Tooheys Brewery

Waste Water Treatment Plant

Preliminary Environmental Assessment

221580

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Glossary of terms

WWTP	Wastewater Treatment Plant
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CIP	Cleaning in Place
AD	Anaerobic Digestion
EIP	Effluent Improvement Program
SPS	Sewage Pumping Station
SS	Suspended Solids
TDS	Total Dissolved Solids
DAF	Dissolved Air Flotation
DoP	Department of Planning

1 Introduction

1.1 Background

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 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. 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 Preliminary Environmental Assessment (PEA) to the Department of Planning and Infrastructure which is the subject of the remainder of this report.

1.2 Overview of project

Tooheys currently generates approximately 3,000 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; and
- 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.

In order to improve the wastewater quality and to meet the stringent Sydney Water requirements, Tooheys proposes to install a 3,500 kL/day wastewater treatment plant (WWTP).

The WWTP is to be located on the rear boundary in the west corner of the site adjacent to Haslams Creek and industrial neighbours as shown in Figure 1.

The proposed treatment process comprise high rate anaerobic digestion (AD) followed by aerobic polishing 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.

The WWTP would have an allowance for a future increase of 20% of flows and loads, based on current wastewater characteristics.

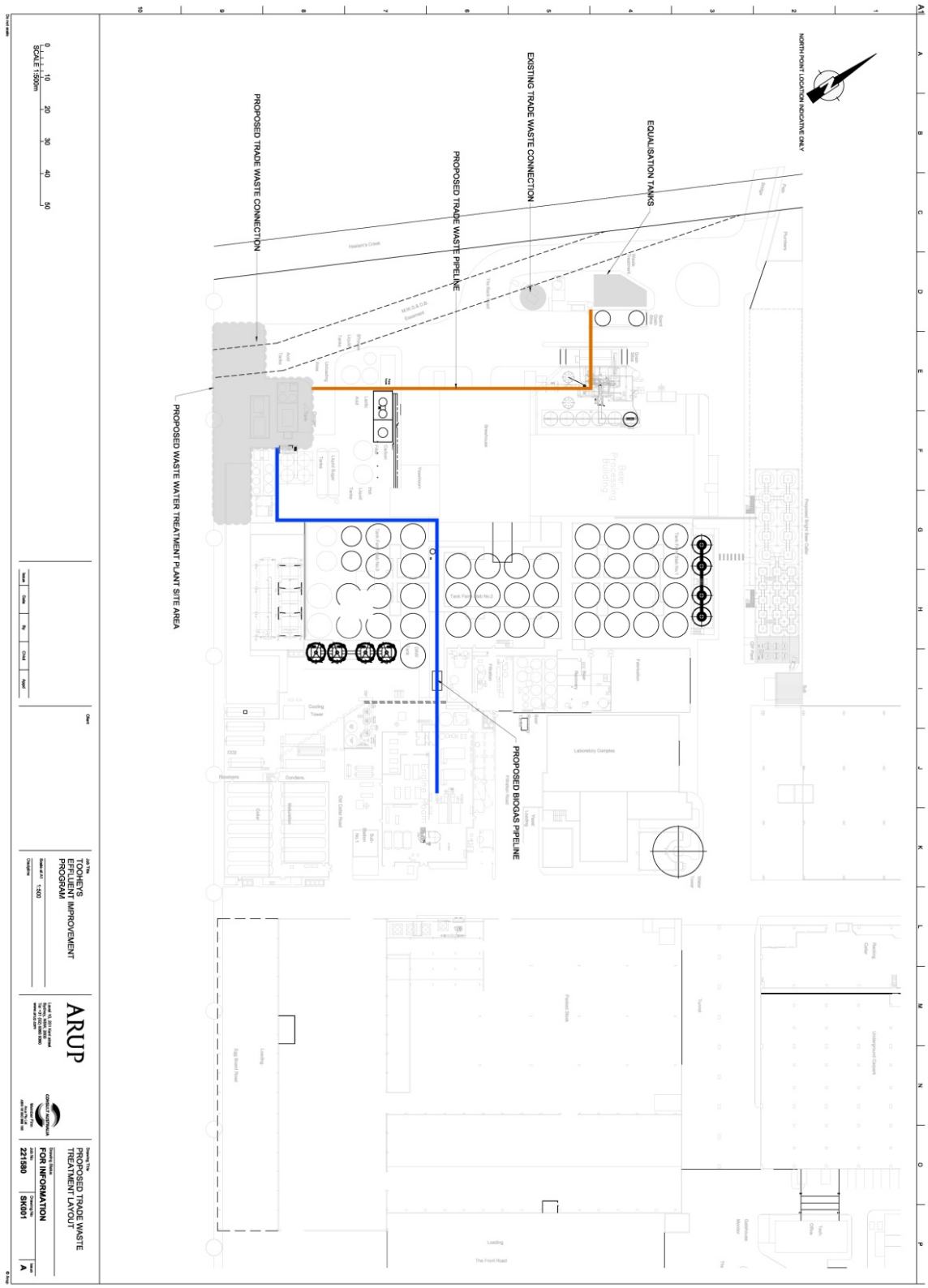


Figure 1 Proposed Project Location

1.3 Need for the project

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.

For Sydney Water's trade waste customers within SPS 67 catchment, the declaration resulted in 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 100 mg/L;
- A temperature limit of less than 25°C;
- 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 discharges wastewater with a BOD concentration of about 3000 mg/L and at a temperature of 38ºC.

Consequently, Tooheys was issued with a Sydney Water requirement to develop an Effluent Improvement Program (EIP). The EIP identified that the effluent quality standards could be met by onsite wastewater treatment in the form of a WWTP and cooling tower.

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

1.4 Objective of this report

Under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) an application is to be made to the Department of Planning and Infrastructure (DoPI) to modify the Minister's approval for a project.

This Preliminary Environmental Assessment (PEA) report has been prepared by Arup to support the application to modify the Part 3A approval for the Tooheys Brewery site and to identify the potential for environmental impact from the proposed modification, including the anticipated positive impacts.

The objective of the PEA is to describe the proposed modifications and guide the further stages of environmental assessment by:

- Identifying those impacts which are significant and are likely to require further investigation.
- Identifying those impacts which are not likely to be significant and for which no further investigation is likely to be required.

2 Existing wastewater treatment

2.1 Existing process

Tooheys currently consumes approximately 4 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 waste water. 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 2). 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 to 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.

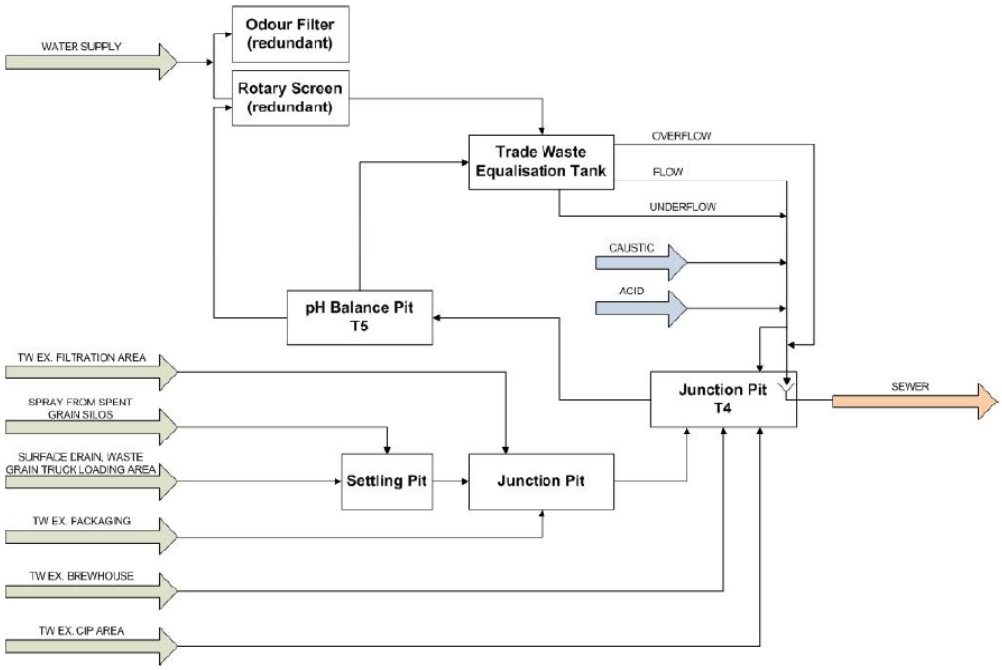


Figure 2 Existing wastewater treatment process flow diagram.

2.2 Existing wastewater quality

The existing wastewater has a BOD of around 3000mg/L which is well above the new standard of 600mg/L to be imposed by Sydney Water. The high BOD 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, as well as detergent and sanitiser losses from CIP operations. The ratio of COD to BOD is about 1.6 indicating that it is readily biodegradable and is present in soluble form.

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.

Nutrients are typical of brewery effluents with phosphorus and nitrogen typically associated with the cleaning products and raw materials utilised in the brewing process. The phosphorus will typically be in the soluble orthophosphate form making it easy to remove, while nitrogen is more likely to be organically bound and may not be readily bioavailable.

The total dissolved solids (TDS) concentrations are quite high and are attributed to the contribution of water from the CIP processes and demineralisation plant.

3 Detailed project description

The major process units for the project include:

- Screening;
- Balance tank;
- Transfer pipeline;
- Preacidification Tank;
- Heat exchanger;
- Mix tank;
- High rate anaerobic reactor;
- Anaerobic sludge storage tank;
- Attached growth aerobic polishing;
- Dissolved air flotation;
- Sludge dewatering;
- Biogas capture and reuse.

Tooheys propose to utilise a secondary treatment process comprising high rate anaerobic treatment followed by attached growth aerobic polishing units to improve its wastewater quality prior to discharge to the Sydney Water sewerage system. The proposed treatment process is described below with process flow diagrams presented in Appendix A.

3.1.1 Wastewater collection

Wastewater from the site will be collected as per existing arrangements, in the pH Balance Pit T5 (Figure 2). From here, it will be pumped with the existing pumps, through a new screen and to the existing wastewater Equalisation Tank.

3.1.2 Screening

A 1mm self cleaning fine screen is required to remove coarse solids which are mostly spent grains. The separated solids will be collected in a fully enclosed container, which will be connected to the off gas treatment system to avoid having odours created by the screenings. The screenings will be removed every 1-2 days, depending on the amount of solids created. Any liquid from the screenings bin will drain back to the pH Balance Pit T5.

It is anticipated using the existing screenings structure (platform) with a new rotating self cleaning drum screen on the top. A chute will be connected to where the screenings are collected to deliver the screenings to the container, which will be located at ground level. The screen is fully enclosed and connected to an off gas treatment system.

3.1.3 Balance tank (existing wastewater equalisation tank)

The existing balance tank will be used to receive the screened wastewater and to balance the peaks in temperature, COD and other wastewater constituents.

3.1.4 Transfer pipeline to WWTP

The wastewater will 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 will be transferred via an overhead pipeline located within an existing pipe rack. New pumps will need to be added at the WWTP site. Ventilation and off-gas treatment systems will be utilised to avoid having accumulation of potentially odorous gases.

3.1.5 Preacidification tank

The wastewater will be pumped into a Preacidification Tank, which is the first stage of the anaerobic process. During this process, the organic material in the wastewater is converted into short chain fatty acids, namely Volatile Fatty Acids (VFA) 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.

Offgas from the Preacidification Tank is removed for treatment through an activated carbon unit.

3.1.6 Heat exchanger

A heat exchanger to cool the raw waste water will be incorporated within the process and will provide protection against overheating the bacteria in the High Rate Anaerobic Reactor.

The cooling unit will be integrated with the recirculation mixing pump on the Preacidification Tank. The cooling liquid for the heat exchanger will be chilled with cooling tower water from the new cooling tower.

3.1.7 Mix tank

The Preacidification tank effluent is pumped into a Mix tank, which also receives effluent of 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.

3.1.8 High rate anaerobic reactor

The High Rate Anaerobic Reactor is designed to convert the majority of the dissolved organic material into biogas utilising a methanogenic bacteria. Typical removal rates of high rate anaerobic reactors for brewery wastewater are 75-80%. The preliminary sizing for the anaerobic reactor indicates a height of 28m and a diameter of 8m based on a worst case scenario of a wastewater temperature of 25°C. The system will be a fully enclosed reactor.

3.1.9 Anaerobic sludge storage tank

The anaerobic process produces a granular anaerobic sludge, which can be stored for significant amounts of time. After some days the bacteria 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 will 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 need to be vented as the sludge coming from the anaerobic reactor will still continue to produce methane and hydrogen sulphide gas for several days.

3.1.10 Attached growth aerobic polishing

Attached growth aerobic polishing will then be undertaken in a fully enclosed reactor. This provides “double” odour treatment by injecting the high sulphide off gasses in to the aeration zone and treating the spent air of the aerobic reactor. This process has been adopted with good results at the Lion Nathan Castlemaine Perkins brewery in Brisbane.

3.1.11 Dissolved air flotation

The main duty of the DAF is to remove suspended solids which are left over from the wastewater, excess solids formed by the aerobic process, and solids formed from the removal of phosphates from the wastewater by the addition of ferric chloride.

3.1.12 Sludge dewatering

The plant will create waste solids, consisting of residual solids from the brewery, excess biomass and ferric phosphate flocs.

This sludge will 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 will 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 >17% in dry solids concentration and is collected in a fully enclosed container, which is connected to a dedicated off-gas treatment system.

3.1.13 Biogas capture and reuse

The biogas produced by the anaerobic processes is expected to produce an average amount of biogas of 5100 m^3/day up to 9900 m^3/day at maximum loading. The biogas from the anaerobic reactor is 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 and with currently measured COD and sulphate concentrations is expected to contain 75-80% methane, 20-25% carbon dioxide and < 0.3% hydrogen sulphide. The biogas will be directly used in the boiler rather than the cogeneration unit where pre-treatment to remove the hydrogen sulphide would be required.

3.2 Plant and equipment size

Indicative sizes of the most significant (in terms of size) plant and equipment are presented in Table 1 below.

Table 1 Plant and Equipment Size

Treatment Unit	Indicative Size		
	Volume	Height	Diameter
Preacidification Tank	700m^3	24m	6m
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)

3.3 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.

3.4 Capital expenditure

The total capital expenditure is estimated at approximately $16M excluding GST.

3.5 Timing

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 June 2014.

4 Environmental risk analysis

The potential environmental risks and the proposed level of assessment to be undertaken with the Environmental Assessment is presented in Table 2.

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 wastewater treatment plant is a minor change to an existing development and the project would not increase the overall production volume of the brewery.

Table 2 Environmental Risk Analysis

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.

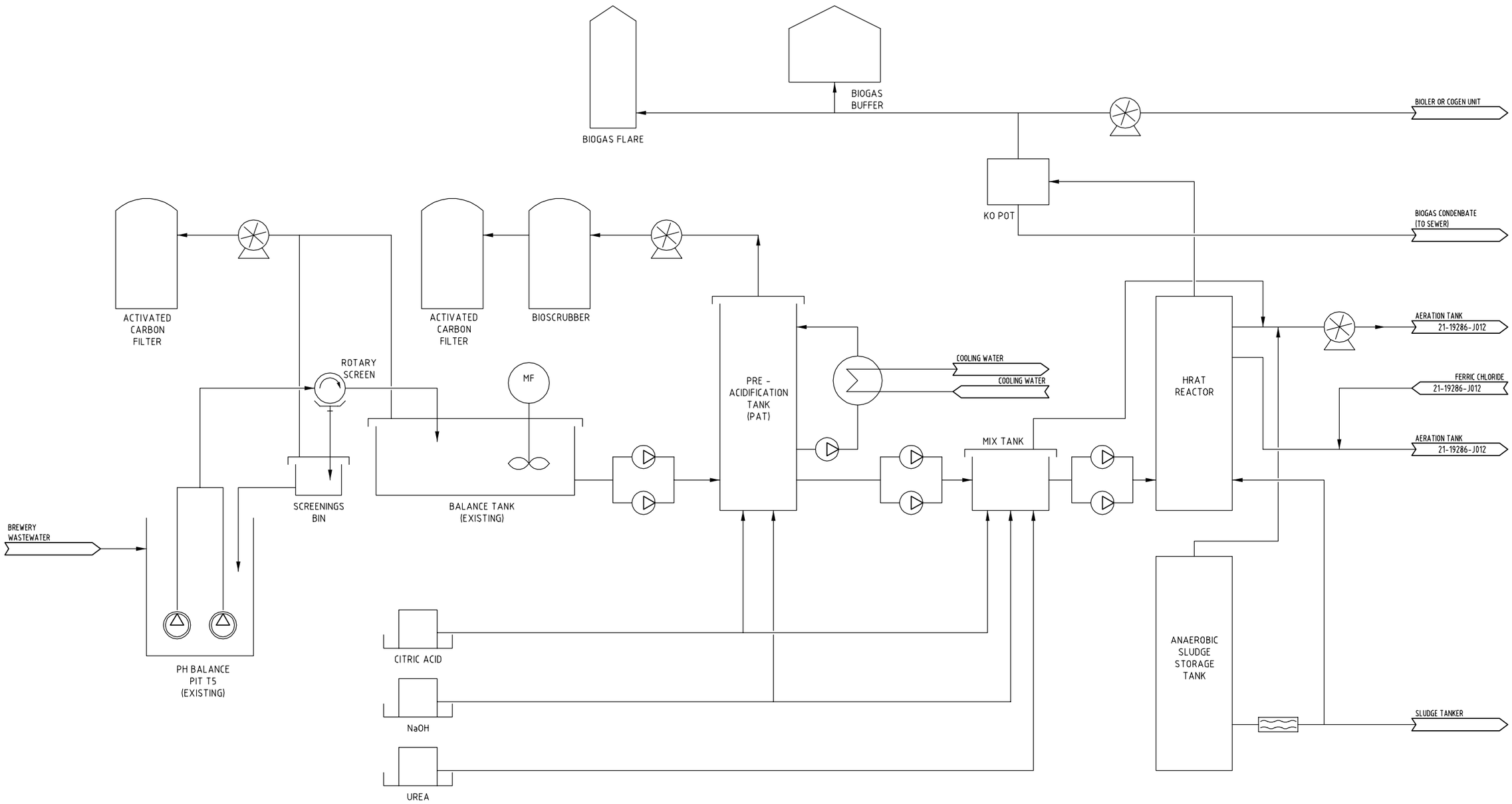
Issue	Potential Impact	Recommendation for further assessment.
Air Quality	There will be no additional impacts to air quality as a result of the operation of the wastewater treatment with the exception of odour emissions (see below). The biogas generated will replace natural gas in the boilers which may 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 management practice and using the best available control technology.	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: • Description of the source and frequency of odour emissions and the identification of the nearest affected receptor;

Issue	Potential Impact	Recommendation for further assessment.
	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.**	• 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.
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	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

Issue	Potential Impact	Recommendation for further assessment.
	neutral outcome in terms of overall energy consumption. **Low environmental significance**	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 A

Process Flow Diagrams



PRELIMINARY

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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Approved			
Date			
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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**

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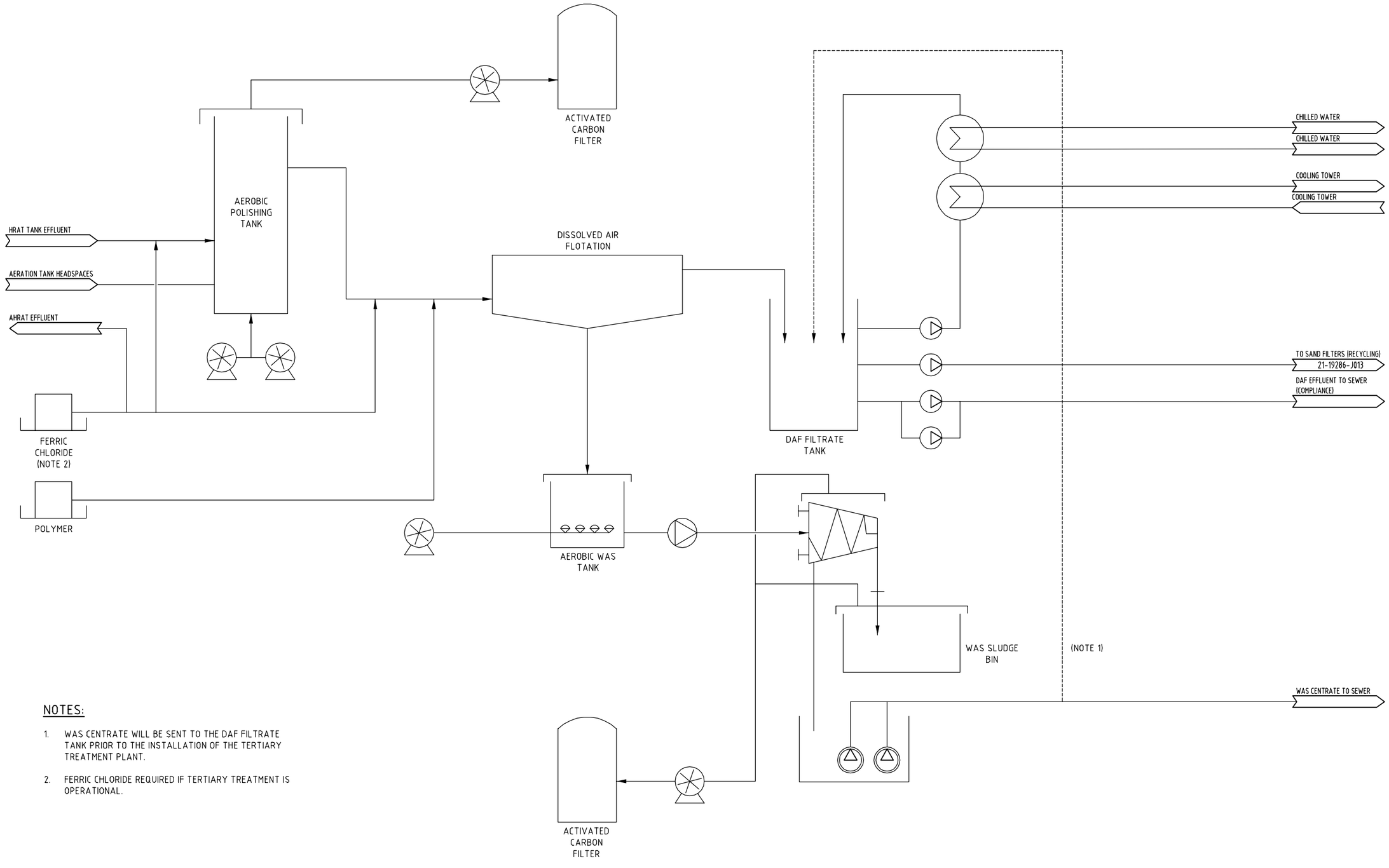

NOTES:

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

Original Size **A1** **Drawing No: 21-19286-J012** **Rev: B**

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