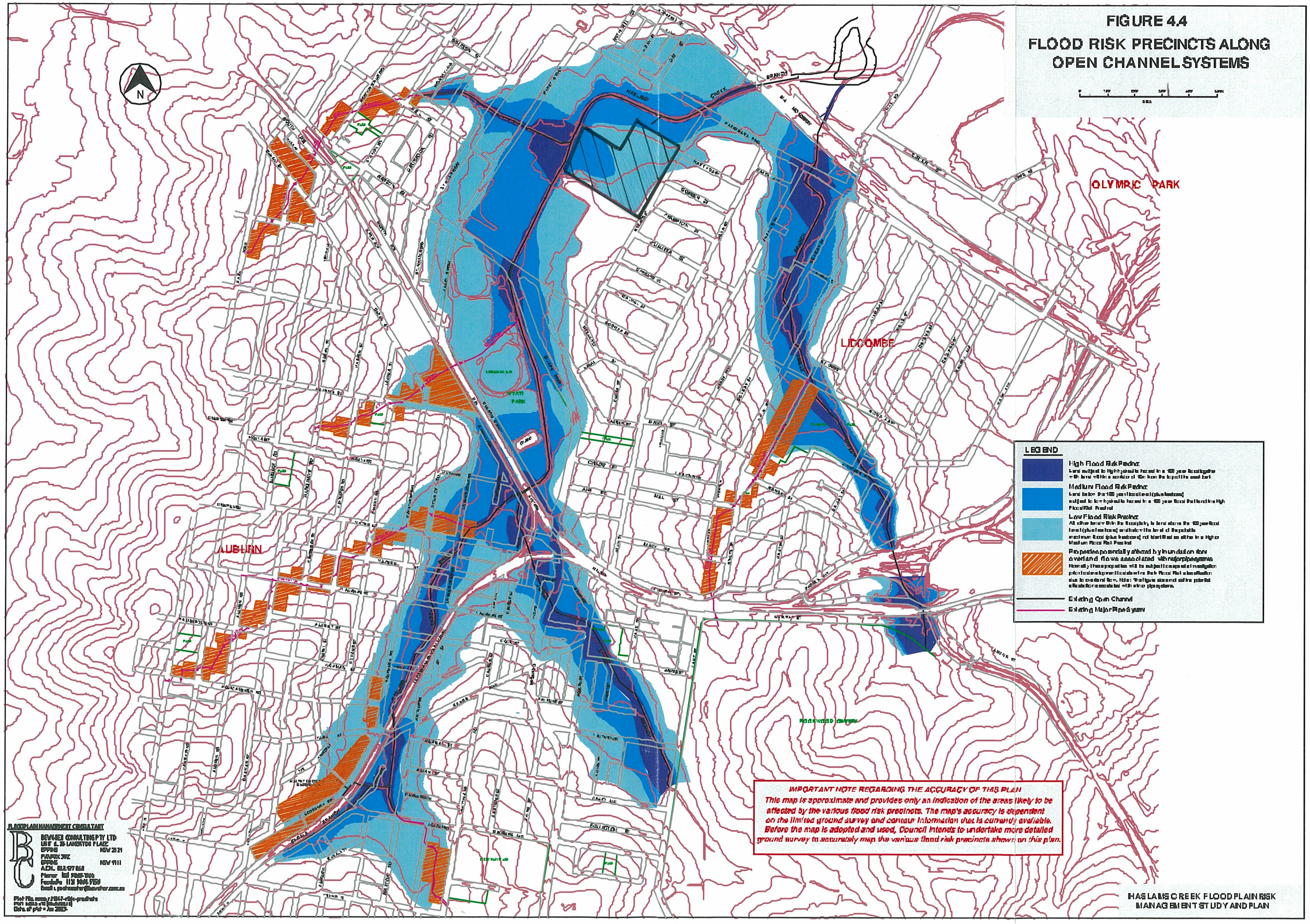


FIGURE 4.4
FLOOD RISK PRECINCTS ALONG OPEN CHANNEL SYSTEMS

Appendix B

Auburn Local Environmental Plan 2010

Flood Planning Map
Foreshore Building Line Map

Auburn Local Environmental Plan 2010

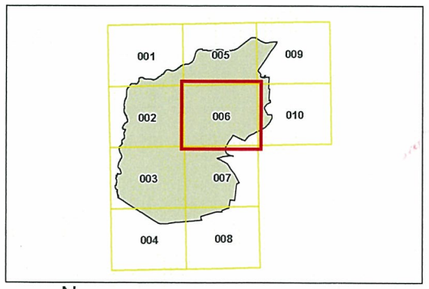
Flood Planning Map
Sheet FLD_006

Flood Planning Land

Flood Planning Area

Cadastre

Cadastre 25/05/10 © LPMA NSW



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Scale: 1:10,000 @ A3

Projection: GDA 1994
MGA Zone 56

Map identification number:
0200_COM_FLD_006_010_20100728

STRATHFIELD COUNCIL

AUBURN CITY COUNCIL
MANY CULTURES ONE COMMUNITY

Auburn Local Environmental Plan 2010

Foreshore Building Line Map
Sheet FBL_006

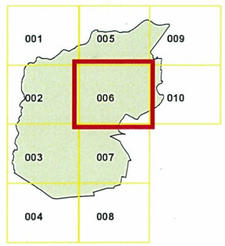
Foreshore building line

Foreshore building line

Land below foreshore building line

Cadastre

Cadastre 25/05/2010 © LPMA NSW



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Metres

Scale: 1:10,000 @ A3

Projection: MGA GDA 1994
Zone56

Map identification number:

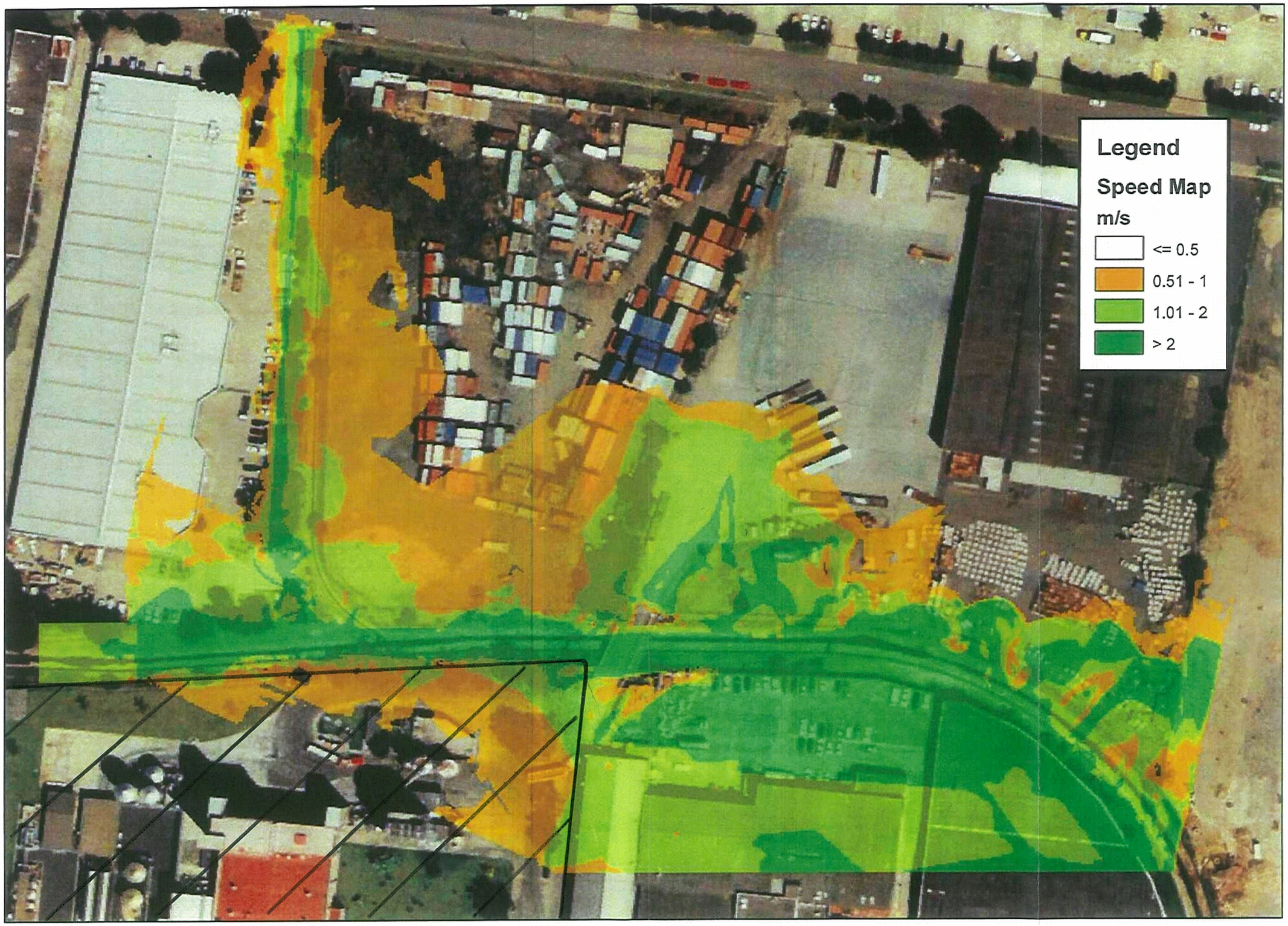
0200_COM_FBL_006_010_20100903

STRATHFIELD COUNCIL

Appendix C

Flood Study for 17 to 19 Percy Street, Auburn

Figure 6 Existing Case – 1:100 year AEP Flood – Speed Map



Existing Case - 1:100 year AEP Flood - Speed Map
Figure 6

Appendix E

Technical assessment – Noise

Tooheys Brewery

Tooheys Brewery WWTP

Noise Assessment

221580

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ARUP

Contents

1 Introduction

Tooheys propose to install a wastewater treatment plant (WWTP) and new cooling tower at its brewery in Lidcombe. These works are not covered by the site wide approval issued in 2006. The project therefore requires assessment as a modification to the existing Part 3A approval for the site under Section 75W of the EP&A Act. This process requires the submission of a Noise Impact Assessment which is contained in this report.

1.1 Site Description

The brewery is located at 29 Nyrang Street in Lidcombe. The site is bound on three sides by industrial premises and by residential receivers across Nyrang Street to the east.

The proposed location of the WWTP is on the south western corner boundary of the site, approximately 275 m from the nearest potentially affected residential receiver in Nyrang Street. Significant acoustic shielding is afforded to the majority of residences in Nyrang Street by the intervening warehouse buildings on both the Tooheys site and the neighbouring industrial sites.

Figure 1 presents an aerial view of the site in the context of its surroundings and the proposed location of the WWTP.

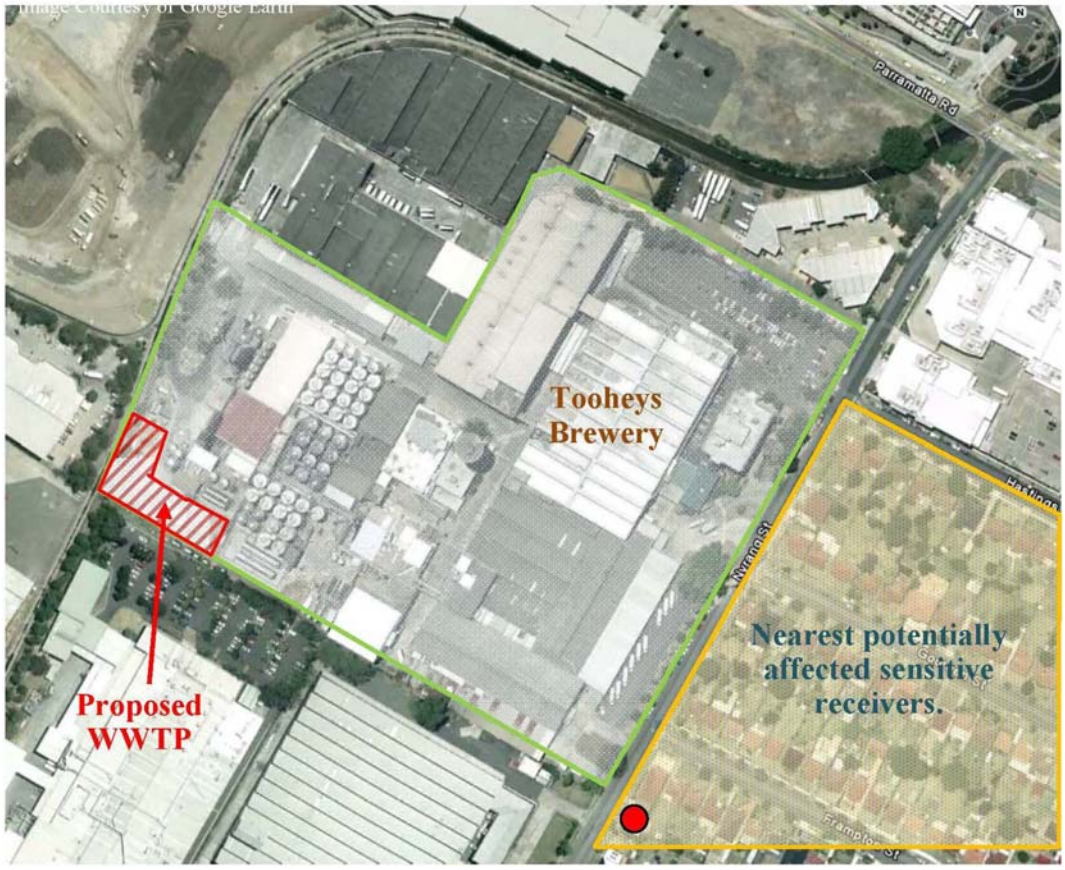


Figure 1 Aerial view of Tooheys Brewery and surroundings

2 Noise Criteria

2.1 Environment Protection Licence (EPL) L1167

The following is an excerpt from the Environment Protection Licence (EPL) L1167, prescribed to the site by the Department of Environment, Climate Change and Water (DECCW) in March 2011:

> *L6 Noise Limits*
>
> *L6.1 Noise generated at the premises must not exceed the noise limits presented in the table below:*
>
> *Noise Limits (dB (A))*

Location	**At All Times $L_{Aeq(15\ minute)}$**
Boundary of 24 Nyrang Street (opposite site entrance)	50

> *Noise from the premises is to be measured at the boundary of 24 Nyrang Street opposite site entrance to determine compliance with the LAeq(15 minute), noise limits in condition L6.1. Note: 5dB (A) must be added to the measured level if noise is substantially tonal or impulsive in character.*

It should be noted with respect to the receiver location that the quoted address is not actually located opposite the site entrance. Further, for the purpose of this study, it is assumed that the criteria apply to all nearby residential receivers.

Noise emission criteria apply to all noise from Tooheys operations, not just the proposed WWTP. It is therefore recommended that noise from the WWTP be designed to be 10 dB below the noise criterion in order to not contribute to the overall industrial noise emissions from the site as a whole. This equates to a noise objective of **40 dBA** at the nearest residential site boundary.

As part of a separate assessment, Tooheys is seeking to negotiate with OEH for an increase in the quoted noise emission criteria. Demonstrating compliance with existing noise emission criteria is therefore considered to be a conservative approach to assessment.

2.2 Industrial Noise Policy

Further to the noise emission objectives derived under the current site specific licence, the Office of Environment and Heritage (OEH) also sets industrial noise emission criteria for industrial receivers in the Industrial Noise Policy (INP). These noise criteria are summarised in Table 1.

Table 1 INP Industrial Noise Emission Criteria for Industrial Receivers

Type of Receiver	**Time of Day**	**Recommended LAeq Noise Level (dBA)**	
		Acceptable	**Recommended Maximum**
Industrial premises	When in use	70	75

3 Noise Impact Assessment

3.1 Operational Noise

3.1.1 Noise Sources

Given the early stage in project development, specific plant selection has not been finalised. It is understood that two options are being considered for the 'aerobic' treatment stage, namely:

- Dissolved Air Flotation (DAF)
- Membrane Bioreactor (MBR)

All other components of processing are understood to be common to both options (i.e. anaerobic, sludge dewatering, chemical, RE, control). The main noise generating equipment in both systems are identified as being the pumps and blowers.

3.1.1.1 Pumps

In the absence of any specific sound power data, empirical calculations have been made based on input information from Aquatec-Maxcon. Table 5 in Appendix B summarises a list of pumps for each stage along with corresponding power ratings and empirically derived sound power spectra used in noise modelling. As advised by Tooheys, an operating speed of approximately 1420 rpm has been adopted in calculations for all pumps.

3.1.1.2 Blowers

As part of a separate assessment[1]., GHD conducted a noise survey of a treatment plant within the Castlemaine Perkins owned XXXX Brewery at Milton. With the permission of GHD, measured noise data obtained of blower noise at a similar site in Milton, Queensland were provided by Aquatec-Maxcon. Aquatec-Maxcon informed Arup that the blowers represent the dominant noise component to the overall WWTP system.

The above facility is based on combined DAF /MBR and reverse osmosis technology.

Table 2 provides a summary of the calculated sound power spectrum as derived from measurements undertaken by GHD.

Table 2 Source Sound Power Spectrum for Blowers

Item of Plant	Octave Band Centre Frequency (Hz) dB re 20µPa								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Blowers	82	83	98	92	86	86	79	68	94

[1] Refer GHD Report *369148 ERA report final*

3.1.2 Noise Modelling and Assessment Methodology

Assessment of WWTP noise impacts was conducted using the CONCAWE[2] noise propagation algorithms contained within the SoundPLAN noise modelling software suite.

The CONCAWE model was developed for conducting environmental noise predictions for noise from large industrial sites, and is commonly used for modelling environmental propagation of sound, including meteorological effects due to wind and/or temperature inversions, ground attenuation and atmospheric attenuation.

Wind rose information previously obtained for the site[3] was used for input into noise prediction settings. General site layout, ground topography and relative location of proposed WWTP was input into the model referencing drawings as provided by the client.

Resultant noise levels were calculated via the use of single point receiver locations aligning Nyrang Street residential boundaries as well as on the industrial boundary immediately to the south of the proposed WWTP.

A table of predicted noise levels at receiver locations is provided in Table 3. Noise levels are based on unmitigated source spectra and have been calculated for both DAF and MBR technologies. Receiver locations are organised from north to south along Nyrang Street.

A colour noise contour map is also provided in Appendix C to illustrate paths of noise propagation.

Table 3 Resultant Noise Levels at Nearby Receivers – Unmitigated

Receiver Location	**Resultant Noise Level (dBA)**	
	DAF	**MBR**
Nyrang Street between Gooreen and Hastings Streets	34	34
Corner of Nyrang and Gooreen Streets (North)	33	33
Corner of Nyrang and Gooreen Streets (South)	33	33
Nyrang Street between Gooreen and Frampton Streets	33	33
Corner of Nyrang and Frampton Streets (North)	39	36
Corner of Nyrang and Frampton Streets (South)	**42**	39
Nyrang Street between Frampton and Elimatta Streets	**48**	**48**
Corner of Nyrang and Elimatta Streets	38	38
Industrial boundary to south of WWTP	**79**	**79**

The data presented in Table 3 shows that noise objectives are exceeded for both technology options at both residential and industrial receivers. The worst affected residential receiver location is identified as Nyrang Street between Frampton and Elimatta Streets.

[2] Manning, CJ (1981) – The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Conservation of Clean Air, Water and the Environment (CONCAWE).

[3] http://www.arup.com.au/tooheys_lidcombe/files/Appendices/Appendix_F_Air_Quality.pdf

A review of the noise contours provided in Appendix B confirms that the most significant noise propagation path to this receiver location is via the gap between the Tooheys Brewery site and the neighbouring industrial site to the south.

It should be noted that, due to the source sound data being empirically derived, predicted noise levels are likely to be overly conservative. It is therefore envisaged that quieter plant selections should be readily available in line with the recommendations of this report.

SoundPLAN modelling has therefore been undertaken of quieter items of plant selection. Tooheys will require contractors to meet these overall noise levels through contract conditions in order to achieve these reduced noise levels.

Table 5 summarises predicted noise levels with the following overall source sound pressure levels:

- Blowers - 75 dBA @ 1m
- Pumps - 70 dBA @ 1m

Again, a colour noise contour map is provided in Appendix C to illustrate paths of noise propagation.

Table 4 Resultant Noise Levels at Nearby Receivers – Mitigated

Receiver Location	**Resultant Noise Level (dBA)**	
	DAF	**MBR**
Nyrang Street between Gooreen and Hastings Streets	26	26
Corner of Nyrang and Gooreen Streets (North)	25	25
Corner of Nyrang and Gooreen Streets (South)	25	25
Nyrang Street between Gooreen and Frampton Streets	25	25
Corner of Nyrang and Frampton Streets (North)	31	28
Corner of Nyrang and Frampton Streets (South)	34	31
Nyrang Street between Frampton and Elimatta Streets	40	40
Corner of Nyrang and Elimatta Streets	30	30
Industrial boundary to south of WWTP	71	71

Predicted noise levels at residential receivers are calculated to remain within the noise objective of 40 dBA with mitigated source noise levels. Noise levels are predicted to remain within the maximum noise objective of 75 dBA at the nearest industrial boundary.

Should maximum allowable noise emission levels be unachievable via appropriate selection of plant items, alternative engineering methods such as acoustic enclosures and/or barriers may need to be explored in order to ensure the acoustic amenity of nearby receivers is maintained. This will need to be reviewed during detailed design once more information is available.

3.2 Construction Noise

To meet Sydney Water's timeframes, Tooheys require construction to commence by July 2012. The construction period is estimated at approximately 19 months

with a further five month trial and commissioning phase. The plant is anticipated to be fully operational by August 2014.

The type of works associated with construction of the WWTP in the context of the significant distances to nearby residential receivers in Nyrang Street is not considered to be a significant issue provided works are conducted during standard hours as defined in the Interim Construction Noise Guideline (ICNG).

Despite the expected negligible noise impact from construction related noise and vibration on the closest residences at Nyrang Street, steps to minimise noise and vibration and maintain good practice should still be applied, including:

- contractor(s) would be required to meet noise levels as specified through the selection of appropriate equipment, use of appropriate enclosures and/or other mitigation methods;
- acoustic monitoring if complaints are received
- where appropriate, obtaining acoustic test certificates for machinery, noisy plant and machinery brought on to the site
- control of working hours such that there is no work audible at nearby residences on Sundays, public holidays, or during the night time or evening periods
- fitting silencers to plant including residential grade mufflers to the exhausts of noisy items of plant
- regular maintenance of plant to prevent plant noise levels increasing due to poor maintenance, such as blowing exhausts and loose and rattling components , etc.
- ensuring machinery is turned off when not in use, and machine enclosures are kept closed.

Regular communication with residents is also recommended, including notification of any changes to the works and reports on progress and provision of a telephone number that residents can call to make complaints and request information.

Appendix A

Glossary

SOUND POWER AND SOUND PRESSURE

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

DECIBEL

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million : one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

'A'-WEIGHTED SOUND LEVEL dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of

approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

Appendix B

Sound Power Spectra

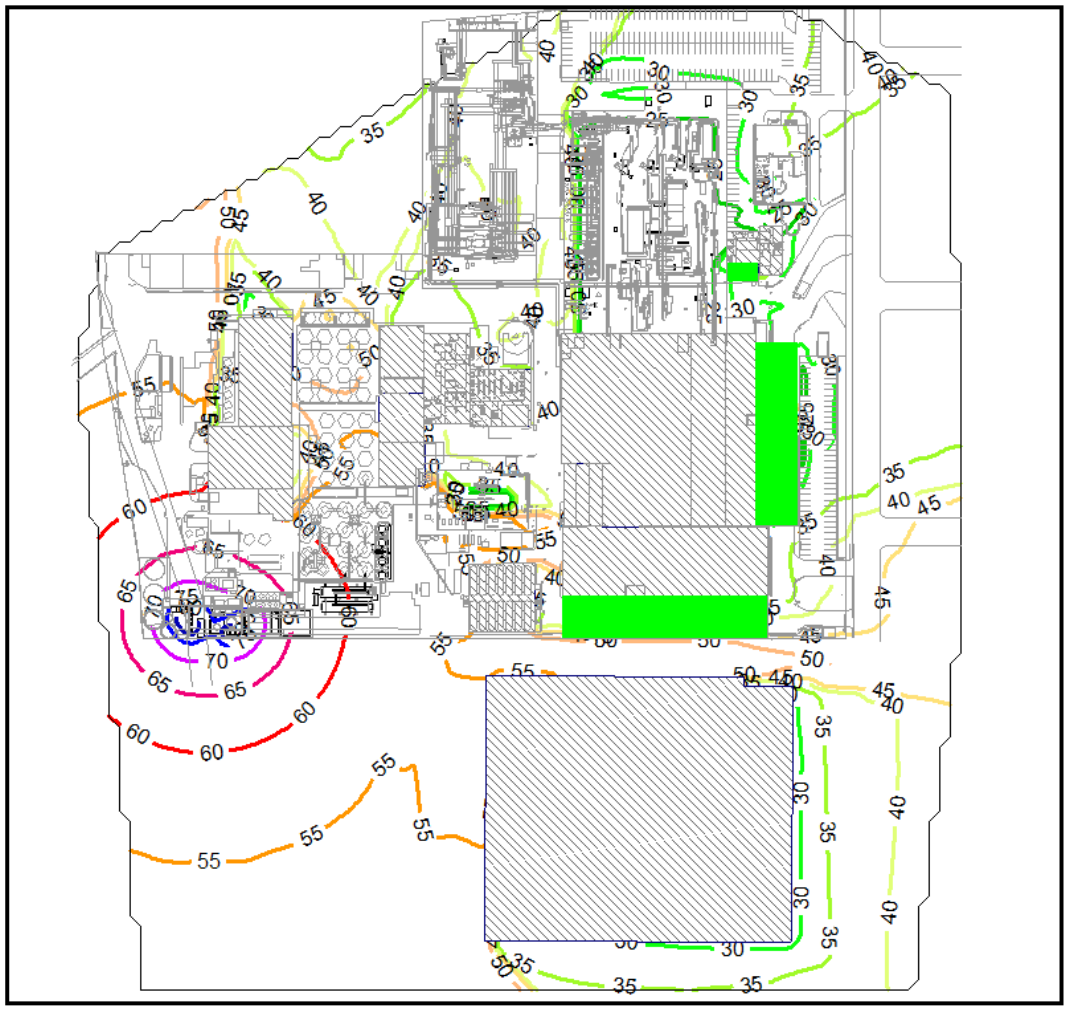
Table 5 Empirically derived Source Sound Power Spectra for Various Pumps

Stage of Treatment	Item of Plant	Power Rating (kW)	Octave Band Centre Frequency (Hz) dB re 20µPa								Overall (dBA)
			63	125	250	500	1k	2k	4k	8k	
Anaerobic	Raw water feed pump	7.5	80	81	83	83	86	83	79	73	89
	Buffer tank mixing pump	5	78	79	81	81	84	81	77	71	88
	Diversion tank bleed pump	5.5	78	79	81	81	84	81	77	71	88
	PAT feed pump	11	81	82	84	84	87	84	80	74	91
	PAT mixing pump	11	81	82	84	84	87	84	80	74	91
	Mixing tank feed pump	22	84	85	87	87	90	87	83	77	94
	IC feed pump	22	84	85	87	87	90	87	83	77	94
	IC anaerobic sludge pump	4	77	78	80	80	83	80	76	70	87
MBR/DAF	Filtrate pump	5.5	78	79	81	81	84	81	77	81	88
	WAS pump	3	76	77	79	79	82	79	75	69	85
	Turbidity sample pump	0.37	67	68	70	70	73	70	66	60	76
Sludge dewatering	Sludge feed pump	2.2	74	75	77	77	80	77	73	67	84
Chemical systems	Polyelectrolyte metering pump	0.55	68	69	71	71	74	71	67	71	78
	Sodium hydroxide metering pump	0.1	61	62	64	64	67	64	60	54	71
	Urea metering pump	0.1	61	62	64	64	67	64	60	54	71
RE system	Internal RE pump	3	76	77	79	79	82	79	75	69	85

Appendix C

Noise Contours

C1 Noise Contour Plot – DAF Plant – Unmitigated



Lion Nathan
Tooheys Brewery Lidcombe
Waste Water Treatment Plant

Waste Water Treatment Plant
Environmental Noise Emission
Contours

To be read in conjunction with
Arup Environmental
Assessment Report

Map
1

Noise contour plot at 2m above ground level

Noise propagation calculated using CONCAWE methodology under worst case environmental conditions

Noise sources derived from representative noise measurements from similar facility and empirical calculations.

Noise levels
LAeq (15minute)

- < 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- 75 - 80
- >= 80

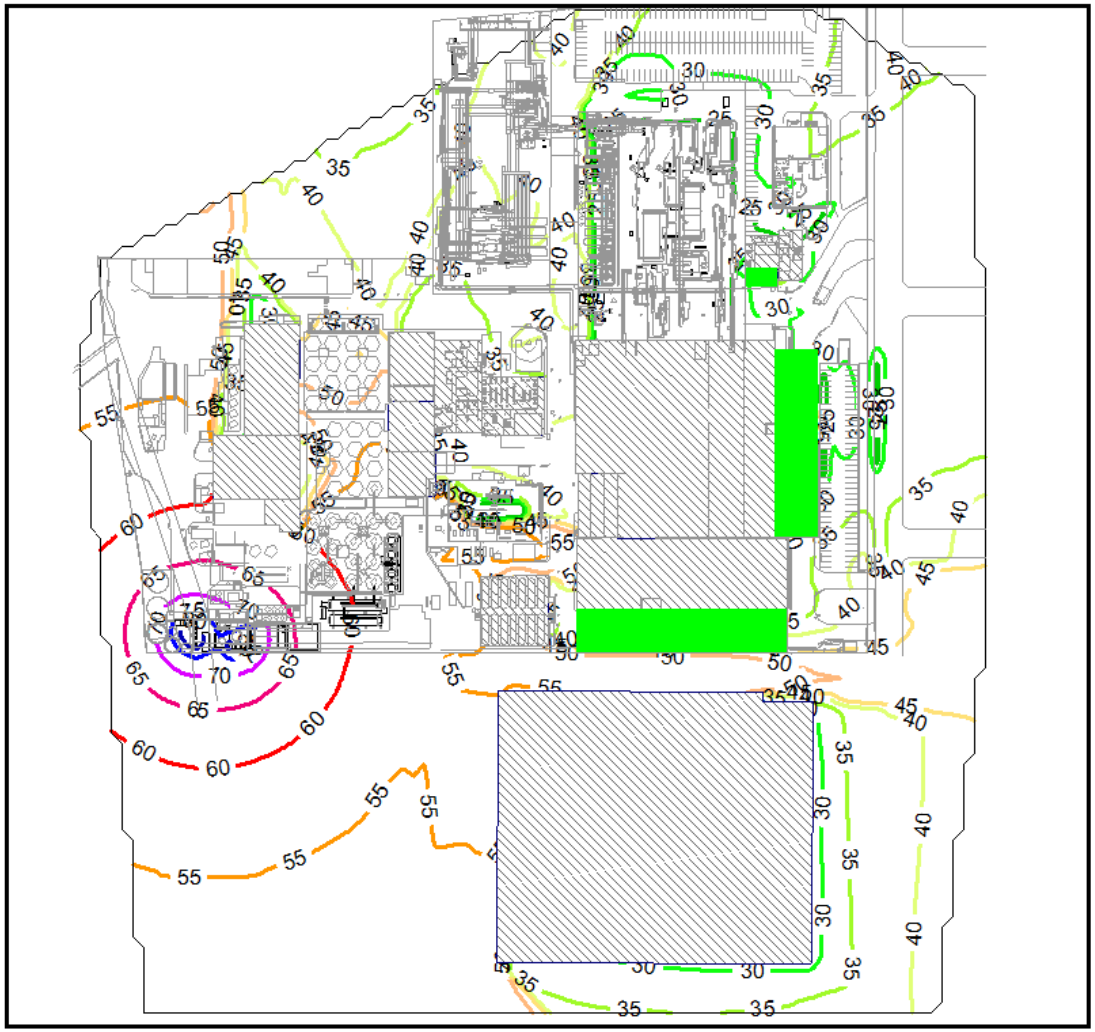
Legend

- Main building
- Point receiver
- Roof area
- Wall

Length scale 1:2859
0 15 30 60 90 120 m

ARUP

C2 Noise Contour Plot – MBR Plant – Unmitigated



Lion Nathan
Tooheys Brewery Lidcombe
Waste Water Treatment Plant

Waste Water Treatment Plant
Environmental Noise Emission
Contours

To be read in conjunction with
Arup Environmental
Assessment Report

Map
2

Noise contour plot at 2m above ground level

Noise propagation calculated using CONCAWE methodology under worst case environmental conditions

Noise sources derived from representative noise measurements from similar facility and empirical calculations.

Noise levels
LAeq (15minute)

- < 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- 75 - 80
- >= 80

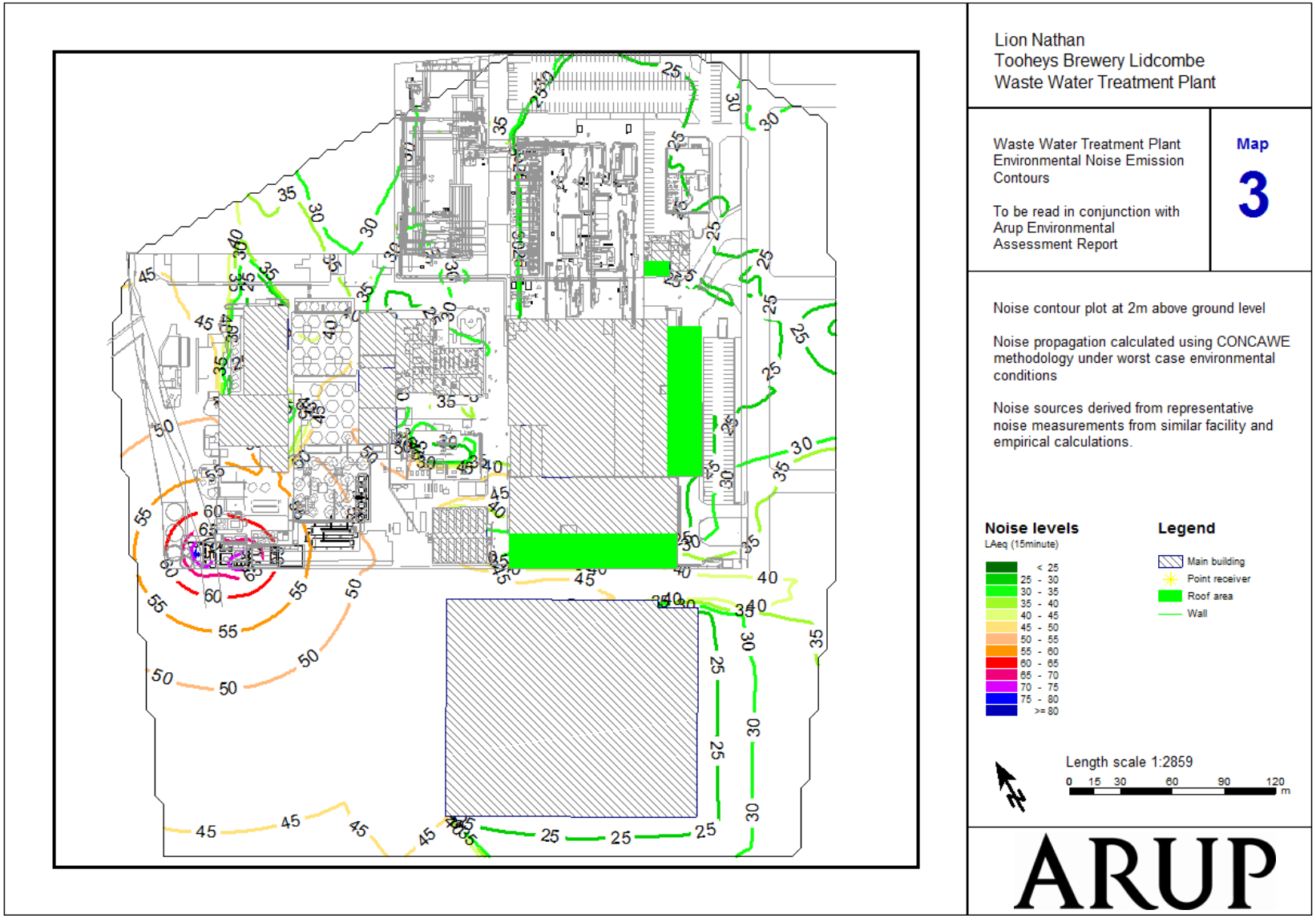
Legend

- Main building
- Point receiver
- Roof area
- Wall

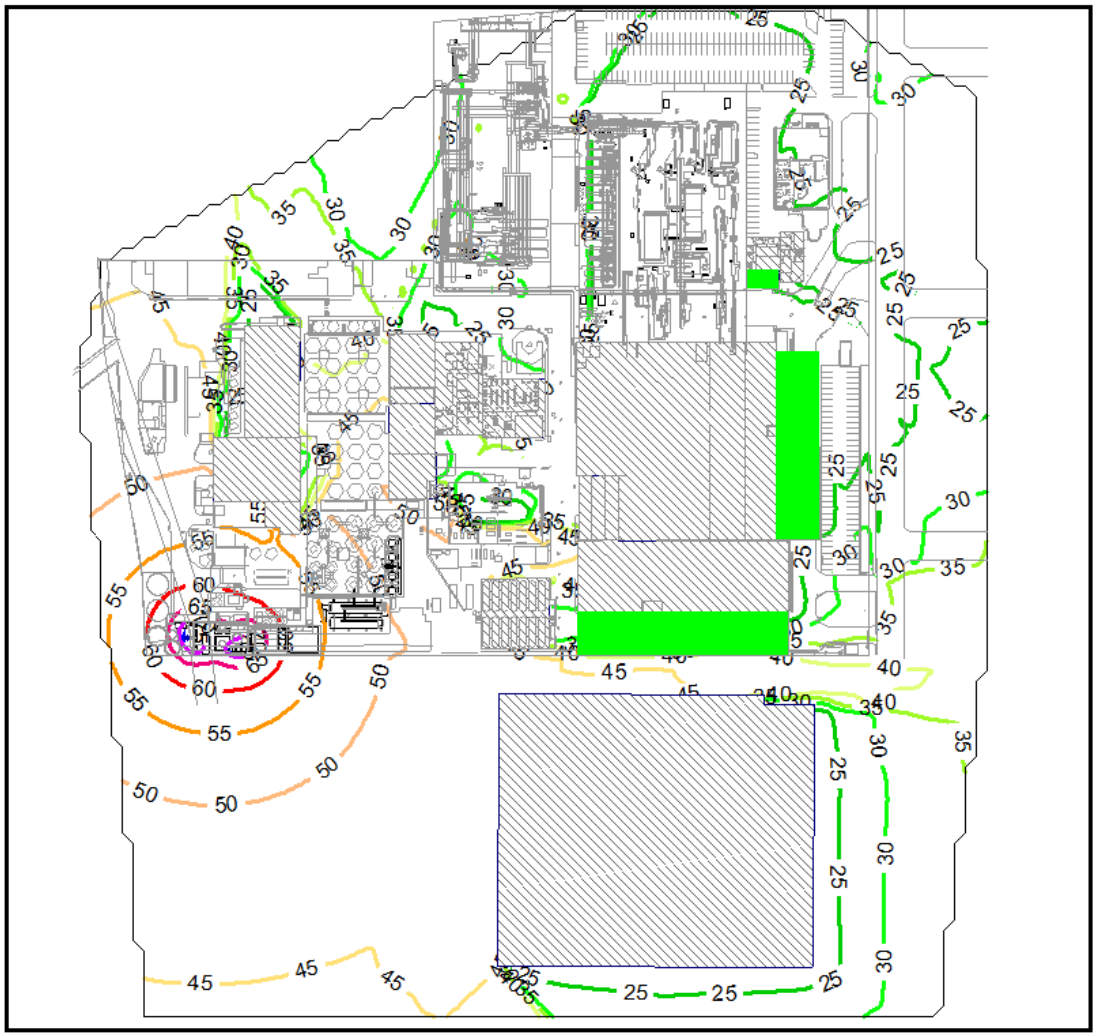
Length scale 1:2859
0 15 30 60 90 120 m

ARUP

C3 Noise Contour Plot – DAF Plant – Mitigated



C4 Noise Contour Plot – MBR Plant – Mitigated



Appendix F

Technical assessment – Air quality

Contents

F1 Introduction

F1.1 Background

Tooheys are proposing to install an on site wastewater treatment plant to treat a daily average of 2,400kL wastewater generated as a result of the brewing process on site. As part of the approvals process, an Environmental Assessment (EA) under Part 3A of the Environmental Planning & Assessment Act (EP&A Act) is required to assess the environmental impacts the WWTP may have on the surrounding environment. Arup has been commissioned to prepare an Air Quality Assessment for the proposal.

The WWTP will produce biogas which is proposed to be combusted on site within an existing boiler to supplement the site's heating plant as well as some flaring. As a result of this combustion, the emissions to air from the site will change in terms of pollutant types and quantities. The air quality assessment therefore considers the potential for the change in emissions profile to impact local and regional air quality.

F1.2 Objective

The objective of this Air Quality Assessment is to:

- assess the changes to regional air quality as a result of the upgrade;
- assess the impact to air quality at sensitive receptors adjacent the site as a result of the proposed upgrade;

F1.3 Scope of Work

The scope of works included the following:

- a site visit of the Tooheys Brewery site in Lidcombe, NSW;
- review of site background information including existing air quality, sensitive receptors, site meteorology and topography;
- review of legislative and regulatory frameworks relevant to the air quality assessment of the proposal;
- review of existing and potential air pollutant emissions and the development of an air emissions inventory for the proposed upgrade;
- qualitative consideration of construction air quality issues;
- assessment of operational air quality impacts at sensitive receptors from the proposed combustion of biogas including nitrogen oxides (NOx) and sulfur dioxide (SO2) in accordance with the Department of Environment and Conservation, Approved Methods for the Modelling and Assessment of Air Pollutants in NSW(AMMAAP), 2006.

F2 Legislative Context

F2.1 Protection of the Environment Operations Act 1997 (POEO Act)

The *Protection of the Environment Operations Act*, 1997 (POEO Act) establishes a system of environment protection licensing for 'scheduled' activities with the potential to have a significant impact on the environment. Schedule 1 of the POEO Act lists the activities requiring an EPA licence including:

Breweries or distilleries that produce alcohol or alcoholic products and that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.

Tooheys brewery produces in excess of 10,000 tonnes per annum and therefore qualifies as a scheduled activity and as such is subject to an Environment Protection Licence (EPL number 1167).

The Licence however, specifies limits for emissions to air from the cogeneration unit only in terms of the following top of stack concentrations.

Pollutant	**100 percentile concentration limit**
Nitrogen Oxides (NO_x)	250 mg/m^3
Carbon monoxide (CO)	125 mg/m^3

Furthermore, Part 5.4 of the POEO Act deals specifically with air pollution including the obligation that occupiers of non-residential premises:

- do not cause air pollution by failing to operate or maintain plant, carry out work or deal with materials in a proper and efficient manner and comply with any air emission standards prescribed by regulations; and
- take all practicable means to prevent or minimise air pollution (even where standards for a particular pollutant are not prescribed by regulation).

F2.2 Protection of the Environment Operations Act (Clean Air) Regulation 2002

Part 4 of the *Protection of the Environment Operations Act (Clean Air) Regulation*, 2002 deals with emission of air pollutants from industrial activities and plant. In particular, the Regulation sets maximum limits on emissions from activities and plant for a number of substances, including oxides of nitrogen, smoke, solid particles, chlorine, dioxins, furans and heavy metals at the point of discharge. The standards are based on levels that are achievable through the application of reasonably available technology and good environmental practices.

The Regulation requires that when any emission unit operated in the Sydney Greater Metropolitan Area is replaced, the replacement emission unit becomes subject to Group 6 emission standards.

The emission limits for Group 6 emission units are presented in Table 1.

Table 1 Applicable POEO (Clean Air) Regulation Standards of Concentration

Pollutant	Emission Unit	Standard of Concentration[1]
Solid particles (Total)	Any activity or plant	50 mg/m3
Nitrogen dioxide (NO_2) or Nitric oxide (NO) or both, as NO_2 equivalent	Any boiler operating on gas	350 mg/m3
	Stationary reciprocating internal combustion engines	450 mg/m3

1 at standard temperature and pressure, dry basis, 3% O2

F2.3 Ambient Air Quality National Environment Protection Measure (NEPM)

In June 1998 the NEPC agreed to set uniform standards for ambient air quality (ambient air does not include indoor air). The standards contained in the NEPM for ambient air quality are listed in Table 2 below.

Table 2 NEPM Standards for Ambient Air Quality

Pollutant	Averaging Period	Maximum Concentration	Goal within 10 years Maximum Allowable Exceedances
Carbon monoxide (CO)	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide (NO_2)	1 hour 1 year	0.12 ppm 0.03 ppm	1 day a year none
Photochemical oxidants (as ozone)	1 hour 4 hours	0.10 ppm 0.08 ppm	1 day a year 1 day a year
Sulfur dioxide (SO_2)	1 hour 1 day 1 year	0.20 ppm 0.08 ppm 0.02 ppm	1 day a year 1 day a year none
Lead	1 year	0.50 µg/m3	none
Particles as PM_{10}	1 day	50 µg/m3	5 days a year

Sydney has exceeded the Air NEPM ozone goal every year since 1995.

F2.4 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

The Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (AMMAAP) lists the methods that are to be used to model and assess emissions of air pollutants from stationary sources in NSW and is referred to in Part 4 of the *Protection of the Environment and Operations (Clean Air) Regulation*, 2002. The assessment criteria prescribed within the AMMAAP refer to ground level concentrations at sensitive receptors and therefore take into account site-specific features such as meteorology and background air quality, and therefore protect against adverse air quality impacts in the areas surrounding the premises. The criteria are presented in Table 3 below.

Table 3 NSW DECC Impact Assessment Criteria

Pollutant	**Averaging Period**	**Concentration**	
		ppm	**µg/m^3**
Sulfur dioxide (SO_2)	10 minutes	25	712
	1 hour	20	570
	24 hours	8	228
	Annual	2	60
Nitrogen dioxide (NO_2)	1 hour	12	246
	Annual	3	62
Photochemical oxidants (as ozone)	1 hour	10	214
	4 hours	8	171
PM_{10}	24 hours	-	50
	Annual	-	30
Total suspended particulates (TSP)	Annual	-	90
		Maximum increase (g/m^2/month)	**Maximum total (g/m^2/month)**
Deposited dust	Annual	2	4
		ppm	**mg/m^3**
Carbon monoxide (CO)	15 minutes	87	100
	1 hour	25	30
	8 hours	9	10

F3 Existing Conditions

F3.1 Existing plant

Tooheys brewery includes a heating plant to provide the thermal energy requirements to the brewing process. The heating plant currently uses natural gas within two existing boilers and a cogeneration plant.

The two high efficiency boilers were installed in 2008 each 12 MW with two separate 25 m stacks protruding from the roof of the utilities building.

The cogeneration plant is a natural gas fired internal combustion engine with 2MW of electrical energy output. Additional waste heat in the form of 1MW of steam and 1MW of hot water (used to produce chilled water via absorption chiller) is generated from the cogeneration plant and added to existing site distribution. The combustion engine for the cogeneration plant is located inside the engine room with the stack protruding from the roof with a height of approximately 9.5 m above floor level.

F3.2 Emissions to air

Combustion of natural gas at the site results in emissions to air of the following pollutants:

- nitrogen oxides (NO_x),
- Nitrogen dioxide (NO_2),
- carbon monoxide (CO),
- carbon dioxide (CO_2),
- particulates (TSP and PM_{10}).

F3.3 Previous Air Quality Assessment

F3.3.1 Project Key

In July 2007 the NSW Department of Planning approved the Project Key upgrade at Tooheys Brewery including an upgrade of the heating plant. The heating plant upgrade included the installation of two new natural gas boilers and decommissioning of the existing natural gas boilers. The air quality impacts from these new boilers were assessed as part of the environmental assessment undertaken by Arup in June 2006.

The assessment concluded that the air quality impacts from the upgrade would be less than the existing brewery and within acceptable limits at sensitive receivers.

F3.3.2 Cogeneration

In January 2010, the NSW Department of Planning approved the installation and operation of a cogeneration facility to provide electrical energy to the site and supplement the heating and cooling capacity. An air quality assessment was produced as part of the planning application which concluded that the cogeneration plant would result in:

- Reduction in total electricity imported to the site
- Increase in imported natural gas to the site
- Reduction in the demand for the new boilers
- Reduced air quality impacts as a result of improved efficiencies

F4 WWTP Proposal

F4.1 Description of proposal

Tooheys now propose to replace natural gas imported to the site with the biogas generated from the WWTP. It is assumed that 95% of the biogas will be captured and piped from the proposed WWTP to the engine room. The residual 5% will be flared. There are also likely to be some fugitive biogas emissions from the WWTP and biogas pipeline. However these are assumed to be insignificant due to the management measures proposed.

The biogas will be fed to the boilers rather than the cogeneration engine due to the properties of the boiler which are better able to accommodate fuel of varying composition.

It is yet to be determined whether the biogas will be blended with the natural gas prior to combustion. For the purposes of this assessment it is assumed that one boiler will be configured to combust biogas on an either/or basis. This would represent a worst case scenario in terms of emission concentrations over short averaging periods. In reality, it is likely that biogas and natural gas will be blended

The WWTP is expected to produce an annual average of 4,400 m^3/day going up to 9,900 m^3/day of biogas at maximum loading.

The biogas composition will vary depending on the wastewater quality. Based on current COD and sulphate concentrations, the biogas is expected to contain 75-80% methane, 20-25% CO_2 and approximately 800ppm hydrogen sulphide.

The biogas will be 100% saturated with water and may contain other impurities such as siloxanes.

F4.2 Potential Emissions to Air

For combustion of natural gas the main pollutants include nitrogen oxides (NO_x), Nitrogen dioxide (NO_2), carbon monoxide (CO), carbon dioxide (CO_2), particulates (TSP and PM_{10}). The combustion of biogas will generate additional pollutants as a result of the impurities within the biogas. In particular, the hydrogen sulphide within the biogas means it has potential to produce sulphur dioxide (SO_2) which has previously not been emitted at the site.

In terms of this assessment only NOx, NO_2 and SO_2 have been considered as these are most likely to be emitted at concentrations closest to regulatory limits. NOx is also a pollutant of regional concern (see Section F5.2 below).

F4.3 Sensitive Receivers

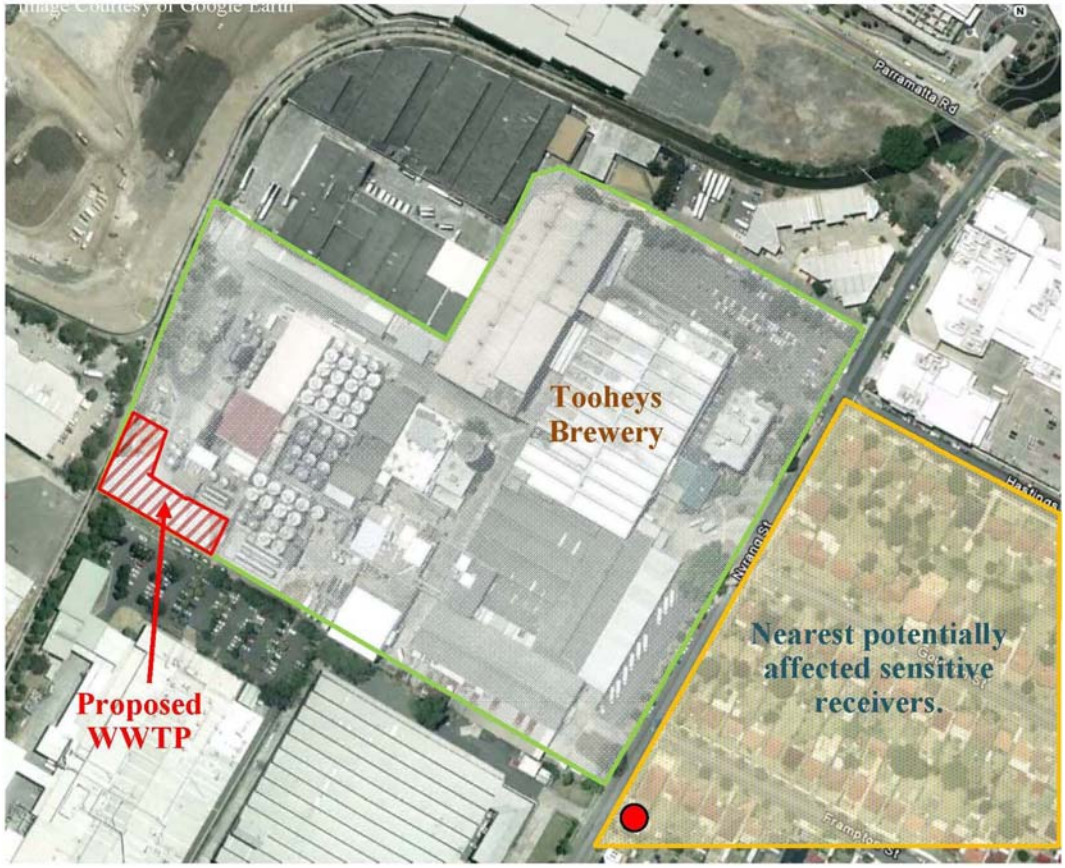


Figure 1 Location of proposed WWTP and nearest potentially affected sensitive receivers

As shown on Figure 1, the closest residential receiver to the works is at the boundary of 24 Nyrang Street approximately 275m from the proposed location of the WWTP.

F5 Existing Air Shed

F5.1 Local Air Quality

F5.1.1 Background SO_2 Concentrations

Figure 2 below presents the daily maximum 1-hour average concentrations of SO_2 at the NSW EPA Chullora Monitoring sites, from January 2008 to August 2011.

The figure shows that the maximum background SO_2 in the area is below the NSW criterion (570 µg/m^3), during the graphed time. The maximum value for SO_2 concentration recorded at Chullora is 2.9 pphm (82.7 µg/m^3).

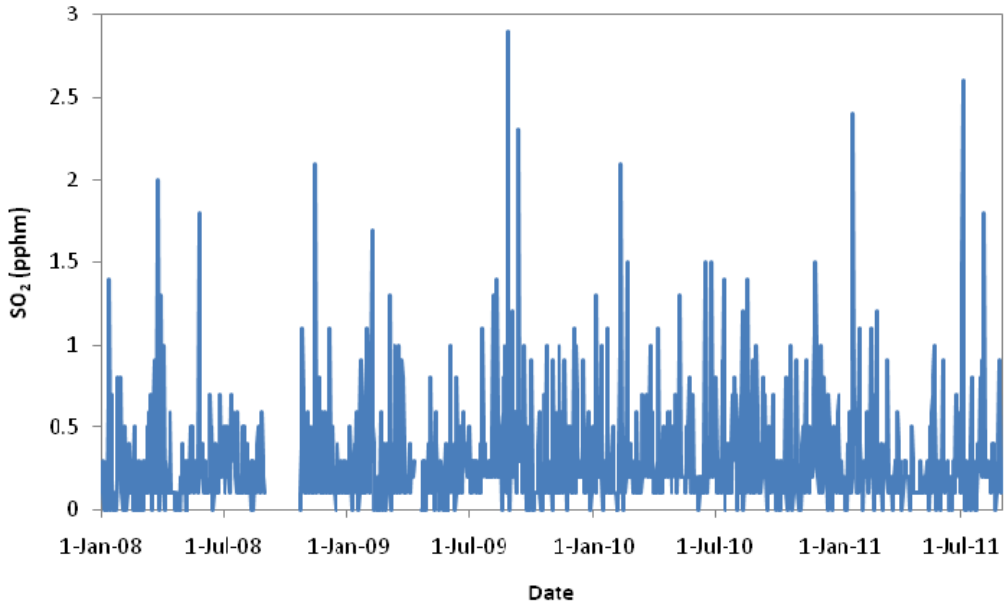


Figure 2 Maximum daily 1-hour average SO_2 concentrations

F5.1.2 Background NO_2 Concentrations

The background NO_2 concentrations are shown in the figure below. Figure 3 presents the daily maximum 1-hour average concentrations of NO_2 at the Chullora monitoring site.

The maximum value for NO_2 concentration recorded at Chullora is 5.7 pphm (117.9 µg/m^3). This maximum value indicates that the NO_2 background concentrations recorded at Chullora are below the NSW criterion (246 µg/m^3).

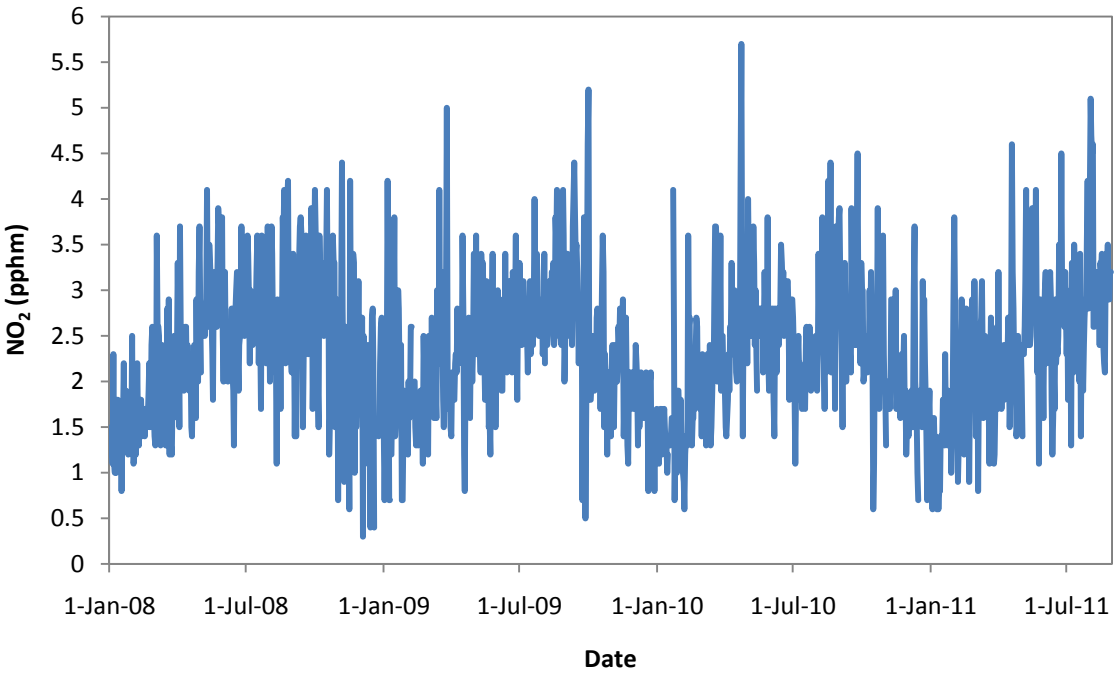


Figure 3 Maximum daily 1-hour average NO_2 concentrations

F5.2 Regional Air Quality

In terms of regional air quality, the main concern is the generation of NOx emissions as the precursor to ozone generation. Ozone is formed in summer by reactions between NOx and volatile organic compounds (VOCs) produced which may be produced anywhere in the regional air shed. Ozone is a respiratory irritant under high exposure levels. During periods of high ozone concentration, hospital admissions for asthma and respiratory conditions increase.

The Sydney Illawarra air shed has a particular issue with ozone, regularly exceeding health based guidelines for ambient concentration of ozone since 1995. The NSW Department of Environment and Climate Change has raised particular concern with the cumulative impacts of increased numbers of small scale cogeneration plants located within the Sydney Illawarra air shed in producing NOx and further exacerbating the issue of ozone concentrations.

Consideration of NOx is therefore important in a regional context.

F5.3 Meteorological Conditions

The prevailing wind directions for the site have been inferred from Bureau of Meteorology yearly data for the nearest applicable weather station at Sydney Olympic Park, see Figure 4 and Figure 5.

The prevailing wind conditions assumed for the site from Sydney Olympic Park data in Figure 4 (9am yearly averages) and Figure 5 (3pm yearly averages) indicate that wind frequency and direction from the west during the morning and form the east during the afternoon are the most dominant.

A north westerly to westerly wind direction would yield the greatest potential for odour impact to residences in Nyrang Street.

The wind directions in the afternoon in the area would be beneficial in reducing odour impacts (east to south easterly winds), but wind direction in the morning from the west are the least desired.

Where possible odour generating events such as tank cleaning should be undertaken under favourable atmospheric conditions (such as in the afternoon with an easterly breeze).

Wind direction is however assessed to be of small importance in the management and assessment of odour impacts, as there is no clearly dominant wind direction for area.

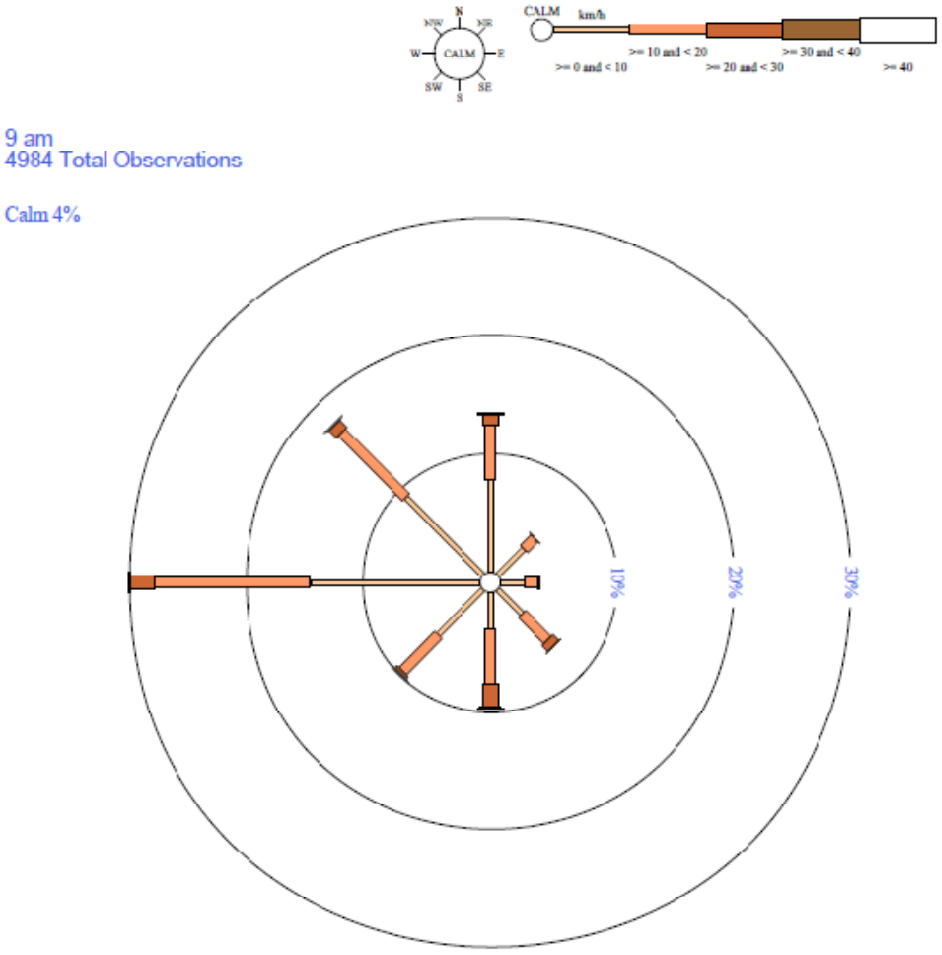


Figure 4 Prevailing wind conditions 9am Sydney Olympic Park

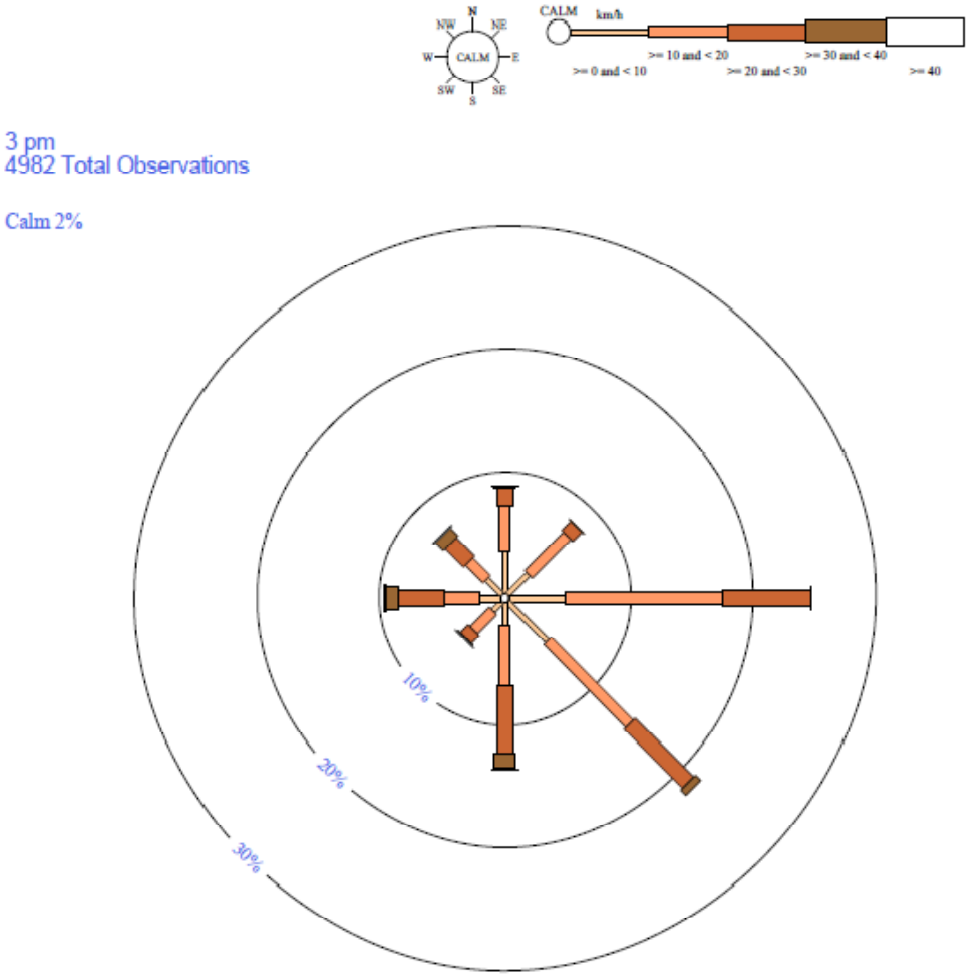


Figure 5 Prevailing wind conditions 3pm Sydney Olympic Park

F5.4 Topography and Built Form

The local topography of the area is flat to gently undulating, with the facility to be constructed at the rear of the Tooheys site.

Built form of the site can also have impact on odour pathways and level of impact. The built form of the existing site is significant and will create some barriers to any odour dispersion with multiple multi storey structures up to ten metres in height between the proposed WWTP and the site boundary on Nyrang Street some 270 metres away.

F6 Impact Assessment –Local Air Quality

F6.1 Methodology

Dispersion modelling has been undertaken for NOx and SO2 as the pollutants of concern associated with natural gas combustion in boilers which are closest to the legislated limits for top of stack emissions. Other potential emissions from the stack are considered to represent low concentrations with respect to top of stack standards and therefore have not been modelled.

Air dispersion modelling of emissions of SO_2 and NOx for the following scenario:

- One boiler operating entirely on biogas;
- One boiler operating entirely on natural gas;
- Cogeneration engine operating on natural gas;
- Flaring of 5% of biogas produced during a peak day.

This represents a conservative case due to:

- Biogas flaring will not be occurring 100% of the time
- The boiler will not be operating on biogas for 100% of the time
- It may be possible in the future to operate the boiler on a mix of biogas and natural gas which would reduce the peak SO_2 emission rate
- Assumption that the biogas is not treated prior to combustion. Some pre-treatment may be required to remove sulfur content.

Air dispersion modelling was undertaken using Ausplume Version 6.0, a Gaussian plume dispersion model derived from the Victorian Environment Protection Authority's "Plume Calculation Procedure"(EPAV: 1985), an extension of the ISC model of Bowers et al. (1979).

The predicted ground level concentrations were added to the background concentrations.

This methodology was adopted to determine whether there is likely to be any additional exceedances of the assessment criteria for ground level concentrations of NO_2 or SO_2 as a result of the proposed upgrade.

This is considered to be a conservative approach as the recorded background air quality concentrations already include NO_2 and SO_2 concentrations attributable to the existing brewery operations.

F6.2 Input Data

The following data were required for input into the Ausplume model:

- emission rates;
- emission source characteristics (stack diameter, stack height, flue gas exit velocity and exit temperature);
- meteorological data file;

- surface roughness;
- 3km by 3km receptor grid at 30m intervals; and
- averaging periods for NOx and SO_2.

F6.3 Emission Source Characteristics

The emission source characteristics used in the dispersion model are presented below.

Table 4 Emission Source Characteristics

Source	Height (m)	Temperature (ºC)	Velocity (m/s)	Diameter (m)
Boiler 1 (natural gas only)	25	200	13.7	0.9
Boiler 2 (natural gas/biogas)	25	200	13.7	0.9
Cogeneration Unit	9.5	204	19.9	0.35
Flare	21.5	450	8.8	1.2

The emission source characteristics are based upon actual data for the existing sources and the proposed design of the flare.

F6.4 Emission Rates

F6.4.1 Nitrogen oxides

Emissions of nitrogen oxides from the flare were calculated using the method outlined in USEPA AP-42 Chapter 13.5 Industrial Flares (US EPA, 1995) as below.

$$E_i = EF_i \times HV \times Q$$

Where:

E_i	=	Emissions of substance i from the flare (g/s)
EF_i	=	Emission factor for substance i (g/MJ)
HV	=	Flare gas heat value (MJ/m^3)
Q	=	Flare gas flow rate (m^3/s)

Emissions of nitrogen oxides from the boiler were calculated empirically assuming the top of stack concentrations meet the legislated maximum limit prescribed by POEO Regulation (350 mg/m^3) for the boiler operating at maximum rated capacity (12MW).

$$ER_{actual} = \left[C_{normalised} \times \left(\frac{273.3K}{T + 273.3K}\right)\right] \times Q_{actual}$$

Where

ER	=	the emission rate
C	=	stack concentration (350 mg/m^3)
T	=	Exit temperature
VFR	=	Flue gas volumetric flow rate

It was assumed that NOx emission rates were the same for both biogas and natural gas. There is some evidence to suggest that NOx emission rates for biogas combustion will be less than for natural gas[1] due to a reduced flame temperature for natural gas combustion which reduces the potential for disassociation of nitrogen in the atmosphere and hence the formation of NOx. The assumption that the NOx emission rate does not vary for biogas is therefore considered conservative.

For the purposes of the local air quality assessment, NO_2 emissions are considered to be 100% NO_2. This is considered a conservative consumption as some of the NOx will exist in the form of NO depending on combustion and atmospheric conditions.

[1] Formation of Air Pollutants at Bio Gas Firing, Wopera, A., Wagnerova, e., Nagy, G.,

F6.4.2 Sulfur dioxide

Sulfur dioxide emission rates were determined according to a mass balance approach for both the flare and the biogas boiler. The boiler was assumed to be operating at maximum capacity (12MW) for 100% of the time. In reality this would require six times the available biogas and so represents a conservative assumption. For the flare it was assumed that 5% of biogas was diverted to the flare during a peak day and combusted over a 24 hour period.

$$E_{SO2} = (Q \times \frac{S}{100} \times \left(\frac{P}{(T \times R)}\right) \times \frac{1}{3600}$$

Where:

E_{SO2} = Emissions of sulfur dioxide due to combustion of biogas or natural gas (g/s)

Q = Maximum flow rate of biogas or natural gas to boiler or flare (m^3/hour)

S = Hydrogen sulfide content of biogas or natural gas combusted (% vol)

P = Pressure (P = 101.3kPa)

T = Temperature

R = Ideal gas constant (R = 0.008312 m^3.kPa/(K.mol)) (m^3.kPa/(K.mol)

Source	Q (m^3 gas per hour)	S (% vol H_2S)
Boiler 1 (natural gas)	1,100	2.1×10^{-4}% (2.1 ppm)
Boiler 2 (biogas)	1,100	0.08% (800ppm)
Cogeneration	480	2.1×10^{-4}% (2.1 ppm)
Flare	17	0.08% (800ppm)

F6.4.3 Summary of Emissions Rates

A summary of the emission rates adopted for the model is presented in Table 5 below.

Table 5 Emission rates adopted in dispersion model

Source	Emission Rates (m/s)	
	SO_2	NO_x
Boiler 1 (natural gas)	2.80	1.76
Boiler 2 (biogas)	1.07×10-2	1.76
Cogeneration	4.57×10-3	8.84×10-2
Flare	1.91×10-2	0.27

F6.4.4 Meteorological data

A meteorological data file was prepared using CSIRO's TAPM model to predict hourly site specific meteorological data. TAPM solves approximations to the fundamental fluid dynamics and scalar transport equations to predict meteorology incorporating the effects of sea breezes and terrain induced flows against a background of larger-scale meteorology provided by synoptic analyses. A 3km by 3k grid around the site was selected using 2008 data as a baseline to produce an AUSPLUME compatible hourly data file.

F6.5 Results

A summary of the results at the nearest sensitive receptor are presented in Table 6 below

Table 6 Summary of results

Averaging Period	Maximum NOx Ground Level Concentration (µg/m^3)		Maximum SO_2 Ground Level Concentration (µg/m^3)	
	Nearest sensitive receptor	Criterion	Nearest sensitive receptor	Criterion
10min	NA	NA	21.6	712
1 hour	20.9	246	15.2	570
24 hour	NA	NA	6.87	228
Annual	1.25	62	0.844	60

These show that the ground level concentrations are below the criterion for both pollutants across all averaging periods over the entire year with the shortest averaging periods being the most critical.

When combined with the background maximum hourly average value as shown in Table 7 below the results are still below the criterion.

Table 7 Summary of results with background concentrations

Maximum hourly concentration	NOx Ground Level Concentration (µg/m^3)	SO_2 Ground Level Concentration (µg/m^3)
Background	116.9	82.7
Modelled at nearest receptor	20.9	15.2
Total	137.8	97.9
Criterion	246	570

F7 Impact Assessment – Regional Air Quality

In terms of regional air quality, impacts are considered for annual average conditions to determine whether the total NOx loading is likely to increase. This will depend upon the increase in fuel consumption.

Currently the brewery consumes approximately 315.8 TJ of natural gas per year. The WWTP is likely to produce 39.9 TJ of biogas. Assuming 5% of this is flared results in 12% of the brewery's energy requirements supplied from biogas on an energy basis.

However due to the reduced energy density of biogas compared to natural gas there will be an increase in the total volume of gas combustion as presented in Table 8 below.

Table 8 Total natural gas and biogas consumption

Scenario		Annual Average Consumption	
		TJ	m^3
Existing (without WWTP)	Natural Gas (Boiler and Cogen)	315.8	8,036,000
Proposal (with WWTP)	Natural Gas (Boiler and Cogen)	277.9	7,071,000
	Biogas (Boiler)	37.9	1,516,000
	Biogas (Flare)	2	80,000
	Total	315.8	8,667,000

NOx emission rates are linked to volumetric flow rate and there therefore is potential for an increase in total NOx emissions of up to 8% as a result of the proposal.

However, there is evidence to suggest that NOx formation may be reduced during biogas combustion as a result of a lower methane content and flame temperature. This will depend upon the actual configuration of the boiler, but will likely reduce the rate of increase in annual average NOx emissions.

F8 Impact Assessment – Construction

To meet Sydney Water's timeframes, Tooheys require construction to commence by July 2012. The construction period is estimated at approximately 19 months with a further five month trial and commissioning phase. The plant is anticipated to be fully operational by August 2014. The rest of the construction period will consist primarily of internal works and building fit-out which are unlikely to involve earthworks.

During construction, emissions to air are likely to include dust generation as a result of soil disturbance. Dust generation may occur where soil is exposed during excavation and may be transported off site in windy conditions or by vehicles.

Emissions from construction traffic over the entire construction period may also occur including particulates, carbon monoxide, nitrogen oxides and volatile organic compounds. It is anticipated that additional heavy vehicle trips and a minor number of construction staff vehicles to and from the site will be generated by construction activities during the proposed upgrade. The majority of these trips would occur outside of the road network peak hours where peak pollution concentrations are usually experienced.

F9 Summary and Conclusion

F9.1 Local Air Quality

The results show that both NO2 and SO2 emissions are likely to be below the relevant criteria at sensitive receivers indicating that the WWTP proposal is not likely to result in local air quality impacts.

Further, the projections of concentrations at sensitive receivers are likely to be conservative given that the modelling assumes the following for each hour within the representative year

- the modelling assumes that the boiler is operating at maximum capacity
- the modelling assumes peak biogas generation rates;
- no pretreatment of biogas to remove sulfur compounds;
- no blending of biogas and natural gas prior to combustion;
- all NOx emissions are in the form of NO_2; and
- maximum background conditions.

In reality, it is unlikely that these conditions would all occur during worst case meteorological conditions.

F9.2 Regional Air Quality

In terms of regional air quality, the project may result in an increase of NOx emissions of less than 8% due to the increased volume of gas to be combusted.

F10 Management Measures

F10.1 Operation

The following measures should be considered:

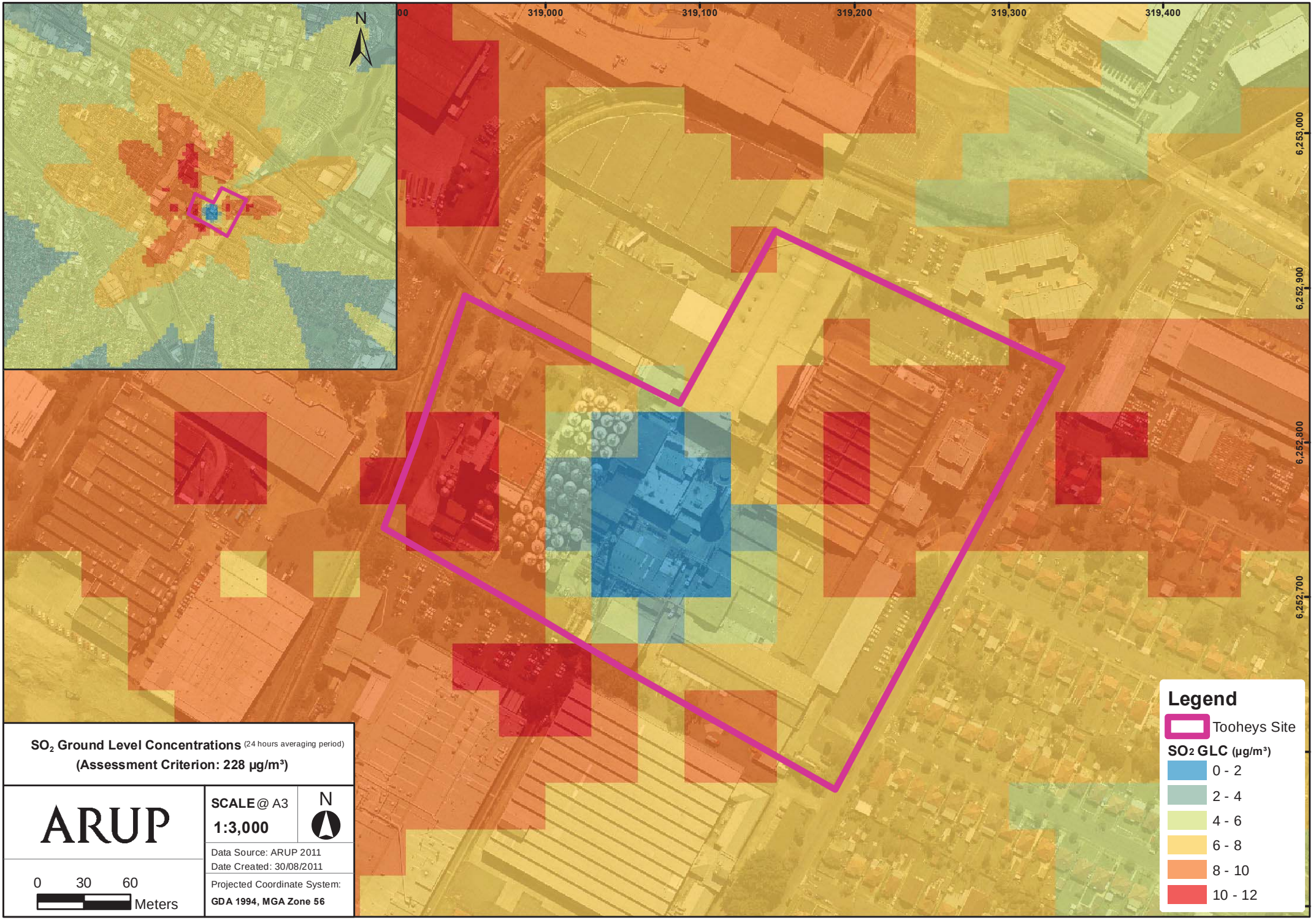
- blending of biogas and natural gas;
- feasibility study into pretreatment of biogas to reduce sulfur content; and
- monitoring programme for NOx emissions from boilers to investigate the impact of biogas combustion compared to natural gas combustion on NOx.

F10.2 Construction

Management measures to reduce air quality impacts during construction include:

- assigning access and haul roads to permanent paved areas;
- watering of exposed soil;
- minimising the duration of exposed soil by construction programming;
- ensuring vehicles, plant and equipment are adequately maintained so as to minimise air;
- quality impacts from exhaust; and
- ensuring vehicle or items of plant or equipment generating excessive exhaust (smoke) are not permitted on site.

Attachment A – SO_2 GLC Contours



SO_2 Ground Level Concentrations (24 hours averaging period)
(Assessment Criterion: 228 µg/m³)

ARUP

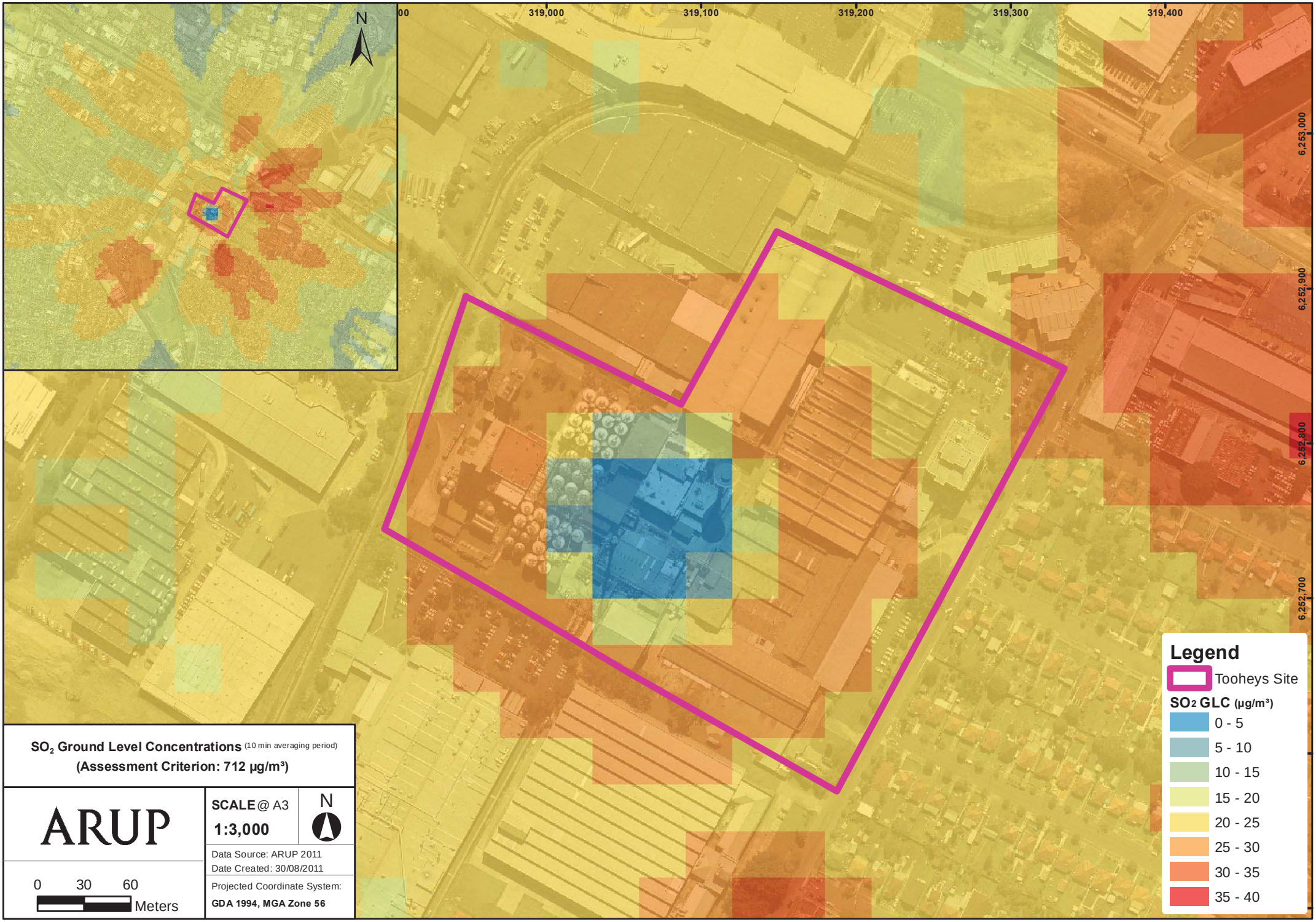
SCALE @ A3
1:3,000

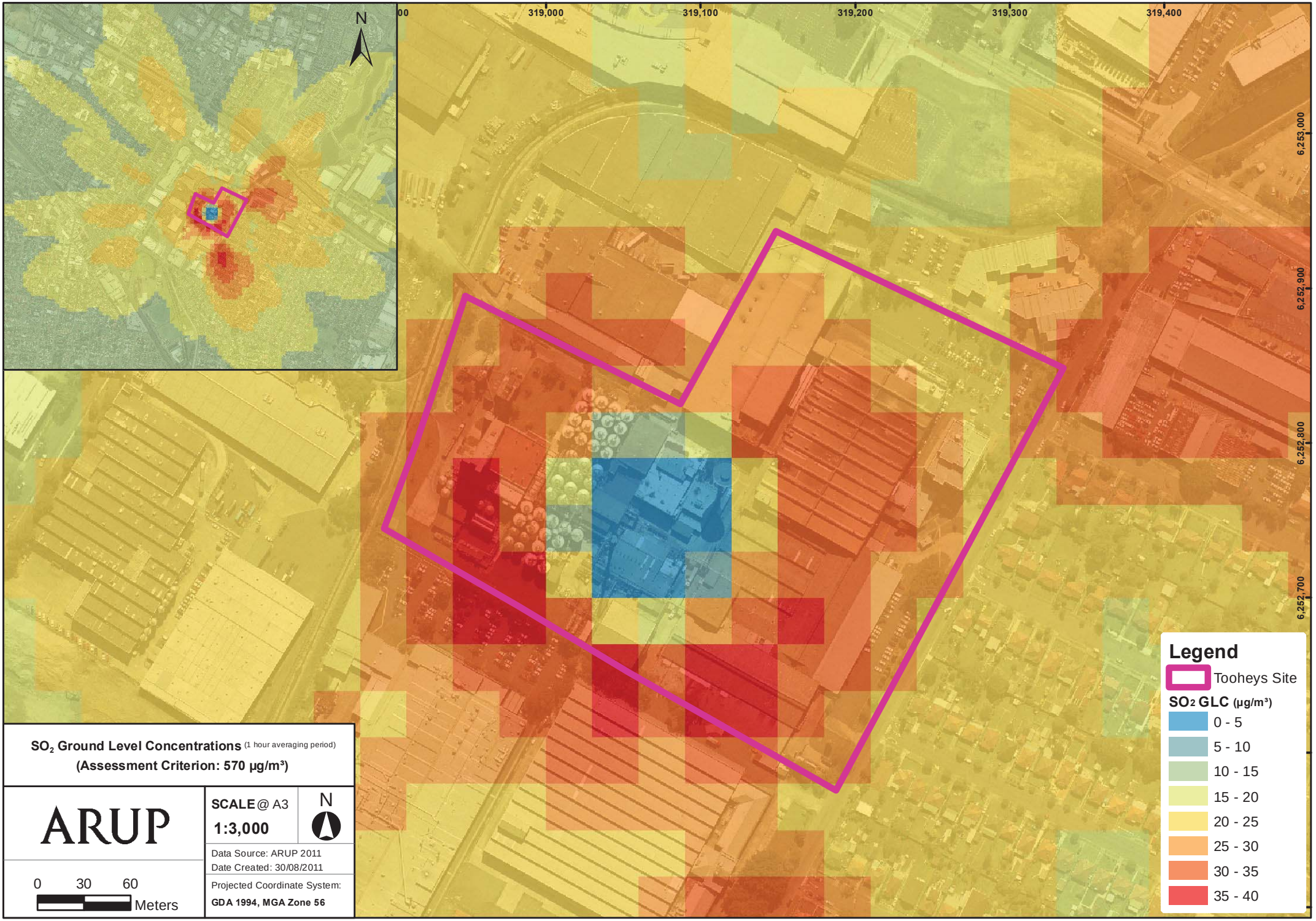
N

Data Source: ARUP 2011
Date Created: 30/08/2011

Projected Coordinate System:
GDA 1994, MGA Zone 56

0 30 60
Meters


N
319,000
319,100
319,200
319,300
319,400
6,253,000
6,252,900
6,252,800
6,252,700
Legend
Tooheys Site
SO2 GLC (µg/m³)
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
SO2 Ground Level Concentrations (10 min averaging period)
(Assessment Criterion: 712 µg/m³)
ARUP
SCALE @ A3
1:3,000
N
Data Source: ARUP 2011
Date Created: 30/08/2011
Projected Coordinate System:
GDA 1994, MGA Zone 56
0 30 60
Meters



SO_2 Ground Level Concentrations (1 hour averaging period)
(Assessment Criterion: 570 µg/m³)

ARUP

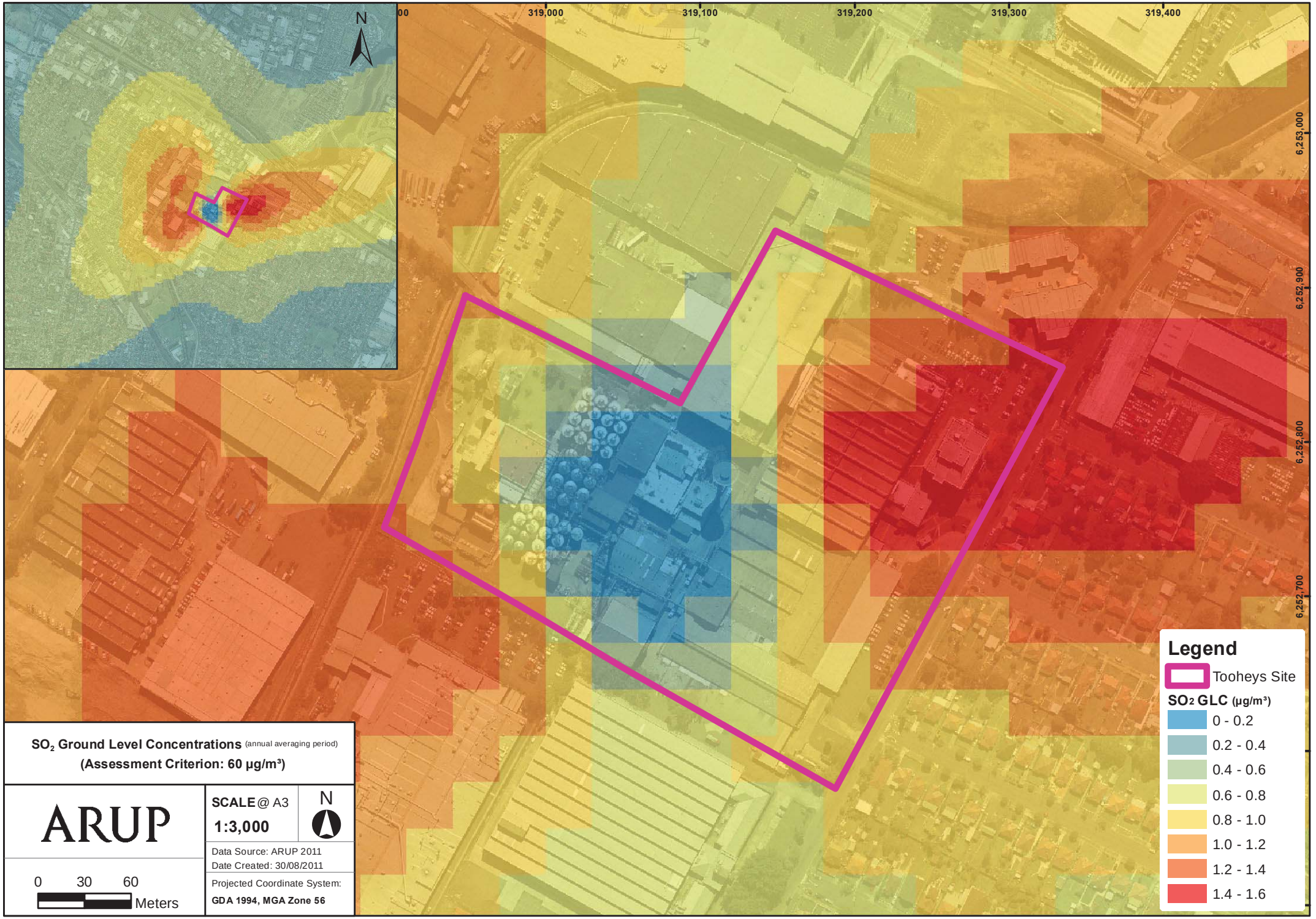
SCALE @ A3
1:3,000

N

Data Source: ARUP 2011
Date Created: 30/08/2011

Projected Coordinate System:
GDA 1994, MGA Zone 56

0 30 60
Meters



SO_2 Ground Level Concentrations (annual averaging period)
(Assessment Criterion: 60 µg/m³)

ARUP

SCALE @ A3
1:3,000

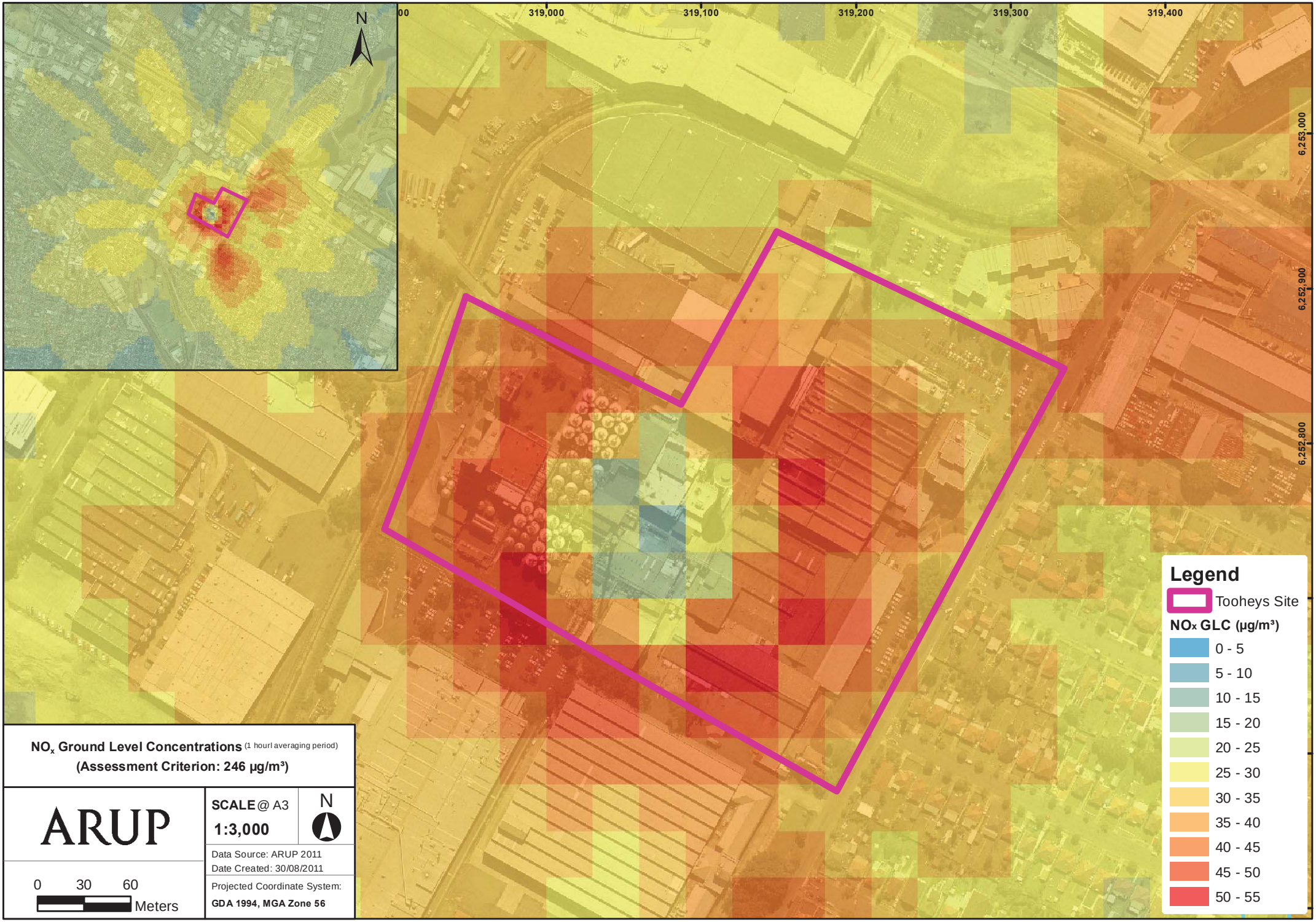
N

Data Source: ARUP 2011
Date Created: 30/08/2011

Projected Coordinate System:
GDA 1994, MGA Zone 56

0 30 60
Meters

Attachment B – NOx GLC Contours



NO_x Ground Level Concentrations (1 hour averaging period)
(Assessment Criterion: 246 µg/m³)

ARUP

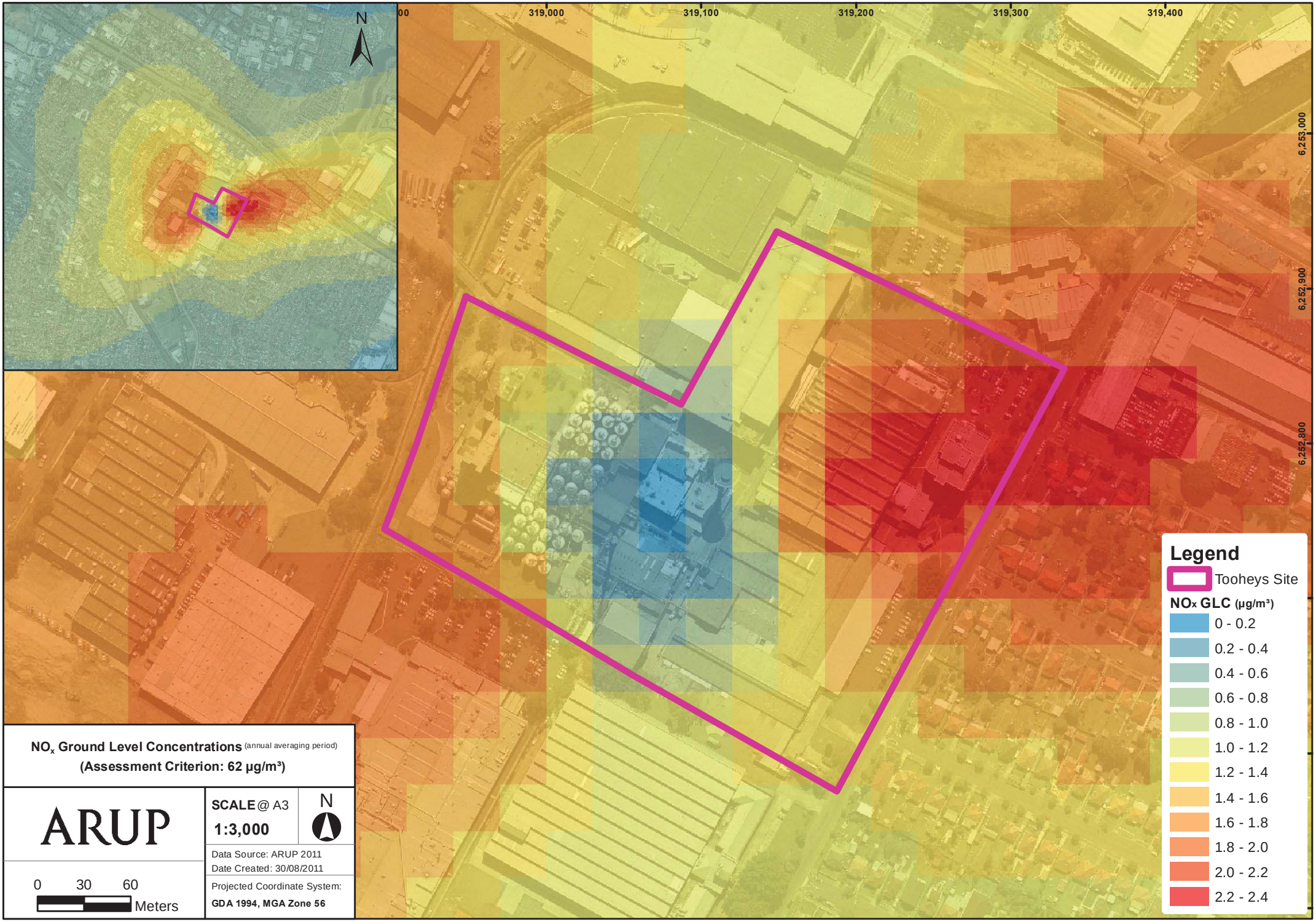
SCALE @ A3
1:3,000

N

Data Source: ARUP 2011
Date Created: 30/08/2011

Projected Coordinate System:
GDA 1994, MGA Zone 56

0 30 60
Meters


N
319,000
319,100
319,200
319,300
319,400
6,253,000
6,252,900
6,252,800
Legend
Tooheys Site
NOx GLC (µg/m³)
0 - 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1.0
1.0 - 1.2
1.2 - 1.4
1.4 - 1.6
1.6 - 1.8
1.8 - 2.0
2.0 - 2.2
2.2 - 2.4
NOx Ground Level Concentrations (annual averaging period)
(Assessment Criterion: 62 µg/m³)
ARUP
SCALE @ A3
1:3,000
N
Data Source: ARUP 2011
Date Created: 30/08/2011
Projected Coordinate System:
GDA 1994, MGA Zone 56
0 30 60
Meters

Appendix G

Technical assessment - Hazard and risk

Lion Nathan National Foods

Tooheys Brewery EA

Tooheys Brewery Waste Water Treatment Plant - Preliminary Hazard Analysis

221580-00

Issue | September 2011

Arup
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Job number 221580-00

ARUP

Contents

Appendices

Executive Summary

Lion Nathan National Foods (Tooheys) proposes to construct a Waste Water Treatment Plant (WWTP) on their existing brewery site at Lidcombe in Sydney, in order to achieve trade waste water quality goals set by Sydney Water Corporation (SWC).

The WWTP proposed will include primary and secondary waste water treatment, a High Rate Anaerobic Reactor (HRAT), biogas treatment, storage and combustion in existing steam boilers and storage, handling and dosing of a number of water treatment chemicals. A number of the water treatment chemicals proposed are hazardous substances and some are considered Dangerous Goods in accordance with the National Transport Commission's Dangerous Goods Code (ADG Code) (Ref 018).

Due to the hazardous substances and potential hazards present in the proposed concept design, the WWTP is to be reviewed under the provisions of the NSW Department of Planning (DoP), State Environment Planning Policy No.33 – Hazardous and Offensive Development (SEPP 33) (Ref 010).

The brewery site is considered to be a 'Potentially Hazardous Industry', and under SEPP 33, a Preliminary Hazard Analysis (PHA) is required to be performed to prove the proposed WWTP is not hazardous.

Methodology:

The PHA risk workshop was based on a Hazard Identification Study (HAZID), using site layouts/surveys, process flow diagrams and information about the proposed hazardous substances and processes involved.

The proposed WWTP was broken into sub-systems and analysed methodically, using a list of potentially hazardous events and a list of guide words or prompts to help formulate scenarios and causes for the hazardous events to occur. Existing safeguards and safeguards that are assumed to be part of the design of the new WWTP were identified for each of the causes of the identified hazardous events.

A primarily qualitative risk analysis was performed on each of the consequences of the hazardous events. Due to the difficulty of quantifying the consequences and likelihoods of the hazardous events, a qualitative assessment was made utilising the Tooheys risk matrix policy (see Appendix C) as a first pass for identifying any intolerable risks.

It should be noted that since the PHA risk workshop was conducted, the preferred design of the WWTP has been changed from a peak capacity of 3500 kL/day to 3,240 kL/day. The secondary treatment process has also been changed from an to include the option of a membrane bio-reactor process. The PHA has since been revised, and no additional risks were found in regard to the concept design changes.

During the analysis of the identified risks, reference was made to the relevant general principles as defined by HIPAP 4: Risk Criteria for Land Use Safety Planning Section 2.4.1 (Ref 004) as follows:

- The avoidance of all avoidable risks
- The risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low
- The effects of significant events should, wherever possible be contained within the site boundary
- Where the risk from an existing installation is already high, further development should not pose any incremental risk

Following on from the principles mentioned above, recommendations have been made against each of the identified risks, to ensure that the residual risks will be As Low As Reasonably Practicable (ALARP).

1 Findings and Recommendations

As mentioned previously, recommendations have been made against each of the identified risks, to ensure that the residual risks will be As Low As Reasonably Practicable (ALARP), following their implementation.

There are no recommendations that would be considered major recommendations, or major changes to the proposed WWTP concept design.

The majority of the recommendations are either design tasks/investigations that would be expected to be part of the detailed design phase or are modifications to existing administrative systems and procedures employed by Tooheys at their Lidcombe site.

A summary of risks identified with consequences occurring outside the site boundary and their associated recommendations can be found in Section 3.

In addition to the specific recommendations generated in the workshop, a number of general WWTP design recommendations that align with the HIPAP 4 (ref 004) general principles are given below:

- Noise and odour sources should be minimised and kept as far away from the site boundary as possible, odour exhaust outlets should be at a high level
- Chemical storage capacities should be kept to a minimum and should be kept as far away from the site boundary as possible without creating other hazards
- The biogas system capacity should be minimised as far as practical, and the high pressure biogas pipeline diameter and pressure should be minimised as far as practical
- Major components of the biogas system, including the waste gas flare and any relief valve outlets should be kept as far away from the site boundary as possible without creating other hazards
- Chemical deliveries and waste disposal vehicle frequencies should be minimised

The off-site effects due to fire or explosion of biogas, and the potential off-site toxic effects from biogas are considered to be highly unlikely. It is recommended that these effects are investigated further through the detailed design phase, HAZOP workshop and Final Hazard Analysis (FHA), to confirm the assumptions of this PHA.

Below is a list of standards and documents that could be used to guide the detailed design phase to ensure best practice design of the biogas system:

- AS 3814 Industrial & Commercial Gas Fired Appliances (Ref. 011)
- AS 4041 Pressure Piping(Ref. 012)
- AS 4343 Pressure Equipment - Hazard Levels(Ref. 013)
- AS 60079 Series - Electrical Apparatus for Explosive Gas Atmospheres Set(Ref. 014)
- CAN/CGA-Bl05-M93 Code for Digester Gas and Landfill Gas Installations(Ref. 015)
- U. S. Department of Energy - Handbook on Biogas Utilization(Ref. 016)

2 WWTP Site Description

The Tooheys Brewery site is located at 29 Nyrang Street, Lidcombe NSW. It has been in operation since 1955 and has undergone several upgrades during this time. In July 2006, Tooheys received single site wide planning approval from the then NSW Department of Planning (DoP), under Part 3A of the Environmental Planning and Assessment (EP&A) Act 1979. The approval was granted for the major upgrade of the brewery known as Project Key as well as a site wide approval for ongoing operations at the brewery.

Tooheys currently generates approximately 2,000 kL per day of wastewater as a result of a number of water utilising processes including:

- Brew house and fermentation operations
- Beer filtration
- Packaging (e.g. filling bottles, cans and kegs)
- Boiler and cooling tower makeup
- Clean in place (CIP) operations

The wastewater is currently discharged to Sydney Water's sewer system under a Sydney Water Trade Waste agreement with only minor treatment to correct pH levels.

2.1 Site Location

Tooheys proposes to install a wastewater treatment plant (WWTP) with a peak capacity of 3,240 kL per day on their existing brewery site at Lidcombe in Sydney. The WWTP is to be located on the rear boundary in the West corner of the site adjacent to Haslams Creek on the North West boundary and industrial neighbours on the South West boundary as shown on the site plans in Appendix B.

2.2 WWTP Process

The proposed treatment process comprise high rate anaerobic digestion (AD) followed by aerobic polishing or a membrane bioreactor process prior to discharge to sewer. Tooheys also propose to divert the biogas generated from the AD process to the existing boilers for energy generation. While it is currently not considered viable to further treat the water for on-site re-use applications, the plant design will allow for future reverse osmosis or other advanced treatment technology to be installed in the future.

2.3 Hazardous Materials Present On Site

The table below gives details of the water treatment chemicals included in the proposed design.

Site Area	Material	DG Class PG/ UN No.	Screening Method	Threshold (tonne)	Notes

Proposed WWTP	Ferric chloride solution	8 PGIII / 2582	Table 3	50	Below the threshold
Proposed WWTP	Citric acid	NA / NA	-	-	
Proposed WWTP	Hydrochloric acid	8 PGIII / 1789	Table 3	50	Below the threshold
Proposed WWTP	Sodium hydroxide solution	8 PGII / 1824	Table 3	25	Below the threshold
Proposed WWTP	Urea	NA / NA	-	-	
Proposed WWTP	Polymer	NA / NA	-	-	

Biogas:

The proposed WWTP biogas system consists of an anaerobic digester, condensate trap, gas storage buffer, waste gas flare, gas compressor and high pressure gas pipeline running to the existing gas fired boilers.

The biogas composition depends on the wastewater composition and with currently measured COD and sulphate concentrations is expected to contain 75-80% methane, 20-25% carbon dioxide and less than 0.3% hydrogen sulphide. The biogas will be directly used in the existing steam boiler without any pre-treatment. The biogas produced by the anaerobic process is expected to be up to 8100 m^3/day at maximum loading. The entire biogas system capacity is expected to be less than 100m^3 of gas at atmospheric conditions.

The low pressure side of the biogas system (prior to gas compressor) is assumed to be at less than 10 kPa (g), and the high pressure side of the system (gas compressor to boilers) is assumed to be at a pressure less than 100 kPa (g). At a typical atmospheric gas density of approximately 0.98 kg/m^3 (ref 017), the total amount of gas expected to be present on the site at any one time is less than 100 kg.

The Upper Explosive Limit (UEL) and Lower Explosive Limit (LEL) for an 80% methane biogas are approximately 15% and 6.5% biogas in air respectively (ref 016).

Biogas is not specifically identified as a dangerous good by the ADG Code, but for the purposes of a PHA, may be regarded as a generic compressed flammable gas mixture of Class 2.1, potentially with a subsidiary risk of Class 2.3 (toxic gasses), due to the presence of hydrogen sulphide.

Referring to Table 1, and Figure 6 of SEPP 33 (ref 010), indicates that the small amount of biogas on the site (<100kg) is not likely to present a significant off-site risk.

3 Hazard Identification

The qualitative HAZID process employed in the risk workshop identified a number of risks with consequences occurring both inside and outside the site boundary.

All of the identified risks with consequences occurring within the site boundary are expected to be resolved to an As Low As Reasonably Practicable (ALARP) level of risk through the project detailed design phase and associated HAZOP and Construction Safety Study. Preliminary recommendations have been given in the risk workshop worksheet in Appendix D.

The risks with consequences occurring outside the site boundary are discussed below.

1. **Cause:** Biogas leak
   Consequences: Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid injury/illness to members of the public
   Existing/Assumed Safeguards: Plant is outdoors; biogas is lighter than air and will disperse
   Recommendations: Consider vehicle impact protection for biogas equipment in design, consider confined spaces in design, identify low points for H2S to accumulate (i.e. storm drains) in design, consultation with neighbours about risks (i.e. identify a leak by smell, evacuation plans)

2. **Cause:** Flame failure of biogas flare or boilers
   Consequences: Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid injury/illness to members of the public
   Existing/Assumed Safeguards: Plant is outdoors , biogas is lighter than air and will disperse, Burner management system will interlock flare/boiler shutoff valve with fail safe flame monitor and pilot light, boilers and flare will be Inspected by Workcover every five weeks and inspected by Tooheys personnel every week
   Recommendations: Consider confined spaces in design, identify low points for H2S to accumulate (i.e. storm drains) in design, consultation with neighbours (i.e. identify a leak by smell, evacuation plans)

3. **Cause:** Incomplete combustion in biogas flare or boilers
   Consequences: Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid injury/illness to members of the public
   Existing/Assumed Safeguards: Plant is outdoors , biogas is lighter than air and will disperse, boilers and flare will be Inspected by Workcover every five weeks and inspected by Tooheys personnel every week
   Recommendations: Consider confined spaces in design, identify low points for H2S to accumulate (i.e. storm drains) in design, consultation with neighbours (i.e. identify a leak by smell, evacuation plans)

4. **Cause:** Sludge, waste water or biogas condensate leak via tank overflow, pipe leak or sludge disposal vehicle accident on-site
   Consequences: Toxic release to waterways/soil, possible non-permanent damage to biophysical environment
   Existing/Assumed Safeguards: Stormwater retention pit/first flush system, segregation of traffic/one way traffic systems, high level alarms on tanks, hardstand area
   Recommendations: Review bunding requirements with EPA during design, review Spill Containment Action Plan

5. **Cause:** Toxic release during powdered chemical handling
   Consequences: Toxic release to air/soil/waterways, possible non-permanent damage to biophysical environment
   Existing/Assumed Safeguards: Stormwater retention pit/first flush system, hardstand areas
   Recommendations: Investigate alternative liquid or solid prill chemical delivery to minimise dust, investigate use of dust extraction/containment equipment in design

6. **Cause:** Hazardous chemical pipe leak or tank overflow
   Consequences: Toxic release to waterways/soil, possible non-permanent damage to biophysical environment
   Existing/Assumed Safeguards: Chemical delivery and storage bunding in accordance with OEH/EPA/AS 3780, Stormwater retention pit/first flush system, high level alarms on tanks , hardstand areas
   Recommendations: Review Spill Containment Action Plan

7. **Cause:** Traffic accident involving hazardous chemical or waste transport vehicle on or off site
   Consequences: Toxic release to waterways/soil, possible non-permanent damage to biophysical environment, injury to public or emergency services personnel
   Existing/Assumed Safeguards: Hardstand areas, delivery bund
   Recommendations: Use only licensed transport contractor/supplier, review Spill Containment Action Plan for new chemicals on-site

8. **Cause:** Backflow from chemical or waste water systems or cooling tower
   Consequences: Contamination of town water supply, minor illness in members of the public
   Existing/Assumed Safeguards: Backflow protection at town water connection to site
   Recommendations: Additional backflow protection on individual chemical system water connections

9. **Cause:** Biogas fire/explosion inside vapour space of sludge disposal tanker via biogas and static discharge
   Consequences: Injury to member of public, minor property damage outside site boundary
   Existing/Assumed Safeguards: Non-sparking style sludge pumps, water based waste, static build up is unlikely
   Recommendations: Hazardous area classification and selection of suitably rated equipment during design including waste removal truck, choose appropriate licensed contractor for waste removal, investigate the need for a fixed earth point for the disposal vehicle on-site

10. **Cause:** Solid waste spill off-site
    Consequences: Toxic release to waterways/soil, possible non-permanent damage to biophysical environment, minor injury to member of public
    Existing/Assumed Safeguards: Tooheys follows waste transport requirements of the POEO Act
    Recommendations: Choose appropriate licensed contractor for waste removal, ensure skip bins/tanks are fit for purpose in design phase, ensure skip bins/tanks are adequately covered/sealed prior to leaving site via waste management plan

11. **Cause:** Lack of maintenance and poor management of new cooling tower leading to contaminated water
    Consequences: Legionella illness in member of the public or employee
    Existing/Assumed Safeguards: Tooheys have a legionella prevention program, which is audited by Auburn Council, plant is outdoors
    Recommendations: Ensure new cooling tower/s are included into existing legionella prevention program

12. **Cause:** Biocide or saline water release from cooling towers
    Consequences: Toxic release to waterways/soil, possible non-permanent damage to biophysical environment
    Existing/Assumed Safeguards: Tooheys follow an approved code of practice for cooling tower operation and maintenance, Stormwater retention pit/first flush system, hardstand areas
    Recommendations: Review Spill Containment Action Plan

4 Presentation of Risk Results

The results of the PHA workshop were recorded in the PHA-Pro 8 software, the output of which can be found in Appendix D. For each hazardous event identified, the results give causes, consequences, existing or assumed safeguards, a qualitative risk assessment and recommendations. A number of risks results are presented for on-site risks, as well as risks with off-site effects.

5 Risk Assessment

The risk identification process was followed by identifying existing safeguards or safeguards that are assumed to be a part of the final design or management systems. The risks were then assessed qualitatively in terms of the expected magnitude of their potential effects and the expected likelihood of the hazardous event and its consequences occurring during the life of the facility.

It is expected that the level of risk posed by all identified risks will be negligible or ALARP, after the suggested recommendations are implemented. Refer to Appendix D for the risk assessment results. The final Hazard Analysis (FHA) is expected to provide a more rigorous analysis of the consequences and likelihoods of any risks that are believed to remain at a level above negligible, as defined in HIPAP 4 (Ref 004).

6 Conclusions

Risks at the proposed WWTP have been identified and assessed qualitatively, and all hazards are considered As Low As Reasonably Practicable (ALARP) or negligible. The revised Preliminary Hazard Analysis (PHA) has found that the proposed development is not expected to be hazardous and would therefore be permissible.

This PHA has been conducted and assessed, assuming that the following procedures and workshops will form a part of the WWTP project life cycle:

- HAZOP Study HIPAP No.8 (Ref.008) Near to completion of detailed design phase
- Final Hazard Analysis HIPAP No.6 (Ref.006) On completion of detailed design and prior to construction
- Fire Safety Study HIPAP No.2 (Ref.002) Prior to construction
- Construction Safety Study HIPAP No.7 (Ref. 007)Prior to construction
- Emergency Response Planning HIPAP No.1 (Ref. 001) Prior to commencement of operations
- Safety Management System assessment HIPAP No.9 (Ref.009) Prior to the commencement of operations
- Hazard Audit HIPAP No.5 (Ref.005) Within 12 months of commencement of operations

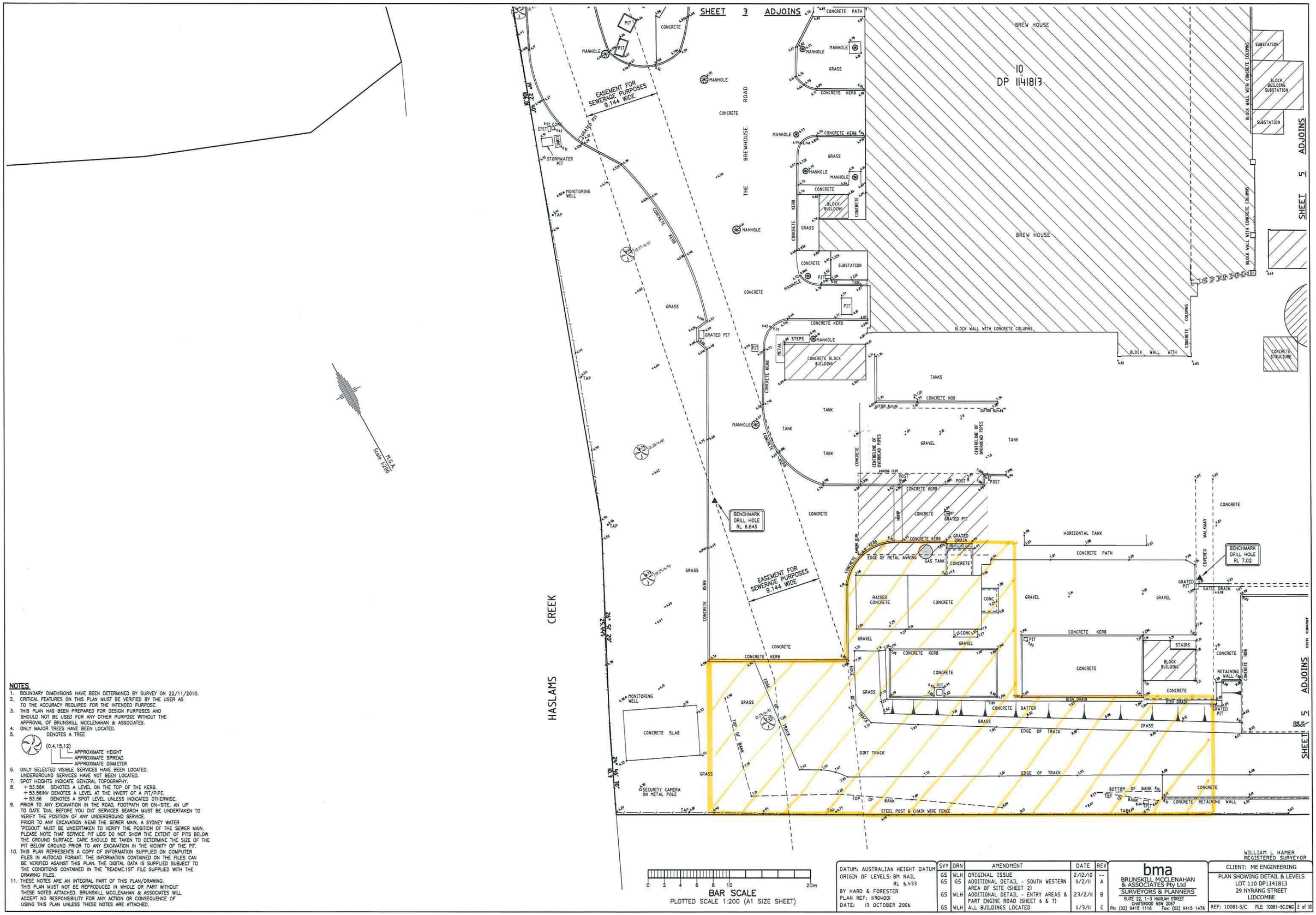
Appendix A

Hazard Analysis Team Members

First Name	Last Name	Title	Company	Department	
					1. 31/05/2011
					Attendance
Paul	Kiely	Project Manager	Tooheys		Present
Scott	Killalea	Senior Project Manager	M.E. Engineering (Tooheys)		Present
Rachel	Barton	HSE Representative	Tooheys		Absent
Fred	Sadie	Technical/Engineering Representative	Tooheys		Partial
Dianne	Thomas	Project Designer	Beca		Present
Melanie	Koerner	Senior Environmental Engineer	Arup	Sustainability (Sydney)	Present
Fiona	Riley	Business Administrator	Arup	Sustainability (Sydney)	Present
Oliver	Manhire	Senior Mechanical Engineer	Arup	Industrial & Process (Melbourne)	Present

Appendix B

WWTP System Drawings and Sub-systems



NOTES

1. BOUNDARY DIMENSIONS HAVE BEEN DETERMINED BY SURVEY ON 22/11/2010.
2. CRITICAL FEATURES ON THIS PLAN MUST BE VERIFIED BY THE USER AS TO THE ACCURACY REQUIRED FOR THE INTENDED PURPOSE.
3. THIS PLAN HAS BEEN PREPARED FOR DESIGN PURPOSES AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE WITHOUT THE APPROVAL OF BRUNSKILL MCCLENAHAN & ASSOCIATES.
4. ONLY MAJOR TREES HAVE BEEN LOCATED.
5. DENOTES A TREE
   (0.4,15,12)
   - APPROXIMATE HEIGHT
   - APPROXIMATE SPREAD
   - APPROXIMATE DIAMETER
6. ONLY SELECTED VISIBLE SERVICES HAVE BEEN LOCATED. UNDERGROUND SERVICES HAVE NOT BEEN LOCATED.
7. SPOT HEIGHTS INDICATE GENERAL TOPOGRAPHY.
8. + 53.56K DENOTES A LEVEL ON THE TOP OF THE KERB.
   + 53.56INV DENOTES A LEVEL AT THE INVERT OF A PIT/PIPE.
   + 53.56 DENOTES A SPOT LEVEL UNLESS INDICATED OTHERWISE.
9. PRIOR TO ANY EXCAVATION IN THE ROAD, FOOTPATH OR ON-SITE, AN UP TO DATE 'DIAL BEFORE YOU DIG' SERVICES SEARCH MUST BE UNDERTAKEN TO VERIFY THE POSITION OF ANY UNDERGROUND SERVICE. PRIOR TO ANY EXCAVATION NEAR THE SEWER MAIN, A SYDNEY WATER 'PEGOUT' MUST BE UNDERTAKEN TO VERIFY THE POSITION OF THE SEWER MAIN. PLEASE NOTE THAT SERVICE PIT LIDS DO NOT SHOW THE EXTENT OF PITS BELOW THE GROUND SURFACE. CARE SHOULD BE TAKEN TO DETERMINE THE SIZE OF THE PIT BELOW GROUND PRIOR TO ANY EXCAVATION IN THE VICINITY OF THE PIT.
10. THIS PLAN REPRESENTS A COPY OF INFORMATION SUPPLIED ON COMPUTER FILES IN AUTOCAD FORMAT. THE INFORMATION CONTAINED ON THE FILES CAN BE VERIFIED AGAINST THIS PLAN. THE DIGITAL DATA IS SUPPLIED SUBJECT TO THE CONDITIONS CONTAINED IN THE "README.1ST" FILE SUPPLIED WITH THE DRAWING FILES.
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BAR SCALE
0 2 4 6 8 10 20m
PLOTTED SCALE 1:200 (A1 SIZE SHEET)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN OF LEVELS: BM NAIL RL 6.493
BY HARD & FORESTER
PLAN REF: 11190-001
DATE: 13 OCTOBER 2006

SVY	DRN	AMENDMENT	DATE	REV
GS	WLH	ORIGINAL ISSUE	2/12/10	--
GS	GS	ADDITIONAL DETAIL - SOUTH WESTERN AREA OF SITE (SHEET 2)	11/2/11	A
GS	WLH	ADDITIONAL DETAIL - ENTRY AREAS & PART ENGINE ROAD (SHEET 6 & 7)	23/2/11	B
GS	WLH	ALL BUILDINGS LOCATED	11/3/11	C

bma
BRUNSKILL MCCLENAHAN & ASSOCIATES Pty Ltd
SURVEYORS & PLANNERS
SUITE 22, 1-3 HAVILAH STREET
CHATSWOOD NSW 2067
Phn: (02) 9415 1116 Fax: (02) 9415 1476

WILLIAM L HAMER
REGISTERED SURVEYOR

CLIENT: ME ENGINEERING

PLAN SHOWING DETAIL & LEVELS
LOT 110 DP1141813
29 NYRANG STREET
LIDCOMBE

REF: 10081-5/C FILE 10081-SC.DWG 2 of 10

A1

NORTH POINT LOCATION INDICATIVE ONLY

EQUALISATION TANKS

EXISTING TRADE WASTE CONNECTION

PROPOSED TRADE WASTE PIPELINE

PROPOSED TRADE WASTE CONNECTION

PROPOSED BIOGAS PIPELINE

PROPOSED WASTE WATER TREATMENT PLANT SITE AREA

0 10 20 30 40 50
SCALE 1:500m

Issue	Date	By	Chkd	Appd

Client

Job Title
TOOHEYS
EFFLUENT IMPROVEMENT
PROGRAM

Scale at A1 1:500

Discipline

ARUP
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Sydney, NSW, 2000
Tel +31 (02) 9360 9360
www.arup.com

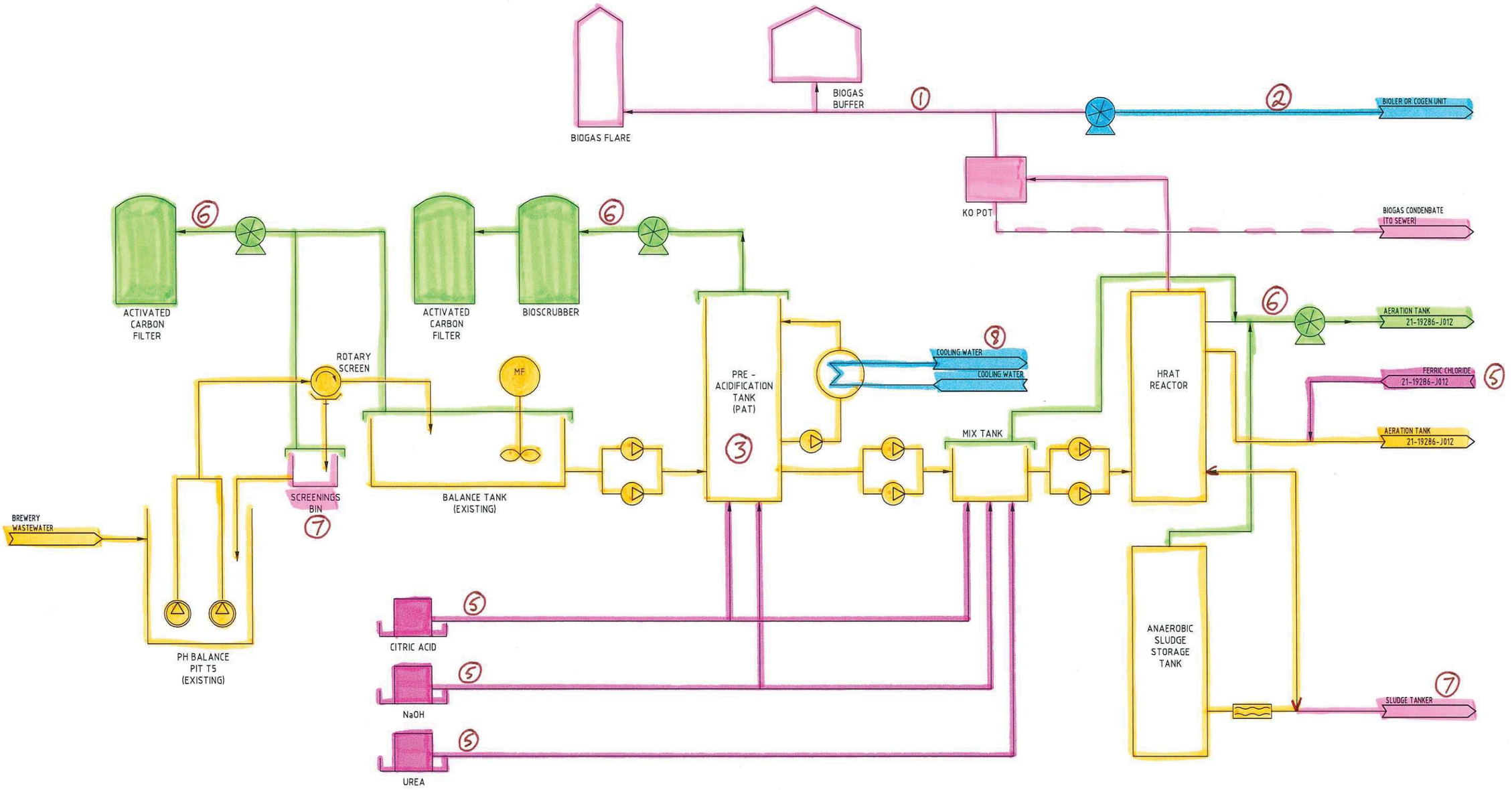
CONSULT AUSTRALIA
Member Firm
Arup Pty Ltd
ABN 18 000 966 165

Drawing Title
PROPOSED TRADE WASTE
TREATMENT LAYOUT

Drawing Status
FOR INFORMATION

Job No	Drawing No	Issue
221580	SK001	A

Do not scale



PRELIMINARY

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
B	FOR ISSUE WITH EFFLUENT IMPROVEMENT PROGRAM	VW	LS	SW	14.9.10
A	FOR ISSUE WITH DRAFT EFFLUENT IMPROVEMENT PROGRAM	VW	AA	SW	6.9.10

GHD CLIENTS | PEOPLE | PERFORMANCE

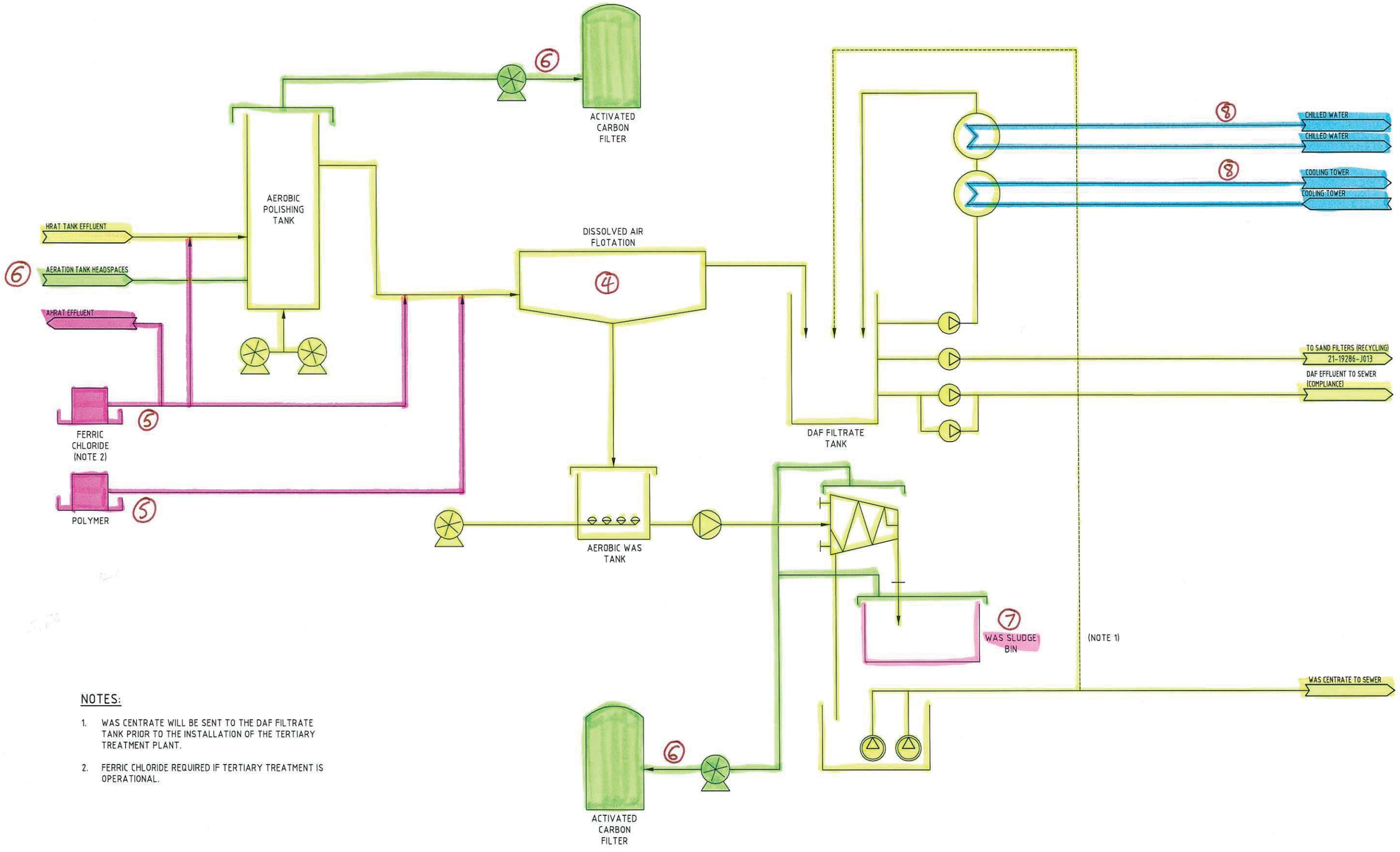
Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia
T 61 2 9239 7100 F 61 2 9239 7199
E sydmail@ghd.com W www.ghd.com

Drawn	V. WANG	Designed	A. ALLAN
Drafting Check		Design Check	E. VAN DRIEL
Approved			
Date			
Scale	NTS	This Drawing must not be used for Construction unless signed as Approved	

Client TOOHEYS
Project EFFLUENT IMPROVEMENT PROGRAM
Title TRADE WASTE TREATMENT PLANT (OPT AEROBIC POLISHING)
ANAEROBIC TREATMENT PROCESS FLOW DIAGRAM

Original Size A1 Drawing No: 21-19286-J011 Rev: B

Plot Date: 14 September 2010 - 1:47 PM Plotted by: Vivien Wang/Sydney/GHD/AU Cad File No: G:\21\19286\CADD\Drawings\21-19286-J011.dwg



NOTES:

1. WAS CENTRATE WILL BE SENT TO THE DAF FILTRATE TANK PRIOR TO THE INSTALLATION OF THE TERTIARY TREATMENT PLANT.
2. FERRIC CHLORIDE REQUIRED IF TERTIARY TREATMENT IS OPERATIONAL.

PRELIMINARY

No.	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
B	FOR ISSUE WITH EFFLUENT IMPROVEMENT PROGRAM	VW	LS	SW	14.9.10
A	FOR ISSUE WITH DRAFT EFFLUENT IMPROVEMENT PROGRAM	VW	AA	SW	6.9.10

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Drawn V. WANG	Designed A. ALLAN	Client	TOOHEYS
Drafting Check	Design Check E. VAN DRIEL	Project	EFFLUENT IMPROVEMENT PROGRAM
Approved		Title	TRADE WASTE TREATMENT PLANT (OPT AEROBIC POLISHING) SECONDARY TREATMENT PROCESS FLOW DIAGRAM
Date			
Scale NTS	This Drawing must not be used for Construction unless signed as Approved	Original Size A1	Drawing No: 21-19286-J012 Rev: B

Plot Date: 14 September 2010 - 1:47 PM Plotted by: Vivien Wang/Sydney/GHD/AU Cad File No: G:\21\19286\CADD\Drawings\21-19286-J012.dwg

Appendix C

Tooheys Risk Matrix Policy

Severity

Severity	Description
5	**Severe** Fatality, permanent disability, property or environmental damage over $500,000, Off site discharge with detrimental effects, No treatment capacity
4	**Major** Lost Time Injury longer than 2 weeks, long term temporary disability (over 1 month), property or environmental damage $50,000 to $500,000, Off site discharge without effects, Limited treatment capacity
3	**Moderate** Any Lost Time Injury, short term temporary disability (under 1 month), property or environmental damage $5,000 to $50,000, On site discharge contained
2	**Minor** First Aid, property or environmental damage up to $5,000, On site discharge immediately contained
1	**Insignificant** No Injuries. Low financial loss, No discharge

Likelihood

Likelihood	Description
5	**Almost Certain** Is expected to occur in most circumstances during the life of the facility
4	**Likely** Could happen regularly during the life of the facility
3	**Possible** Might happen at some time during the life of the facility
2	**Unlikely** Could happen but only rarely during the life of the facility
1	**Rare** Could happen, but probably never will during the life of the facility

Risk Ranking

Risk Ranking	Description
Very High	Unacceptable. Prohibit activity, do not re-start until hazard is eliminated or the risk controlled to a lower level of assessment.
High	Requires action within a specified time frame **"Are additional controls available? Are they reasonably practicable to implement?"** An action plan to be developed within one week and additional controls implemented within one month or as soon as practicable.
Medium	Requires action **"Are additional controls available? Are they reasonably practicable to implement?"** An action plan to be developed, target dates established and recommended controls implemented.
Low	Acceptable. Maintain integrity of existing controls, monitor and review effectiveness.

Risk Matrix

LIKELIHOOD	1	2	3	4	5
5	Medium	Medium	High	Very High	Very High
4	Low	Medium	High	High	Very High
3	Low	Medium	Medium	High	High
2	Low	Low	Medium	Medium	Medium
1	Low	Low	Low	Low	Medium

SEVERITY

Appendix D

Risk Workshop Worksheet

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 1. Biogas collection and storage, including waste gas flare and condensate disposal, headspace of bioreactor and other portions with pressurised biogas

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1. Leak from tank or pipe with ignition	1. Fire (low intensity, no explosion) within site boundary	1. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training	4	1	Low	1. Determine relevant authorities and certifications required by WorkCover for biogas equipment	Tooheys/Designer
			2. Biogas and hazardous zone equipment designed and installed to relevant standards. Installation and commissioning by licensed gas fitters and electricians licensed for hazardous zone installations				3. Ensure fire safety study is updated for changes on-site	Tooheys
2. Fire/explosion/projectiles	2. Flame failure in waste gas flare	1. Fire (low intensity, no explosion) within site boundary	1. Burner management system will interlock flare shutoff valve with fail safe flame monitor and pilot light	4	2	Medium	25. Ensure waste gas flare is designed, installed and commissioned in accordance with AS 3814 Industrial and	Tooheys/Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 1. Biogas collection and storage, including waste gas flare and condensate disposal, headspace of bioreactor and other portions with pressurised biogas

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
							Commercial Gas-fired Appliances or similar applicable standard	
3. Fire/explosion/projectiles	3. External fire, vehicle impact, lightning strike damaging biogas piping or vessels	1. Fire (low intensity, no explosion) within site boundary		4	2	Medium	2. Review requirements for lightning protection on-site	Designer
							3. Ensure fire safety study is updated for changes on-site	Tooheys
							4. Consider vehicle impact protection for biogas equipment in design	Designer
4. Fire/explosion/projectiles	4. Leak from tank or pipe with delayed ignition	1. Fire (low intensity, no explosion) within site boundary	1. Plant is outdoors 2. Gas is lighter than air and will disperse 3. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training	4	1	Low	3. Ensure fire safety study is updated for changes on-site	Tooheys

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 1. Biogas collection and storage, including waste gas flare and condensate disposal, headspace of bioreactor and other portions with pressurised biogas

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
5. Toxic release to air	5. Leak from tank or pipe	1. Toxicity impacts causing evacuation and first aid from concentrated H2S within site boundaries (employees)	1. Plant is outdoors	2	1	Low	4. Consider vehicle impact protection for biogas equipment in design	Designer
		2. Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid	2. Gas is lighter than air and will disperse 3. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training	3	1	Low		
6. Toxic release to air	6. Flame failure in waste gas flare	1. Toxicity impacts causing evacuation and first aid from concentrated H2S within site boundaries (employees)	1. Plant is outdoors	2	1	Low		
		2. Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid	2. Gas is lighter than air and will disperse 3. Burner management system will interlock flare shutoff valve with fail safe flame	3	1	Low		

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 1. Biogas collection and storage, including waste gas flare and condensate disposal, headspace of bioreactor and other portions with pressurised biogas

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	L	RR	Recommendations	Responsibility
			monitor and pilot light					
7. Toxic release to waterways	7. Leak from condensate pipe	1. Condensate release to waterways	1. Stormwater retention pit/first flush system	1	1	Low		
8. Toxic release to soil	8.							
9. Waste water/sludge release	9.							
10. Solid waste release/spill off-site	10.							
11. Odour beyond site boundary	11. Leak from tank or pipe	1. EPA fine/prosecution (regulatory)	1. Routine maintenance to detect leaks	3	2	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)	2. Community consultation, complaints procedure 3. Odour assessment	3	3	Medium		
12. Odour beyond site boundary	12. Flame failure in waste gas flare	1. EPA fine/prosecution (regulatory)	1. Burner management system will interlock flare shutoff valve with fail safe flame monitor and pilot light	3	2	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community	2. Routine maintenance to	3	3	Medium		

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 1. Biogas collection and storage, including waste gas flare and condensate disposal, headspace of bioreactor and other portions with pressurised biogas

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
		relations)	detect leaks					
13. Odour beyond site boundary	13. Routine maintenance of system (purging pipes and vessels)	1. EPA fine/prosecution (regulatory)	1. SWMS, Consideration of maintenance in design	3	2	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)		3	3	Medium		
14. Noise beyond site boundary	14. Blower noise for combustion fan at biogas flare	1. EPA fine/prosecution (regulatory)	1. Enclosed flare	3	2	Medium	6. Noise assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)	2. Noise assessment	3	3	Medium		
15. Contamination of town water supply	15.							
16. Flammable/toxic gasses in storm drains	16.							
17. High temperature release to waterways	17.							
18. Harm to motorist or pedestrian off-site	18.							
19. Contamination of brewery product	19.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1. External fire, vehicle impact, lightning strike damaging biogas piping or vessels	1. Fire (low intensity, no explosion) within site boundary	1. Ventilation (natural, perforated walls)	5	2	Medium	7. Consider emergency shut-off valve for biogas, linked to fire alarm, gas detectors etc	Designer
		2. Lost time injury to employees	2. Fire services (sprinklers)	5	2	Medium	8. Review opportunity to automate existing natural gas emergency shut-off valve and link to fire alarm, gas detectors etc	Designer
		3. Infrastructure and production losses	3. Dedicated ammonia plant room with dedicated safety system 4. Manual isolation valve on natural gas pipeline to engine room (can isolate from outside of engine room) 5. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training 6. Biogas and hazardous zone equipment designed and installed to relevant standards. Installation and commissioning by licensed gas fitters and electricians licensed for hazardous zone installations	5	2	Medium	26. Consider methane LEL gas detector/s in the engine room	Designer
2. Fire/explosion/projectiles	2. Leak from pipe with ignition	1. Fire (low intensity, no explosion)	1. Ventilation (natural, perforated	5	2	Medium	7. Consider emergency shut-off valve	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
		within site boundary	walls)				for biogas, linked to fire alarm, gas detectors etc	
		2. Lost time injury to employees	2. Fire services (sprinklers)	5	2	Medium	8. Review opportunity to automate existing natural gas emergency shut-off valve and link to fire alarm, gas detectors etc	Designer
		3. Infrastructure and production losses	3. Dedicated ammonia plant room with dedicated safety system	5	2	Medium	26. Consider methane LEL gas detector/s in the engine room	Designer
			4. Manual isolation valve on natural gas pipeline to engine room (can isolate from outside of engine room)					
			5. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training					
			6. Biogas and hazardous zone equipment designed and installed to relevant standards. Installation and commissioning by licensed gas fitters and					

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
			electricians licensed for hazardous zone installations					
3. Fire/explosion/projectiles	3. Flame failure of boilers	1. Fire (low intensity, no explosion) within site boundary	1. Boiler burner management system includes interlock for flame failure, pre and post purge of boiler furnace 2. Inspected by Workcover every five weeks, inspected by Tooheys personnel every week	5	2	Medium		
4. Fire/explosion/projectiles	4. Leak from pipe with delayed ignition	1. Fire and explosion within site boundary	1. Ventilation (natural, perforated walls)	5	2	Medium	7. Consider emergency shut-off valve for biogas, linked to fire alarm, gas detectors etc	Designer
		2. Lost time injury to employees	2. Fire services (sprinklers)	5	2	Medium	8. Review opportunity to automate existing natural gas emergency shut-off valve and link to fire alarm, gas detectors etc	Designer
		3. Infrastructure and production losses	3. Dedicated ammonia plant room with dedicated safety system 4. Manual isolation valve on natural gas pipeline to engine	5	2	Medium	26. Consider methane LEL gas detector/s in the engine room	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
			room (can isolate from outside of engine room) 5. Hazardous area classification, separation of zones from site boundary, appropriate signage and personnel training 6. Biogas and hazardous zone equipment designed and installed to relevant standards. Installation and commissioning by licensed gas fitters and electricians licensed for hazardous zone installations 7. Manned 12 hours per day, 5 days per week, security guard walk around once per day on weekends					
5. Toxic release to air	5. Leak from tank or pipe	1. Toxicity impacts causing evacuation and first aid from concentrated H2S within site boundaries (employees)	1. Natural ventilation in engine room 2. Gas is lighter than air and will disperse	3	2	Medium	4. Consider vehicle impact protection for biogas equipment in design 9. Review ventilation requirements of applicable Australian Standards for	Designer Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
							engine room	
6. Toxic release to air	6. Flame failure of boilers	1. Toxicity impacts causing evacuation and first aid from concentrated H2S within site boundaries (employees)	1. Release will be at high level from boiler stacks	2	1	Low		
		2. Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid	2. Gas is lighter than air and will disperse	3	1	Low		
			3. Boiler burner management system includes interlock for flame failure, pre and post purge of boiler furnace					
			4. Inspected by Workcover every five weeks, inspected by Tooheys personnel every week					
7. Toxic release to air	7. Emissions due to incomplete combustion in boilers	1. Toxicity impacts from concentrated H2S outside site boundaries causing evacuation and first aid	1. Release will be at high level from boiler stacks	3	1	Low	10. Air quality assessment (SOx monitoring) for boiler exhaust running on biogas	Tooheys
			2. Gas is lighter than air and will disperse				27. Investigate scrubbing biogas prior to combustion	Designer
			3. Inspected by Workcover every five weeks, inspected by Tooheys personnel every week					

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
8. Toxic release to waterways	8.							
9. Toxic release to soil	9.							
10. Waste water/sludge release	10.							
11. Solid waste release/spill off-site	11.							
12. Odour beyond site boundary	12. Leak from tank or pipe	1. EPA fine/prosecution (regulatory)	1. Routine maintenance to detect leaks	3	2	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)	2. Community consultation, complaints procedure 3. Odour assessment	3	3	Medium		
13. Odour beyond site boundary	13. Routine maintenance of system (purging pipes and vessels)	1. EPA fine/prosecution (regulatory)	1. SWMS, Consideration of maintenance in design	3	2	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)		3	3	Medium		
14. Noise beyond site boundary	14. Noise from biogas compressor	1. EPA fine/prosecution (regulatory)	1. Noise assessment	3	2	Medium	28. Investigate acoustic enclosure for biogas compressor	Designer
		2. Neighbour complaints (community relations)		3	2	Medium	6. Noise assessment to provide recommendations	Designer
15. Contamination of town water supply	15.							
16. Flammable/toxic gasses in storm drains	16.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 2. High pressure biogas system, including compressor and boilers

Type: Equipment ID:

Design Conditions/Parameters: 5100-9900 m^3/day, Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
17. High temperature release to waterways	17.							
18. Harm to motorist or pedestrian off-site	18.							
19. Contamination of brewery product	19.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 3. Primary treatment, including brewery waste water collection

Type: Equipment ID:

Design Conditions/Parameters: 3500 kL/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1.							
2. Toxic release to air	2. Toxic atmosphere in pits and tanks	1. Lost time injury or fatality of employees	1. Existing Tooheys confined space procedures	5	1	Medium	29. Confined space assessment for all new and existing equipment in WWTP	Tooheys/Designer
							30. Appropriate signage for all confined spaces	Tooheys/Designer
3. Toxic release to waterways	3. Overflow of tanks	1. Toxicity impacts to Haslams Creek	1. High level alarms on tanks	3	1	Low	11. Review requirements for site bunding with EPA	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 3. Primary treatment, including brewery waste water collection

Type: Equipment ID:

Design Conditions/Parameters: 3500 kL/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
		2. EPA fine/prosecution (regulatory)	2. Stormwater retention pit/first flush system	3	1	Low	12. Review Spill Containment Action Plan	Tooheys
4. Toxic release to waterways	4. Leak from tank or pipe	1. Toxicity impacts to Haslams Creek	1. Stormwater retention pit/first flush system	3	1	Low	11. Review requirements for site bunding with EPA	Designer
		2. EPA fine/prosecution (regulatory)		3	1	Low	12. Review Spill Containment Action Plan	Tooheys
5. Toxic release to soil	5. Leak from tank or pipe	1. EPA fine/prosecution (regulatory)	1. Hardstand areas	3	1	Low	12. Review Spill Containment Action Plan	Tooheys
6. Waste water/sludge release	6. As per "Toxic release to waterways"							
7. Solid waste release/spill off-site	7.							
8. Odour beyond site boundary	8. See "Foul air extraction and odour control systems"							
9. Noise beyond site boundary	9. Noise from primary treatment pumps, screen, mixer ect	1. EPA fine/prosecution (regulatory)	1. Noise assessment	3	1	Low	6. Noise assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)		3	1	Low		
10. Contamination of town water supply	10.							
11. Flammable/toxic gasses in storm drains	11.							
12. High temperature release to waterways	12.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 3. Primary treatment, including brewery waste water collection

Type: Equipment ID:

Design Conditions/Parameters: 3500 kL/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
13. Harm to motorist or pedestrian off-site	13.							
14. Contamination of brewery product	14. Leak from pipe in vicinity of food grade materials or equipment	1. Product contamination (product recall, not public health issue)	1. Avoidance of known process inputs	4	1	Low	13. Waste water pipeline route to avoid running over food grade equipment and materials, or apply spill containment measures	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 4. Secondary treatment, including disposal to sewer

Type: Equipment ID:

Design Conditions/Parameters: 3500 kL/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1.							
2. Toxic release to air	2. See "Primary treatment, including brewery waste water collection"							
3. Toxic release to waterways	3. See "Primary treatment, including brewery waste water collection"							
4. Toxic release to soil	4. See "Primary treatment, including brewery waste water collection"							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 4. Secondary treatment, including disposal to sewer

Type: Equipment ID:

Design Conditions/Parameters: 3500 kL/day Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
5. Waste water/sludge release	5. See "Primary treatment, including brewery waste water collection"							
6. Solid waste release/spill off-site	6.							
7. Odour beyond site boundary	7. See "Primary treatment, including brewery waste water collection"							
8. Noise beyond site boundary	8. See "Primary treatment, including brewery waste water collection"							
9. Contamination of town water supply	9.							
10. Flammable/toxic gasses in storm drains	10.							
11. High temperature release to waterways	11.							
12. Harm to motorist or pedestrian off-site	12.							
13. Contamination of brewery product	13. See "Primary treatment, including brewery waste water collection"							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 5. Chemical dosing systems and chemical delivery facilities

Type: Equipment ID:

Design Conditions/Parameters: Citric acid, caustic soda (sodium hydroxide), urea, ferric chloride, polymer Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1.							
2. Toxic release to air	2. Release during handling of powdered chemicals	1. EPA fine/prosecution (regulatory)	1. Design of chemical handling and storage systems	3	1	Low	22. Investigate delivery of liquid chemicals to avoid powder handling issues	Designer
		2. Contamination of water/soil		3	1	Low		
3. Toxic release to waterways	3. Leak from tank or pipe	1. EPA fine/prosecution (regulatory)	1. Bunding for chemical storage tanks	3	1	Low	20. Bunding to be designed in accordance with OEH guidelines	Designer
		2. Lost time injury to employees	2. Hardstand areas	3	2	Medium	23. Chemical systems in accordance with Australian Standards for hazardous chemical storage and handling	Designer
		3. Contamination of water/soil	3. Stormwater retention pit/first flush system	3	1	Low		
			4. PPE					
4. Toxic release to waterways	4. Spill during chemical delivery	1. EPA fine/prosecution (regulatory)	1. Bunded area for chemical delivery trucks	3	1	Low		
		2. Lost time injury to employees		3	1	Low		
		3. Contamination of water/soil		3	1	Low		
5. Toxic release to soil	5. As per "Toxic release to waterways"							
6. Waste water/sludge release	6.							
7. Spill off site	7. Traffic/Transport incident off-site	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys will choose competent contractor and communicate risk to contractor	3	1	Low		
		2. Contamination of water/soil		3	1	Low		
		3. Risk to public health		3	1	Low		
8. Odour beyond site boundary	8.							
9. Noise beyond site boundary	9. Noise from powder handling equipment and delivery vehicles	1. EPA fine/prosecution (regulatory)	1. Chemical deliveries schedules for day time only	1	1	Low	6. Noise assessment to provide recommendations	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 5. Chemical dosing systems and chemical delivery facilities

Type: Equipment ID:

Design Conditions/Parameters: Citric acid, caustic soda (sodium hydroxide), urea, ferric chloride, polymer Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
		2. Neighbour complaints (community relations)	2. Noise assessment	1	1	Low		
10. Contamination of town water supply	10. Backflow from chemical systems	1. Contamination of town water supply	1. Backflow protection at site town water connection	4	1	Low	31. Consider backflow protection for individual chemical system water connections	Designer
		2. Contamination of on-site potable water system		4	3	High		
11. Flammable/toxic gasses in storm drains	11.							
12. High temperature release to waterways	12.							
13. Harm to motorist or pedestrian off-site	13. Traffic/Transport incident off-site	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys will choose competent contractor and communicate risk to contractor	3	1	Low		
		2. Risk to public health		3	1	Low		
14. Contamination of brewery product	14. Leak from pipe in vicinity of food grade materials or equipment	1. Product contamination (product recall, not public health issue)		4	1	Low	24. Chemical pipeline routes to avoid running over food grade equipment and materials, or apply spill containment measures	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 6. Foul air extraction and odour control systems

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1. Ignition during replacement of activated carbon (combustible dust)	1. Dust explosion	1. Tooheys will choose competent contractor and communicate risk to contractor	4	1	Low		
2. Fire/explosion/projectiles	2. Ignition of high concentration of biogas in aeration blower system from HRAT	1. Fire (low intensity, no explosion) within site boundary		4	3	High	15. Review PFD; consider removing cross connection from HRAT head space to the aeration blower system (note; this may be a drafting mistake)	Designer
3. Toxic release to air	3.							
4. Toxic release to waterways	4.							
5. Toxic release to soil	5.							
6. Waste water/sludge release	6.							
7. Solid waste release/spill off-site	7.							
8. Odour beyond site boundary	8. Raw foul air released from exhausted carbon filters	1. EPA fine/prosecution (regulatory)	1. Preventative maintenance and monitoring	3	2	Medium	16. Provide duty/standby odour control filters of adequate capacity to allow carbon regeneration	Designer
		2. Neighbour complaints (community relations)		3	2	Medium		
9. Odour beyond site boundary	9. Power blackout on foul air blowers	1. EPA fine/prosecution (regulatory)	1.	3	3	Medium	17. Investigate back-up power supply for foul air system(cogen and/or dedicated diesel generator etc)	Designer
		2. Neighbour complaints (community relations)		3	3	Medium		
10. Odour beyond site boundary	10. Mechanical failure of blowers or ducting etc	1. EPA fine/prosecution (regulatory)	1. Preventative maintenance and	3	3	Medium	5. Odour assessment to provide	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 6. Foul air extraction and odour control systems

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
		2. Neighbour complaints (community relations)	monitoring via SCADA	3	3	Medium	recommendations	
11. Odour beyond site boundary	11. Human intervention (maintenance or covers removed)	1. EPA fine/prosecution (regulatory)	1. SOPs, SWMS	3	3	Medium	5. Odour assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)		3	3	Medium		
12. Noise beyond site boundary	12. Noise from foul air blowers	1. EPA fine/prosecution (regulatory)	1. Noise assessment	3	2	Medium	18. Investigate acoustic enclosures for foul air blowers	Designer
		2. Neighbour complaints (community relations)		3	2	Medium	6. Noise assessment to provide recommendations	Designer
13. Contamination of town water supply	13.							
14. Flammable/toxic gasses in storm drains	14.							
15. High temperature release to waterways	15.							
16. Harm to motorist or pedestrian off-site	16.							
17. Contamination of brewery product	17.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 7. Solid waste removal facilities, including sludge tanker loading

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Fire/explosion/projectiles	1. Ignition of biogas in vapour space of tanker truck due to static discharge or other	1. Fire or explosion at tanker loading	1. Non sparking style pumps 2. Tooheys will choose competent contractor and communicate risk to contractor 3. Hazardous areas classification and suitably rated equipment 4. SWMS, risk assessment	5	1	Medium	19. Review existing system at XXXX plant	Tooheys/Designer
2. Toxic release to air	2.							
3. Toxic release to waterways	3. Malicious acts/vandalism	1. EPA fine/prosecution (regulatory)	1. Hardstand areas	3	1	Low		
		2. Toxicity impacts to Haslams Creek	2. Stormwater retention pit/first flush system 3. Security/CCTV	3	1	Low		
4. Toxic release to waterways	4. Leak from tank or pipe	1. EPA fine/prosecution (regulatory)	1. Hardstand	3	1	Low		
		2. Toxicity impacts to Haslams Creek	2. Stormwater retention pit/first flush system	3	1	Low		
5. Toxic release to waterways	5. Traffic/Transport incident on-site	1. EPA fine/prosecution (regulatory)	1. Segregation of traffic, one way traffic systems	3	1	Low	20. Bunding to be designed in accordance with OEH guidelines	Designer
		2. Toxicity impacts to Haslams Creek	2. Stormwater retention pit/first flush system	3	1	Low		
6. Toxic release to soil	6. Leak from tank or pipe	1. EPA/RTA fine/prosecution (regulatory)	1. Hardstand areas	1	1	Low		
7. Waste water/sludge release	7. As per "Toxic release to waterways"							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 7. Solid waste removal facilities, including sludge tanker loading

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
8. Solid waste release/spill off-site	8. Traffic/Transport incident off-site	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys follows waste transport requirements of the POEO Act 2. Tooheys will choose competent contractor and communicate risk to contractor 3. SWMS, risk assessment	1	1	Low		
9. Solid waste release/spill off-site	9. Overfilling of skip bins or transport tanks, inadequate covering of loads	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys follows waste transport requirements of the POEO Act 2. Tooheys will choose competent contractor and communicate risk to contractor 3. SWMS, risk assessment	2	2	Low		
10. Odour beyond site boundary	10. Odour from spill or leak during transport and handling	1. EPA fine/prosecution (regulatory)	1. Odour control on screening bin and waste sludge bin	1	1	Low		
		2. Neighbour complaints (community relations)	2. Fit for purpose bins	1	1	Low		
11. Noise beyond site boundary	11. Vehicle movements and bin loading/unloading	1. Neighbour complaints (community relations)	1. Waste removal scheduled during day time	1	1	Low	6. Noise assessment to provide recommendations	Designer

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 7. Solid waste removal facilities, including sludge tanker loading

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
			2. Noise assessment					
12. Contamination of town water supply	12.							
13. Flammable/toxic gasses in storm drains	13.							
14. High temperature release to waterways	14.							
15. Harm to motorist or pedestrian off-site	15. Traffic/Transport incident off-site	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys follows waste transport requirements of the POEO Act 2. Tooheys will choose competent contractor and communicate risk to contractor	1	1	Low		
16. Harm to motorist or pedestrian off-site	16. Overfilling of skip bins or transport tanks, inadequate covering of loads	1. EPA/RTA fine/prosecution (regulatory)	1. Tooheys follows waste transport requirements of the POEO Act 2. Tooheys will choose competent contractor and communicate risk to contractor	1	1	Low		
17. Contamination of brewery product	17.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 8. Cooling water systems and cooling tower

Type: Equipment ID:

Design Conditions/Parameters: Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
1. Fire/explosion/projectiles	1.							
2. Toxic release to air	2. Lack of maintenance and poor management of cooling tower leading to contaminated water	1. Legionella case recorded from public or employee	1. Waste water cooling is a closed loop system	5	1	Medium	21. Ensure new cooling tower/s are included into existing legionella prevention program	Tooheys
		2. EPA fine/prosecution (regulatory)	2. Tooheys have a legionella prevention program, which is audited by Auburn Council	3	1	Low		
			3. Tooheys follow an approved code of practice for cooling tower operation and maintenance					
3. Toxic release to waterways	3. Cooling tower overflow, maintenance incident	1. Biocide/saline water release to waterways	1. Tooheys follow an approved code of practice for cooling tower operation and maintenance	3	1	Low		
		2. EPA fine/prosecution (regulatory)	2. Stormwater retention pit/first flush system	3	1	Low		
4. Toxic release to soil	4.							
5. Waste water/sludge release	5.							

System: 1. Waste Water Treatment Plant (WWTP)

Subsystem: 8. Cooling water systems and cooling tower

Type:

Equipment ID:

Design Conditions/Parameters:

Drawings:

Facility / Event	Cause/comment	Consequences	Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
6. Solid waste release/spill off-site	6.							
7. Odour beyond site boundary	7.							
8. Noise beyond site boundary	8. Fans on cooling tower	1. EPA fine/prosecution (regulatory)	1. Noise assessment	1	1	Low	6. Noise assessment to provide recommendations	Designer
		2. Neighbour complaints (community relations)	2. VSD controls on fans	1	1	Low		
9. Contamination of town water supply	9. Backflow from cooling tower makeup into town water supply	1. Contamination of town water supply	1. Backflow protection at site town water connection	1	1	Low	14. Consider backflow protection for cooling tower makeup water connection	Designer
10. Flammable/toxic gasses in storm drains	10.							
11. High temperature release to waterways	11.							
12. Harm to motorist or pedestrian off-site	12.							
13. Contamination of brewery product	13.							

Appendix E

Glossary and Abbreviations

Term/Abbreviation	Meaning
AD:	Anaerobic Digestion
ADG Code:	National Transport Commission - Dangerous Goods Code
ALARP:	As Low As Reasonably Practicable
CIP:	Clean in place
DoP:	NSW Department of Planning
EA:	Environmental Assessment
EP&A Act:	Environmental Planning and Assessment Act 1979
FHA:	Final Hazard Analysis
HAZID:	Hazard Identification Study
HAZOP:	Hazard and Operability Study
HRAT:	High Rate Anaerobic Reactor
LEL:	Lower Explosive Limit
OEH:	Office of Environment & Heritage
PG:	Packaging Group
PHA:	Preliminary Hazard Analysis
POEO Act:	The Protection of the Environment Operations Act 1997
SEPP 33:	State Environment Planning Policy No.33 – Hazardous and Offensive Development
SWC:	Sydney Water Corporation
SWMS:	Safe Work Method Statement
UEL:	Upper Explosive Limit
WWTP:	Waste Water Treatment Plant

Appendix F

References

Reference 001 - NSW DoP - HIPAP 1: Emergency Response Planning, 2008
Reference 002 - NSW DoP - HIPAP 2: Fire Safety Study, 2008
Reference 003 - NSW DoP - HIPAP 3: Risk Assessment, 2008
Reference 004 - NSW DoP - HIPAP 4: Risk Criteria for Land Use Safety Planning, 2008
Reference 005 - NSW DoP - HIPAP 5: Hazard Audit, 2008
Reference 006 - NSW DoP - HIPAP 6: Final Hazard Analysis, 2011
Reference 007 - NSW DoP - HIPAP 7: Construction Safety Study, 2008
Reference 008 - NSW DoP - HIPAP 8: HAZOP Study, 2008
Reference 009 - NSW DoP - HIPAP 9: Safety Management System Assessment, 2011
Reference 010 - NSW DoP – Applying SEPP 33, 2008
Reference 011 - AS 3814 Industrial & Commercial Gas Fired Appliances, 2009
Reference 012 - AS 4041 Pressure Piping, 2006
Reference 013 - AS 4343 Pressure Equipment - Hazard Levels, 2005
Reference 014 - AS 60079 Series - Electrical Apparatus for Explosive Gas Atmospheres Set, 2008
Reference 015 - CAN/CGA-Bl05-M93 Code for Digester Gas and Landfill Gas Installations, 2007
Reference 016 - U. S. Department of Energy - Biogas Utilization Handbook, 1988
Reference 017 - www.engineeringtoolbox.com
Reference 018 - National Transport Commission’s Dangerous Goods Code, 2007

Appendix H

Technical assessment - Odour

Contents

H1 Introduction

Tooheys propose to install a new wastewater treatment plant (WWTP) and cooling tower at its brewery in Lidcombe to improve the quality of the wastewater discharged from site.

The proposed process is divided into two stages:

- Stage 1 – Primary treatment (Anaerobic)
- Stage 2 – Secondary treatment (Aerobic)

Within Stage 2 there are two potential treatment methods:

- Membrane Bioreactor (MBR); or
- Dissolved Air Flotation (DAF).

The decision to adopt MBR or DAF technology will depend upon the outcomes of the final feasibility stage. Both options have been considered within this odour assessment.

For either option, the plant is to be designed for average flow rates of 2,400 kL/day and peak flow rate of 3,240 kL/day.

The project requires assessment as a modification to the existing Part 3A approval for the site under Section 75W of the EP&A Act. As part of the Environmental Assessment process, a Level 1 Odour Assessment[1] has been undertaken to determine the potential impacts of the proposal on odour.

A Level 1 odour assessment is a screening-level technique based on generic parameters for the type of activity and the site. It may be used to assess site suitability and odour mitigation measures for new or modified activities.

In addition to the requirements of a Level 1 odour assessment, some dispersion modelling for each of the DAF and MBR option for odour has been undertaken.

[1] DECC Technical Framework - Assessment and Management of Odour from Stationary Sources in NSW 2006

H2 Background Information

H2.1 Site Description

The brewery is located at 29 Nyrang Street in Lidcombe. The site is bound on three sides by industrial premises and across Nyrang Street to the east by residential receivers. The brewery has been in operation since 1955 and has undergone several upgrades during this time.

The proposed location of the WWTP is in the western corner of the site adjacent to Haslams Creek to the north west and industrial neighbours to the south west, and in the order of 275 m from the nearest potentially affected residential receiver in Nyrang Street. Significant shielding is afforded to the majority of residences in Nyrang Street by the significant intervening warehouse buildings on both the Tooheys and neighbouring industrial site.

Figure 1 presents an aerial view of the site in the context of its surroundings and the proposed location of the WWTP.

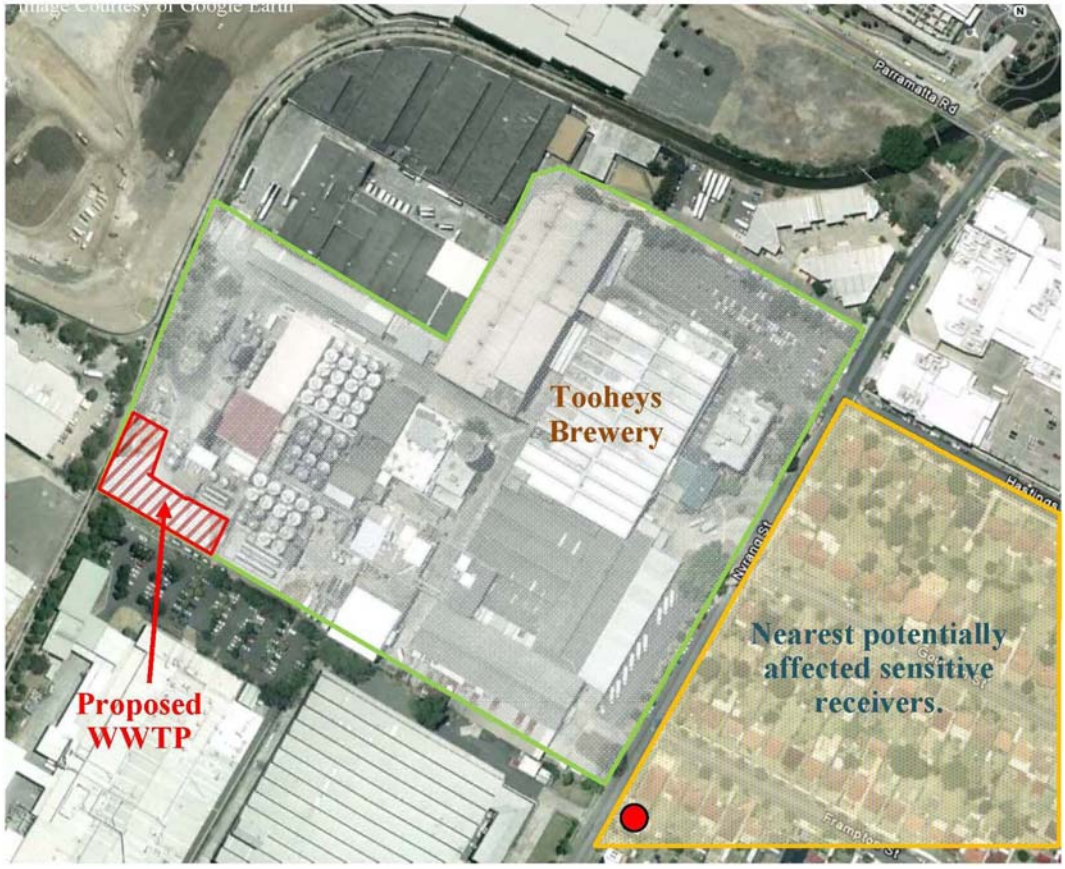

Figure 1 Aerial view of Proposed WWTP at Lidcombe Brewery

As shown on Figure 1, the closest residential receiver to the works is;

Location	Distance from WWTP	Odour Criteria2
Boundary of 24 Nyrang Street	Approximately 275m	2 OU H2S 1.38ug/m3

H2.2 Description of Proposed Works

H2.2.1 WWTP Process

The proposed treatment process comprises high rate reactor such as the External Circulation Sludge Bed (ECSB) treatment system followed by a DAF system (or an aerobic membrane bioreactor (MBR) system) designed for average flow rates of 2,400 kL/day and peak flow rate of 3,240 kL/day.

Tooheys propose to divert the biogas generated from the anaerobic digestion process to the existing boilers for energy generation. This biogas system consists of an anaerobic digester, condensate trap, gas storage buffer, waste gas flare, gas compressor and high pressure gas pipeline running to the existing gas fired boilers. The location of key components of the proposed WWTP with respect to odour are shown on Figure 2.

Figure 2 Proposed WWTP Location

[2] DECC Technical Framework Assessment and management of odour from stationary sources in NSW Nov 2006 Table 3.1

H2.3 Existing Condition - Odour

Generally, odours from breweries are associated with volatile organic compound released during the heating stages of the process prior to fermentation. Malodours during the post fermentation operations are mostly due to the release of ethanol and small quantities of other total volatile organic compounds (TVOCs), including ethyl acetate.

From a review of the Tooheys brewery process and facilities, sources of potential odour have been identified as:

- direct emissions from wort boiling;
- direct emissions from the maturation and fermentation vessels;
- brewery waste water;
- potential leaks from the ammonia cooling plant;
- ventilation of beer cellars and packaging lines;
- leaks and spills from valves and pipelines; and
- storage of spent grains.

The largest current potential source of odour from the existing brewery operations is the evaporation of volatile organic compounds derived from wort boiling. Wort boiling occurs in brew kettles, within the brewhouse, where the boil vapour is recompressed and reused before being condensed, cooled and disposed of as a liquid effluent.

The fermentation and maturation stages of the process produce volatile organic compounds including ethanol and ethyl acetate. However, the gases from the fermentation and maturation process are collected to recover carbon dioxide. During this process, the carbon dioxide is purified, so that it may be reused in further stages of the beer making process. In this process, the fermentation gas is passed through a gas scrubber, where it is cleaned by counterflow of water removing the water soluble impurities, and a gas purifier, removing further substances influencing odour and taste of the beer.

Existing waste water diverted to trade waste has the potential for odour emissions where brewery effluent and spills are transported off site via an on site drainage network. The onsite trade waste system is well contained within grated underground drainage channels.

In 2002, Tooheys implemented an odour reduction programme as part of the Environmental Protection Licence. Odour emissions since this time have likely decreased. One odour complaint has been received in this time during 2009.

It is therefore considered that background odour concentrations are likely to be low.

H2.4 Prevailing wind conditions

The prevailing wind directions for the site have been inferred from Bureau of Meteorology yearly data for the nearest applicable weather station at Sydney Olympic Park, see Figures 2 and 3.

The prevailing wind conditions assumed for the site from Sydney Olympic Park data in Figure 3 (9am yearly averages) and Figure 4 (3pm yearly averages) indicate that wind frequency and direction from the west during the morning and form the east during the afternoon are the most dominant.

A north westerly to westerly wind direction would yield the greatest potential for odour impact to residences in Nyrang Street.

The wind directions in the afternoon in the area would be beneficial in reducing odour impacts (east to south easterly winds), but wind direction in the morning from the west are the least desired.

Where possible odour generating events such as tank cleaning should be undertaken under favourable atmospheric conditions (such as in the afternoon with an easterly breeze).

Wind direction is however assessed to be of small importance in the management and assessment of odour impacts, as there is no clearly dominant wind direction for the area.

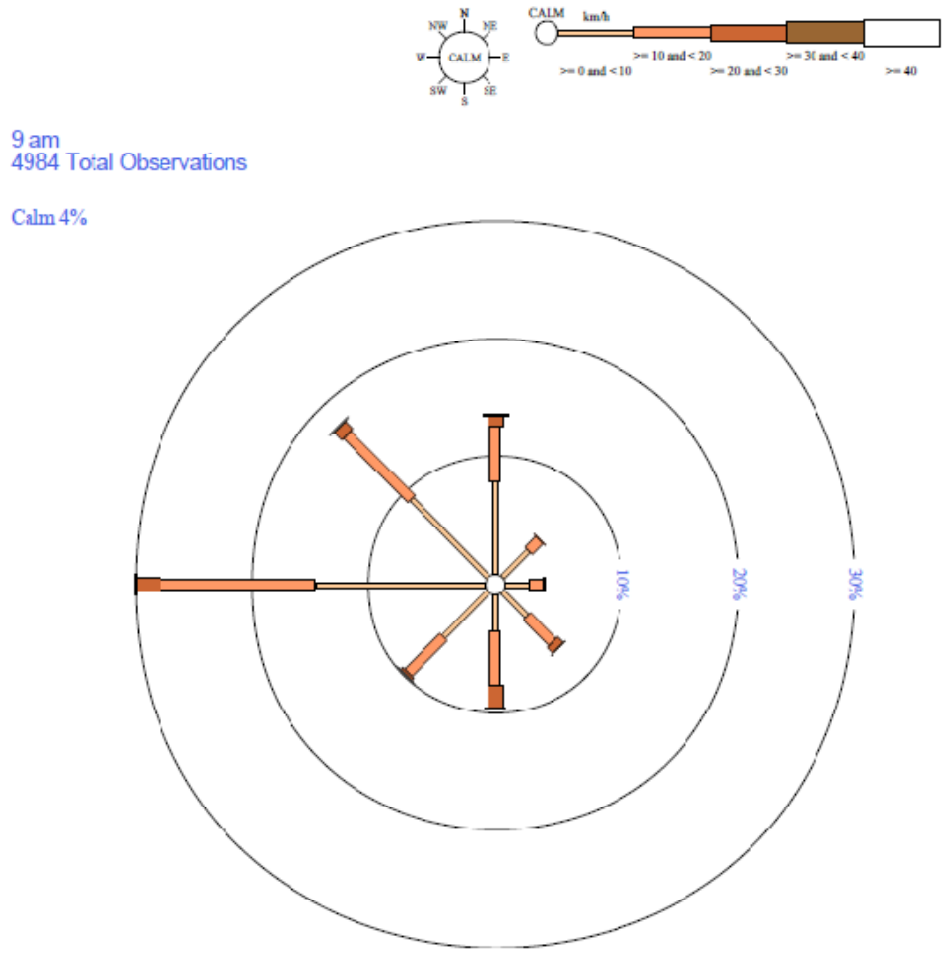

Figure 3 Prevailing wind conditions 9am Sydney Olympic Park

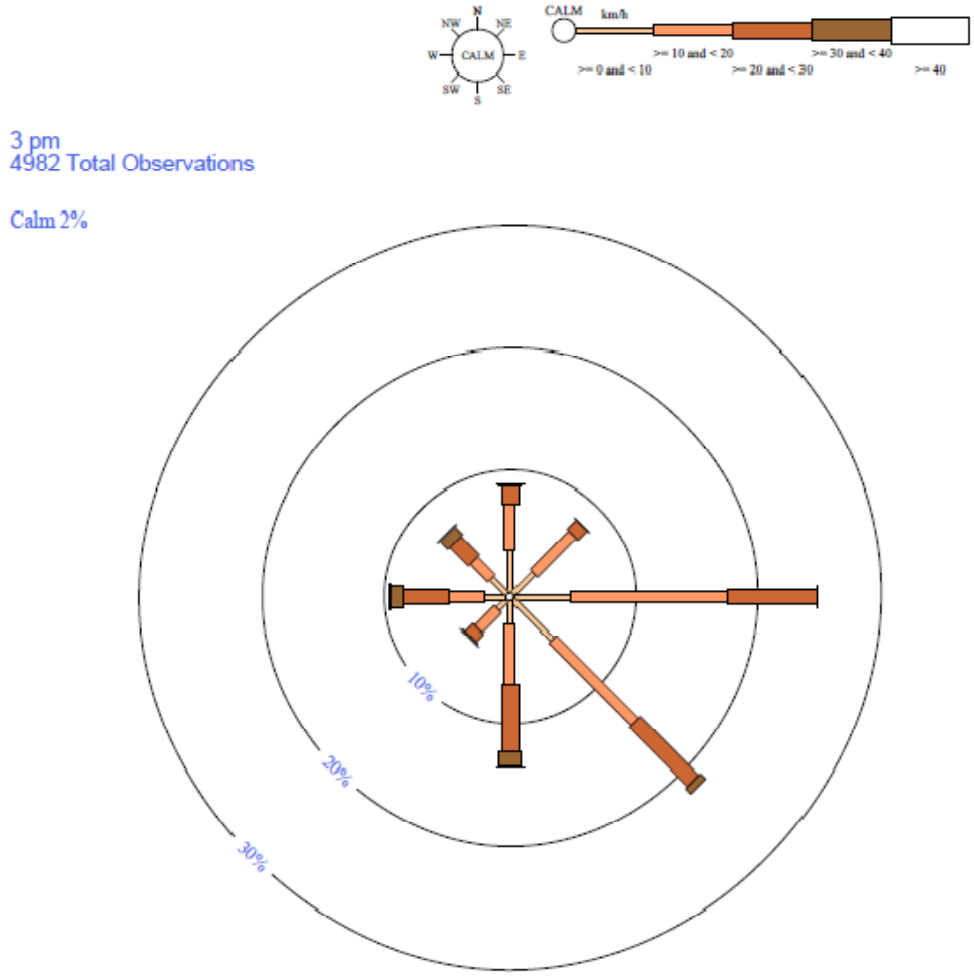

Figure 4 Prevailing wind conditions 3pm Sydney Olympic Park

H2.5 Topography of Built Form

The local topography of the area is flat to gently undulating, with the facility to be constructed at the rear of the Tooheys site.

This terrain factor of low relief is not considered to be beneficial in reducing odour impact to nearby receivers by the DECCW guidelines (discussed below).

Build form of the site can also have impact on odour pathways and level of impact. The built form of the existing site is significant and will create some barriers to any odour dispersion with multiple multi storey structures up to ten metres in height between the proposed WWTP and the site boundary on Nyrang Street some 270 metres away.

H3 Statutory Requirements

H3.1 NSW Legislation

Protection of the Environment Operation Act 1997 (POEO Act) and Regulations

The POEO Act allows for licensed activities to be required to meet conditions designed to prevent or minimise odour. The legislation includes the concept of 'offensive odour' and it is an offence for scheduled activities to emit 'offensive odour'. Tooheys has an existing licence on its site that is to be updated in regards to the proposed WWTP. This Odour Impact Assessment finds that 'offensive odour' as defined by the Act is not likely.

Offensive odour is defined under the POEO Act as;

"*an odour:*

a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:

i) harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations."

In addition, it is an offence for any person to undertake an activity in such a manner as to cause air pollution, which includes odour.

H3.2 Guidelines

OEH Technical Framework - Assessment and Management of Odour from Stationary Sources in NSW

The NSW DECC *Technical Framework - Assessment and Management of Odour from Stationary Sources in NSW 2006* provides a policy framework for assessing and managing activities that emit odour and offers guidance on dealing with odour issues to industry, consent authorities, planners, environmental regulators and odour specialists.

The technical framework for odour assessment, and the technical notes associated with the framework have been used to complete this preliminary odour assessment.

The odour criteria applicable to the development are found in the DECCW technical framework.

Table 1 Impact assessment criteria for complex mixtures of odorous air pollutants

Population of affected community	Odour assessment criteria (OU)
Rural single residence (≤ 2)	7.0
~ 10	6.0
~ 30	5.0
~ 125	4.0
~ 500	3.0
Urban area (≥ 2000) and/or schools and hospitals	2.0

The 2 OU criterion applies for the Tooheys site.

Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

The OEH also specifies criteria for a range of individual odorous pollutants within its Approved Methods for Modelling and Assessment of Air Pollutants in NSW. These are presented in the tables below, including population dependent criteria for hydrogen sulfide.

Table 2 Impact assessment criteria for individual odorous air pollutants

Substance	Impact Assessment Criteria	
	mg/m3	ppm
Acetaldehyde	0.042	0.023
Acetic acid	0.27	0.11
n-butanol	0.5	0.16
n-butyl acetate	1.02	0.21
Butyl acrylate	0.1	0.019
Butyl mercaptan	0.007	0.002
Carbon disulfide	0.07	0.023
Chlorobenzene	0.1	0.023
Cumene (isopropyl benzene)	0.021	0.004
Cyclohexanone	0.26	0.07
Diacetone alcohol	0.7	0.15
Diethylamine	0.03	0.01
Dimethylamine	0.009	0.0052
Diphenyl ether	0.08	0.01
Ethanol	2.1	1.1
Ethyl acetate	12.1	3.5
Ethyl acrylate	0.0004	0.0001
Methanol	3	2.4
Methylamine	0.0027	0.0023
Methyl ethyl ketone	3.2	1.1

Methyl isobutyl ketone	0.23	0.05
Methyl mercaptan	0.00046	0.00023
Methyl methacrylate	0.12	0.027
Methyl styrene	0.14	0.028563
Nitrobenzene	0.0026	0.00052
Perchlorethylene	3.5	0.52
Phenol	0.02	0.0052
Phosphine	0.0031	0.0023
n-propanol	0.041	0.016
Pyridine	0.007	0.0023
Styrene (monomer)	0.12	0.027
Toluene	0.36	0.09
Triethylamine	0.2	0.05
Xylenes	0.19	0.04

Table 3 Hydrogen sulfide impact assessment criteria

Population of affected community	**Impact assessment criteria (µg/m3)**
Single residence (≤ 2)	4.83
~ 10	4.14
~ 30	2.45
~ 125	4.0
~ 500	3.0
Urban area (≥ 2000) and/or schools and hospitals	2.0

A range of odorous volatile organic compounds are likely to be relevant for the existing brewery including and alcohols. The proposed waste water treatment plant, will impact the odour profile of the site including generation of new odorous compounds potentially including hydrogen sulphide.

H4 Methodology

A Level 1 Odour Assessment is a screening-level technique based on generic parameters for the type of activity and the site. It may be used to assess site suitability and odour mitigation measures for new or modified activities but excludes detailed dispersion modelling or monitoring of odour emissions. This level of assessment has been chosen as a first approach to identify whether the site is suitable or further assessment of odour impact is necessary.

If the potential increase in odour emissions from the site is expected to be significant, then a Level 2 or Level 3 odour assessment will be required under the DECCW technical framework (including odour sampling and modelling of air quality and odour dispersion).

For new developments, estimates of odour emission rates should be based on actual odour measurements on samples taken from similar facilities, either full-scale facilities operating elsewhere, or experimental or demonstration-scale facilities. Where this is not possible, published emission factors and/or data supplied by manufacturers of process and control equipment should be used.

The *Emission estimation technique manual for Sewage and Wastewater Treatment Version 2.0* August 2008 (National Pollutants Inventory) and experience from similar waste water treatment plants has been used to estimate the types and quantities of emissions that are to expected from a waste water treatment plant of the size specified by Tooheys. The potential emissions are best described as point and area sources with wind speed and ambient temperature influencing dispersion.

The majority of the plants processes are to be kept enclosed, biogas is to be combusted and carbon filters will be in use for air outlets, hence the generation of odour is not expected to be significant.

However fugitive emissions (sulphur compounds and VOCs) from waste water tanks exposed to ambient air are known to be potential sources of odour and these have been investigated.

H5 Odour Emission Sources

The existing wastewater storage and treatment occur in the western corner of the site. The proposed WWTP will also be in the western corner of the site and will be no closer to the nearest sensitive residential receiver in Nyrang Street than the existing condition.

The onsite wastewater treatment process will potentially result in an increased holding time of wastewater on site instead of immediate discharge to trade waste.

This will potentially increase the duration of brewery related odour emissions. These emissions will occur during the stages prior to anaerobic digestion and are considered relatively insignificant given that the same quantity of wastewater is already treated on site and that the odour characteristics will be generally the same as the existing site.

However, the proposed WWTP has the potential to generate new sources of odour compared to the existing condition due to the introduction anaerobic digestion processes with the potential for release of hydrogen sulfide compounds downstream of the anaerobic digestion stage.

Activated carbon filters have been proposed as odour control technology.

H5.1 Potential Odour Sources

The potential new odour sources from the proposed WWTP include fugitive emissions from:

- Buffer tank;
- Pre-acidification tank;
- Heat exchanger;
- Mix tank;
- High rate anaerobic reactor;
- Anaerobic sludge storage tank;
- Aerobic treatment (membrane bioreactor of dissolved air flotation);
- Sludge dewatering;
- Aerobic polishing process using activated carbon filters;
- Biogas capture and reuse;
- Waste sludge transport.

Stack source emissions from

- Carbon filter outlet points.

Carbon filters will be applied to processes upstream of the anaerobic reactor including the buffer tank and pre-acidification tank as well as to the downstream sludge transport system.

Chemicals used on site are not included as potential odour sources as they are to be subject to strict handling and storage requirements.

Potential emissions from the WWTP upstream of the buffer tank have not been modelled, as any emissions from waste water prior to treatment are assumed to be common to both the existing condition and the proposed WWTP.

H6 Odour Impact Assessment

H6.1 Ground Level Concentration

Although the total emissions are likely to be minor as a result of the WWTP, there is expected to be some change to the existing odour level. The ground level concentrations in odour units (OU) at nearby sensitive receptors are therefore likely to change as a result of the upgrade. These impacts have been investigated by the use of dispersion modelling techniques.

H6.1.1 Modelling Methodology

For the purpose of the odour dispersion model, reliable data on hydrogen sulfide (H_2S) emission was not available, as H_2S emission is specific to wastewater type and is not yet known. For conservatism, we have modelled odour emissions based on factors from other facilities, and not H_2S. This odour modelling is at a screening level and odour monitoring will still be required during operation.

Odour in Odour Units (OU) has been modelling using AUSPLUME, to assess the proposal based on odour criteria as shown in Table 4.

Table 4 Odour Criteria

Sensitive receiver location	Distance from WWTP	Odour criteria (*DECC*)
Boundary of 24 Nyrang Street	Approximately 275m	2 OU

The results of preliminary odour monitoring undertaken at the Lion Nathan XXXX Castlemaine brewery WWTP have been obtained and provide odour emissions of each WWTP component. The Castlemaine facility adopts both DAF and membrane technology prior to reverse osmosis. The odour assessment undertaken for this site did not include dispersion modelling as due to the design which ensured that:

- Critical odour areas are covered and under negative pressure;
- Malodorous air is either directed to boilers for destruction of treated in one of two carbon filters which reduce odorous emissions in the order of 99.9%.

Instead, an odour monitoring plan has been implemented to monitor odour emissions at source.

Fugitive odour emission rates for the Tooheys WWTP are expected to be comparable to Castlemaine due to similar design and capacity. However, the buffer distance of the Tooheys plant from sensitive receivers (275m) is much greater than the approximate 100m distance from residential areas at Castlemaine[3] and indicates that odour impact at Tooheys can be appropriately minimised.

[3] PAE Holmes Air Quality Assessment XXXX Brewery Proposed Gas Fired Boiler and Waste Gas Flare Castlemaine Perkins 12 March 2008

Notwithstanding, in order to provide extra certainty in this impact assessment, some quantitative odour modelling for the site has been undertaken and this is discussed in Section 6.3.

Dispersion modelling has been undertaken for odour measured in odour units (OU) in accordance with the requirements for dispersion modelling in NSW.[4] Dispersion modelling has been undertaken using the AUSPLUME v 6.0 dispersion model for the DAF option and the MBR option.

AUSPLUME Version 6.0 is a Gaussian plume dispersion model derived from the Victorian Environment Protection Authority's "Plume Calculation Procedure"(EPAV: 1985), an extension of the ISC model of Bowers et al. (1979).

The predicted ground level concentrations for OU were modelled as a standalone impact without an additional background odour level that may currently exist. The results of the modelling are therefore additional to whatever odour impact is currently existent in the area, however this background level is expected to be well beneath the odour criteria for sensitive receivers in this location of 2 OU.

H6.1.2 Input Data

Sources of odour from the proposed WWTP have been described for each of the Options (DAF Option and MBR Option). Sources for each option have been classified as either stack sources (emissions occurring from carbon filter outlet points) or as area sources (fugitive emissions from tanks).

The following data were required for input into the AUSPLUME model:

- emission rates in odour units;
- stack properties (stack diameter, height exit velocity and temperature);
- meteorological data file;
- surface roughness;
- 3km by 3km receptor grid at 30m intervals; and
- averaging period for OU (1 hour).

H6.1.3 Emission Rates

Emissions from the components of the WWTP have been classified where possible as either area source or stack for the purposes of modelling in AUSPLUME.

Emission rates have been estimated based on information from Castlemaine WWTP odour monitoring results[5], Franz-Bernd Frenchen[6] and typical municipal waste water treatment odour emission rates. In general the emission rates found for the numerous components are not specific to brewery WWTPs and are a best approximation made with data from municipal WWTPs.

[4] Approved methods for the Modelling and Assessment of Air Pollutants in New South Wales DECC (NSW) 2005
[5] New EQ, Odour monitoring conducted for Castlemaine Perkins at the XXXX facility in Milton QLd 13 Jan 2010
[6] Odours in wastewater treatment: measurement, modelling and control, by Richard Stuetz, Franz-Bernd Frechen, chapter 10, pp210

For this reason the emission rates used are assumed to be conservative due to the generally greater waste water load managed by municipal WWTPs.

Values for the physical dimensions and exit conditions have been obtained from Tooheys documentation regarding the WWTP components and Castlemaine WWTP odour monitoring results (in particular air filter temperatures, exit velocity and diameter).[7]

Emission rates were calculated based on the WWTP supplying the facility at peak load and with fugitive emissions reduced by 95% compared to open tank rates.

Emission rates for area sources have been estimated for all new WWTP components in Table 5 and Table 6. Details of emission rates from stack sources from the WWTP are given in Table 7 and Table 8. This grouping of sources has been chosen due to the different carbon scrubbing and odour outlet points for the upstream and downstream processes.

Existing spill diversion and buffer tanks exist on site at the northern end of the site but are not modelled as they will not be an additional odour source over the existing condition.

Area sources

The area sources adopted in the Ausplume model are for DAF are presented in Table 5.

Table 5 DAF Option Fugitive Emission Rates (Area Sources)

Area Source	Height	Area	Assumed Odour Emission Rate
	m	m	OU/m^2/sec
Buffer tank	10.0	113.04	0.0165
Preacidification Tank	24.0	28.26	0.3
Mix Tank	4.0	12.56	0.3
Attached growth aerobic reactor	28.0	4.91	0.075
DAF	3.5	38.50	1.50
DAF filtrate tank	3.0	9.00	0.30
Aerobic WAS tank	28.0	9.00	0.6
Centrifuge	3.0	6.00	5
WAS sludge bin	1.0	18.00	0.6
WAS centrate pit	3.0	9.00	0.30

The area sources adopted in the Ausplume model are for DAF are presented in Table 6.

[7] New EQ, Odour monitoring conducted for Castlemaine Perkins at the XXXX facility in Milton QLd 13 Jan 2010

Table 6 MBR Option Fugitive Emission Rates (Area Sources)

Area Source	Height	Diameter	Assumed Odour Emission Rate
	m	m	OU/m^2/sec
Buffer tank	10.0	113.04	0.02
Pre-Acidification Tank	12.0	63.59	0.30
Mix Tank	4.0	12.56	0.30
Pre- Aeration Tank	5.5	200.96	0.08
Membrane Tank x2	4.5	113.30	1.50
Dewatering press	1.0	12.00	0.60
WAS sludge bin	1.0	18.00	0.60
WAS centrate sump	3.0	9.00	0.30

Stack Sources

The stack sources adopted in the Ausplume model corresponding to the two carbon filter outlets are shown in Table 7 and Table 8 below. The odour emission rates are derived assuming municipal WWTP values from each tank directed to a carbon filter which is able to achieve 95.25% odour reduction.

Table 7 DAF Option Carbon Filter Emission Rates (Stack Sources)

Stack source	Components	Height	Area	Exit Velocity	Exit Temperature	Assumed Odour Emission Rate
		m	m	m/s	ºC	OU/m^2/sec
Carbon Filter 1	Buffer tank, preacidification tank, mix tank	10	0.06	4.6	40	9.83
Carbon Filter 2	Aerobic reactor, sludge collection system	10	0.06	4.6	40	39.11

Table 8 Membrane Option Carbon Filter Emission Rates (Stack Sources)

Stack source	Components	Height	Area	Exit Velocity	Exit Temperature	Assumed Odour Emission Rate
		m	m	m/s	ºC	OU/m^2/sec
Carbon Filter 1	Buffer tank, preacidification tank, mix tank	10	0.06	4.6	40	9.83
Carbon Filter 2	Aerobic reactor, sludge collection system	10	0.06	4.6	40	39.11

H6.1.4 Meteorological Data File

AUSPLUME requires that a meteorological data file is used to determine the effect of the local meteorology upon the dispersion of air pollutants.

A meteorological data file was produced in accordance with the requirements for a Level 1 assessment from the DECC *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (AMMAAP) requiring hourly representative values for wind speed, wind direction, temperature, stability class and mixing height for at least 1 year.

A meteorological data file was prepared using CSIRO's TAPM model to predict hourly site specific meteorological data. TAPM solves approximations to the fundamental fluid dynamics and scalar transport equations to predict meteorology incorporating the effects of sea breezes and terrain induced flows against a background of larger-scale meteorology provided by synoptic analyses. A 3km by 3k grid around the site was selected using 2008 data as a baseline to produce an AUSPLUME compatible hourly data file.

This data was considered representative of long term conditions and also represents the most recent conditions.

The raw TAPM data included hourly values for ambient temperature, wind speed, wind direction and sigma theta. Hourly values for stability class were calculated using the sigma theta estimation technique which is a turbulence based method using the standard deviation of the wind direction in combination with the scalar mean wind speed (USEPA, 2000). Mixing heights were calculated based on the procedure outlined in the AMMAAP for a Level 1 assessment.

H6.2 Results

The full results of the air dispersion modelling for odour from the combined stack sources and area sources for both the DAF option and the MBR Option are presented in the AUSPLUME text file outputs in Attachment 1.

The results of this modelling are presented in Table 9, Figure 5 and Figure 6.

Table 9 OU Results

Option	Predicted Maximum Ground Level Concentration (OU)		Background Concentration (OU)	Criteria (µg/m^3)
	Maximum outside site boundary[2]	At Sensitive Receiver[1]		
DAF	1.69	0.092	NA	NA
MBR	2.2	0.155	NA	2

[1] At Nyrang Street, approximately 275 m to the east of the WWTP

[2] Odour level modelled at closest neighbouring industrial boundary adjacent to Haslams Creek

The results of the odour modelling are best represented in Figure 5 and Figure 6 indicating the potential dispersion of an odour plume and a minimal OU level associated with the WWTP at sensitive receivers along Nyrang Street under either the DAF option of the MBR option.

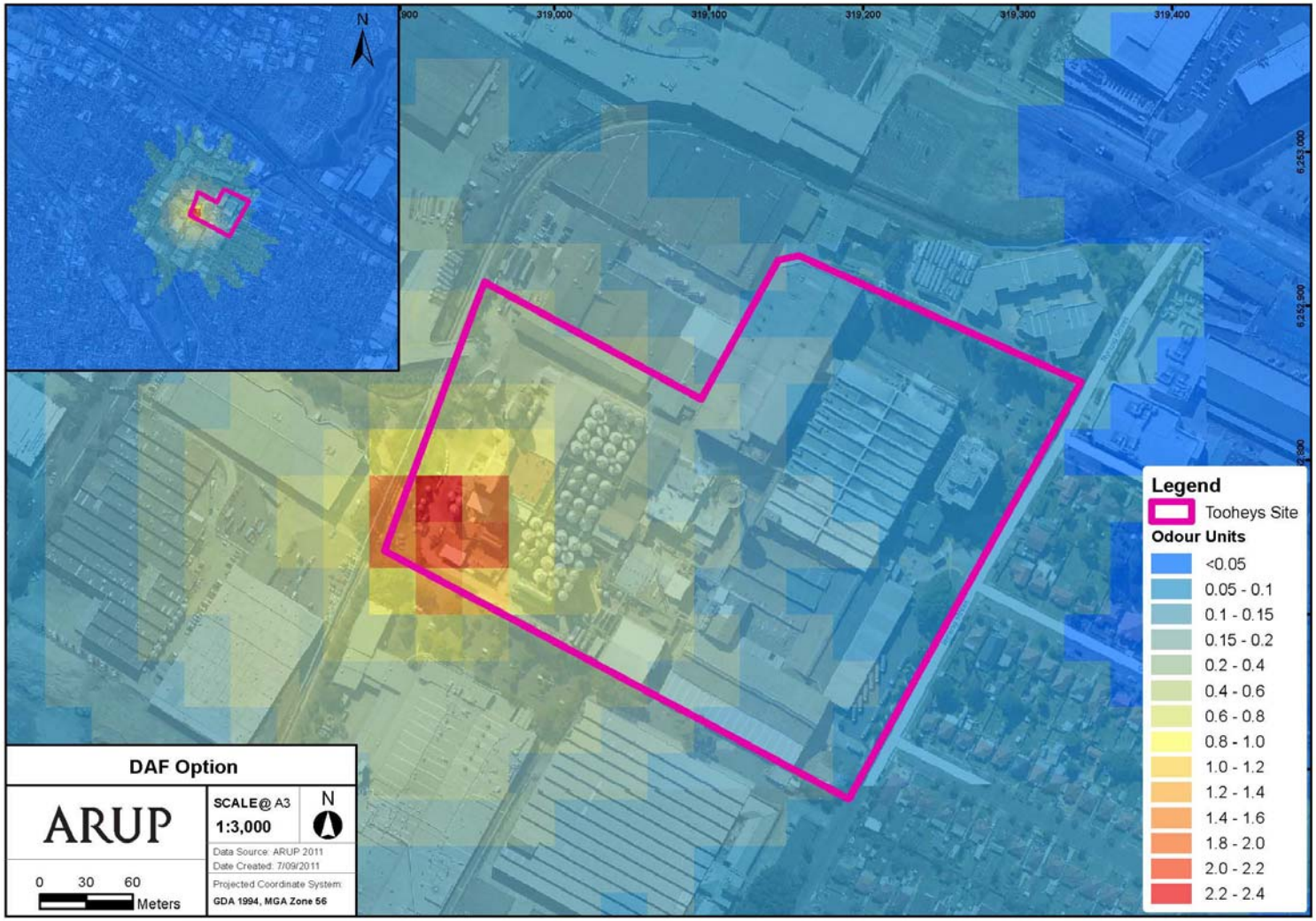

Figure 5 DAF option odour dispersion modelling results

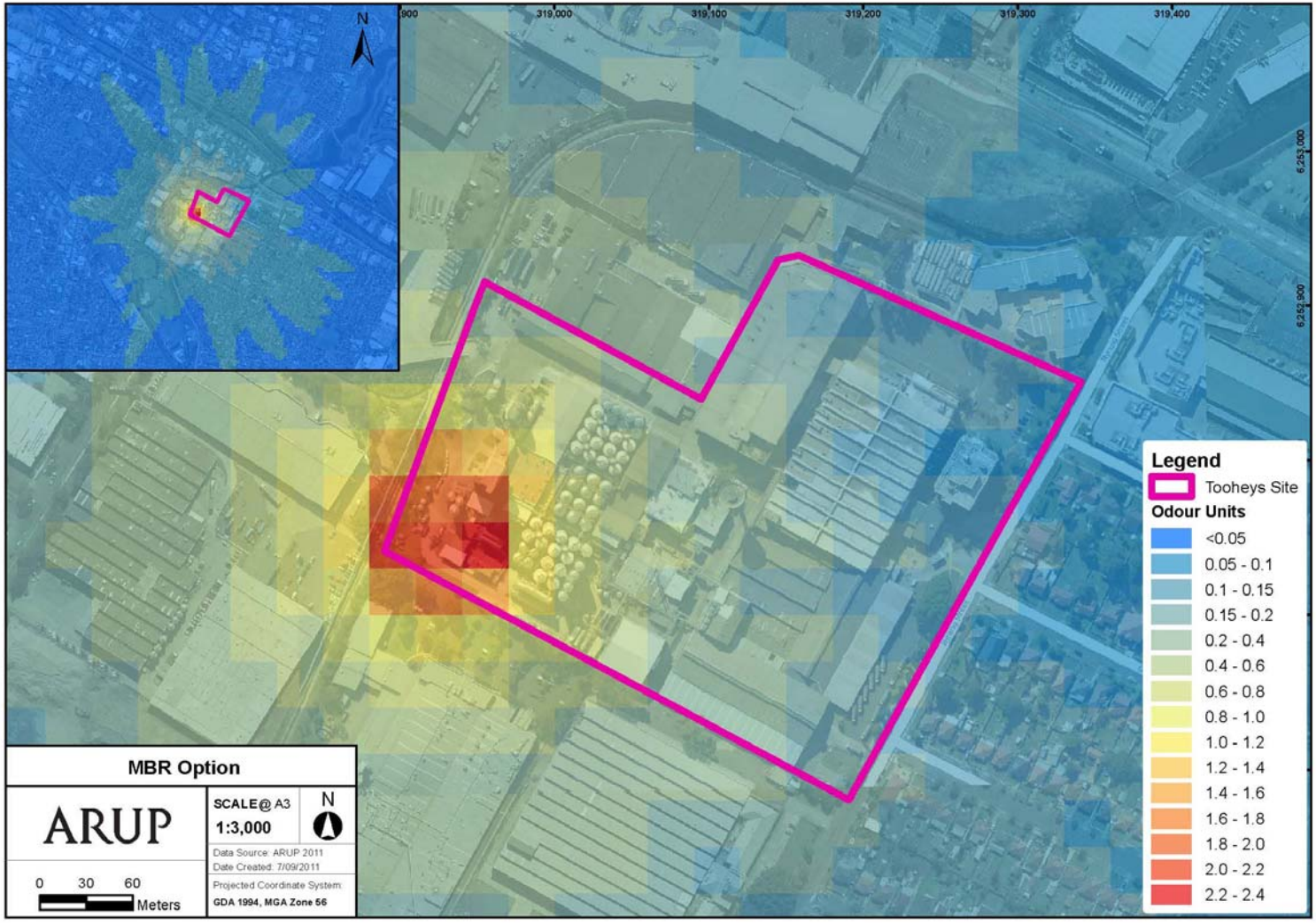

Figure 6 MBR option odour dispersion modelling results

H6.3 Summary

The results of the odour dispersion modelling are considered conservative. While the background concentration for odour at the site and for sensitive receivers is not known and has not been modelled, the results for emissions from the proposed WWTP options have resulted in odour levels at sensitive receivers which are less than 8% of the relevant criteria. Therefore it is likely that the WWTP under either option is unlikely to raise the criteria above acceptable levels during normal operating conditions.

However, recommended management measures and monitoring as described in Section 7 are required to be undertaken.

H7 Management Measures

Management measures for odour to be applied on the site are to include:

- An odour monitoring plan would be prepared and implemented in accordance with the *Approved Methods for the Sampling and Analysis for Air Pollutants in New South Wales* (NSW DEC, 2006);
- Regular inspection and testing of the pre-acidification tank and mix tank would be undertaken to ensure optimum acidic conditions are present;
- Odour sampling and analysis would to be undertaken as part of post-commissioning performance testing. Minimum testing required to be undertaken is for sulphurous compounds including hydrogen sulfide and volatile organic compounds at the plant and at the site boundary;
- All potential odour sources related to the wastewater and biogas system would be adequately contained and regularly inspected and tested;
- The existing gas boilers and flaring system would combust the biogas completely without unintended or unburnt emissions;
- Where possible any odour generating events such as tank cleaning would be undertaken under favourable atmospheric conditions (such as an easterly breeze);
- The installation of a screen (such as stands of trees and shrubs) at the western boundary of the site would be considered if required to reduce potential effects to surrounding industrial neighbours;
- Loading of sludge to removal vehicles would be undertaken so as to minimise odours from sludge escaping to the environment;
- Chemical storage facilities are to be kept as far away from sensitive receivers as possible;
- All chemicals to be stored on site would be handled and stored in accordance with proper hazard management procedures;
- Activated carbon filters would be regularly inspected and maintained to an optimum standard of operation. The malfunction of carbon filters due to poor maintenance is a key potential odour emission source.

H7.1 Odour Monitoring

During the operation of the WWTP a regular inspection and monitoring schedule will be maintained. The assessed odour levels presented in Table 10 below will be used as a guide in recording observations regarding odour. Odour investigation is primarily to be undertaken on the outlet from carbon filters and scrubbers, but should be undertaken on all elements of the WWTP on a regular basis.

Table 10 Assessed Odour Level

Assessed Odour	Level	Comment
Extreme	6	The odour is not tolerable. This should be very rarely encountered. For an offensive odour, immediate action should be taken to limit further exposure and mitigation needs to quickly put in place.
Very High	5	The odour is clearly recognisable. The exposure received is considered intolerable or undesirable and prompt action to mitigate against further exposure is deemed necessary.
High	4	The odour is clearly present. The exposure received is considered undesirable.
Clearly present	3	Odour is clearly recognisable but it is tolerable.
Weak	2	The odour is most likely present but the character of the odour is difficult to define.
Very weak	1	The odour is possible present, but the character of the odour is not recognisable.
Not perceptible	0	No odour.

The regularity, responsibility and recording of results from odour monitoring are to be clearly described in the Environmental Management Plan for the WWTP.

H8 Conclusion

The odour impacts from the proposed WWTP are assessed to be acceptable where the odour monitoring and management measures are implemented.

Odour modelling using AUSPLUME for both the DAF option and the MBR option indicates minimal odour impact is likely to nearby sensitive receivers as a result of the WWTP in normal operation. Odour levels at sensitive receivers (0.092 for dissolved air flotation and 0.155 OU for MBR) are well below the odour criteria of 2 OU.

The WWTP is designed to be enclosed and reduce emissions to air and under normal operations the odour impacts are expected to be negligible.

Post commissioning, testing for odour and the operation of an odour complaints system as described in Section 7 will establish if odour generation occurs, and remedial measures would be required to be undertaken.