APPLICATION ON NOTIFICATION – Category 2

Applicant:	DeLorean Energy
Development Number:	361/L007/18
Nature of Development:	Waste to energy anaerobic digestion plant: organic waste reception, storage, treatment and disposal; and production of electrical energy, biomethane and thermal heat. Removal of 5 regulated trees and 11 significant trees.
Development Type:	Merit
Subject Land:	1-2 Gidgie Court, Edinburgh Parks
Development Plan:	Salisbury Council Development Plan consolidated 15 December 2016
Zone / Policy Area:	Urban Employment Zone
Contact Officer:	Janine Philbey
Phone Number:	7109 7062
Consultation Start Date:	8 October 2018
Consultation Close Date:	23 October 2018

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders St, Adelaide, during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered or emailed to the State Commission Assessment Panel.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapreps@sa.gov.au
Fax Number: (08) 8303 0753

South Australian
DEVELOPMENT ACT, 1993
REPRESENTATION ON APPLICATION – CATEGORY 2

Applicant:	DeLorean Energy
Development Number:	361/L007/18
Nature of Development:	Construction of a waste to energy anaerobic digestion plant comprising: organic waste reception, storage, treatment and disposal; and production of electrical energy, biomethane and thermal heat. Removal of 7 regulated trees, 11 significant trees. Construction of temporary signage.
Development Type:	Merit
Zone / Policy Area:	Urban Employment Zone
Subject Land:	1-2 Gidgie Court, Edinburgh Parks
Contact Officer:	Janine Philbey
Phone Number:	7109 7062
Close Date:	23 October 2018

My Name: ______________________ My phone number: ______________

Primary method(s) of contact: **Email:** ______________________

Postal Address: ______________________ **Postcode:** ________

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
(please tick one)

- ☐ owner of local property
- ☐ occupier of local property
- ☐ a representative of a company/other organisation affected by the proposal
- ☐ a private citizen

The address of the property affected is: ______________________

Postcode ________

My interests are:
(please tick one)

- ☐ I support the development
- ☐ I support the development with some concerns
- ☐ I oppose the development

The specific aspects of the application to which I make comment on are: ______________________

____

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____

I: *(please tick one)*

- ☐ wish to be heard in support of my submission
- ☐ do not wish to be heard in support of my submission *(Please tick one)*

By: *(please tick one)*

- ☐ appearing personally
- ☐ being represented by the following person *(Please tick one)*

Signature: Date:

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 /or
Email: scapreps@sa.gov.au

DEVELOPMENT APPLICATION FORM

361/ /2018/

Please use BLOCK LETTERS and Black or Blue Ink

City of Salisbury

I wish to apply for *(tick only one)*: ☑ Development Plan Consent ☐ Building Rules Consent ☐ Full Development Approval *(consists of both consents, which is required prior to any work commencing)*	
APPLICANT: COMPANY / FIRST NAME DeLorean Energy	**SURNAME**
POSTAL ADDRESS: Level 1, 10 Ord Street, West Perth 6005	**EMAIL:** INFO@Deloreanenergy.com.au
OWNER NAME: (This must be completed) Joseph Oliver	☐ as above
OWNER POSTAL ADDRESS:	☐ as above
OWNER PHONE NO: 08 6147 7577 0412 378 018	**OWNER EMAIL:** Joe.oliver@foodenergy.com.au
CONTACT PERSON FOR FURTHER INFORMATION	☐ as above
NAME: Hamish Jolly	**TELEPHONE (W):** 08 6147 7577 **(M):**
EMAIL: hamish.jolly@biogass.com.au	*Information from Council will be given by electronic communication to the nominated email address.*
BUILDER NAME: Biogass Renewables	**BUILDERS EMAIL:** info@biogass.com.au
BUILDER POSTAL ADDRESS: 1205 Hay Street, West Perth, WA 6005	**CONTACT NO.:** 08 6147 7577 **LICENCE NO.:**
CURRENT USE OF PROPERTY: Vacant	
DESCRIPTION OF PROPOSAL: Construction of Anaerobic Digestion facility	**DEVELOPMENT COST** $ 33,000,000

LOCATION OF PROPOSAL

Street No: 1-2	**Street:** Gidgie Court		**Suburb:** Edinburgh	
Lot No: 505	**Section:**	**Plan:** D68296	**Volume:** 5946	**Folio:** 160

OFFICE USE ONLY

Registration Date: / /2018	**Zone:**	**Ward:**

BUILDING RULES CLASSIFICATION

Classification sought:	
If Class 5, 6, 7, or 9 classification is sought, state the proposed number of employees	**Male:** **Female:**
If Class 9a classification is sought, state the number of persons for whom accommodation is provided:	
If Class 9b classification is sought, state the proposed number of occupants of the various spaces at the premises:	

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the Development Regulations, 1993. Developments requiring public notification will be made available to the public for comment via Council's web site at www.salisbury.sa.gov.au

SIGNATURE: ____________________ **DATE:** 08/06/2018

Certificate of Title

Title Reference	CT 5946/160
Status	CURRENT
Easement	YES
Owner Number	9001259*
Address for Notices	LEVEL 9 (WEST) RIVERSIDE CENTRE NORTH TERRACE ADELAIDE SA 5000
Area	2.274HA (CALCULATED)

Estate Type

FEE SIMPLE

Registered Proprietor

URBAN RENEWAL AUTHORITY
OF LEVEL 9 (WEST) RIVERSIDE CENTRE NORTH TERRACE ADELAIDE SA 5000

Description of Land

ALLOTMENT 505 DEPOSITED PLAN 68296
IN THE AREA NAMED EDINBURGH
HUNDRED OF MUNNO PARA

Last Sale Details

There are no sales details recorded for this property

Constraints

Encumbrances

NIL

Stoppers

NIL

Valuation Numbers

Valuation Number	Status	Property Location Address
4425406709	CURRENT	1-2 GIDGIE COURT, EDINBURGH, SA 5111

Notations

Dealings Affecting Title

NIL

Notations on Plan

NIL

Registrar-General's Notes

NIL

Administrative Interests

NIL

DELOREAN GROUP

Waste-to-Energy Anaerobic Digestion Planning Report

DELOREAN ENERGY SA ONE

125,000TPA Salisbury SA Facility - Phase 1

1-2 Gidgie Court, Edinburgh SA 5111

Date	Revision	Status	Prepared	Reviewed	Approved
07/06/2018	A	Final	MA	JO	HJ
19/09/2018	B	Final	MA	JO	HJ

TABLE OF CONTENTS

Abbreviations and Acronyms

AD	Anaerobic Digestion
ADF	Anaerobic Digestion Facility
BOD	Biological Oxygen Demand
CHP	Combined Heat & Power
COD	Chemical Oxygen Demand
DS	Dry solids
EI&C	Electrical Installation & Control
OS	Organic Solids
PLC	Programmable Logic Controller
PU	Packaged Unit
SS	Suspended Solids

Units

TPA	tons per annum
TPW	tons per week
TPD	ton per day
t/hr	ton per hour
dm3	cubic decimeter (= 1 liter)
t/m3	ton per cubic meter
kg VS/m^3·day	kg Volatile Solids per cubic meter reactor volume per day.
m3/hr	cubic meter per hour
Nm3/hr	normal cubic meter per hour
MW	megawatt
MWhr	megawatt hour
MW(th)	megawatt thermal energy
MW(e)	megawatt electrical energy
GJ	gigajoule
ppm	parts per million
kg/hr	kilograms per hour
mbar	millibar
m3/m2*hr	cubic meter (air) per square meter surface area per hour

PLANNING REPORT

Biogass Renewables Pty Ltd

1. Executive Summary

The Delorean Energy SA One waste to energy bio digestion plant, herein referred to as "The Development", is required to adhere to the rules and restrictions outlined in the Salisbury Council Development plan.

Key items that require planning and acceptable design include the following:

- Building and structure height
- Emissions including noise, odour and light
- Landscaping including the quality and quantity of plants
- Land and building boundaries and distances from roads, properties and other zones.
- The treatment of significant and regulated trees on site.
- Appropriate use of land.

Biogass Renewables has completed a planning report for the Development relative to the Salisbury Development Plan and have incorporated smart and innovative design to satisfy the criteria of the Salisbury Development Plan.

This planning report aims to address all relevant criteria and conditions pertaining to the waste to energy biodigestion plant. The layout of the document follows the same order as the Salisbury Council Development Plan for ease of reference.

2. Building Near Airfields

2.1. Structure Heights

The Development is located within area C of the RAAF Airfield in Edinburgh, requiring special approval for any structures higher than 15m from the ground. The current design for The Development will ensure all buildings and structures have a height no higher than 15m from the ground.

2.2. Noise

The Development is not within any airfield Noise Affected Areas and hence no further action is required.

2.3. Lighting

The Development is located within the Controlled Light Installation Area (within 6km radius of the RAAF base). The Development will be in operation 24 hours a day however regular staffing is limited to normal working hours ranging from 7AM to 5PM. Through this there is no requirement for increased lighting requirements, meaning the Development will adhere to the Controlled Light Installation Area criteria. Refer to appendix 4 - Lighting Plan.

2.4. Birds

The Development will not attract birds to the area due to the process being entirely in-vessel. All waste is delivered and processed inside an enclosed Receival Hall with no outdoor exposure of waste or waste products... In addition, the Development is located in excess of 3km from the nearby RAAF base, requiring no further action.

2.5. Public Safety Risk

The Development will take all possible safety precautions to eliminate risk to public safety and will not create unacceptable risks pertaining to:

- Lighting glare
- Smoke, dust and exhaust emissions
- Air turbulence
- Storage of flammable liquids
- Reflective surfaces
- Materials that affect aircraft navigational aids.

Construction materials and management plans will be used to control the above risks and ensure they do not become a risk to the public.

3. Crime Prevention

The Development has been designed for the following crime prevention measures:

- Maximise surveillance of public spaces
- Provide robust environment resistant to vandalism and graffiti

- Lighting utilised in frequently used public spaces (refer to Appendix 4 - Lighting Plan)
- Signage and lighting used to indicate paths and entries
- Landscaped to discourage crime
- Bunding, buildings and fences clearly differentiate public and private areas
- Discouraged and removed access between roofs
- Removal of any pedestrian entrapment points

4. Hazards

The Development has been designed to offtake any stormwater, flooding or tank rupture fluids and divert them to sump areas where they are either captured and stored or pumped directly into the on-site waste water processing facility

Biogas generated on site will comply with ICEX standards with a full HAZOP on site to uphold safety standards

The Development utilises co-generation units and self-enclosed flares to burn the produced biogas on site. The units are located away from any trees, with all combustion being internal with no exposed ignition sources.

The Development will be completely sealed at the ground level, resulting in the soil and ground water salinity not being affected

All waste delivered to The Development is contained either within Agricultural Silos or in specially built containment bunkers within the Reception Hall. The Reception Hall has a biofilter assembly which produces 4-5 air changes per hour and keeps the shed under constant negative pressure. The doors will be fast closing to eliminate any escaping odour or pollutants.

The bunkers in combination with the Reception hall and biofilter assembly eliminates the chance of:

- Discharge of polluted water from The Development
- Contamination of the land
- Airborne migration of pollutants.

5. Industrial Development

The site office will be located at the front of The Development facing the main rood (Woomera Avenue) allowing direct pedestrian access from the main carpark

The public vehicle entrances and exits are located to allow traffic to flow in both directions and allow forward direction for both access and exit.

The warehouse façade will consist of low reflection materials with a design that has an appealing appearance from public roads.

Fencing adjacent to the public road will be set back by a minimum of 10m from the main road (Woomera Avenue) and 4m from the secondary road (Gidgie Court). the area in front will be filled with landscaping and parking for employees and visitors.

6. Infrastructure

The Development will have a final designed to include provisions of the following utilities and services:

- Electricity supply
- Water supply
- Drainage and stormwater systems
- Waste disposal
- Effluent disposal systems
- Formed all-weather public roads
- Telecommunications services
- Social infrastructure, community services and facilities
- Gas services

Any development around electricity lines and other services will meet all clearances and safety restrictions required by the council and the state. New service infrastructure installed on site such as gas lines, electricity, water and telecommunications will be underground and concealed, adhering to any state and national requirements.

7. Interface between Land uses

The Development will be located and designed to minimise adverse impact and conflict to land users.

7.1. Emission of effluent, odour, smoke, fumes, dust or other pollutants

The waste receival area is fully enclosed within the Reception Hall which is constantly under negative pressure through the use of a biofilter.

The ground is fully sealed from the soil, allowing no effluent or other pollutants into the ground. The Biofilter collects and absorbs the odour from the shed before dispersing the clean air into the atmosphere. As the waste operations are completed within the shed, there is no chance for dust or other pollutants to escape the confines.

Any water received on site from the Digester process will be processed through the waste water processing facility on site. This will clean the water to an acceptable level for either reintroduction into the AD process or export to Salisbury Water for compliant usage or disposal. Stormwater collected on site will either be reintroduced into the AD process or exported to Salisbury Water. Depending on the stormwater quality, the stormwater my or may not be processed in the waste water treatment plant prior to use. Refer to Appendix 3: Stormwater management plan for more information on the treatment of stormwater.

Emissions of the fumes from the CHP and emergency flare will be controlled and modelled to ensure adverse effects on both the environment and other land holders are not adversely affected.

7.2. Noise

Noise modelling will be completed on the Development to ensure acceptable noise restrictions are adhered to. The loudest component of the plant is likely to be the co-generation units, which currently emit 75dB from 1m away. Noise attenuation measures will be incorporated throughout the Development to meet the council and state requirements as well as the protection policy criteria.

Noise impacts from the equipment within the shed will be contained within the shed walls.

7.3. Vibration

The Development civils will be designed to minimise vibrations and the transfer of vibrations to neighbouring land users.

7.4. Light spill

As the Development will be manned mostly during daylight hours, lighting around the Development will be minimal with the exception of lighting for security and monitoring processes.

Most labour-intensive operations are conducted within the Reception Hall which will contain the shed lighting and eliminate light spillage.

The lighting will also adhere to the requirements set by the RAAF for maximum light emission past the horizontal. Refer to Appendix 4 - Lighting Plan.

7.5. Glare

The buildings and structures will be constructed with materials with low glare to reduce impacts on land holders, the public and the nearby RAAF base.

7.6. Traffic Impacts

The Development has been designed for separate entrances and exits for waste disposal trucks to use. The quantity of trucks entering the Development is estimated to be 50 trucks per day, which activity is consistent with the normal expectations for premises in this industrial/commercial precinct. Refer to the Delorean Energy Traffic management Plan for more information.

8. Landscaping, Fences and Walls

The land will be enhanced with appropriate plants and other landscaping works including locally indigenous plant species where possible. Fences and walls installed around the premises will be functionally designed to enhance the attractiveness of The Development.

Perimeter fencing will be at minimum 2.1m high and will be constructed from council approved materials.

9. Natural Resources

The Development will retain and protect the natural resources and environment on the site. Water will be sourced from storm water and the south Australian water mains. Any water collected from natural resources will either be put back into the digestion process or exported to Salisbury Water depending on the site requirements at the time.

If water is to be exported to Salisbury Water, the water will be processed through the waste water treatment plant prior.

The waste receival areas will be bunded with specialised bunkers. This area will be sealed to stop any pollutants or salts from entering the soil below.

10. Regulated and significant Trees

Refer to Appendix 1: Arborist Tree report and Appendix 2: Arborist Impact Report for a detailed report and analysis of the planned treatment of regulated and significant trees on site.

11. Renewable Energy Facility

The Development will be located in the industrial area of Edinburgh Parks in the North of Adelaide. The local area has an abundance of commercial and industrial operations that can supply the Development with waste streams for processing.

The area is also suitable for power generation and transfer as the land has adequate infrastructure to install a grid connection on site. The Development is located in very close vicinity to the mains gas pipelines, allowing upgraded mains-grade biomethane to be injected into the gas mains.

The Development will be landscaped and will use appropriate materials for construction to minimise visual impact.

As stated in earlier sections, the area will be completely sealed to stop any leaching of pollutants or salts and will be within the safety guidelines for building near an airport.

12. Transport and Access

The Development will provide safe and efficient movement for all motorised and non-motorised transport modes. Access will be made to accommodate all vehicles including emergency services, public infrastructure services and commercial vehicles. The location supports and makes best use out of the existing transport facilities and networks due to the industrial area locality.

Off-street vehicle parking will be supplied on site to meet the demand in accordance with "Off street parking requirements". The parking area will be consistent with AS 2890 parking facilities. Under the "off street parking requirements" the following parking requirements are required:

Area type	Parking bays per 100m2	Site Area	Total Bays required
Office	3.33	339.6	11.3
Warehouse greater than 2000m2	0.67	3183	21.3

Total (rounded up)			33

The Development will meet the requirements of 33 parking bays on site, with extra Heavy vehicle and bus parking in addition, fulfilling The Development plan requirements.

13. Waste and Waste Management Facilities

13.1. Waste

The Development is designed to accept organic commercial and industrial food waste as well as dry agricultural waste from the outer region. All imported solid C&I waste is tipped into separated bunkers within the Reception Hall. Liquid waste is pumped into the Digester Feed tank from within the Reception Hall, resulting in all processing being conducted within the Reception hall negating any adverse effects for the public outside. The area is fully sealed with an impervious floor, eliminating any discharge to the ground. Agricultural waste will be transferred through a pneumatic conveyor system which keeps it sealed from spillage or blowing away.

The industrial and commercial food waste will be put through a separator to remove cardboard and plastics, which will then be captured and sent to a recycling facility via truck. Agricultural waste will be mixed with water before input into the Digester Feed Tank.

After the organics have been processed through the system, the resulting slurry is referred to as the "digestate". The digestate is separated from the water and transported away to local composting and farming operations. The separated water is cleaned through the waste water processing facility and is either pumped back into the system or exported to Salisbury Water.

A waste water management system will be in place to ensure all waste water and storm water is captured and processed adequately to either be pumped into the AD system or exported to Salisbury Water.

Ablution facilities will be connected to the local sewage network.

13.2. Location

The location of The Development is within the Urban Employment Zone, this being an appropriate use of the land. The Development will be separated from sensitive land uses and environmentally sensitive areas.

The Development satisfies the following criteria:

- 3km from airfield to minimise bird strikes
- 250m away from public open spaces
- 100m away from nearest surface water
- Land not subject to slipping

Sufficient area will be provided for the maximum expected volume and containment of potential water contaminants and diversion of clean storm water away from waste areas. The waste bunkers within the Reception hall are designed to hold 2 days' worth of organic materials.

The Development will be screened from public view, with the shed, fencing and landscaping providing a barrier to view.

13.3. Management

Noise attenuation will be utilised to ensure The Development does not interfere with the amenity of sensitive loads.

The access roads to The Development are appropriately sized and constructed for the expected traffic. The design of The Development infrastructure will have dimensions allowing the support and acceptance of all waste vehicles, and emergency vehicles in a forward motion for both entry and exit.

The Development will be able to accept up to 9 trucks at any one time, well over the average of 5 trucks every hour.

The Development will be fenced off with either chain wire mesh or pre-coated painted metal fencing, which will be at a height of 2.1m, higher than the minimum requirement of 2m.

14. Urban Employment Zone

14.1. Land Use

The anaerobic digestion development is classed under the industry form of development, making it an appropriate use of land.

The Development will not impede the operation of established land uses through encroachment, over development of sites or noise/emissions or any other harmful or nuisance-creating impact

14.2. Form and Character

The Development is consistent with the desired character of the zone as described under the section titled "DESIRED CHARACTER" Under the "Urban

Employment Zone" section of the Salisbury Council Development Plan.

Building setbacks will adhere to The Development plan guidelines. The Reception hall height is greater than 6m, resulting in the following minimum setbacks from the roads:

- 10 metres from the primary road frontage (Woomera Avenue)
- 4 metres from the secondary road frontage (Gidgie Court)

The building façade does not face any land zoned for residential purposes resulting in less restrictions for noise and light spillage, however the design will incorporate measures to reduce sound and light for land users in the area

The plant equipment with potential to cause an environmental nuisance include the following:

- 1 x Biogas to Biomethane upgrade
- 3 x Cogeneration CHP engines
- 2 x Emergency Flares
- 1 x Biofilter exhaust

The above-mentioned plant items are all located within the urban employment zone and are not situated near an allotment not zoned for employment. The Development will be designed to minimise the effect this plant has on the amenity of the locality

Noise will be attenuated to ensure noise emissions meet the acceptable criteria. As some sections of the plant will be in operation 24/7, the noise attenuation will be designed to create as little noise emissions as possible.

The Development location is in excess of 450m away from any residential areas, the hours of operation are not expected to detract from any nearby residential areas.

The Development design will be adaptable to changes over time should any changes be necessary. Components that can accommodate multiple uses designed within The Development are:

- Parking area
- Site office/meeting rooms
- Reception hall

The total area occupied by buildings is well below the threshold of 50%. The total ratio of building area to non-building area is:

Component	Total
Total Land Area	22700 m^2
Combined Office & Shed area	3523 m^2
Proportion of land occupied by buildings	15.51%

The Development is located outside of the "limited development area" as well as the "No structures and Development area" and hence is not required to fulfil the requirements of these area criteria's.

14.3. Land Division

As the land will not be divided, the rules regarding the creation of allotments does not apply.

14.4. *Procedural matters*

14.4.1. Complying Development

The below table outlines the complying criteria/conditions the proposed development will achieve:

Item	Complying Criteria / Conditions	Response
1	The building, or any part, is not located within: (a) areas affected by aircraft noise shown on Concept Plan Map Sal/2 - Edinburgh Defence Airfield Aircraft Noise Exposure (b) an area shown on Concept Plan Map Sal/3 - Edinburgh Defence Airfield Lighting Constraints where restrictions on the amount of upward light apply.	(a) development is not located within the areas affected by aircraft noise (b) Development is within the Controlled Light Installation Area (6km radius). Lighting will be kept to a level which satisfies the criteria
2	The Development does not involve an activity of environmental significance or major environmental significance identified in Schedules 21 and 22 of The Development Regulations 2008.	The Development is not expected to involve any of the activities specified in schedules 21 and 22 of The Development Regulations 2008. Schedule 21 - Petroleum Production, storage or processing works or facilities – Biomethane will not be stored on site. - Fuel burning – Flaring will be used rarely and won't surpass a yearly average heat release of 0.5MW Schedule 22 - Petroleum Production, storage or processing works or facilities – Biomethane will not be stored on site.

		- Waste or Recycling Depots – (a) waste is not stored while awaiting transport, (b) The Development is not located at a residential premise - Discharge of stormwater to underground aquifers – Stormwater to be recycled or exported to Salisbury Water - Fuel burning – Flaring will be used rarely and won't surpass a yearly average heat release of 0.5MW
3	The Development does not require referral pursuant to Section 37 of The Development Act 1993.	The Development will not require referral pursuant to section 37 of The Development act
4	The Development site is greater than 60 metres from the nearest residential zone boundary.	The Development Is over 450m away from the nearest residential boundary
5	The Development has direct access to a sealed roadway.	The Development has direct access to Woomera Avenue and Gidgie Court
6	All vehicles able to access/egress The Development in a forward direction.	The Development layout allows for entry and exit of the parking area and facility in a forward motion
7	A site coverage of less than 50 per cent.	The Development is covered by less than 16% by buildings
8	Building height does not exceed airport building heights shown on Concept Plan Map Sal/1 - Edinburgh Defence Airfield Defence (Area Control) Regulations and is no greater than 12 metres.	All structures will adhere to the Zone D airfield restrictions of under 15m height. Buildings (Reception hall and office) will adhere to a further height restriction of 12m.
9	Building setback in accordance with the following: (a) buildings up to a height of 6 metres sited at least 8 metres from	The Development buildings and fencing to be set back by 10m from the primary road (Woomera Avenue) and 4m from the Secondary road (Gidgie Court)

	the primary street alignment (b) buildings exceeding a height of 6 metres sited at least 10 metres from the primary street alignment (c) 4 metres from the secondary street frontage.	
10	The Development is designed as follows: (a) buildings adjacent public streets are designed to overlook the street and have a maximum unarticulated length of 30 metres (15 metres for offices) (b) comprise low-reflective materials and pre-colour treatment if metal clad.	Buildings will be designed to a visually appealing standard by having articulated wall lengths no longer than 30m and constructed out of low reflective materials.
11	Landscaping comprises: (a) an area of not less than 10 per cent of the site (b) a landscaped setback area of more than 3 metres wide along any street boundary, except where a building is setback a lesser distance from any street boundary in which case the intervening setback is landscaped (c) a mix of species expected to grow to less than 0.5 metres in height and species expected to grow with clear stems to 2 metres height and with the canopy above.	(a) Landscaped areas will comprise of at least 10% of The Development (b) The landscaped area will be at least 3 metres wide along a street boundary (c) Landscaped areas will provide plant species expected to grow either no higher than 0.5m or more than 2m high.
12	A clearance of not less than 3 metres being provided for access purposes between any structure and one side boundary of the site.	Access ways 3m wide will be kept along all sides of non-street facing boundaries

13	Off-street vehicle parking and specifically marked disabled parking provided at the rate of not less than: (a) 2 per 100 square metres (industrial building area under 200 square metres) (b) 1.33 per 100 square metres (industrial building area 200-2000 square metres) (c) 0.67 per 100 square metres (industrial building area greater than 2000 square metres) (d) 3.3 spaces per 100 square metres (office building area) (e) 2 per 100 square metres (service trade premises building area).	Requirements for parking stand at 33 bays, The Development design incorporates room for 33 parking spaces total, not including heavy vehicle and bus bays
14	14 All buildings, including the associated filling of land - are sited, designed and constructed to prevent the entry of floodwaters in a 1-in-100 year average return interval flood event.	adequate drainage and site sloping will be installed to allow water from a 1-in-100 year flood event to be safely diverted away. Refer to Appendix 3: Stormwater management plan
15	Areas used for the loading or unloading of materials or for the storage of chemicals and materials used in industrial operations and processes are to incorporate bunding or containment facilities that: (a) prevent the entry of external stormwater (b) contain any spilt materials from entering the stormwater system.	The digestion tank area is bunded to allow the capture of 120% of the tank volume. The area is designed to capture any tank ruptures and storm water and divert them into the waste water processing plant on site.
16	All loading and/or unloading of vehicles to occur within the boundaries of the site.	All loading and unloading of solid and liquid C&I wastes will be completed on site within the Reception hall. Unloading of dry feedstock will be done next to the waste silos using a pneumatic

		conveyor system.
17	All outside loading and unloading and goods storage areas should be screened by solid fencing or dense screen landscaping.	The Development is surrounded by fences, with the bulk of the unloading occurring within the Reception hall.
18	All stormwater drainage is retained and treated on-site or connected to an approved stormwater management scheme.	all storm water is collected and either exported to Salisbury Water if it is clean, or it is put through the waste water treatment facility if contaminated. The water leaving the waste water treatment facility is either put back into the digestion process or exported to Salisbury Water
19	Waste collection and storage areas provided which are: (a) screened and separated from adjoining areas (b) designed to ensure that wastes do not contaminate stormwater or enter the stormwater collection system.	The waste receival area is a set of specially built bunkers designed to contain the waste. The area is sealed with no chance of contaminating the storm water or soil below

20	The Development comprises a maximum of two advertising displays, each of which does not encroach upon the public road reserve and accords with the following: (a) A maximum of one pylon sign per site that: (i) has a maximum height of 6 metres (ii) has a maximum area of 8 square metres (iii) is located between the building and the front property boundary. (b) A maximum of one freestanding directory sign per site that: (i) has a maximum height of 3 metres (ii) has a maximum length of 6 metres. (c) A maximum of one flush wall sign per site that: (i) has a maximum area of 8 square metres (ii) is erected on the building façade (iii) is located below the parapet of the building.	Advertisement signage will satisfy the conditions set out by the Salisbury Development Plan. Refer to Appendix 5: Preliminary Signage Template for an illustration of the desired street front signage
21	Fencing exceeding 2.1 metres in height (including colour –coated wire mesh fencing) adjacent to public roads should be set back in one of the following ways: (a) in-line with the building façade (b) behind the building line (c) behind a landscaped area that softens its visual impact.	Fencing around the perimeter of The Development will be at least 2.1m high and will be in line with the building face and setback regulations

Appendix 1: Arborist Impact Report

Arboricultural Impact Assessment and Development Impact Report

Site: 1-2 Gidgie Court, Edinburgh

Date: Friday, 14 September 2018

ATS5157-1-2GidCtDIR

Contents

Report Reference Number: ATS5157-1-2GidCtDIR

Report prepared for

Biogass Renewables Pty Ltd Attn: Martyn Anderson

Author

Marcus Lodge Consulting Arborist Arborman Tree Solutions Pty Ltd

Brief

Arborman Tree Solutions was engaged to undertake an Arboricultural Impact Assessment and provide a Development Impact Report for 1-2 Gidgie Court, Edinburgh. The purpose of the Arboricultural Impact Assessment and Development Impact Report is to identify potential impacts the proposed development will have on the trees within the site.

The proposed development includes the construction of a new Biogass plant and this report seeks to the impact the proposal will have on the trees within the site and to recommend impact mitigation strategies in accordance with Australian Standard AS4970-2009 *Protection of trees on development sites* (AS4970-2009) for trees to be retained.

In accordance with section 2.2 of the AS4970-2009 (2.2) the following information is provided:

- Assessment of the general condition and structure of the subject trees.
- Identification of the legislative status of trees on site as defined in the *Development Act 1993*.
- Identify and define the Tree Protection Zone for each tree and mark on the plan.
- Identify potential impacts the development may have on tree health and/or stability.
- Recommend impact mitigation strategies in accordance with AS4970-2009 for trees to be retained.
- Provide information in relation to the management of trees.

Documents and Information Provided

The following information was provided for the preparation of this assessment:

- Design Drawings 1-2 Gidgie Court (Lot 505) Site drawing 180828
- Preliminary Tree Assessment ATS5157-1-2GidCtPTA

Executive Summary

Arborman Tree Solutions has assessed the potential impacts to the 23 Regulated and/or Significant Trees from the proposed development and supporting infrastructure. The assessment has determined the impacts to the trees and recommended mitigations strategies where appropriate.

Note: the Preliminary Tree Assessment ATS5157-1-2GidCtPTA identified 24 trees with a trunk circumference greater than two metres at one metre above ground level. However, one of these trees, Tree 20, is dead and therefore exempt from regulation and has not been included in this report.

The encroachment within the Tree Protection Zone (TPZ) of 21 of the 23 trees is recognized as a Major Encroachment in that it is greater than 10% of the TPZ area. There are two trees, Trees 3 and 5 with an encroachment of 10% or less and this is considered to be a minor encroachment as defined in Australian Standard AS4970-2009 *Protection of trees on development sites* (AS4970-1993).

The encroachments result in various levels of impact ranging from None to Conflicted. The consequence of the impact is that six trees require protection and/or mitigation and seventeen trees require removal. Trees 1 to 6 are located adjacent to the property boundary and the proposal has been modified around these trees to minimise the impact of the encroachment; Tree 3 whilst not impacted by the development is in poor condition and has been recommended for removal. Trees 7 and 8 whilst in the same planting group are adjacent to the proposed generators and enclosed flares and there is a potential fire risk associated with the trees in this proximity and has therefore been recommended for removal. Trees 9-19 and 21-24 are located such that they are in direct conflict with the proposed development and their location does not allow for the site in a functional manner for this type of use.

The long-term health, structure and stability of the trees identified for retention is not expected to be compromised if the recommendations within this document and the guidelines of AS4970-2009 are adhered to.

Site Location

Figure 1: Site location - 1-2 Gidgie Court, Edinburgh

Methodology

The proposed design was reviewed in association with the information supplied in the Preliminary Tree Assessment ATS5157-1-2GidCtPTA and in the Design Drawings and CAD files as supplied by Biogass Renewables.

The potential impact of the proposed works on tree condition is considered in accordance with the guidelines in AS4970-2009 *Protection of trees on development sites* (AS4970-2009). When determining potential impacts of an encroachment in to a Tree Protection Zone (TPZ), the following should be considered as outlined in section 3.3.4 of AS4970-2009 section 3.3.4;

a) Location of roots and root development.

b) The potential loss of root mass from the encroachment.

c) Tree species and tolerance to root disturbance.

d) Age, vigour and size of the tree.

e) Lean and stability of the tree.

f) Soil characteristics and volume, topography and drainage.

g) The presence of existing or past structures or obstacles affecting root growth.

h) Design factors.

Impacts are classified into the following categories: -

No Impact -	no encroachment into the TPZ has been identified.
Low <10% -	the identified encroachment is less than 10% of the TPZ area.
Low >10% -	the identified encroachment is greater than 10% of the TPZ area however there are factors that indicate the proposed development will not negatively impact tree viability.
High >10% -	the identified encroachment is greater than 10% of the TPZ area but does not impact the Structural Root Zone (SRZ) or the trunk.
Substantial -	the identified encroachment is greater than 20% of the TPZ area but does not impact the SRZ or the trunk.
Conflicted -	the identified encroachment impacts the SRZ and/or the trunk.

Trees with calculated encroachments greater than 10% and with an Impact identified as ‘Low’ have features or considerations identified in clauses in AS4970-2009 3.3.4 which indicate these trees should be sustainable.

Trees with calculated encroachments greater than 10% and with an Impact identified as ‘High’ do not have any features or considerations identified in clauses in AS4970-2009 3.3.4 and therefore non-destructive excavation and/or tree sensitive construction is required to minimise potential impacts.

Trees with an Impact identified as ‘Substantial’ have calculated encroachments greater than 20% and therefore alternative design solutions, additional root investigations and/or tree sensitive construction measures are required, in some instances tree removal may be required to accommodate the development.

Trees with an Impact identified as ‘Conflicted’ directly impact upon the SRZ or the trunk of the tree, additional root investigations or tree sensitive construction measures are not available and the only option is alternative designs or tree removal.

Regulatory Status, Tree Protection Zones and Development Impacts are shown in Appendix B.

Assessment

The proposed development involves the construction of a new Biogass plant and associated infrastructure. This assessment aims to identify potential impacts and recommend mitigation strategies in accordance with Australian Standard AS4970-2009 *Protection of trees on development sites* (AS4970-2009) to ensure tree sustainability.

Note: the Preliminary Tree Assessment ATS5157-1-2GidCtPTA identified 24 trees with a trunk circumference greater than two metres at one metre above ground level. However, one of these trees, Tree 20, is dead and therefore exempt from regulation and has not been included in this report.

The encroachment within the Tree Protection Zone of 21 of the 23 trees has been calculated to be greater than 10% of the total TPZ area. This encroachment is recognised as a 'Major Encroachment' as defined by AS4970-2009. A Major encroachment may have a Low impact on the tree and therefore long-term health, structure and stability are not likely to be affected or it could be Conflicted with the development and requires removal.

There are four trees, Tree 1, 2, 4 and 6, where the impact is considered to be Low due to the site conditions and in the case of Trees 1 and 2 the species tolerance to activity in the root zone as a result of its specialised root system. Additionally, the landscaped area around these trees has been modified to increase the area around each tree and reduce the impact to a Low level.

The encroachment within the Tree Protection Zone of Trees 3 and 5 has been calculated to be equal to or less than 10% of the total TPZ area. This encroachment is recognised as a 'Minor Encroachment' as defined by AS4970-2009. A 'Minor Encroachment' has a Low impact on the tree and therefore long-term health, structure and stability are not likely to be affected. As above the landscaped area around these trees has been modified to increase the area around each tree and reduce the impact to a Low level. Tree 3 however is a poor-quality specimen and has been recommended for removal on these grounds only.

The trees are planted in a row and the area below the trees is relatively uncompacted and unmaintained and presents as a suitable environment for root growth. The area beyond the planting row is partially maintained and is relatively compacted open ground that is not considered to conducive to substantial root growth.

The species of Trees 1 and 2 (*Eucalyptus camaldulensis*) has a good tolerance to root disturbance as it has evolved along water courses throughout mainland Australia and has a dimorphic root system that is able to exploit water at great depths and has a relatively dynamic and replaceable surface root system. This root structure is therefore able to tolerate considerable soil disturbance which AS4970-2009 section 3.3.4 (c) allows consideration for.

Trees 7 and 8 are located in an area to be retained for landscaping and have root zone encroachments that whilst Major are still likely to result in a Low impact. However, due to the location and proximity of the generators and enclosed flares there is a potential fire risk associated with these trees. Due to the proximity of the generators and flares it is recommended these two trees are removed as part of this development. Tree 8 however is a poor-quality specimen and has been recommended for removal on these grounds as well as the potential conflict with the development.

The remaining trees, Trees 9-19 and 21-24, are in direct conflict with the proposal and will require removal for this development to proceed. Unlike Trees 1-8 this group of trees is not an edge planting rather it is wholly within the site and as such restricts opportunities for development. The site is located in an area identified for industrial development and as such this development appears to be otherwise reasonable and expected. Given the proposed use of this site and the requirements of the plant and equipment alternative designs that could still achieve the required outcomes are not available. Tree 19 is also a poor-quality specimen and has been recommended for removal on these grounds as well as the potential conflict with the development.

If the recommendations within this document and the guidelines of AS4970-2009 are closely adhered to, the structural integrity, stability and health of the trees identified for retention is not expected to be compromised by this development. Trees not identified for retention have impacts that indicate they cannot be protected and therefore they require removal for this development to proceed.

Recommendation

The following recommendations are presented based on the Arboricultural Impact Assessment:

1. Trees 1, 2 and 4-6 will not be substantially impacted and therefore only require the implementation of standard tree protection methodologies.

2. Trees 7 and 8 are in close proximity to the generators and enclosed flares there is a potential fire risk associated with these trees and therefore they are recommended for removal.

3. Trees 9-19 and 21-24 are in direct conflict with the proposed development and require removal for the development to be successful.

4. Tree 3 whilst not impacted by the development is recommended for removal due to its poor overall condition and short useful life expectancy.

5. Trees 8 and 19 have also been recommended for removal due to their poor overall condition and short useful life expectancy.

6. All trees to be retained require protection in accordance with AS4970-2009 and should be included within the Tree Protection Plan.

7. A Project Arborist should be appointed to assist in the compilation of the Tree Protection Plan and the installation of the tree protection measures.

Thank you for the opportunity to provide this report. Should you have any questions or require further information, please contact me and I will be happy to be of assistance.

Yours sincerely

MARCUS LODGE
Senior Consulting Arboriculturist
Diploma in Arboriculture
International Society of Arboriculture – Tree Risk Assessment

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Glossary

Size:	approximate height and width of tree in metres.
Age:	identification of the maturity of the subject tree.
Useful Life Expectancy:	expected number of the years that the subject specimen will remain alive and sound in its current location and/or continues to achieve the relevant Principles of Development Control.
Health:	visual assessment of tree health.
Structure:	visual assessment of tree structure.
Circumference:	trunk circumference measured at one metre above ground level. This measurement is used to determine the status of the tree in relation to the *Development Act 1993*.
Diameter at Breast Height (DBH):	trunk diameter measured at 1.4 metres above ground level used to determine the Tree Protection Zone as described in Australian Standard AS4970-2009 *Protection of trees on development sites*.
Diameter at Root Buttress (DRB):	trunk diameter measured just above the root buttress as described in Australian Standard AS4970-2009 *Protection of trees on development sites* and is used to determine the Structural Root Zone.
Tree Damaging Activity	Tree damaging activity includes those activities described within the *Development Act 1993* such as removal, killing, lopping, ringbarking or topping or any other substantial damage such as mechanical or chemical damage, filling or cutting of soil within the TPZ. Can also include forms of pruning above and below the ground.
Tree Protection Zone:	area of root zone that should be protected to prevent substantial damage to the tree's health.
Structural Root Zone:	calculated area within the tree's root zone that is considered essential to maintain tree stability.
Project Arborist	A person with the responsibility for carrying out a tree assessment, report preparation, consultation with designers, specifying tree protection measures, monitoring and certification. The Project Arborist must be competent in arboriculture, having acquired through training, minimum Australian Qualification Framework (AQTF) Level 5, Diploma of Horticulture (Arboriculture) and/or equivalent experience, the knowledge and skills enabling that person to perform the tasks required by this standard.

References

Australian Standard AS4970–2009 ***Protection of trees on development sites***: Standards Australia.

Matheny N. Clark J. 1998: ***Trees and Development a Technical Guide to Preservation of Trees During Land Development***: International Society of Arboriculture, Champaign, Illinois, USA.

Appendix A - Tree Assessment Methodology

Tree Assessment Form (TAF©)

The Tree Assessment Form (TAF) summarises the findings of the tree assessment and provides a quick reference to the condition, legislative status and recommendations for each tree.

Record	Description
Tree	A perennial woody plant with a mature height of greater than 5 metres and life expectancy of more than 10 years.
Genus and Species	Trees are identified using normal field plant taxonomy techniques. Due to hybridisation and plant conditions available on the day of observation it may not always be possible to identify the tree to species level; where species cannot be ascertained *sp.* is used.
Height	Tree height is observed and recorded in the following ranges; 0-5m, 5-10m, 10-15m, 15-20m and >20m.
Spread	Crown width (diameter) is recorded using the following fields 0-5m, 5-10m, 10-15m, 15-20m and >20m.
Tree Health	Tree health is assessed using the Arborman Tree Solutions - Tree Health Assessment Method that is based on international best practice.
Tree Structure	Tree structure was assessed using Arborman Tree Solutions - Tree Structure Assessment Method that is based on international best practice.
Tree Risk Assessment	Trees were assessed using the International Society of Arboriculture Level 1 Tree Assessment method. The person conducting the assessment has acquired the International Society of Arboriculture Tree Risk Assessment Qualification (TRAQ).
Legislative Status	Legislation status was identified through the interpretation of the *Development Act 1993*, and the *Natural Resource Management Act 2004* as well as other relevant legislation, therefore determining regulatory status of the subject tree.
Mitigation	Measures to reduce tree risk may be recommended in the form of pruning and this listed in the Tree Assessment Findings (Appendix C). Tree pruning is recommended in accordance with AS4373-2007 *Pruning amenity trees* where practicable. Where measures to mitigate risk is not possible and the risk is unacceptable, then tree removal or further investigation is recommended.

Useful Life Expectancy (ULE)

Useful Life Expectancy (ULE) is a measure of the period for which the tree is expected to remain viable in the landscape.

ULE Rating	Definition
Surpassed	The tree has surpassed its Useful Life Expectancy.
<2 Years	The tree is considered to have a Useful Life Expectancy of less than two years.
<5 years	The tree is considered to have a Useful Life Expectancy of less than five years.
<10 years	The tree is considered to have a Useful Life Expectancy of less than ten years.
>10 years	The tree is considered to have a Useful Life Expectancy of more than ten years.

Maturity (Age)

The maturity of the tree is based on the stage of its live cycle.

Age Class	Definition
Senescent	The tree has surpassed its optimum growing period and is declining and/or reducing in size. May be considered as a veteran in relation to its ongoing management. Tree will have generally reached greater than 80% of its expected life expectancy.
Mature	A tree which has reached full maturity in terms of its predicted life expectancy and size, the tree is still active and experiencing cell division. Tree will have generally reached 20-80% of its expected life expectancy.
Semi Mature	A tree which has established, but has not yet reached maturity. Normally tree establishment practices such as watering will have ceased. Tree will generally not have reached 20% of its expected life expectancy.
Juvenile	A newly planted tree or one which is not yet established in the landscape. Tree establishment practices such as regular watering will still be in place. Tree will generally be a newly planted specimen up to five years old; this may be species dependent.

Tree Health Assessment (THA©)

Tree Health is assessed on a number of factors which are all considered to give an overall rating.

Category	Description
Good	Tree displays high vigour, uniform leaf colour, no or little dieback (<5%), crown density (>85%) and or healthy axillary buds and typical internode length. The tree has little to no pest and/or disease infestation.
Fair	Tree displays low vigour, dull leaf colour, little dieback (<15%), crown density (>70%) and/or reduced axillary buds and internode length. Minor pest and/or disease infestation potentially impacting on tree health.
Poor	Tree displays no vigour, chlorotic or dull leaf colour, moderate to high crown dieback (>15%), low crown density (<70%) and/or few or small axillary buds and shortened internode length. Pest and or disease infestation is evident and/or widespread.
Dead	The tree has died and has no opportunity for recovery.

Tree Structure Assessment (TSA©)

Tree Structure is assessed on a number of factors which are all considered to give an overall rating.

Category	Description
Good	Little to no branch failure observed within the crown, well-formed unions, no included bark, good branch and trunk taper present, root buttressing and root plate are typical.
Fair	History of minor branch failure observed in crown, well-formed unions, no included bark, acceptable branch and trunk taper present, root buttressing and root plate are typical.
Poor	History of significant branch failure observed in crown, poorly formed unions, included bark present, branch and trunk taper absent, root buttressing and root plate are atypical.
Failed	The structure of the tree has or is in the process of collapsing.

Tree Retention Rating (TRR)

The Tree Retention Rating is based on a number of factors that are identified as part of the standard tree assessment criteria including Condition, Size, Environmental, Amenity and Special Values. These factors are combined in a number of matrices to provide a Preliminary Tree Retention Rating and a Tree Retention Rating Modifier which combine to provide a Tree Retention Rating that is measurable, consistent and repeatable

Preliminary Tree Retention Rating

The Preliminary Tree Retention Rating is conducted assessing Tree Health and Structure to give an overall Condition Rating and Height and Spread to give an overall Size Rating. The following matrices identify how these are derived.

Condition Matrix				
Structure	Health			
	Good	Fair	Poor	Dead
Good	C1	C2	C3	C4
Fair	C2	C2	C3	C4
Poor	C3	C3	C4	C4
Failed	C4	C4	C4	C4

Size Matrix					
Spread	Height				
	>20	15-20	10-15	5-10	<5
>20	S1	S1	S1	S2	S3
15-20	S1	S1	S2	S3	S3
10-15	S1	S2	S2	S3	S4
5-10	S2	S3	S3	S4	S5
<5	S3	S3	S4	S5	S5

The results from the Condition and Size Matrices are then placed in the Preliminary Tree Retention Rating Matrix.

Preliminary Tree Retention Rating				
Size	Condition			
	C1	C2	C3	C4
S1	High	Moderate	Low	Low
S2	Moderate	Moderate	Low	Low
S3	Moderate	Moderate	Low	Low
S4	Moderate	Moderate	Low	Low
S5	Low	Low	Low	Low

The Preliminary Tree Retention Rating gives a base rating for all trees regardless of other environmental and/or amenity factors and any Special Value considerations. The Preliminary Tree Retention Rating can only be modified if these factors are considered to be of high or low enough importance to warrant increasing or, in a few cases, lowering the original rating.

Tree Retention Rating Modifier

The Preliminary Tree Retention Rating is then qualified against the recognised Environmental and Amenity benefits that trees present to the community thereby providing a quantitative measure to determine the overall Tree Retention Rating. Data is collected in relation to Environmental and Amenity attributes which are compared through a set of matrices to produce a Tree Retention Rating Modifier.

Environmental Matrix				
Origin	Habitat			
	Active	Inactive	Potential	No Habitat
Indigenous	E1	E1	E2	E3
Native	E1	E2	E3	E3
Exotic	E2	E3	E3	E4
Weed	E3	E3	E4	E4

Amenity Matrix				
Character	Aesthetics			
	High	Moderate	Low	None
Important	P1	P1	P2	P3
Moderate	P1	P2	P3	P3
Low	P2	P3	P3	P4
None	P3	P3	P4	P4

Tree Retention Rating Modifier				
Amenity	Environment			
	E1	E2	E3	E4
P1	High	High	Moderate	Moderate
P2	High	Moderate	Moderate	Moderate
P3	Moderate	Moderate	Moderate	Moderate
P4	Moderate	Moderate	Moderate	Low

Tree Retention Rating

The results of the Preliminary Tree Retention Rating and the Tree Retention Rating Modifier matrices are combined in a final matrix to give the actual Tree Retention Rating.

Tree Retention Rating Matrix			
Tree Retention Rating Modifier	Preliminary Tree Retention Rating		
	High	Moderate	Low
High	Important	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

Special Value Trees

There are potentially trees that have Special Value for reasons outside of normal Arboricultural assessment protocols and therefore would not have been considered in the assessment to this point; to allow for this a Special Value characteristic that can override the Tree Retention Rating can be selected. Special Value characteristics that could override the Tree Retention Rating would include factors such as the following:

Cultural Values

Memorial Trees, Avenue of Honour Trees, Aboriginal Heritage Trees, Trees planted by Dignitaries and various other potential categories.

Environmental Values

Rare or Endangered species, Remnant Vegetation, Important Habitat for rare or endangered wildlife, substantial habitat value in an important biodiversity area and various other potential categories.

Where a tree achieves one or more Special Value characteristics the Tree Retention Rating will automatically be overridden and assigned the value of Important.

Tree Retention Rating Definitions

Important These trees are considered to be important and will in almost all instances be required to be retained within any future development/redevelopment. It is highly unlikely that trees that achieve this rating would be approved for removal or any other tree damaging activity. Protection of these trees should as a minimum be consistent with Australian Standard AS4970-2009 *Protection of trees on development sites* however given the level of importance additional considerations may be required.

High These trees are considered to be important and will in most instances be required to be retained within any future development/redevelopment. It is unlikely that trees that achieve this rating would be approved for removal or any other tree damaging activity. Protection of these trees should be consistent with Australian Standard AS4970-2009 *Protection of trees on development sites*.

Moderate These trees are considered to be suitable for retention however they achieve less positive attributes than the trees rated as Important or High and as such their removal or other tree damaging activity is more likely to be considered to be acceptable in an otherwise reasonable and expected development. The design process should where possible look to retain trees with a Moderate Retention Rating. Protection of these trees, where they are identified to be retained, should be consistent with Australian Standard AS4970-2009 *Protection of trees on development sites*.

Low These trees are not considered to be suitable for retention in any future development/redevelopment; trees in this category do not warrant special works or design modifications to allow for their retention. Trees in this category are likely to be approved for removal and/or other tree damaging activity in an otherwise reasonable and expected development. Protection of these trees, where they are identified to be retained, should be consistent with Australian Standard AS4970-2009 *Protection of trees on development sites*.

Development Impact Assessment

Potential development impacts were determined in accordance with Australian Standard 4970-2009 *Protection of trees on development sites.* The identification of the impact of development considers a number of factors including the following:

a. The extent of encroachment into a tree's Tree Protection Zone by the proposed development as a percentage of the area.

b. Results of any non-destructive exploratory investigations that may have occurred to determine root activity.

c. Any required pruning that may be needed to accommodate the proposed development.

d. Tree species and tolerance to root disturbance.

e. Age, vigour and size of the tree.

f. Lean and stability of the tree.

g. Soil characteristics and volume, topography and drainage.

h. The presence of existing or past structures or obstacles potentially affecting root growth.

i. Design factors incorporated into the proposed development to minimise impact.

Impacts were classified into the following categories:

- **None** - The proposed development does not impact on the tree.
- **Low** - The proposed development is unlikely to impact the health of the tree.
- **Moderate** - The proposed development is expected to impact the health of the tree however mitigation strategies are available to maintain tree condition.
- **High** - The proposed development is expected to substantially the health and potentially the stability of the tree.
- **Conflicted** The proposed development substantially affects the tree including the Structural Root and/ the trunk.

Trees with an impact identified as 'Low' require general Tree Protection Zone management.

Trees with Low Retention Ratings and High or Conflicted impacts are recommended for removal as alternative designs or installation methods are not warranted.

Trees with a Moderate Retention Rating and High or Conflicted impacts are recommended for further investigation such as minor design alteration, other considerations or removal.

Trees with a High Retention Rating and High or Conflicted impacts are recommended for alternative installation methods, alternative designs or if these are not practicable or are unreasonable, tree removal may be recommended.

Appendix B - Tree Assessment Findings

Eucalyptus camaldulensis

Tree No: 1

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 12.72 metres

GPS Coords (MGA Zone 54)	283557 E, 6153362 N
Legislative Status	Significant
Development Impact	Low
Recommendation	Apply Tree Protection

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% of the TPZ area however this species is tolerant of changes to its root zone and as such this is not expected to have a long-term impact on tree viability.

Observations

This tree is in good overall condition.

Recommendation

This tree should be protected in accordance with AS4970-2009.

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Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Fair

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 14.76 metres

GPS Coords (MGA Zone 54)	283561 E, 6153366 N
Legislative Status	Significant
Development Impact	Low
Recommendation	Apply Tree Protection

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% of the TPZ area however this species is tolerant of changes to its root zone and as such this is not expected to have a long-term impact on tree viability.

Observations

This tree is in fair overall condition.

Recommendation

This tree should be protected in accordance with AS4970-2009.

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Eucalyptus cladocalyx

Tree No: 3

Sugar Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Poor

Trunk Circumference: >2 metres

Useful Life Expectancy: <10 years

Tree Protection Zone (TPZ): 9.00 metres

GPS Coords (MGA Zone 54)	283582 E, 6153392 N
Legislative Status	Regulated
Development Impact	Low
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is 10% of the TPZ area and this species is tolerant of changes to its root zone and as such this is not expected to have a long-term impact on tree viability.

Observations

The tree has a history of branch failure. There is extensive decay within the primary structure.

Recommendation

Tree removal is recommended; this tree is not in conflict with the development however it is a poor quality specimen and is recommended for removal regardles of development.

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Eucalyptus cladocalyx

Tree No: 4

Sugar Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 9.72 metres

GPS Coords (MGA Zone 54)	283581 E, 6153411 N
Legislative Status	Regulated
Development Impact	Low
Recommendation	Apply Tree Protection

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% of the TPZ area however this species is tolerant of changes to its root zone and as such this is not expected to have a long-term impact on tree viability.

Observations

This tree is in fair overall condition.

Recommendation

This tree should be protected in accordance with AS4970-2009.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 9.72 metres

GPS Coords (MGA Zone 54)	283591 E, 6153433 N
Legislative Status	Regulated
Development Impact	Low
Recommendation	Apply Tree Protection

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is less than 10% of the TPZ area and the proposed development is not expected to have a noticeable impact on the viability of this tree.

Observations

This tree is in fair overall condition.

Recommendation

This tree should be protected in accordance with AS4970-2009.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus polyanthemos

Red Box

Inspected: Monday, 27 August 2018

Height: >10 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 9.84 metres

GPS Coords (MGA Zone 54)	283597 E, 6153444 N
Legislative Status	Regulated
Development Impact	Low
Recommendation	Apply Tree Protection

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% of the TPZ area however this species is tolerant of changes to its root zone and as such this is not expected to have a long-term impact on tree viability.

Observations

This tree is in fair overall condition.

Recommendation

This tree should be protected in accordance with AS4970-2009.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus cladocalyx

Sugar Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >10 metres

Health: Fair

Structure: Good

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 11.28 metres

GPS Coords (MGA Zone 54)	283606 E, 6153459 N
Legislative Status	Regulated
Development Impact	High
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% and this tree is in close proximity to the generators and enclosed flares and there is a potential fire risk associated with this tree. Given this the impact on the tree is considered to be high and it will

Observations

This tree is in fair overall condition.

Recommendation

The level of impact on this tree is such that its removal is the most appropriate management option.

Eucalyptus cladocalyx

Tree No: 8

Sugar Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >10 metres

Health: Fair

Structure: Poor

Trunk Circumference: >2 metres

Useful Life Expectancy: <10 years

Tree Protection Zone (TPZ): 10.44 metres

GPS Coords (MGA Zone 54)	283612 E, 6153471 N
Legislative Status	Regulated
Development Impact	High
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10% and this tree is in close proximity to the generators and enclosed flares and there is a potential fire risk associated with this tree. Given this the impact on the tree is considered to be high and it will

Observations

There is extensive decay within the primary structure.

Recommendation

The level of impact on this tree is such that its removal is the most appropriate management option. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

Tree No: 9

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Poor

Trunk Circumference: >3 metres

Useful Life Expectancy: <10 years

Tree Protection Zone (TPZ): 15.00 metres

GPS Coords (MGA Zone 54)	283712 E, 6153466 N
Legislative Status	Significant
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

The tree has a history of branch failure. There is extensive decay within the primary structure.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 10.20 metres

GPS Coords (MGA Zone 54)	283712 E, 6153458 N
Legislative Status	Regulated
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Fair

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 10.01 metres

GPS Coords (MGA Zone 54)	283709 E, 6153454 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Fair

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 15.00 metres

GPS Coords (MGA Zone 54)	283704 E, 6153447 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 13.20 metres

GPS Coords (MGA Zone 54)	283699 E, 6153427 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

Tree No: 14

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 14.40 metres

GPS Coords (MGA Zone 54)	283687 E, 6153415 N
Legislative Status	Significant
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Good

Structure: Good

Trunk Circumference: >2 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 10.32 metres

GPS Coords (MGA Zone 54)	283682 E, 6153403 N
Legislative Status	Regulated
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >2 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 11.16 metres

GPS Coords (MGA Zone 54)	283680 E, 6153397 N
Legislative Status	Regulated
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

Tree No: 17

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >15 metres

Health: Fair

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 15.00 metres

GPS Coords (MGA Zone 54)	283675 E, 6153383 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

Tree No: 18

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >2 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 7.44 metres

GPS Coords (MGA Zone 54)	283667 E, 6153371 N
Legislative Status	Regulated
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Regulated Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than two metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

Tree No: 19

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >15 metres

Health: Poor

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: <10 years

Tree Protection Zone (TPZ): 14.40 metres

GPS Coords (MGA Zone 54)	283665 E, 6153365 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

There is dieback of branch ends throughout the crown.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 15.00 metres

GPS Coords (MGA Zone 54)	283650 E, 6153336 N
Legislative Status	Significant
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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PROFESSIONALS IN ARBORICULTURE

Eucalyptus camaldulensis

Tree No: 22

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Fair

Structure: Fair

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 11.40 metres

GPS Coords (MGA Zone 54)	283645 E, 6153328 N
Legislative Status	Significant
Development Impact	**Conflicted**
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >15 metres

Spread: >10 metres

Health: Fair

Structure: Fair

Trunk Circumference: >3 metres

Useful Life Expectancy: >10 years

Tree Protection Zone (TPZ): 14.28 metres

GPS Coords (MGA Zone 54)	283643 E, 6153324 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in fair overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

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Eucalyptus camaldulensis

River Red Gum

Inspected: Monday, 27 August 2018

Height: >20 metres

Spread: >15 metres

Health: Good

Structure: Good

Trunk Circumference: >3 metres

Useful Life Expectancy: >20 years

Tree Protection Zone (TPZ): 15.00 metres

GPS Coords (MGA Zone 54)	283638 E, 6153317 N
Legislative Status	Significant
Development Impact	Conflicted
Recommendation	Remove

Legislative Status

This tree is identified as a Significant Tree as defined in the Development Act 1993. This tree has a trunk circumference greater than three metres and is not subject to any exemption from regulation.

Development Impact

The identified encroachment is greater than 10%. Given the level and type of encroachment this tree is not sustainable in this development.

Observations

This tree is in good overall condition.

Recommendation

This tree is in direct conflict with the proposed development and its removal is required.

Appendix C - Mapping

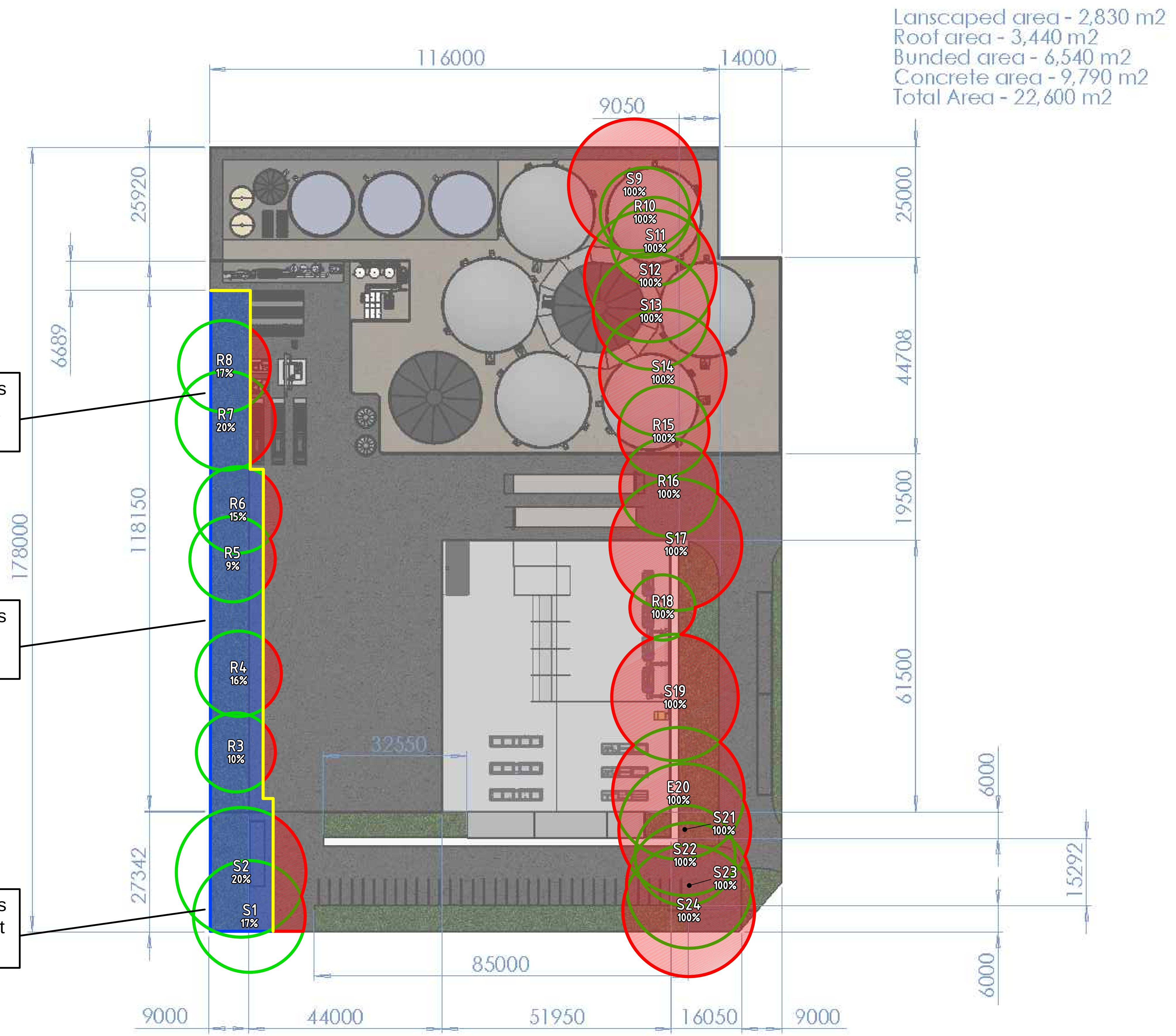
Arborman Pty Ltd

- TPZ
- Construction Edge
- Encroachment Zone
- Tree Protection Zone

Approximate encroachments for trees 7 and 8 are based on a 9.00m offset from the boundary.

Approximate encroachments for trees 3 to 6 are based on a 12.00m offset from the boundary.

Approximate encroachments for trees 1 and 2 are based on a 14.30m offset from the boundary.



REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR REVIEW	09/08/2018	MARTYN A.	JOSEPH O.	

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CLIENT: FOOD ENERGY
PROJECT NO: J116

TITLE: SALISBURY AD PLANT CONCEPT LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:1000 | DWG NO. J116-001 | SHEET NO. 2 OF 4 | REV 0

Appendix D – Tree Assessment Summary

Tree Assessment Summary

Tree No.	Botanic Name	Legislative Status	Development Impact	TPZ Radius	Observations	Recommendations
1	*Eucalyptus camaldulensis*	Significant	Low	12.72 metres	This tree is in good overall condition.	This tree should be protected in accordance with AS4970-2009.
2	*Eucalyptus camaldulensis*	Significant	Low	14.76 metres	This tree is in fair overall condition.	This tree should be protected in accordance with AS4970-2009.
3	*Eucalyptus cladocalyx*	Regulated	Low	9.00 metres	The tree has a history of branch failure. There is extensive decay within the primary structure.	Tree removal is recommended; this tree is not in conflict with the development however it is a poor quality specimen and is recommended for removal regardles of development.
4	*Eucalyptus cladocalyx*	Regulated	Low	9.72 metres	This tree is in fair overall condition.	This tree should be protected in accordance with AS4970-2009.
5	*Eucalyptus camaldulensis*	Regulated	Low	9.72 metres	This tree is in fair overall condition.	This tree should be protected in accordance with AS4970-2009.
6	*Eucalyptus polyanthemos*	Regulated	Low	9.84 metres	This tree is in fair overall condition.	This tree should be protected in accordance with AS4970-2009.
7	*Eucalyptus cladocalyx*	Regulated	High	11.28 metres	This tree is in fair overall condition.	The level of impact on this tree is such that its removal is the most appropriate management option.
8	*Eucalyptus cladocalyx*	Regulated	High	10.44 metres	There is extensive decay within the primary structure.	The level of impact on this tree is such that its removal is the most appropriate management option. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.
9	*Eucalyptus camaldulensis*	Significant	**Conflicted**	15.00 metres	The tree has a history of branch failure. There is extensive decay within the primary structure.	This tree is in direct conflict with the proposed development and its removal is required. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.

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Tree Assessment Summary

Tree No.	Botanic Name	Legislative Status	Development Impact	TPZ Radius	Observations	Recommendations
10	*Eucalyptus camaldulensis*	Regulated	**Conflicted**	10.20 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
11	*Eucalyptus camaldulensis*	Significant	**Conflicted**	10.01 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
12	*Eucalyptus camaldulensis*	Significant	**Conflicted**	15.00 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
13	*Eucalyptus camaldulensis*	Significant	**Conflicted**	13.20 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
14	*Eucalyptus camaldulensis*	Significant	**Conflicted**	14.40 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
15	*Eucalyptus camaldulensis*	Regulated	**Conflicted**	10.32 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
16	*Eucalyptus camaldulensis*	Regulated	**Conflicted**	11.16 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
17	*Eucalyptus camaldulensis*	Significant	**Conflicted**	15.00 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
18	*Eucalyptus camaldulensis*	Regulated	**Conflicted**	7.44 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
19	*Eucalyptus camaldulensis*	Significant	**Conflicted**	14.40 metres	There is dieback of branch ends throughout the crown.	This tree is in direct conflict with the proposed development and its removal is required. Additionally this is a poor quality specimen that would be recommended for removal regardless of development.
21	*Eucalyptus camaldulensis*	Significant	**Conflicted**	15.00 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.

Tree Assessment Summary

Tree No.	Botanic Name	Legislative Status	Development Impact	TPZ Radius	Observations	Recommendations
22	*Eucalyptus camaldulensis*	Significant	**Conflicted**	11.40 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
23	*Eucalyptus camaldulensis*	Significant	**Conflicted**	14.28 metres	This tree is in fair overall condition.	This tree is in direct conflict with the proposed development and its removal is required.
24	*Eucalyptus camaldulensis*	Significant	**Conflicted**	15.00 metres	This tree is in good overall condition.	This tree is in direct conflict with the proposed development and its removal is required.

Appendix E - Tree Protection Zone Guidelines

Tree Protection Zone General Specifications and Guidelines

The Tree Protection Zone(s) is identified on the site plan. The TPZ is an area where construction activities are regulated for the purposes of protecting tree viability. The TPZ should be established so that it clearly identifies and precludes development/construction activities including personnel.

If development activities are required within the TPZ then these activities must be reviewed and approved by the Project Arborist. Prior to approval, the Project Arborist must be certain that the tree(s) will remain viable as a result of this activity.

Work Activities Excluded from the Tree Protection Zone:

a) Machine excavation including trenching;

b) Excavation for silt fencing;

c) Cultivation;

d) Storage;

e) Preparation of chemicals, including preparation of cement products;

f) Parking of vehicles and plant;

g) Refuelling;

h) Dumping of waste;

i) Wash down and cleaning of equipment;

j) Placement of fill;

k) Lighting of fires;

l) Soil level changes;

m) Temporary or permanent installation of utilities and signs, and

n) Physical damage to the tree.

Protective Fencing

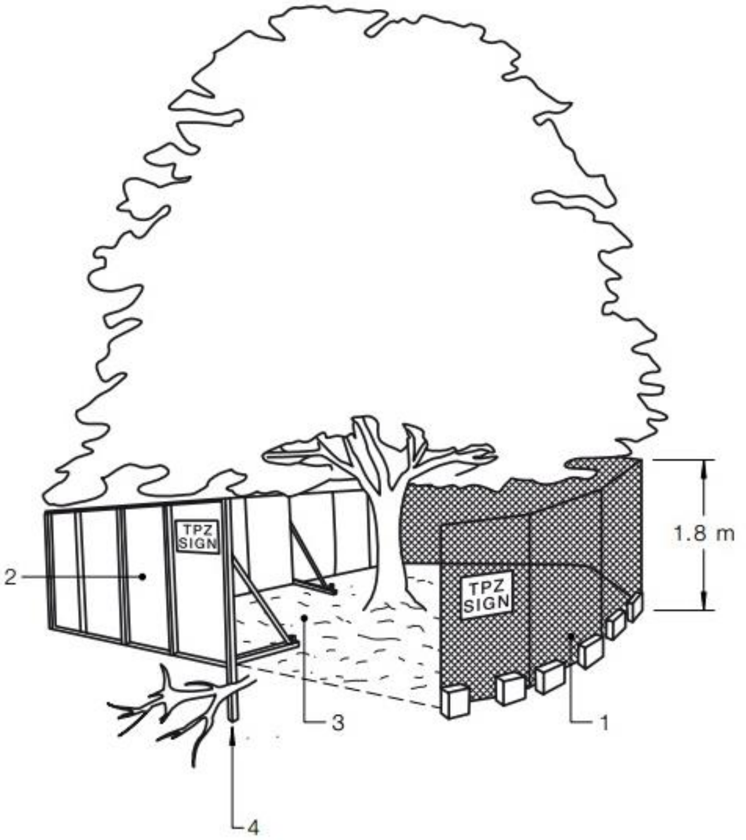
Protective fencing must be installed around the identified Tree Protection Zone (See Figure1). The fencing should by chain wire panels and compliant with AS4687 - 2007 *Temporary fencing and hoardings*. Shade cloth or similar material should be attached around the fence to reduce dust, other particulates and liquids entering the protected area.

Temporary fencing on 28kg bases are recommended for use as this eliminates any excavation requirements to install fencing. Excavation increase the likelihood of root damage therefore should be avoided where possible throughout the project.

Existing perimeter fencing and other structures may be utilised as part of the protective fencing.

Any permanent fencing should be post and rail with the set out determined in consultation with the Project Arborist.

Where the erection of the fence is not practical the Project Arborist is to approve alternative measures.



LEGEND:

1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.

2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.

3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

Figure 1 Showing example of protection fencing measures suitable.

Other Protection Measures

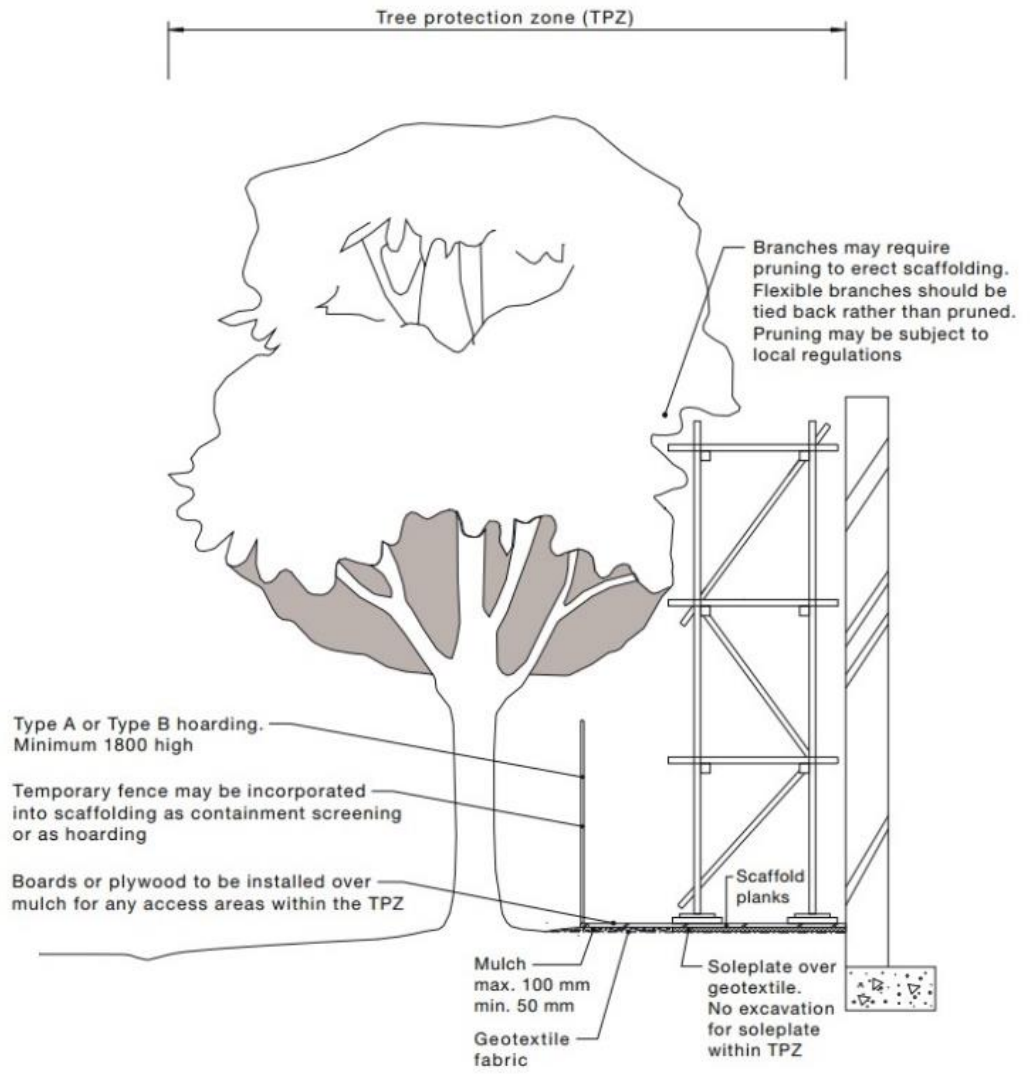
General

When a TPZ exclusion area cannot be established due to practical reasons or the area needs to be entered to undertake construction activities then additional tree protection measures may need to be adopted. Protection measures should be compliant with AS4970-2009 and approved by the Project Arborist

Installation of Scaffolding within Tree Protection Area.

Where scaffolding is required within the TPZ branch removal should be minimised. Any branch removal required should be approved by the Project Arborist and performed by a certified Arborist and performed in accordance with AS4373-2007. Approval to prune branches must be documented and maintained.

Ground below scaffold should be protected by boarding (e.g. scaffold board or plywood sheeting) as shown in Figure below. The boarding should be left in place until scaffolding is removed.



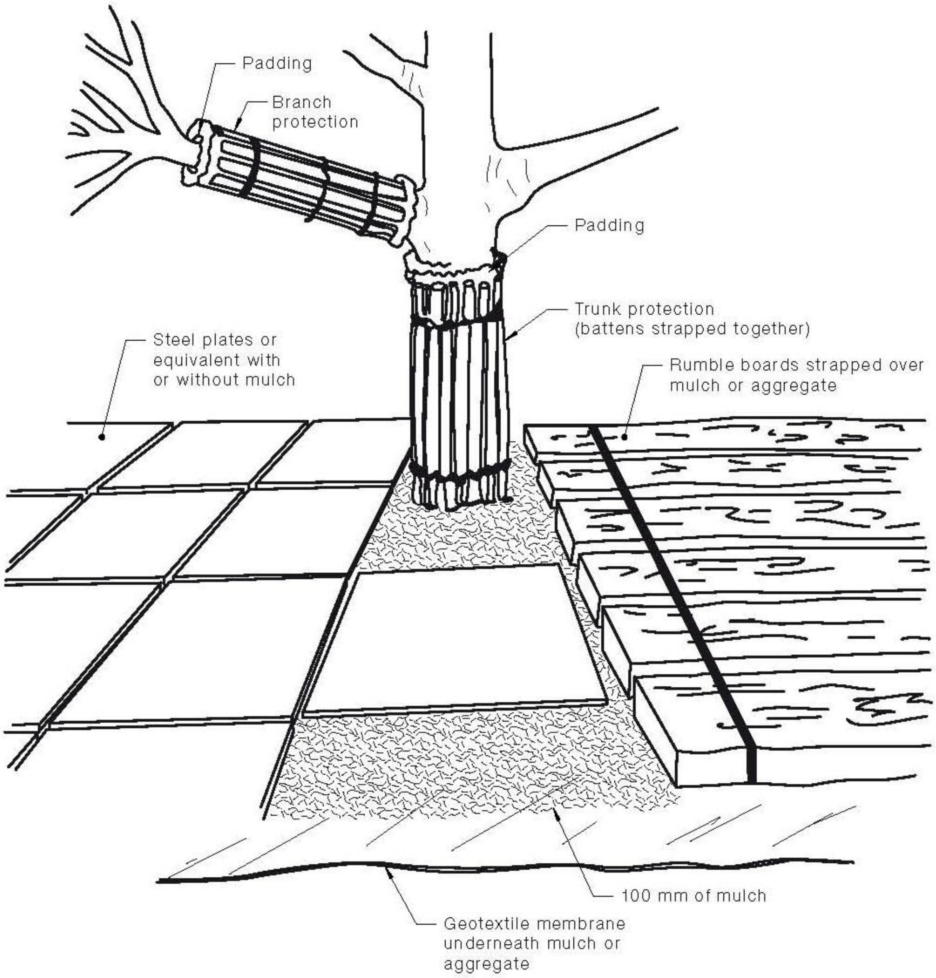
NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

Figure 2 – Showing scaffold constructed within TPZ.

Ground Protection

Where access is required within the TPZ ground protection measures are required. Ground protection is to be designed to prevent both damage to the roots and soil compaction.

Ground protection methods include the placement of a permeable membrane beneath a layer of non-compactable material such as mulch or a no fines gravel which is in turn covered with rumble boards or steel plates.



NOTES:

1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.

2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

Figure 3 – Ground protection methods.

Document Source:

Diagrams in this document are sourced from AS4970-2009 Protection of trees on development sites*. Further information and guidelines are available in within that document.*

Paving Construction within a Tree Protection Zone
Paving within any Tree Protection Zone (TPZ) must be carried out above natural ground level unless it can be shown with non-destructive excavation (AirSpade® or similar) that no or insignificant root growth occupies the proposed construction area.

Due to the adverse effect filling over a Tree Protection Zone (TPZ) can have on tree health; alternative mediums other than soil must be used. Available alternative mediums include structural soils or the use of a cellular confinement system such as *Ecocell®*.

Ecocell®
Ecocell® systems are a cellular confinement system that can be filled with large particle sized gravels as a sub-base for paving systems to reduce compaction to the existing grade.

Site preparation

- Clearly outline to all contracting staff entering the site the purpose of the TPZ's and the contractors' responsibilities. No fence is to be moved and no person or machinery is to access the TPZ's without consent from the City of Unley and/or the Project Arborist.

- Fence off the unaffected area of the TPZ with a temporary fence leaving a 1.5 metre gap between the work area and the fence; this will prevent machinery access to the remaining root zone.

Installation of Ecocell® and EcoTrihex Paving®

- Install a non-woven geotextile fabric for drainage and separation from sub base with a minimum of 600mm overlap on all fabric seams as required.

- Add Ecocell®, fill compartments with gravel and compact to desired compaction rate.

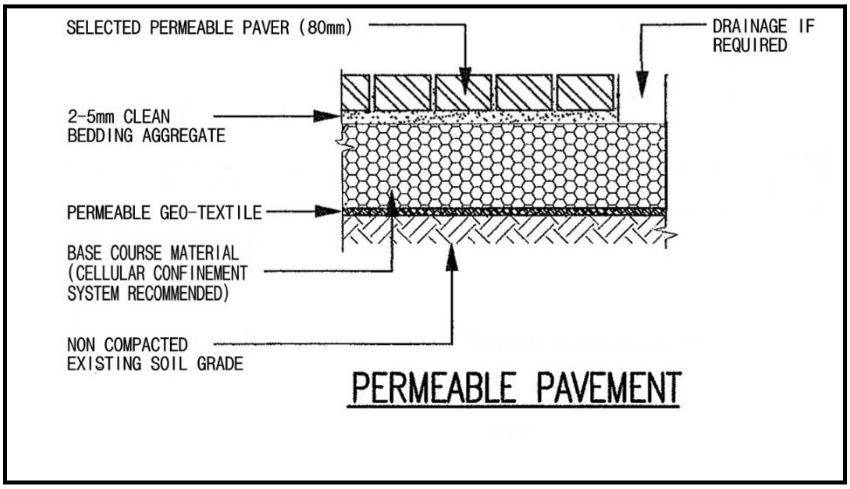
- If excessive groundwater is expected incorporate an appropriate drainage system within the bedding sand level.

- Add paving sand to required depth and compact to paving manufacturer's specifications.

- Lay EcoTrihex Paving® as per manufactures specifications and fill gaps between pavers with no fines gravel.

- Remove all debris, vegetation cover and unacceptable in-situ soils. No excavation or soil level change of the sub base is allowable for the installation of the paving.

- Where the finished soil level is uneven, gullies shall be filled with 20 millimetre coarse gravel to achieve the desired level.



This construction method if implemented correctly can significantly reduce and potentially eliminated the risk of tree decline and/or structural failure and effectively increase the size of the Tree Protection Zone to include the area of the paving.

Certificates of Control

Stage in development	Tree management process	
	Matters for consideration	**Actions and certification**
Development submission	Identify trees for retention through comprehensive arboricultural impact assessment of proposed construction. Determine tree protection measures Landscape design	Provide arboricultural impact assessment including tree protection plan (drawing) and specification
Development approval	Development controls Conditions of consent	Review consent conditions relating to trees
Pre-construction (Sections 4 and 5)		
Initial site preparation	State based OHS requirements for tree work Approved retention/removal Refer to AS 4373 for the requirements on the pruning of amenity trees Specifications for tree protection measures	Compliance with conditions of consent Tree removal/tree retention/transplanting Tree pruning Certification of tree removal and pruning Establish/delineate TPZ Install protective measures Certification of tree protection measures
Construction (Sections 4 and 5)		
Site establishment	Temporary infrastructure Demolition, bulk earthworks, hydrology	Locate temporary infrastructure to minimize impact on retained trees Maintain protective measures Certification of tree protection measures
Construction work	Liaison with site manager, compliance Deviation from approved plan	Maintain or amend protective measures Supervision and monitoring
Implement hard and soft landscape works	Installation of irrigation services Control of compaction work Installation of pavement and retaining walls	Remove selected protective measures as necessary Remedial tree works Supervision and monitoring
Practical completion	Tree vigour and structure	Remove all remaining tree protection measures Certification of tree protection
Post construction (Section 5)		
Defects liability/ maintenance period	Tree vigour and structure	Maintenance and monitoring Final remedial tree works Final certification of tree condition

Document Source:
This table has been sourced from AS4970-2009 Protection of trees on development sites. *Further information and guidelines are available in within that document.*

Tree Protection Zone

NO ACCESS

Contact: Arborman Tree Solutions

Ph. 8240 5555
m: 0418 812 967
e: arborman@arborman.com.au

arborman® tree solutions
PROFESSIONALS IN ARBORICULTURE

Appendix 2: Stormwater Management Plan

20181148L001A_Biogass Development Stormwater Management Plan

10 September 2018

Biogass Renewables Pty Ltd
Level 5, Tower 2, 121 King William Street
Adelaide SA, 5000

Attention: Martyn Anderson

BIOGASS DEVELOPMENT STORMWATER MANAGEMENT PLAN

As requested, we have undertaken an assessment of the proposed facility and have prepared the following Stormwater Management Plan (SMP).

Background

Biogass Renewables is proposing to develop a new facility at Gidgie Court, Edinburgh. The site is currently vacant land and lies within the City of Salisbury (Council) local government area. In order to obtain development approval, a SMP must be submitted to Council. The site will consist of a bunded area for tank storage, new buildings and a wastewater treatment plant (WWTP) for the treatment of process water and stormwater.

Requirements

The following Council and Salisbury Water requirements are to be considered:

Council

- Detention of runoff such that the post-development flow rate leaving the site does not exceed the pre-development flow rate, in order to prevent increase in flood risk downstream.
- Management of external flows.
- Water quality to meet state-wide objectives (DEWNR[1]), as shown in Table 1.1.

Table 1.1 DEWNR Stormwater Performance Targets

Pollutant	Current best practice performance targets
Total suspended solids (SS)	80% reduction of the untreated urban annual load
Total phosphorus (TP)	60% reduction of the untreated urban annual load
Total nitrogen (TN)	45% reduction of the untreated urban annual load
Litter	90% reduction of the untreated urban annual load
Flows	Maintain discharges to within the capacity of the existing receiving stormwater infrastructure

Salisbury Water

- Maximum flow rate into the Salisbury Water network on Woomera Road of 25 L/s.
- Water quality to meet managed aquifer recharge (MAR) standards.

[1] Department of Environment, Water and Natural Resources (2013) ‘Water sensitive urban design’.

Site Operation

As part of the Biogass operations, process water and surface runoff will be treated in the WWTP. The rate of flow through the WWTP is 400 m^3/day operating 24 hours per day, 7 days per week. This equates to approximately 4.7 L/s which will mostly be reused within the plant.

Any treated water that is not reused within the plant will be pumped to the Salisbury Water distribution pipe on Woomera Avenue. Salisbury Water have indicated that they can receive a maximum rate of 25 L/s. This is the combined rate for waste water and stormwater inputs into the system, with a connection expected to be on Woomera Avenue. Process water will not be discharged into Council's stormwater network.

Stormwater will be falling on three catchment areas within the site: the bunded area housing various tanks, the roof area and the ground. It is recommended that:

- The bunded area is large enough to capture the full volume of the 1% annual exceedance probability (AEP) 24-hour rainfall event (equivalent to the 100-year average recurrence interval (ARI) event).
- The roof water is captured in tanks and is sent directly to the Salisbury Water distribution pipe in Woomera Avenue at a rate of 20 L/s.
- The surface water is captured in underground tanks and then sent to the WWTP at a maximum rate of 4.7 L/s. This assumes that the WWTP can be used solely for processing of stormwater during high storm periods.

This arrangement ensures a total flow to the distribution pipe of approximately 25 L/s, comprising a maximum flow of 5 L/s from the treatment plant and 20 L/s from the roof area.

Hydrological and Hydraulic Modelling

DRAINS, a hydrological and hydraulic software package, was used to size the various stormwater components for the development including storage tanks, detention tanks and pipe sizes. The parameters used in the model are:

Bunded area	6,913 m^2
Roof area	3,876 m^2
Surface area	11,910 m^2
Impervious % (surface area)	75.5%
Pervious % (surface area)	24.5%
Impervious depression storage	1 mm
Pervious depression storage (pre-development)	30 mm
Pervious depression storage (post-development)	45 mm
Continuing loss	3 mm/hr
Impervious time of concentration	5 min
Pervious time of concentration	20 min

Stormwater Management Plan

The SMP has been prepared such that the receiving drainage systems are protected from potential site contaminants, sediments and an increase in runoff volumes. Each of the three catchments are being managed differently as outlined below and illustrated on the SMP attached to the end of this letter.

Bunded Area

The bunded area is likely to be contaminated with suspended solids, hydrocarbons and other pollutants from the plant equipment. Therefore, no stormwater is to overflow from the bunded area and spill towards Council's drainage system untreated. It is recommended that stormwater up to and including the 1% AEP 24-hour event is retained within the bunded area. The stormwater is to be held within this area until such time that it can be processed through the onsite WWTP.

The DRAINS model indicates that the total volume of stormwater runoff within the bunded area for a 1% AEP 24-hour event is 720 m^3. Based on the site layout drawings and tank sizes provided by Biogass, this results in a flood depth of approximately 220 mm. Biogass will need to ensure that infrastructure within the bunded area is protected from stormwater flooding. As such, any critical infrastructure should be set with a floor level at least 300 mm above this flood depth.

The EPA[2] requires the bund volume to be large enough to contain 120% of the volume of the largest tank. Given the large volume of the proposed tanks, the relatively small stormwater volume within the bunded area will not be the determining factor of the bund height.

All stormwater falling within the bunded area is to be treated through the WWTP, before being reused within the plant or pumped to the Salisbury Water distribution pipe. This can be achieved using a sump pump system. It is recommended that at least two pumps are installed within the stormwater sump, with a combined flow rate of 4.7 L/s. Only one pump will be necessary for everyday small flows, with both pumps in operation for larger flows. The pumps should operate alternatively between storm events so that they are both regularly used and the risk of pump failure is minimised.

The time required to pump 720 m^3 of stormwater at a rate of 4.7 L/s is in the order of 42 hours. Therefore, during major storm events the WWTP should be used solely for the processing of stormwater with usual process water bypassing the WWTP.

Roof Runoff

Stormwater from buildings is considered ‘clean’. Salisbury Water has confirmed it will accept uncontaminated water directly from the roofing area. As such, it has been assumed in the calculations that roof runoff won’t be processed through the WWTP.

Roof water can be directed to rainwater tanks for use within the operation of the plant or other non-potable uses if needed. The minimum size of rainwater tanks is 1,000 L, however Biogass will need to determine the tank size that is required for their purposes.

Additional tanks will be needed to store excess roof runoff whilst it is pumped to the Salisbury Water distribution pipe. It is recommended that these tanks are sized to hold up to the 1 exceedance per year (EY) event (equivalent to the 1-year ARI event), with a maximum pump outflow rate of 20 L/s. This arrangement is expected to capture most rainfall events for supply to the Salisbury Water network and therefore a larger system is not considered practicable.

The DRAINS model indicates that a tank with a capacity of 10 kL and a two stage pump arrangement would allow all events up to the 1 EY event to be pumped to the Salisbury Water distribution pipe. This could be a single tank with diameter of 2.5 m and height of 2 m, or multiple tanks in series providing the same volume. It is recommended that two pumps are installed in the tank which can operate independently or together depending on the incoming runoff volume. The pumps should operate alternatively between storm events so that they are both regularly used and the risk of pump failure is minimised.

Events exceeding the 1 EY event are to overflow to an underground detention tank (see Surface Runoff section below).

The size of this storage tank is flexible depending on Biogass’ operations. If the tank size is changed or eliminated, then the detention tank volume will need to be reviewed. This can be finalised during the detailed design stage.

We have assumed that the capacity within the Salisbury Water distribution main won’t be reduced due to low demand during the wet season.

Surface Runoff

Stormwater runoff from the ground is to be directed to an underground storage tank where the excess volume is stored until such time that it can be processed through the WWTP. It is recommended that

[2] Environment Protection Authority South Australia (2016) ‘Bunding and spill management’, EPA 080/16.

primary treatment devices consisting of a gross pollutant trap (GPT) and oil/grit separator be installed, allowing surface runoff to be treated prior to discharge into the underground tank.

The storage tank has been sized assuming that the runoff volume from a 1 EY event can be processed through the plant at a rate of 4.7 L/s. The DRAINS model indicates that a tank with a capacity of 125 kL would be required for storage of surface runoff for the 1 EY event. Pumping of water from the surface runoff storage tank should be prioritised over pumping of water from the sump pump within the bunded area.

The size of this storage tank is flexible depending on Biogass' operations. If the tank size is changed or eliminated, then the detention tank volume will need to be reviewed. This can be finalised during the detailed design stage.

Events larger than the 1 EY are to overflow to the same underground detention tank that the excess water from the roof area will overflow to.

Detention System

It is a Council requirement that the peak outflows from the site do not exceed the current (undeveloped) peak flow leaving the site for up to and including the 1% AEP event.

The DRAINS model indicates that a 140kL tank with an outflow pipe size of 300 mm would be required to meet Council requirements. The post-development flow rate leaving the site is 189 L/s, which is less than the pre-development flow rate of 246 L/s.

Outflows from the detention tank will join the existing Council stormwater drain (1,050 mm diameter) along Woomera Avenue. Outflows will not go through a treatment process, other than the initial GPT and oil/grit separator. However, it is anticipated that overflow is likely to occur only in events greater than the 1EY. Typically, stormwater treatment devices are designed for low flow events with larger storm events bypassing directly to the underground pipe or road. Therefore, the layout proposed in this SMP is aligned with general stormwater treatment practices.

Pipe Network

Council requires that the internal pipe network is sized to manage the 10% AEP event. In order to satisfy this criterion, the following pipe sizes are required:

- 300 mm diameter pipe for the overflow pipe from the roof runoff storage tank, discharging into the detention tank.
- 525 mm diameter pipe for the overflow pipe from the surface runoff storage tank, discharging into the detention tank.
- 300 mm diameter pipe for the outlet from the detention tank, discharging into Council's stormwater drain. The Data SA database shows that the invert of the Council drain is approximately 22.24 mAHD. The invert of the outlet pipe should be set at least 50 mm above this level.

External Flows

An assessment of regional flow paths has confirmed that the site will not be subject to flooding from external flows in a 1% AEP event.

Alternative SMP

If Biogass estimates that the construction of the surface runoff storage tanks and the processing costs are uneconomical, an alternative SMP may be adopted, as outlined below:

- Use the 'clean' roof water within the plant or pump to Salisbury Water network with any excess directed to the underground detention tank.
- Direct the surface runoff to a stormwater treatment train which will be sized to comply with state-wide water quality targets.
- Overflows from the treatment train will be directed to the underground detention tank. The detention tank will be sized to meet Council's discharge requirements.

Utilising a treatment train of water quality improvement devices will eliminate the need for Biogass to treat stormwater through the WWTP.

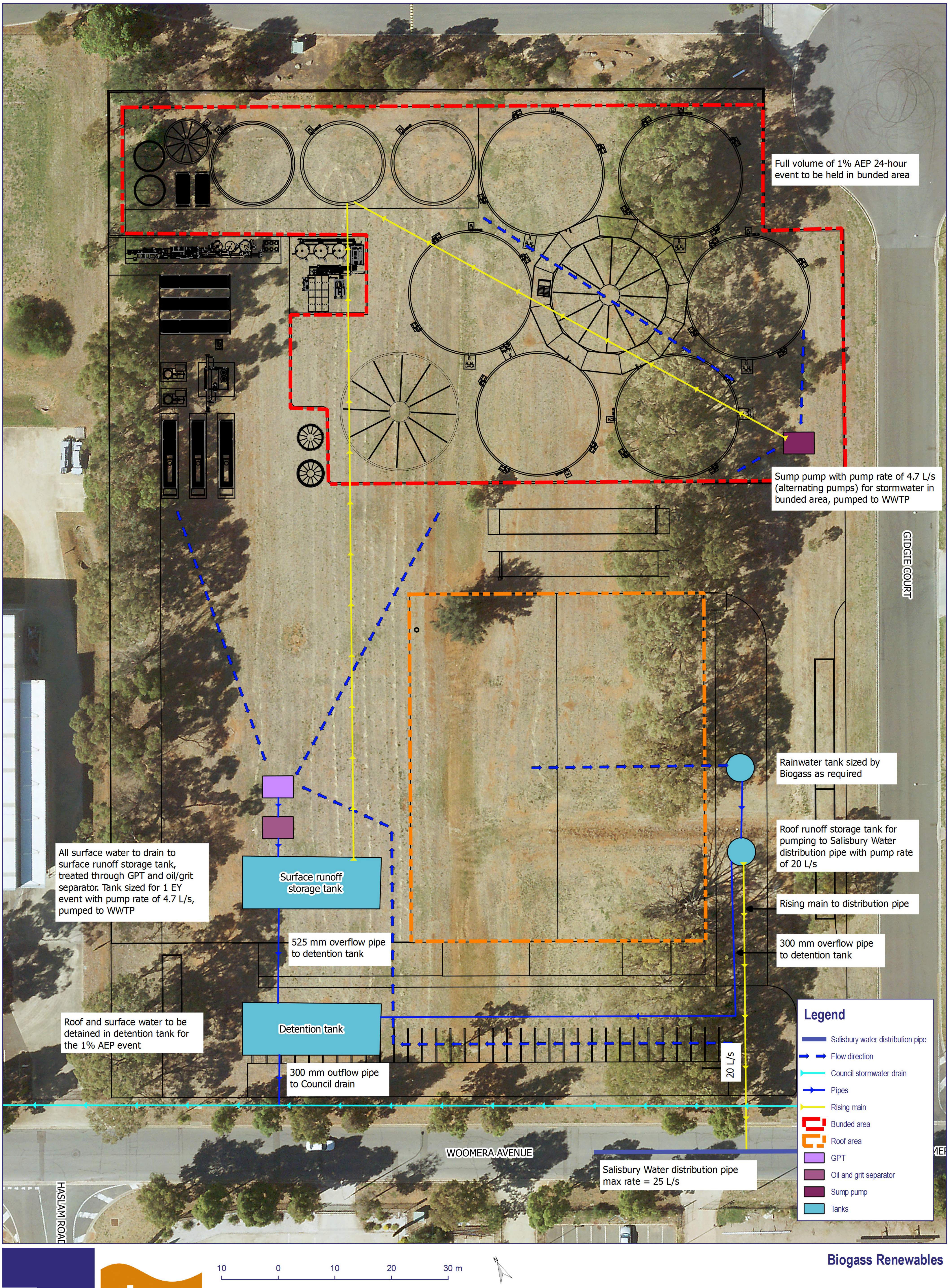
If you have any queries about the above, please contact Samantha West on 8273 3100.

Yours faithfully
TONKIN CONSULTING

S. West

SJ West
Project Leader

Enc Figure 1 – Stormwater management plan schematic
Flood risk statement



Job Number: 20181148
Filename: 20181148GQ001
Revision: REV A
Date: 2018-09-10
Drawn: Michael McEvoy

Data Acknowledgement:
Aerial imagery from MetroMap, 2017
Roads layer from Data SA, 2018
Site layout from Biogass Renewables, 2018

Biogass Renewables

RENEWABLE ENERGY FACILITY
STORMWATER MANAGEMENT PLAN

Figure 1

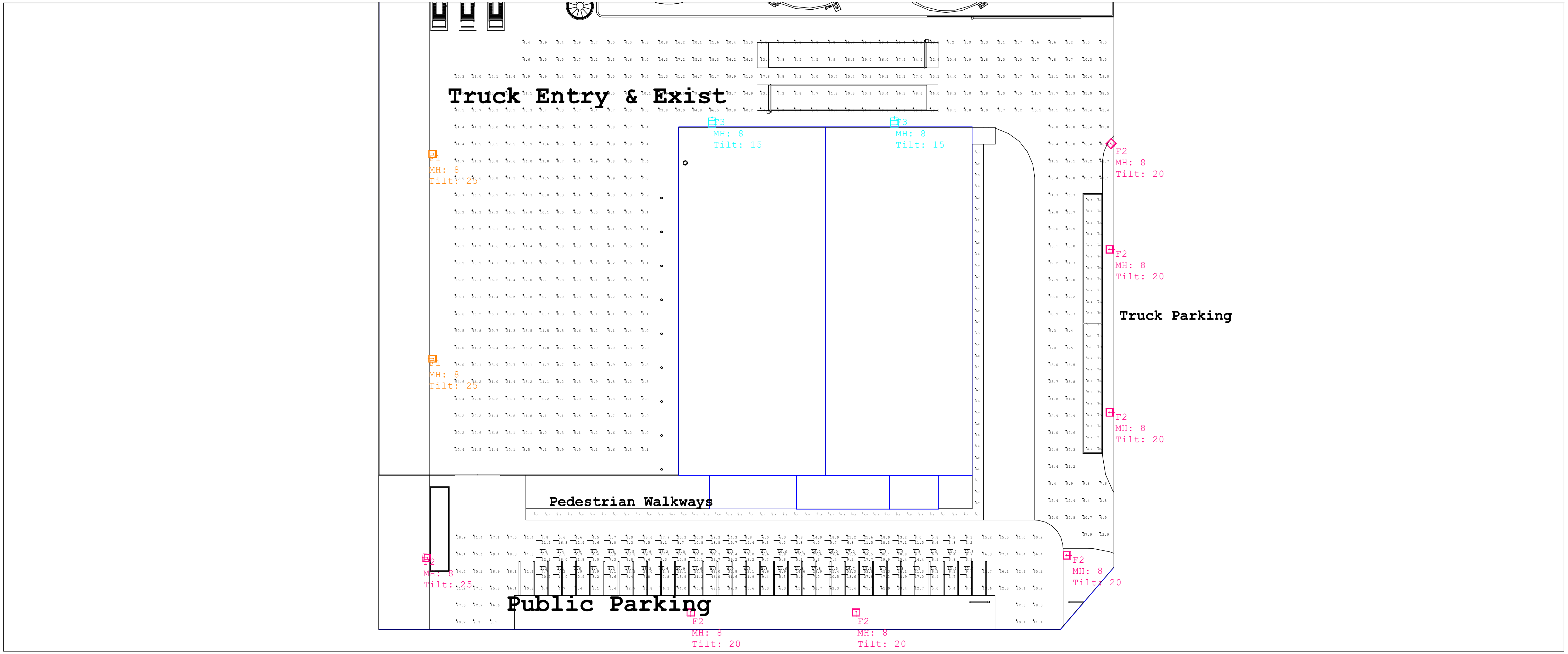
Flood Risk Statement

This statement forms part of, and is to be read in conjunction with, all flood reports and flood related data provided by Tonkin Consulting. Use of the flood reports and flood related data is conditional upon acceptance of this statement.

1. Flood risk is conventionally expressed in terms of Average Recurrence Interval which is the average or expected value of the period between exceedances of a given flood. For example, a flood with an average recurrence interval of 100 years:
   – is expected to be exceeded on average once in 100 years – a 1% probability of being exceeded in any given year
   – is expected to be exceeded at random - at a time which may be within any year of the 100 year interval, or not within the 100 year interval, or it may occur more than once in the 100 year interval.
2. The risk of inundation by flood is not eliminated, when the protection is based on specific Average Recurrence Interval criteria as exceedance of a flood of a specific Average Recurrence Interval is statistically inevitable.
3. Whilst care is taken to maximise the confidence in the predicability of flood risk, a degree of uncertainty is unavoidable.
4. Variations may occur, in the future, to the climate, catchment, watercourse or flood plain which could vary the flood risk.
5. The choice of the level of risk could consider, amongst others, the following factors:
   – likely damages and inconvenience
   – cost and time for replacement and repairs
   – type and use of the structure
   – access and safety during a flood
   – flood insurance cost and availability
   – intended life cycle of the structure
   – attitude of the owners of the structure to the acceptance of risk
   – the cost, practicality and environmental impact of reducing the risk further.
6. Denoted flood levels relate to predicted average water levels. FREEBOARD above a flood level, where noted, is an allowance for expected elevations of actual water levels, due to local disturbances, wave action and other causes, above the average water level, and is NOT A FACTOR OF SAFETY ALLOWANCE.
7. The flood report and data are the property of the client and the client shall determine and accept responsibility for the distribution of the report to others.

Further explanation of matters relating to flood risk is offered if required.

Appendix 3: Lighting Plan



View_1:Plan Rotated 0 Tilted 0
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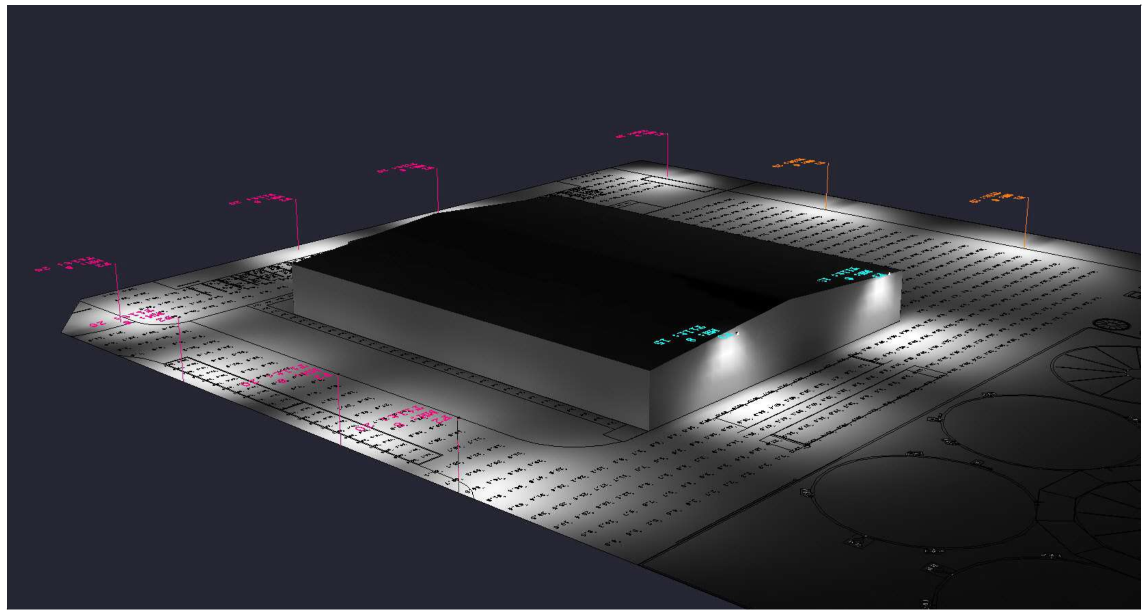
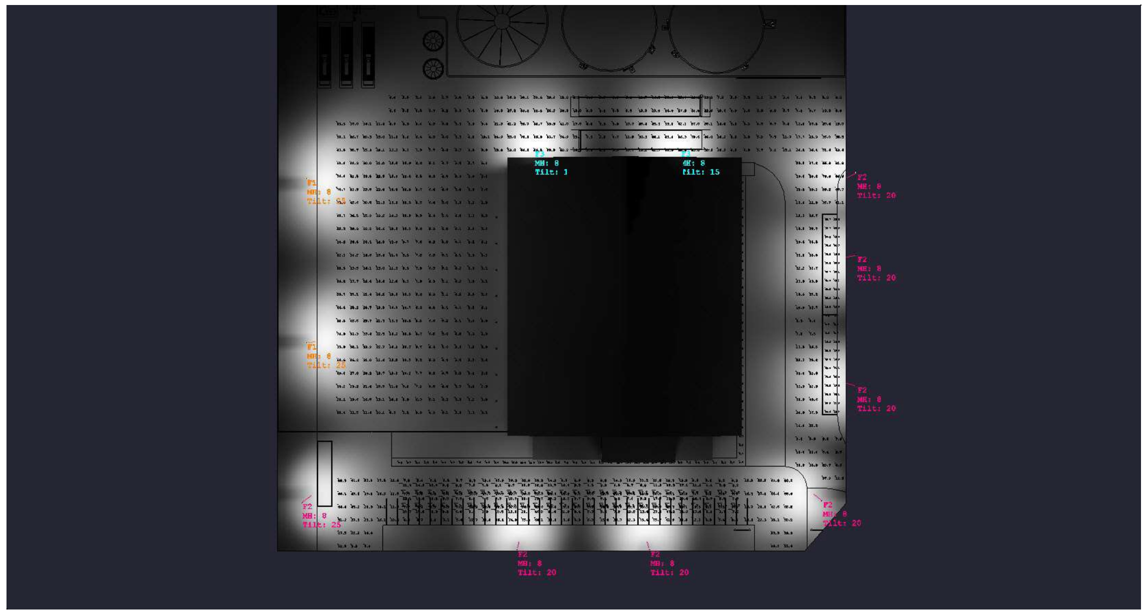
Luminaire Schedule							
Symbol	Qty	Label	Arrangement	Total Lamp Lumens	LLF	Description	Tag
	2	PARX300W-ASYM	SINGLE	N.A.	0.800	Haneco LED Floodlight 300W Pole Mounted	F1
	7	PARX200W-ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Pole Mounted	F2
	2	PARX200W ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Wall Mounted	F3

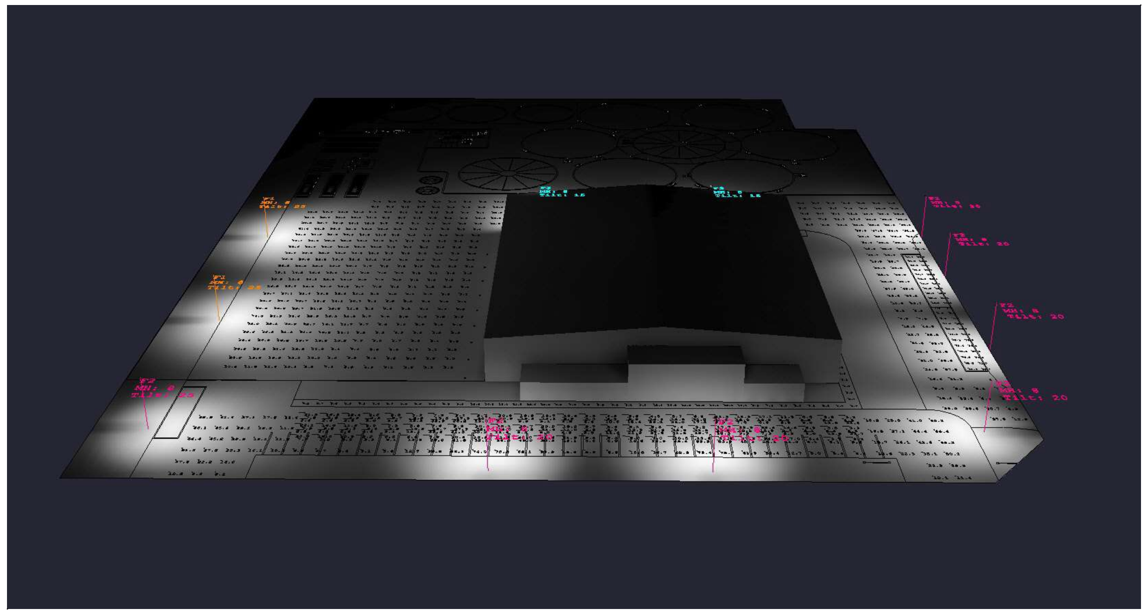
NOTE:
-THE LIGHTING LEVELS IN THIS CALCULATION WOULD ACHIEVE THE AUSTRALIAN STANDARDS
-AS/NZS 1158.3.1- CAT P11(b) PUBLIC CAR PARK AREAS
-AS/NZS 1158.3.1 CAT P1 FOR CARRIAGE AND ACCESS WAYS
-AS/NZS 1158.3.1 CAT P11(c) Truck Parking
- ALL CALCULATIONS ARE BASED ON NORMAL PARAMETERS AND WITH NO OBSTRUCTIONS.
- PHOTOMETRIC FILES SUPPLIED BY HANECO AND ITS SUPPORTING AGENTS.
- DESIGN SOFTWARE USED -AGI32.
- ANY CHANGES TO THE CALCULATION/PROJECT PARAMETERS WILL AFFECT THE FINAL ILLUMINATION LEVELS.
-CALCULATIONS ARE SUBJECT TO ACCURACIES AND TOLERANCES NOMINATED IN AS/NZS 3827.1:1998 AND 3827.2.1998.
THE LIGHT LOSS FACTOR (LLF) APPLIED TO THIS LIGHTING LAYOUT IS .80. A TYPICAL MAINTENANCE PROGRAM TO ACCOMMODATE THIS VALUE WOULD BE TO CLEAN AND INSPECT ALL LUMINAIRES EVERY 2 YEARS

HANECO
IDEAS THAT SHINE
262 Marion Rd
Netley, SA 5037
www.haneco.com.au
PH: 08 8297 6373

PROJECT: Food Energy WA			
SIZE A3	REFERENCE NUMBER 5756	DATE OF ISSUE 30/08/2018	REV
FILE: Food Energy WA.AGI			
DESIGNER: **Clarke Hu**			1







Luminaire Schedule							
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	7	PARX200W-ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Pole Mounted	F2
	2	PARX200W ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Wall Mounted	F3

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-AS/NZS 1158.3.1 CAT P11(c) Truck Parking

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PROJECT: **Food Energy WA**

SIZE	REFERENCE NUMBER	DATE OF ISSUE	REV
A3	5756	30/08/2018	

FILE: Food Energy WA.AGI

DESIGNER: **Clarke Hu**

Luminaire Schedule							
Symbol	Qty	Label	Arrangement	Total Lamp Lumens	LLF	Description	Tag
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	7	PARX200W-ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Pole Mounted	F2
	2	PARX200W ASYM	SINGLE	24402.6	0.800	Haneco LED Floodlight 200W Wall Mounted	F3

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Min/Avg	Min/Max
Pedestrian Walkways	Illuminance	Lux	7	14.5	2.9	N.A.	N.A.
Public Parking	Illuminance	Lux	24	75.8	3.1	N.A.	N.A.
Public Parking EV1	Illuminance	Lux	13	47.2	3.2	0.24	0.07
Public Parking EV2	Illuminance	Lux	14	41.6	2.2	0.16	0.05
Truck Entry & Exist	Illuminance	Lux	19	96.5	2.1	N.A.	N.A.
Truck Parking	Illuminance	Lux	50	87.8	3.0	N.A.	N.A.

Luminaire Location Summary						
LumNo	Label	X	Y	Z	Orient	Tilt
1093	PARX300W-ASYM	84.584	68.125	8	359.961	25
1097	PARX200W-ASYM	131.057	22.452	8	90	20
1098	PARX200W-ASYM	160.302	22.452	8	90	20
1100	PARX300W-ASYM	84.584	104.317	8	359.961	25
1102	PARX200W-ASYM	205.952	105.572	8	135.546	20
1103	PARX200W-ASYM	205.952	87.442	8	180	20
1104	PARX200W-ASYM	205.952	58.618	8	180	20
1105	PARX200W-ASYM	198.368	33.335	8	180	20
1106	PARX200W-ASYM	83.57	32.938	8	357.059	25
1107	PARX200W ASYM	134.825	110.708	8	90	15
1108	PARX200W ASYM	167.072	110.708	8	90	15


PARX Pole Mounted


PARX Wall Mounted

NOTE:
-THE LIGHTING LEVELS IN THIS CALCULATION WOULD ACHIEVE THE AUSTRALIAN STANDARDS
-AS/NZS 1158.3.1- CAT P11(b) PUBLIC CAR PARK AREAS
-AS/NZS 1158.3.1 CAT P1 FOR CARRIAGE AND ACCESS WAYS
-AS/NZS 1158.3.1 CAT P11(c) TRUCK PARKING AREAS
-AS4282 OBTRUSIVE LIGHTING HAS NOT BEEN ASSESSED OR IMPLIED AT THIS POINT.
- ALL CALCULATIONS ARE BASED ON NORMAL PARAMETERS AND WITH NO OBSTRUCTIONS.
- PHOTOMETRIC FILES SUPPLIED BY HANECO AND ITS SUPPORTING AGENTS.
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SIZE A3	REFERENCE NUMBER 5756	DATE OF ISSUE 30/08/2018	REV
FILE: Food Energy WA.AGI			
DESIGNER: Clarke Hu			3

Appendix 4: Preliminary Signage Template

DELOREAN
ENERGY

BIOGASS RENEWABLES

Proposed In-Vessel Waste-to-Energy Anaerobic Digestion Design Report

DELOREAN ENERGY SA ONE

125,000TPA Salisbury SA Facility - Phase 1

1-2 Gidgie Court, Edinburgh SA 5111

Date	Revision	Status	Prepared	Reviewed	Approved
10/06/2018	A	Final	MA	JO	HJ
14/09/2018	B	Final	MA	JO	HJ

DESIGN REPORT

Biogass Renewables

TABLE OF CONTENTS

Abbreviations and Acronyms

AD	Anaerobic Digestion
ADF	Anaerobic Digestion Facility
BOD	Biological Oxygen Demand
CHP	Combined Heat & Power
COD	Chemical Oxygen Demand
DS	Dry solids
EI&C	Electrical Installation & Control
OS	Organic Solids
PLC	Programmable Logic Controller
PU	Packaged Unit
SS	Suspended Solids

Units

TPA	tons per annum
TPW	tons per week
TPD	ton per day
t/hr	ton per hour
dm3	cubic decimeter (= 1 liter)
t/m3	ton per cubic meter
kg VS/m^3·day	kg Volatile Solids per cubic meter reactor volume per day.
m3/hr	cubic meter per hour
Nm3/hr	normal cubic meter per hour
MW	megawatt
MWhr	megawatt hour
MW(th)	megawatt thermal energy
MW(e)	megawatt electrical energy
GJ	gigajoule
ppm	parts per million
kg/hr	kilograms per hour
mbar	millibar
m3/m2*hr	cubic meter (air) per square meter surface area per hour

DESIGN REPORT

Biogass Renewables Pty Ltd

1. BACKGROUND

Biogass Renewables is an Australian energy company building mature-technology, site-specific anaerobic digestion facilities for the commercial, industrial, resources and government sectors in Australasia.

We integrate best-of-breed Australian, European and British componentry and design, delivered in the Australian context, using Australian know-how.

Biogass retains its own commercial, engineering and technical expertise in Australia, supported by a consortium of specialist European and British technology suppliers and technicians.

Biogass Renewables has successfully commissioned a 35,000-50,000 tonne per annum food waste capable of 2.4MW(e) 2.6MW(th) capacity bioenergy plant for Richgro at its principle metropolitan composting and manufacturing operations south of Perth in Western Australia.

Biogass Renewables operates a biogas potential testing laboratory enabling Biogass to sample and test prospective feedstocks to estimate biogas yields to assist in the design and feasibility for each new AD plant and also retains the in-house expertise to support the development of submissions for financial assistance.

Biogass Renewables is a member of the Australian Organics Recycling Association, Bioenergy Australia and the Waste Management Association of Australia.

The organic processing facility designed by Biogass Renewables, has been designed to meet bespoke design criteria, which will evolve through the design process.

The facility proposed is capable of processing up to 125,000TPA of expired industrial and commercial organic and agricultural waste, the facility utilises an option to include mechanical separation of contamination from the organic waste streams which has been designed to process up to 10% of contamination at the front end, installed within an enclosed negative pressure reception hall to meet the EPA requirements.

The reception building is designed to output a clean organic waste stream as the feedstock for a mesophilic biological anaerobic digestion process. The process breaks down the volatile organic matter in the feed sludge through a process of hydrolysation, pasteurisation, and then in-vessel biodigestion in the presence of methanogen bacteria. The methane forming bacteria convert the organic acids to methane gas, carbon dioxide and water, producing biogas at around 60 – 65% methane.

Biogas is cleaned with in the headspace of the digester through a chemical conversion of H2S and micro-dosing of air (O2) to give sulphate (SO4) and water (H2O), chilled through a biogas dryer and associated gas management equipment, before:

1) Upgrading to biomethane for a baseline of 22GJ/hr of gas energy; and
2) Boosting and combusting through three Combined Heat and Power Units (CHP) for up to 4.68MW electricity and 4.86MW thermal production. These are high-efficiency reciprocating engines for the production of electricity and heat to be utilised on site for the running of the plant before exporting surplus power into the local electricity grid.

The facility incorporates an enclosed compliant high-temperature flare which activates only if the generator is not operational, or excessive surplus biogas is generated.

In the biodigestion process, non-volatile solids (along with the few non-biodegradable organic solids) become digested sludge that is fed from the digester tanks into a digester outlet tank, ready to be separated into the solid and liquid fractions. The solid fraction is exported offsite by truck as a viable commercial biofertilizer product, whilst the liquid fraction is passed through an onsite wastewater treatment plant for clean-up to meet MAR standards. A proportion of the processed water is recirculated back into the anaerobic digestion system with the balance exported from the site to Salisbury Water for compliant usage or disposal within its network.

2. KEY OBJECTIVES

The objective of the design of this project is to build and operate a commercially viable anaerobic digestion facility in Salisbury, South Australia. This facility will be designed to:

- Accept and process up to 125,000TPA of trucked organic waste consisting of;
  - 100,00TPA of Commercial & Industrial (C&I) Organic Waste
  - 25,000TPA of Solid Agricultural Feedstock Waste
- Include an option for processing contaminated waste streams and pre-treating a broad range of wastes
- Be capable of producing a baseline of 2911m^3 of biogas per hour for use in generation of electricity and heat with the options to:
  - upgrade biogas to biomethane for injection into the gas mains.
  - Pipe biogas to nearby business customers in and adjacent to the Food Park to enable decentralised biogas-fuelled generation at various locations in the Food Park (each would require its own approval under this option)
- To supply the existing site operations with power and heat to meet the parasitic energy draw from the facility.
- Minimise odour
- Maximise re-use opportunities for digestate

The key design objectives for the project are:

- Achieving zero harm
- A facility with a high level of operability, maintainability and constructability; and
- No delays or additional cost on site due to design issues or errors;

The objectives of this Design Report are to:

- Detail how the design will be performed by the Contractor;
- Specify the policies and procedures applicable to the design which are to be used by the Project Design Team; and
- Assign responsibilities to key members of the Project Team.

3. DESIGN EXECUTION STRATEGY

The design will be completed in-house by Biogass, unless otherwise specified.

3.1. LOCATION

The proposed site location is:

Lot 505,1-2 Gidgie Court, Edinburgh, South Australia 5111

3.2. DESIGN WORKS

3.2.1.Concrete

The design of all concrete works including footings, bunding, storm water capture and drainage and ground slabs will incorporate steel fibre reinforcement. The steel fibre reinforcing reduces construction time whilst assisting in minimising thickness and shrinkage cracks in ground slabs. Correct sealing methods will be used to seal the tanks and ensure tank integrity. Where applicable, Strand7 a Finite Element Analysis program will be used to design the concrete and will be designed with the local civils contractor.

3.2.2.Structural

All structural design will be completed on the structural analysis package Space Gass or similar as well as internal programs and spreadsheets. Design shall be in accordance with relevant Australian standards and building codes and shall incorporate elements for ease of construction.

3.2.3.EI&C

To accelerate the project schedule preliminary electrical calculations, modelling and earth grid design will be completed for input into the grid connection submission at the start of the project. The remainder of deliverables will be completed in accordance with the project schedule when mature primary electrical data, equipment lists, and General Arrangements are completed.

3.3. REPORTING

A weekly design progress report will be produced for the Project Report which shall include as a minimum work pack progress, earned hours, hold ups and outstanding technical queries.

3.4. DESIGN SCHEDULE

The design schedule is included as a sub-section of the full project schedule. Progress of deliverables and associated works packs will be updated weekly to allow correct tracking to baseline.

4. QUALITY CONTROL

Quality assurance and control shall be in accordance with Biogass - ISO 9001 compliant Design Procedure. The following processes are included in the procedure and will ensure compliance with ISO 9001 requirements.

- Design Project Commencement Process
- Safety in Design Process
- 3D Model Development and Review
- Design Drawing Development and Review Process
- Design Document Development and Review Process
- Vendor and Sub-contractor Document Review Process
- Design Hold Process
- Design Change Process
- TQ/RFI Process
- Non-conformance Process
- Corrective Action Process
- Preventive Action Process
- Design Project Completion Process

5. PROCESS DESIGN

The process design has been broken out in to three sections:

- Reception Hall
- In-Vessel Anaerobic Digestion Process
- Gas Management and Power Utilities

5.1.1. Waste Reception Hall

Receival of solid organic and liquid feed material into an insulated circa 70x52m negative-pressure Shed

Solid and liquid organic input material is imported to site by truck. Trucks will pass through a weighbridge at the entrance to the site before entering an insulated Reception Hall through fast-closing doors.

Once inside the Reception Hall, solid material will be tipped into storage bays (each allowing for up to 800m3 of volume or two days' tipping capacity). At this point plant operators will have first sight of the input material and will be able to remove any large or problematic waste materials, before the materials are loaded into the process.

Liquid material is pumped directly into a 3,500m3 Digester Feed Tank from inside the Reception Hall, via two dedicated four-inch cam lock liquid inlet connection points. The liquid waste stream is piped through a filter system into the Feed Tank. The liquid connection area houses a bunded area which captures any spills from the truck pump-out process and pumps back in to the feed tank for capture.

The Reception Hall allows for 5 waste trucks to back in at any one time, with the reception building housing traffic lights to indicate which bay is free for the following waste truck to pull in to.

The design has allowed for 4 pre-processing units for removal of inert and plastic waste streams. The pre-processing units separates inert material from the organic fraction. Inert material is captured in outlet skips for subsequent disposal to landfill. The pre-processing units will be capable of processing up to 12-15T/hour. The solid fraction is diluted with recirculated process liquor ensuring a pumpable organic sludge output as per the attached mass balance (Appendix 1).

Solid agricultural waste streams

Solid agricultural waste streams are imported to site via truck from agricultural and farming regions within South Australia. The dry agricultural waste is input directly into 2 grain Silos on site using a pneumatic conveyor system. The pneumatic conveyor system utilises moving air within a "blowline" to transfer or "blow" agricultural waste from the delivery truck into the silos within fully contained pipework.

The Silos will have a total combined capacity of circa 200T of agricultural waste, allowing for at least 2 days storage on site. The Silos will be connected to a mixing system that will combine liquid and the agricultural waste into a pumpable slurry. The slurry is then pumped directly into the Digester Feed Tank.

Odour capture within the Reception Hall - Biofilter

The Reception Hall l is connected to an appropriately-sized biofilter and remains under a slight negative pressure to capture and extract all odours from within the building. Partitioning in the form of curtains will be incorporated into the design to separate the odour producing areas from the rest of the shed. The extraction and biofilter system is sized to deliver 4-5 air changes of the odour producing areas per hour. Extracted air is captured through an internal ducting system and passed through a biological air scrubber for removal and cleaning of odour. The biofilter medium is spongolite – a porous rock formed from fossilised sea sponge (similar to scoria medium which is widely used for biofiltration). The spongolite medium is maintained in an enclosed, humid environment allowing a habitat for odour-eating bacteria.

The biofilter will be located within the Reception Hall and will be designed with an exhaust stack, dispersing any exhaust into the air. The stack will extend upwards from the filter unit and penetrate through the Reception Hall roof into the open air. The exhaust stack will undergo emissions modelling where the final design will ensure compliance with emission and odour regulations.

Additionally, the Reception Hall will be fitted with fast-closing (30-second) doors so that tipping and pumping from trucks all takes place in a fully enclosed environment.

The Reception Hall construction includes cladding incorporating cool room-slab insulation to minimise the ambient temperature inside the Hall and to prevent premature decomposition before materials are processed.

Standing operating procedure is that all solid materials must be loaded into the plant process before close of business each day, with end of day washdown of the reception floor and bays to prevent potential for odorous materials laying overnight or accumulation on the floor.

5.1.2.Digester Feed Tank

The Digester Feed Tank (3,500m3) starts the first phase of digestion – the hydrolysis phase and is designed to hold the mechanically processed organic waste stream inputs at ambient temperature, allowing for storage of 5 days of accumulated input. The Digester Feed Tank is sized to dispense material into the process 7 days a week, allowing 365-day digester operation. This also allows for more storage capacity if the output process is not operational for a short period of time.

The digester feed tank is mixed by an in-tank agitator, ensuring a homogenous mix and keeping the solids in suspense ready for output to a pasteuriser - based on an input waste stream of up to 20% dry solid content.

All pumps are vortex centrifugal chopper pumps reducing particle size for greater surface area as well as processing a higher percentage of dry solids.

5.2.3 Pasteurisation Tanks

A volume of clean organic liquid feed is piped from the Digester Feed Tank on an hourly basis into a three-tank pasteurising system. The process is designed to meet PAS110 standards and can handle 22T/hour of wet feedstock. Heating of the pasteuriser is achieved by using surplus heat from the AD Plant co-generation units as per the attached mass balance (Appendix 1).

Within the three-tank pasteurisation process, the first operation is to fill and pre-heat up to 72°C, with the second phase holding at 70°C for a period of 1 hour. The third phase is emptying into the AD plant's main Digester Tanks. Each phase takes approximately 1 hour to complete, allowing for full pasteurisation to the European PAS110 standards within 3 hours. Holding each batch at over 72°C for 1 hour will ensure the pathogen log kill is reduced and stabilised before inputting into the Digester Tank.

In addition to pathogen kill, the pasteurisation process delivers efficiencies by enabling a shorter bioreactor retention time by thermal treating waste streams pre-digestion and can deliver a slightly higher breakdown and gas yield. This process will also assist in breaking down fats, grease and oils, by thermal treatment.

The process can be switched to pasteurise the outlet digestate instead of the input feedstock if required.

5.2.4 Anaerobic Digestion Process

The AD Plant is controlled from a Main Control Centre (MCC) located in a container next to the Reception Hall. Operation and control of the AD Plant process is provided by a programmable logic controller (PLC) in the MCC. Process status display and control parameters are monitored and adjusted via the MCC's human machine interface (HMI). The operation and adjustment of the HMI is by trained staff only. The MCC is connected to a SCADA system for remote system monitoring, operation, rectification and intervention if required.

Design of the 3500m3 Primary Digester Tanks

The primary anaerobic digestion process will take place inside six 3500m3 primary mesophilic 38°C digesters.

The Digesters are designed for a 30-day retention period, to maximise breakdown of different types of waste streams. Using a continuous feed process, proposed commercial and industrial organic waste streams which are generally low in fibre and high in sugars will break down in a mesophilic process within 15 days and is 95% exhausted of energy within 20 days from input.

The Digesters are designed to allow for removal of small floating plastics such as fruit labels, and other light floating organic fraction as well as any non-organic settled solids, such as small grit and glass, by way of a top and bottom capture exit point.

The Digesters process a set volume of blended feed every hour in a continuous diet feeding system. Based on a 30-day retention, each Digester will receive circa 5m3/hour.

The Digesters use an external mixing and heating / cooling system allowing for maintenance and repair of these systems from outside the tank without impacting Digester operation.

The external Digester mixing system has been designed to operate as follows:

- A directional mixing nozzle works by increasing the speed of the digestate at the bottom of the tank causing the contents to turn within the tank.
- A venturi mixing nozzle draws biogas from the roof space connection by creating a vacuum on the gas connection side, hydrolysing the digestate to improve gas yields and take off.

- A top mixing nozzle which enables the mixing of the tank's digestate through an actuated valve is utilised to break up any caking or crusting of the surface material.

The external heating system on the Digesters has been designed to operate as follows:

- The Digester tank has a heat exchanger built into one mixing configuration, which is used to maintain and raise the temperature within the Digester.
- Three (3) temperature-measuring points are located on the tank which monitors the sludge temperature and hot water temperature.
- If the sludge temperature drops below a set value, the hot water from the CHP will be directed to flow through the heat exchanger.
- The heating system is operational during normal operating process to ensure a constant linear heat transfer through the material ensuring a homogenous mixture within the digestate.

Operation of the 3000m3 Digester Discharge Tank

Spent digestate is passed from the Digesters into a Digester Discharge Tank for buffering pending separation and post-processing of the digestate.

The Digester discharge tank is fed hydrostatically from the Digester tanks. The digestate in this tank contains active bacteria that will decline due to lack of feed, however will still produce methane gas that is fed back to the primary Digester tanks' gas space. The spent digestate is actively mixed to ensure a constant blend of dry solids and liquid product. The mixed product is outputted to a centrifuge located in the Reception Hall on an 8 hours/day, 5 days per week basis. The digester outlet tank has enough capacity to store digestate for a period of time if the centrifuge is not operational.

5.2.5 Digestate Solid and Liquid Separation

Mixed digestate product is output from the outlet tank and piped into the Reception Hall where it is mechanically separated by centrifuge into liquid and solid fractions. The solid fraction is outputted at 30% dry solids (a spadeable material suitable as a bio-fertiliser) into a collection bay, with the liquid fraction piped into an adjacent wastewater treatment plant.

5.2.5 Waste Water Treatment Plant

Separated liquid wastewater (and storm water as required) will be diverted to a purpose-built waste water treatment plant for processing. The objective of the wastewater treatment plant is to process the wastewater to MAR standard. The liquid will go through a homogenization phase before being diverted into an anoxic reactor. The liquids will then be channelled into one of 2 aerobic reactors.

The liquid will then go through an ultrafiltration phase which produces a UF permeate. The Permeate is processed in a reverse osmosis unit, after which it is put back into the digestion process.

The system also utilises a reverse osmosis unit for the treating of UF permeate from the ultrafiltration units.

Post processing, a proportion of the MAR-compliant wastewater will be recirculated back into the AD process, with the balance exported from site by connection to Salisbury Water's pipe infrastructure for use or complaint disposal by Salisbury Water.

5.2.6 Gas Management and Power Utilities

Biogas generated within the Digesters is collected in the biodome headspace collecting circa 500m3 of biogas per Digester. Biogas from agricultural and food waste organics has the following general characteristics:

- 60-65% CH_4
- 35-40% CO_2
- Typically, a minute amount of H_2S up to 500ppm.

Design of Gas Offtake Lines

Digester biogas offtake lines are fed automatically from the gas levels within the primary Digester Tanks and the Discharge Tank. The pressure within the Digester Tank (and Discharge Tank) are monitored by the PLC but would not exceed circa 8 mbar, similar to the gas pressure of a household stove.

The offtake lines on the Digester Tanks will be monitored by the MCC system to ensure that the gas flow is maintained at correct pressure and humidity content to either activate the Flare or CHP. From the offtake point, biogas is processed as follows:

- The offtake lines will direct the gas into a dehumidifier to reduce the liquid content of the gas. The recovered liquid is recirculated back into the digestion system.
- The flow of gas from the primary digester tank to the off-take lines is at a normal operating rate when the gas reaches a pressure of 7 to 8 mbar.
- The offtake lines will direct the gas to a gas booster system, where the pressure of the gas will be increased from 8 mbar to 110 mbar to fuel the biogas CHP units, or for activation of the enclosed high-temperature Flare if required.

Biomethane Upgrade

The design incorporates a biomethane upgrade process to convert biogas (65% methane) to mains-grade biomethane (97% methane) equivalent to natural gas.

A gas upgrade system will remove carbon dioxide, hydrogen sulphide, water and other contaminants from the biogas. The purification process removes contaminants from the raw biogas stream - these being absorbed or scrubbed leaving more methane per unit volume of gas.

The biogas will be consumed at a maximum rate up to 2000m^3/hr which can convert the gas to approximately 1020m^3/hr of biomethane. During regular operation however, with the CHP units in use, the gas unit is expected to consume approximately 1,100m^3/hr of biogas and produce 570m^3/hr of biomethane. The expected energy potential from the biomethane produced will be approximately 22GJ/hr

The biomethane will be injected into the local gas mains where it will be used by businesses and dwellings in the area connected to the mains.

Design of the Combined Heat & Power Unit (CHP)

As described, the Digesters are under a small positive pressure to allow the biogas to flow out of the Digester to the gas management skid, with the dry biogas then boosted up to the operation pressure – 110mbar/10KPA for consumption within three 1.56MWe Combined Heat and Power (CHP) reciprocating units. At 60-65% CH4 the generators will each combust a maximum of 600m3/hour of biogas producing 1,560kWe and 1,620kWth – 95 °C hot water, giving a maximum electrical efficiency of 43%, and a thermal efficiency of 44% capturing the exhaust gas hot water circuit for full thermal efficiency.

The CHP Unit is designed for biogas, allowing for a high tolerance of H2S as required.

The CHP unit is operational when biogas is produced by the digesters. The engines are designed to run on biogas at between 50-100% capacity or 780-1,560kW.

The biodome gas bag levels within each Digester are measured to set the load rate of the engines. If the gas bag level is increasing in volume, the engine load signal is increased to match the gas production. Alternatively, the gas bags can be used as storage to meet the grid network peak loads to capitalise on the export of power during peak intervals.

Design of H2S Removal and Gas Clean Up

H2S clean up within the biogas is managed by a chemical conversion - adding a micro-dose of air in to the head space of each Digester to give H2S + O2 = SO4 + H2O, which enables the SO4 – sulphate to drop out into the digestate for removal.

Design of High Temperature Enclosed Flare

Being a biological process continuously breaking down volatile matter, the process generates biogas at all times. If the AD plant's power generation engines are not in operation, two emergency High Temperature Enclosed flares will operate automatically to safely combust the surplus biogas.

The High Temperature Enclosed Flares are designed to burn at 1000 °C at a combined total flow rate up to 4000m3/hour to ensure a safe site can be maintained without any venting to the atmosphere. The Flare is designed to combust the excess biogas produced under a controlled safe system. At 1000 °C the Flare will eliminate any potential airborne pathogens from the biogas ensuring a 100% combusted biogas to carbon release to atmosphere.

The Flare activates automatically when Digester gas pressure reaches a defined level set just below the pressure relief valve set point.

The Flare will be monitored by the AD Supervisor to ensure that the automatic operation of flare ignition is maintained when the CHP unit is not operating.

5.2. SITE OFFICE AND FACILITY RECEPTION

The facility will be designed to show the site office and reception at the front of the site by the entry and exit ways to show an appealing "shop front" whilst shielding the operations and plant from public view.

The office layout will comprise of the following rooms:

- Ground Level
    - Reception area
    - Meeting room
    - Office room
    - Kitchen/Lunch room
    - Restrooms – Male, Female and Disabled
- Second Level
    - Observation/Education area

The Building will be constructed with full disabled access in mind, with ramps, large walkways and an elevator to travel between floors. A separate restroom will also be designed for the use of the disabled.

The office will be designed to Australian and council standards and will have all necessary features to deem it acceptable such as appropriate entries and exits (including emergency exits) and adequate exit signage.

6. BASIS OF DESIGN

6.1. Appearance

The facility will be designed to enhance the appearance of the localities and the wider area around Edinburgh. The design of the buildings will be consistent with buildings in the area and will be the first and foremost part of the site the public will view. The land immediately adjacent to the roads will be landscaped and maintained in a presentable manner

Multiple driveways will provide access into the facility site from both Woomera Avenue and Gidgie Court. Commercial Vehicles will use separate entrances and exits to allow safe access for the public.

Signage promoting the facility will be placed by the entrances of the site depicting the company logo of "DeLorean Energy" along with the facility name. The signage will be consistent with signage by others in the area and will comply with Council requirements.

6.2. DESIGN LIFE

6.2.1. Operational Design Life

With regular routine maintenance, the Facility has a 25-year design life period.

6.2.2. Structural Design Life

The infrastructure and concrete elements within the facility have been designed for a design life of 50 years. The structure is designed to safely withstand a 1/100-year storm.

6.3. PLANT PERSONNEL AND OPERATION SCHEDULE

The Plant will have personnel comprising of operators and office workers working in both the plant facility and office. The site will comprise of the following personnel:

- 1 x Plant Manager
- 4 x Plant Operators
- 1 x Receptionist
- 2 x Office staff.

The plant has a proposed front-end processing operational schedule of 5 days a week, 7AM – 5PM, with all personnel working to these time requirements. The anaerobic and generation process is will be running 24 hours a day, 7 days a week.

6.4. DESIGN REDUNDANCY

The steel structures will offer design redundancy by providing multiple load paths, either through bracing systems or utilising the steel-concrete interface. Utilising an integrated footing system in the shed means there is a larger distribution stress, which manifests as further design redundancy.

The facility process design offers redundancy to ensure the total volume of waste, facility design – 125,000TPA can be processed within the operational time for standard operations.

6.5. *SITE LAYOUT*

The facility will have multiple entry points for both public and commercial use. There will be multiple driveways into the facility from both Woomera Avenue and Gidgie Court for convenience and ease. Commercial Vehicles will use separate entrances and exits to the public to allow safe access for employees and the public alike.

The car park will span along Woomera Avenue and Gidgie Court, with space available for parking consistent with Council requirements and more than enough to service both employees and the public. The delineation of the parking and traffic direction will be applied to current Australian standards and will comply with council requirements.

6.5.1. Public and Pedestrian Access

From the car park, there is a designated path to a site office and welfare facilities. There is also a potential to install a viewing room to the reception Hall for educational purposes. Visitors will be able to see the operations with appropriate supervision in designated viewing areas on site. For safety and to prevent interference with the process, the viewing areas will be demarcated with guard railing, compliant to AS 1657. An elevated viewing platform will be included, also equipped with the appropriate safety apparatus to observe the facility operations.

6.5.2. Road Layout

Access roads will be sealed bitumen road with crushed rock base course and select fill sub-base. The road layout has been designed to allow for minimum interference between incoming and outgoing vehicles. The area in front of the shed provides adequate room to manoeuvre a truck or heavy vehicle. The car park is situated away from the loading point to eliminate the interface between visitors and loading vehicles. The waste will be delivered inside the Reception Hall directly into bunkers which can be used as an area for stockpiling two days of waste.

6.5.3. Traffic Management

Traffic is split into two categories:

- Light Vehicles (e.g. personnel and visitors)

- Heavy Vehicles (e.g. dump trucks, tankers, road trains).

Light Vehicles will enter the site through either of the two entrance ways provided on Woomera Avenue with parking located running along Woomera Avenue. Vehicles can then choose to exit from either of the same entrances on Woomera Avenue or, in the unlikely event of obstructions, the Heavy Vehicle entrance on Gidgie Court.

Heavy Vehicles will enter the site on the entrance way provided on Gidgie Court. Trucks will stop on the weighbridge before entering the industrial area of the site. From here, trucks will have ample room to manoeuvre and position themselves to offload material.

Once material has been offloaded, Vehicles will proceed to a second weighbridge prior to the exit on Gidgie Court. Once weighed in, the truck will exit onto Gidgie Court. The layout of the site has been designed to avoid collisions through the reduction of intersecting paths and separate entry and exit ways.

As many as 50 Trucks are expected to visit the facility every day once the site is in full operation, resulting in approximately 5 trucks every hour. The Facility has been designed to cope with the influx of vehicles with the following measures:

- 4 x commercial and industrial solid food waste receival bays
- 3 x digestate trailer bays
- 1 x Liquid feedstock receival bay
- 1 x Agricultural waste intake bay

This assures that the plant can accept up to 9 trucks at any one time.

As stated in section 5.1.1, The Reception Hall will have traffic lights installed to indicate which bays are free and which are in use.

Heavy Vehicle parking is also supplied on the Gidgie Court side of the site to allow large vehicles to stop on site without impeding other vehicles in the event the weighbridge is engaged. A bus waiting bay is also included, opening the opportunity for educational tours for large groups such as schools and universities.

All vehicles will be able to travel in a forward motion when entering, exiting and navigating around the site. Refer to the attached Traffic Management Plan for more information.

Refer to Traffic Management Plan for more information

6.5.4. Signage

Adequate signage will be provided as per the requirements in the relevant Acts and Standards. Areas will be clearly marked with the appropriate signage for visitors and operators alike.

6.5.5. Tank Bunding

The plant is required to have capture capacity of 120% of the largest tank at all times resulting in a required 4,200m3 of capture volume. Bunding will be installed around the perimeter of the tank area which will be designed to capture any liquids and divert them to drainage points scattered around the site.

The bunded area will be completely sealed, allowing no liquids captured within the area to leach into the ground or surrounding environment. Refer to *Appendix 2: Lot 505 Preliminary Design Drawings for an illustration of the site with the bunded area.*

6.5.6. Drainage

The stormwater from the shed roof and surrounding site area will be diverted into sump areas on site. Stormwater will either be diverted into the on-site waste water treatment plant for further processing or exported to Salisbury Water for compliant usage or disposal within its network depending on the site requirements at the time and the water quality.

6.6. BUILDINGS AND TECHNICAL

The buildings and structures will be designed to adhere to Australian building standards and council standards. Structural layouts, with details of connection methods will be issued once the design has been finalised.

The building specification for the materials and workmanship will comply with the Salisbury Council Development Plan and Australian standards. A full schedule of materials, finishes, plant and equipment details will be provided to the council upon design finalisation.

Essential fire safety provisions will be adhered to in the final design.

Refer to Appendix 3 - Material and Colour Schedules for more information on building/structural materials.

6.7. EARTHWORK AND GROUND CONDITIONS

It is assumed that ground conditions at the site will be capable of sustaining a bearing pressure of 200kPa and CBR of 7% by utilising standard static compaction methods (i.e. without ground improvement). The site has also been assumed as being able to be excavated utilising traditional earthmoving equipment without drilling or blasting.

Two copies of calculations based on the footing report with an accredited engineers' recommendations and supporting structural computations will be supplied to comply with the development act and regulations once the design has been finalised.

6.7.1.Foundations

With the requirements set out above, the foundations for equipment, tanks and shed are one of the following:

- Pad/strip footings
- Raft footing
- Ground slab with integrated thickenings

No allowance for concrete or screw piles have been made as it is assumed that the ground conditions can be met.

6.7.1.Landscaping

The Site will be landscaped to match the aesthetic of the surrounding land and businesses in the area. The front of the business will be landscaped to promote an appealing image from public view whilst adhering to council requirements.

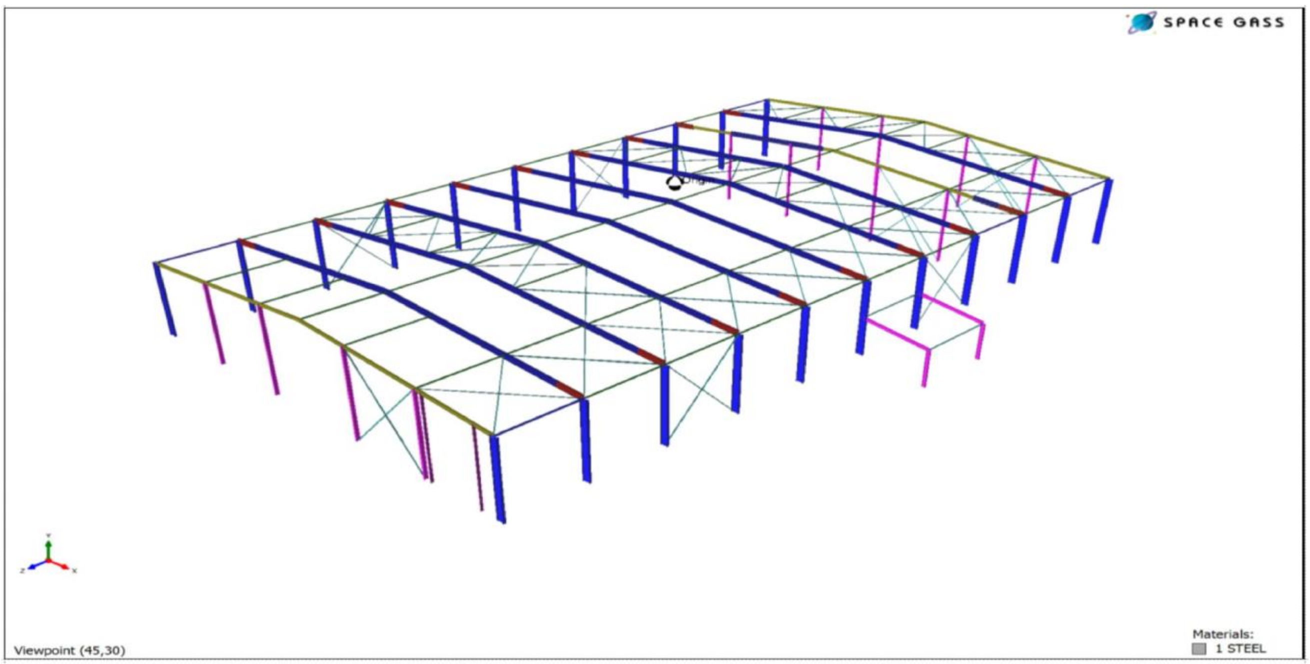
6.8. ORGANICS RECEPTION HALL

The organics Reception Hall makes up majority of the structural work. The shed is a steel portal frame building with Colorbond cladding and insulation. The concept designed focused on providing ample space to carry out the required process whilst also satisfying the following codes and Australian standards:

- Building Code of Australia
- AS/NZS 1170 – Structural Design Actions
- AS 4100:1998 – Steel Structures

- AS/NZS 4859.1:2002 – Materials for the thermal insulation of buildings
- AS/NZS 3500.3:2015 – Plumbing and Drainage

The dimensions of the shed are circa 70 x 52m. With 3m high bunkers in the inside of the building, there is more than 800 m3 storage capacity (equivalent to two days of waste). The bunker walls are equipped with cast in steel to prevent damage from the loader



6.8.1. Concrete Slab

The concrete slab is reinforced with steel fibres to increase the spacing of joints and streamline the construction process by eliminating the need to tie traditional reinforcement (rebar or mesh).

6.9. BOUNDARIES AND FENCING

Internal fencing around the perimeter of the site will be constructed and made to match internal fencing of other businesses in the area whilst adhering to council requirements. The fencing will be made from suitable materials able to withstand environmental factors

6.10. FIRE PROTECTION

An adequate quantity of hydrants, booster pumps and street fire plugs (if deemed necessary) will be included in the final design. Locations and quantities will adhere to council and Australian Standards.

6.11. COMMUNICATIONS

Site communications for remote access and package plant access will be either hard wired from the existing telecommunications on site to meet the network requirements.

7. SAFETY IN DESIGN

Safety in design will be completed in accordance with the relevant acts and standards. A risk register will be maintained to mitigate and control any risks identified before and throughout the design and construction phases.

Appendix 1: Mass Balance

Appendix 2: Lot 505 Preliminary Design Drawings

Appendix 3: Material and Colour Schedules

High Level Mass Balance

Project Name	**Delorean Energy**	**Document No:**	**P210-P100**
Project Number	**J116**	**Revision:**	**A**
Project Section	**Feedstock Analysis As Tested**	**Date:**	**10/06/2018**
		Compiled By:	**J Oliver**
		Checked By:	
		Approved By:	**H Jolly**

Design Basis

Waste Streams	Units	Grain Waste	C&I Organic Waste			ReCirc - Process Water
Annual Throughput	TPA	25,000	100,000			120,000
Weekly Throughput	TPW	480.77	1923.08			2,308
Daily Throughput	TPD	68	274			329
DM%	%	89%	28%			0.5%
VM%	%	93%	89%			90.0%
Density	Kg/m3	200	720			1000.0
Biogas Yield	m3/ tonne	420	150			0.5
Methane Content	%	60%	60%			60%
Volitile solids	vskg/T	828	179			4.50
Biogas Production /yr	m3 / year	10500000.00	15000000.00			60000.00
Biogas Production /hr	m3 / hour	1198.63	1712.33			6.85

Daily Load

Water input		**273.97**		
Water recyled		**328.77**		
Total water input		**602.74**	Dry Solids	20.8%
M3 Volume input / day	M3/day	**671.23**	Contaminant	0% *Assumed*
Tonnes of feedstock	tds/day	342.47		
Tonnes per hour - 8hours	tds/day	42.81	Water	79%

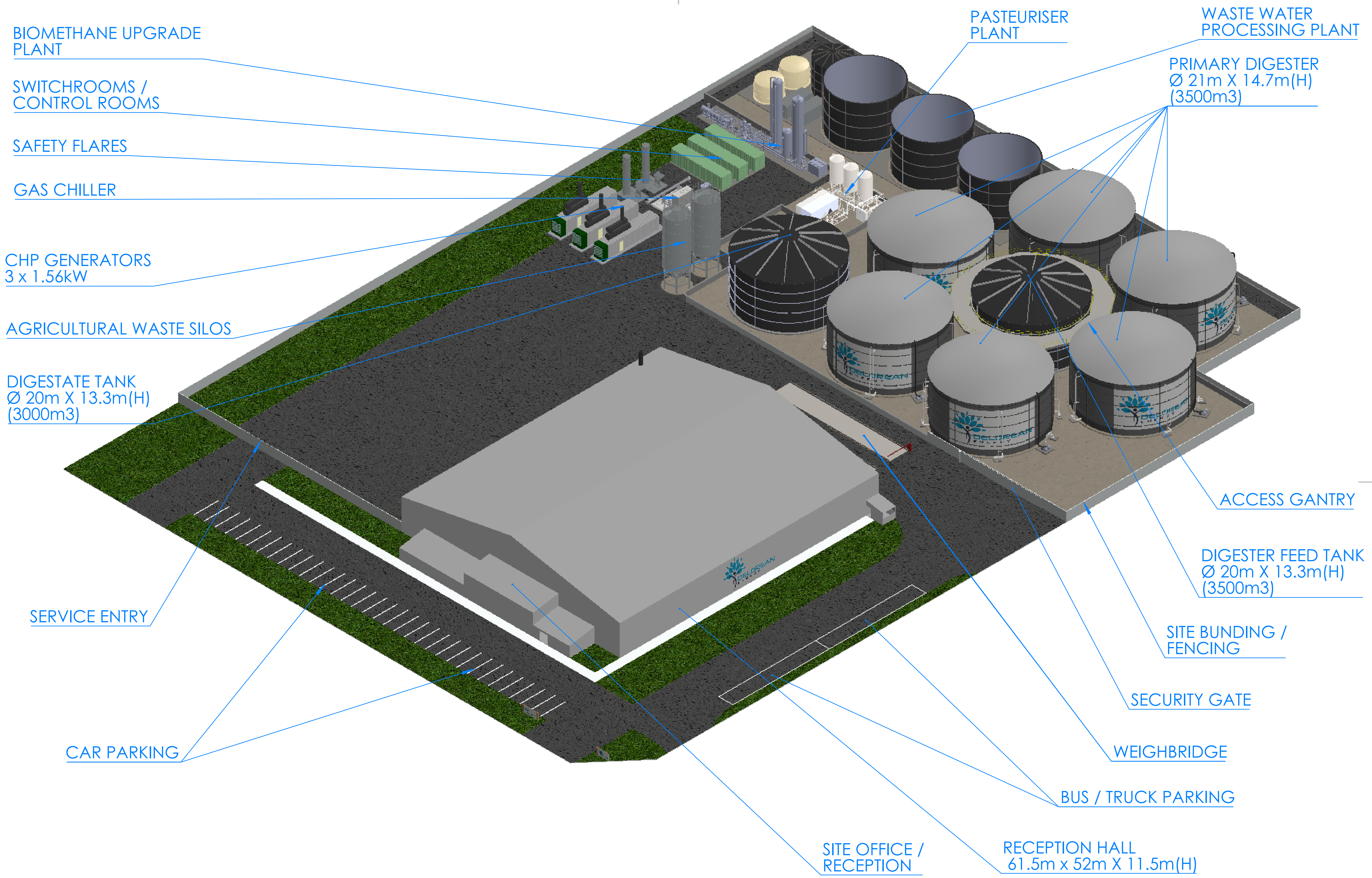
Blended Feed Characteristics

Operation

Days	Digestion	365	Days/pa

			Phase 1
Total Annual Throughput			**245,000**
KGVS/M3 / day			5.37
Total Digestion volume			20,000
Digestion Retention			30
Total Digestion Capability at 30 Days Retention			243,333
Digestion Spare Capacity at 30 Days Retention			-1%
Total Output @	7%		**208,250**
Solids seperated to	35%	Tonnes / year	41,650
		Tonnes / day	**114**
Liquid fraction < 1% solids		m3 / year	166,600
		m3 / day	**456**
Liquid Recirculated		**m3 / day**	**329**
Liquid Output		**m3 / day**	**128**

		m3 / hour	**m3 / Day**	**m3 / Year**
Total Biogas / Hour		**2910.96**	**69863.01**	**25500000.00**
Feedstock ave gas production / M3		**104.08**		
		KW / Hour	**MW / Day**	**MW / Year**
Biogas to Heat	KW thermal/hr	**15282.53**	**366.78**	**133875.00**
or			**MW / Day**	**MW / Year**
Biogas to CHP	KW thermal/hr	**7859.59**	**188.63**	**68850.00**
	KW Elec/hr	**7568.49**	**181.64**	**66300.00**
		Kg/Hour	**Tonne / day**	**Tonne / Year**
	CO2 output	**2672.26**	**64.13**	**23409.00**
or		**m3 / hour**	**m3 / Day**	**m3 / Year**
Biogas to biomethane	m3/hr-97%CH4	**1484.59**	**35630.14**	**13005000.00**
			GJ/day	**GJ/Year**
Total GJ produced	GJ/Hour	**56.80**	**1363.21**	**497570.49**



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0	ISSUED FOR REVIEW	22/05/2018	MARTYN A.	JOSEPH O.	

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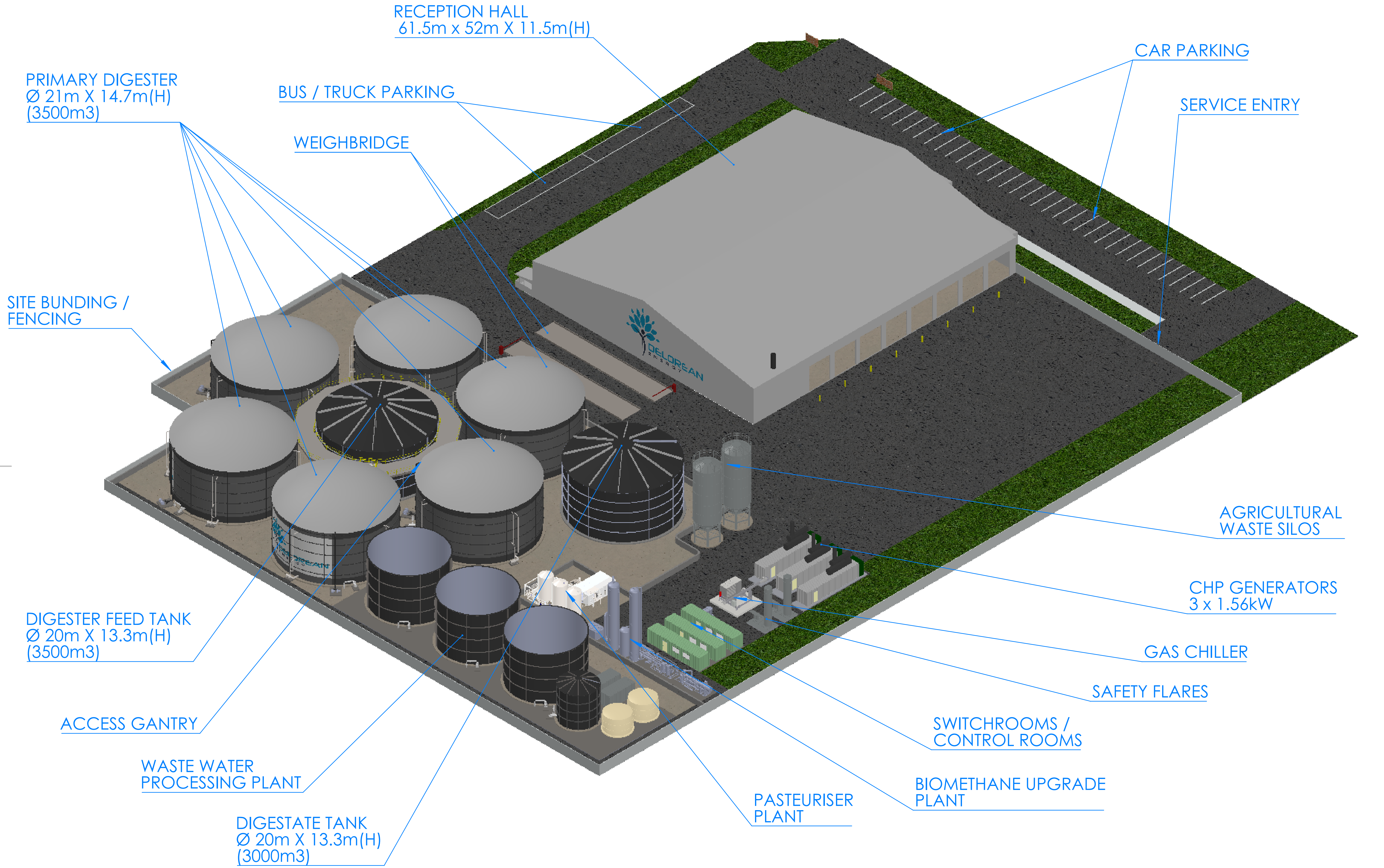
GROUND LEVEL, 1205 HAY STREET
WEST PERTH
WESTERN AUSTRALIA 6005
T: +61 (0)8 9489 2598
Email: info@biogass.com.au

CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
PLANT CONCEPT LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:600 | DWG NO. J116-002 | SHEET NO. 1 OF 15 | REV 1



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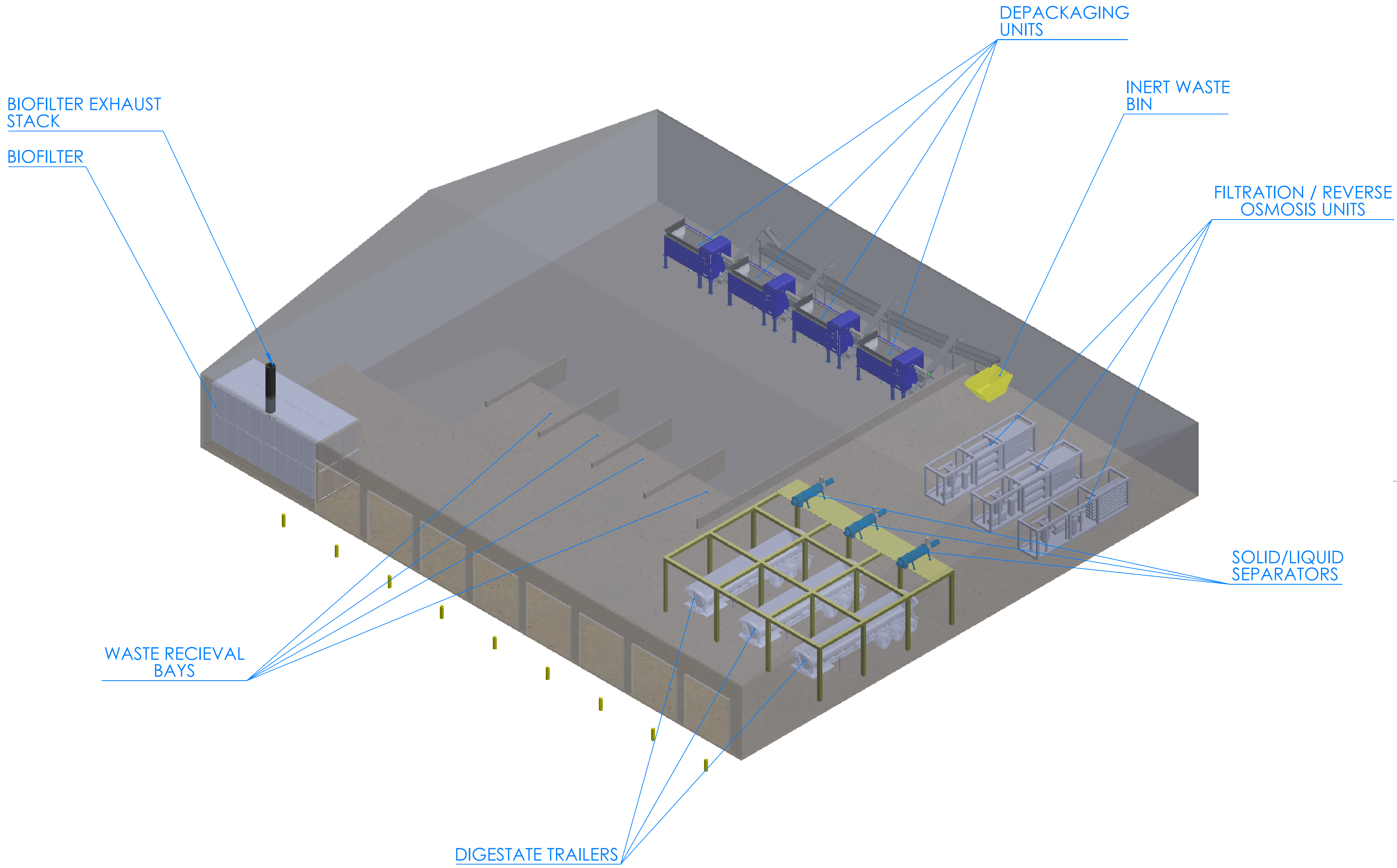
CLIENT: DELOREAN GROUP

PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE PLANT CONCEPT LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:600 | DWG NO. J116-002 | SHEET NO. 2 OF 15 | REV 1



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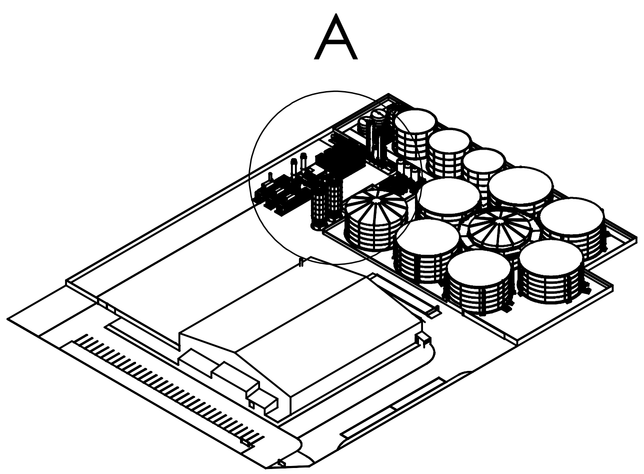
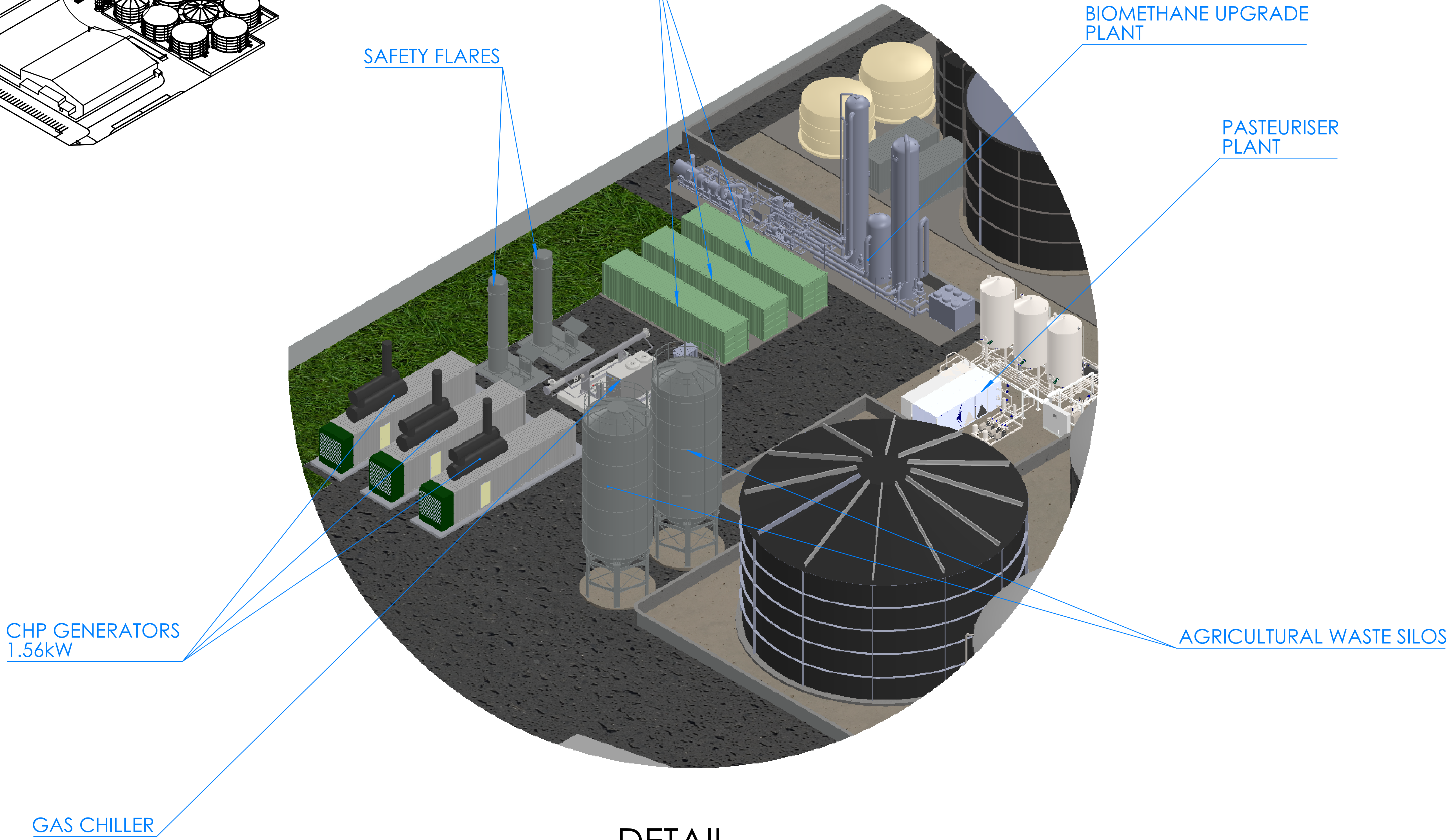
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
RECIEVAL HALL DETAIL

ALL DIMENSIONS IN mm | SCALE 1:300 | DWG NO. J116-002 | SHEET NO. 3 OF 15 | REV 1





DETAIL A

SCALE 1 : 300

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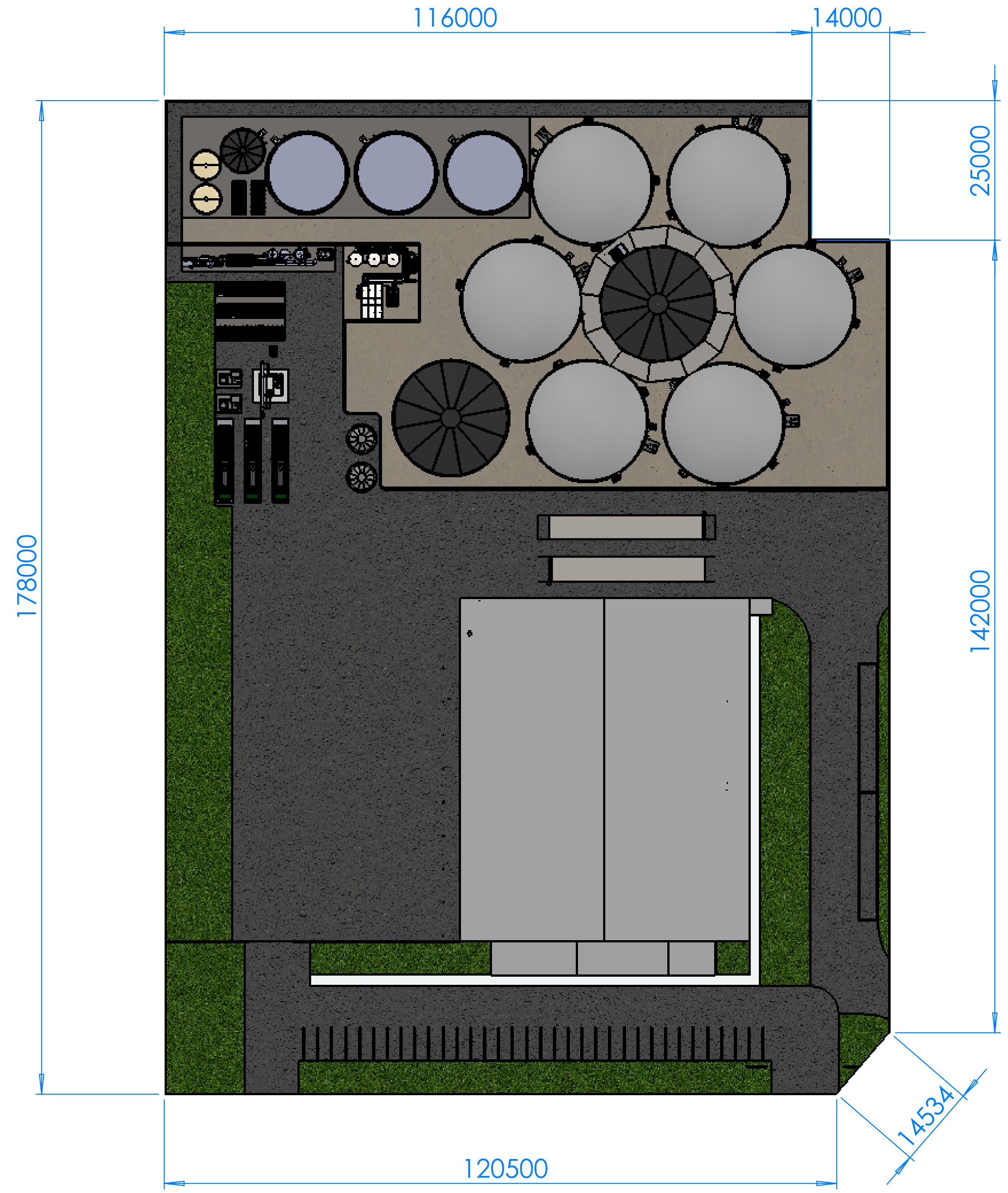
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
GAS MANAGEMENT DETAIL

ALL DIMENSIONS IN mm | SCALE 1:300 | DWG NO. J116-002 | SHEET NO. 4 OF 15 | REV 1



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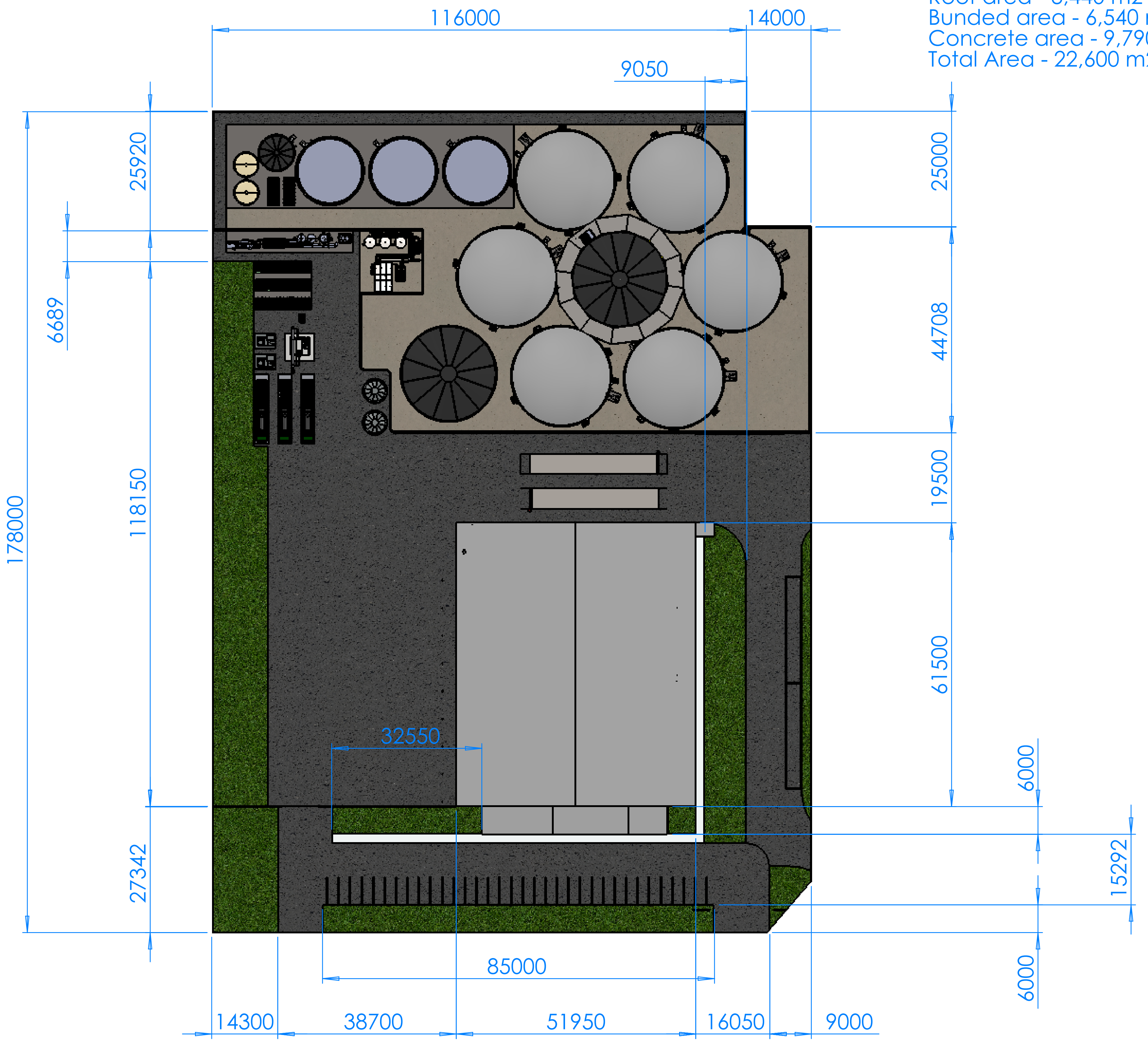
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
SITE DIMENSIONS

ALL DIMENSIONS IN mm | SCALE 1:1000 | DWG NO. J116-002 | SHEET NO. 5 OF 15 | REV 1

8 7 6 5 4 3 2 1

Lanscaped area - 2,830 m2
Roof area - 3,440 m2
Bunded area - 6,540 m2
Concrete area - 9,790 m2
Total Area - 22,600 m2



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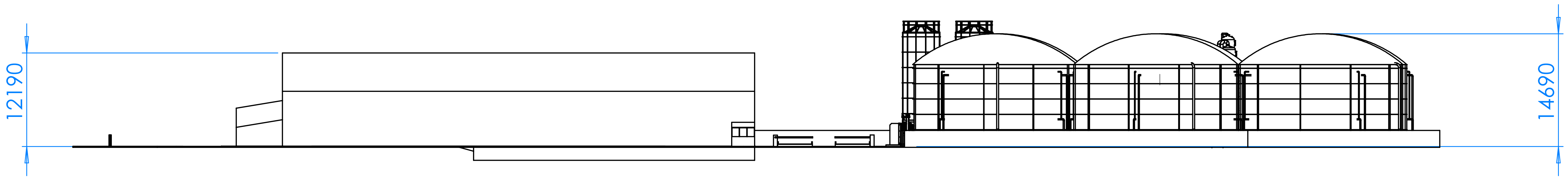
CLIENT: DELOREAN GROUP
PROJECT NO: J116

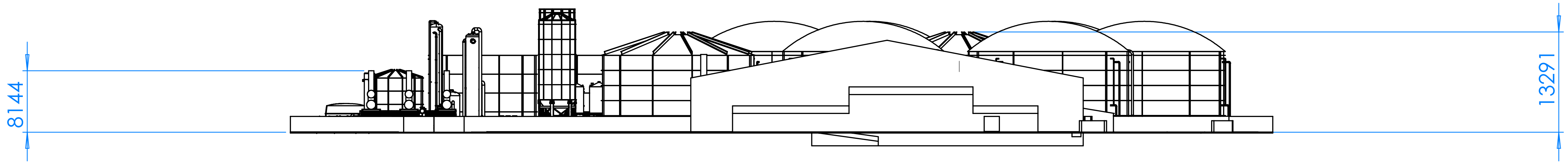
TITLE: DELOREAN ENERGY SA ONE
SITE DIMENSIONS

ALL DIMENSIONS IN mm | SCALE 1:1000 | DWG NO. J116-002 | SHEET NO. 6 OF 15 | REV 1

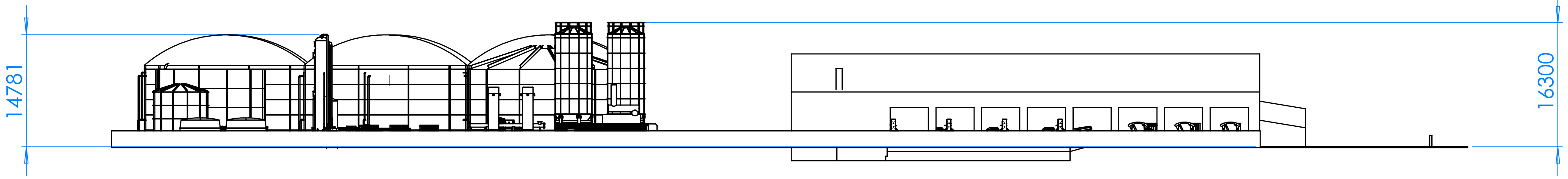
8 7 6 5 4 3 2 1



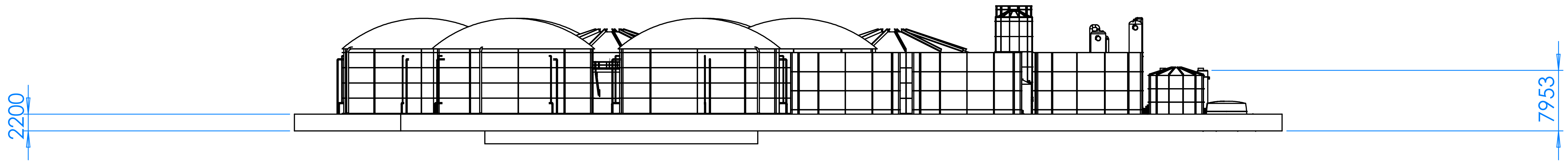
WEST VIEW



NORTH VIEW



EAST VIEW



SOUTH VIEW

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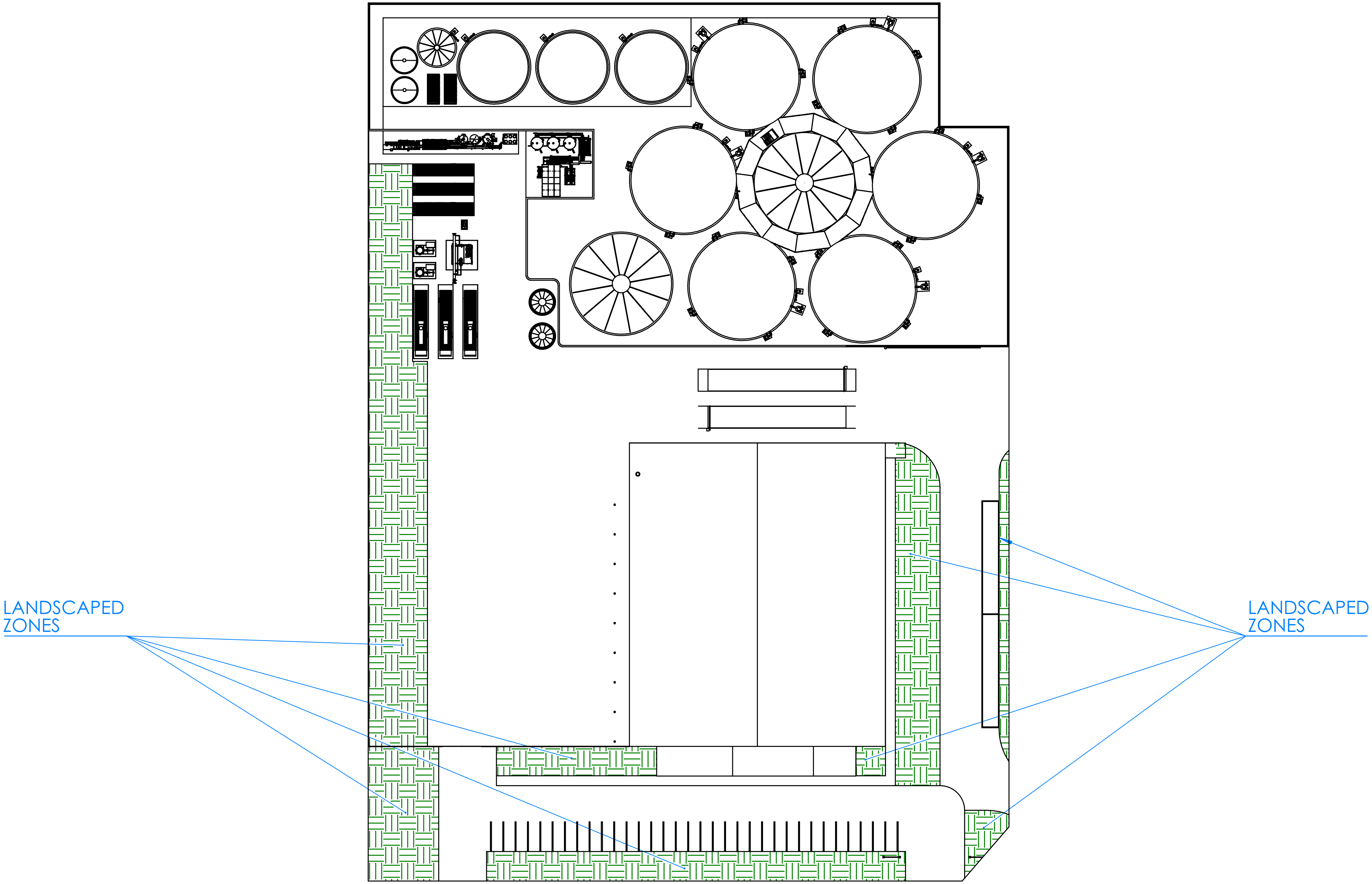
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
SITE ELEVATIONS

ALL DIMENSIONS IN mm | SCALE 1:600 | DWG NO. J116-002 | SHEET NO. 7 OF 15 | REV 1



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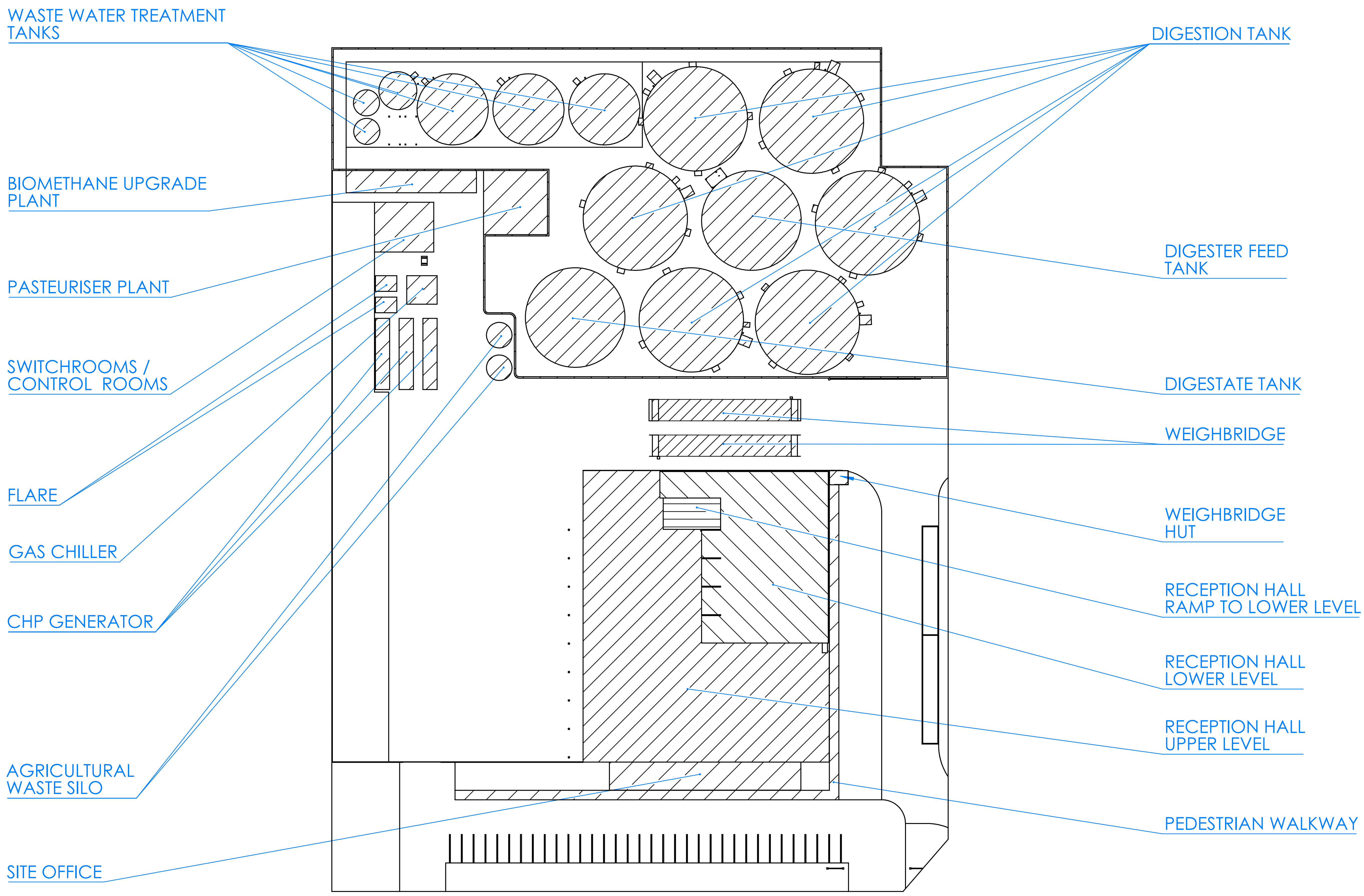
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
LANDSCAPING LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 8 OF 15 | REV 1



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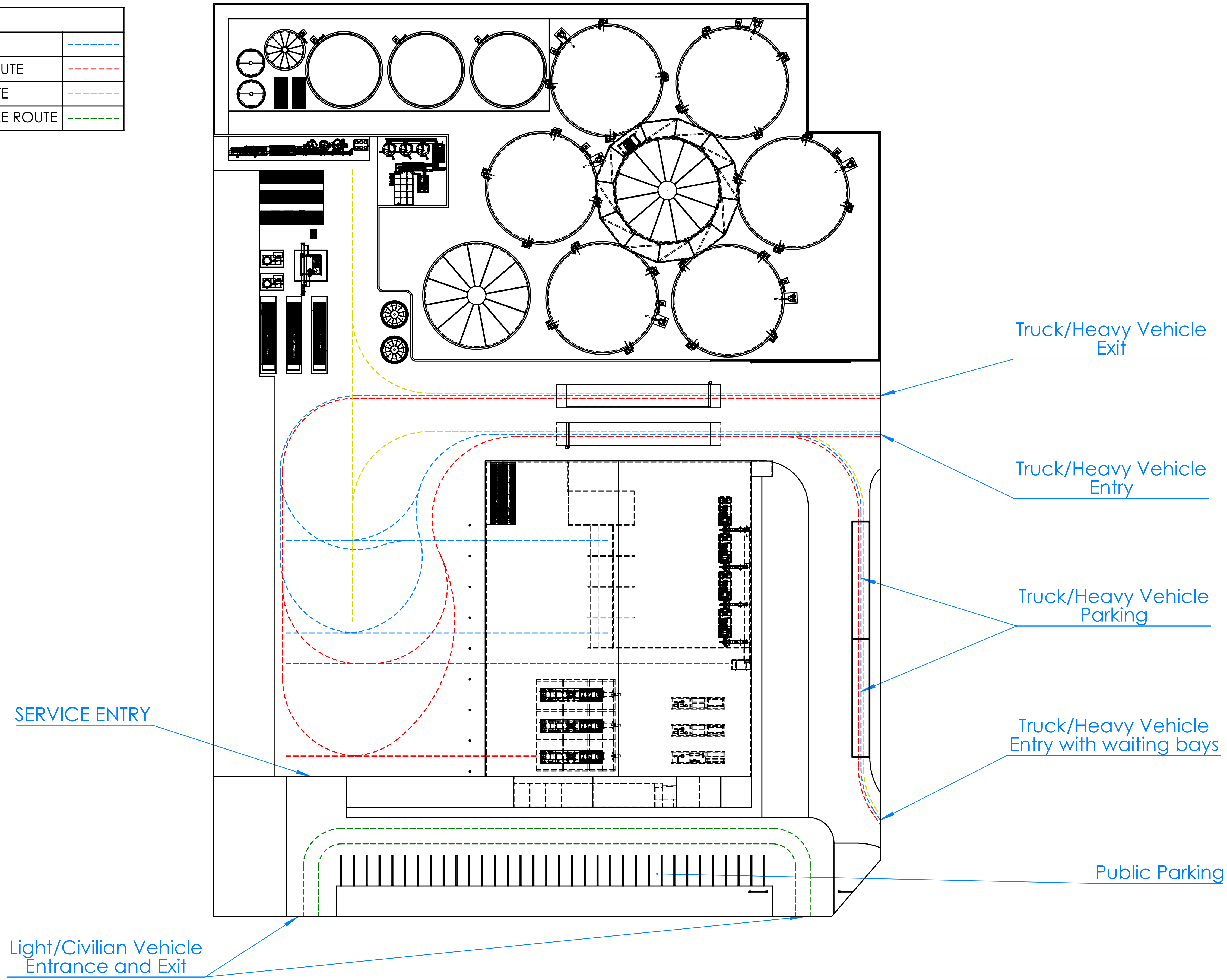
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
CIVILS LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 9 OF 15 | REV 1

LEGEND	
RIGID TRUCK ROUTE	blue dashed line
SEMITRAILER TRUCK ROUTE	red dashed line
B-DOUBLE TRUCK ROUTE	yellow dashed line
LIGHT/CIVILIAN VEHICLE ROUTE	green dashed line



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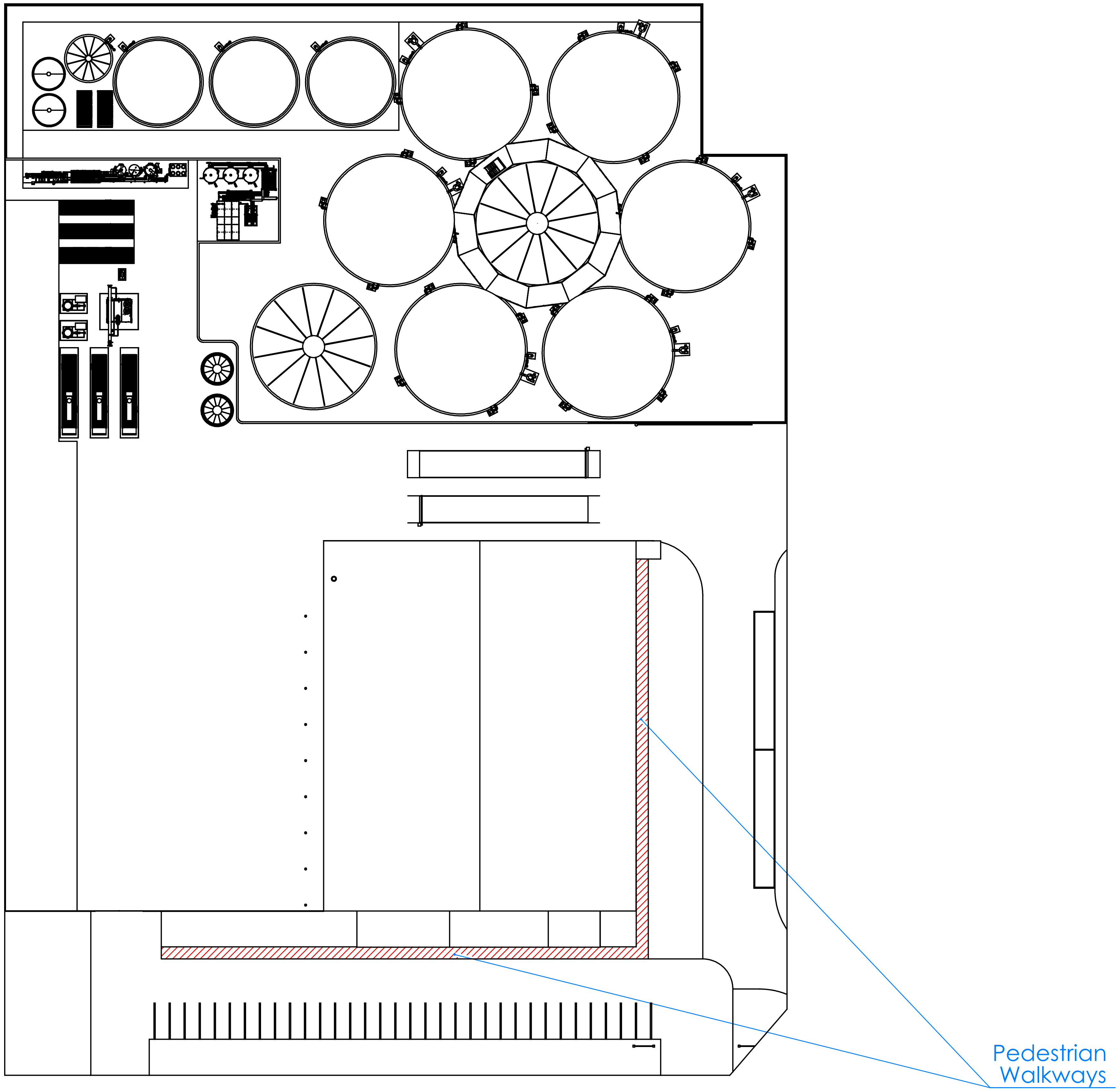
CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
SITE ACCESS DIAGRAM

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 10 OF 15 | REV 1



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CLIENT: DELOREAN GROUP

PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
SITE ACCESS DIAGRAM

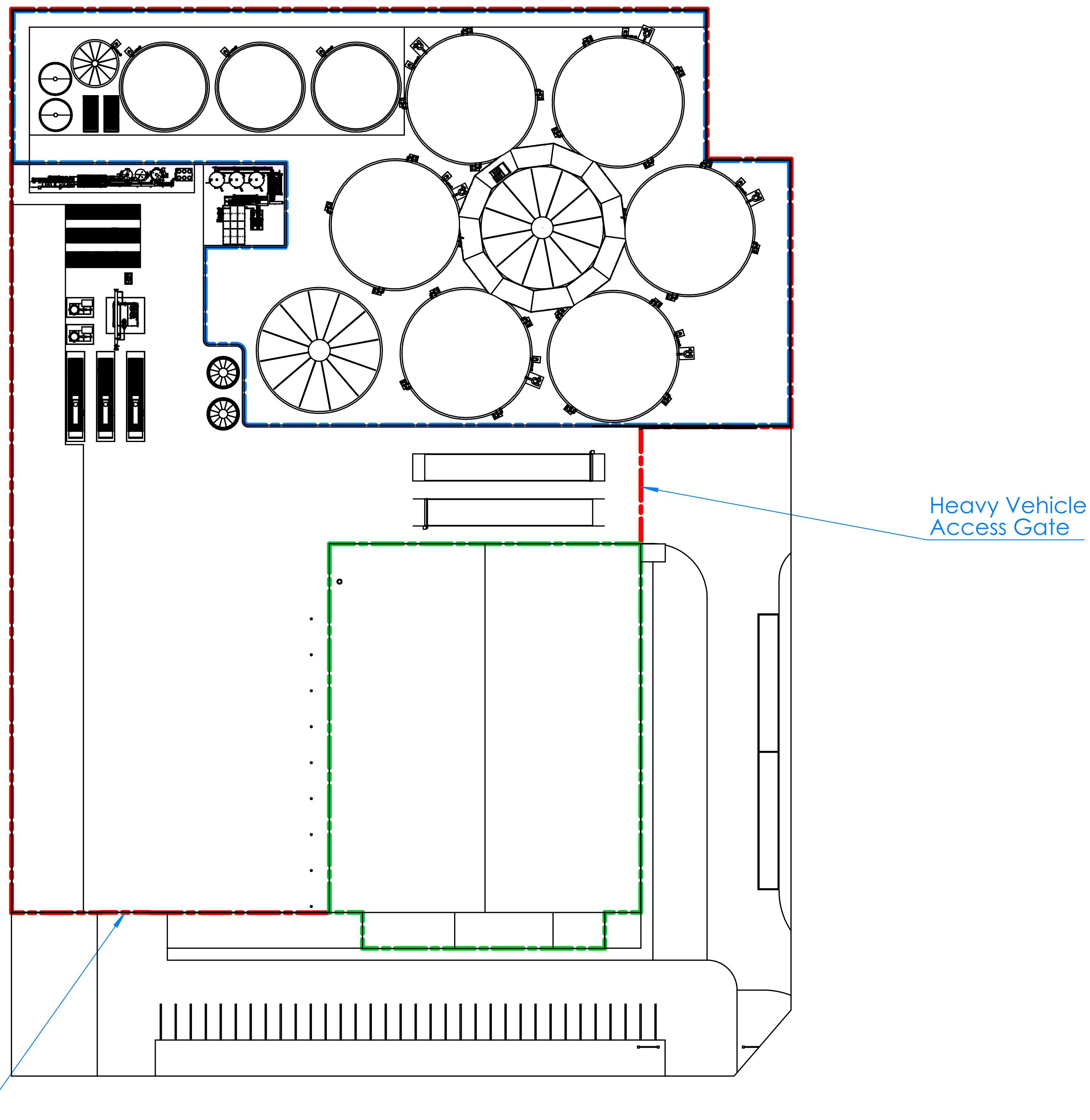
ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 11 OF 15 | REV 1

LEGEND	
SITE PEREMETER FENCING	red dashed line
SITE BUNDING	blue dashed line
RECEPTION HALL/SITE OFFICE	green dashed line

Site Perimeter Fencing comprised of either chain wire mesh or pre-coated painted metal fencing

Site Bunding will be constructed from appropriate concrete material with reinforcement incorporated as required

Reception Hall and Office are to be cladded with pre-coated painted panels



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CLIENT: DELOREAN GROUP

PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE CIRCULATION AND FENCING

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 12 OF 15 | REV 1

REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
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Email: info@biogass.com.au

CLIENT: DELOREAN GROUP
PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE
SITE OVERVIEW LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:2000 | DWG NO. J116-002 | SHEET NO. 13 OF 15 | REV 1

REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
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Email: info@biogass.com.au

CLIENT: DELOREAN GROUP

PROJECT NO: J116

TITLE: DELOREAN ENERGY SA ONE

SITE OVERVIEW LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:2200 | DWG NO. J116-002 | SHEET NO. 14 OF 15 | REV 1

ALLOTMENT BOUNDARY

REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
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Email: info@biogass.com.au

CLIENT: DELOREAN GROUP
PROJECT NO: J116
ALL DIMENSIONS IN mm

TITLE: DELOREAN ENERGY SA ONE
SITE ALLOTMENT BOUNDARY

DWG NO. J116-002 SHEET NO. 15 OF 15 REV 1

Site Material Schedule

Structure	Exterior Material	Coating (Indicative)
Site Office	Brickwork with exterior cladding	Painted - White
Reception Hall	Colourbond Steel	Painted - White
Digester Feed Tank	Glass fused steel/Stainless Steel	Painted - Cobalt Blue
Digester Tank - Walls	Glass fused steel/Stainless Steel	Painted - Cobalt Blue
Digester Tank - Roof	PVC coated polyester fabric	Painted - White
Digester Digestate Tank	Glass fused steel/Stainless Steel	Painted - Cobalt Blue
Waste Water Treatment Tanks	Glass fused steel/Stainless Steel	Painted - Cobalt Blue
CHP Co-generator	Steel	Painted – Beige
Emergency Flare	Galvanised Steel	Galvanised
Grain Silos	Steel	Painted - TBD
Control Rooms	Steel	Painted - Beige
Site Fencing	Colourbond Steel	Painted - White
Site bunding	Concrete	Concrete

Environmental Report

DeLorean Energy Pty Ltd

Waste-to-Energy Anaerobic Digestion Plant – Edinburgh, South Australia

11 June 2018

ABSTRACT

This is an EPA works approval application by Delorean Energy Pty Ltd for the design, construct, commissioning and operation of a 125,000 TPA Anaerobic Digestion plant in Edinburgh, South Australia.

Contents

1. Executive Summary

This EPA works approval application relates to the proposed establishment of a waste-to-energy facility located in Edinburgh, South Australia receiving 125,000 TPA of organic waste and generating up to 8MW.

The proposed facility utilises proven Anaerobic Digestion (AD) technology designed and built Biogass Renewables Pty Ltd and currently in operation at their Richgro facility in Jandakot, Western Australia.

Under the works approval and license, the AD facility will receive a targeted 125,000TPA of Commercial & Industrial (C&I) waste and Agricultural Waste Feedstock. The facility will receive feedstock in the form of solids, semi-solids and liquids. Expected feedstocks include but are not limited to; fruits, vegetables, grain, dairy processing by-products, dissolved air filtration (DAF); fats, oils and grease and food processing wash waters.

Anticipated energy outputs will be 4.7MW of electrical energy, 21.7GJ/hr of biomethane and 4.9MW of thermal heat. Output digestate is separated into liquid and solid fractions to be reused, disposed or sold as compost.

This waste-to-energy project serves to create social, environmental and commercial benefit for governments, communities, businesses and other stakeholders. It is consistent with resource recovery initiatives as indicated by the waste hierarchy.

2. Primary Information

2.1 Company and Contact Information

Applicant business information

Business Name:	DeLorean Energy Pty Ltd
Registered Address:	Level 1, Ord St West Perth WA 6005

Contact person for enquiries relating to this application

Contact Person:	Jonathan Luu
Company:	Biogass Renewables Pty Ltd
Phone:	+61 (0)410 227 362
Email:	jonathan.luu@biogass.com.au

2.2 Company Legal Entities

The proposed AD facility is to be designed and built by the *Construction Entity*, developed by the *Developer Entity* and owned and operated by the *Project Owner Entity*. The company legal entities and relevant details are listed.

Entity	Company Name	Company Details	Key Responsibilities

Construction Entity	Biogass Renewables Pty Ltd	ABN: 36 115 358 944 ACN: 115 358 944 Registered Address: Ground Floor, 1205 Hay St, West Perth, WA 6005	Engineering, Procurement and Construction (EPC).
Project Developer Entity	Food Energy Pty Ltd	ABN: 36 115 358 944 ACN: 115 358 944 Registered Address: Level 1, Ord St West Perth WA 6005	End-to-end accountability of project delivery and operation.
Project Owner Entity	DeLorean Energy Pty Ltd	ABN: 31 624 148 661 ACN: 624 148 661 Registered Address: Level 1, Ord St West Perth WA 6005	Delegated owner and operator of the project. Manages EPC and O&M contractors.

2.3 Cost of works and application fee

Cost of works: Estimated $33M
Application fee: Refer to Development Application

3. Land Use

3.1 Planning and Other Approvals

Type of approval required	Approving authority	Status
Development Application	City of Salisbury	Submitted
Electrical Connection Application	South Australia Power Network (SAPN)	In Progress
Gas Grid Connection	Australian Gas Infrastructure Group (AGIG)	In Progress
Contractor Building License	Government of South Australia	In Progress

Table 1 – Current status of relevant planning and approval applications

3.2 Site Location

A site layout, location map and sensitive receptor map is attached as Appendices 1, 2 and 3 respectively. Details of the proposed site location is as follows:

Premise address: Lot 505, 1-2 Gidgie Court, Edinburgh SA 5111

Dimensions: Circa 130m x 190m

Size: Circa 2.27 ha

Municipality: Edinburgh, City of Salisbury

Zoning:	Industrial zone
Description:	The site is currently un-utilised vacant land. Surrounding roads are Woomera Avenue (main road) and Gidgie Court (side road). The closest neighbouring residents are commercial and industrial businesses including Coats Hire, Northern Adelaide Waste Management Authority, Mayfield Industries and Ahrns Handling Equipment.
Rationale:	The premise has been selected as the site for the proposed development due to its proximity to feedstock suppliers and the value that its current use represents from a financial, environmental and social perspective.
Site layout:	The site has been designed to provide adequate distance away from all nearby residences reducing disturbance from plant noise, odour and supporting logistics movements. Furthermore, design aims to minimise disturbance to remnant vegetation and the potential risk posed to operational irrigation channels.

4. Track Record

4.1 Recent Track Record of Other Operations

Biogass Renewables Pty Ltd (Biogass), has undertaken over 30 plant design and feasibility analyses for Australian bioenergy plants and has delivered and commissioned the successful bioenergy project in Western Australia (see below). Its key personnel have designed, and project managed over 10 plants in the UK.

Biogass has successfully commissioned a 35,000-50,000 tonne per annum food waste capable of 2.4MW (e) 2.6MW(th) capacity bioenergy plant for Richgro at its principle metropolitan composting and manufacturing operations south of Perth in Western Australia. The facility has been in operation since 2015 and has maintained an excellent environmental and social record throughout this time.

Biogass has handled the concept, scoping, feasibility analysis, grant application, finance and investment coordination, approvals, design, procurement, construction, commissioning, offtake agreements, and ongoing operations of the Jandakot Bioenergy Project at Richgro Garden Products in Western Australia.

The company currently has no notable relevant offences or enforcement actions to date.

JANDAKOT BIOENERGY PLANT		
Location	Jandakot, Perth, WA	
Start date	November 2013	

Completion date	January 2015	
Client	Richgro Garden Products	
Value	Phase 1 $8 million, Phase 2 additional $1.5 million	
Scope of works	• Biogass Renewables undertook the development, design, financing, construction, commissioning and operation of the Jandakot Bioenergy Plant – Processing Australian commercial and industrial organic waste/resource streams to power generation. Biogass Renewables handled all approvals from planning to DER (EPA) including grid connection and sale of the renewable power generated on site.	
Inputs	• Phase 1: 35,000 tonnes – Phase 2: 50,000 tonnes per annum commercial and industrial food organics.	
Outputs	• The type(s) of output produced by the facility and how this is managed – small amount of removed contamination - landfill, 1 t/day, recycled plastic (PET) 3 t/week, aluminium – 1 t/week, digestate – 80 KL/day – recirculated 15%, spread to onsite compost – 85% • The product(s) that are produced by the facility (energy/steam/heat) - hot water – 2.5 MWh, power up to 2.4 MW, 1.98 MW exported to grid	
Outcomes	• Richgro garden products – A licenced waste receiver of organic waste streams – predominantly green organics from council collections • Previous electricity costs from the energy retailer of $400,000+/annum • Enabling Richgro to take future higher revenue waste streams from contaminated organic material • Output a bio-fertiliser to blend with existing Richgro product improving nutritional and breakdown characteristics • To form a closed loop, with potential to utilise heat and CO_2 produced on site • Biogass Renewables is the project developer • Commissioned 2015 • Designed to produce over 2 MWe capacity electricity – 1.7 MWe to the grid • Sub – 4-year payback on capital (before grants etc.)	

Details of environmental challenges and non-compliances and how they were managed	Richgro Garden Products located on the Jandakot drinking water mound, with residential neighbours, within 200 m from the site posed a higher level of design considerations from noise, odour, emissions, and spillages, to ensure the site was compliant to the local Department of Environmental Regulation requirements, this was factored in to the design ensuring the supply of overseas packaged equipment met Australian Standards and to ensure the site limitations and considerations were met and adhered to, a full odour, noise and emissions report was completed with great success on the facility. This information can be made available if required.

Table 2 – Jandakot Bioenergy Plant Overview

5. Stakeholder and Community Engagement

The entity has been in consultation with the relevant stakeholders and community groups regarding the proposed project for several months. During this time individual meetings have been held with members of the SA Government, councils and local community members including the Department of Primary Industries and Regions (PIRSA) and local businesses.

Throughout the consultation period the community response to the proposal has been positive, with stakeholder's keen to see the project go ahead as it is viewed as providing a sustainable and competitively priced outlet for food wastes and energy generation in the region. Local groups have also supported the employment generated from the project throughout construction and ongoing operation phases.

For a full list of stakeholder and community engagement, please refer to Appendix 4 – Stakeholder Engagement.

6. Project Proposal

6.1 Project Overview

The objective of this project is to design, build and operate a best practice organic waste treatment facility that will demonstrate how the technology can be integrated with food production to reduce the environmental footprint across the food supply chain.

The site will operate 24 hours a day, 7 days a week and will have a rated output of 8MW, of which approximately 4.7MW will be electrical energy, 21.7GJ/hr biomethane gas and the reminder thermal energy.

The facility will utilize an anaerobic digestion process to treat circa 125,000 tonnes per year of organic waste from the food processors in the surrounding region. The food wastes that will be accepted will vary seasonally however the plant has been designed to accept the following key feedstocks:

- ***Agricultural Wastes*** – Damaged grain, fruit and vegetables that are unsuitable for sale

- ***Industrial food manufacturing wastes*** – Peels, piths, pips, seeds, and other by-products, out of spec or damaged products from canneries, dairy manufacturers, abattoirs, and other food manufacturers; and

- ***Post commercial food wastes*** – Out of date and out of spec products from supermarkets, waste food, grease trap waste

The plant will be self-sufficient and will be capable to provide the energy to local businesses. The operation has been designed to be as close to zero-waste as possible and is consistent with the waste hierarchy.

Figure 1 – Waste Hierarchy

- ***Prevention*** – Prevention of waste from site is priority. All waste that is deemed unnecessary is not part of the AD process or facility operating procedure.

- ***Reuse*** – All materials are reused as much as reasonably possible. For example, all process water is captured and reused back into the process.

- ***Recycling*** – All material that can be recovered and recycled, will be recycled. Packaging waste is cleaned, segregated and baled to facilitate recycling.

- ***Composting*** - The anaerobic digestion process generates a digestate that is nutrient rich and is suitable for use as an organic fertiliser.

- ***Recovery*** – The proposed facility is a waste-to-energy project. It aims to recover energy from waste that would otherwise be sent to landfill.

- ***Disposal*** – Only unrecoverable and unrecyclable waste will be disposed, minimising waste sent to landfill.

6.2 Construction Scope of Work

The scope of work for construction will be conducted by the *Construction Entity* (Biogass Renewables Pty Ltd) for the design, construction, commissioning of the baseline AD bioenergy facility. The scope includes supply of the following:

- Civil engineering and construction, including detailed earthworks, and equipment bases
- Feeding and processing system for the bulk acceptance and processing of solid waste streams with a liquid waste stream input for blending the waste streams
- Negative pressure reception shed with biofilter
- Fully-automated, liquid pumping and receivable system servicing the digester buffer tank
- 4 x Tiger de-packager units
- Liquid inlet pipework
- Digester buffer tank
- Pasteurisation facility designed to process either the feedstock input or the digestate output at any one time.
- 6 x fully-automated primary biodigesters complete with pumps, mixing systems, bio-domes and instrumentation, delivering biogas (55-65% methane).
- Stainless steel gas pipework to ground level
- Underground Plastic liquids pipework to ground level
- Digestate tank
- Digestate centrifuge for removing and separating solids from the liquid stream
- Master process control system with remote SCADA interface
- Gas Analyser and micro air dosing system for managing the H_2S levels within the gas space of the digester
- 3 x 1.56MW packaged CHP generators including full heat recovery
- Biogas to biomethane upgrade package equipment
- Fully automated emissions-compliant high temperature enclosed safety flare for the combustion of surplus or waste biogas.
- Connection to the SAPN electricity grid
- Wet and dry commissioning of the facility
- Seeding the digester and process
- FOS TAC unit for digester health monitoring
- Full final design and compliance documentation including:
    - Detailed design drawings
    - General arrangement/site layout
    - Civils layout
    - Pipework layout
    - Conduit layout
    - System Mass Balance Calculation
    - Process Flow Diagram

- Process and Instrument Diagram
- EX Documentation
- HAZOP Documentation

6.3 Process and Technology

6.3.1 Process Summary

The bioenergy operation will process up to 100,000 TPA of Commercial & Industrial (C&I) organics waste and 25,000 tonnes of Agricultural Waste Feedstock including grainy waste material, totalling approximately 125,000 tonnes of input per year.

The facility is expected to generate in the order 4.7MW of electricity, 21.7GJ/hr of biomethane and 4.9MW of thermal heat. Approximately 166,600m3/year of AD water will be produced, with flow rates of up to 456m3/day when at full capacity. The plant is also designed to operate with a continuous process on 24 hours per day, 7 days per week.

6.3.2 Process Flow

The end-to-end process flow can be broadly simplified into the following process steps:

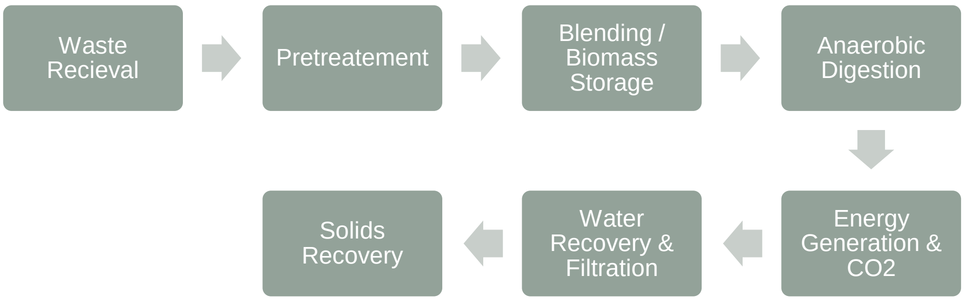


Figure 2 – Simplified Process Flow

1. ***Waste Receival*** – C&I Waste and Agricultural Waste Feedstock is received, classified and stored until required for the AD system.

2. ***Pretreatment*** – Waste is physically separated into organic feedstock for the AD system and inerts for disposal / recycling.

3. ***Blending / Biomass Storage*** – Feedstock is blended into a homogenous mixture and stored ready for the AD process.

4. ***Anaerobic Digestion*** – Feedstock undergoes a series of biological breakdown stages to produce usable biogas as an output.

5. ***Energy & CO2 Generation*** – Electricity, heat, biomethane and carbon dioxide are produced as process outputs.

6. ***Water Recovery & Filtration*** – The output digestate sludge liquid fraction is separated and reused after entering a waste water treatment process.

7. ***Solids Recovery*** – The output digestate sludge solid fraction is separated and sold as organic compost.

6.3.3 Process Inputs, Outputs and Controls

Key anaerobic digestion process steps, inputs, outputs and control methods are detailed in the table below:

	Key Process step	Key Inputs	Key outputs	Key Controls
1	**Waste Receival**	100,000 tonnes/year C&I Organic Waste 25,000 tonnes/year Agricultural Waste Feedstock	Feedstock material ready for processing	• Organic wastes will only be accepted in compliance with the EPA License and relevant agreement with the supplier • Biofilter installed to treat all building exhaust air
2	**Pre-treatment**	Commercial and Industrial Organic Waste, Agricultural Waste Feedstock	Organic slurry Compacted packaging waste	• High level sensors on vessels • Sorting screens • PLC control • Biofilter installed to treat all building exhaust air
3	**Blending / Biomass Storage**	Organic slurry Ferric Chloride Electricity	Biomass suitable for anaerobic digestion or storage	• pH controlled • High level sensors • PLC controlled • Closed system
4	**Anaerobic Digestion**	Biomass Electricity Heat	Biogas Digestate	• Temperature controlled • Vessel level sensors • Closed system • Pressure controlled
5	**Energy & CO2 Generation**	Biogas	4.7MWh electricity 21.7GJ/hr biomethane gas 4.9MWh useable heat 64tonne/day CO2 generated from process	• PLC controlled • Catalytic converter • Sound dampening • Temperature and output monitored • Emissions cooling/cleaning system • Temperature and output monitored
6	**Water Recovery & Filtration**	Digestate liquid Electricity Water	329m3/day	• Pressure sensors on all units • Closed system

		treatment chemicals	Recirculated digestate liquid Recycled process water Liquid fertilizer Concentrated digestate liquid 128m3/day Liquid output	• Flow control on all systems • PLC control
7	**Solids Recovery**	Dewatered digestate Concentrated digestate liquid Biogas Electricity	114Tonnes/day Solid fertilizer product	• Feed rate controlled • Temperature controlled • Biofilter installed if required • PLC controlled

Table 3 – AD Key Process Inputs, Outputs and Controls

6.3.4 Process Flow Details

1. Waste Receival

The AD plant will accept two main waste streams; Commercial and Industrial (C&I) organic waste and Agricultural Waste Feedstock.

Third party food wastes will be delivered to the site by truck. The inbound vehicle will be weighed at an onsite weighbridge, and the load will be inspected for non-conformity. Third party waste will only be received from clients who have booked delivery of a consignment of waste / resource and provided details of the materials' content. Non-conforming loads are not discharged or accepted at the site.

Waste is to be classified into the following categories (see Table 10 for full feedstock list):

a) Packaged food wastes - Delivered on pallets or in pallecons and will be unloaded into the receival area by forklift. Storage of packaged food wastes will be kept to a minimum, with on-site storage limited to the materials that will be processed in the following 48 hours.

b) *Bulk dry / wet solids* – Includes grains, whole fruits, vegetables and food processing wastes. Delivered in tipper trucks, with materials tipped into concrete receival bays to facilitate subsequent handling by front-end loader. Storage of bulk food wastes will be kept to a minimum, with on-site storage limited to the materials that will be processed in the following 24 to 48 hours.

c) *Bulk liquids* - Delivered by tanker truck and will be discharged directly into the fully enclosed feed system of the pre-treatment plant.

d) *Agricultural waste* – Delivered by truck includes damaged, off-spec wheat, barley, grain etc. Agricultural waste will be transferred into holding silos by a fully enclosed blower system.

The facility will receive approximately 25,000 tonnes of Agricultural Waste Feedstock per year that will be loaded directly into the dry feed system and approximately 100,000 tonnes of C&I organic waste per year that will be transferred to the receival area by tractor and trailer and unloaded by front-end loader.

The receival hall will be located inside the bunded, concrete floored reception building, and has been designed to enable the safe and efficient unloading of a variety of organic wastes. Solid and semi-solid waste is deposited into graded bunkers and have been designed to hold 2 days of waste. Liquid waste is pumped directly into a sump, for subsequent pumping to a liquid storage tank or immediate processing.

Trucks are washed before departure with all wastewater draining to the sump for processing in the digestion system.

As the activities in this building have the potential to generate odour, this building will be fitted with a biofilter odour treatment system ensuring approximately 4-5 air changes per hour with blower rated at 525m3 per minute, 31,500m3 per hour. Receival building is also fitted with automatic 6 second fast-shutting doors. Floors will also be graded with a drainage sump. Washdown water is also reused in the AD system.

2. Pre-treatment

The pre-treatment system has been designed to accept a wide variety of organic wastes and incorporates feed hoppers, shredders, pulping units and liquid separation units.

Solid wastes will be loaded into the feed hoppers by front-end loader, before being shredded and transferred into the pulping unit via a conveyor. Liquid wastes and process water are pumped directly into the pulping unit, where digestible materials are blended and dissolved into a biomass slurry. The pulping process and all subsequent process steps take place in sealed vessels, minimising odour generation.

Non-digestible materials such as plastic and metal packaging materials, and sand/grit from vegetables are separated from the digestible biomass as it progresses through the plant. Heavy inert materials, consisting of metals and heavy plastic are removed in the de-packaging unit. Light inert materials such as plastic film is removed by manual labour prior to entering the system. The packaging materials will be segregated for recycling or be returned to the supplier under the terms of the supply contracts.

The pre-treatment plant will be located inside the bunded, concrete floored, pre-treatment plant building to minimise the risk of soil or water contamination. As the activities in this building have the potential to generate odour, this building will be fitted with an odour treatment system.

3. Blending / Biomass Storage

The biomass slurry from the pre-treatment plant is sent to the feeding tank where the day's inputs are blended and homogenised to ensure a consistent quality of feed to the anaerobic digestion process. The feedstock is also pH adjusted for optimum digestion and dosed with ferric chloride to chemically bind any free Sulphur and minimise the potential for Hydrogen Sulphide formation in the digestion process.

Feedstocks are blended and balanced to optimise composition for biological process stability and maximum biogas yield. Each blend is sampled for chemical analysis and balanced.

During blending, the biomass also undergoes hydrolysis to begin the anaerobic digestion process. The proposed plant has been designed to incorporate a biomass storage tank which will hold up to 5 days feedstock supply to smooth out peaks and troughs in the delivery of third party food wastes and to allow gradual transition between changing feedstocks, ensuring continuous operation of the plant at peak throughput.

The fully sealed glass-fused steel feeding tank will be completely sealed and will be located on a bunded concrete hardstand along with the anaerobic digestion tanks. This hardstand will be designed with bunding and the risk of fugitive odour emissions or land/groundwater contamination from this process is considered to be negligible. There are no potential emissions points.

4. Anaerobic Digestion

The anaerobic digestion system can be broadly separated into the following stages:

a) *Hydrolysis* –During Hydrolysis complex organic molecules are mixed with water and agitated for approximately 5 days at between 30^{o}C and 40^{o}C to convert them to simple dissolved monomers and polymers.

b) *Pasteurisation* - The clean digester feed is fed in to a two-tank pasteurisation operation, the first operation is to fill and pre-heating from 25-30degC up to 72degC for 50 minutes, with the second phase holding at 72degC for a period of 1 hour, before emptying. It is anticipated that it will empty within 5 minutes per operation. This allows for full pasteurisation to the European PAS110 standards and will ensure the pathogen log kill is reduced and stabilised before inputting into the digester feed tank. The process can also be changed to pasteurise the outlet digestate if required, ensuring a full robust process.

c) *Fermentation* - During fermentation the dissolved monomers and polymers from the Hydrolysis tank are maintained under mesophilic conditions (between 35^{o}C and 40^{o}C) for a minimum of 20 days residence time to enable a series of fermentation/digestion steps to convert them into acetic acid, hydrogen and carbon dioxide.

Digestors are warmed using parasitic heat from the plant’s biogas generators. All tanks and vessels in the anaerobic digestion process will be temperature controlled, insulated stainless steel tanks, with a galvanised iron cladding; the final post digestion tank fitted with a flexible roof to allow for variations in biogas generation.

The glass-fused steel tanks and vessels that make up the anaerobic digestion process will be completely sealed and will be located on a bunded concrete hardstand that will be designed in line with EPA bunding guidelines and the risk of fugitive odour emissions or land / groundwater contamination from this process is considered to be negligible.

Biogas, comprising approximately 65% methane/35% CO_2 v/v accumulates in the gas domes, and can be positively displaced by pumping air between the gas dome’s two membranes.

Estimated residence of feedstock in digesters is between 25 and 30 days, during which a reduction in volume of 20% is expected. There are no potential emissions points.

5. Energy & CO2 Generation

The plant will generate 69,900m^3 of biogas per day. The gaseous output from the process will be cooled and purified through an activated carbon filtration system, before being burned through a Combined Heat and Power (CHP) unit rated to produce approximately 4.7MW of electricity and 4.9MW of thermal heat or upgraded to 21.7GJ/hr of biomethane.

The electricity generated will be used to power the anaerobic digestion plant as well as being fed into the electricity grid. The heat generated will be used to maintain the anaerobic digestion tanks and vessels at optimal temperature.

Both the CHP unit and the water heater will be housed inside a noise insulated container and situated on a concrete floor.

An upgrade system is incorporated to convert the biogas (65% methane) to biomethane (97% methane) equivalent to natural gas to for input into the gas mains.

Overpressure in the system will be released though a high temperature flaring system. The flare operating temperature is approximately 1000 degrees Celsius to kill potential pathogens. Approximately 64tonne/day CO2 is generated and managed with the emissions cooling/cleaning system. Temperature and output also monitored with the PLC system. The flare will only be operated on an emergency basis, or when one of the generators is not operating for routine maintenance (estimated 12 days per year) or in the unlikely event that the generators fail (worst case estimated 7 days).

6. Water Recovery and Filtration

The output digestate from the digestion process will be dewatered through a centrifuge. The liquid stream from the centrifuge will be treated though a waste water treatment system and membrane filtration system then directly recycled back into the system. Approximately 329m3/day of process liquid is recirculated.

The membrane filtration system will consist of a first pass Ultrafiltration (UF) unit where pathogens and any remaining solids will be directed to either the recycling circuit or the drier feed, while filtered water is then passed through a Reverse Osmosis (RO) unit. The concentrate from the RO filtration system will be bottled and sold as organic fertiliser, and the treated water will be recirculated for use as process water.

The water recovery and filtration system will be located inside the bunded, concrete floored reception building.

The bulk liquid fertiliser tank will be completely sealed and will be located on a bunded concrete hardstand along with the anaerobic digestion tanks. As a result, the risk of fugitive odour emissions or land/groundwater contamination from the Water recovery and filtration process is considered to be negligible.

Approximately 128m3/day of output process liquid is piped offsite into aquifer storage operated by Salisbury Water.

7. **Solids Recovery**

The solid fraction of the digestate is separated using the same process by dewatering though a centrifuge. Solids produced are a spade-able and nutrient rich material to be used as compost. The solid fraction output rate is expected to amount to 114Tonnes/day.

The complete solids recovery process occurs within the confines of the reception building. The collection point for transfer of the digestate will take place inside the negative pressure building so no digestate will be exposed to the external open air without a treatment in place.

Heavy vehicles are used to offtake the material on a daily basis as required inside the building prior to transporting offsite to compost facilities.

6.4 Environmental Best Practice

Biogass Renewables aims to exceed environmental performance expectations across all categories and wants to set a new standard for Australian best practice in the treatment of wastes from food production. The project has been designed from the outset to incorporate high level environmental performance into all processes and operations across the site.

Energy use and GHG emissions

- Methane emissions will be reduced as food waste is diverted from landfill and anticipated to reduce net GHG emissions.
- The CHP units are specified to provide both electricity and process heat.
- All pipes and vessels that are heated and/or cooled are insulated to minimise heat loss to atmosphere.
- Where possible, roofed work and storage areas incorporate transparent roofing panels to minimise the requirement for artificial lighting.
- New pumps and motors have been sized to ensure that they will operate at peak efficiency and energy efficient models have been selected.
- On larger pumps and motors, soft starters and Variable Speed Drives will be fitted to maximise operational efficiency and minimise load spikes.

Emissions to air

- The liquid wastes will be piped directly to the treatment plant significantly reducing odour generation.
- Waste deliveries and processing will be scheduled to minimise storage time on the site to minimise the generation of odour from putrescent feedstocks.
- Receival of potentially odorous wastes, bulk waste handling and pre-treatment areas will be in an enclosed building which incorporates bio-filters to remove odour.
- All anaerobic digestion process vessels will be sealed to prevent fugitive emissions.
- Biomass will be dosed with Ferric Chloride to chemically fixate sulphur in the feedstock to minimise Hydrogen Sulphide generation.

- High efficiency CHP, water heater and flare units have been selected to maximise combustion efficiency and minimise the generation of unwanted gaseous by-products.

Noise emissions

- The CHP unit will be fitted with noise attenuators/silencers to ensure that sound output is below 75dB at 1m meeting the boundary requirements
- The CHP and water heater units will be located inside soundproofed buildings to ensure that noise emissions from the site are within guideline values.
- The plant has been located to ensure an adequate separation distance to the nearest residential sensitive receptors and from the nearest commercial / industrial receptors which will further reduce the likelihood of noise impacts. Refer to Appendix 3.

Water use and discharge

- Consumption of potable water across the site is minimised through reuse of process water wherever possible.
- Stormwater, flooding or tank rupture fluids will be diverted to sump areas where it is captured and either pumped into the aquifer or onsite waste water treatment plant for reuse in the AD process
- No waste water will be discharged from the site, with digestate liquid being concentrated to generate a liquid fertiliser product, and the remaining water being reused in the process.
- All site activities will be carried out on bunded concrete pads and under roofed areas to minimise the risk of contaminated water generation.

Land and Groundwater

- The operational site areas are completely sealed to ensure that pollutants cannot be discharged into the soil.
- All materials will be handled, stored, treated and transferred on bunded concrete areas to minimise the risk of a spill resulting in contamination of land or groundwater.
- All processes will be carried out either in bunded, concrete floored buildings, or in sealed vessels and/or tanks located on bunded concrete hardstands.
- All new bunds and hardstand areas will be designed and built to comply with or exceed EPA Guidelines and all relevant Australian Standards.
- Concrete hardstand areas and bunds will be routinely checked to ensure that their integrity is not compromised.

Waste Management

- The proposal will divert 125,000 tonnes of C&I waste and Agricultural Waste Feedstock per year from landfill.
- The process has been designed to produce the minimum possible waste requiring disposal – solid fraction of digestate is output for sale as an organic fertiliser.
- Spent activated carbon from the CHP biogas scrubber system will be processed through the AD plant.
- Packaging waste is segregated to maximise recycling potential.
- Scheduling waste delivery (where possible) to minimise the need for onsite storage.

- Pre-treatment of all non-packaged wastes within 2 days of receival.
- Conduct all receival, handling and processing activities in enclosed buildings or vessels with bunded concrete hardstand floors.
- Acceptance protocols to ensure only suitable wastes are used as feedstock.

7. Integrated Environmental Assessment

The proposed operation is a resource recovery and renewable energy project on an industrial site, with very favorable outcomes compared to the alternative of landfill disposal. The solution is designed to minimise environmental impact whist ensuring energy security through renewable sources.

The plant has been conceived from the outset to serve as an example of best practice integrated waste processing. This following environmental assessment considers environmental impacts and benefits of the project and stipulates how risks will be mitigated.

	Assessment
Proposed Solution	• Large scale anaerobic digestion waste to energy plant to treat 3rd party organic waste, supply electricity to the National Electricity Market (NEM)
Advantages	• Significant net GHG emissions reduction • Significant reduction in waste to landfill • No solid or liquid waste requiring external treatment or disposal to landfill • Minimised odour • Constant and reliable biogas generation • Generates regional employment • Creation of an opportunity for a social enterprise assisting disabled people to gain skills and employment • Use of the organic material as digester feedstock • Generation of electricity for transfer to other manufacturers and/or export to the grid, • Increased recycling of packaging (plastics, cardboard, tin plate, aluminium etc.) • Creation of fertiliser products from the digestate • Secure and ethical management of clients' products and brands • A reliable consistent service to local manufacturers that also causes a net reduction of the environment footprint of their operation • Net operational profit
Disadvantages	• Capital cost • Operation and maintenance required • Cost of connecting to the NEM • Potential reluctance of incumbent generators/distributors to facilitate new connections to the NEM

The proposed operation will minimise emissions to air and water and will achieve very high rates of resource recovery. It will be a net generator of renewable energy, irrigation water and potentially organic fertiliser.

7.1 Net Environmental Benefit

The proposed facility will result in a net reduction of GHG emissions and a breakdown of the anticipated future energy use and GHG emissions are provided. Estimated greenhouse gas emissions were calculated using the National Greenhouse Accounts Factors July 2017. The detail of all calculations is provided in Appendix 5 – Emissions Calculations.

7.1.1 GHG Emissions Assessment

Baseline

Operation of the proposed facility will process an anticipated 125,000 tonnes per year of food waste as feedstock. As most of this food waste is currently disposed of in a variety of regional landfills, the equivalent greenhouse gas emissions avoided is estimated below.

Source	Production	Emissions Factor	CO2-e
	Tonnes/year	kg CO2-e/kg	Tonnes/year
Food Waste	125,000	1.9	237,500

Table 4 - Annual GHG emissions from existing food waste disposed to regional landfill

Source	Offset	Production		Emissions Factor	CO2-e
		MW/h	MW/year	kg CO2-e/kWh	Tonnes/year
Electricity	**Fossil Fuels**	4.7	41,172	0.56	23,056

Table 5 - Annual GHG emissions from displaced electricity generation from fossil fuels

For the calculation, it is assumed that the biogas converted to biomethane will produce the same amount of greenhouse gas emissions as the natural gas that it offsets.

The anaerobic digestion process is designed as a totally enclosed system to maximise capture of biogas and therefore maximise energy generation. The system will also be carefully managed to maintain a consistent rate of biogas generation. In the event of excess pressure building up in any of the vessels, all pressure release valves discharge through the emergency flare. Therefore, it is assumed that fugitive methane emissions from the plant can be considered to be negligible.

As a result, the full 260,566 tonnes per year of GHGs currently released directly to atmosphere by existing food waste disposal practices will be avoided following the construction of the proposed waste to energy plant.

Proposed Plant Solution

The proposed facility will generate 25,500,000m3/year of biogas. This biogas will be consumed onsite through the operation of:

- 3 x 1.56 MWh Combined Heat and Power unit

In addition to combustion of biogas the plant will require a front-end loader and a forklift in the receival and dispatch areas of the plant. All electricity required to operate the waste-to-energy plant will be generated onsite through the CHP unit.

Source	Consumption	Energy Content Factor	Emissions Factor	CO2-e
	L/year	GJ/kL	kg CO2-e/GJ	Tonnes/year
Diesel Consumption	39,624	38.6	70.5	107,829
LPG Consumption	5,200	26.2	61.5	8,379

Table 6 - Annual GHG emissions produced from heavy site heavy machinery

Source	Consumption	Energy Content Factor	Emissions Factor	CO2-e
	m3/year	GJ/m3	kg CO2-e/GJ	Tonnes/year
Biogas for Electricity Combustion	15,769,737	0.0337	4.83	2,567

Table 7 - Annual GHG emissions from biogas for electricity generation

Net Greenhouse Gas Emissions

Overall, the proposal is anticipated to result in a net GHG emissions reduction of ***140,198*** tonnes of CO_2e per year.

7.1.2 Best Practice Energy and GHG Management

The proposed plant incorporates best practice at all levels of energy and GHG management. From the meta-level of conceptual project design where the initial scope of the project was expanded to include treatment of 3rd party food wastes down to the specification of pipe insulation, energy efficient lighting, pumps and motors, the proposal aims to set the Australian benchmark for best practice in a waste treatment project. As a result:

- Methane emissions from the food waste which will be diverted from landfill will reduce GHG emissions.
- A high efficiency CHP unit has been specified to provide both electricity and process heat for the plant itself
- All pipes, tanks and other vessels that are heated and/or cooled have been insulated to minimise heat loss to atmosphere.
- Where possible, roofed work and storage areas will incorporate transparent roofing panels to minimise the requirement for artificial lighting.
- New pumps and motors have been sized to ensure that they will operate at peak efficiency and energy efficient models have been selected.
- On larger pumps and motors, soft starters and Variable Speed Drives will be fitted to maximise operational efficiency and minimise load spikes.

7.2 Risk Assessment

The potential risks associated with the project are understood and will be managed as described in this application.

- Water resource use - See *Water Resource Use*.
- Odour and other air emissions from the site - See *Air Emissions.*
- Noise from the site - See *Noise Emissions*.
- Increase in traffic to and from the site - See *Traffic Management*.

8. Water Resource Use

The AD facility is a net generator of water and the site has been designed to be self-sustaining through the incorporation of a high level of water recycling. The facility it will require very little, if any, potable water input from mains other than for staff amenities and limited wash down of equipment.

Total liquid output from the site will be expected to be 456m3/day. Of this volume, 329m3/day is reused and recirculated to assist with the AD process. The remaining volume of 128m3/day is treated though a water treatment system and sent to the aquifer operated by Salisbury Water.

Stormwater will be diverted to sump areas and redirected to either the aquifer or onsite waste water treatment plant for reuse in the AD process.

Waste liquids from bottles and containers can be injected directly into the feeding systems and reused as a necessary liquid process component, avoiding the requirement for mains water.

The use of mains water for equipment will be minimised through the use of high pressure trigger nozzles. These will only be used at the end of depackaging runs and is necessary to reduce odour from old residues on equipment.

9. Air Emissions

The construction and operations of the AD facility will be compliant with the *Environment Protection (Air Quality) Policy 2016* under the *Environment Protection Act 1993*. The following section details the anticipated emissions and mitigation strategies relevant to air quality however a full emissions modelling assessment is currently being undertaken and will be provided in due course.

9.1 Air Emissions Assessment Overview

Air emissions from proposed facility

The proposed facility will generate emissions to air in both the construction phase and operations phase.

During construction, the primary focus will be managing nuisance dust to ensure that it does not cause issues for neighbouring properties.

During operations, potential emissions may include:

- Unclassified Indicators (both dust and odour) to be generated,
- Substances generated and emitted through the combustion of biogas; and
- Odorous emissions (Hydrogen Sulphide)

Dust Management

During the construction phase the risk of dust produced will be minimised through:

- Limiting the area of exposed soil at any time to the minimum required
- Applying best practice dust minimisation practices throughout the construction phase

Once the plant is operational dust generation will be minimised by surfacing all roads and car parks with non-dust generating materials such as gravel, sealing all operational areas with concrete and maintaining vegetation cover on all non-operational areas of the site.

Odour Management

It is recognised that there is a risk of odour generation from the proposed operation, particularly in the waste receival, handling and pre-treatment stages of the process. This will be mitigated by conducting all materials receival, handling and pre-processing activities within enclosed buildings, storing liquid wastes in closed tanks, maintaining a high level of housekeeping, and managing onsite storage of bulk solids so that materials are processed within 48 hours of their arrival.

An odour removal system will also be installed to treat any odours that are generated. Based on the currently available high-level designs it is expected that extraction points will be fitted near the entrance of the building to prevent odour escaping.

Should this arrangement prove to be insufficient once commissioning is underway, the proponent has allowed extra space adjacent to the installed units to expand the installed treatment capacity if required.

Experience has shown that the gas cleaning stage at the end of the drier unit is sufficient to control any odour generation and that subsequent odour treatment is not necessary. However, if this is found to be insufficient once commissioning is underway, a further odour removal system will be added.

Furthermore, the risk of adversely impacting upon sensitive receptors is also reduced by the proposed plant being at situated as per Appendix 3.

Substances

The combustion of biogas through the CHP unit, rotary drier, water heater and emergency flare will generate Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Volatile Organic Compounds and particulates. Based on expected combustion rates through each unit and using the emissions factors for combustion of landfill gas, the following emission rates have been estimated.

Hydrogen Sulphide generation during the anaerobic digestion process will be suppressed by the addition of Ferric Chloride. It is expected that very low levels of Hydrogen Sulphide may still be generated, but as all biogas will be combusted before release to atmosphere it is expected that emission rates will be within acceptable parameters. Where emission rates are found to be above acceptable limits during commissioning an additional biogas desulphurisation step will be put in place to prevent emissions exceeding the acceptable limits during operation.

Air quality best practice

The proponent of the project has sourced only technology that is considered EU best practice and is committed to ensuring that the project outperforms any other system that is currently available in Australia. To this end:

- Waste deliveries and processing will be scheduled to minimise storage time on the site to minimise the generation of odour from putrescent feedstocks.
- The Agricultural Waste Feedstock will be piped directly to the facility silos, minimising dust and odor generation.
- Receival of potentially odorous wastes, bulk waste handling and pre-treatment areas will be in an enclosed building which incorporates bio-filters to remove odour.
- All process vessels, transfer lines and storage tanks will be sealed to prevent fugitive emissions.
- No process gases will be released to atmosphere without being burned to reduce their GHG potential.
- Biomass will be dosed with Ferric Chloride to chemically fixate sulphur in the feedstock to minimise Hydrogen Sulphide generation.
- High efficiency CHP, water heater and flare units have been selected to maximise combustion efficiency and minimise the generation of unwanted gaseous by-products.
- The CHP unit will have a catalytic converter fitted to the exhaust to minimise NOx emissions.
- All relief valves will vent to the emergency flare

Air quality impact assessment

Air emissions from the proposal are not at a level where they are expected to impact on local amenity or public health.

10. Noise Emissions

The construction and operations of the AD facility will be compliant with the *Environment Protection (Noise) Policy 2017* under the *Environment Protection Act 1993*. The following section details the anticipated emissions and mitigation strategies relevant to noise however a full noise modelling assessment is currently being undertaken and will be provided in due course.

10.1 Noise Impact Assessment Overview

The location of the facility has been selected and the layout of the plant arranged to ensure that all activity areas are sufficiently distanced to the nearest sensitive receptors as displayed in Appendix 3.

The table below shows the items of equipment and activities that have been identified as potentially causing noise disturbance and the mitigation measures that have been put in place to ensure that the proposal does not cause a significant increase in noise disturbance to neighboring properties.

Noise source	Activity	Mitigation
Vehicle movements on site	Delivery of 3rd party waste feedstock to the facility	Facility to operate between 0700—1800 hours Monday—Friday 0700—1300 hours on Saturdays. Site vehicle movements will occur either inside buildings or on designated roads.
De-packaging and baling equipment	Pre-processing	Normal operating hours will be between 0700-1800 hours on weekdays. These units are all inside buildings and operate at levels consistent with OHS requirements.
Loaders and forklifts	Material transportation	Normal operating hours will be between 0700-1800 hours on weekdays. Transfer and materials handling activities will be conducted within enclosed buildings. External loader movements will be restricted to working hours. Smart reversing alarms to minimise potential disturbance.
Unloading pallets and materials	Material transportation	Normal operating hours will be between 0700-1800 hours on weekdays. Forklifts will move these (they will not be dropped heavily) and activity occurs in or to the north of buildings.
Moving and loading recyclables	Material transportation	Normal operating hours will be between 0700-1800 hours on weekdays. These will be moved using forklifts inside the reception building.
Combined Heat and Power Unit	AD plant operation	The CHP will be fitted with a muffler / silencer to reduce sound output. The unit will be housed in a soundproofed housing to minimise external noise.
AD flare	AD plant operation	The flare operates on demand and should not be is not anticipated to be noticeably audible to sensitive receptors.

Table 8 - Expected noise sources and mitigation measures

11. Water Management

11.1 Water Management and Run-off Discharges

The construction and operations of the AD facility will be compliant with the *Environment Protection (Water Quality) Policy 2015* under the *Environment Protection Act 1993*. The following section details the anticipated emissions and mitigation strategies relevant to water quality.

The proposal poses a minimal risk to surface water. The site has been designed to minimise the risk of generating contaminated surface water through containing all product transfer, handling, pre-processing and drying activities within enclosed buildings, and all other processes within sealed vessels located on bunded concrete hardstands.

All tanks are bunded to 120% of tank volume to safeguard against potential spillage from tank failure. Bunding will consist of approximately a 1.5m high wall completely enclosing the perimeter of all tank zones. Stormwater will be diverted to sump areas and redirected to either the aquifer or onsite waste water treatment plant for reuse in the AD process.

A detailed breakdown of key process steps, locations and safeguards related to water management are as follows:

Key Process step	Location and safeguards
Waste Receival	• Will take place inside the bunded, concrete floored Pre-treatment plant building, with sump pits to ensure that stormwater is not contaminated, and no spills are released to the environment
Pre-treatment	• Will take place inside the bunded, concrete floored Pre-treatment plant building, with sump pits to ensure that stormwater is not contaminated, and no spills are released to the environment
Blending / Biomass Storage	• Will take place inside sealed process tanks and vessels that will be located on a bunded, concrete hardstand area to minimise the risk that any stormwater will become contaminated, and to prevent the release of stormwater that does become contaminated or any spills to the environment.
Anaerobic Digestion	• Will take place inside sealed process tanks and vessels that will be located on a bunded, concrete hardstand area to minimise the risk that any stormwater will become contaminated, and to prevent the release of stormwater that does become contaminated or any spills to the environment.
Water Recovery & Filtration	• Will take place inside the bunded, concrete floored reception building, to ensure that stormwater is not contaminated, and no spills are released to the environment • A wastewater treatment system, reverse osmosis unit and ultrafiltration unit treat process liquids generated
Solids Recovery	• Will take place inside the bunded, concrete floored reception building, to ensure that stormwater is not contaminated, and no spills are released to the environment
Electricity & Heat Generation	• Will take place inside the bunded, concrete floored CHP and water heater building, to ensure that stormwater is not contaminated, and no spills are released to the environment

Table 9 - Key process steps, their location and the safeguards in place to prevent the contamination of stormwater, groundwater or soils

12. Waste Handling

12.1 Waste Handling and Treatment Premises

The digestate sludge that remains at the completion of the anaerobic digestion is rich in Carbon, Nitrogen, Phosphorus and Potassium and as such is very suitable for use as an organic fertilizer. To avoid potentially needing to dispose of this valuable material, the wastes accepted into the plant will be carefully managed to avoid any contamination, and the process has been designed to ensure that it remains suitable for beneficial use.

The plant is designed to be able to accept packaged food waste and therefore the residual packaging materials will make up a component of the waste produced. Where packaged food wastes are accepted, the pre-treatment process generates a clean, shredded packaging residual that is pre-segregated into heavy and light fractions to enable easy recycling, and baled to facilitate easy transport. The proponent intends to structure food waste purchase agreements such that the supplier of the food waste retains ownership of, and responsibility for, the disposal of the residual packaging materials.

12.2 Hazardous Industrial Waste

The proposal is not expected to generate any hazardous industrial waste, as the residual packaging wastes is inert and digestate quality will be strictly controlled to ensure it is suitable for beneficial reuse.

12.3 Waste Feedstock

The plant will accept two main waste streams; C&I organic waste and Agricultural Waste Feedstock.

It is anticipated that there the plant will receive approximately 25,000 TPA of Agricultural Waste feedstock and 100,000 TPA of C&I organic waste. Agricultural Waste will be pumped directly into holding silos before entering the feed system. C&I organic waste will be unloaded in the receival shed and transported by front-end loader into the feed system.

The types of third party food wastes that will be received are summarised in the table below.

Waste Type	Examples	Solid / Liquid	Origin	Maximum storage quantity (tonnes)
Fruit & vegetables	Off-spec, damaged fruit & vegetables. Peels, seeds, other materials that do not contain free liquid content	Solid	Farms, Transporters, Processing plants, Supermarkets	50,000
Packaged "Dry" Food wastes	Powdered milk solids, damaged pizza, cheese, biscuits, dry pasta	Solid	Processing plants, Supermarkets	20,000

Animal processing wastes	Blood sludge, fats & oils	Liquid	Abattoirs	10,000
Milk processing by-products	Whey, bulk off-spec milk	Liquid	Dairies, milk processing plants	10,000
Pre-consumer fresh food wastes	Out of date mixed food wastes, bread, meat, fruit & vegetables	Liquid	Supermarkets	10,000
Agricultural Waste Feedstock	Damaged, off-spec wheat, barley etc	Solid	Farms, Transporters	25,000
			Total	**125,000**

Table 10 - Types of wastes that will be received by the proposed plant

All delivery vehicles will enter and leave the site across a weighbridge to ensure that waste receival is accurately tracked. All wastes will be inspected, sampled and tested in the onsite laboratory at the time of delivery to ensure that they are not contaminated with anything that may adversely affect processing or impact on digestate quality. Any contaminated materials will be rejected.

Packaged materials, or materials in small containers such as pallets, IBC's or fruit boxes will be counted, labelled and individually weighed before being emptied into the appropriate feed bay, or in the case of packaged materials, directly into the feed hopper as required. The number of units, type of food waste and the weight of each unit will be recorded to maintain records of feedstock available for blending into the plant, and to track against digestate quality.

12.4 Waste Receival

The receival area will be adjacent to the pre-treatment plant, and will be inside a bunded, concrete floored building, designed to enable the safe and efficient transfer of a variety of organic waste materials into the processing plant, enable easy cleaning, and meet or exceed all required design and environmental criteria. As the activities in this building have the potential to generate odour, it will be fitted with a Biofilter odour treatment system.

Third party food wastes will be delivered to the site by truck on a 'just in time' basis, and can be grouped into the following main categories:

- Packaged food wastes
- Bulk solids (such as grains, whole fruit and vegetables, and food processing wastes)
- Bulk liquids
- Agricultural Waste feedstocks (such as grain dust, GOMF)

Storage of packaged food wastes will be kept to a minimum, with on-site storage limited to the materials that will be processed in the following 48 hours.

Storage of bulk food wastes will be kept to a minimum, with on-site storage limited to the materials that will be processed in the following 24 to 48 hours.

Bulk liquids will be delivered by tanker truck and will be discharged directly into the feed system of the pre-treatment plant.

Control of contaminants and pathogens in the digestate will be managed through careful selection and management of feedstocks, rigorous process management and control, and a strict quality control regime including regular sampling and laboratory testing of the wastes received and of the final product. Strict application of this management and quality control framework will ensure that the digestate consistently meets acceptable standards for use as a fertiliser.

12.5 Waste Disposal

As outlined in previous sections, the process will generate minimal waste requiring offsite disposal. Material that is recyclable will be transported to designated recycling facilities and non-recyclables sent to designated traditional waste disposal facilities. Wastes that are generated will be tracked and recorded.

13. Fire Risk

The facility is an industrial site consisting of open land. The main buildings and sealed areas on the site are not included in a fire prone risk overlay due to the reduced risk for such areas, but open unsealed areas and the surrounding properties have a high fire risk overlay. However, fire risk for the site is low. The site and surrounding land have very few trees, and typically during hotter periods is either dry and bare or green and irrigated with little grass fire risk.

Any construction on the site will comply with South Australian fire code building standards determined through the building approvals process.

A CFA-approved fire management plan will be developed for the site.

The main sources of risk are:

- External fire source (grass fire of windblown embers)
- AD flare and exhaust
- Combustion of stored cardboard, paper, plastic and timber
- Sparks from vehicles and equipment on site
- Explosive risk from stored biogas

The main fire risks identified, and mitigation measures are shown below:

Risk	Mitigation	Likelihood with mitigation	Consequence	Residual risk with mitigation
External fire source (grass fire or windblown embers)	▪ Maintenance of fire breaks at site perimeter and control of vegetation in open areas on the site ▪ Sprinkler system over AD tanks will be operated during any fire event ▪ Excess biogas from tanks will be purged and flared during	Low	Low-moderate	Low

	any imminent fire risk as part of an emergency response plan ▪ Firefighting equipment and training to be maintained			
AD flare and exhaust	▪ Spark arresters fitted and maintained ▪ Control of vegetation on site	Low	Low (any fires will be contained on site due to lack of vegetation and fire breaks)	Low
Combustion of materials stored on site	▪ Flammable materials will be stored inside sheds where overhead sprinkler systems are fitted or on shipping containers on site ▪ No smoking permitted outside of designated staff areas, to be at least 20 m from stored flammable materials ▪ Quantities of flammable recovered packaging on site will be limited, with collections scheduled when a container load or semi-truck load of baled material is accumulated on site.	Low	Low (any fires will be contained on site due to lack of vegetation and fire breaks)	Low
Sparks from vehicles and equipment on site	▪ No use of likely spark sources (circular saws, mowers, forklifts) outside on days of total fire ban ▪ Control of vegetation on site ▪ Maintenance of fire-fighting equipment and training	Low	Low (any fires will be contained on site due to lack of vegetation and maintenance of fire breaks)	Low
Explosive risk from stored biogas	▪ Maintenance of fully enclosed AD system ▪ Limiting quantities of stored gas ▪ Fire sprinkler systems fitted to AD storage tanks ▪ Emergency purge and flare to allow controlled and rapid combustion of gas ▪ Emergency site evacuation procedures	Low	Potentially moderate to high, but very unlikely	Low

Table 11 – Fire Risk Assessment

14. Other Site Precautions

14.1 Maintenance and Shutdown

All facility infrastructure, equipment and processes are designed to minimise the operational maintenance and shutdown requirements.

The buffer tank has capacity to store up to 5 days of feedstock material to providing flexibility for input variations. This accommodates for temporary isolated and shutdown maintenance activities while feedstock continues to enter the system.

The plant design accommodates for partial shutdown and isolation of various system components whilst allowing continued operation. Contingency equipment allows for breakdown maintenance such as 4 de-packaging units and 6 digester tanks.

During maintenance, relevant system will be fully isolated where necessary and potential hazards removed. During tank equipment changeout, the required tanks will be fully drained of material for up to 30 days so that the item can be isolated and serviced to limit potential hazardous consequences. This will be conducted with proper risk management procedure. Refer to Appendix 6 – HAZOP Risk Assessment.

Although the plant is designed to operate 24 / 7 without any planned shutdowns, in the instance of an unplanned shutdown while the plant is at full load capacity, feedstock material will not be accepted and will revert to existing waste receival arrangements i.e. landfill.

14.2 Traffic Management

Traffic is split into two categories, Light Vehicles (e.g. Personnel and visitors) and Heavy Vehicles (e.g. Dump Trucks, Tankers, Road trains).

Light Vehicles will enter the site through either of the twoentrance ways provided on Woomera Avenue From here, vehicles have a choice to park in parking areas running alongside Woomera Avenue or Gidgie Court Vehicles can then choose to exit from either of the same entrances On Woomera Avenue or, in the event of an obstruction, the heavy vehicle entrance on Gidgie Court.

Heavy Vehicles will enter the site on the entrance way provided on Gidge Court Trucks will stop on the weighbridge before entering the industrial area of the site. From here, trucks will have ample room to manoeuvre and position themselves for offload.

Once material has been offloaded, Vehicles will proceed to the Weighbridge prior to the exit on Woomera Avenue Once weighed in, the truck will exit onto Woomera Avenue. The layout of the site has been designed to reduce collisions as much as possible through the reduction of intersecting paths and separate entry and exit ways.

As many as 50 Trucks are expected to visit the facility every day once the site is in full operation, resulting in approximately 5 trucks every hour. The Facility has been designed to cope with the influx of vehicles with the following measures:

- 4 Commercial and industrial solid food waste receival bays
- 3 Digestate trailer bays
- 1 Liquid feedstock receival bay
- 1 Agricultural Waste intake bay

This assures the plant can accept up to 9 trucks at any one time.

The receival shed will have traffic lights installed to indicate which bays are free and which are in use.

Heavy Vehicle parking is also supplied on the Gidgie Court side of the site to allow buses and large vehicles to stop on site without impeding other vehicles. This opens the opportunity for educational tours for large groups such as schools and universities.

All vehicles will be able to travel in a forward motion when entering, exiting and navigating around the site.

14.3 Pest and Vermin Management

Risk of pests and vermin on site is mitigated though physical barriers and effective general site management. Mitigation measures include the following:

- Fast and same-day processing of waste streams reduces the risks to attract rodents and other pests.
- All tanks and connecting pipework are fully enclosed oxygen-free systems so that no organic process material is exposed.
- Electrical cabling and wires are contained in enclosed casing where possible.
- Doors on reception shed will be automatic fast closing doors to ensure that shed open time is minimised.
- The site will also be kept in good condition at all times through effective operational management best practice.

14.4 Litter Management

Litter on site will be managed through the following:

- Storing and depackaging materials inside buildings
- Baling recovered packaging types
- Storing baled materials so they are secure from crows and other birds (they will typically be stored inside the site buildings)
- Conducting weekly perimeter fence and site litter clean ups, including inspection and clean-up of stormwater pits
- Provision of staff litter, rubbish and recycling stations across the site, including cigarette litter bins in any designated outdoor smoking areas.

14.5 Storage of Fuels, Chemical and Oils

Fuels, oils and chemicals will be stored in secured and bunded areas. Spill kits will be located at each storage point, and staff instructed in correct use of these. Chemicals on site will include pH dosing and biogas cleaning/'scrubbing' chemicals (typically a Ca OH product that can strip out H_2S and CO_2).

15. Seeking other EPA approvals

15.1 Commissioning Plan

A commissioning approval will be sought for operation of the site following its construction. A commissioning plan will be provided to EPA once timeframes of works are better defined.

15.2 New License or License Amendment Subsequent to Works Approvals

The site will be required to be licensed as at the completion of construction and commissioning works.

16. List of Appendices

Appendix 1 – Site Plan

Appendix 2 – Location Map

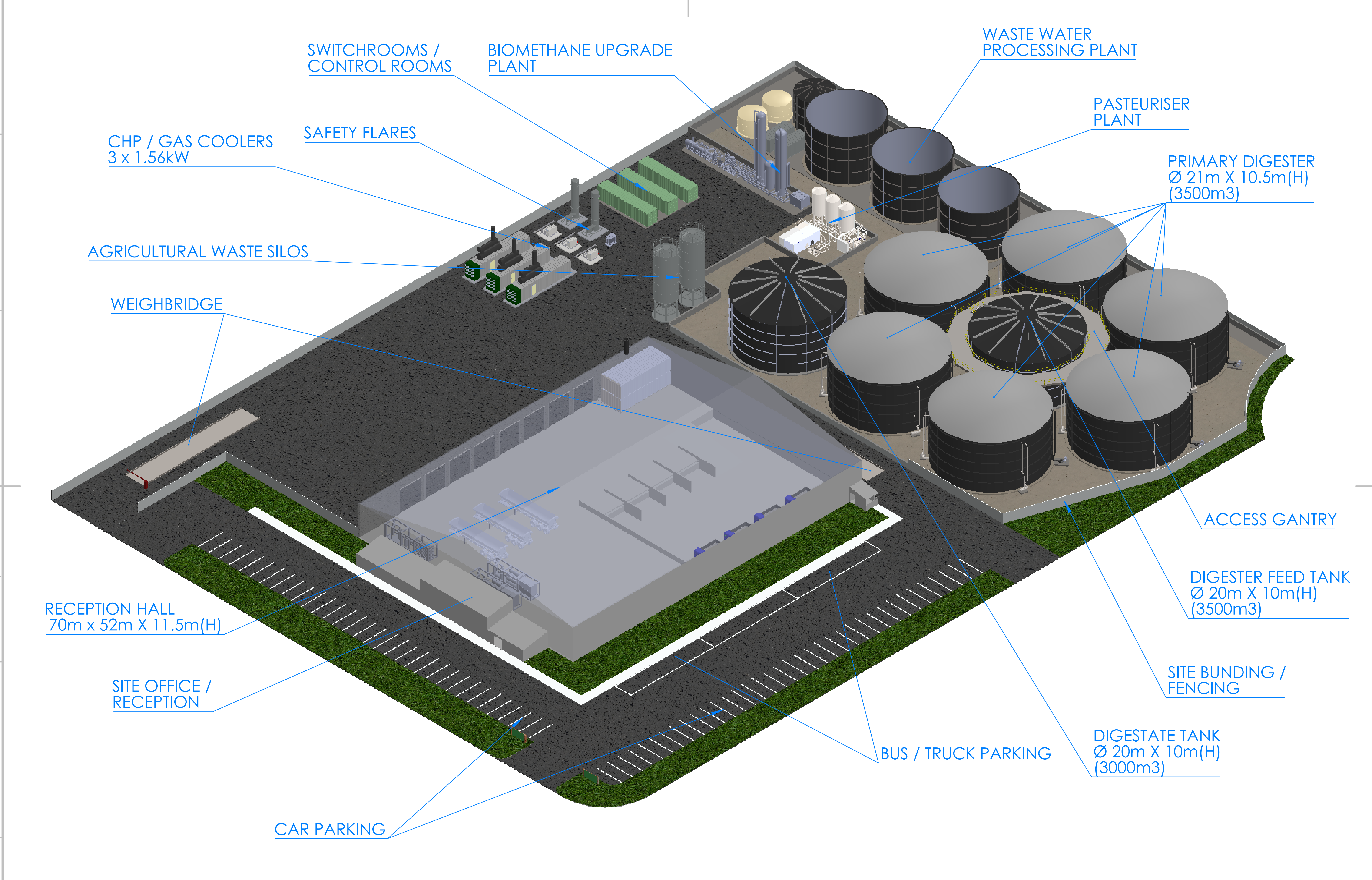
Appendix 3 – Sensitive Receptor Map

Appendix 4 – Stakeholder Engagement

Appendix 5 – GHG Emissions Calculations

Appendix 6 – HAZOP Risk Assessment

Appendix 1 – Site Plan



REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR REVIEW	22/05/2018	MARTYN A.	JOSEPH O.	

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CLIENT: FOOD ENERGY
PROJECT NO: J116
TITLE: SALISBURY AD PLANT
CONCEPT LAYOUT

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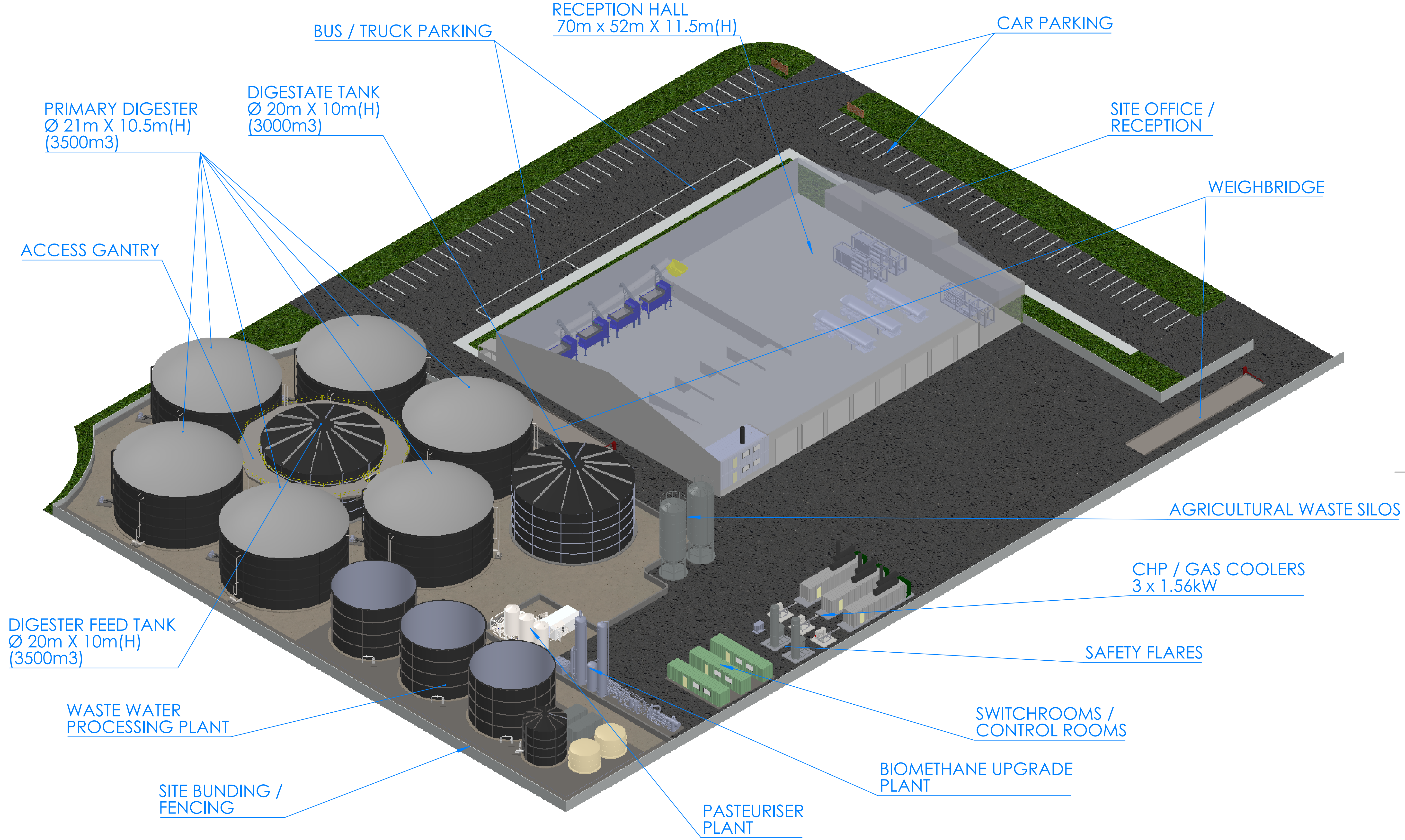

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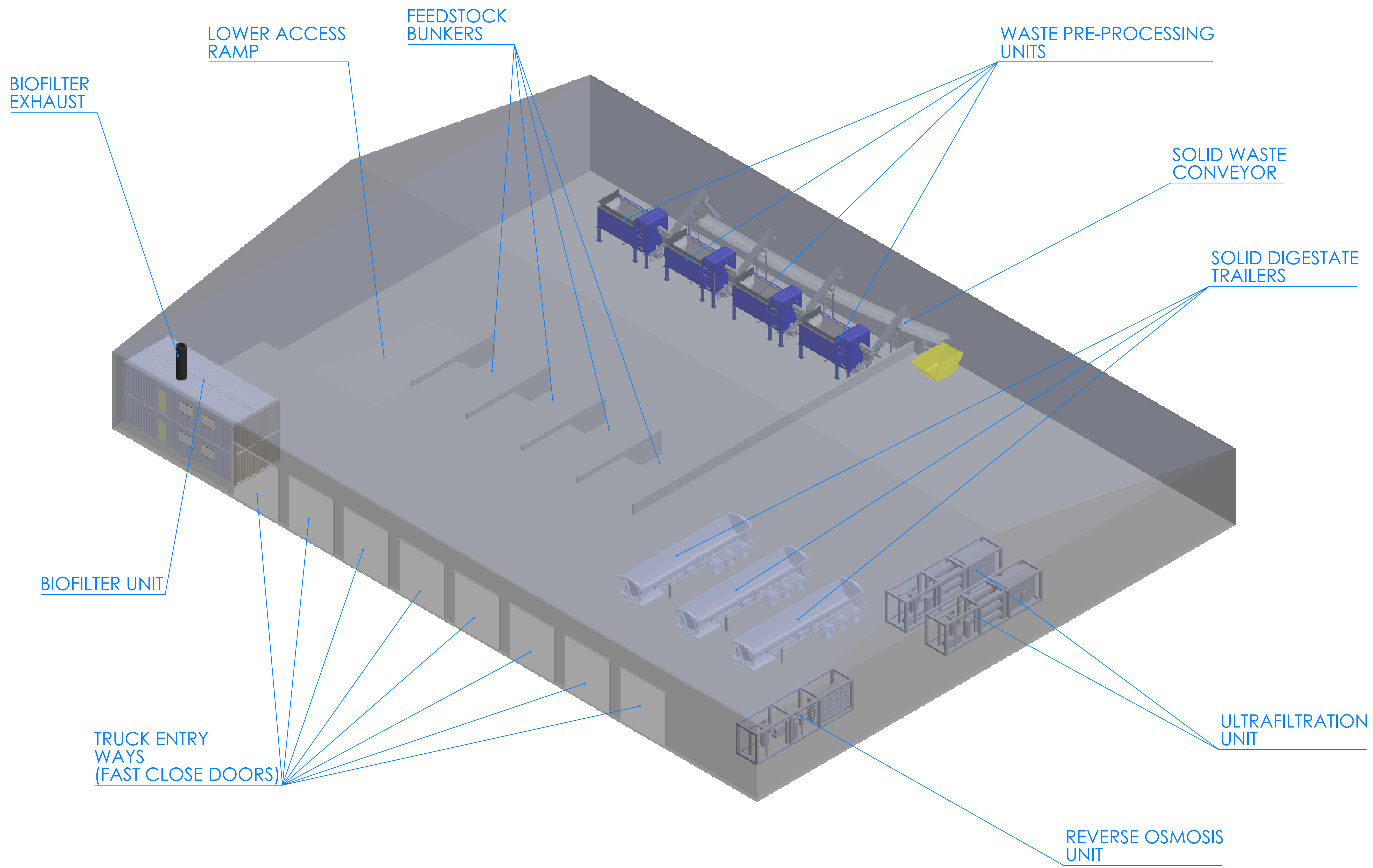

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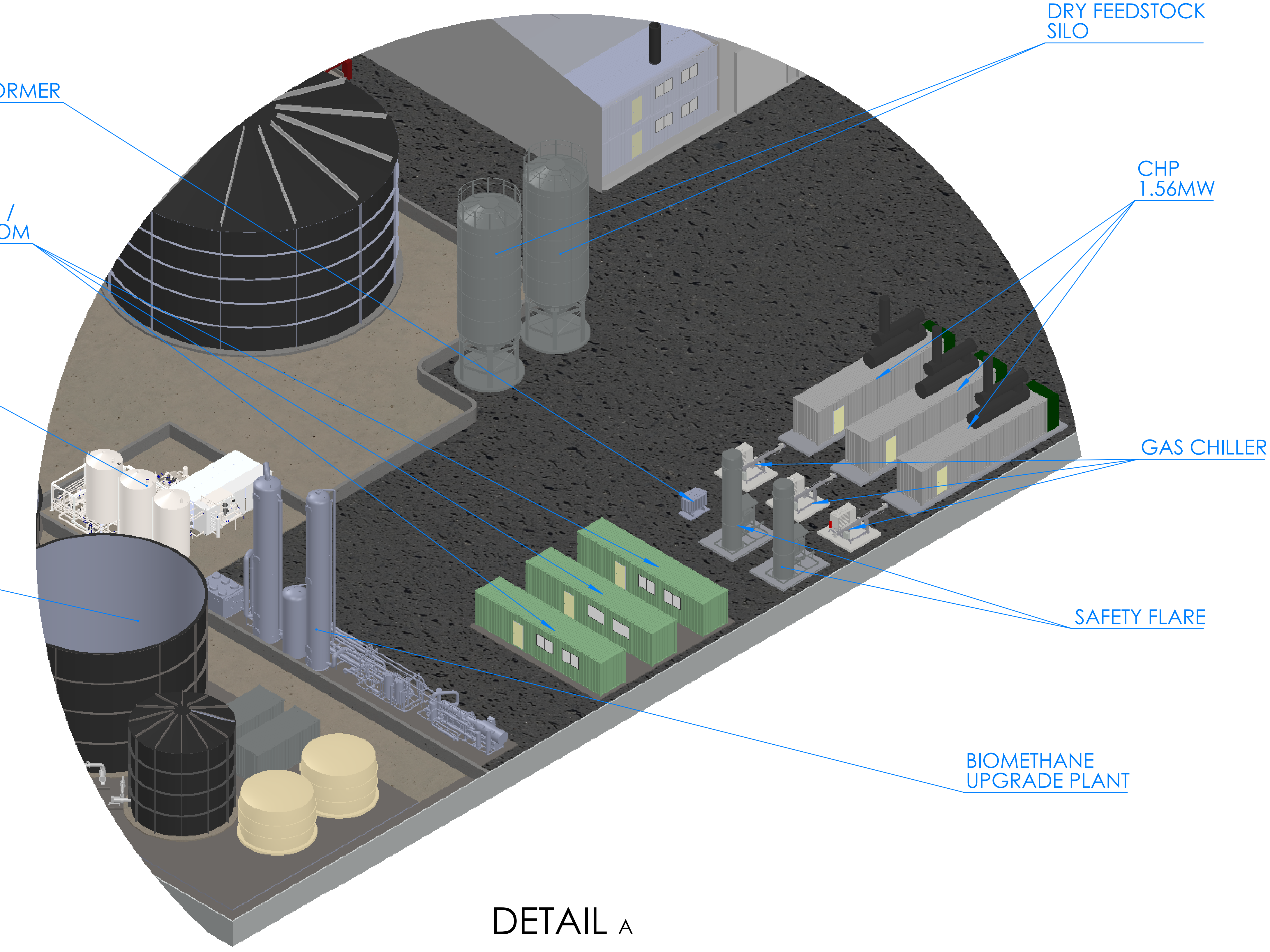

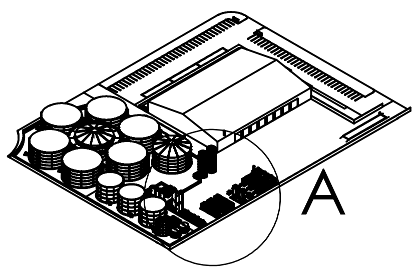

DETAIL A

SCALE 1 : 300

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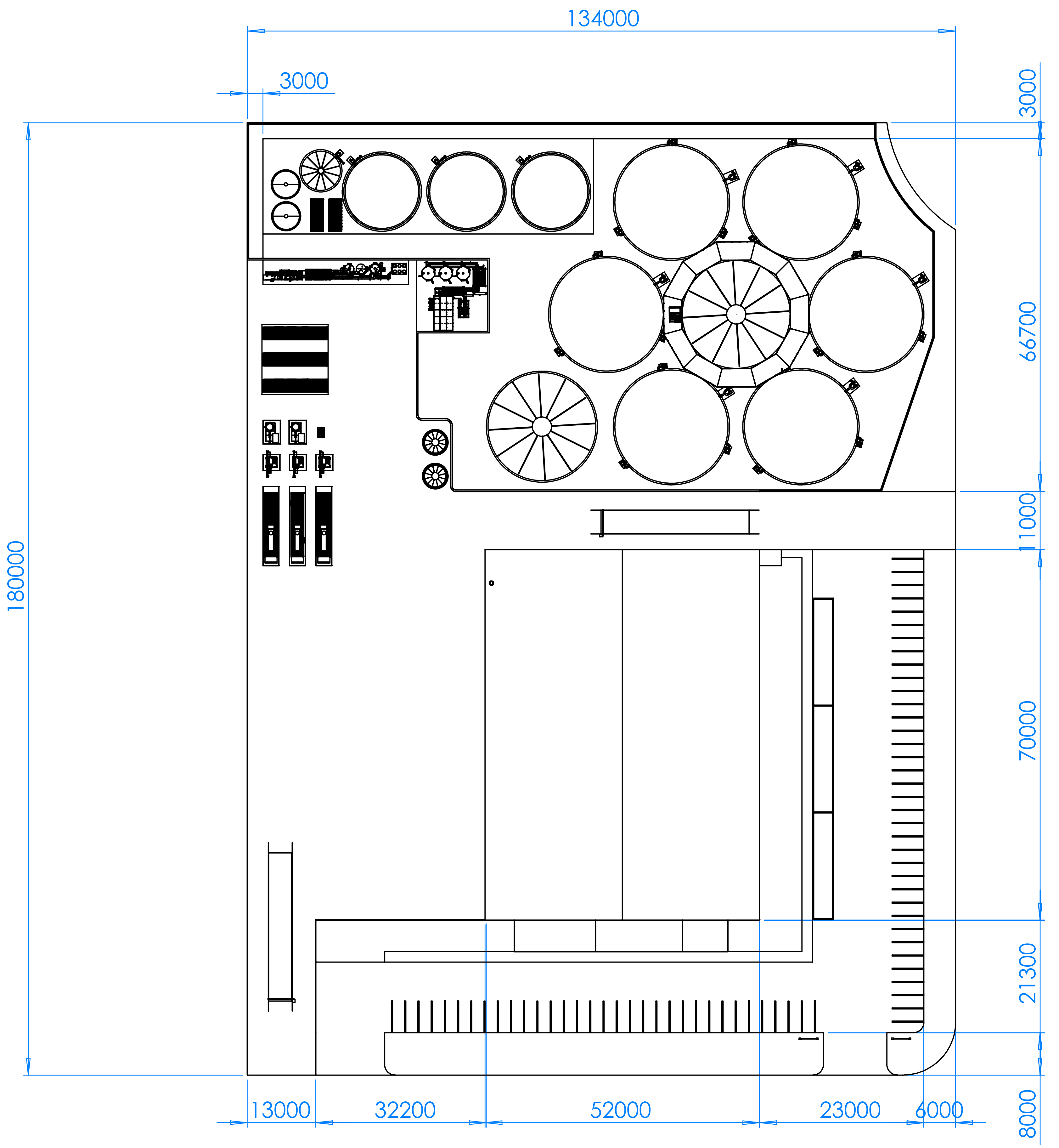

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PROJECT NO: J116

TITLE: SALISBURY AD PLANT CONCEPT LAYOUT

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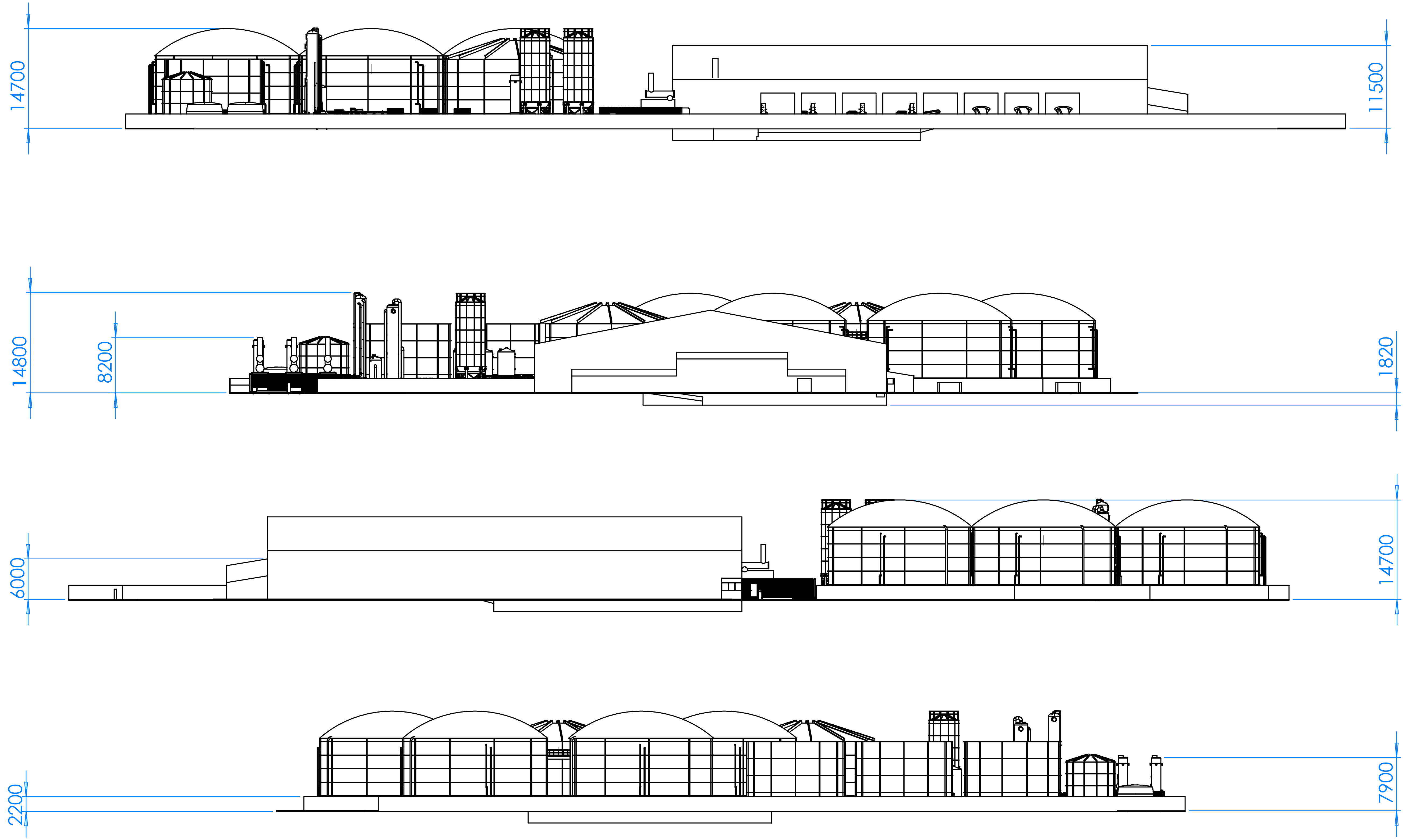

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PROJECT NO: J116

TITLE: SALISBURY AD PLANT CONCEPT LAYOUT

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TITLE: SALISBURY AD PLANT
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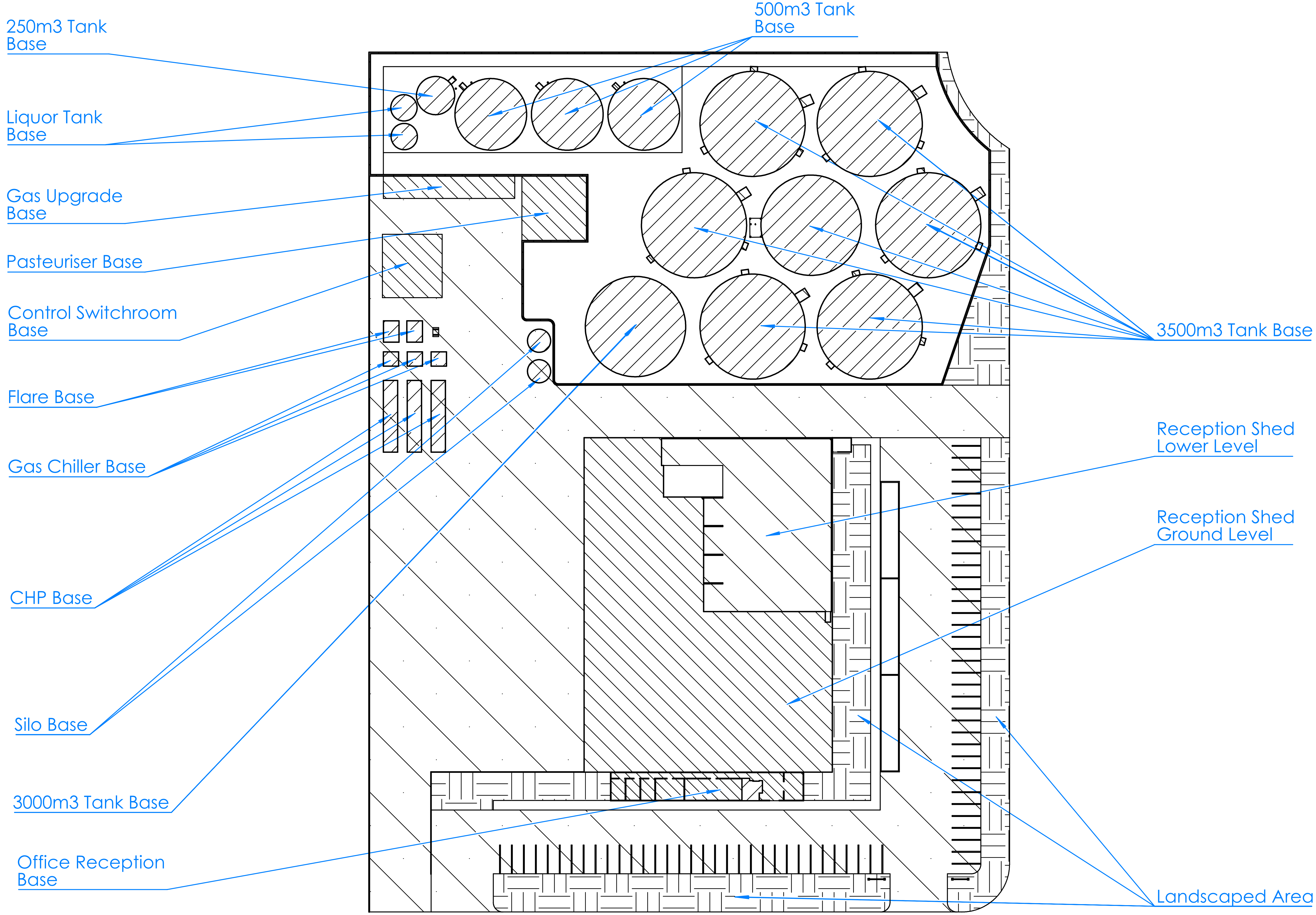
TITLE: SALISBURY AD PLANT CONCEPT LAYOUT

ALL DIMENSIONS IN mm	SCALE 1:2200	DWG NO. J116-001	SHEET NO. 8 OF 8	REV 0



REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
0	ISSUED FOR REVIEW	22/05/2018	MARTYN A.	JOSEPH O.	

BIOGASS RENEWABLES PTY LTD
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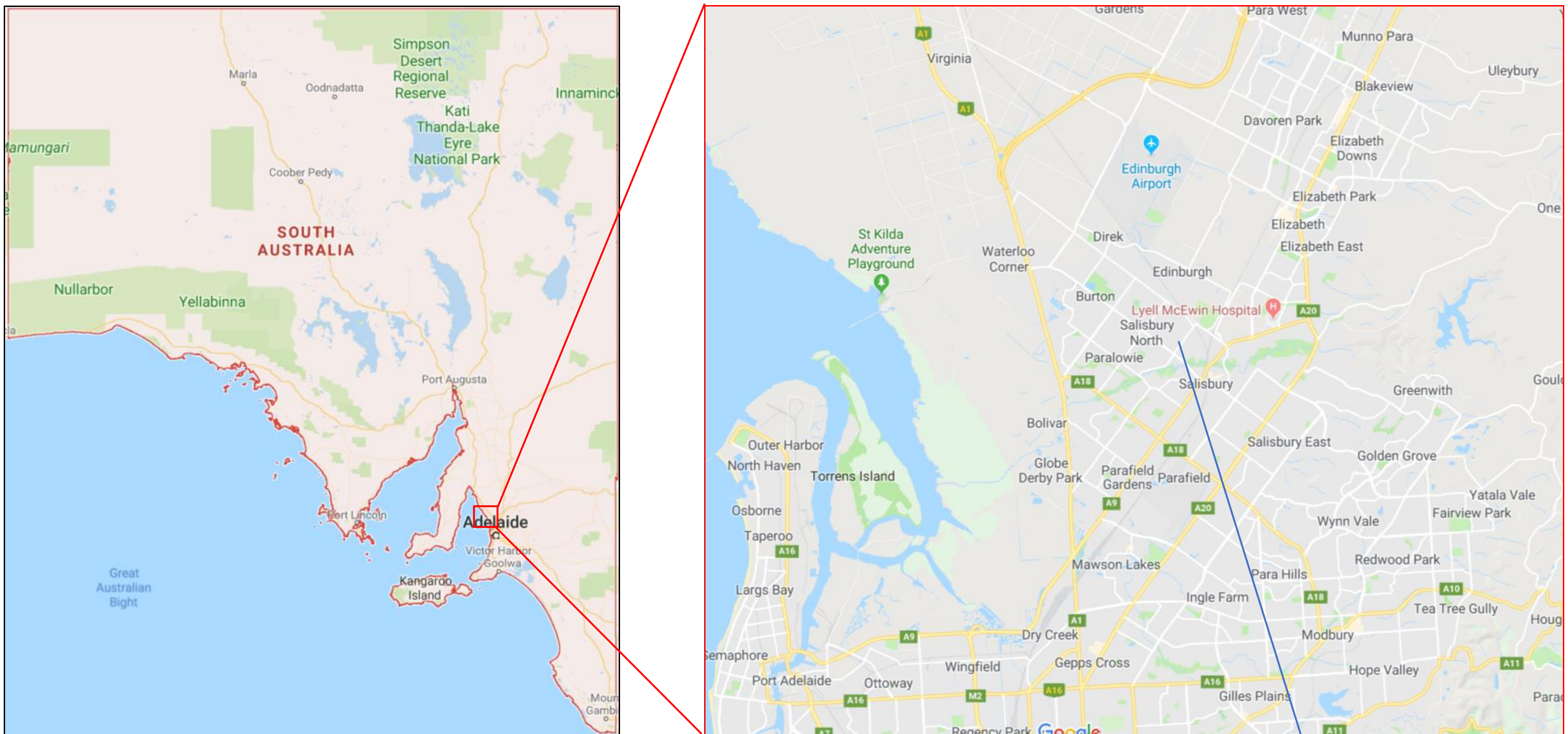
CLIENT: FOOD ENERGY
PROJECT NO: J116

TITLE: SALISBURY AD PLANT
CONCEPT CIVILS LAYOUT

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 1 OF 1 | REV 0

Appendix 2 – Location Map – Lot 505



1-2 Gidgie Ct,
Edinburgh SA 5111

Figure 1 - Site Location Ariel

[Source: Google Maps]

Figure 2 - Arial close-up of site location and surrounds

[Source: Google Maps]

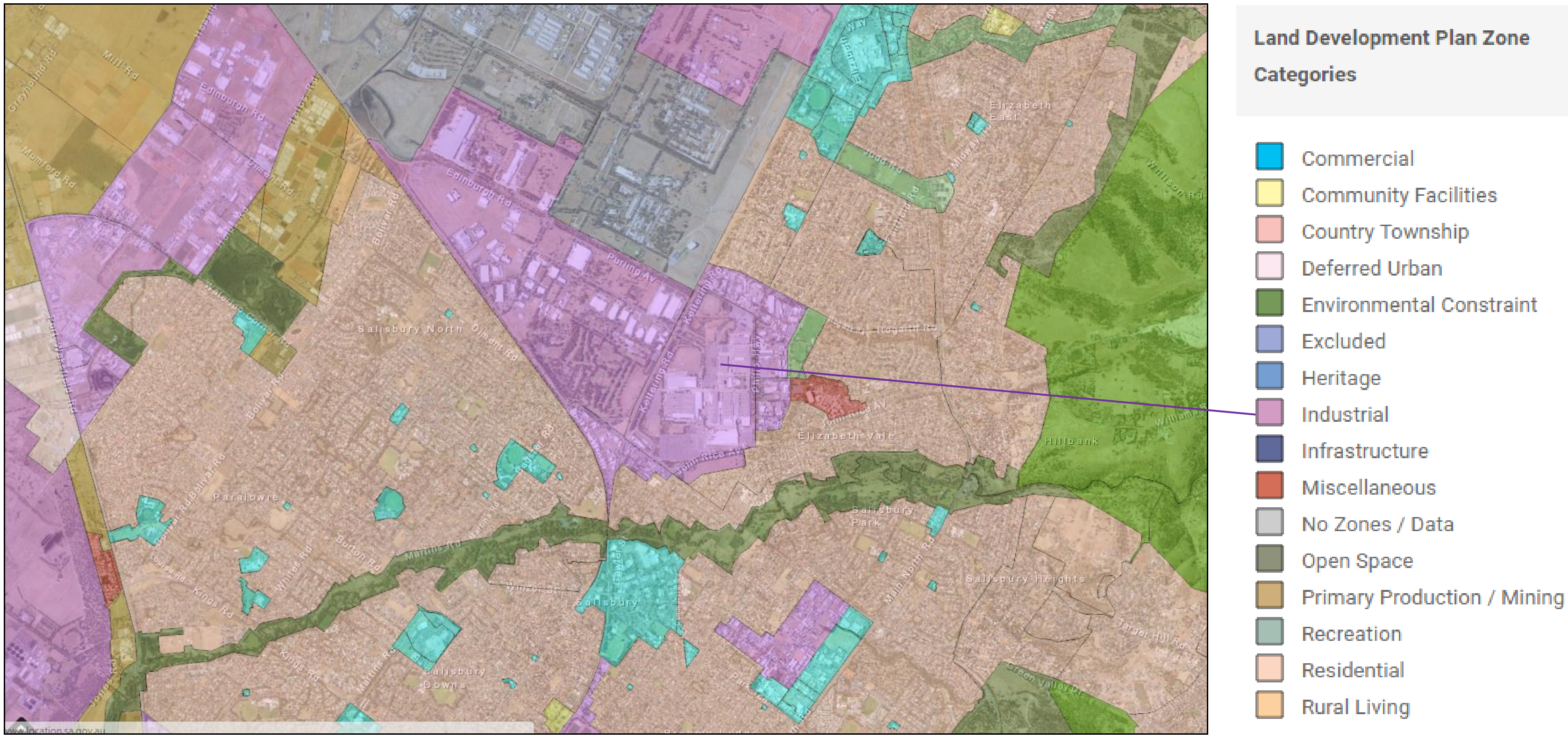


Figure 3 - Zoning Map for Site Location

[Source: location.sa.gov.au]

Appendix 3 – Sensitive Receptors Map – Lot 505

No.	Distance from Property / Activity Boundary	Sensitive Receptor
0	0m	Proposed Site Location (Lot 505)
1	7m	Northern Adelaide Waste Management Authority
2	18m	GTS Freight Management
3	18m	Mayfield
4	18m	Coats Hire
5	15m	Ahrns Handling Equipment
6	15m	DSA SA
7	68m	Commercial / Industrial
8	75m	Edinburgh Parks Nursery
9	115m	Commercial / Industrial
10	175m	Commercial / Industrial
11	205m	Commercial / Industrial
12	175m	Print Lord
13	260m	Commercial / Industrial
14	280m	ZF Lemforder
15	290m	Commercial / Industrial
16	410m	Cape
17	460m	Residential Housing

Note: Closest residential senistive receptor is 460m from proposed site location

Appendix 4 – Stakeholder Engagement

Stakeholder Type	Stakeholder	Date	Attendees (Optional)	Comments
Councils	Salisbury Council SA Water	Wed 07-Mar-2018	-Hamish Jolly -CEO John Harry (CEO Salisbury Council) -Charles Mansueto (CEO Salisbury Water) -Nina -General Manager City Development - Terry Sutcliffe -Bruce Naumann	
	SA Water	Fri 16-Feb-2018	-Hamish Jolly -Darryn Pinto -Joe Oliver -Bruce Naumann	
	Council Solutions	Tue 27-Feb-2018	-Darryn Pinto -Bruce Wright -Paul Howlett -Oliver Barry -Taryn Alderdice	
	SRWRA	Wed 28-Mar-2018		
	Onkaparinga Council	Wed 14-Feb-2018	-Ben Calder -Darryn Pinto	Call to discuss council tender
	Playford Council	Wed 30-May-2018	-Darryn Pinto -Playford Council CEO	Northern Adelaide Recovery Centre
SA Government	PIRSA	Sun 25-Mar-2018	-Hamish Jolly -Darryn Pinto -Stephen Dubrich -Joe Oliver	
	PIRSA	Tue 27-Mar-2018	-Darryn Pinto -John Pitt	

	DPC	Wed 28-Mar-2018	-Hamish Jolly -Darryn Pinto -Mary Lewitzka	Kick off monthly status update meeting
	PIRSA	Thu 29-Mar-2018	-Darryn Pinto -John Pitt	Area visit - Virginia Park
	PIRSA	Sat 24-Mar-2018	-Darryn Pinto -David Leach	Discuss Wine Industry Opportunities
Food Park Tennants	Food Park Tenants (Multiple)	Sat 26-May-2018	-Hamish Jolly -Olive Co -La Casa Del Formaggio -Auscold Logistics -Mary Lewitzka -Stephen Dubrich -Nina Parletta	Major/kickoff foodpark engagement meeting
	La Casa Del Formaggio	Sat 26-May-2018	-Darryn Pinto -Sean Pearce (CFO) -Claude (CEO/Owner)	
	Olive Co	Tue 17-Apr-2018	-Darryn Pinto -Steve (GM)	
	Coles	Tue 17-Apr-2018	-Darryn Pinto -Steve (GM)	
	Ingham's	Tue 17-Apr-2018	-Darryn Pinto -Steve (GM)	
	Adelaide Processors	Tue 17-Apr-2018	-Darryn Pinto -Dean (GM)	
	Barossa Fine Foods	Tue 17-Apr-2018	-Darryn Pinto -David Jones (Ops Manager)	

Organic Waste Producers	SA Produce Markets	Wed 14-Feb-2018	-Hamish Jolly -Darryn Pinto -Karen Butler (Facilities Manager)
	Peats Soils	Wed 14-Feb-2018	-Hamish Jolly -Peter Wadiwitz (CEO)
	Pendleton Fine Foods	Wed 14-Feb-2018	-Darryn Pinto -Nick Whiting (CEO)
	Gourmet Poultry	Tue 27-Mar-2018	-Darryn Pinto -Hamish Campbell
	Baiada Poultry	Wed 28-Mar-2018	-Darryn Pinto -Dada Hu (SA GM)
	SA Mushrooms	Thu 19-Apr-2018	-Darryn Pinto -Nick Fernia (CEO)
	SA Chamber of Produce	Tue 08-May-2018	-Darryn Pinto -George Giameos
	Tip Top	Tue 08-May-2018	-Darryn Pinto -Peter Thorpe
	Tuckers Natural	Wed 09-May-2018	-Darryn Pinto -Andrew Keil (GM Ops)

Appendix 4 - GHG Emissions Calculations

Baseline - Avoided emissions from landfill

Source	Production	Emissions Factor	CO2-e
	Tonnes/year	kg CO2-e/kg	Tonnes/year
Food Waste	125,000	1.9	237,500

Baseline - Avoided emissions from alternative fossil fuels

Source	Offset	Production		Emissions Factor	CO2-e
		MW/h	MW/year	kg CO2-e/kWh	Tonnes/year
Electricity	**Fossil Fuels**	4.7	41,172	0.56	23,056

TOTAL GHG Emissions Avoided	**260,556**	**Tonnes/year**

AD Facility Emissions

Source	Consumption	Energy Content Factor	Emissions Factor	CO2-e
	L/year	GJ/kL	kg CO2-e/GJ	Tonnes/year
Diesel Consumption	39,624	38.6	70.5	107,829
LPG Consumption	5,200	26.2	61.5	8,379

Source	Consumption	Energy Content Factor	Emissions Factor	CO2-e
	m3/year	GJ/m3	kg CO2-e/GJ	Tonnes/year
Biogas for Electricity Combusion	15,768,000	0.0337	4.83	2,567

Total GHG Emissions Produced	**118,774**	**Tonnes/year**

Net GHG Emissions Avoided	**141,782**	**Tonnes/year**

972H Wheel Loader

Fuel Consumption	19.05	L/h
Operating Hours	2,080	h/year
Annual Fuel Consumption	39,624	L/year

RX70 Forklift

Fuel Consumption	2.5	L/h
Operating Hours	2,080	h/year
Annual Fuel Consumption	5,200	L/year

Biogas	25,500,000	m3/year
Electricity	15,768,000	m3/year
Biomethane	9,732,000	m3/year

Table 41: Waste mix methane conversion factors

Waste types	Default DOC proportion	Conversion factor CO_2-e (t=tonnes)
	A	B
Food	0.15	t x 1.9

State or Territory	Emission factor kg CO_2-e/kWh
New South Wales and Australian Capital Territory	0.84
Victoria	1.13
Queensland	0.79
South Australia	0.56
South West Interconnected System (SWIS) in Western Australia	0.76
North Western Interconnected System (NWIS) in Western Australia	0.66
Darwin Katherine Interconnected System (DKIS) in the Northern Territory	0.57
Tasmania	0.12
Northern Territory	0.67

Sources: National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1) and Department of the Environment.

Table 37: Scope 3 emission factors – natural gas for a product that is not ethane (inclusive of coal seam gas)

State or territory	Natural Gas EF for scope 3	Natural Gas EF for scope 3
	Metro	Non-metro
	kg CO_2-e /GJ	kg CO_2-e /GJ
New South Wales and ACT	12.8	13.6
Victoria	3.9	3.9
Queensland	8.7	7.8
South Australia	10.4	10.3
Western Australia	4.0	3.9
Tasmania	NA	NA
Northern Territory	NA	NA

Source: Wilkenfeld and Associates (2012), derived from NGER data

Table 4: Fuel combustion emission factors - fuels used for transport energy purposes

Transport equipment type	Fuel combusted	Energy content factor (GJ/kL unless otherwise indicated)	Emission factor kg CO_2-e/GJ (relevant oxidation factors incorporated)		
			CO_2	CH_4	N_2O
General transport					
	Gasoline (other than for use as fuel in an aircraft)	34.2	67.4	0.5	1.8
	Diesel oil	38.6	69.9	0.1	0.5
	Gasoline for use as fuel in an aircraft	33.1	67.0	0.05	0.7
	Kerosene for use as fuel in an aircraft	36.8	69.6	0.01	0.6
	Fuel oil	39.7	73.6	0.07	0.6
	Liquefied petroleum gas	26.2	60.2	0.6	0.7

Table 2: Emission factors for the consumption of natural gas

Fuel combusted	Energy content factor (GJ/m^3 unless otherwise indicated)	Emission factor kg CO_2-e/GJ (relevant oxidation factors incorporated)		
		CO_2	CH_4	N_2O
Natural gas distributed in a pipeline	39.3×10^{-3}	51.4	0.1	0.03
Coal seam methane that is captured for combustion	37.7×10^{-3}	51.4	0.2	0.03
Coal mine waste gas that is captured for combustion	37.7×10^{-3}	51.9	4.1	0.03
Compressed natural gas (reverting to standard conditions)	39.3×10^{-3}	51.4	0.1	0.03
Unprocessed natural gas	39.3×10^{-3}	51.4	0.1	0.03
Ethane	62.9×10^{-3}	56.5	0.03	0.03
Coke oven gas	18.1×10^{-3}	37.0	0.03	0.05
Blast furnace gas	4.0×10^{-3}	234.0	0.0	0.03
Town gas	39.0×10^{-3}	60.2	0.0	0.03
Liquefied natural gas	25.3 GJ/kL	51.4	0.1	0.03
Gaseous fossil fuels other than those mentioned in the items above	39.3×10^{-3}	51.4	0.1	0.03
Landfill biogas that is captured for combustion (methane only)	37.7×10^{-3}	0.0	4.8	0.03
Sludge biogas that is captured for combustion (methane only)	37.7×10^{-3}	0.0	4.8	0.03
A biogas that is captured for combustion, other than those mentioned in the items above	37.7×10^{-3}	0.0	4.8	0.03

Appendix 6 – HAZOP Risk Assessment

HAZOP/ RISK ASSESSMENT Study Record Sheet	
HAZOP No: HAZ-J116-001 **Meeting Held on:** 1 June 2018 **Meeting Held at:** 1205 Hay St, West Perth WA 6005	**Project:** Edinburgh SA **Present:** Hamish Jolly Joseph Oliver Martyn Anderson Jonathan Luu **Secretary:** Joseph Oliver **Chairman:** Hamish Jolly
GENERAL BACKGROUND The following minutes summarise the HAZOP / Risk Assessment conducted for the proposed waste-to-energy facility. The key objective of the workshop was to identify hazards and operability issues associated with the proposed installation of the plant.	

WORK SCOPE ITEMS Major items in the project scope are summarised below. • Waste Receival & Storage • Pre-treatment & Mixing • Hydrolysis & Anaerobic Digestion • Water recovery & Filtration • Solids Recovery • Electricity, Heat and Gas Generation • Flare System
LIST OF SYSTEMS System: 1– Waste Receival & Storage System: 2 – Pre-treatment & Mixing System: 3 – Hydrolysis & Anaerobic Digestion System: 4 – Water recovery & Filtration System: 5 – Solids Recovery System: 6 – Electricity, Heat & Gas Generation System: 7 - Flare

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
System: 1 – **Waste Receival & Storage**										
1.1	Inputs	Incorrect or excess material delivered to site	Operational issues Compliance Personnel health	Standard Operating Procedures (SOP) / Training Receival Procedures to check incoming materials. Fast and same day processing Quality Checks and Monitoring 2 days storage volume in receival bunkers	SOP / Training Create receival procedures manual					
1.2	Mechanical Equipment	Failure of tanks, pipework or mechanical instruments	Overfill of tanks, pipework and instrumentation Potential for leaks and spills Potential personnel hazard	Standard Operating Procedures (SOP) / Training Flow-meters / Pressure sensors with interlocks to pumps Tank gauges with high alarms Bunded areas Drainage sump	SOP / Training Install sensors and interlocks Install bunding Install drainage sump					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Date
1.3	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					
1.4	Environmental	Failure to contain odours	Potential localized odours	Process occurs in enclosed waste receival, storage and handling building Biofilter / ozone / odour treatment on exhaust Bunded areas Drainage sump Fast and same day processing	Install appropriate equipment Install bunding Install drainage sump					
1.5	OHS	Machinery Hazards Noxious Odours Bio Hazards	Operator Safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks	SOP / Training Supply appropriate PPE Guards and interlocks installed					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
System: 2 – Pre-treatment & Mixing										
2.1	Inputs	Incorrect or excess material entering system	Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring	SOP / Training					
2.2	Mechanical Equipment	Failure of tanks, pipework or mechanical instruments	Overfill of tanks, pipework and instrumentation Potential for leaks and spills Potential personnel hazard	Standard Operating Procedures (SOP) / Training Flow-meters / Pressure sensors with interlocks to pumps Tank gauges with high alarms Bunded areas Drainage sump	SOP / Training Install sensors and interlocks Install bunding Install drainage sump					
2.3	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
2.4	Environmental	Failure to contain odours	Potential localized odours	Fully enclosed system Bunded areas Drainage sump	Install appropriate equipment Install bunding Install drainage sump					
2.5	OHS	Machinery Hazards Noxious Odours Bio Hazards	Operator Safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks Fully enclosed system	SOP / Training Supply appropriate PPE Guards and interlocks installed					
System: 3 – Hydrolysis & Anaerobic Digestion										
3.1	Inputs	Incorrect or excess material entering system	Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring	SOP / Training					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Date
3.2	Mechanical Equipment	Failure of tanks, pipework or mechanical instruments	Overfill of tanks, pipework and instrumentation Potential for leaks and spills Potential personnel hazard	Flow-meters / Pressure sensors with interlocks to pumps Tank gauges with high alarms Standard Operating Procedures (SOP) / Training Bunded areas Drainage sump	Install sensors and interlocks SOP / Training Install bunding Install drainage sump					
3.3	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					
3.4	Environmental	Failure to contain odours	Potential localized odours	Fully enclosed system Bunded areas Drainage sump	Install appropriate equipment Install bunding Install drainage sump					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Date
3.5	OHS	Machinery Hazards Noxious Odours Bio Hazards	Operator safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks Fully enclosed system	SOP / Training Supply appropriate PPE Guards and interlocks installed					
3.6	Gas Discharge	Blockage in gas line Excess gas pressure / production	Potential leaks to environment Pressure build-up and release Fire potential Potential release of H2S, GHG and odour	Oxygen micro-dosing to convert H2S into H20 and sulphates Release of gas through pressure relief valve Pressure / flow sensors with interlocks to relief valve Tank gauges with high alarms Flare system backup	H2S monitoring with alarms Installation of flame proof equipment Install sensors and interlocks with alarms Firefighting equipment Supply appropriate PPE					
System: 4 – Water Recovery & Filtration										
4.1	Inputs	Incorrect or excess material entering system	Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring	SOP / Training					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
4.2	Mechanical Equipment	Failure of tanks, pipework or mechanical instruments	Overfill of tanks, pipework and instrumentation Potential for leaks and spills Potential personnel hazard	Flow-meters / Pressure sensors with interlocks to pumps Tank gauges with high alarms Standard Operating Procedures (SOP) / Training Bunded areas Drainage sump	Install sensors and interlocks SOP / Training Install bunding Install drainage sump					
4.3	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					
4.4	Environmental	Failure to contain odours	Potential localized odours	Fully enclosed system Bunded areas Drainage sump	Install appropriate equipment Install bunding Install drainage sump					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Date
4.5	OHS	Machinery Hazards Noxious Odours Bio Hazards	Operator safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks Fully enclosed system	SOP / Training Supply appropriate PPE Guards and interlocks installed					
System 5: Solids Recovery										
5.1	Inputs	Incorrect or excess material entering system	Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring	SOP / Training					
5.2	Mechanical Equipment	Failure of tanks, pipework or mechanical instruments	Overfill of tanks, pipework and instrumentation Potential for leaks and spills Potential personnel hazard	Flow-meters / Pressure sensors with interlocks to pumps Tank gauges with high alarms Standard Operating Procedures (SOP) / Training Bunded areas Drainage sump	Install sensors and interlocks SOP / Training Install bunding Install drainage sump					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Date
5.3	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					
5.4	Environmental	Failure to contain odours	Potential localized odours	Process occurs in enclosed waste receival, storage and handling building Biofilter / ozone / odour treatment on exhaust Fast and same day processing Bunded areas Drainage sump	Install appropriate equipment Install bunding Install drainage sump					
5.5	OHS	Machinery Hazards Noxious Odours Bio Hazards	Operator safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks Fully enclosed system	SOP / Training Supply appropriate PPE Guards and interlocks installed					
System: 6 – Electricity, Heat and Gas Generation										

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
6.1	Inputs	Incorrect or excess material entering system	Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring Flare system backup	SOP / Training					
6.2	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks	Ensure equipment stops if process control system failure					
6.3	OHS	Machinery Hazards Noxious Odours	Operator safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks	SOP / Training Supply appropriate PPE Guards and interlocks installed					
6.4	Gas Discharge	Leak in gas line Excess gas pressure / production	Potential leaks to environment Pressure build-up and release Fire potential	Pressure / flow sensors with interlocks Flare system backup	Install sensors and interlocks with alarms Firefighting equipment Supply appropriate PPE					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed	
									Y/N	Date
6.5	Environmental	Noise barrier failure Catalytic converter failure	High noise level GHG Emissions	House generator in container to provide noise barrier Catalytic Converter on CHP exhaust stack	Install appropriate equipment					
6.6	Temperature	CHP unit failure	High temperature damage to unit Fire potential	Standard Operating Procedures (SOP) / Training Temperature sensors and interlocks / shutdown Fire protection Leak detectors PPE	SOP / Training Supply appropriate PPE Install fire protection					
System: 7 – Flare System										

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
7.1	Inputs	Incorrect or excess material entering system	Incomplete burning Flame smoking Increased radiant heat Increase flame noise Operational issues Compliance	Standard Operating Procedures (SOP) / Training Quality Checks and Monitoring Barriers and “Hot” signs near flare	SOP / Training PPE Design to Australian Standards Install barriers and signs					
7.2	Process Control	Electrical Failure	Loss of system control	Electrical Interlocks System to shut in fail safe mode	Ensure equipment stops if process control system failure Install fail safe system					
7.3	OHS	Equipment hazards Noxious Odours	Operator safety	Standard Operating Procedures (SOP) / Training PPE Guards and interlocks	SOP / Training Supply appropriate PPE Guards and interlocks installed					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
7.4	Gas Discharge	Leak in gas line Excess gas pressure / production	Potential leaks to environment Pressure build-up and release Fire potential	Pressure / flow sensors with interlocks Flare system backup Leak detectors	Install sensors and interlocks with alarms Firefighting equipment PPE					
7.5	Environmental	Flaring failure / issues	Incorrect gas discharge Noise from operation	Standard Operating Procedures (SOP) / Training Equipment testing	SOP / Training Install appropriate equipment Design to Australian Standards Commissioning					
7.6	Flow	Blockage in flare	Build-up of gases in stack Potential for ignition in stack	Flow-meters / Pressure sensors with interlocks Design in check valve and liquid seal to prevent reverse flow Pressure relief value to atmosphere	Install check valve and liquid seal					

No	Category	Cause	Consequence	Safeguards	Action Required	Action Cat	Action By	Decision/Status/ Document Reference	Completed Y/N	Completed Date
7.7	Temperature	Large volume of gas burning	Radiant Heat	Operator PPE Barriers and "Hot" signs near flare	Install sensors and alarms Supply appropriate PPE Install barriers and signs					

Intended for
Emissions Assessments Pty Ltd

Date
September 2018

BIOGASS RENEWABLES
SALISBURY ANAEROBIC DIGESTION PLANT AIR QUALITY ASSESSMENT

BIOGASS RENEWABLES
SALISBURY ANAEROBIC DIGESTION PLANT AIR QUALITY ASSESSMENT

Revision	**Final**
Date	**25/09/2018**
Made by	**Martin Parsons**
Checked by	**Ruth Peiffer**
Approved by	**Nick Houldsworth**

Ref	318000493

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FIGURES

TABLES

APPENDICES

1. INTRODUCTION

1.1 Background

Biogass Renewables Pty Ltd (Biogass) are proposing to develop an Anaerobic Digestion Plant (the Plant) at the parks precinct in Edinburgh, South Australia. The premises are located at Lot 104 - 116 Purling Ave, Edinburgh, South Australia. The location of the proposed facility is shown in Figure 1, with nearest sensitive receptors being located approximately 450 m south-west and 300 m south of the site.

Emissions Assessments Pty Ltd (Emissions Assessments) requested Ramboll Australia Pty Ltd (Ramboll) undertake an air dispersion modelling assessment to determine the likely air quality impacts associated with routine operations and a flaring scenario for the Plant. This report presents the approach, methodology and results of air dispersion modelling for the Plant operating under each of the modelled scenarios. The maximum predicted ground level concentrations (GLCs) of the modelled compounds have been compared against the relevant ambient air quality criteria.

1.2 Overview of Process

The Plant will use organic waste to produce biogas (methane) through an anaerobic digestion process. The anaerobic digestion process is a fully enclosed system.

The organic waste (100,000 tonnes per annum [tpa] of food waste, 25,000 tpa of grain dust) is received, stored and pre-processed in a purpose built, sealed and fully enclosed negative pressure structure, before being pumped in a continuous process to a digester feed tank then onto one of six digester tanks, where it is stirred and agitated at intervals to encourage the release of biogas. An automated system regulates the necessary parameters such as pH and temperature. The digester breaks down the material to produce biogas, comprising approximately methane, carbon dioxide, water and hydrogen sulphide.

The biogas is collected under a fire resistant, double membrane dome on top of each digester. A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.
The biomethane will then be fed to a power plant, which drives a generator to produce electricity for onsite use by Biogass. The digestion tanks harvest the steam and hot water from the power plant, which is used to stabilise the temperature of the biomass in the digestion and storage tanks.

Figure 1: General Location of the proposed Biogass Facility

1.3 Details of Process

An overview of the layout of the plant is shown in Figure 2 with detailed description of the operation provided in the following sections.

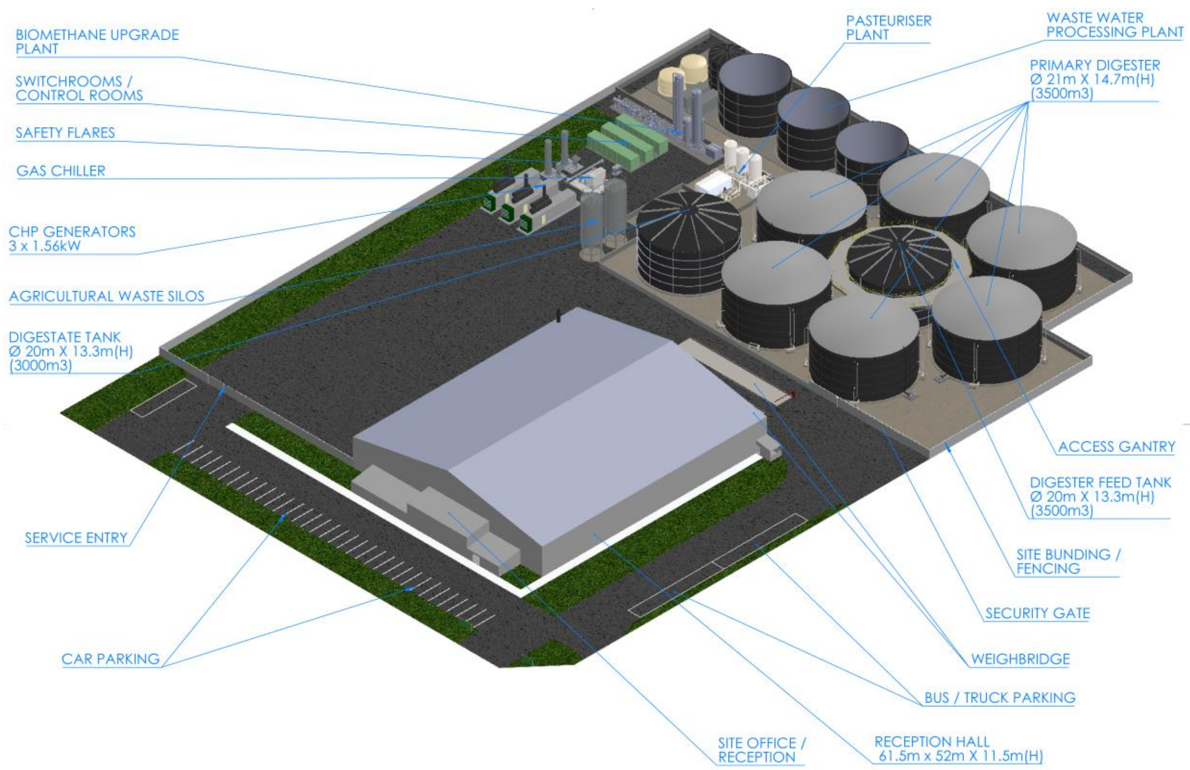

Figure 2: Layout of Plant

Source: Emissions Assessments

1.3.1 Receivals Hall

The waste is received in the receivals hall which is a 60 m x 52 m x 11.5 m high hooped roof building. The receivals hall is fitted with concrete bunkers, graded floor and drainage sump. The receivals hall will be under negative pressure and connected to fully enclosed, single stack biofilter.

All vehicle entry points to process buildings will be via fast acting roller shutter doors which open and close on a pressure switch. All doors associated with process buildings will be connected to an alarm system which alerts operators in the event of doors being left open. Doors will only be opened for entry and exit of trucks with doors sealed before unloading occurs.

The solid and semi-solid waste will be deposited into graded bunkers with liquid waste pumped directly into a sump, for subsequent pumping to a liquid storage tank. Trucks are washed before departure with all wastewater draining to the sump for processing in the digestion system.

1.3.2 Staging Process (no emissions)

Blended and balanced feedstock is pumped in sealed pipes to a fully enclosed digester feed tank where it is mixed and warmed using heat from the plant's biogas generators.

1.3.3 Anaerobic Digestion (no emissions)

Feedstock is pumped daily in sealed pipes from the digester feed tank to the primary digester tanks. These tanks are interoperable or can be isolated. The digesters are warmed using heat from the plant's biogas generators. Biogas accumulates in the gas domes, and can be positively displaced by pumping air between the gas dome's membranes.

1.3.4 Digestate Storage and Reuse (no emissions)

On a daily basis, digestate is pumped in sealed pipes to a digestate storage tank. The digestate will be pumped directly into a tanker truck for transport offsite.

1.3.5 Biogas Processing and Safety Flare

Biogas in the domes is positively displaced and drawn off in sealed gas pipes. The gas will then pass through a biomethane upgrade plant which will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.

The entire gas management system is connected to an enclosed gas flare system comprising two flares. Gas can be directed to a flare at all gas storage and processing stages so as to bypass any equipment processing failure that may occur. The flare will only be operated on an emergency basis, or when one of the generators is not operating for routine maintenance (estimated 12 days per year), or in the unlikely event that all generators fail (worst case estimated 7 days).

A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.

1.3.6 Power and Heat Generation and Application

Clean methane gas, scrubbed and separated (carbon dioxide fraction removed) is compressed as fuel for three generators. Energy generated will be used to power the anaerobic digestion plant. The balance will supply 100% of Biogass' onsite energy requirements. Heat from the generator will be captured via a heat exchanger to heat the digester feed tank and the primary digesters.

2. ATMOSPHERIC EMISSIONS

2.1 Emission Sources

The atmospheric emissions sources included in the air dispersion modelling assessment for the Plant operating under routine conditions include:

- One biofilter stack, with emissions of concern being odour;
- Three gas fired reciprocating engines, with the emissions of concern being biomethane combustion products; and
- Emissions from the biomethane upgrade plant, consisting of hydrogen sulphide and odour.

The receivals hall was also considered as a potential emission source. However, as the Hall will be fitted with fast acting roller shutter doors and will be under negative pressure and connected to the fully enclosed, single stack biofilter, potential emissions are considered to be negligible. The main doors will only open for vehicle entry for waste delivery and digestate transport. With fast door opening and closing times of 6 seconds, it is likely that the doors will be open for around 30 seconds per truck entry. Emissions monitoring at similar sites has indicated emissions from door openings and leakage from buildings with rapid roller shutter doors and comparable management practices are negligible. The receivals hall has not been included in the modelling assessment on this basis.

The full flaring scenario included in this assessment has considered the following atmospheric emission sources:

- Two enclosed flares, used when one or all of the generators are unavailable with the emissions of concern being biomethane combustion products.

2.1.1 Biofilter Emissions

The biofilter will use spongelite as the filter media. Air from the receivals hall will be humidified using misting nozzles running on timer, with a fan running inside the air extraction pipe. All biofilter fans will run on standard electric motor, with a spare which can be connected immediately in event of a failure.

2.1.2 Power Generation

The plant will use three 526 kW capacity Jenbacher 3-type biogas generators (GE JGS312 GS-N.L D225) manufactured by General Electric. The GE Jenbacher engine uses a LEANOX control system with oxides of nitrogen emissions guaranteed < 500 mg/Nm^3 (101.3 kPa, dry and 5% O_2).

Emissions associated with the generators include:

- Oxides of nitrogen (NO_x) consisting mostly of nitrogen oxide (NO) and a lesser concentration of nitrogen dioxide (NO_2). NO_x is formed primarily from the oxidation of fuel-bound nitrogen and nitrogen in the air;
- Sulphur oxides (SO_x) which are predominantly in the form of sulphur dioxide (SO_2), formed from the oxidation of sulphur in the fuel; and
- Carbon monoxide (CO) formed from the incomplete combustion of the fuel.

Particulate matter (PM) and non-methane volatile organic emissions from the generators are considered to be negligible as the fuel source is a gaseous fuel with minor higher chain paraffins and as such, have not been included in the modelling assessment.

2.1.3 Enclosed Flares

Each enclosed flare will reach a height of 8 m and diameter of 1.7 m. The biogas is fed in at the bottom and combusted with the combustion temperature and efficiency controlled by a thermocouple near the top of stack, which adjusts the air inflow at the base of the stack via dampers. If the exhaust temperature is too high, the dampers are opened further and more air is drawn in and if too low, the dampers are restricted to restrict the air flow to maintain optimum combustion. Destruction removal efficiencies of 99% and 99.95% for methane and hydrogen sulphide (H_2S) respectively are guaranteed by the manufacturer.

2.1.4 Biomethane Upgrade Plant

A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane. Emissions of concern from the biomethane upgrade plant will include H_2S and odour.

2.2 Emissions Estimations

Emission estimates for the biofilter, power generation and flares were derived from stack monitoring data from another biogas production facility with a similar configuration located in Jandakot, Western Australia (as provided by Emissions Assessments). The emissions estimates applied in this assessment have been derived from worst case concentrations, as measured when the reference plant was operating at 100% load and are considered conservative.

Emission estimates for the biomethane upgrade plant were derived from manufacturer's specifications.

The exhaust parameters and emission estimates for each of the modelled sources are provided in Table 1.

Table 1: Emission Parameters for the Plant

Parameter	Units	Routine Operations			Flaring
		Bio Filter	CHP Power Generation x 3	Biomethane Upgrade	Flares x 2
Exhaust Parameters					
Operation		Continuous	Continuous	Continuous	< 12 days per year
Number		1	3	1	2
Coordinates	**UTM**	283634, 6153412	283603, 6153437 283607, 6153435 283611, 6153433	283640, 6153473	283611, 6153455 283615, 6153453
Height	**m**	14.5	8.6	14.5	8.0
Diameter	**m**	0.88	0.32	0.25	1.73
Temp	**Deg C**	22	410	15	1000
	K	295	683	288	1273
Measured Oxygen	**%**	NA	8.3	NA	10.9
Stack Moisture	**%**	1.5	4.4	NA	1.5
Volumetric Flow	**Nm^3/s Dry**	19.1	1.16	0.73	10.2
	Am^3/s	20.3	2.8	0.77	47.0

Parameter	Units	Routine Operations			Flaring
		Bio Filter	CHP Power Generation x 3	Biomethane Upgrade	Flares x 2
Exit Velocity	**m/s**	33.3	34.6	15.7	20.0
Emission Estimates					
OU	**o/u.m^3/s**	1670	NA	105	NA
H_2S	**mg/m^3[1]**	NA	5.0	55	5.2
	g/s	NA	0.01	0.04	0.05
NO_x	**mg/m^3[1]**	NA	400	NA	51
	g/s	NA	0.46	NA	0.52
SO_2	**mg/m^3[1]**	NA	46	NA	8.8
	g/s	NA	0.05	NA	0.09
CO	**mg/m^3[1]**	NA	590	NA	16
	g/s	NA	0.69	NA	0.16

Notes

1. Referenced to STP (273.15K, 101.3kPa) and expressed as dry values.

2.3 Non-Routine Emissions

Non-routine emissions from biogas plants (apart from the infrequent flaring) may potentially arise as a result of a malfunctioning of the flare, the air extraction system or the biofilter. For the Plant these will be addressed by the management practices outlined in the following sections.

2.3.1 Flaring

Flaring upset conditions may potentially occur if gas is vented via the flare without combustion occurring. The biogas plant flare system will mitigate this risk by configuring the ignition system to be battery powered with backup solar charging. The monitoring system also includes monitoring of the exhaust temperatures and exhaust gases, such that if combustion is not occurring an alarm will be activates to alert to the need for intervention.

2.3.2 Biofilter

Higher than normal emissions can occur through biofilters (or fugitive release from the receivals hall) due to failure of extraction motors, loss of power, loss of humidification of the inlet air and problems in the biofilter media, such as compaction of the bed, degradation in the efficiency and the need to perform maintenance such as replace the filter media. These will be managed as follows:

- The extraction system on all biofilters at the site will utilise standard motors, with one motor always kept onsite as a spare. The biofilter for this plant will use two fans. Loss of a motor will only reduce the extraction flow rate by 50% for a period anticipated for no more than 3 hours;
- The power supply for the pumps will be provided by onsite generators, and when not available, by mains power. Redundancy is therefore built into the power supply and a power failure event could only occur if the onset generators failed, and there happened to be a simultaneous mains power failure. The likelihood of these concurrent events is extremely low. Owing to the redundant design it is therefore expected that odour escape owing to power failure has negligible probability of occurring;
- The humidification system will be designed to ensure humidity for all inlet conditions is maintained at 70%; and

- The biofilter media is anticipated to last for 8 years. This is much longer than organic biofilter media as it does not suffer issues such as compaction and degradation in media performance. The media is anticipated to be replaced on an as-required basis, but not less than every 8 years. Monitoring of the stack emissions will be conducted to assess the performance of the biofilter. If a deterioration in performance below minimum standards is attributed to degradation of the media, all waste receivals will be held over pending a replacement of the media, a process of up to two days.

Given the above design and proposed management of the plant, the probability of non-routine emissions from the Plant occurring is considered to be negligible and as such, have not been included in the modelling assessment.

3. AIR QUALITY CRITERIA

3.1 Human Health

For ambient GLCs, the SA Environment Protection Authority (EPA) outlines state-wide standards in its Environment Protection (Air Quality) Policy 2016. The policy seeks to apply the standards at residential areas or places where people may congregate, such as beaches or picnic areas. The standards relevant to this assessment are listed in Table 2.

Table 2: SA EPA Environment Protection (Air Quality) Policy 2016 - Applicable Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration ($\mu g/m^3$)[1]
CO	1-hour	31,240
	8-hour	11,250
NO_2	1-hour	250
	1-year	60
H_2S	3-minutes	510
SO_2	1-hour	570
	1-day	230
	1-year	60

Notes:

1. Concentrations are referenced to 0 deg C and 101.3kPa.

3.2 Odour

The SA EPA has outlined state-wide standards for odour that are applicable to this study. The standards state that an activity cannot result in the number of odour units being exceeded for the number of persons (as specified in Table 3) over a 3 minute averaging time 99.9% of the time (based on evaluations at ground level using a prescribed testing, assessment, monitoring or modelling methodology for the pollutant and activity).

Table 3: SA EPA Environment Protection (Air Quality) Policy 2016 – Applicable Odour Standards

Number of people	Odour Units (OU) (3-minute average, 99.9% of time)
2000 or more	2
350 - 1999 (inclusive)	4
60 - 349 (inclusive)	6
12 - 59 (inclusive)	8
Single residence (fewer than 12)	10

4. EXISTING AIR QUALITY

In order to determine a background concentration to assess potential cumulative impacts for the purposes of this study, monitoring data from two SA EPA monitoring stations; Elizabeth (NO_2 and CO) and Northfield (SO_2). These locations were chosen as they are the nearest ambient air quality monitoring stations to the proposed site and the monitored values are considered to be generally representative of background concentrations.

Monitoring data collected at each site between 1 January 2015 to 31 May 2018 was utilised for the purpose of this assessment. No specific guidance for selection of an appropriate background concentration is provided by the SA EPA. The Environment Protection Authority Victoria (Vic EPA) State Environment Protection Policy (Ambient Air Quality) (SEPP (AQM)) (Gov. of Vic., 2001) recommends the 75th percentile concentration (concentration which is exceeded by 25% of concentrations for that averaging period) should be adopted as a background level. Correspondence with SA EPA personnel indicated this approach would be suitable to determine ambient background concentrations for use in this assessment.

A summary of the ambient concentrations measured at the Elizabeth and Northfield SA EPA monitoring stations are presented in Table 4.

Table 4 indicates that of the applicable pollutants, background concentrations are relatively low in the region.

Table 4: 75th Percentile and Annual Average Ambient Concentrations for CO, NO_2 and SO_2

<table>
<tr><th>Pollutant</th><th>Averaging Period</th><th>75th Percentile Concentration ($\mu g/m^3$)[1]</th><th>Annual Average ($\mu g/m^3$)[1]</th></tr>
<tr><td rowspan="2">CO[2]</td><td>1-hour</td><td>25</td><td rowspan="3">NA</td></tr>
<tr><td>8-hour</td><td>25</td></tr>
<tr><td rowspan="2">NO_2[2]</td><td>1-hour</td><td>10</td></tr>
<tr><td>24-hour</td><td>NA</td><td>8</td></tr>
<tr><td rowspan="3">SO_2[3]</td><td>1-hour</td><td>0</td><td rowspan="2">NA</td></tr>
<tr><td>24-hour</td><td>0.14</td></tr>
<tr><td>Annual</td><td>NA</td><td>0.2</td></tr>
</table>

Notes:

1. Concentrations are referenced to 0 deg C and 101.3kPa.
2. As measured at the Elizabeth SA EPA monitoring station.
3. As measured at the Northfield SA EPA monitoring station.

It is noted the annual average SO_2 concentration measured at the Northfield monitoring station is 0.2 $\mu g/m^3$, while the 75th percentile 1-hour average is zero; this is reflective of a large proportion of the hourly monitoring data being equal to zero.

5. MODELLING METHODOLOGY

5.1 Model Selection

The SA EPA has stipulated that unless prior agreement has been obtained, all air dispersion modelling should be completed using the CALPUFF air dispersion model using a meteorological dataset from 2009.

5.2 CALPUFF Model Set Up

The following model set up options within CALPUFF were used:

- Building downwash was included using the BPIP-Prime algorithms with site layout and elevation. The tanks, silos and receivals hall were included in the modelling;
- Grid spacing's of 100 m over a 7 km x 7 km model domain were applied, centred approximately on the site;
- The TAPM prognostic meteorological model developed by CSIRO was used to generate a gridded meteorological dataset for the modelling domain. Monitored meteorological data from the Bureau of Meteorology (BoM) Elizabeth monitoring station were used with the TAPM output as inputs into the CALMET meteorological processor to develop a meteorological data file suitable for use in CALPUFF;
- No chemical transformation or deposition, except for the prediction of NO_2 (as discussed in Section 5.3);

A summary of the CALPUFF inputs applied in this assessment is provided in Appendix 1.

An annual wind rose generated by the CALMET meteorological processor for the proposed site location is presented in Figure 3, with the annual frequency of wind speeds presented in Table 5.

Table 5: Distribution of Wind Speeds for 2009 (CALMET-Generated Data)

Wind Speed	Calms	0.5–2.0 m/s	2.0-3.5 m/s	3.5-5.0 m/s	5.0-6.5 m/s	6.5-8.0 m/s	>8m/s
(%)	1.4	36.2	36	19.3	5.4	1.4	0.2

5.3 3 Minute Averaging Periods

A simple averaging-time scaling factor can be used to estimate short-term peak concentrations for applications. This adjustment primarily addresses the effect of meandering (fluctuations in the wind about the mean flow for the hour) on the average lateral distribution of material. The scaling factor used to adjust the lateral dispersion coefficient[1] for averaging time is the 1/5th power law:

$$Cl = Cs(60/tl)^{0.2}$$

where
Cl = Concentration for new averaging period;
Cs = Concentration for the 1 hour average period;
tl is the averaging time (min.) of interest

[1] Turner, D.B., 1970: Workbook of Atmospheric Dispersion Estimates. U.S. EPA Office of Air Programs Publication No. AP-26. Research Triangle Park, NC.

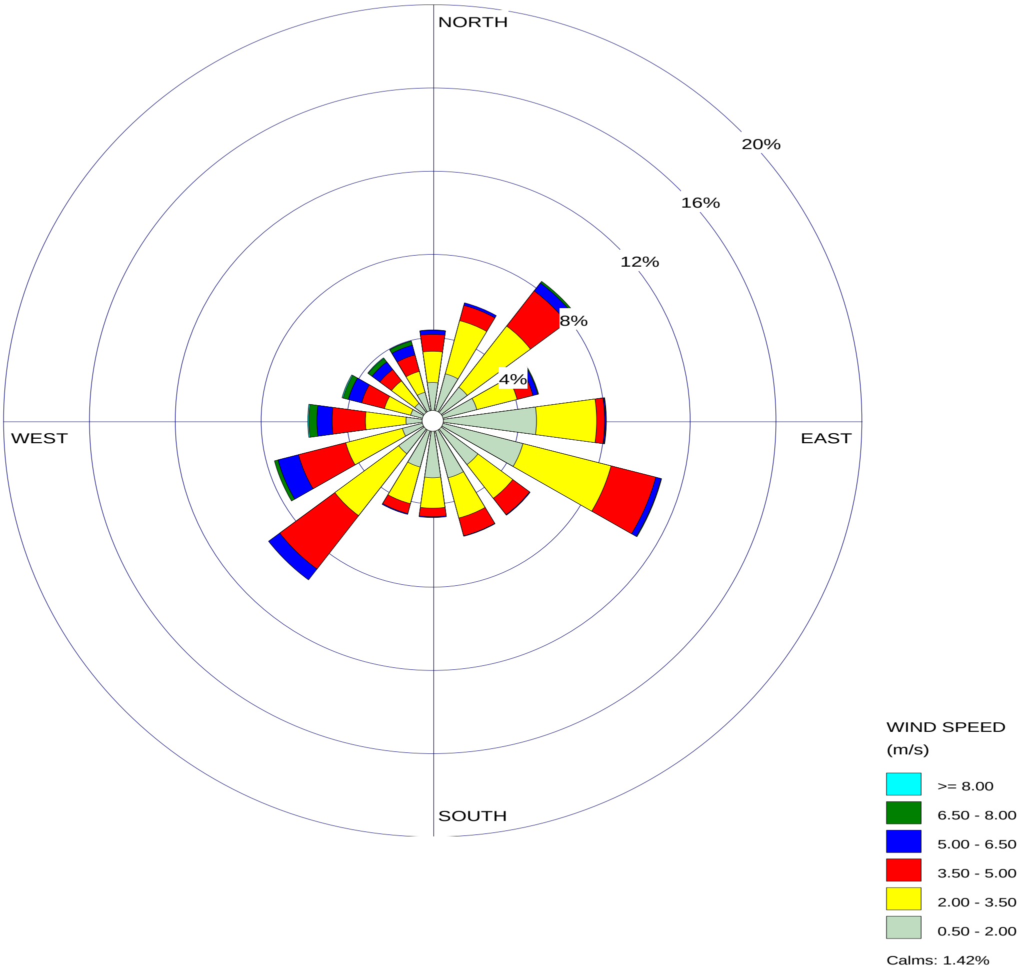

Figure 3: 2009 CALMET-Generated Annual Wind Rose

5.4 Treatment of Oxides of Nitrogen

A key element in assessing the potential environmental impacts from ground level NO_2 concentrations is estimating NO_2 concentrations from modelled NO_x emissions. The final NO_2 concentration is a combination of the NO emitted as NO_2 from the source stacks and the amount of NO that is converted to NO_2 by oxidation in the plume after release.

Generally, after the NO_x is emitted from the stack, additional NO_2 is formed as the plume mixes and reacts with the surrounding air. There are several reactions that both form and destroy NO_2, but the primary reaction is oxidation with ozone according to the following reaction:

$$NO + O_3 \rightarrow NO_2 + O_2$$

This reaction is essentially instantaneous as the plume entrains the surrounding air. It is limited by the amount of ozone available and by how quickly the plume mixes with the surrounding air. Thus the ratio of NO_2 to NO_x increases as the plume disperses downwind.

In order to predict NO_2 concentrations, Ramboll has applied the US Environmental Protection Agency (USEPA) Ozone Limiting Method (OLM). This method assumes that ozone is the limiting reagent (i.e. the ozone concentration is less than the remaining NO_x concentration) and requires an NO_2 to NO_x in-stack ratio. In the absence of a site-specific in-stack ratio, it has been assumed that 10% of NO_x emissions are NO_2 (a common assumption for gas combustion sources). Hourly average ozone concentrations for application in the OLM were obtained from the Elizabeth ambient air quality monitoring station.

The OLM approach is considered conservative over short-term averaging periods as it assumes the reaction between NO_x and ozone occurs instantaneously, when in reality this is likely to take place over a number of hours, during which time the plume is subject to dispersion.

6. MODELLING RESULTS

6.1 Ambient Air Quality Assessment

GLCs of the modelled compounds have been predicted for the following scenarios:

- Routine operations, with all three generators operating at maximum load and no flaring. This is considered conservative as the generators are typically sized to run at around 85% maximum load; and
- Full flaring scenario, with both flares are operating at the maximum gas flow rate and no generator operation.

The results of the odour assessment for emissions from the biofilter and the biomethane upgrade stack are presented in Section 6.2.

The predicted GLCs for the Plant operating under routine conditions, both in isolation and cumulatively with background concentrations, are summarised in Table 6. The predicted GLCs concentrations are all expected to remain well below their respective standards across the modelled domain, with the exception of the maximum 1-hour average NO_2 GLC which is predicted to equal 92% of the respective guideline for operations in isolation and 96% of the guideline when considered cumulatively with ambient background concentrations.

The maximum predicted 1-hour average GLCs for NO_2 for routine operations in isolation is presented in Figure 4, indicating that the highest predicted concentrations are expected to occur onsite. The maximum 1-hour average NO_2 GLCs predicted at the nearby residences and other potential sensitive receptor locations (i.e. golf course) are not expected to be any greater than 75 µg/m^3, well below the corresponding SA EPA 1-hour average NO_2 standard of 250 µg/m^3. It is also noted that the predicted NO_2 GLCs are considered conservative given the use of the OLM method (refer to Section 5.4), particularly for short-term concentrations close to the source.

The predicted GLCs for the Plant operating under the full flaring scenario are also summarised in Table 6. The predicted GLCs concentrations are all expected to remain well below their respective standards across the modelled domain when considered both in isolation and cumulatively with background concentrations.

Contours of the predicted GLCs for all modelled compounds and averaging periods for both scenarios are presented in Appendix 2.

Table 6: Predicted Maximum GLCs for Routine Operations and Full Flaring

Pollutant	Averaging Period	Criteria	Background Conc.	Routine Operations (3 Generators)				Full Flaring (2 Flares)			
				Maximum Concentration		Cumulative Maximum Concentration		Maximum Concentration		Cumulative Maximum Concentration	
		µg/m³	µg/m³	µg/m³	% of Criteria	µg/m³	% of Criteria	µg/m³	% of Criteria	µg/m³	% of Criteria
CO	1-hour	31,240	25	2,722	9%	2,747	9%	150	0.5%	175	1%
	8-hour	11,250	25	1,535	14%	1,560	14%	68	1%	93	1%
NO_2	1-hour	250	10	229	92%	239	96%	98	39%	108	43%
	Annual	60	8	17	28%	25	41%	6	10%	14	24%
H_2S	3-minute	510	NA	55	11%	55	11%	94	18%	94	18%
SO_2	1-hour	570	0	212	37%	212	37%	82	14%	82	14%
	24-hour	230	0.14	72	31%	72	31%	23	10%	23	10%
	Annual	60	0.2	10	17%	11	18%	2	3%	2	4%

Notes:

1. Concentrations are referenced to 0 deg C and 101.3kPa.
2. Background concentrations are the 75th percentile 1-hour and 24-hour concentrations and annual average concentrations (as per Table 4).

Figure 4: Routine Operations - Maximum Predicted 1-hour Average NO_2 GLCs ($\mu g/m^3$) in Isolation

6.2 Odour Assessment

The maximum predicted 99.9th percentile 3-minute average odour concentration for routine operations (considering emissions from the biofilter and the biomethane upgrade stack) is presented in Table 5. Contours of the predicted 99.9th percentile 3-minute average odour levels are presented in Figure 5.

The predicted odour levels remain below the SA EPA criteria of 2 OU throughout the modelled domain. Odour concentrations predicted to occur at the nearest residential and other sensitive receptor locations remain below 0.5 OU (Figure 5).

Table 7: Maximum Predicted Odour Concentrations for the Biogas Plant

Pollutant	Averaging Period	Criteria	Maximum Predicted 99.9th Percentile
		(OU)	(OU)
Odour	3-minute (99.9th Percentile%)	2	1.88

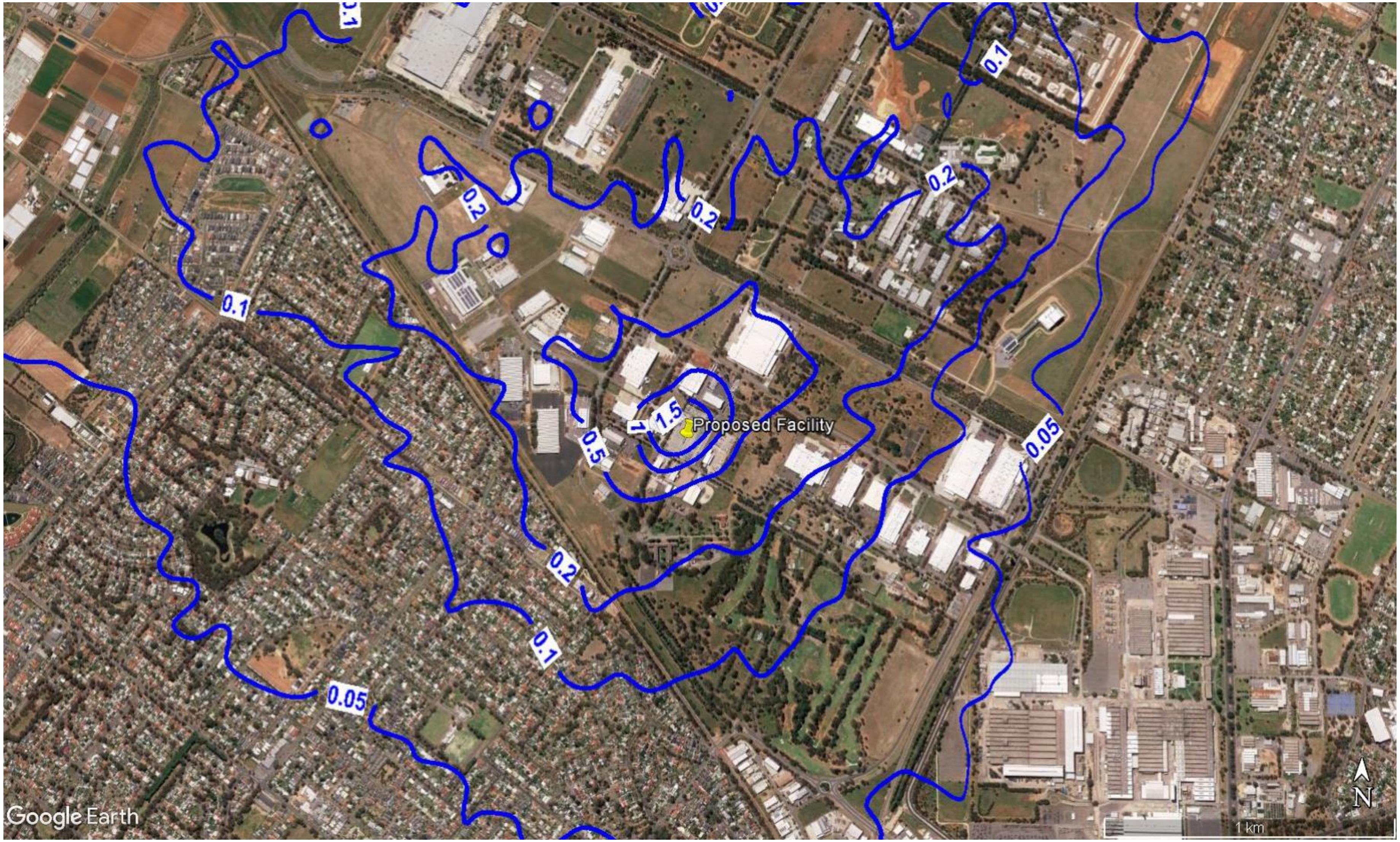

Figure 5: Routine Operations - Predicted 3-minute Average 99.9th Percentile Odour Concentrations (OU)

7. CONCLUSIONS

Air dispersion modelling has been completed to assess the potential air quality impacts associated with emissions from the proposed Plant operating under routine and full flaring operating scenarios.

Predicted GLCs have been estimated using the CALPUFF model and meteorological data generated by TAPM, in combination with meteorological monitoring data recorded at the nearest BoM monitoring station located at Elizabeth.

Where ambient monitoring data was available for compounds of interest, this has been used to determine the cumulative impacts of the proposed Plant.

The key findings of the air dispersion modelling are as follows:

- Predicted GLCs for all modelled compounds remain below the corresponding SA EPA standards across the modelled domain for both routine and full flaring operations, considered in isolation and cumulatively;
- The GLCs predicted at sensitive receptor locations remain well below the relevant SA EPA standards for all pollutants and modelled scenarios;
- The maximum predicted 1-hour NO_2 GLC most closely approaches the relevant guideline, representing 92% of the 1-hour average NO_2 standard of 250 µg/m^3 when considered in isolation. This GLC is considered to be conservative given the assumptions applied to estimate NO_2 GLCs from predicted NO_x GLCs;
- The maximum 1-hour average NO_2 GLCs predicted at the nearby residences and other potential sensitive receptor locations represent no more than 30% of the corresponding standard; and
- Odour concentrations are predicted to remain below the SA EPA criteria for routine operations across the modelled domain and are equal to less than 25% of the applicable criteria at the nearest residential and other sensitive receptor locations.

8. DISCLAIMER AND LIMITATIONS

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APPENDIX 1

CALPUFF INPUTS

CALPUFF Parameters

INPUT GROUP: 0 -- Input and Output File Names		
Parameter	**Description**	**Value**
PRFDAT	CTDM/AERMET-type meteorological profile data file	PROFILE.DAT
PUFLST	CALPUFF output list file (CALPUFF.LST)	CALPUFF.LST
CONDAT	CALPUFF output concentration file (CONC.DAT)	CONC.DAT
DFDAT	CALPUFF output dry deposition flux file (DFLX.DAT)	DFLX.DAT
WFDAT	CALPUFF output wet deposition flux file (WFLX.DAT)	WFLX.DAT
LCFILES	Lower case file names (T = lower case, F = upper case)	F
NMETDOM	Number of CALMET.DAT domains	1
NMETDAT	Number of CALMET.DAT input files	8
NPTDAT	Number of PTEMARB.DAT input files	0
NARDAT	Number of BAEMARB.DAT input files	0
NVOLDAT	Number of VOLEMARB.DAT input files	0
NFLDAT	Number of FLEMARB.DAT input files	0
NRDDAT	Number of RDEMARB.DAT input files	0
NLNDAT	Number of LNEMARB.DAT input files	0
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-01-01-01-0000-2009-02-16-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-02-16-00-0000-2009-04-03-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-04-03-00-0000-2009-05-18-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-05-18-00-0000-2009-07-03-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-07-03-00-0000-2009-08-17-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-08-17-00-0000-2009-10-02-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-10-02-00-0000-2009-11-16-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-11-16-00-0000-2009-12-31-23-0000.DAT
INPUT GROUP: 1 -- General Run Control Parameters		
Parameter	**Description**	**Value**
INPUT GROUP: 1 -- General Run Control Parameters		
Parameter	**Description**	**Value**

METRUN	Run all periods in met data file? (0 = no, 1 = yes)	0
IBYR	Starting year	2009
IBMO	Starting month	1
IBDY	Starting day	1
IBHR	Starting hour	1
IBMIN	Starting minute	0
IBSEC	Starting second	0
IEYR	Ending year	2009
IEMO	Ending month	12
IEDY	Ending day	31
IEHR	Ending hour	22
IEMIN	Ending minute	0
IESEC	Ending second	0
ABTZ	Base time zone	UTC+0900
NSECDT	Length of modeling time-step (seconds)	3600
NSPEC	Number of chemical species modeled	7
NSE	Number of chemical species to be emitted	7
ITEST	Stop run after SETUP phase (1 = stop, 2 = run)	2
MRESTART	Control option to read and/or write model restart data	0
NRESPD	Number of periods in restart output cycle	0
METFM	Meteorological data format (1 = CALMET, 2 = ISC, 3 = AUSPLUME, 4 = CTDM, 5 = AERMET)	1
MPRFFM	Meteorological profile data format (1 = CTDM, 2 = AERMET)	1
AVET	Averaging time (minutes)	60
PGTIME	PG Averaging time (minutes)	60
IOUTU	Output units for binary output files (1 = mass, 2 = odour, 3 = radiation)	1
INPUT GROUP: 2 -- Technical Options		
Parameter	**Description**	**Value**
MGAUSS	Near field vertical distribution (0 = uniform, 1 = Gaussian)	1
MCTADJ	Terrain adjustment method (0 = none, 1 = ISC-type, 2 = CALPUFF-type, 3 = partial plume path)	3
MCTSG	Model subgrid-scale complex terrain? (0 = no, 1 = yes)	0
MSLUG	Near-field puffs modeled as elongated slugs? (0 = no, 1 = yes)	0
MTRANS	Model transitional plume rise? (0 = no, 1 = yes)	1
MTIP	Apply stack tip downwash to point sources? (0 = no, 1 = yes)	1
MRISE	Plume rise module for point sources (1 = Briggs, 2 = numerical)	1
MTIP_FL	Apply stack tip downwash to flare sources? (0 = no, 1 = yes)	0
MRISE_FL	Plume rise module for flare sources (1 = Briggs, 2 = numerical)	2

INPUT GROUP: 2 -- Technical Options		
Parameter	**Description**	**Value**
MBDW	Building downwash method (1 = ISC, 2 = PRIME)	1
MSHEAR	Treat vertical wind shear? (0 = no, 1 = yes)	0
MSPLIT	Puff splitting allowed? (0 = no, 1 = yes)	0
MCHEM	Chemical transformation method (0 = not modeled, 1 = MESOPUFF II, 2 = User-specified, 3 = RIVAD/ARM3, 4 = MESOPUFF II for OH, 5 = half-life, 6 = RIVAD w/ISORROPIA, 7 = RIVAD w/ISORROPIA CalTech SOA)	0
MAQCHEM	Model aqueous phase transformation? (0 = no, 1 = yes)	0
MLWC	Liquid water content flag	1
MWET	Model wet removal? (0 = no, 1 = yes)	0
MDRY	Model dry deposition? (0 = no, 1 = yes)	0
MTILT	Model gravitational settling (plume tilt)? (0 = no, 1 = yes)	0
MDISP	Dispersion coefficient calculation method (1= PROFILE.DAT, 2 = Internally, 3 = PG/MP, 4 = MESOPUFF II, 5 = CTDM)	3
MTURBVW	Turbulence characterization method (only if MDISP = 1 or 5)	3
MDISP2	Missing dispersion coefficients method (only if MDISP = 1 or 5)	3
MTAULY	Sigma-y Lagrangian timescale method	0
MTAUADV	Advective-decay timescale for turbulence (seconds)	0
MCTURB	Turbulence method (1 = CALPUFF, 2 = AERMOD)	1
MROUGH	PG sigma-y and sigma-z surface roughness adjustment? (0 = no, 1 = yes)	0
MPARTL	Model partial plume penetration for point sources? (0 = no, 1 = yes)	1
MPARTLBA	Model partial plume penetration for buoyant area sources? (0 = no, 1 = yes)	1
MTINV	Strength of temperature inversion provided in PROFILE.DAT? (0 = no - compute from default gradients, 1 = yes)	0
MPDF	PDF used for dispersion under convective conditions? (0 = no, 1 = yes)	0
MSGTIBL	Sub-grid TIBL module for shoreline? (0 = no, 1 = yes)	0
MBCON	Boundary conditions modeled? (0 = no, 1 = use BCON.DAT, 2 = use CONC.DAT)	0
MSOURCE	Save individual source contributions? (0 = no, 1 = yes)	0
MFOG	Enable FOG model output? (0 = no, 1 = yes - PLUME mode, 2 = yes - RECEPTOR mode)	0
MREG	Regulatory checks (0 = no checks, 1 = USE PA LRT checks)	0
INPUT GROUP: 3 -- Species List		

Parameter	Description	Value
CSPEC	Species included in model run	TR1
CSPEC	Species included in model run	TR2
CSPEC	Species included in model run	TR3
CSPEC	Species included in model run	TR4
CSPEC	Species included in model run	TR5
CSPEC	Species included in model run	TR6
CSPEC	Species included in model run	TR7
INPUT GROUP: 4 -- Map Projection and Grid Control Parameters		
Parameter	**Description**	**Value**
PMAP	Map projection system	UTM
FEAST	False easting at projection origin (km)	0.0
FNORTH	False northing at projection origin (km)	0.0
IUTMZN	UTM zone (1 to 60)	54
UTMHEM	Hemisphere (N = northern, S = southern)	S
RLAT0	Latitude of projection origin (decimal degrees)	0.00N
RLON0	Longitude of projection origin (decimal degrees)	0.00E
XLAT1	1st standard parallel latitude (decimal degrees)	30S
XLAT2	2nd standard parallel latitude (decimal degrees)	60S
DATUM	Datum-region for the coordinates	WGS-84
NX	Meteorological grid - number of X grid cells	39
NY	Meteorological grid - number of Y grid cells	39
NZ	Meteorological grid - number of vertical layers	11
DGRIDKM	Meteorological grid spacing (km)	1
ZFACE	Meteorological grid - vertical cell face heights (m)	0.0, 20.0, 100.0, 200.0, 350.0, 500.0, 750.0, 1000.0, 2000.0, 3000.0, 4000.0, 5000.0
XORIGKM	Meteorological grid - X coordinate for SW corner (km)	263.8390
YORIGKM	Meteorological grid - Y coordinate for SW corner (km)	6133.5530
IBCOMP	Computational grid - X index of lower left corner	17
JBCOMP	Computational grid - Y index of lower left corner	17
IECOMP	Computational grid - X index of upper right corner	23
JECOMP	Computational grid - Y index of upper right corner	23
LSAMP	Use sampling grid (gridded receptors) (T = true, F = false)	T
IBSAMP	Sampling grid - X index of lower left corner	17
JBSAMP	Sampling grid - Y index of lower left corner	17

IESAMP	Sampling grid - X index of upper right corner	23
JESAMP	Sampling grid - Y index of upper right corner	23
MESHDN	Sampling grid - nesting factor	10
INPUT GROUP: 5 -- Output Options		
Parameter	**Description**	**Value**
ICON	Output concentrations to CONC.DAT? (0 = no, 1 = yes)	1
IDRY	Output dry deposition fluxes to DFLX.DAT? (0 = no, 1 = yes)	0
IWET	Output wet deposition fluxes to WFLX.DAT? (0 = no, 1 = yes)	0
IT2D	Output 2D temperature data? (0 = no, 1 = yes)	0
IRHO	Output 2D density data? (0 = no, 1 = yes)	0
IVIS	Output relative humidity data? (0 = no, 1 = yes)	0
INPUT GROUP: 5 -- Output Options		
Parameter	**Description**	**Value**
LCOMPRS	Use data compression in output file (T = true, F = false)	T
IQAPLOT	Create QA output files suitable for plotting? (0 = no, 1 = yes)	0
IPFTRAK	Output puff tracking data? (0 = no, 1 = yes use timestep, 2 = yes use sampling step)	0
IMFLX	Output mass flux across specific boundaries? (0 = no, 1 = yes)	0
IMBAL	Output mass balance for each species? (0 = no, 1 = yes)	0
INRISE	Output plume rise data? (0 = no, 1 = yes)	0
ICPRT	Print concentrations? (0 = no, 1 = yes)	0
IDPRT	Print dry deposition fluxes? (0 = no, 1 = yes)	0
IWPRT	Print wet deposition fluxes? (0 = no, 1 = yes)	0
ICFRQ	Concentration print interval (timesteps)	1
IDFRQ	Dry deposition flux print interval (timesteps)	1
IWFRQ	Wet deposition flux print interval (timesteps)	1
IPRTU	Units for line printer output (e.g., 3 = ug/m**3 - ug/m**2/s, 5 = odor units)	3
IMESG	Message tracking run progress on screen (0 = no, 1 and 2 = yes)	2
LDEBUG	Enable debug output? (0 = no, 1 = yes)	F
IPFDEB	First puff to track in debug output	1
NPFDEB	Number of puffs to track in debug output	1000
NN1	Starting meteorological period in debug output	1
NN2	Ending meteorological period in debug output	10
INPUT GROUP: 6 -- Subgrid Scale Complex Terrain Inputs		

Parameter	Description	Value
NHILL	Number of terrain features	0
NCTREC	Number of special complex terrain receptors	0
MHILL	Terrain and CTSG receptor data format (1= CTDM, 2 = OPTHILL)	2
XHILL2M	Horizontal dimension conversion factor to meters	1.0
ZHILL2M	Vertical dimension conversion factor to meters	1.0
XCTDMKM	X origin of CTDM system relative to CALPUFF system (km)	0.0
YCTDMKM	Y origin of CTDM system relative to CALPUFF system (km)	0.0
INPUT GROUP: 9 -- Miscellaneous Dry Deposition Parameters		
Parameter	**Description**	**Value**
RCUTR	Reference cuticle resistance (s/cm)	30
RGR	Reference ground resistance (s/cm)	10
REACTR	Reference pollutant reactivity	8
NINT	Number of particle size intervals for effective particle deposition velocity	9
IVEG	Vegetation state in unirrigated areas (1 = active and unstressed, 2 = active and stressed, 3 = inactive)	1
INPUT GROUP: 11 -- Chemistry Parameters		
Parameter	**Description**	**Value**
MOZ	Ozone background input option (0 = monthly, 1 = hourly from OZONE.DAT)	1
BCKO3	Monthly ozone concentrations (ppb)	80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00
MNH3	Ammonia background input option (0 = monthly, 1 = from NH3Z.DAT)	0
MAVGNH3	Ammonia vertical averaging option (0 = no average, 1 = average over vertical extent of puff)	1
BCKNH3	Monthly ammonia concentrations (ppb)	10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00
RNITE1	Nighttime SO2 loss rate (%/hr)	0.2
RNITE2	Nighttime NOx loss rate (%/hr)	2
RNITE3	Nighttime HNO3 loss rate (%/hr)	2
MH2O2	H2O2 background input option (0 = monthly, 1 = hourly from H2O2.DAT)	1
BCKH2O2	Monthly H2O2 concentrations (ppb)	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
RH_ISRP	Minimum relative humidity for ISORROPIA	50.0
SO4_ISRP	Minimum SO4 for ISORROPIA	0.4

BCKPMF	SOA background fine particulate (ug/m**3)	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
OFRAC	SOA organic fine particulate fraction	0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15
VCNX	SOA VOC/NOX ratio	50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00
NDECAY	Half-life decay blocks	0
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters		
Parameter	**Description**	**Value**
SYTDEP	Horizontal puff size for time-dependent sigma equations (m)	550
MHFTSZ	Use Heffter equation for sigma-z? (0 = no, 1 = yes)	0
JSUP	PG stability class above mixed layer	5
CONK1	Vertical dispersion constant - stable conditions	0.01
CONK2	Vertical dispersion constant - neutral/unstable conditions	0.1
TBD	Downwash scheme transition point option (<0 = Huber-Snyder, 1.5 = Schulman-Scire, 0.5 = ISC)	0.5
IURB1	Beginning land use category for which urban dispersion is assumed	10
IURB2	Ending land use category for which urban dispersion is assumed	19
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters		
Parameter	**Description**	**Value**
ILANDUIN	Land use category for modeling domain	20
Z0IN	Roughness length for modeling domain (m)	.25
XLAIIN	Leaf area index for modeling domain	3.0
ELEVIN	Elevation above sea level (m)	.0
XLATIN	Meteorological station latitude (deg)	-999.0
XLONIN	Meteorological station longitude (deg)	-999.0
ANEMHT	Anemometer height (m)	10.0
ISIGMAV	Lateral turbulence format (0 = read sigma-theta, 1 = read sigma-v)	1
IMIXCTDM	Mixing heights read option (0 = predicted, 1 = observed)	0
XMXLEN	Slug length (met grid units)	1
XSAMLEN	Maximum travel distance of a puff/slug (met grid units)	1
MXNEW	Maximum number of slugs/puffs release from one source during one time step	99
MXSAM	Maximum number of sampling steps for one puff/slug during one time step	99

NCOUNT	Number of iterations used when computing the transport wind for a sampling step that includes gradual rise	2
SYMIN	Minimum sigma-y for a new puff/slug (m)	1
SZMIN	Minimum sigma-z for a new puff/slug (m)	1
SZCAP_M	Maximum sigma-z allowed to avoid numerical problem in calculating virtual time or distance (m)	5000000
SVMIN	Minimum turbulence velocities sigma-v (m/s)	0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37
SWMIN	Minimum turbulence velocities sigma-w (m/s)	0.2, 0.12, 0.08, 0.06, 0.03, 0.016, 0.2, 0.12, 0.08, 0.06, 0.03, 0.016
CDIV	Divergence criterion for dw/dz across puff (1/s)	0, 0
NLUTIBL	TIBL module search radius (met grid cells)	4
WSCALM	Minimum wind speed allowed for non-calm conditions (m/s)	0.5
XMAXZI	Maximum mixing height (m)	3000
XMINZI	Minimum mixing height (m)	50
TKCAT	Emissions scale-factors temperature categories (K)	265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315.
PLX0	Wind speed profile exponent for stability classes 1 to 6	0.07, 0.07, 0.1, 0.15, 0.35, 0.55
PTG0	Potential temperature gradient for stable classes E and F (deg K/m)	0.02, 0.035
PPC	Plume path coefficient for stability classes 1 to 6	0.5, 0.5, 0.5, 0.5, 0.35, 0.35
SL2PF	Slug-to-puff transition criterion factor (sigma-y/slug length)	10
FCLIP	Hard-clipping factor for slugs (0.0 = no extrapolation)	0
NSPLIT	Number of puffs created from vertical splitting	3
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters		
Parameter	**Description**	**Value**
IRESPLIT	Hour for puff re-split	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0
ZISPLIT	Minimum mixing height for splitting (m)	100
ROLDMAX	Mixing height ratio for splitting	0.25
NSPLITH	Number of puffs created from horizontal splitting	5
SYSPLITH	Minimum sigma-y (met grid cells)	1

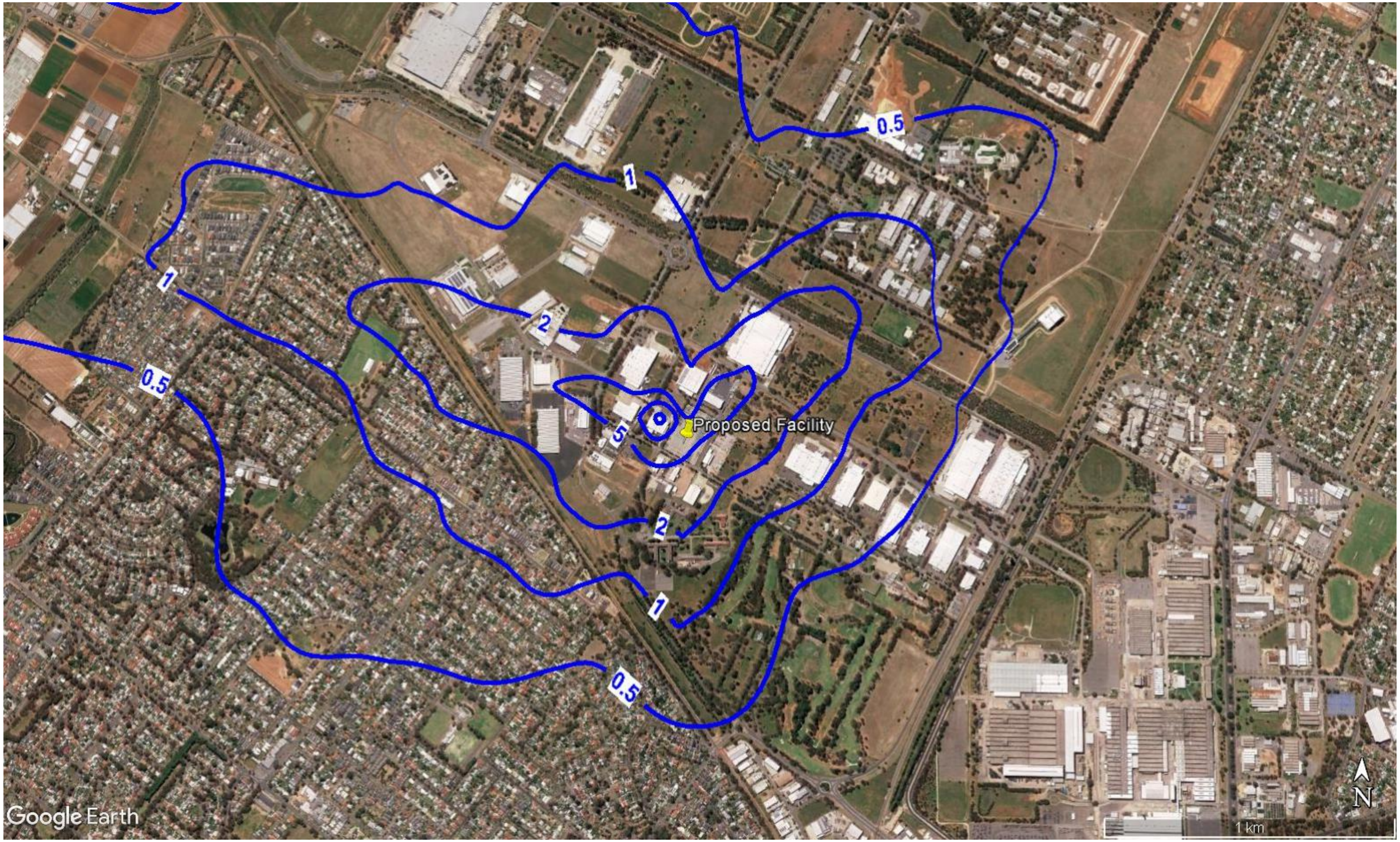
SHSPLITH	Minimum puff elongation rate (SYSPLITH/hr)	2
CNSPLITH	Minimum concentration (g/m**3)	1E-007
EPSSLUG	Fractional convergence criterion for numerical SLUG sampling integration	0.0001
EPSAREA	Fractional convergence criterion for numerical AREA source integration	1E-006
DSRISE	Trajectory step-length for numerical rise integration (m)	1.0
HTMINBC	Minimum boundary condition puff height (m)	500
RSAMPBC	Receptor search radius for boundary condition puffs (km)	10
MDEPBC	Near-surface depletion adjustment to concentration (0 = no, 1 = yes)	1
INPUT GROUP: 13 -- Point Source Parameters		
Parameter	**Description**	**Value**
NPT1	Number of point sources	7
IPTU	Units used for point source emissions (e.g., 1 = g/s)	1
NSPT1	Number of source-species combinations with variable emission scaling factors	0
NPT2	Number of point sources in PTEMARB.DAT file(s)	0
INPUT GROUP: 14 -- Area Source Parameters		
Parameter	**Description**	**Value**
NAR1	Number of polygon area sources	0
IARU	Units used for area source emissions (e.g., 1 = g/m**2/s)	1
NSAR1	Number of source-species combinations with variable emission scaling factors	0
NAR2	Number of buoyant polygon area sources in BAEMARB.DAT file(s)	0
INPUT GROUP: 15 -- Line Source Parameters		
Parameter	**Description**	**Value**
NLN2	Number of buoyant line sources in LNEMARB.DAT file	0
NLINES	Number of buoyant line sources	0
ILNU	Units used for line source emissions (e.g., 1 = g/s)	1
NSLN1	Number of source-species combinations with variable emission scaling factors	0
NLRISE	Number of distances at which transitional rise is computed	6
INPUT GROUP: 16 -- Volume Source Parameters		
Parameter	**Description**	**Value**
NVL1	Number of volume sources	0
IVLU	Units used for volume source emissions (e.g., 1 = g/s)	1
NSVL1	Number of source-species combinations with variable emission scaling factors	0

Parameter	Description	Value
NVL2	Number of volume sources in VOLEMARB.DAT file(s)	0
INPUT GROUP: 17 -- FLARE Source Control Parameters (variable emissions file)		
Parameter	**Description**	**Value**
NFL2	Number of flare sources defined in FLEMARB.DAT file(s)	0
INPUT GROUP: 18 -- Road Emissions Parameters		
Parameter	**Description**	**Value**
NRD1	Number of road-links sources	0
NRD2	Number of road-links in RDEMARB.DAT file	0
NSFRDS	Number of road-links and species combinations with variable emission-rate scale-factors	0
INPUT GROUP: 19 -- Emission Rate Scale-Factor Tables		
Parameter	**Description**	**Value**
NSFTAB	Number of emission scale-factor tables	0
INPUT GROUP: 20 -- Non-gridded (Discrete) Receptor Information		
Parameter	**Description**	**Value**
NREC	Number of discrete receptors (non-gridded receptors)	0
NRGRP	Number of receptor group names	0

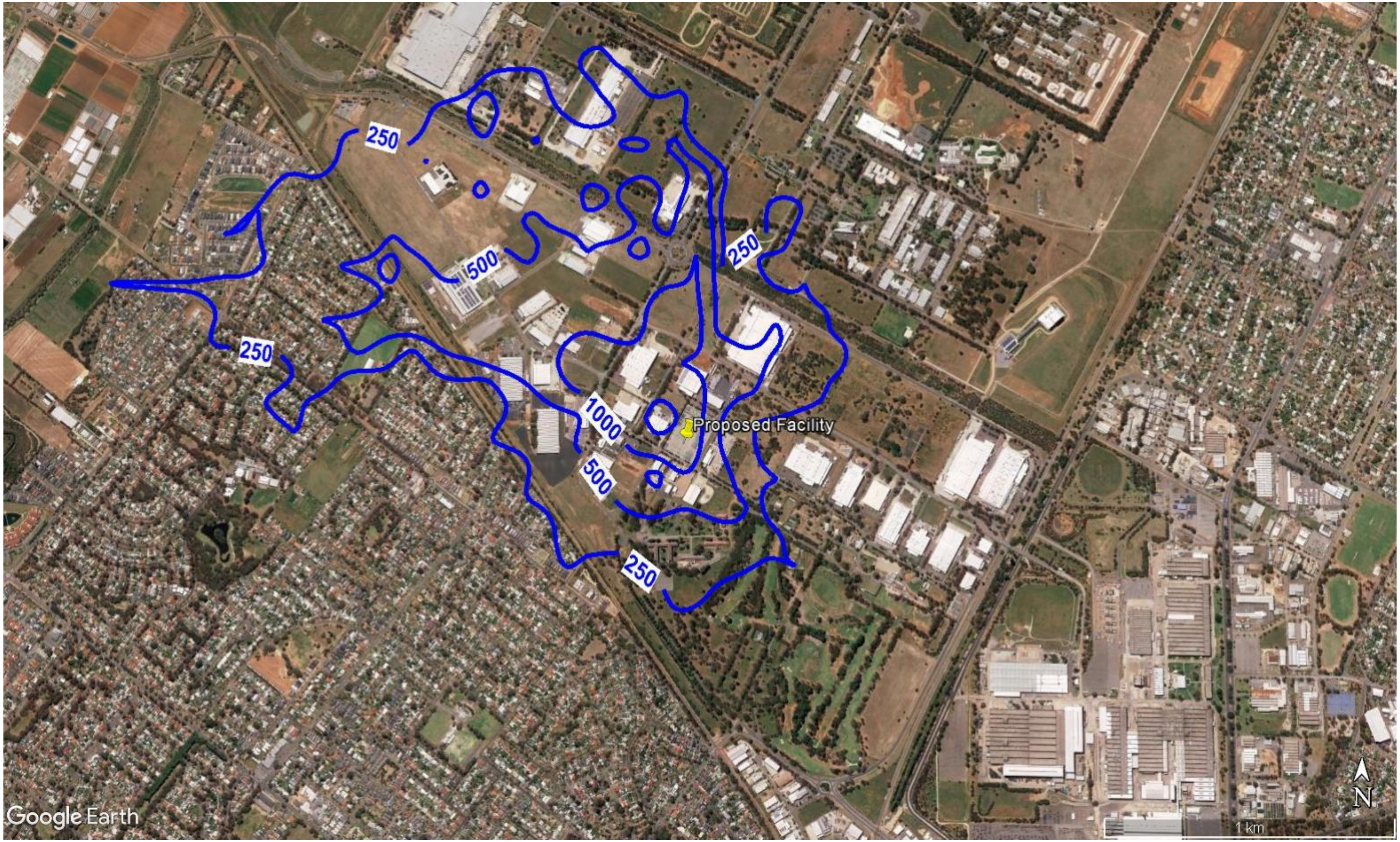
APPENDIX 2

CONTOUR PLOTS

Scenario 1 (Normal Operations) – Annual Average Predicted Concentrations in Isolation of NO_2



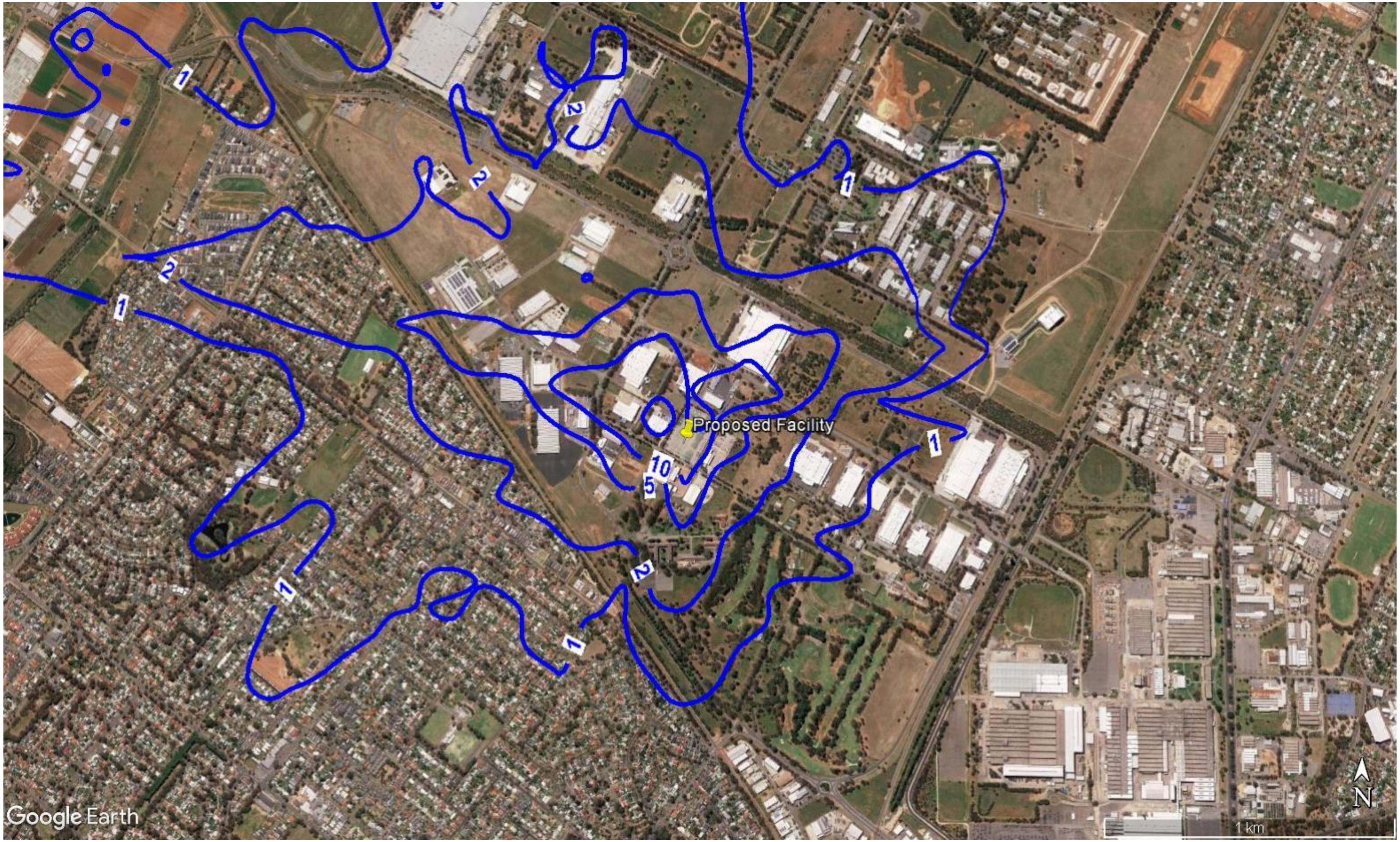
Scenario 1 (Normal Operations) – 1 Hour Average Maximum Predicted Concentrations in Isolation of CO



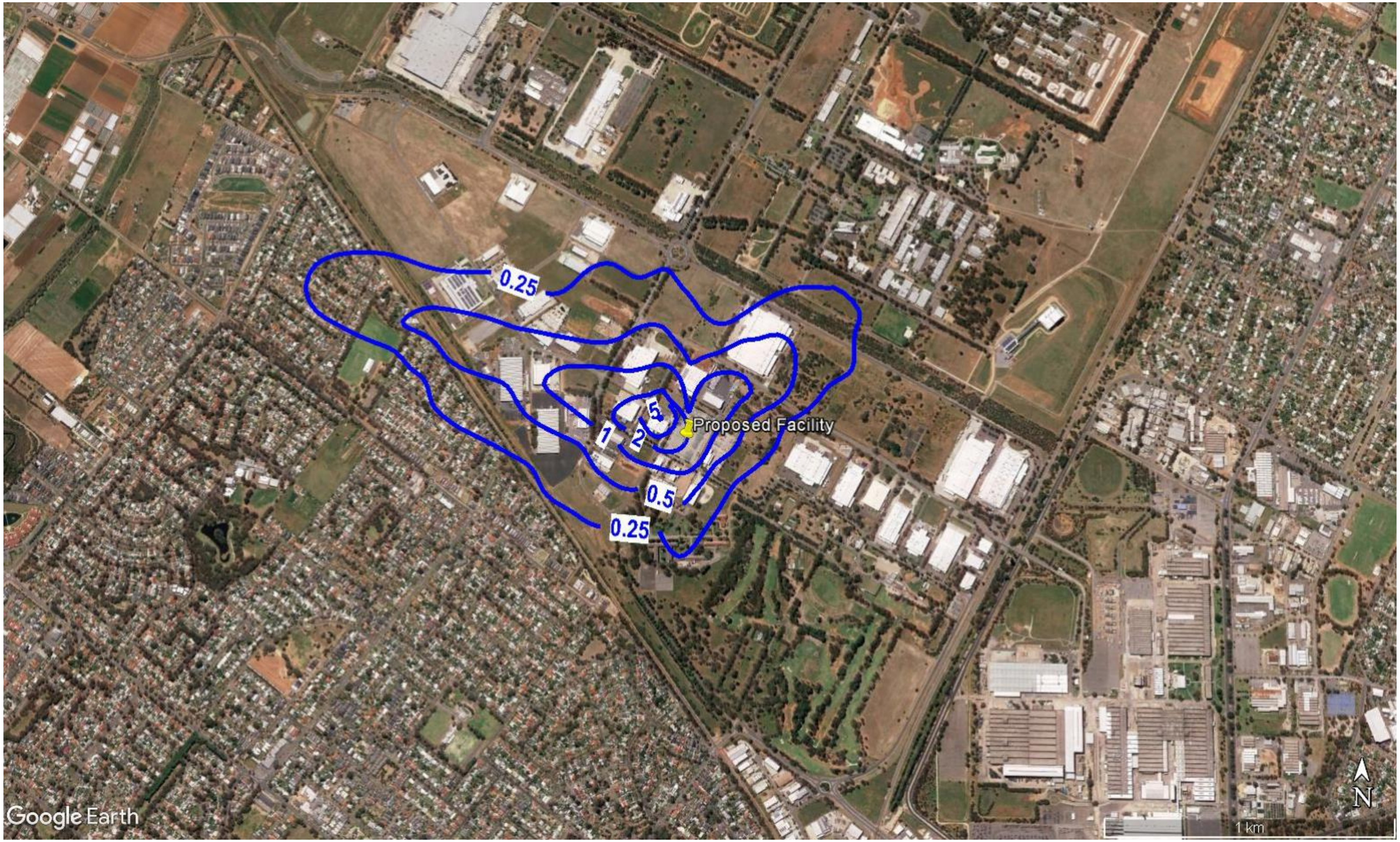
Scenario 1 (Normal Operations) – 8 Hour Average Maximum Predicted Concentrations in Isolation of CO

Scenario 1 (Normal Operations) – 1 Hour Average Maximum Predicted Concentrations in Isolation of SO_2

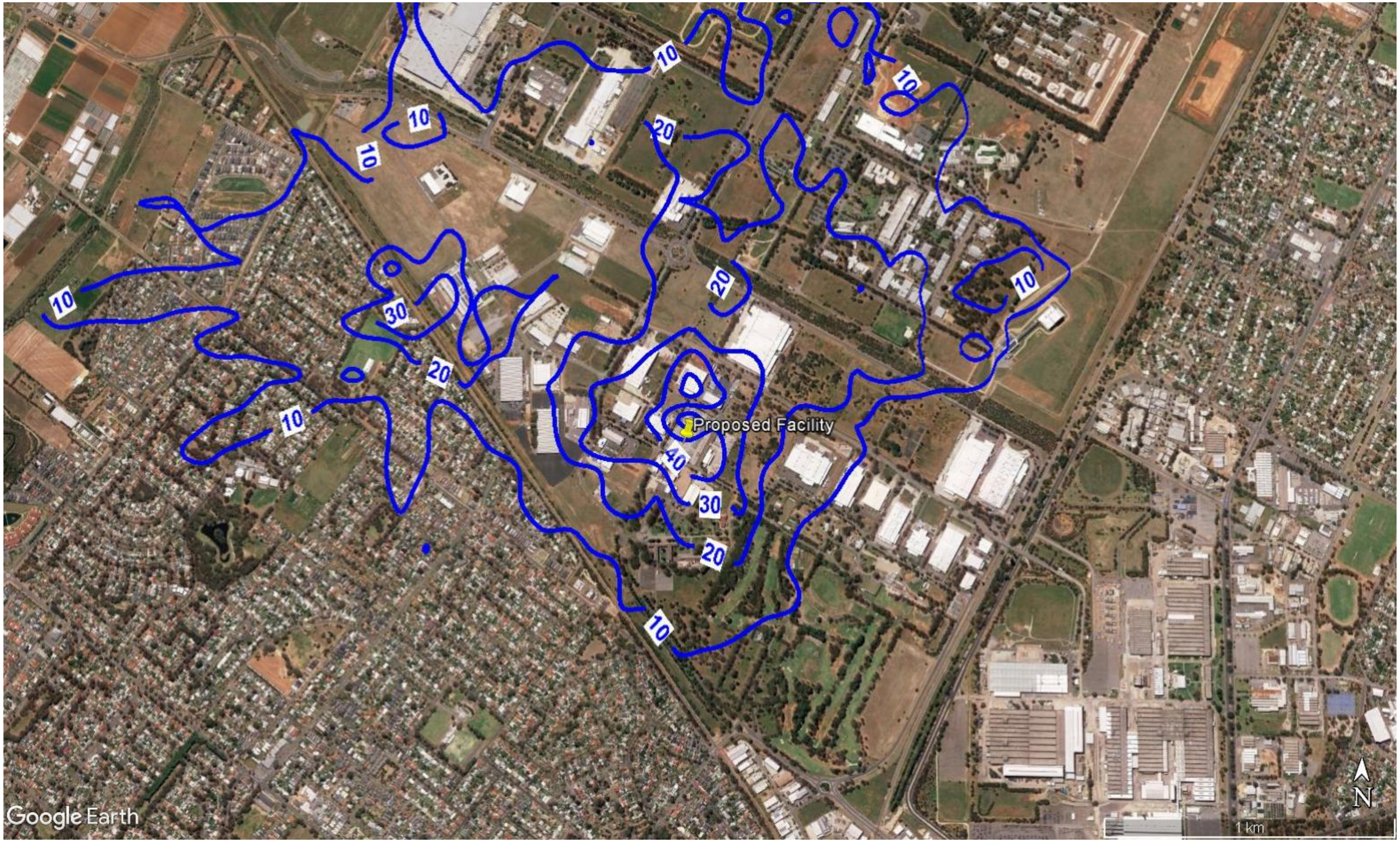
Scenario 1 (Normal Operations) – 24 Hour Average Maximum Predicted Concentrations in Isolation of SO_2



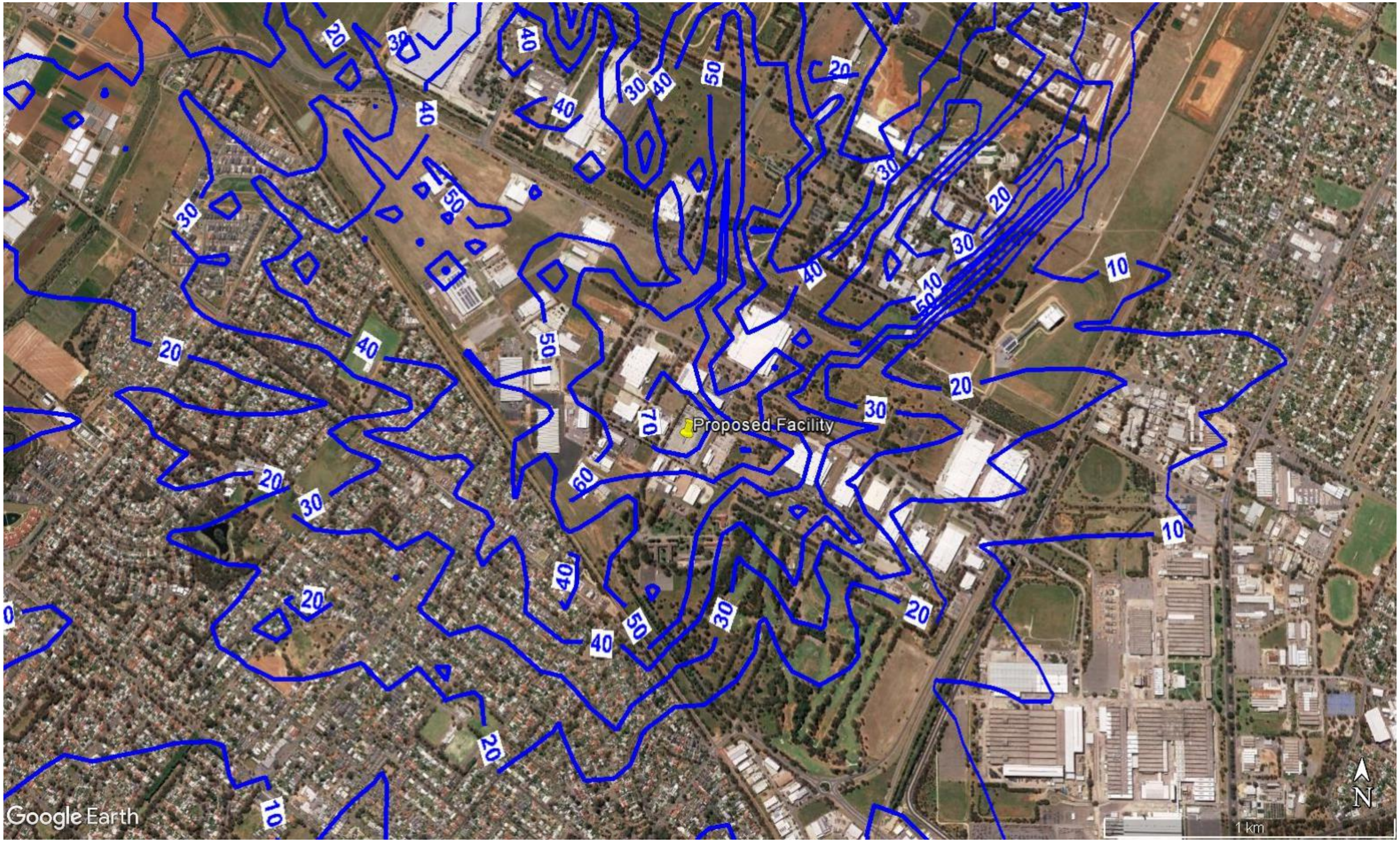
Scenario 1 (Normal Operations) – Annual Average Predicted Concentrations in Isolation of SO_2



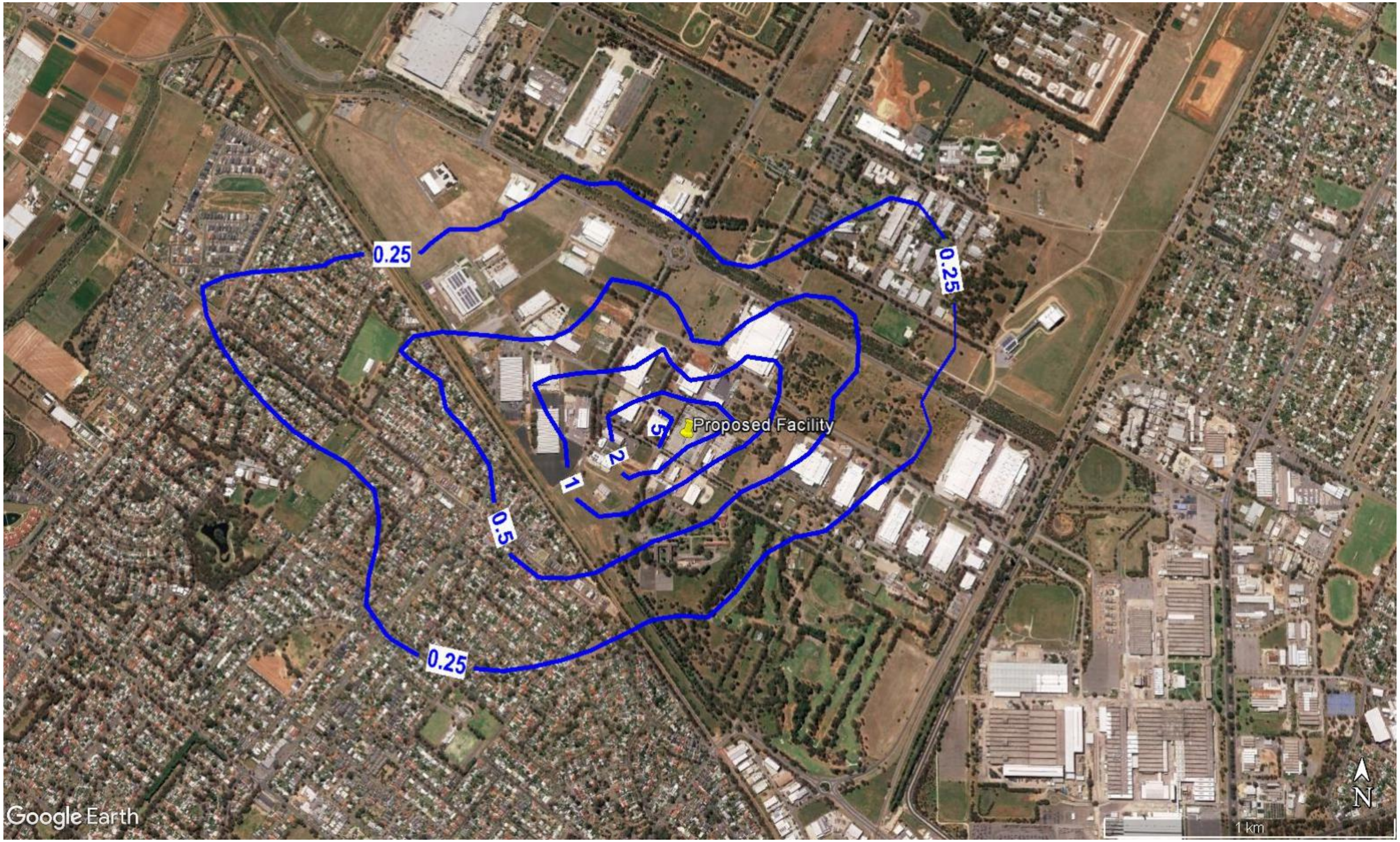
Scenario 1 (Normal Operations) – 3-minute Average Maximum Predicted Concentrations in Isolation of H2S



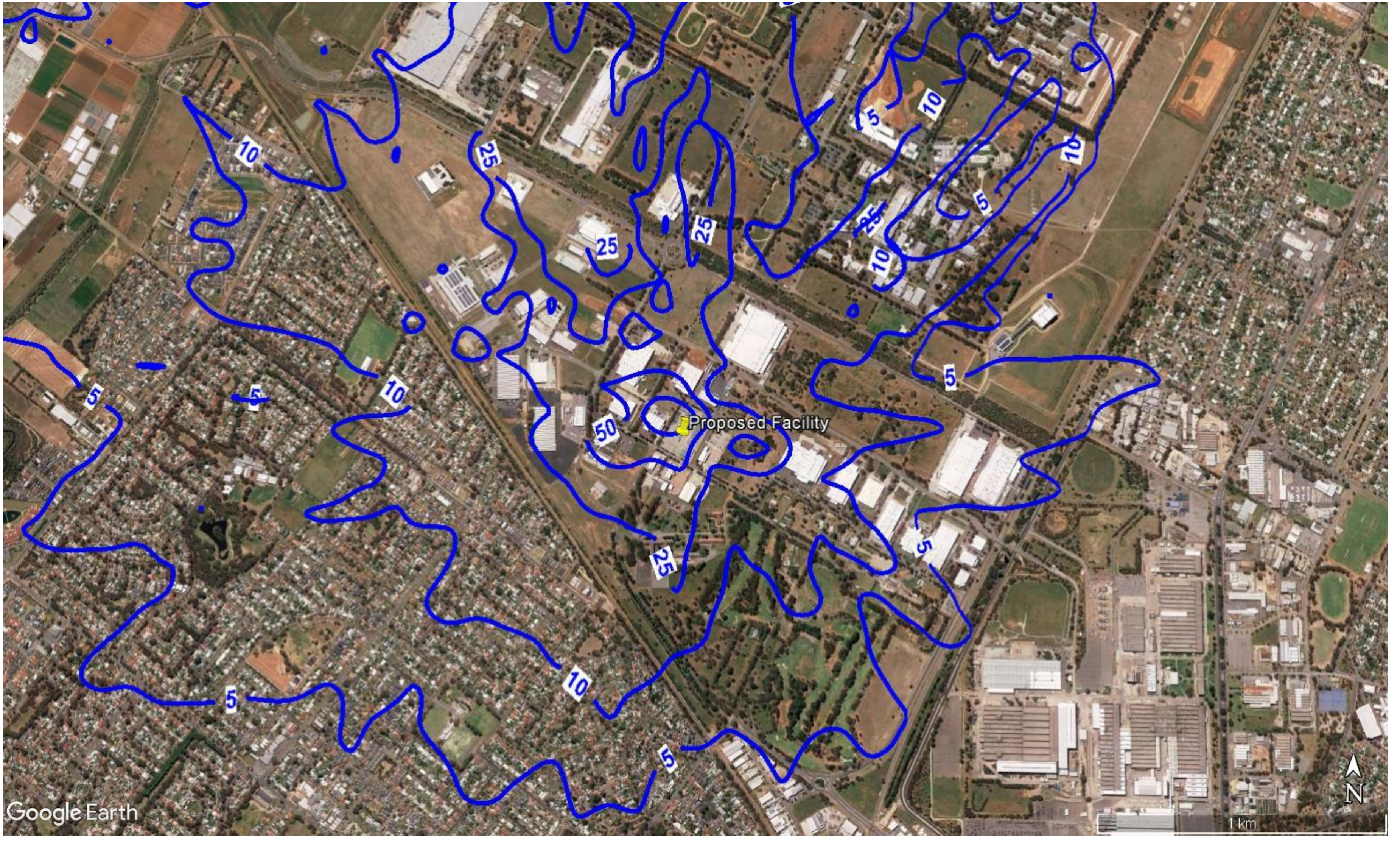
Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of NO_2



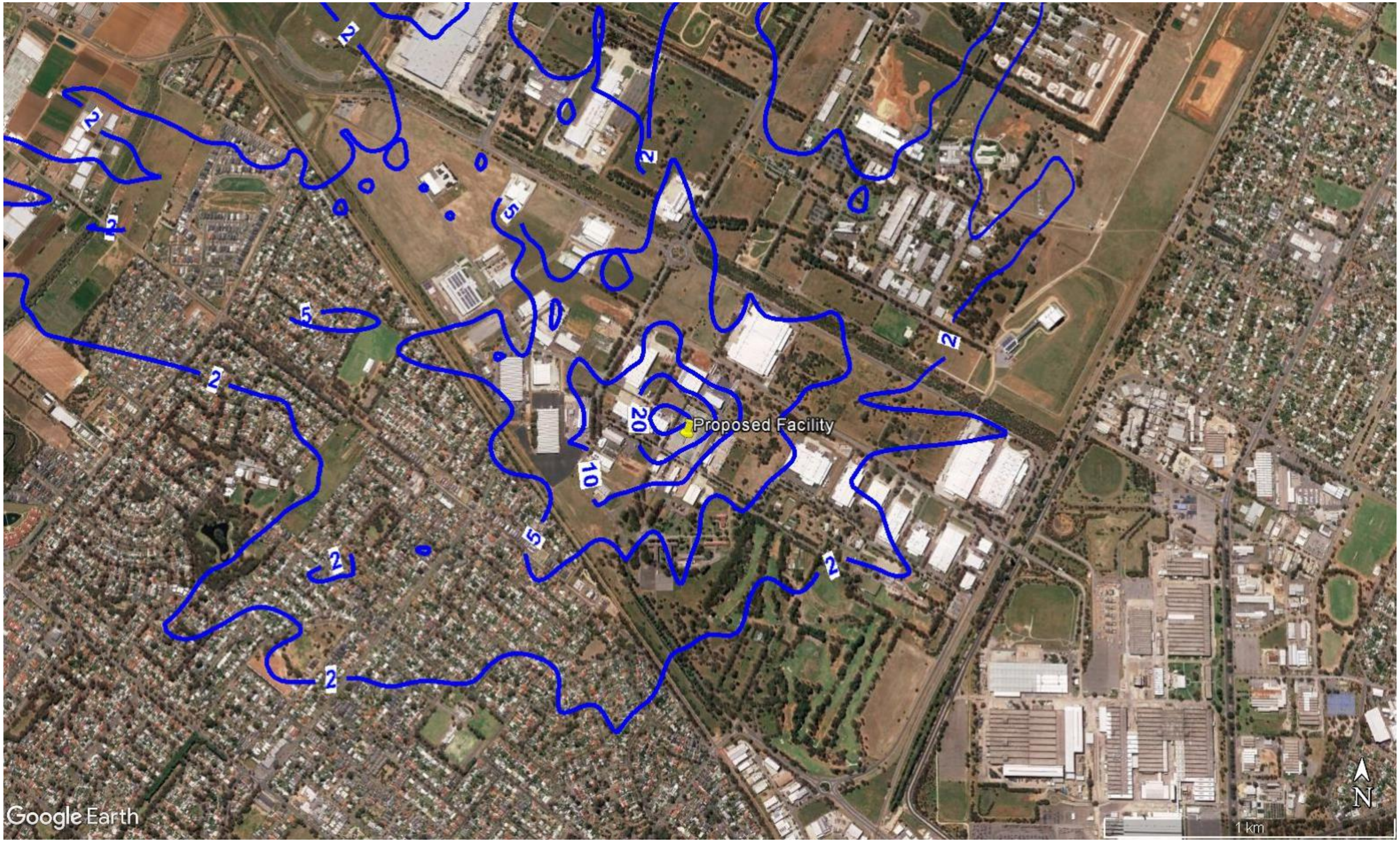
Scenario 2 (Upset Conditions) – Annual Average Predicted Concentrations in Isolation of NO_2



Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of CO

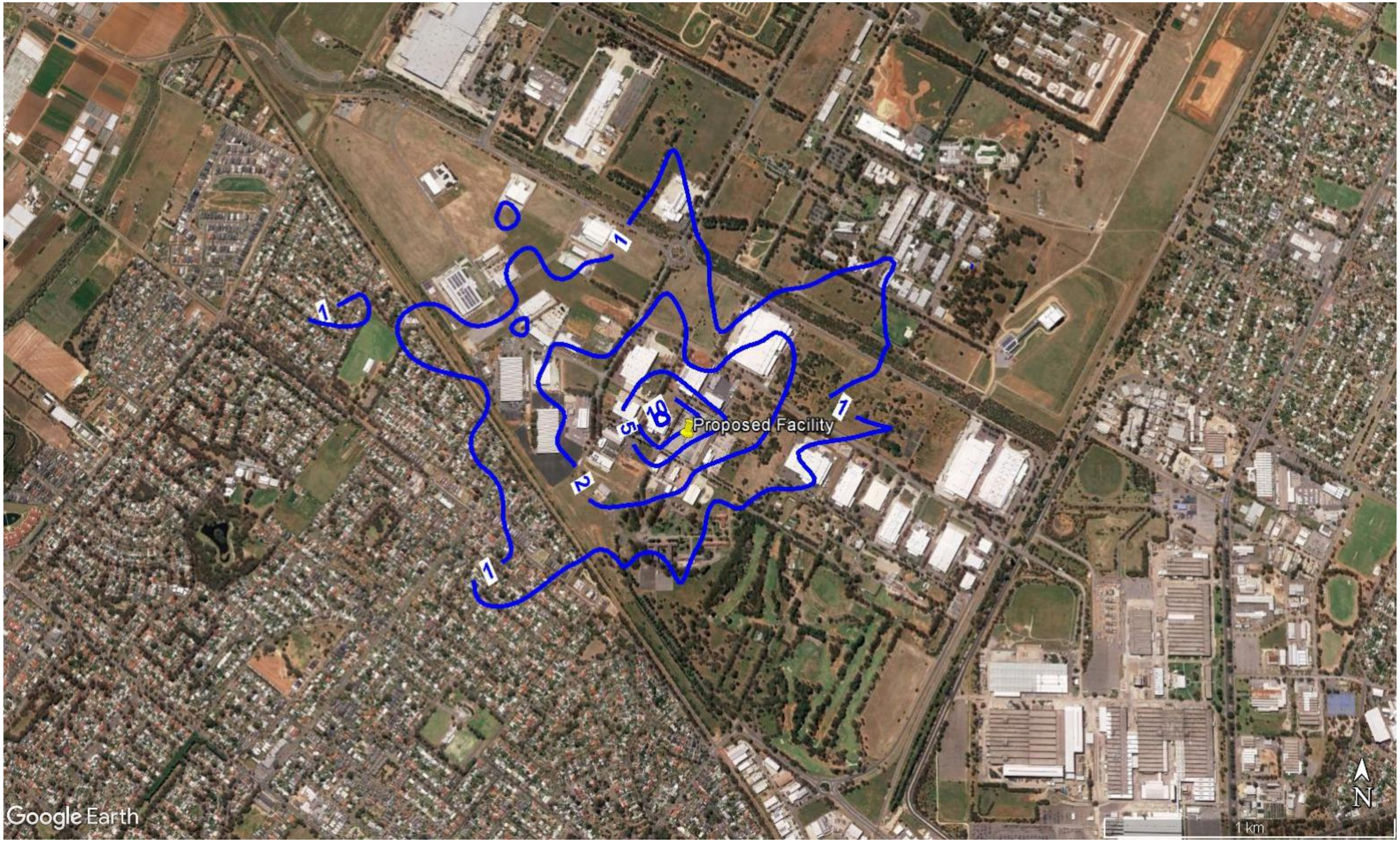


Scenario 2 (Upset Conditions) – 8 Hour Average Maximum Predicted Concentrations in Isolation of CO

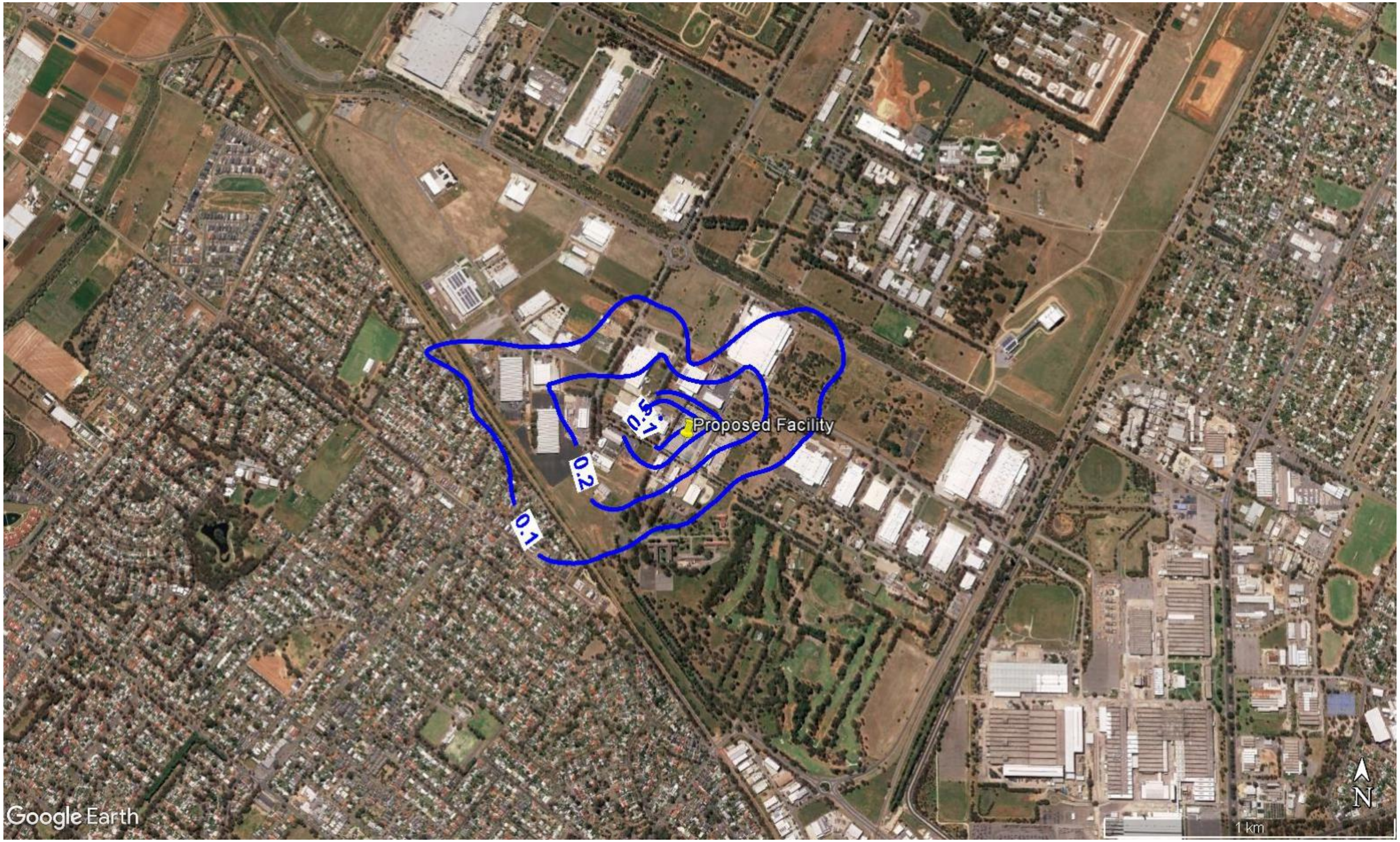


Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of SO_2

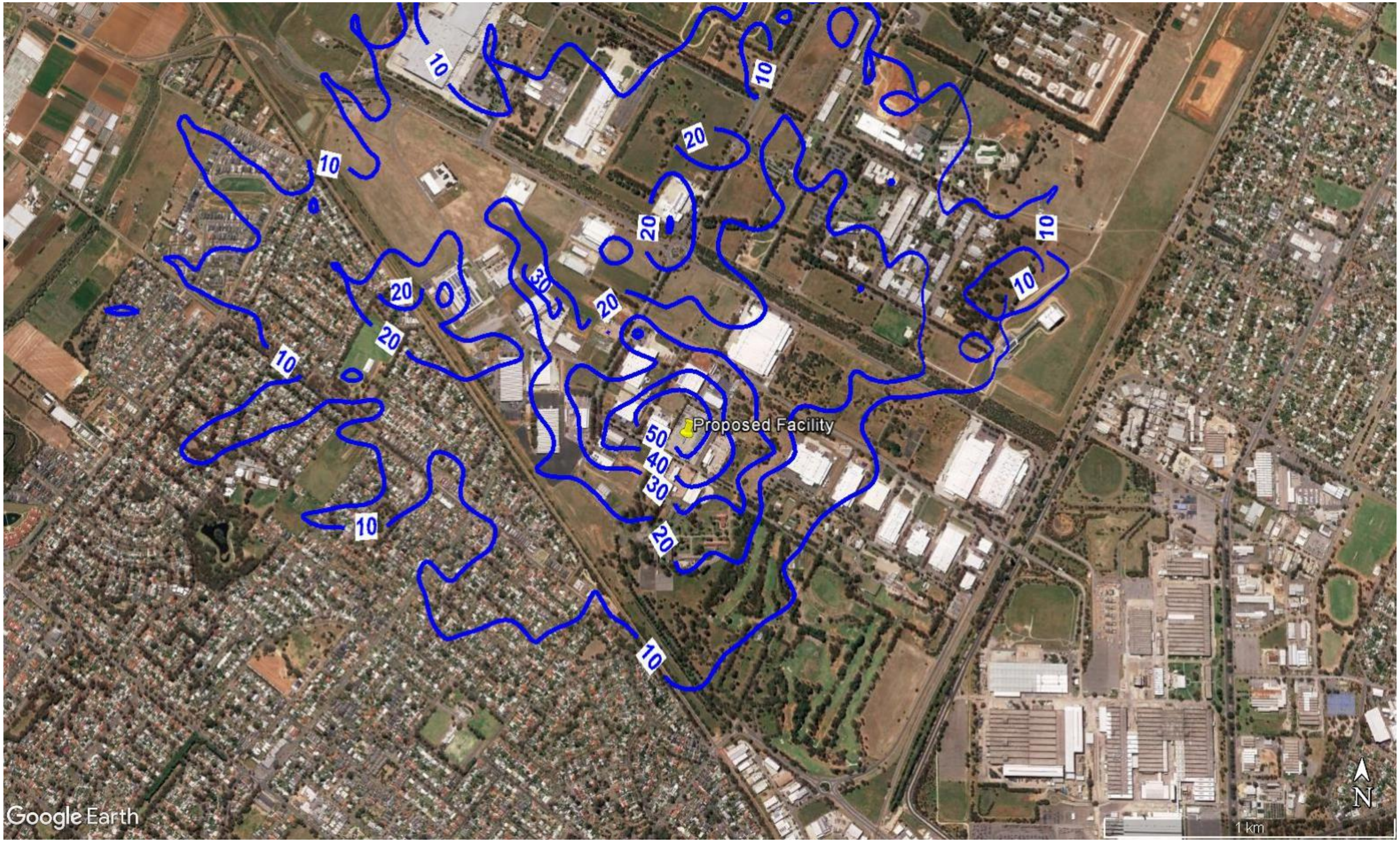
Scenario 2 (Upset Conditions) – 24 Hour Average Maximum Predicted Concentrations in Isolation of SO_2



Scenario 2 (Upset Conditions) – Annual Average Predicted Concentrations in Isolation of SO_2



Scenario 2 (Upset Conditions) – 3-minute Average Maximum Predicted Concentrations in Isolation of H2S



ANAEROBIC DIGESTION BIOENERGY PROJECT

EPA SOUTH AUSTRALIA

RESPONSE TO DEVELOPMENT APPLICATION INFORMATION REQUEST

DELOREAN ENERGY SA ONE (IN ASSOCIATION WITH BIOGASS RENEWABLES PTY LTD)

Date	Revision	Revision Comment	Prepared	Reviewed	Approved
16/08/18	A	Issued	JL	JO	HJ

Response to Development Application Information Request

To whom it may concern,

It is acknowledged that the EPA South Australia has been in contact with DeLorean Energy SA ONE Pty Ltd regarding the development of the Anaerobic Digestion bioenergy facility being constructed by Biogass Renewables Pty Ltd in Edinburgh, South Australia.

Biogass Renewables Pty Ltd works towards ensuring compliant and fit-for-purpose design that meets all applicable requirements of approving authorities.

We hope the attached information provides adequate responses to the information requested by the EPA.

Best regards,

Hamish Jolly, Director
Biogass Renewables Pty Ltd
Ground Floor, 1205 Hay St
West Perth WA 6005
hamish.jolly@biogass.com.au
www.biogass.com.au

RESPONSE TO DEVELOPMENT APPLICATION INFORMATION REQUEST

DeLorean Energy Pty Ltd (DeLorean) in association with Biogass Renewables Pty Ltd (Biogass) submits the following information to address the information requested by the EPA South Australia (EPA) in relation to the proposed project:

Response Details	
Respondent	DeLorean Energy SA One (in association with Biogass)
Proposal	Construction of a new Anaerobic Digestion Bioenergy Plant
Location	A505 DP68296, Hundred Munno Para, 1-2 Gidgie Court, Edinburgh, SA 5111
Development Number	361 / L007 / 18

Response		
No.	**Respondent**	**Commentary**
Plant / Equipment and Process		
1	EPA	Clarify the total annual production of methane in tonnes (as 100% methane).
	DeLorean / Biogass	The total expected annual production of biogas is 25,500,000 m3. Converting to nominal tonnes of methane (typically constitutes 60% of biogas), total estimated annual production is 10,933,630 TPA CH4. Please refer to *Appendix 1 – Methane Calculations* for calculation workings.
2	EPA	Provide an overall balance showing the quantity of methane produced by anaerobic digestion (AD) as well as: a. Quantity of methane consumed by electrical power generation b. Quantity of methane expected to be exported offsite c. Quantity of methane expected to be lost in any gas treatment or purification process
	DeLorean / Biogass	The plant will generate 69,900m^3 of biogas per day. The gaseous output from the process will be cooled and purified through an activated carbon filtration system, before being burned through a Combined Heat and Power (CHP) unit rated to produce approximately 4.7MW of electricity and 4.9MW of thermal heat or upgraded to 21.7GJ/hr of biomethane. The expected quantities of methane consumed is as follows: a. Methane consumed by the sites electrical energy generation parasitic draw is expected to be 1,903,363 TPA b. Methane exported offsite is expected to be 9,840,267 TPA (injected into general gas system) c. There is no expected methane consumed in any gas treatment, purification process or any wash water technology used onsite. Please refer to *Appendix 1 – Methane Calculations* for calculation workings.
3	EPA	A description of the proposed Biofilter, including but not limited to: a. How the humidity and temperature of the odorous gases presented to the Biofilter would be controlled. b. How peaks in odour arising from reception hall operation would be managed.

		c. A prediction of the odour levels in the air leaving the biofilter. Odour levels should be expressed in Odour Units, as defined by Australian Standard: AS/NZS 4323.3:2001 – *Stationary source emissions.: Determination of odour concentration by dynamic olfactometry.*
	DeLorean / Biogass	Responses in relation to biofilter are provided as follows: a. The biofilter is a single stack unit containing a spongelight rock medium that degrades bacteria and pollutants. The humidity and temperature of the odourous gases are managed with the humidifier system. Temperature and humidity sensors are incorporated to ensure accurate moisture dosing and system control. b. The odour fluctuations in the reception hall will be controlled with the biofilter and humidifer unit. The air is humidified using misting nozzles with fans located inside the air extraction pipe ensuring 4-5 complete air changes per hour. Ducting will be concentrated over the reception hall zones with high concentrations in odour; the feedstock receival area and digestate offtake area. c. The biofilter unit is confirmed and guranteed to deliver <500 OU/m3.
4	EPA	Provide appropriate engineering design of the biofilter (to ensure it is designed to work effectively).
	DeLorean / Biogass	Exact engineering design of the biofilter shall be provided following procurement and as soon as an acceptable unit and supplier has been selected through the competitive tendering process.
5	EPA	Provide a management plan for the proposed biofilter that includes contingency planning around the controls that would be in place to ensure the biofilter would be effective 100% of the time.
	DeLorean / Biogass	The biofilter management plan shall include the following to ensure that the biofilter is effective 100% of the time: • Biofilter Standard Operating Procedure (SOP). The SOP shall be duly enforced by the responsible site manager. • Biofilter mainanance and operation shall be conducted by trained responsible persons on a regular basis in accordance with the SOP. • The design of the receival hall incorporates independant fast closing doors operating on approximately 6 seconds. Opening and overlap of the doors is minimised by using on an ad-hoc basis only to contain odours and maintain the slight negative pressure in the building. An exact biofilter management plan shall be provided following procurement and as soon as an acceptable unit and supplier has been selected through the competitive tendering process.
6	EPA	A description of how the ferric sulphide resulting from the reaction betewen ferric chloride and hydrogen sulphide within the AD process would be managed to avoid liberation of hydrogen sulphide.
	DeLorean / Biogass	DeLorean / Biogass removes the previous requirement for ferric chloride dosing as per the *DeLorean Environmental Report*. Sulphide clean up is managed via a biological removal system. The method is an industry standard practice and involves micro dosing air into the head space of the digester to give $H_2S + O_2 = SO_4 + H_2O$. This enables the SO_4 – sulphate to precipitate into the digestate for

		safe removal and offtake. The reference facility is currently operating at 20-50ppm, from up to 2000ppm's. Included is a further reduction from 50ppm's to less than 5ppm's ready for input in to the on-site boiler.
7	EPA	A description of how the proposed gas chiller would be operated and how any resultant condensate would be managed.
	DeLorean / Biogass	The gas chiller is operated through the parasitic power generated by the site and controlled by the Master Control Centre (MCC). The condensate is fully captured and recirculated back into the anerobic digestion process.
8	EPA	A description of how the proposed catalytic converter on the CHP exhaust would operate, including (but not limited to): a. Reagents to be used and how they would be stored b. Time required to raise the catalyst bed to operating temperature c. Prediction of the oxides of nitorgen mass flow in the exhaust leaving the bed
	DeLorean / Biogass	DeLorean / Biogass removes the previous requirement for catalytic converters as per the *DeLorean Environmental Report*. Reason is that procurement has now been amended to source only lean-burn CHP engines which are not required to be fitted with catalytic converters. Predicted NOx output is 500mg/Nm3 at STP and 5% O2. Please refer to Appendix 2 – Indicative CHP Emissions for details.
9	EPA	A prediction of the carbon monoxide mass flow in the exhaust ffrom the CHP catalyst bed.
	DeLorean / Biogass	Predicted CO output is 1400mg/Nm3 at STP and 5% O2. Please refer to *Appendix 2 – Indicative CHP Emissions* for details.
10	EPA	A description of the plant proposed the increase the concentration of methane in the gas produced by AD to a level that permits its export off site. This description should include (but not limited to): a. Reagents to be used and how they would be stored b. How the carbon dioxide removed by this step would be managed c. What emissions to air would arise as a result of this operation
	DeLorean / Biogass	The plant will use a biogas upgrade system to convert biogas to biomethane for export through pipeline injection. Answers to the EPA's specific questions are as follows: a. With Greenlane's water-wash system there are no chemicals, that is a major advantage of the Greenlane Biogas design - it is easy to operate, rugged in terms of no pre-treatment requirement of the biogas being fed into the upgrading system. With PSA system whilst the (adsorptive) media is regenerated it would need replenishing over time (depending upon biogas composition). b. On the water-wash systems, the (dissolved) CO2 is stripped out of the water, and the air/gas mixture exits the top of the stripping vessel. The air/gas mixture is usually discharged to a biological filter, carbon filter or Thermal Oxidiser (RTO) - depending upon the level of H2S in the biogas. c. Expected gas output composition as follows 95.7% CH4, 2% CO2, 1.82% N2, 0.47% O2, <3 H2S (ppm).

11	EPA	A description of any other processes for pH control and biogas cleaning/scrubbing that are proposed for this site. This descripton should include (but not be limited to): a. Reagents to be used and how they would be stored b. How any waste products arising from such operations would be managed
	DeLorean / Biogass	Other processes that will be employed by the site are as follows: • Processes outputs are circulated through the onsite digestate treatment plant. The digestate treament is composed of the following steps: 1. Digestate primary treatement – digestate dewatering 2. Bioreactor treament unit 3. Ultrafiltration (UF) units 4. Reverse Osmosis (RO) units Please refer to *Appendix 3 – Digestate Treatement Plant Chemcial Consumption* for detail on expected regents used. • PH (decrease) is a result of the normal biological breakdown of the biomass. Organic loading can be used to control pH and will be monitored regularly through periodic measurement and testing. • Onsite chemical laboratory for regular feedstock and process testing. • Oxygen micro-dosing to remove H2S (refer to point 6 for detailed description).
Water Quality		
12	EPA	A discharge from site of 128m3/day is required for supply to Salisbury Water, describe what contingency would be in place if that supply requirement is disrupted, either though water quality issues or issues on Salibury Water's ability to accept the water. Clarify if there is another dispoal option requried, and if so describe what that option would be.
	DeLorean / Biogass	In the event that the Salisbury Water's supply requirement is disrupted, the site will have a water storage capcity of approximately 5 days until Salisbury Water can rectify the disruption or find an intermediate solution.
13	EPA	For the collection and distribution of stormwater to the City of Salisbury, clarify how would it be confirmed that the water quality is satisfactory to send direct to Salisbury Water if an incident comproising water quity was to occur in the budned area, or clarify if it is the intent that all water collected within the bund would always sent through the treament process.
	DeLorean / Biogass	Confirming that the latter is correct, all water collected within the bund will be sent through a water treatment process. The output will be cleaned to meet the standards required by Salisbury Water for proper disposal. The water treatment process will consist of mechanical separators, reverse osmosis, ultrafiltration and an on-site waste water treament plant.
Waste Management		
14	EPA	Provide details to adequately characterise the digestate and reverse osmosis condensate including the physical and chemical composition. In adressing this aspect please ensure the fate of any chemical additives or regents of the process are included.

	DeLorean / Biogass	The digestate is mechanically separated into solid and liquid fractions. The solid fraction is approximinately 30% dry material content and spade-able product which is used as organic compost. The liquid fraction is expected to be 0.5% dry material content and is recirculated back into the process. Please refer to *Appendix 3 – Digestate Treatement Plant Chemcial Consumption* for detail on expected regents used Please refer to *Appendix 4 – Reference Facility Indicative Digestate Composition* for detail on the outfeed digestate composition.
15	EPA	At any given time, how much waste (in tonnes or m3) would be: a. Stored on site in the reception shed b. Stored in the agricultural waste silos c. Undergoing processing in the hydrolysis, pasteurisation, and digester tanks.
	DeLorean / Biogass	The feedstock storage is as follows: a. The reception building will have capacity to store 48 hours of material or approximately 770 Tonnes. The processes of the receoption buidling will ensure that received waste materials will have an onfloor time of not more then 48 hours prior to processing adn encapsulation within tank systems. During this period the waste material will be within the reception hall only. b. The agricultural grain silos will have capacity to store 48 hours of material or approximately 190 Tonnes. This material is securely stored within a silo as is standard. c. The hydrolysis tank will have capacity to store 3,500KL of biomass and is not open to atmosphere, all gasses produced are captured and treated. The six digester tanks will have capacity to store 3,500KL of biomass each (total 21,000KL) and is not open to atmosphere, all gasses produced are captured and treated The pasturiser has a capacity of approximately 22T/hr and is not open to atmosphere, this is a modified pipework system enroute to tge hydrolosis tank
16	EPA	Clarify the maximum residence time (stockpile turnover timeframe) of any waste (solid and liquid) received at the facility.
	DeLorean / Biogass	The maximum residence time of all incoming feedstock will be; 2 days storage in the reception building awaiting feeding; 5 days in the hyrolysis tank; 30 days in the biodigesters; 2 days in the reception building awaiting offtake (total 39 days). However, the opration of the facility strives for same-day continuous processing.
17	EPA	Clarify whether any digestate or sludge would be stored at the subject site, and the manner of any such storage, for any period of time while awaiting off-site transport.
	DeLorean / Biogass	The maximum residence time of any outgoing digestate will be 48 hours. The solid fraction of the digestate will be fully contained in the reception building and loaded into semitrailers for offtake. The liquid digestate will be cycled through the closed-loop plant process. However, the opration of the facility strives towards same-day

		continuous processing.
18	EPA	Confirmation what testing would take place for all incoming wastes (as stated on page 28 of the *DeLorean Energy Enviornmental Report*).
	DeLorean / Biogass	Feedstock entering the facility will be subject to the following testing: - Inspection by qualified and competent responsible persons in charge for acceptance - Incomming trucks will be required to have their loads recorded on a weighbridge - New complex biomass is sampled and tested for physical and chemcial properties at the on-site chemical laboratory on an as needs basis. For example, a new supplier comes online, their product will be tested. Adhoc deliveries will be tested depending on the source and delivery type. All delivery types will be tested on a rotating basis to ensure that DeLorean can maintain a stong record of the exact type of incoiming material. - All unnaceptable feedstock will be rejected
19	EPA	There is potential for some of the by-products from the proposed processes to generate Listed Wastes (as outlined in Schedule 1 Part B of the Environment Proctection Act), please provide confimation of any such wastes with estimated quanitites and management proposals.
	DeLorean / Biogass	As per Schedule 1 Part B of the Environment Proctection Act, no chemicals from the *Listed Wastes* will be produced as a product from the operation. However, small trace elements of *Sulphides and Sulphide Solutions* may be produced as a by-product only. Please note that Sulphide is not produced on large scale or as a sellable product. The management method will be though biological oxygen micro-dosing to remove H2S (refer to point 6 for detailed description). In additon, screening and testing of incoming waste streams and testing of digestates will be undertaken on a regular basis to ensure that Listed Wastes are not tipped at the site, removed from the system and / or appropriately disposed of.
20	EPA	It is stated that the digestate would consitute a compost produtct ready for sale as organic fertiliser. Clarification is required as to the standard or specification the digestate and RO condensate would meet. Please refer to the *EPA Compost Guideline*, January 2013 for assistance with your response.
	DeLorean / Biogass	As per the *EPA Compost Guideline*, the only the incoming feedstock is classed as Category A as it encompasses food waste according to the guideline. Please note that this is not a waste product but a clean feedstock product. All product entering the facility will be pasturised to ensure pathogens are eliminated to meet PAS110 standards.
21	EPA	Clarify whether pasteurisation of the digestate is required prior to any reuse of this material (as suggested on page 15 of the *DeLorean Energy Environmental Report*).
	DeLorean / Biogass	All material is pasturised during the process to ensure pathogens are eliminated to meet PAS110 standards. The output digestate is a spadable material with the volatile component removed during the anaerobic digestion process. As a result, no further processing is required as the product is be ready for use as organic compost.

22	EPA	Confirmation of the quanitites of digestate / compost that would be: a. Sent off-site for further treatment, e.g. by a licenced composting facility b. Reused or processed in some manner, or directly reused as a fertiliser / compost or Waste Derived Soil Enhancer. Note: the EPA Standard for the production and use of waste derived soil enhancer applies to the direct reuse of waste as a soil enhancer.
	DeLorean / Biogass	The digestate is not a waste product but instead is a salable material ready for use as organic compost. All solid output digestate will be sent to licenced composting facilities. Further treatment is not required as the digestate is a ready to use organic fertiliser however composting facilities may decide to improve compost properties by adding material at their discretion. All liquid digestate will be circulated though the on-site water treatment facility. Total liquid output from the site will be expected to be 456m3/day. Of this volume, 329m3/day is reused and recirculated to assist with the AD process. The remaining volume of 128m3/day is treated though a water treatment system and sent to the aquifer operated by Salisbury Water.
23	EPA	Provide an estimate of the quntities of waste that would be sent to landfill for disposal on an annual basis.
	DeLorean / Biogass	The amount of waste generated to be sent to landfill is highly dependent on the type of incoming material which can vary significantly on a day to day basis. However, taking the reference facility as a baseline, an estimated 0.5% will be of input material will be sent to landfil. This equates to approximately 500TPA from the 100,000TPA expected Commerical & Industrial (C&I) waste. The dry feedstock (i.e. grain material) is clean and is not expected to contain any waste requiring landfill.
Air Quality		
24	EPA	As identified in the *DeLorean Energy Environmental Report*, porovide an air quality assessment report taht comlies with the requirements fo the EPAs Ambient air quality asssessment 2016 publication. The report should contain, as a miniumim, include: a. A map that identities (including distances) all sensitive receptors within 100m of the proposed plant. b. Identification of all potential pollutant emissions, including fugitive emissions, and their emissions rates under a worst case scenario (ie. maximum emission rates) as well as typical operating conditions c. An air dispersion modelling report for all the pollutants of concern (eg. Odour, H2s, NO2, SO2, CO, PM2.5 and PM10), for worst-case scenario and typical operation, based on robust and defenible emission rate data and undertaken by suitably qualified and experienced air quality modeller
	DeLorean / Biogass	A comprehanisve *Air Quality Assessment* has been undertaken by a suitabily qualified consultant and is provided in Appendix 5
Noise		
25	EPA	As identified in teh *DeLorean Energy Environmental Report*, provide a report prepared by a suitably experienced, professional acousitic engineering consultant* demonstrating that tworst case predicted noise from the proposal can meet the following Noise Criteria** (refer to *EPA Develpoment Appolicaiton Information Request*).

	DeLorean / Biogass	A comprehanisve *Noise Assessment* is currently being undertaken by a suitabily qualified consultant and will be provided to the EPA as soon as possible.

APPENDIX 1 – METHANE CALCUALTIONS

Biogas to methane calculation

Biogas	25,500,000	m3
Methane (CH4) in biogas	60%	%

PV=nRT

P	101325	Pa
V	15,300,000	m3
R	8.31	J k-1 mol-1
T	273	T
n (solve)	683,351,847	mols

n=m/M

n	683,351,847	mols
M	16	CH4
m (solve)	10,933,629,547	kg

Methane consumption

Site parasitic	10%	%
	1,093,362,955	kg

Exported	90%	%
	9,840,266,593	kg

Lost in gas treatment	0%	%
	-	kg

APPENDIX 2 – INDICATIVE CHP EMISSIONS

TCG	2020V16	Exhaust analysis		
MWM Data exhaust mass flow wet =			8282	kg/h

Assumptions		
Biogas contains	55%	CH4
Combustion air is dry and at STP		

Exhaust Bulk Composition (Wet)				
	kg/h (wet)	mass % (wet)	m3/h (wet)	vol % (wet)
CO2	1319	15.9%	673	10.4%
N2	5695	68.8%	4570	70.8%
O2	675	8.2%	474	7.3%
H20	593	7.2%	741	11.5%
TOTAL	8282	1	6459	1
Density at STP =			1.29	g/l (wet)
Volume at STP =			6459	Nm3/h (wet)

Exhaust Bulk Composition (dry)				
	kg/h (dry)	mass % (dry)	m3/h (dry)	vol % (dry)
CO2	1319	17.1%	673	11.8%
N2	5695	74.1%	4570	79.9%
O2	675	8.8%	474	8.3%
TOTAL	7689	1	5718	1
Density at STP =			1.35	g/l (dry)
Volume at STP =			5718	Nm3/h (dry)

NOx will be ≤	500	mg/Nm3 dry gas and STP at 5% O2.		
This is equivelent to	396	mg/Nm3 dry gas and STP at	8.3%	O2
At full load this will be	2.27	kg/h dry gas and STP in the exhaust maximum		
CO will be ≤	1400	mg/Nm3 dry gas and STP at 5% O2.		
This is equivelent to	1110	mg/Nm3 dry gas and STP at	8.3%	O2
At full load this will be	6.35	kg/h dry gas and STP in the exhaust maximum		

Exhaust Flow rate will depend on the temperature		
Temperature	Flow rate (wet)	Flow rate (dry)
C	m3/h	m3/h
0	6459	5718
150	10007	8860
180	10717	9488
210	11427	10117
450	17105	15143

APPENDIX 3 – DIGESTATE TREATEMNT PLANT CHEMICAL CONSUMPTION

PARAMETER	VALUE	U.M.
Polyelectrolyte (*)	--	gr/m^3 of treated digestate
Acetic Acid (**); nutrients	--	gr/m^3 of treated digestate
Sulfuric acid (30%) (#)	2000,0 approx.	gr/m^3 of treated digestate
Sodium hydroxide (30%) (#)	200,0 approx.	gr/m^3 of treated digestate
RO Antiscalant (100%)	6,0	gr/m^3 of treated digestate
Sodium hypochlorite (14%)	50,0	gr/m^3 of treated digestate
Acid membrane cleaner (100%)	20,0	gr/m^3 of treated digestate
Caustic membrane cleaner (100%)	50,0	gr/m^3 of treated digestate
Antifoam (100% biodegradable non silicon)	--	gr/m^3 of treated digestate

(#) The dosage of sulphuric acid is necessary for the pH correction (acidification) at the RO entrance in order to control the scaling of the membranes. The consumption of the sulphuric acid strongly depends on many factors; the main ones are: alkalinity concentration in the raw digestate, ammonia concentration in the raw digestate, reduction of nitrogen in the solid separation section, reduction of the nitrogen content carried on in the biological process, hardness and sulphate concentration in the digestate, desired recovery in the RO system. All these parameters have a reciprocal influence and the consumption of sulphuric acid becomes from a specific process optimization. The dosage of sodium hydroxide is necessary for the neutralization of the carbon dioxide in the reverse osmosis permeate. The carbon dioxide presence in the reverse osmosis permeate is due to the sulphuric acid dosage and proportional to this one. So, the sulphuric acid consumption and the sodium hydroxide consumption can be guaranteed only after a detailed analysis of the digestate is received. The reported values come from experience done in similar application.

(*) The consumption of polyelectrolyte strongly depends by the type of polyelectrolyte utilized (there are many type with many different characteristics in the market) and by the optimization tests carried on with the real digestate produced by the plant. The field test is the common practice in order to choice the optimal type and the dosage of polyelectrolyte for the dewatering process.

(**) Normally it is not necessary to dose any biodegradable carbon in the digestate liquid fraction at the biological inlet but sometimes, especially at the plant start-up, a dosage of prompt biodegradable carbon is useful for the biomass growth and consolidation. Anyway, an eventual acetic acid dosage is evaluable after a jar test to be done on the raw digestate in order to evaluate the quality and quantity of COD of the liquid fraction after the solids separation.

APPENDIX 4 – REFERENCE FACILITY INDICATIVE DIGESTATE COMPOSITION

The following information is taken from chemical testing of outfeed samples taken from the reference facility located in Jandakot, Western Australia. Results display the averages of periodic testing and data collection over 3 years.

Chemical	ppm
N	5,003.4
pH	549.2
Cl	1,119.5
N.NH4	3,207.1
N.NO3	1.0
N.NOx	1.4
Ca	649.4
Cu	1.7
Fe	443.5
Mg	91.5
Mn	4.0
K	859.2
Na	703.3
S	165.3
Zn	21.0
Co	0.1
Ni	0.1
Al	170.0
Ar	0.0
Cd	0.0
Cr	0.4
Pb	0.3
Mo	0.0
Se	0.0
Moisture %	96.7
pH	7.9

APPENDIX 5 –AIR QUALITY ASSESSMENT

Intended for
Emissions Assessments Pty Ltd

Date
September 2018

BIOGASS RENEWABLES
SALISBURY ANAEROBIC DIGESTION PLANT AIR QUALITY ASSESSMENT

BIOGASS RENEWABLES
SALISBURY ANAEROBIC DIGESTION PLANT AIR QUALITY ASSESSMENT

Revision	**Final**
Date	**25/09/2018**
Made by	**Martin Parsons**
Checked by	**Ruth Peiffer**
Approved by	**Nick Houldsworth**

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1. INTRODUCTION

1.1 Background

Biogass Renewables Pty Ltd (Biogass) are proposing to develop an Anaerobic Digestion Plant (the Plant) at the parks precinct in Edinburgh, South Australia. The premises are located at Lot 104 - 116 Purling Ave, Edinburgh, South Australia. The location of the proposed facility is shown in Figure 1, with nearest sensitive receptors being located approximately 450 m south-west and 300 m south of the site.

Emissions Assessments Pty Ltd (Emissions Assessments) requested Ramboll Australia Pty Ltd (Ramboll) undertake an air dispersion modelling assessment to determine the likely air quality impacts associated with routine operations and a flaring scenario for the Plant. This report presents the approach, methodology and results of air dispersion modelling for the Plant operating under each of the modelled scenarios. The maximum predicted ground level concentrations (GLCs) of the modelled compounds have been compared against the relevant ambient air quality criteria.

1.2 Overview of Process

The Plant will use organic waste to produce biogas (methane) through an anaerobic digestion process. The anaerobic digestion process is a fully enclosed system.

The organic waste (100,000 tonnes per annum [tpa] of food waste, 25,000 tpa of grain dust) is received, stored and pre-processed in a purpose built, sealed and fully enclosed negative pressure structure, before being pumped in a continuous process to a digester feed tank then onto one of six digester tanks, where it is stirred and agitated at intervals to encourage the release of biogas. An automated system regulates the necessary parameters such as pH and temperature. The digester breaks down the material to produce biogas, comprising approximately methane, carbon dioxide, water and hydrogen sulphide.

The biogas is collected under a fire resistant, double membrane dome on top of each digester. A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.
The biomethane will then be fed to a power plant, which drives a generator to produce electricity for onsite use by Biogass. The digestion tanks harvest the steam and hot water from the power plant, which is used to stabilise the temperature of the biomass in the digestion and storage tanks.

Figure 1: General Location of the proposed Biogass Facility

1.3 Details of Process

An overview of the layout of the plant is shown in Figure 2 with detailed description of the operation provided in the following sections.

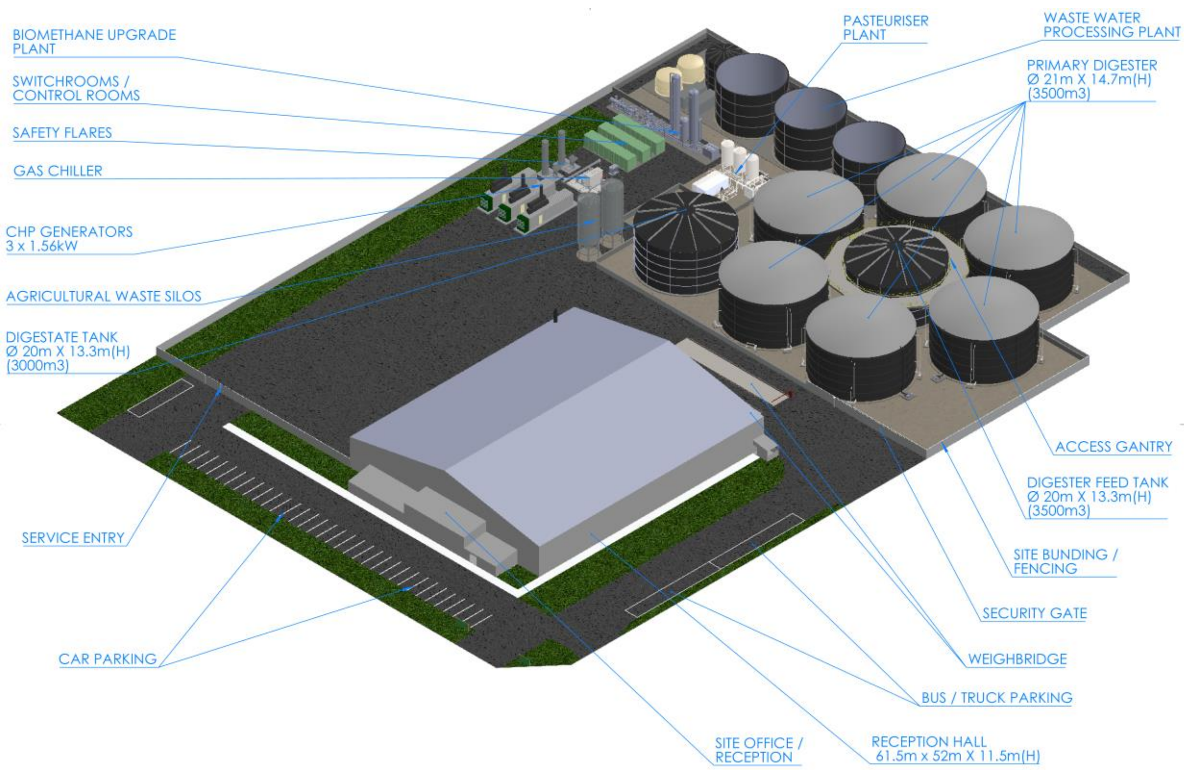

Figure 2: Layout of Plant

Source: Emissions Assessments

1.3.1 Receivals Hall

The waste is received in the receivals hall which is a 60 m x 52 m x 11.5 m high hooped roof building. The receivals hall is fitted with concrete bunkers, graded floor and drainage sump. The receivals hall will be under negative pressure and connected to fully enclosed, single stack biofilter.

All vehicle entry points to process buildings will be via fast acting roller shutter doors which open and close on a pressure switch. All doors associated with process buildings will be connected to an alarm system which alerts operators in the event of doors being left open. Doors will only be opened for entry and exit of trucks with doors sealed before unloading occurs.

The solid and semi-solid waste will be deposited into graded bunkers with liquid waste pumped directly into a sump, for subsequent pumping to a liquid storage tank. Trucks are washed before departure with all wastewater draining to the sump for processing in the digestion system.

1.3.2 Staging Process (no emissions)

Blended and balanced feedstock is pumped in sealed pipes to a fully enclosed digester feed tank where it is mixed and warmed using heat from the plant’s biogas generators.

1.3.3 Anaerobic Digestion (no emissions)

Feedstock is pumped daily in sealed pipes from the digester feed tank to the primary digester tanks. These tanks are interoperable or can be isolated. The digesters are warmed using heat from the plant's biogas generators. Biogas accumulates in the gas domes, and can be positively displaced by pumping air between the gas dome's membranes.

1.3.4 Digestate Storage and Reuse (no emissions)

On a daily basis, digestate is pumped in sealed pipes to a digestate storage tank. The digestate will be pumped directly into a tanker truck for transport offsite.

1.3.5 Biogas Processing and Safety Flare

Biogas in the domes is positively displaced and drawn off in sealed gas pipes. The gas will then pass through a biomethane upgrade plant which will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.

The entire gas management system is connected to an enclosed gas flare system comprising two flares. Gas can be directed to a flare at all gas storage and processing stages so as to bypass any equipment processing failure that may occur. The flare will only be operated on an emergency basis, or when one of the generators is not operating for routine maintenance (estimated 12 days per year), or in the unlikely event that all generators fail (worst case estimated 7 days).

A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane.

1.3.6 Power and Heat Generation and Application

Clean methane gas, scrubbed and separated (carbon dioxide fraction removed) is compressed as fuel for three generators. Energy generated will be used to power the anaerobic digestion plant. The balance will supply 100% of Biogass' onsite energy requirements. Heat from the generator will be captured via a heat exchanger to heat the digester feed tank and the primary digesters.

2. ATMOSPHERIC EMISSIONS

2.1 Emission Sources

The atmospheric emissions sources included in the air dispersion modelling assessment for the Plant operating under routine conditions include:

- One biofilter stack, with emissions of concern being odour;
- Three gas fired reciprocating engines, with the emissions of concern being biomethane combustion products; and
- Emissions from the biomethane upgrade plant, consisting of hydrogen sulphide and odour.

The receivals hall was also considered as a potential emission source. However, as the Hall will be fitted with fast acting roller shutter doors and will be under negative pressure and connected to the fully enclosed, single stack biofilter, potential emissions are considered to be negligible. The main doors will only open for vehicle entry for waste delivery and digestate transport. With fast door opening and closing times of 6 seconds, it is likely that the doors will be open for around 30 seconds per truck entry. Emissions monitoring at similar sites has indicated emissions from door openings and leakage from buildings with rapid roller shutter doors and comparable management practices are negligible. The receivals hall has not been included in the modelling assessment on this basis.

The full flaring scenario included in this assessment has considered the following atmospheric emission sources:

- Two enclosed flares, used when one or all of the generators are unavailable with the emissions of concern being biomethane combustion products.

2.1.1 Biofilter Emissions

The biofilter will use spongelite as the filter media. Air from the receivals hall will be humidified using misting nozzles running on timer, with a fan running inside the air extraction pipe. All biofilter fans will run on standard electric motor, with a spare which can be connected immediately in event of a failure.

2.1.2 Power Generation

The plant will use three 526 kW capacity Jenbacher 3-type biogas generators (GE JGS312 GS-N.L D225) manufactured by General Electric. The GE Jenbacher engine uses a LEANOX control system with oxides of nitrogen emissions guaranteed < 500 mg/Nm^3 (101.3 kPa, dry and 5% O_2).

Emissions associated with the generators include:

- Oxides of nitrogen (NO_x) consisting mostly of nitrogen oxide (NO) and a lesser concentration of nitrogen dioxide (NO_2). NO_x is formed primarily from the oxidation of fuel-bound nitrogen and nitrogen in the air;
- Sulphur oxides (SO_x) which are predominantly in the form of sulphur dioxide (SO_2), formed from the oxidation of sulphur in the fuel; and
- Carbon monoxide (CO) formed from the incomplete combustion of the fuel.

Particulate matter (PM) and non-methane volatile organic emissions from the generators are considered to be negligible as the fuel source is a gaseous fuel with minor higher chain paraffins and as such, have not been included in the modelling assessment.

2.1.3 Enclosed Flares

Each enclosed flare will reach a height of 8 m and diameter of 1.7 m. The biogas is fed in at the bottom and combusted with the combustion temperature and efficiency controlled by a thermocouple near the top of stack, which adjusts the air inflow at the base of the stack via dampers. If the exhaust temperature is too high, the dampers are opened further and more air is drawn in and if too low, the dampers are restricted to restrict the air flow to maintain optimum combustion. Destruction removal efficiencies of 99% and 99.95% for methane and hydrogen sulphide (H_2S) respectively are guaranteed by the manufacturer.

2.1.4 Biomethane Upgrade Plant

A biomethane upgrade plant will be used to upgrade the biogas to a methane-rich product gas, also known as biomethane. Emissions of concern from the biomethane upgrade plant will include H_2S and odour.

2.2 Emissions Estimations

Emission estimates for the biofilter, power generation and flares were derived from stack monitoring data from another biogas production facility with a similar configuration located in Jandakot, Western Australia (as provided by Emissions Assessments). The emissions estimates applied in this assessment have been derived from worst case concentrations, as measured when the reference plant was operating at 100% load and are considered conservative.

Emission estimates for the biomethane upgrade plant were derived from manufacturer's specifications.

The exhaust parameters and emission estimates for each of the modelled sources are provided in Table 1.

Table 1: Emission Parameters for the Plant

Parameter	Units	Routine Operations			Flaring
		Bio Filter	CHP Power Generation x 3	Biomethane Upgrade	Flares x 2
Exhaust Parameters					
Operation		Continuous	Continuous	Continuous	< 12 days per year
Number		1	3	1	2
Coordinates	**UTM**	283634, 6153412	283603, 6153437 283607, 6153435 283611, 6153433	283640, 6153473	283611, 6153455 283615, 6153453
Height	**m**	14.5	8.6	14.5	8.0
Diameter	**m**	0.88	0.32	0.25	1.73
Temp	**Deg C**	22	410	15	1000
	K	295	683	288	1273
Measured Oxygen	**%**	NA	8.3	NA	10.9
Stack Moisture	**%**	1.5	4.4	NA	1.5
Volumetric Flow	**Nm^3/s Dry**	19.1	1.16	0.73	10.2
	Am^3/s	20.3	2.8	0.77	47.0

Parameter	Units	Routine Operations			Flaring
		Bio Filter	CHP Power Generation x 3	Biomethane Upgrade	Flares x 2
Exit Velocity	**m/s**	33.3	34.6	15.7	20.0
Emission Estimates					
OU	**$o/u.m^3/s$**	1670	NA	105	NA
H_2S	**mg/m^3[1]**	NA	5.0	55	5.2
	g/s	NA	0.01	0.04	0.05
NO_x	**mg/m^3[1]**	NA	400	NA	51
	g/s	NA	0.46	NA	0.52
SO_2	**mg/m^3[1]**	NA	46	NA	8.8
	g/s	NA	0.05	NA	0.09
CO	**mg/m^3[1]**	NA	590	NA	16
	g/s	NA	0.69	NA	0.16

Notes

1. Referenced to STP (273.15K, 101.3kPa) and expressed as dry values.

2.3 Non-Routine Emissions

Non-routine emissions from biogas plants (apart from the infrequent flaring) may potentially arise as a result of a malfunctioning of the flare, the air extraction system or the biofilter. For the Plant these will be addressed by the management practices outlined in the following sections.

2.3.1 Flaring

Flaring upset conditions may potentially occur if gas is vented via the flare without combustion occurring. The biogas plant flare system will mitigate this risk by configuring the ignition system to be battery powered with backup solar charging. The monitoring system also includes monitoring of the exhaust temperatures and exhaust gases, such that if combustion is not occurring an alarm will be activates to alert to the need for intervention.

2.3.2 Biofilter

Higher than normal emissions can occur through biofilters (or fugitive release from the receivals hall) due to failure of extraction motors, loss of power, loss of humidification of the inlet air and problems in the biofilter media, such as compaction of the bed, degradation in the efficiency and the need to perform maintenance such as replace the filter media. These will be managed as follows:

- The extraction system on all biofilters at the site will utilise standard motors, with one motor always kept onsite as a spare. The biofilter for this plant will use two fans. Loss of a motor will only reduce the extraction flow rate by 50% for a period anticipated for no more than 3 hours;
- The power supply for the pumps will be provided by onsite generators, and when not available, by mains power. Redundancy is therefore built into the power supply and a power failure event could only occur if the onset generators failed, and there happened to be a simultaneous mains power failure. The likelihood of these concurrent events is extremely low. Owing to the redundant design it is therefore expected that odour escape owing to power failure has negligible probability of occurring;
- The humidification system will be designed to ensure humidity for all inlet conditions is maintained at 70%; and

- The biofilter media is anticipated to last for 8 years. This is much longer than organic biofilter media as it does not suffer issues such as compaction and degradation in media performance. The media is anticipated to be replaced on an as-required basis, but not less than every 8 years. Monitoring of the stack emissions will be conducted to assess the performance of the biofilter. If a deterioration in performance below minimum standards is attributed to degradation of the media, all waste receivals will be held over pending a replacement of the media, a process of up to two days.

Given the above design and proposed management of the plant, the probability of non-routine emissions from the Plant occurring is considered to be negligible and as such, have not been included in the modelling assessment.

3. AIR QUALITY CRITERIA

3.1 Human Health

For ambient GLCs, the SA Environment Protection Authority (EPA) outlines state-wide standards in its Environment Protection (Air Quality) Policy 2016. The policy seeks to apply the standards at residential areas or places where people may congregate, such as beaches or picnic areas. The standards relevant to this assessment are listed in Table 2.

Table 2: SA EPA Environment Protection (Air Quality) Policy 2016 - Applicable Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration ($\mu g/m^3$)[1]
CO	1-hour	31,240
	8-hour	11,250
NO_2	1-hour	250
	1-year	60
H_2S	3-minutes	510
SO_2	1-hour	570
	1-day	230
	1-year	60

Notes:
1. Concentrations are referenced to 0 deg C and 101.3kPa.

3.2 Odour

The SA EPA has outlined state-wide standards for odour that are applicable to this study. The standards state that an activity cannot result in the number of odour units being exceeded for the number of persons (as specified in Table 3) over a 3 minute averaging time 99.9% of the time (based on evaluations at ground level using a prescribed testing, assessment, monitoring or modelling methodology for the pollutant and activity).

Table 3: SA EPA Environment Protection (Air Quality) Policy 2016 – Applicable Odour Standards

Number of people	Odour Units (OU) (3-minute average, 99.9% of time)
2000 or more	2
350 - 1999 (inclusive)	4
60 - 349 (inclusive)	6
12 - 59 (inclusive)	8
Single residence (fewer than 12)	10

4. EXISTING AIR QUALITY

In order to determine a background concentration to assess potential cumulative impacts for the purposes of this study, monitoring data from two SA EPA monitoring stations; Elizabeth (NO_2 and CO) and Northfield (SO_2). These locations were chosen as they are the nearest ambient air quality monitoring stations to the proposed site and the monitored values are considered to be generally representative of background concentrations.

Monitoring data collected at each site between 1 January 2015 to 31 May 2018 was utilised for the purpose of this assessment. No specific guidance for selection of an appropriate background concentration is provided by the SA EPA. The Environment Protection Authority Victoria (Vic EPA) State Environment Protection Policy (Ambient Air Quality) (SEPP (AQM)) (Gov. of Vic., 2001) recommends the 75th percentile concentration (concentration which is exceeded by 25% of concentrations for that averaging period) should be adopted as a background level. Correspondence with SA EPA personnel indicated this approach would be suitable to determine ambient background concentrations for use in this assessment.

A summary of the ambient concentrations measured at the Elizabeth and Northfield SA EPA monitoring stations are presented in Table 4.

Table 4 indicates that of the applicable pollutants, background concentrations are relatively low in the region.

Table 4: 75th Percentile and Annual Average Ambient Concentrations for CO, NO_2 and SO_2

Pollutant	Averaging Period	75th Percentile Concentration (µg/m^3)[1]	Annual Average (µg/m^3)[1]
CO[2]	1-hour	25	NA
	8-hour	25	
NO_2[2]	1-hour	10	
	24-hour	NA	8
SO_2[3]	1-hour	0	NA
	24-hour	0.14	
	Annual	NA	0.2

Notes:

1. Concentrations are referenced to 0 deg C and 101.3kPa.
2. As measured at the Elizabeth SA EPA monitoring station.
3. As measured at the Northfield SA EPA monitoring station.

It is noted the annual average SO_2 concentration measured at the Northfield monitoring station is 0.2 µg/m^3, while the 75th percentile 1-hour average is zero; this is reflective of a large proportion of the hourly monitoring data being equal to zero.

5. MODELLING METHODOLOGY

5.1 Model Selection

The SA EPA has stipulated that unless prior agreement has been obtained, all air dispersion modelling should be completed using the CALPUFF air dispersion model using a meteorological dataset from 2009.

5.2 CALPUFF Model Set Up

The following model set up options within CALPUFF were used:

- Building downwash was included using the BPIP-Prime algorithms with site layout and elevation. The tanks, silos and receivals hall were included in the modelling;
- Grid spacing's of 100 m over a 7 km x 7 km model domain were applied, centred approximately on the site;
- The TAPM prognostic meteorological model developed by CSIRO was used to generate a gridded meteorological dataset for the modelling domain. Monitored meteorological data from the Bureau of Meteorology (BoM) Elizabeth monitoring station were used with the TAPM output as inputs into the CALMET meteorological processor to develop a meteorological data file suitable for use in CALPUFF;
- No chemical transformation or deposition, except for the prediction of NO_2 (as discussed in Section 5.3);

A summary of the CALPUFF inputs applied in this assessment is provided in Appendix 1.

An annual wind rose generated by the CALMET meteorological processor for the proposed site location is presented in Figure 3, with the annual frequency of wind speeds presented in Table 5.

Table 5: Distribution of Wind Speeds for 2009 (CALMET-Generated Data)

Wind Speed	Calms	0.5–2.0 m/s	2.0-3.5 m/s	3.5-5.0 m/s	5.0-6.5 m/s	6.5-8.0 m/s	>8m/s
(%)	1.4	36.2	36	19.3	5.4	1.4	0.2

5.3 3 Minute Averaging Periods

A simple averaging-time scaling factor can be used to estimate short-term peak concentrations for applications. This adjustment primarily addresses the effect of meandering (fluctuations in the wind about the mean flow for the hour) on the average lateral distribution of material. The scaling factor used to adjust the lateral dispersion coefficient[1] for averaging time is the 1/5th power law:

$$Cl = Cs(60/tl)^{0.2}$$

where
Cl = Concentration for new averaging period;
Cs = Concentration for the 1 hour average period;
tl is the averaging time (min.) of interest

[1] Turner, D.B., 1970: Workbook of Atmospheric Dispersion Estimates. U.S. EPA Office of Air Programs Publication No. AP-26. Research Triangle Park, NC.

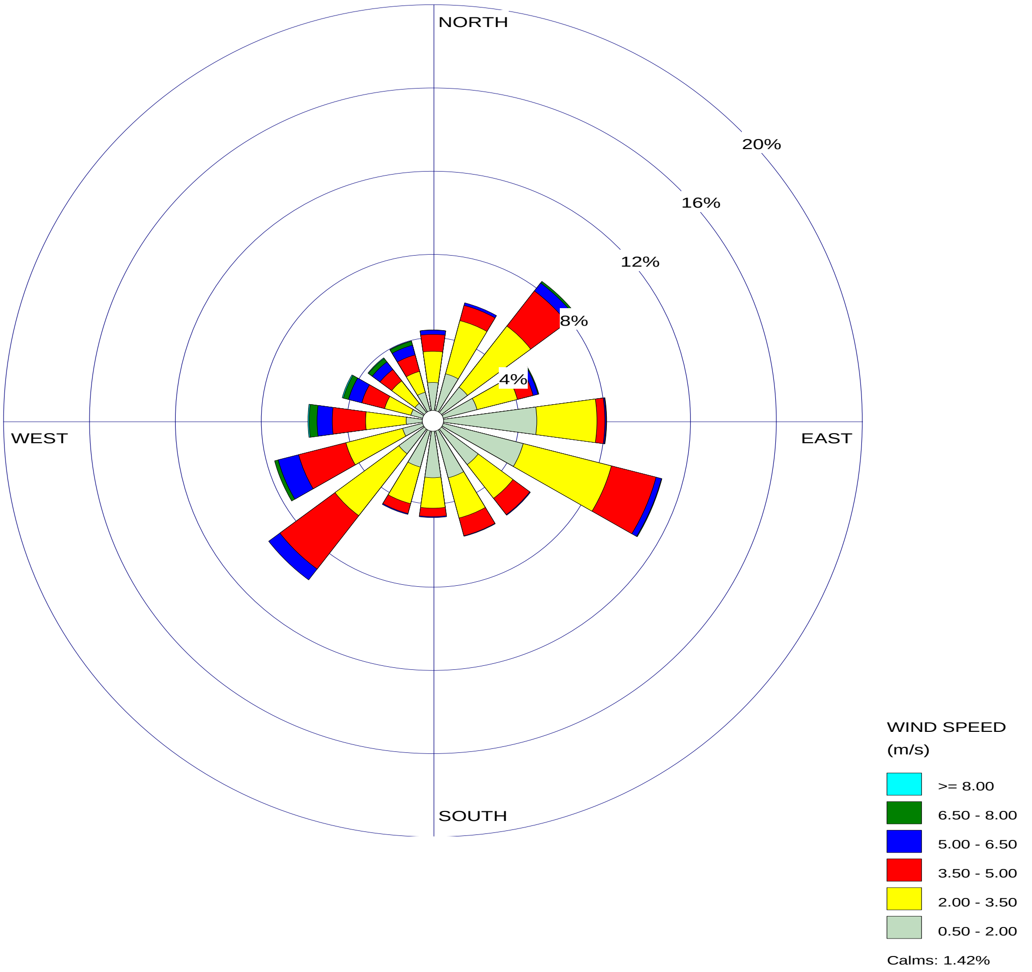

Figure 3: 2009 CALMET-Generated Annual Wind Rose

5.4 Treatment of Oxides of Nitrogen

A key element in assessing the potential environmental impacts from ground level NO_2 concentrations is estimating NO_2 concentrations from modelled NO_x emissions. The final NO_2 concentration is a combination of the NO emitted as NO_2 from the source stacks and the amount of NO that is converted to NO_2 by oxidation in the plume after release.

Generally, after the NO_x is emitted from the stack, additional NO_2 is formed as the plume mixes and reacts with the surrounding air. There are several reactions that both form and destroy NO_2, but the primary reaction is oxidation with ozone according to the following reaction:

$$NO + O_3 \rightarrow NO_2 + O_2$$

This reaction is essentially instantaneous as the plume entrains the surrounding air. It is limited by the amount of ozone available and by how quickly the plume mixes with the surrounding air. Thus the ratio of NO_2 to NO_x increases as the plume disperses downwind.

In order to predict NO_2 concentrations, Ramboll has applied the US Environmental Protection Agency (USEPA) Ozone Limiting Method (OLM). This method assumes that ozone is the limiting reagent (i.e. the ozone concentration is less than the remaining NO_x concentration) and requires an NO_2 to NO_x in-stack ratio. In the absence of a site-specific in-stack ratio, it has been assumed that 10% of NO_x emissions are NO_2 (a common assumption for gas combustion sources). Hourly average ozone concentrations for application in the OLM were obtained from the Elizabeth ambient air quality monitoring station.

The OLM approach is considered conservative over short-term averaging periods as it assumes the reaction between NO_x and ozone occurs instantaneously, when in reality this is likely to take place over a number of hours, during which time the plume is subject to dispersion.

6. MODELLING RESULTS

6.1 Ambient Air Quality Assessment

GLCs of the modelled compounds have been predicted for the following scenarios:

- Routine operations, with all three generators operating at maximum load and no flaring. This is considered conservative as the generators are typically sized to run at around 85% maximum load; and
- Full flaring scenario, with both flares are operating at the maximum gas flow rate and no generator operation.

The results of the odour assessment for emissions from the biofilter and the biomethane upgrade stack are presented in Section 6.2.

The predicted GLCs for the Plant operating under routine conditions, both in isolation and cumulatively with background concentrations, are summarised in Table 6. The predicted GLCs concentrations are all expected to remain well below their respective standards across the modelled domain, with the exception of the maximum 1-hour average NO_2 GLC which is predicted to equal 92% of the respective guideline for operations in isolation and 96% of the guideline when considered cumulatively with ambient background concentrations.

The maximum predicted 1-hour average GLCs for NO_2 for routine operations in isolation is presented in Figure 4, indicating that the highest predicted concentrations are expected to occur onsite. The maximum 1-hour average NO_2 GLCs predicted at the nearby residences and other potential sensitive receptor locations (i.e. golf course) are not expected to be any greater than 75 µg/m^3, well below the corresponding SA EPA 1-hour average NO_2 standard of 250 µg/m^3. It is also noted that the predicted NO_2 GLCs are considered conservative given the use of the OLM method (refer to Section 5.4), particularly for short-term concentrations close to the source.

The predicted GLCs for the Plant operating under the full flaring scenario are also summarised in Table 6. The predicted GLCs concentrations are all expected to remain well below their respective standards across the modelled domain when considered both in isolation and cumulatively with background concentrations.

Contours of the predicted GLCs for all modelled compounds and averaging periods for both scenarios are presented in Appendix 2.

Table 6: Predicted Maximum GLCs for Routine Operations and Full Flaring

Pollutant	Averaging Period	Criteria	Background Conc.	Routine Operations (3 Generators)				Full Flaring (2 Flares)			
				Maximum Concentration		Cumulative Maximum Concentration		Maximum Concentration		Cumulative Maximum Concentration	
		µg/m³	µg/m³	µg/m³	% of Criteria	µg/m³	% of Criteria	µg/m³	% of Criteria	µg/m³	% of Criteria
CO	1-hour	31,240	25	2,722	9%	2,747	9%	150	0.5%	175	1%
	8-hour	11,250	25	1,535	14%	1,560	14%	68	1%	93	1%
NO_2	1-hour	250	10	229	92%	239	96%	98	39%	108	43%
	Annual	60	8	17	28%	25	41%	6	10%	14	24%
H_2S	3-minute	510	NA	55	11%	55	11%	94	18%	94	18%
SO_2	1-hour	570	0	212	37%	212	37%	82	14%	82	14%
	24-hour	230	0.14	72	31%	72	31%	23	10%	23	10%
	Annual	60	0.2	10	17%	11	18%	2	3%	2	4%

Notes:

1. Concentrations are referenced to 0 deg C and 101.3kPa.
2. Background concentrations are the 75th percentile 1-hour and 24-hour concentrations and annual average concentrations (as per Table 4).

Figure 4: Routine Operations - Maximum Predicted 1-hour Average NO_2 GLCs (µg/m^3) in Isolation

6.2 Odour Assessment

The maximum predicted 99.9th percentile 3-minute average odour concentration for routine operations (considering emissions from the biofilter and the biomethane upgrade stack) is presented in Table 5. Contours of the predicted 99.9th percentile 3-minute average odour levels are presented in Figure 5.

The predicted odour levels remain below the SA EPA criteria of 2 OU throughout the modelled domain. Odour concentrations predicted to occur at the nearest residential and other sensitive receptor locations remain below 0.5 OU (Figure 5).

Table 7: Maximum Predicted Odour Concentrations for the Biogas Plant

Pollutant	Averaging Period	Criteria	Maximum Predicted 99.9th Percentile
		(OU)	(OU)
Odour	3-minute (99.9th Percentile%)	2	1.88

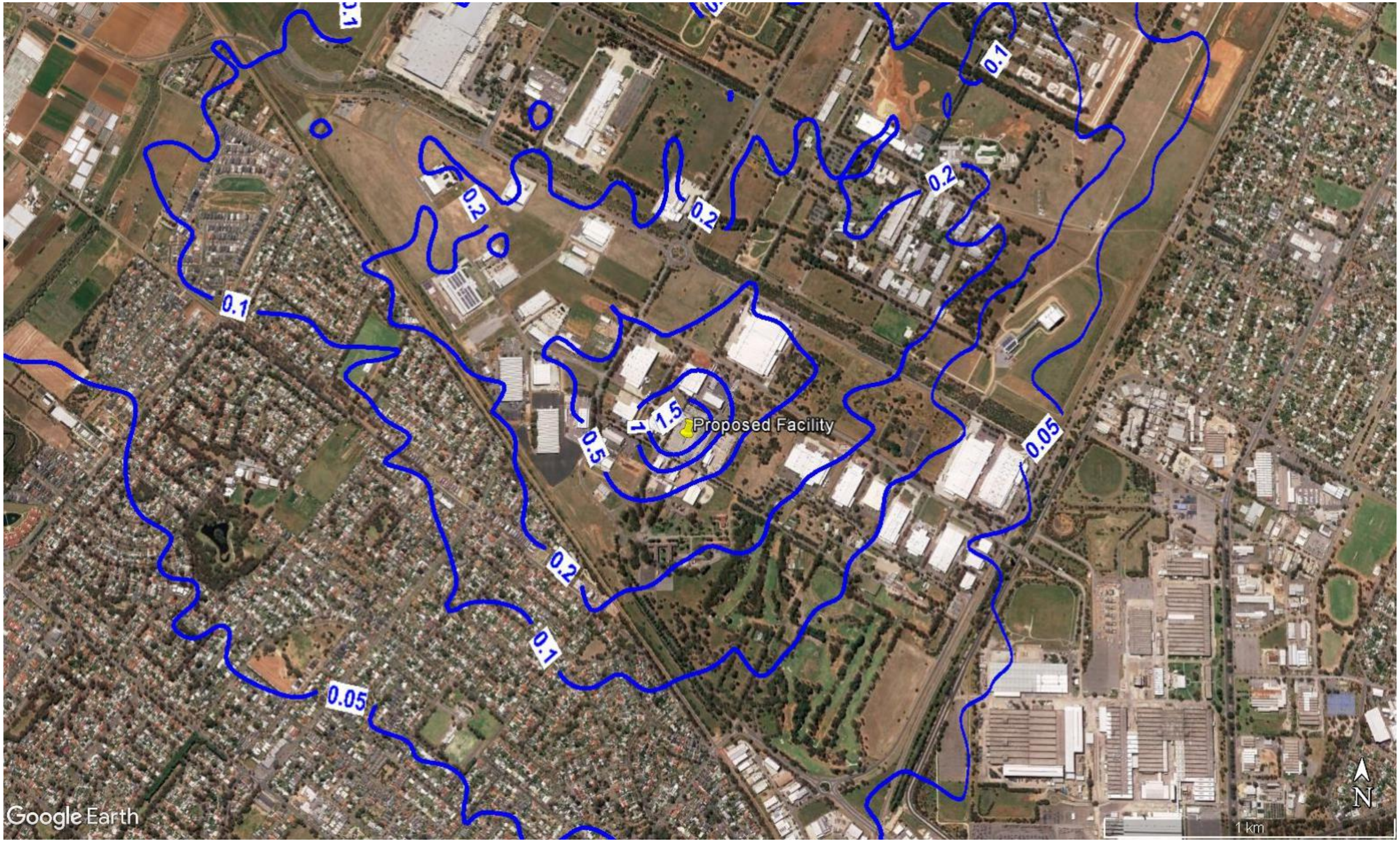

Figure 5: Routine Operations - Predicted 3-minute Average 99.9th Percentile Odour Concentrations (OU)

7. CONCLUSIONS

Air dispersion modelling has been completed to assess the potential air quality impacts associated with emissions from the proposed Plant operating under routine and full flaring operating scenarios.

Predicted GLCs have been estimated using the CALPUFF model and meteorological data generated by TAPM, in combination with meteorological monitoring data recorded at the nearest BoM monitoring station located at Elizabeth.

Where ambient monitoring data was available for compounds of interest, this has been used to determine the cumulative impacts of the proposed Plant.

The key findings of the air dispersion modelling are as follows:

- Predicted GLCs for all modelled compounds remain below the corresponding SA EPA standards across the modelled domain for both routine and full flaring operations, considered in isolation and cumulatively;
- The GLCs predicted at sensitive receptor locations remain well below the relevant SA EPA standards for all pollutants and modelled scenarios;
- The maximum predicted 1-hour NO_2 GLC most closely approaches the relevant guideline, representing 92% of the 1-hour average NO_2 standard of 250 µg/m^3 when considered in isolation. This GLC is considered to be conservative given the assumptions applied to estimate NO_2 GLCs from predicted NO_x GLCs;
- The maximum 1-hour average NO_2 GLCs predicted at the nearby residences and other potential sensitive receptor locations represent no more than 30% of the corresponding standard; and
- Odour concentrations are predicted to remain below the SA EPA criteria for routine operations across the modelled domain and are equal to less than 25% of the applicable criteria at the nearest residential and other sensitive receptor locations.

8. DISCLAIMER AND LIMITATIONS

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APPENDIX 1

CALPUFF INPUTS

CALPUFF Parameters

INPUT GROUP: 0 -- Input and Output File Names		
Parameter	**Description**	**Value**
PRFDAT	CTDM/AERMET-type meteorological profile data file	PROFILE.DAT
PUFLST	CALPUFF output list file (CALPUFF.LST)	CALPUFF.LST
CONDAT	CALPUFF output concentration file (CONC.DAT)	CONC.DAT
DFDAT	CALPUFF output dry deposition flux file (DFLX.DAT)	DFLX.DAT
WFDAT	CALPUFF output wet deposition flux file (WFLX.DAT)	WFLX.DAT
LCFILES	Lower case file names (T = lower case, F = upper case)	F
NMETDOM	Number of CALMET.DAT domains	1
NMETDAT	Number of CALMET.DAT input files	8
NPTDAT	Number of PTEMARB.DAT input files	0
NARDAT	Number of BAEMARB.DAT input files	0
NVOLDAT	Number of VOLEMARB.DAT input files	0
NFLDAT	Number of FLEMARB.DAT input files	0
NRDDAT	Number of RDEMARB.DAT input files	0
NLNDAT	Number of LNEMARB.DAT input files	0
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-01-01-01-0000-2009-02-16-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-02-16-00-0000-2009-04-03-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-04-03-00-0000-2009-05-18-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-05-18-00-0000-2009-07-03-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-07-03-00-0000-2009-08-17-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-08-17-00-0000-2009-10-02-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-10-02-00-0000-2009-11-16-00-0000.DAT
METDAT	CALMET gridded meteorological data file (CALMET.DAT)	CALMET_2009-11-16-00-0000-2009-12-31-23-0000.DAT

INPUT GROUP: 1 -- General Run Control Parameters		
Parameter	**Description**	**Value**
INPUT GROUP: 1 -- General Run Control Parameters		
Parameter	**Description**	**Value**

METRUN	Run all periods in met data file? (0 = no, 1 = yes)	0
IBYR	Starting year	2009
IBMO	Starting month	1
IBDY	Starting day	1
IBHR	Starting hour	1
IBMIN	Starting minute	0
IBSEC	Starting second	0
IEYR	Ending year	2009
IEMO	Ending month	12
IEDY	Ending day	31
IEHR	Ending hour	22
IEMIN	Ending minute	0
IESEC	Ending second	0
ABTZ	Base time zone	UTC+0900
NSECDT	Length of modeling time-step (seconds)	3600
NSPEC	Number of chemical species modeled	7
NSE	Number of chemical species to be emitted	7
ITEST	Stop run after SETUP phase (1 = stop, 2 = run)	2
MRESTART	Control option to read and/or write model restart data	0
NRESPD	Number of periods in restart output cycle	0
METFM	Meteorological data format (1 = CALMET, 2 = ISC, 3 = AUSPLUME, 4 = CTDM, 5 = AERMET)	1
MPRFFM	Meteorological profile data format (1 = CTDM, 2 = AERMET)	1
AVET	Averaging time (minutes)	60
PGTIME	PG Averaging time (minutes)	60
IOUTU	Output units for binary output files (1 = mass, 2 = odour, 3 = radiation)	1
INPUT GROUP: 2 -- Technical Options		
Parameter	**Description**	**Value**
MGAUSS	Near field vertical distribution (0 = uniform, 1 = Gaussian)	1
MCTADJ	Terrain adjustment method (0 = none, 1 = ISC-type, 2 = CALPUFF-type, 3 = partial plume path)	3
MCTSG	Model subgrid-scale complex terrain? (0 = no, 1 = yes)	0
MSLUG	Near-field puffs modeled as elongated slugs? (0 = no, 1 = yes)	0
MTRANS	Model transitional plume rise? (0 = no, 1 = yes)	1
MTIP	Apply stack tip downwash to point sources? (0 = no, 1 = yes)	1
MRISE	Plume rise module for point sources (1 = Briggs, 2 = numerical)	1
MTIP_FL	Apply stack tip downwash to flare sources? (0 = no, 1 = yes)	0
MRISE_FL	Plume rise module for flare sources (1 = Briggs, 2 = numerical)	2

INPUT GROUP: 2 -- Technical Options		
Parameter	**Description**	**Value**
MBDW	Building downwash method (1 = ISC, 2 = PRIME)	1
MSHEAR	Treat vertical wind shear? (0 = no, 1 = yes)	0
MSPLIT	Puff splitting allowed? (0 = no, 1 = yes)	0
MCHEM	Chemical transformation method (0 = not modeled, 1 = MESOPUFF II, 2 = User-specified, 3 = RIVAD/ARM3, 4 = MESOPUFF II for OH, 5 = half-life, 6 = RIVAD w/ISORROPIA, 7 = RIVAD w/ISORROPIA CalTech SOA)	0
MAQCHEM	Model aqueous phase transformation? (0 = no, 1 = yes)	0
MLWC	Liquid water content flag	1
MWET	Model wet removal? (0 = no, 1 = yes)	0
MDRY	Model dry deposition? (0 = no, 1 = yes)	0
MTILT	Model gravitational settling (plume tilt)? (0 = no, 1 = yes)	0
MDISP	Dispersion coefficient calculation method (1= PROFILE.DAT, 2 = Internally, 3 = PG/MP, 4 = MESOPUFF II, 5 = CTDM)	3
MTURBVW	Turbulence characterization method (only if MDISP = 1 or 5)	3
MDISP2	Missing dispersion coefficients method (only if MDISP = 1 or 5)	3
MTAULY	Sigma-y Lagrangian timescale method	0
MTAUADV	Advective-decay timescale for turbulence (seconds)	0
MCTURB	Turbulence method (1 = CALPUFF, 2 = AERMOD)	1
MROUGH	PG sigma-y and sigma-z surface roughness adjustment? (0 = no, 1 = yes)	0
MPARTL	Model partial plume penetration for point sources? (0 = no, 1 = yes)	1
MPARTLBA	Model partial plume penetration for buoyant area sources? (0 = no, 1 = yes)	1
MTINV	Strength of temperature inversion provided in PROFILE.DAT? (0 = no - compute from default gradients, 1 = yes)	0
MPDF	PDF used for dispersion under convective conditions? (0 = no, 1 = yes)	0
MSGTIBL	Sub-grid TIBL module for shoreline? (0 = no, 1 = yes)	0
MBCON	Boundary conditions modeled? (0 = no, 1 = use BCON.DAT, 2 = use CONC.DAT)	0
MSOURCE	Save individual source contributions? (0 = no, 1 = yes)	0
MFOG	Enable FOG model output? (0 = no, 1 = yes - PLUME mode, 2 = yes - RECEPTOR mode)	0
MREG	Regulatory checks (0 = no checks, 1 = USE PA LRT checks)	0
INPUT GROUP: 3 -- Species List		

Parameter	Description	Value
CSPEC	Species included in model run	TR1
CSPEC	Species included in model run	TR2
CSPEC	Species included in model run	TR3
CSPEC	Species included in model run	TR4
CSPEC	Species included in model run	TR5
CSPEC	Species included in model run	TR6
CSPEC	Species included in model run	TR7
INPUT GROUP: 4 -- Map Projection and Grid Control Parameters		
Parameter	**Description**	**Value**
PMAP	Map projection system	UTM
FEAST	False easting at projection origin (km)	0.0
FNORTH	False northing at projection origin (km)	0.0
IUTMZN	UTM zone (1 to 60)	54
UTMHEM	Hemisphere (N = northern, S = southern)	S
RLAT0	Latitude of projection origin (decimal degrees)	0.00N
RLON0	Longitude of projection origin (decimal degrees)	0.00E
XLAT1	1st standard parallel latitude (decimal degrees)	30S
XLAT2	2nd standard parallel latitude (decimal degrees)	60S
DATUM	Datum-region for the coordinates	WGS-84
NX	Meteorological grid - number of X grid cells	39
NY	Meteorological grid - number of Y grid cells	39
NZ	Meteorological grid - number of vertical layers	11
DGRIDKM	Meteorological grid spacing (km)	1
ZFACE	Meteorological grid - vertical cell face heights (m)	0.0, 20.0, 100.0, 200.0, 350.0, 500.0, 750.0, 1000.0, 2000.0, 3000.0, 4000.0, 5000.0
XORIGKM	Meteorological grid - X coordinate for SW corner (km)	263.8390
YORIGKM	Meteorological grid - Y coordinate for SW corner (km)	6133.5530
IBCOMP	Computational grid - X index of lower left corner	17
JBCOMP	Computational grid - Y index of lower left corner	17
IECOMP	Computational grid - X index of upper right corner	23
JECOMP	Computational grid - Y index of upper right corner	23
LSAMP	Use sampling grid (gridded receptors) (T = true, F = false)	T
IBSAMP	Sampling grid - X index of lower left corner	17
JBSAMP	Sampling grid - Y index of lower left corner	17

IESAMP	Sampling grid - X index of upper right corner	23
JESAMP	Sampling grid - Y index of upper right corner	23
MESHDN	Sampling grid - nesting factor	10
INPUT GROUP: 5 -- Output Options		
Parameter	**Description**	**Value**
ICON	Output concentrations to CONC.DAT? (0 = no, 1 = yes)	1
IDRY	Output dry deposition fluxes to DFLX.DAT? (0 = no, 1 = yes)	0
IWET	Output wet deposition fluxes to WFLX.DAT? (0 = no, 1 = yes)	0
IT2D	Output 2D temperature data? (0 = no, 1 = yes)	0
IRHO	Output 2D density data? (0 = no, 1 = yes)	0
IVIS	Output relative humidity data? (0 = no, 1 = yes)	0
INPUT GROUP: 5 -- Output Options		
Parameter	**Description**	**Value**
LCOMPRS	Use data compression in output file (T = true, F = false)	T
IQAPLOT	Create QA output files suitable for plotting? (0 = no, 1 = yes)	0
IPFTRAK	Output puff tracking data? (0 = no, 1 = yes use timestep, 2 = yes use sampling step)	0
IMFLX	Output mass flux across specific boundaries? (0 = no, 1 = yes)	0
IMBAL	Output mass balance for each species? (0 = no, 1 = yes)	0
INRISE	Output plume rise data? (0 = no, 1 = yes)	0
ICPRT	Print concentrations? (0 = no, 1 = yes)	0
IDPRT	Print dry deposition fluxes? (0 = no, 1 = yes)	0
IWPRT	Print wet deposition fluxes? (0 = no, 1 = yes)	0
ICFRQ	Concentration print interval (timesteps)	1
IDFRQ	Dry deposition flux print interval (timesteps)	1
IWFRQ	Wet deposition flux print interval (timesteps)	1
IPRTU	Units for line printer output (e.g., 3 = ug/m**3 - ug/m**2/s, 5 = odor units)	3
IMESG	Message tracking run progress on screen (0 = no, 1 and 2 = yes)	2
LDEBUG	Enable debug output? (0 = no, 1 = yes)	F
IPFDEB	First puff to track in debug output	1
NPFDEB	Number of puffs to track in debug output	1000
NN1	Starting meteorological period in debug output	1
NN2	Ending meteorological period in debug output	10
INPUT GROUP: 6 -- Subgrid Scale Complex Terrain Inputs		

Parameter	Description	Value
NHILL	Number of terrain features	0
NCTREC	Number of special complex terrain receptors	0
MHILL	Terrain and CTSG receptor data format (1= CTDM, 2 = OPTHILL)	2
XHILL2M	Horizontal dimension conversion factor to meters	1.0
ZHILL2M	Vertical dimension conversion factor to meters	1.0
XCTDMKM	X origin of CTDM system relative to CALPUFF system (km)	0.0
YCTDMKM	Y origin of CTDM system relative to CALPUFF system (km)	0.0
INPUT GROUP: 9 -- Miscellaneous Dry Deposition Parameters		
Parameter	**Description**	**Value**
RCUTR	Reference cuticle resistance (s/cm)	30
RGR	Reference ground resistance (s/cm)	10
REACTR	Reference pollutant reactivity	8
NINT	Number of particle size intervals for effective particle deposition velocity	9
IVEG	Vegetation state in unirrigated areas (1 = active and unstressed, 2 = active and stressed, 3 = inactive)	1
INPUT GROUP: 11 -- Chemistry Parameters		
Parameter	**Description**	**Value**
MOZ	Ozone background input option (0 = monthly, 1 = hourly from OZONE.DAT)	1
BCKO3	Monthly ozone concentrations (ppb)	80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00
MNH3	Ammonia background input option (0 = monthly, 1 = from NH3Z.DAT)	0
MAVGNH3	Ammonia vertical averaging option (0 = no average, 1 = average over vertical extent of puff)	1
BCKNH3	Monthly ammonia concentrations (ppb)	10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00
RNITE1	Nighttime SO2 loss rate (%/hr)	0.2
RNITE2	Nighttime NOx loss rate (%/hr)	2
RNITE3	Nighttime HNO3 loss rate (%/hr)	2
MH2O2	H2O2 background input option (0 = monthly, 1 = hourly from H2O2.DAT)	1
BCKH2O2	Monthly H2O2 concentrations (ppb)	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
RH_ISRP	Minimum relative humidity for ISORROPIA	50.0
SO4_ISRP	Minimum SO4 for ISORROPIA	0.4

BCKPMF	SOA background fine particulate (ug/m**3)	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
OFRAC	SOA organic fine particulate fraction	0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15
VCNX	SOA VOC/NOX ratio	50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00
NDECAY	Half-life decay blocks	0
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters		
Parameter	**Description**	**Value**
SYTDEP	Horizontal puff size for time-dependent sigma equations (m)	550
MHFTSZ	Use Heffter equation for sigma-z? (0 = no, 1 = yes)	0
JSUP	PG stability class above mixed layer	5
CONK1	Vertical dispersion constant - stable conditions	0.01
CONK2	Vertical dispersion constant - neutral/unstable conditions	0.1
TBD	Downwash scheme transition point option (<0 = Huber-Snyder, 1.5 = Schulman-Scire, 0.5 = ISC)	0.5
IURB1	Beginning land use category for which urban dispersion is assumed	10
IURB2	Ending land use category for which urban dispersion is assumed	19
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters		
Parameter	**Description**	**Value**
ILANDUIN	Land use category for modeling domain	20
Z0IN	Roughness length for modeling domain (m)	.25
XLAIIN	Leaf area index for modeling domain	3.0
ELEVIN	Elevation above sea level (m)	.0
XLATIN	Meteorological station latitude (deg)	-999.0
XLONIN	Meteorological station longitude (deg)	-999.0
ANEMHT	Anemometer height (m)	10.0
ISIGMAV	Lateral turbulence format (0 = read sigma-theta, 1 = read sigma-v)	1
IMIXCTDM	Mixing heights read option (0 = predicted, 1 = observed)	0
XMXLEN	Slug length (met grid units)	1
XSAMLEN	Maximum travel distance of a puff/slug (met grid units)	1
MXNEW	Maximum number of slugs/puffs release from one source during one time step	99
MXSAM	Maximum number of sampling steps for one puff/slug during one time step	99

NCOUNT	Number of iterations used when computing the transport wind for a sampling step that includes gradual rise	2
SYMIN	Minimum sigma-y for a new puff/slug (m)	1
SZMIN	Minimum sigma-z for a new puff/slug (m)	1
SZCAP_M	Maximum sigma-z allowed to avoid numerical problem in calculating virtual time or distance (m)	5000000
SVMIN	Minimum turbulence velocities sigma-v (m/s)	0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37
SWMIN	Minimum turbulence velocities sigma-w (m/s)	0.2, 0.12, 0.08, 0.06, 0.03, 0.016, 0.2, 0.12, 0.08, 0.06, 0.03, 0.016
CDIV	Divergence criterion for dw/dz across puff (1/s)	0, 0
NLUTIBL	TIBL module search radius (met grid cells)	4
WSCALM	Minimum wind speed allowed for non-calm conditions (m/s)	0.5
XMAXZI	Maximum mixing height (m)	3000
XMINZI	Minimum mixing height (m)	50
TKCAT	Emissions scale-factors temperature categories (K)	265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315.
PLX0	Wind speed profile exponent for stability classes 1 to 6	0.07, 0.07, 0.1, 0.15, 0.35, 0.55
PTG0	Potential temperature gradient for stable classes E and F (deg K/m)	0.02, 0.035
PPC	Plume path coefficient for stability classes 1 to 6	0.5, 0.5, 0.5, 0.5, 0.35, 0.35
SL2PF	Slug-to-puff transition criterion factor (sigma-y/slug length)	10
FCLIP	Hard-clipping factor for slugs (0.0 = no extrapolation)	0
NSPLIT	Number of puffs created from vertical splitting	3

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters

Parameter	Description	Value
IRESPLIT	Hour for puff re-split	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0
ZISPLIT	Minimum mixing height for splitting (m)	100
ROLDMAX	Mixing height ratio for splitting	0.25
NSPLITH	Number of puffs created from horizontal splitting	5
SYSPLITH	Minimum sigma-y (met grid cells)	1

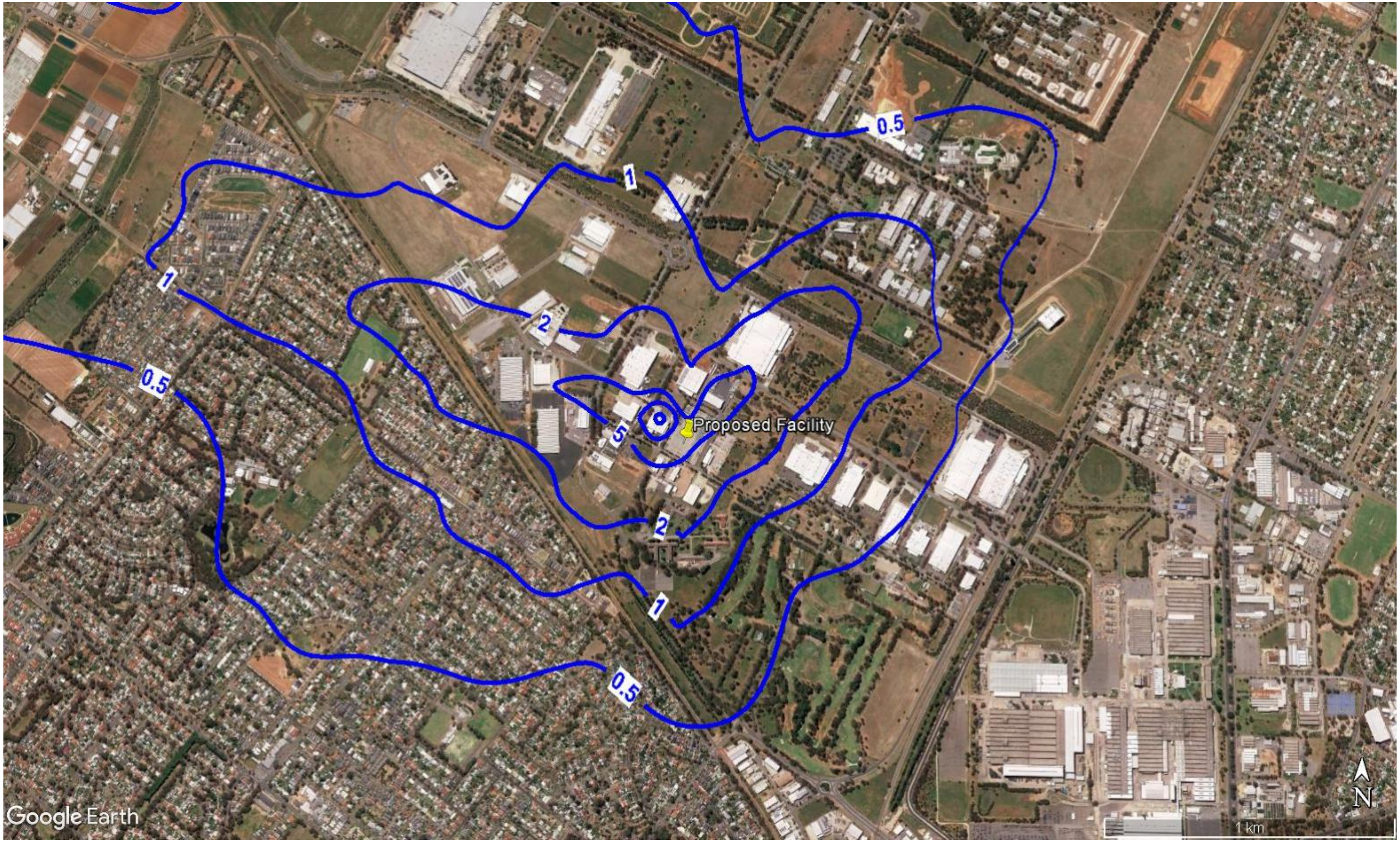
SHSPLITH	Minimum puff elongation rate (SYSPLITH/hr)	2
CNSPLITH	Minimum concentration (g/m**3)	1E-007
EPSSLUG	Fractional convergence criterion for numerical SLUG sampling integration	0.0001
EPSAREA	Fractional convergence criterion for numerical AREA source integration	1E-006
DSRISE	Trajectory step-length for numerical rise integration (m)	1.0
HTMINBC	Minimum boundary condition puff height (m)	500
RSAMPBC	Receptor search radius for boundary condition puffs (km)	10
MDEPBC	Near-surface depletion adjustment to concentration (0 = no, 1 = yes)	1
INPUT GROUP: 13 -- Point Source Parameters		
Parameter	**Description**	**Value**
NPT1	Number of point sources	7
IPTU	Units used for point source emissions (e.g., 1 = g/s)	1
NSPT1	Number of source-species combinations with variable emission scaling factors	0
NPT2	Number of point sources in PTEMARB.DAT file(s)	0
INPUT GROUP: 14 -- Area Source Parameters		
Parameter	**Description**	**Value**
NAR1	Number of polygon area sources	0
IARU	Units used for area source emissions (e.g., 1 = g/m**2/s)	1
NSAR1	Number of source-species combinations with variable emission scaling factors	0
NAR2	Number of buoyant polygon area sources in BAEMARB.DAT file(s)	0
INPUT GROUP: 15 -- Line Source Parameters		
Parameter	**Description**	**Value**
NLN2	Number of buoyant line sources in LNEMARB.DAT file	0
NLINES	Number of buoyant line sources	0
ILNU	Units used for line source emissions (e.g., 1 = g/s)	1
NSLN1	Number of source-species combinations with variable emission scaling factors	0
NLRISE	Number of distances at which transitional rise is computed	6
INPUT GROUP: 16 -- Volume Source Parameters		
Parameter	**Description**	**Value**
NVL1	Number of volume sources	0
IVLU	Units used for volume source emissions (e.g., 1 = g/s)	1
NSVL1	Number of source-species combinations with variable emission scaling factors	0

NVL2	Number of volume sources in VOLEMARB.DAT file(s)	0
INPUT GROUP: 17 -- FLARE Source Control Parameters (variable emissions file)		
Parameter	**Description**	**Value**
NFL2	Number of flare sources defined in FLEMARB.DAT file(s)	0
INPUT GROUP: 18 -- Road Emissions Parameters		
Parameter	**Description**	**Value**
NRD1	Number of road-links sources	0
NRD2	Number of road-links in RDEMARB.DAT file	0
NSFRDS	Number of road-links and species combinations with variable emission-rate scale-factors	0
INPUT GROUP: 19 -- Emission Rate Scale-Factor Tables		
Parameter	**Description**	**Value**
NSFTAB	Number of emission scale-factor tables	0
INPUT GROUP: 20 -- Non-gridded (Discrete) Receptor Information		
Parameter	**Description**	**Value**
NREC	Number of discrete receptors (non-gridded receptors)	0
NRGRP	Number of receptor group names	0

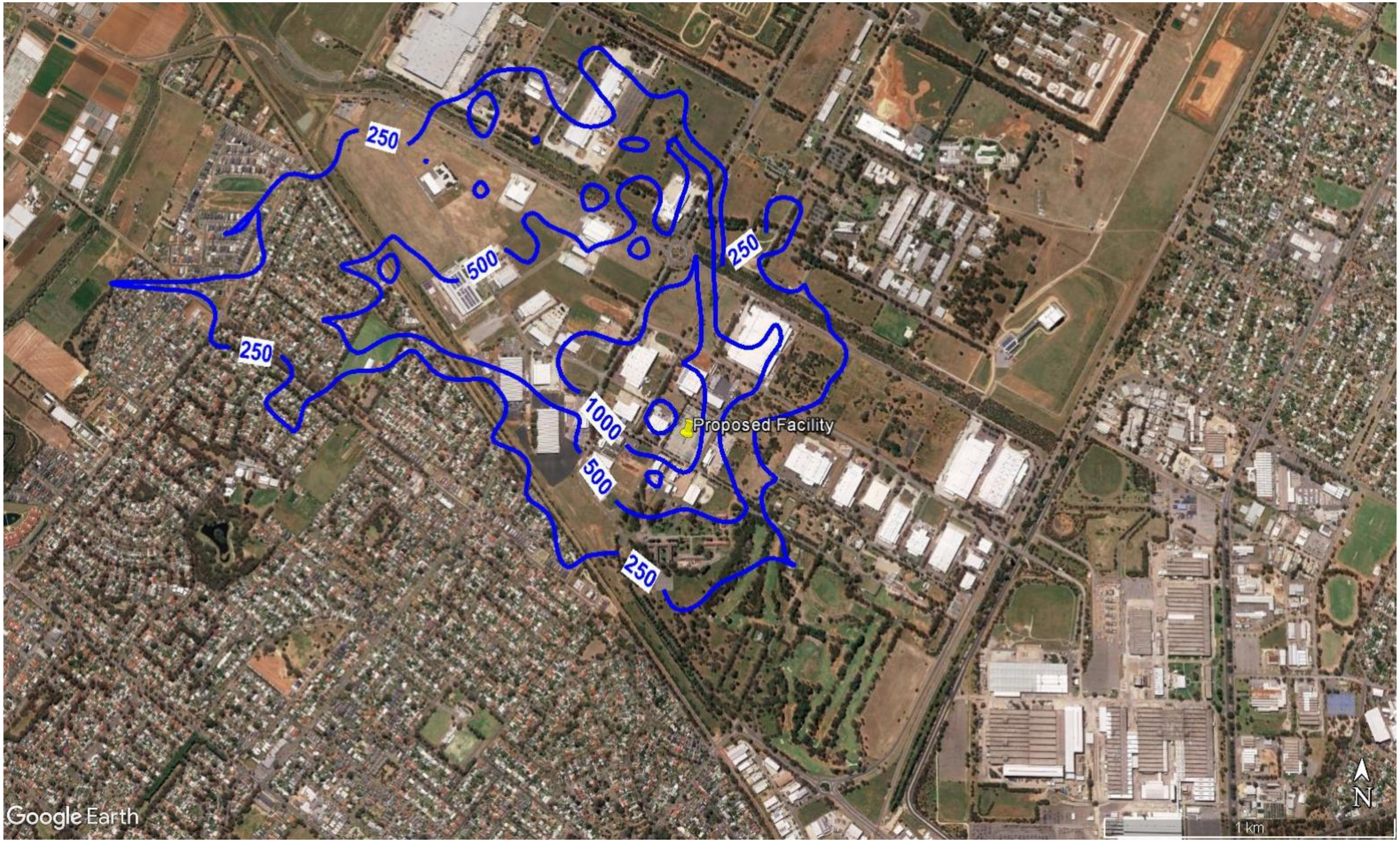
APPENDIX 2

CONTOUR PLOTS

Scenario 1 (Normal Operations) – Annual Average Predicted Concentrations in Isolation of NO_2



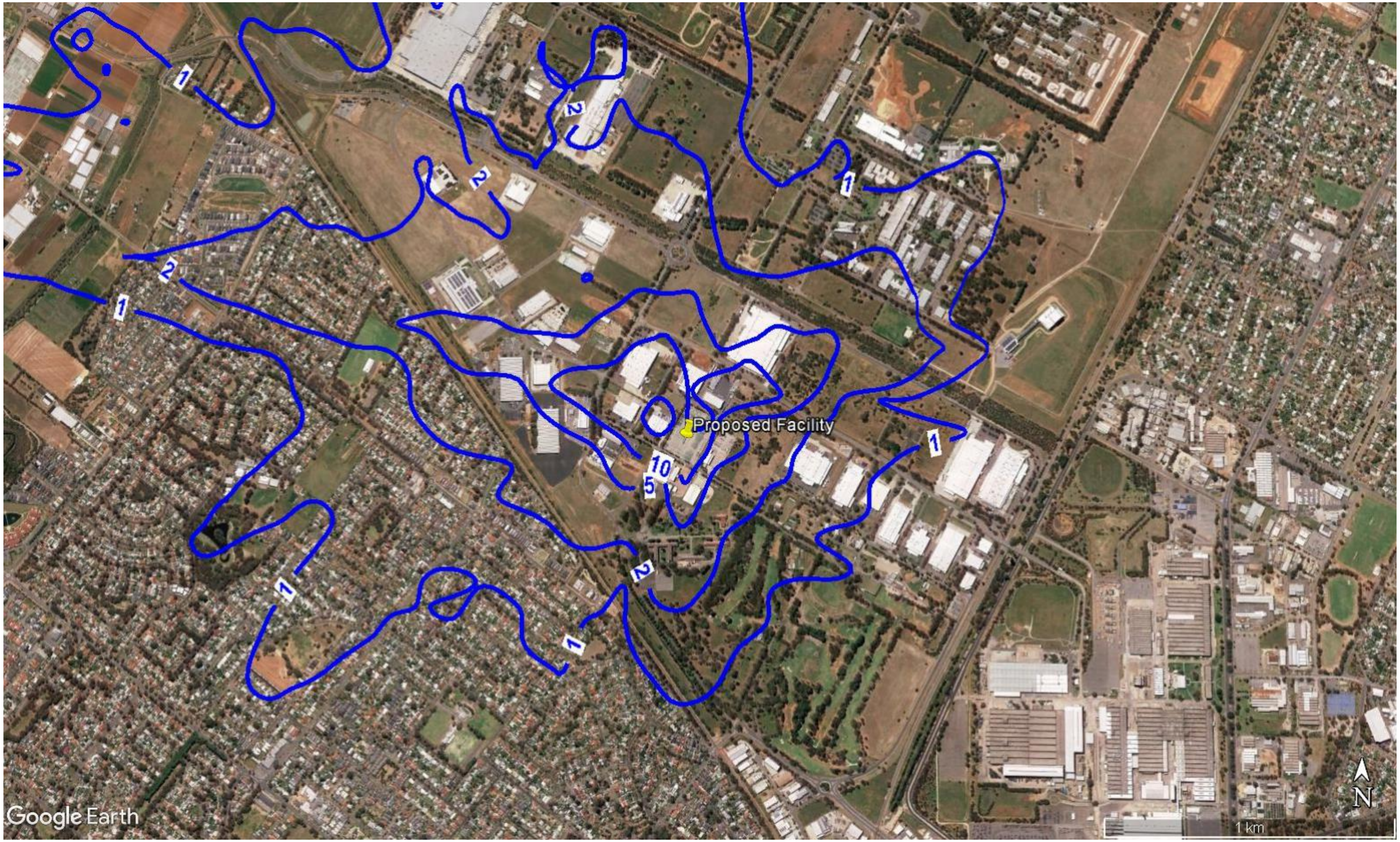
Scenario 1 (Normal Operations) – 1 Hour Average Maximum Predicted Concentrations in Isolation of CO



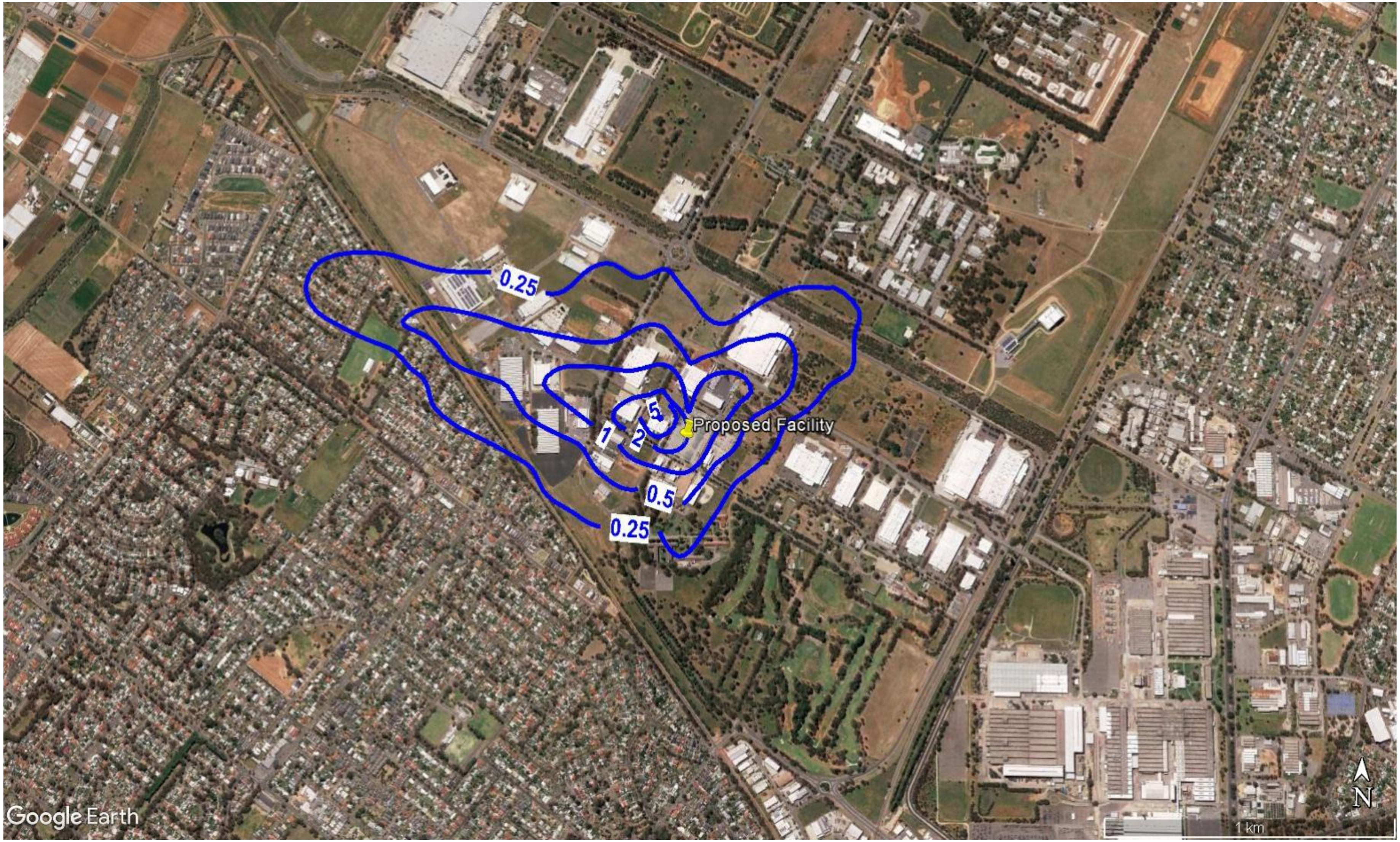
Scenario 1 (Normal Operations) – 8 Hour Average Maximum Predicted Concentrations in Isolation of CO

Scenario 1 (Normal Operations) – 1 Hour Average Maximum Predicted Concentrations in Isolation of SO_2

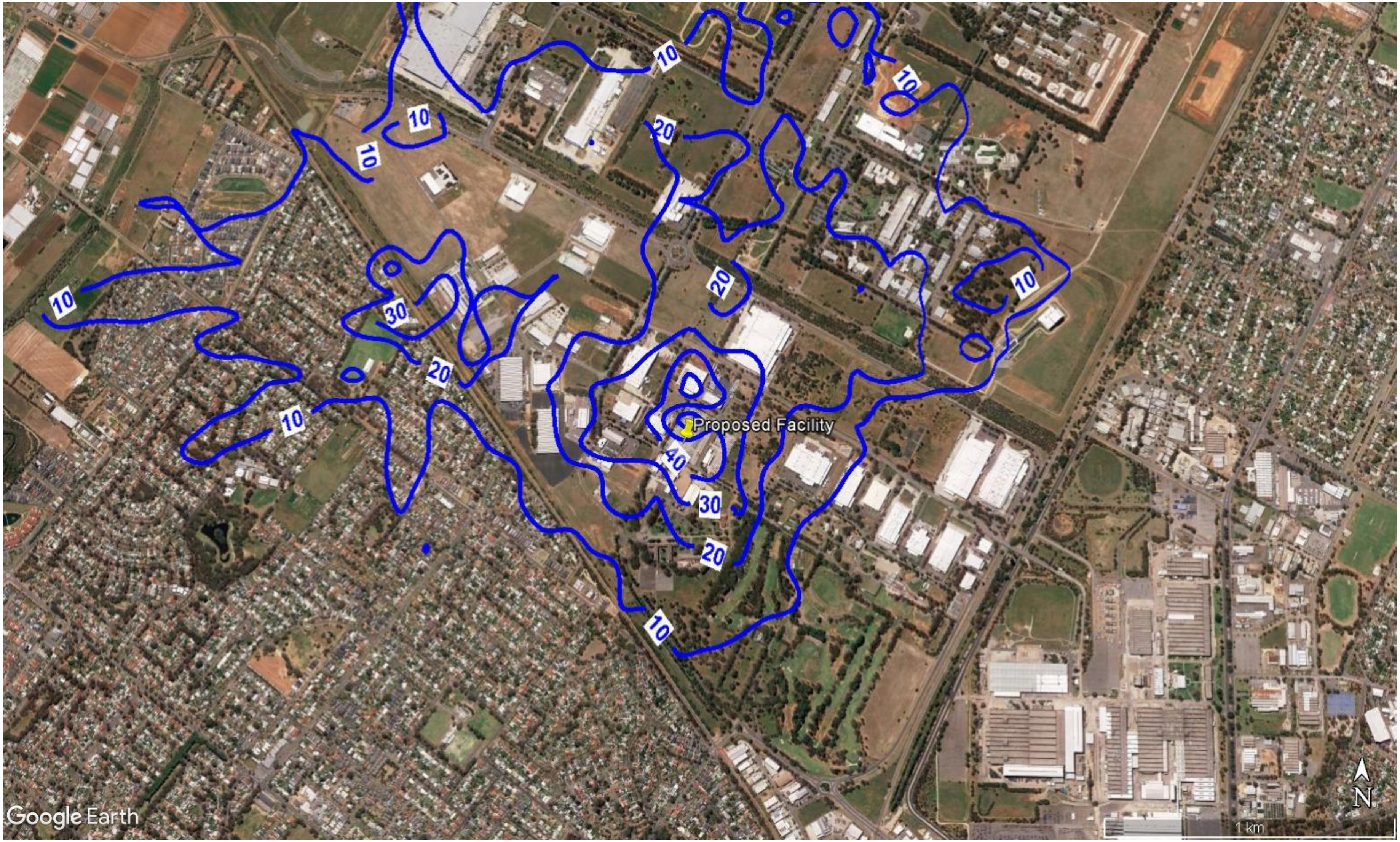
Scenario 1 (Normal Operations) – 24 Hour Average Maximum Predicted Concentrations in Isolation of SO_2



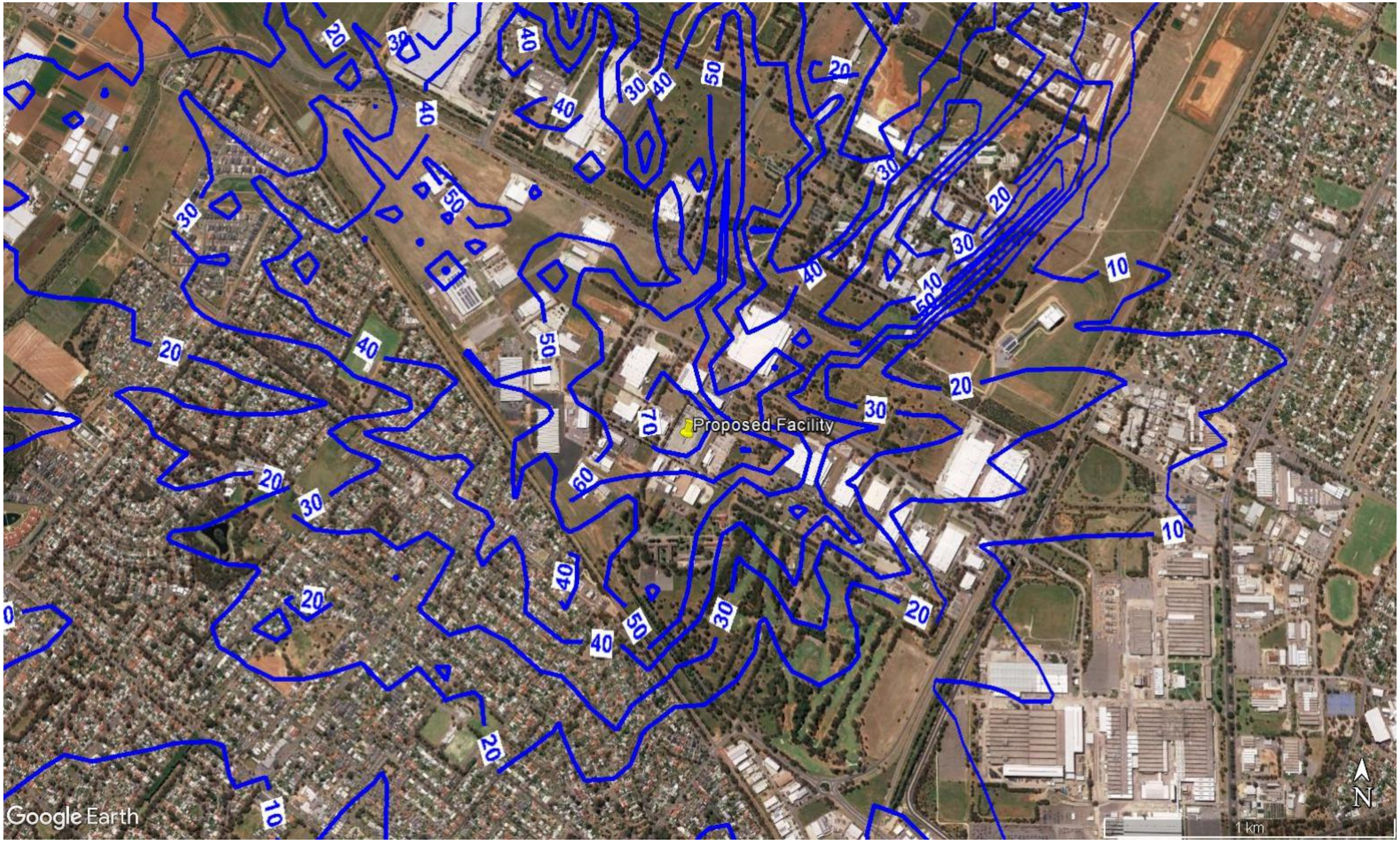
Scenario 1 (Normal Operations) – Annual Average Predicted Concentrations in Isolation of SO_2



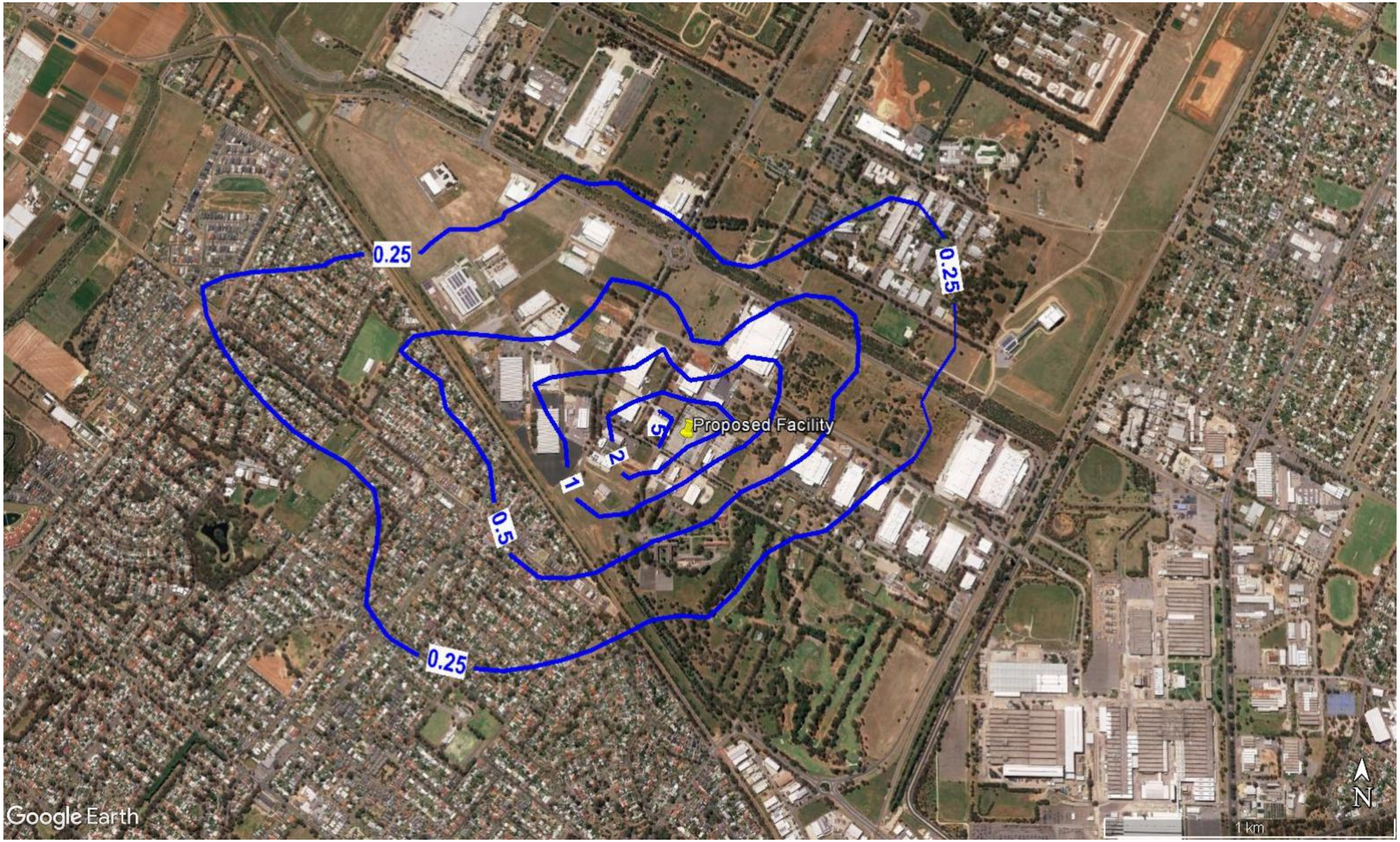
Scenario 1 (Normal Operations) – 3-minute Average Maximum Predicted Concentrations in Isolation of H2S



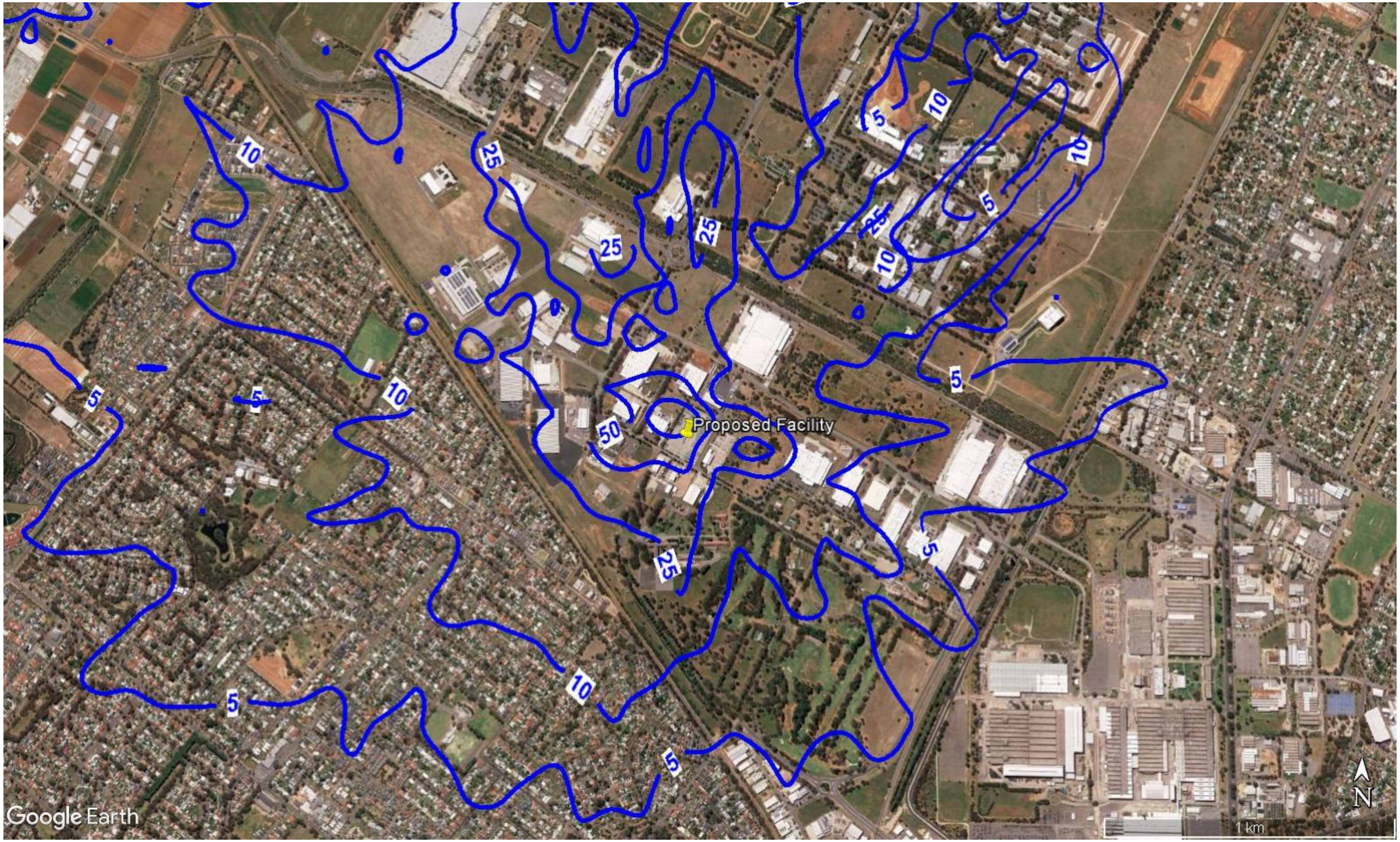
Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of NO_2



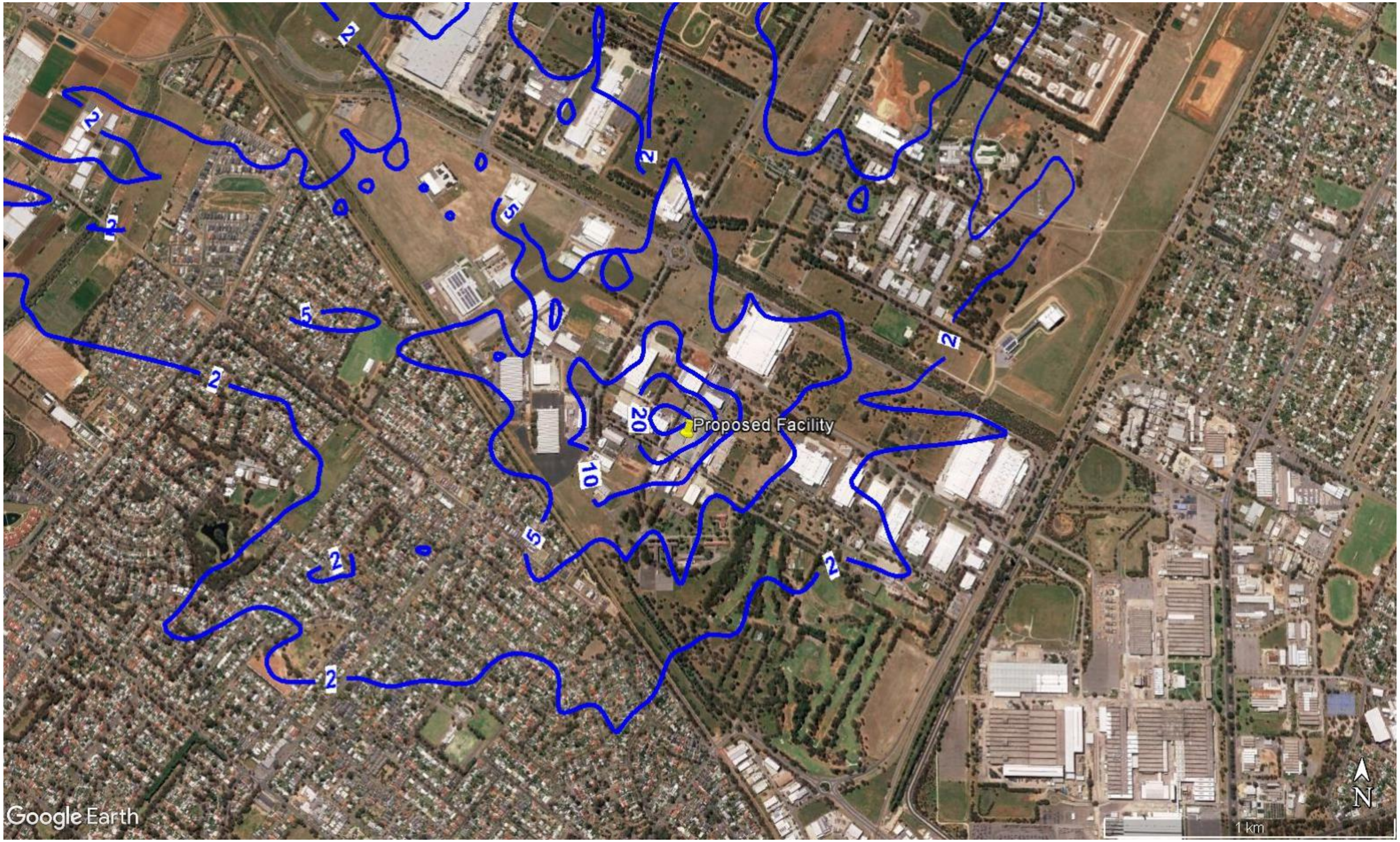
Scenario 2 (Upset Conditions) – Annual Average Predicted Concentrations in Isolation of NO_2



Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of CO

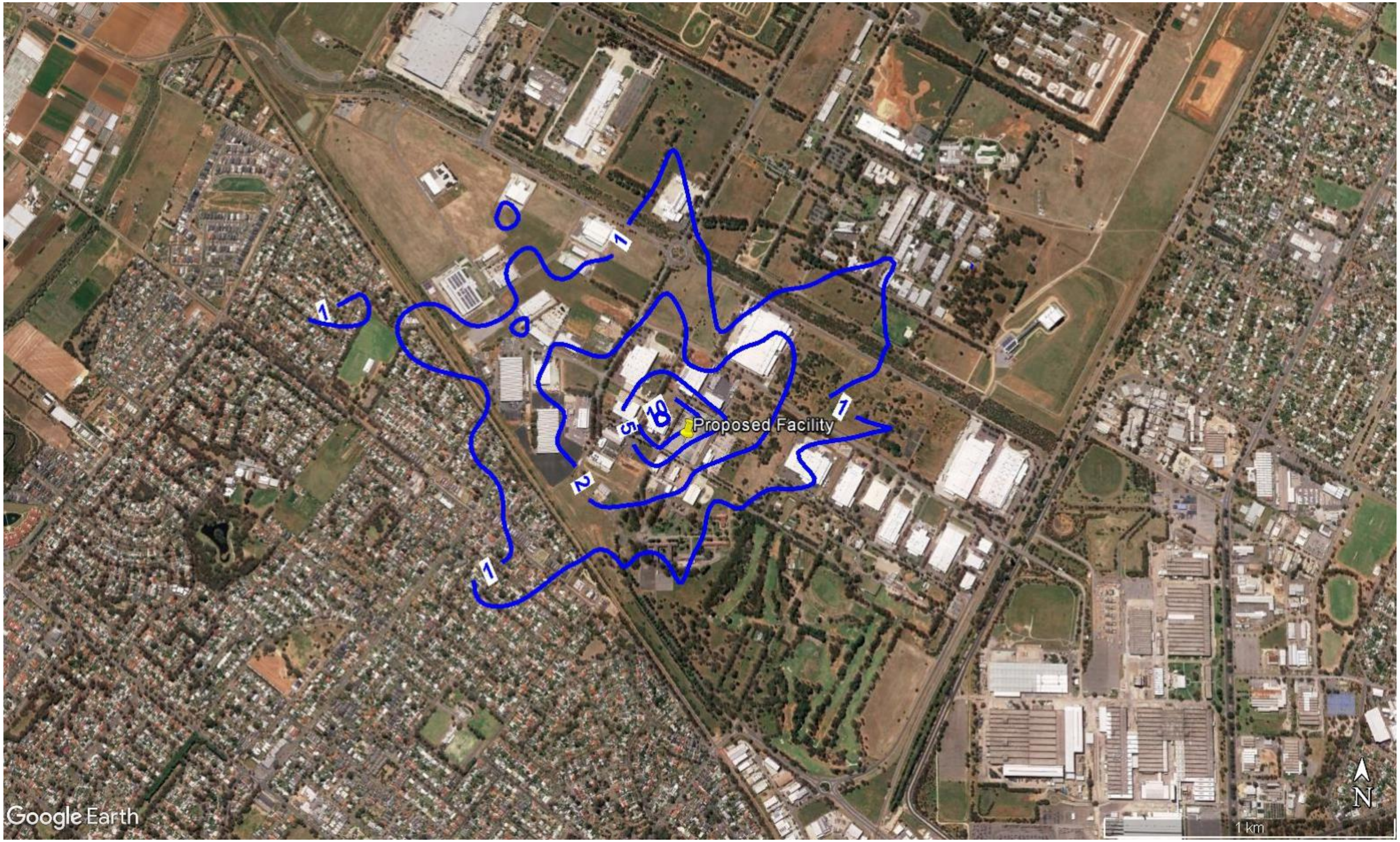


Scenario 2 (Upset Conditions) – 8 Hour Average Maximum Predicted Concentrations in Isolation of CO

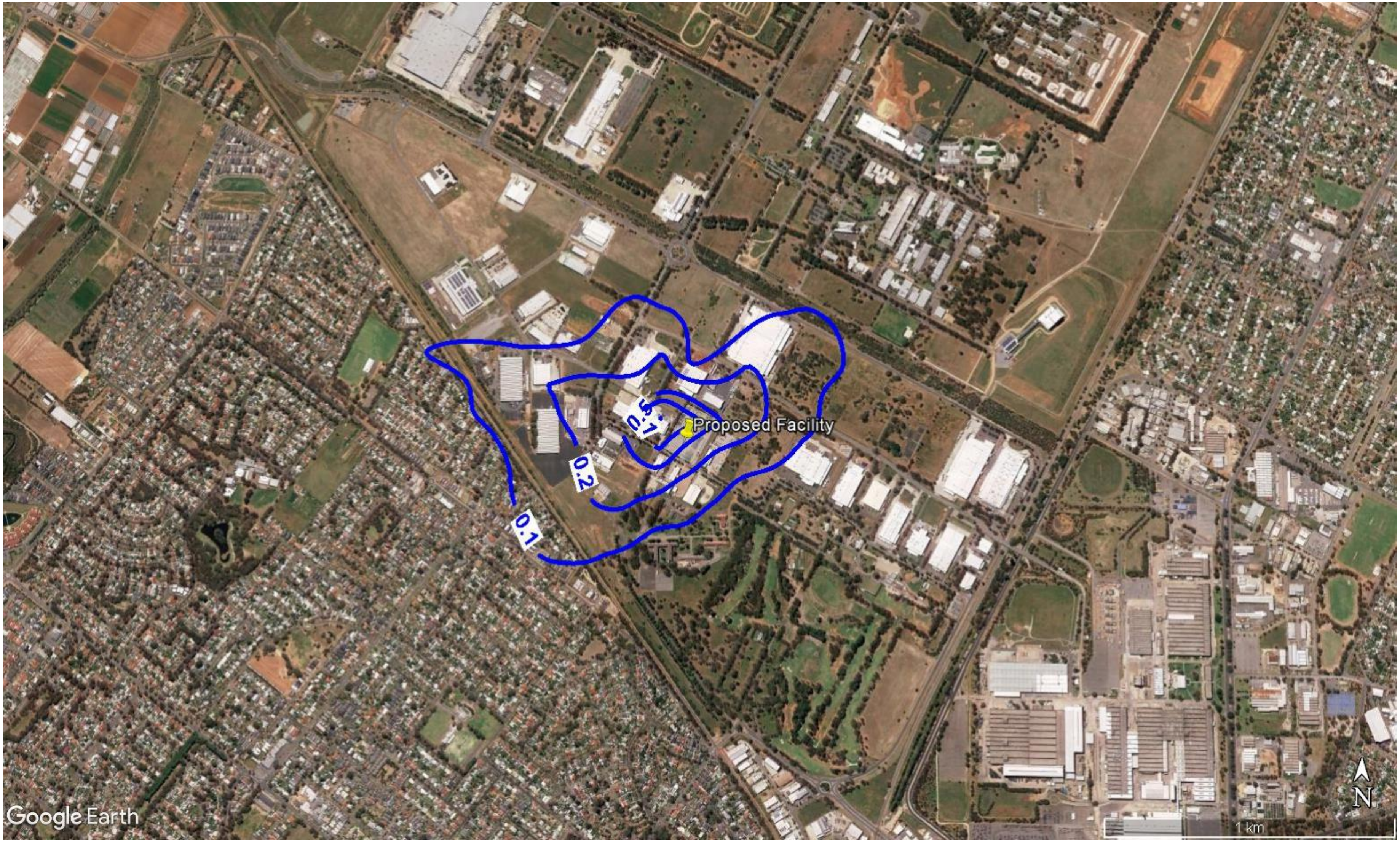


Scenario 2 (Upset Conditions) – 1 Hour Average Maximum Predicted Concentrations in Isolation of SO_2

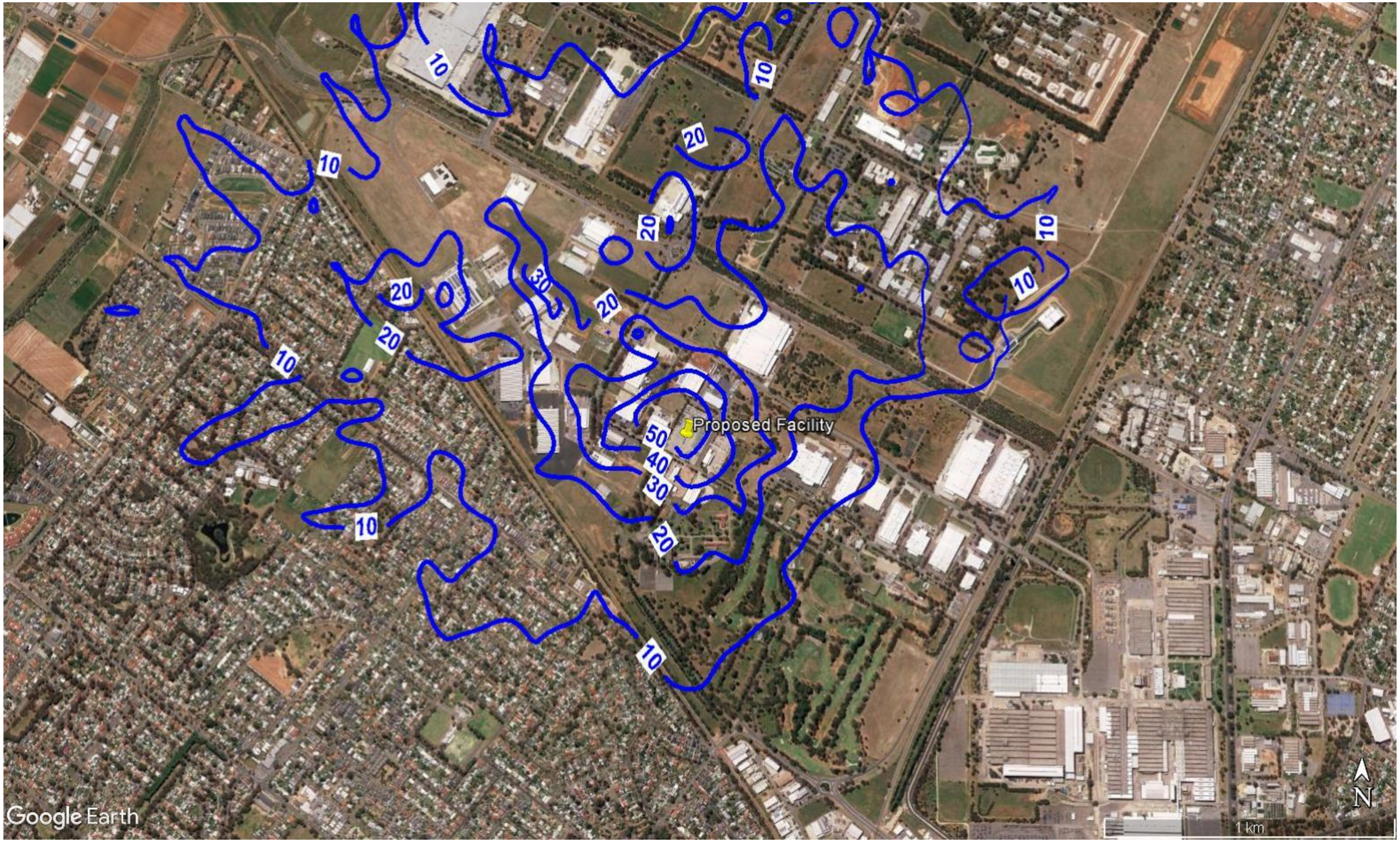
Scenario 2 (Upset Conditions) – 24 Hour Average Maximum Predicted Concentrations in Isolation of SO_2



Scenario 2 (Upset Conditions) – Annual Average Predicted Concentrations in Isolation of SO_2



Scenario 2 (Upset Conditions) – 3-minute Average Maximum Predicted Concentrations in Isolation of H2S



Delorean Energy

TRAFFIC MANAGEMENT PLAN

Contents

Purpose

The purpose of this Traffic Management Plan (TMP) is to detail how Delorean Energy manages traffic risks associated with pedestrians, plant and vehicle traffic in the workplace.

Scope

This TMP applies to all staff, visitors and contractors to the Delorean Energy facility located in Edinburgh, SA, unless otherwise specified. The requirements of this TMP shall be complied with 24 hours a day, every day of the year by any persons entering the facility.

Traffic Management Objectives

The primary objectives of the TMP are to:

- provide protection to staff, contractors and the general public from traffic hazards that may arise as a result of entering a the Delorean Energy facility
- manage potential adverse impacts on traffic flows and pedestrian movements to ensure road and pedestrian network performance is maintained at an acceptable level.
- To minimise adverse impacts on users of the road reserve and adjacent properties and facilities.

Facility

The Delorean Energy facility is located at 1-2 Gidgie Court, Edinburgh of South Australia, approximately 21km North of the Adelaide CBD. The site will have public access via Woomera Avenue and Gidgie Court and commercial vehicle access via separate entry/exit ways on Gidgie Court.

The Facility has multiple bays for commercial vehicle operations with a capacity of 9 trucks at any one time:

- 4 x commercial and industrial solid food waste receival bays
- 1 x liquid feedstock receival / outgoing inert waste bay
- 1 x Agricultural waste receival bay
- 3 x Digestate trailer bays

The site has been designed to allow all vehicles to enter and exit the facility in a forward motion.

Public parking is supplied on site to service the parking needs of staff, visitors and the general public.

Refer to *Appendix 1: Site vehicle movements and access layout* for more information

Commercial Vehicles

Commercial Vehicle Types

The Delorean Energy facility will be receiving heavy vehicles in a range of shapes and sizes. The heavy vehicles entering the site are:

Description	Maximum Length	Turning Radius (5-15km/hr)
2 Axle Rigid Truck	12.5m	15m
3 Axle Rigid Truck	12.5m	15m
4 Axle Rigid Truck	12.5m	15m
4 Axle Twinsteer Rigid Truck	12.5m	15m
5 Axle Twinsteer Rigid Truck	12.5m	15m
6 Axle Semitrailer	19m	15m
3 Axle Truck and 4 Axle Dog Trailer	19m	15m
8 Axle B-Double	26m	15m
9 Axle B-Double	26m	15m

Refer to *Appendix 2: Vehicle Turning Paths (Swept)* for minimum turning paths of commonly accepted vehicles

Commercial Vehicle Routes

Commercial vehicles will be travelling to the Delorean Energy facility from various locations around South Australia. Due to the positioning of the facility, vehicles can only come from either the North, East or South. Commercial vehicles will avoid routes through residential areas and will only travel on approved roads set by the South Australian Department of Planning, Transport and Infrastructure.

Commercial Vehicles will enter the City of Salisbury jurisdiction from either of the following routes:

- Salisbury Highway (A20)
- Main North Road (A20)
- Princess Highway (A1)
- Northern Expressway (M20)

Commercial Vehicles on The Salisbury Highway

Commercial Vehicles travelling on Salisbury Highway will take the following Route:

- Turn North West onto Commercial Road
- Turn North East onto Purling Avenue
- Turn North West onto Woomera Avenue
- Turn North onto Gidgie Court
- Enter Delorean Energy Facility turning West.

Commercial Vehicles on Main North Road

Commercial vehicles travelling on Main North Road will take the following route:

- Turn South West onto Salisbury Highway

- Turn North West onto Commercial Road
- Turn North East onto Purling Avenue
- Turn North West onto Woomera Avenue
- Turn North onto Gidgie Court
- Enter Delorean Energy Facility turning West.

Commercial Vehicles on The Princess Highway

Commercial Vehicles Travelling on Princess Highway will take the following route:

- Turn East onto Waterloo Corner Road
- Take first exit at the first roundabout onto Heaslip Road
- Turn South East onto Edinburgh Road
- Continue onto Purling Avenue
- Turn North West onto Woomera Avenue
- Turn North onto Gidgie Court
- Enter Delorean Energy Facility turning West.

Commercial Vehicles on The Northern Expressway

Commercial Vehicles travelling on the Northern Expressway will take the following route:

- Take the Heaslip road/Edinburgh exit onto Heaslip Road heading South.
- Continue through the next 2 roundabouts to stay on Heaslip road
- Turn South East onto Edinburgh Road
- Continue onto Purling Avenue
- Turn North West onto Woomera Avenue
- Turn North onto Gidgie Court
- Enter Delorean Energy Facility turning West.

Refer to *Appendix 3: RAVNet Map for 26m B Double (GML)* for a map of the acceptable roadways for use by B-double trucks and below.

Procedure for Entering Facility

Public Vehicles

Public vehicles comprise of employee personal vehicles, visitor vehicles, general public and educational vehicles such as buses.

Public vehicles will enter the site from any of the two entry/exit points on Woomera Avenue where they will immediately have access to parking for both light vehicles and buses.

Public vehicles will have the option to exit the facility from either of the entry/exit points on Woomera Avenue.

Refer to *Appendix 1: Site vehicle movements and access layout* for more information

Pedestrians

Primary pedestrian routes are footpaths which act as a major route for pedestrians and link to site office and parking areas.

Pedestrians will have access to purpose built walkways from the parking area, site office and weighbridge office, allowing safe foot access to all major public areas of the site.

Refer to *Appendix 1: Site vehicle movements and access layout* for more information

Commercial Vehicles

Commercial Vehicles comprise of dump trucks, tankers and any other waste carrying vehicles who will be offloading waste into the facility.

Commercial vehicles will enter the facility through the heavy vehicle entry/exit way on Gidgie Court. Vehicles are weighed on the ingoing weighbridge, after which they may enter the industrial area of the site. Commercial Vehicle waiting bays will be available on site before the weighbridge in the unlikely event that the weighbridge is in pre-engaged.

Vehicles will have room inside the industrial area to manoeuvre themselves into a position to complete their task whether it be waste delivery or digestate removal. Refer to appendix 1 for the swept turning path of the largest expected vehicle.

Traffic lights will be installed on the doors of the Reception Hall, allowing incoming trucks to be allocated to a specific disposal/input bay.

After the vehicle has completed its task, it will go through the outgoing weighbridge and exit the site onto Gidgie Court.

Refer to *Appendix 1: Site vehicle movements and access layout* for more information

Commercial Vehicle Volume

Once in full operation, the facility is expected to draw 50 trucks per day, 5 days a week. This results in approximately 5 trucks every hour, well below the capacity of 9 trucks at any one time.

Continuous Improvement

Delorean Energy will strive to continually improve and measure its health and safety performance and will routinely review the TMP as a means to resolve potential or identified issues

Risk Management

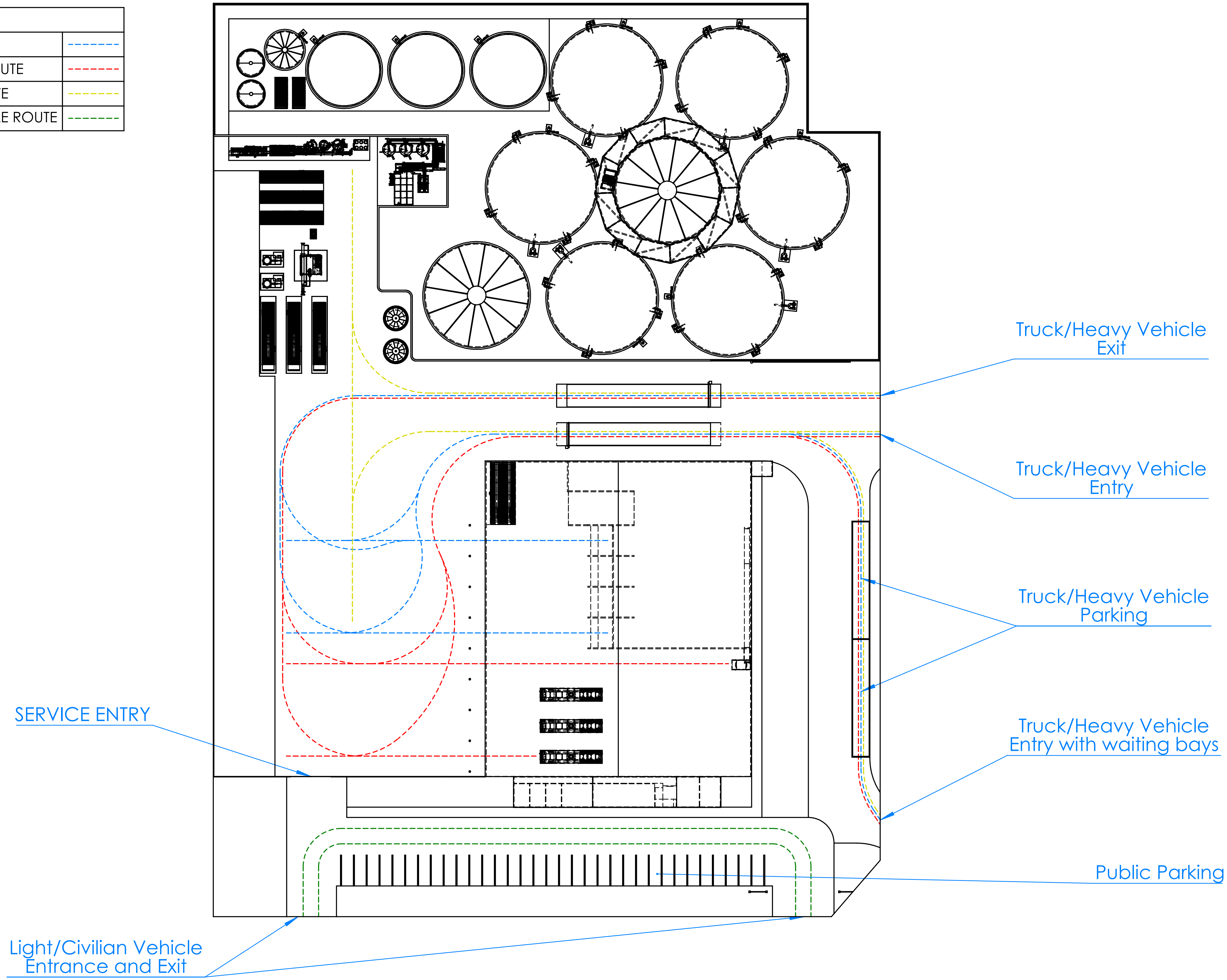
Delorean Energy is committed to identifying, assessing and controlling all foreseeable risks in order to minimise or prevent the likelihood of an injury or illness occurring.

Incident and Accident Procedures

The requirements for reporting, recording and notifying workplace injuries, work-caused illnesses, and dangerous or potentially dangerous events are compliant with the work health and safety commission and will comply with the Salisbury council guidelines.

Appendix 1: Site Vehicle Movements and Access Layout

LEGEND	
RIGID TRUCK ROUTE	blue dashed line
SEMITRAILER TRUCK ROUTE	red dashed line
B-DOUBLE TRUCK ROUTE	yellow dashed line
LIGHT/CIVILIAN VEHICLE ROUTE	green dashed line



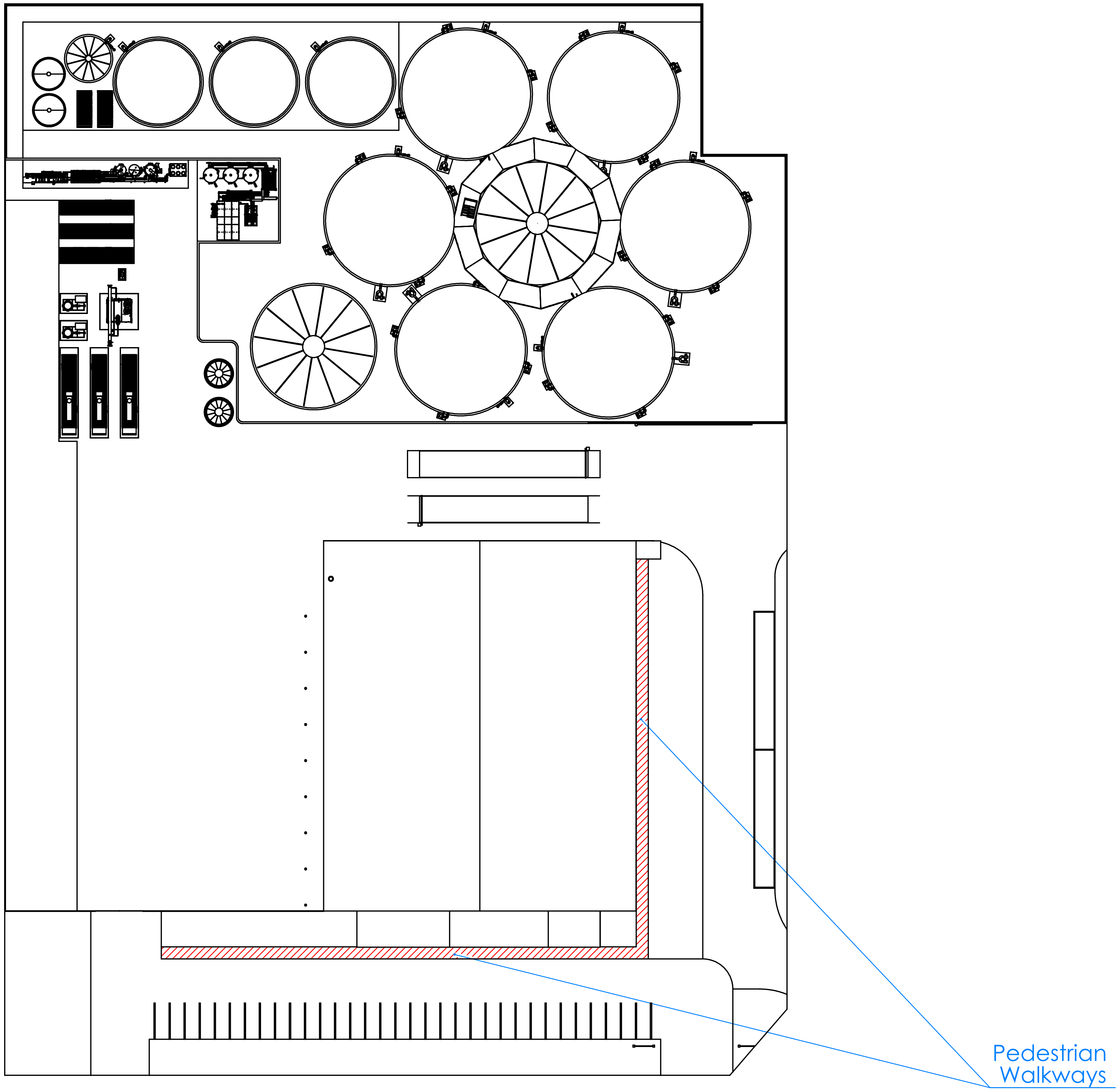
1	SECOND REVISION	14/09/2018	MARTYN A.	JOSEPH O.	
0	ISSUED FOR REVIEW	22/05/2018	MARTYN A.	JOSEPH O.	
REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

BIOGASS RENEWABLES PTY LTD
GROUND LEVEL, 1205 HAY STREET
WEST PERTH
WESTERN AUSTRALIA 6005
T: +61 (0)8 9489 2598
Email: info@biogass.com.au

CLIENT: FOOD ENERGY
PROJECT NO: J116

TITLE: SALISBURY AD PLANT
SITE ACCESS DIAGRAM

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 10 OF 15 | REV 1



REVISION	REVISION DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
1	SECOND REVISION	14/09/2018	MARTYN A.	JOSEPH O.	
0	ISSUED FOR REVIEW	22/05/2018	MARTYN A.	JOSEPH O.	

BIOGASS RENEWABLES PTY LTD
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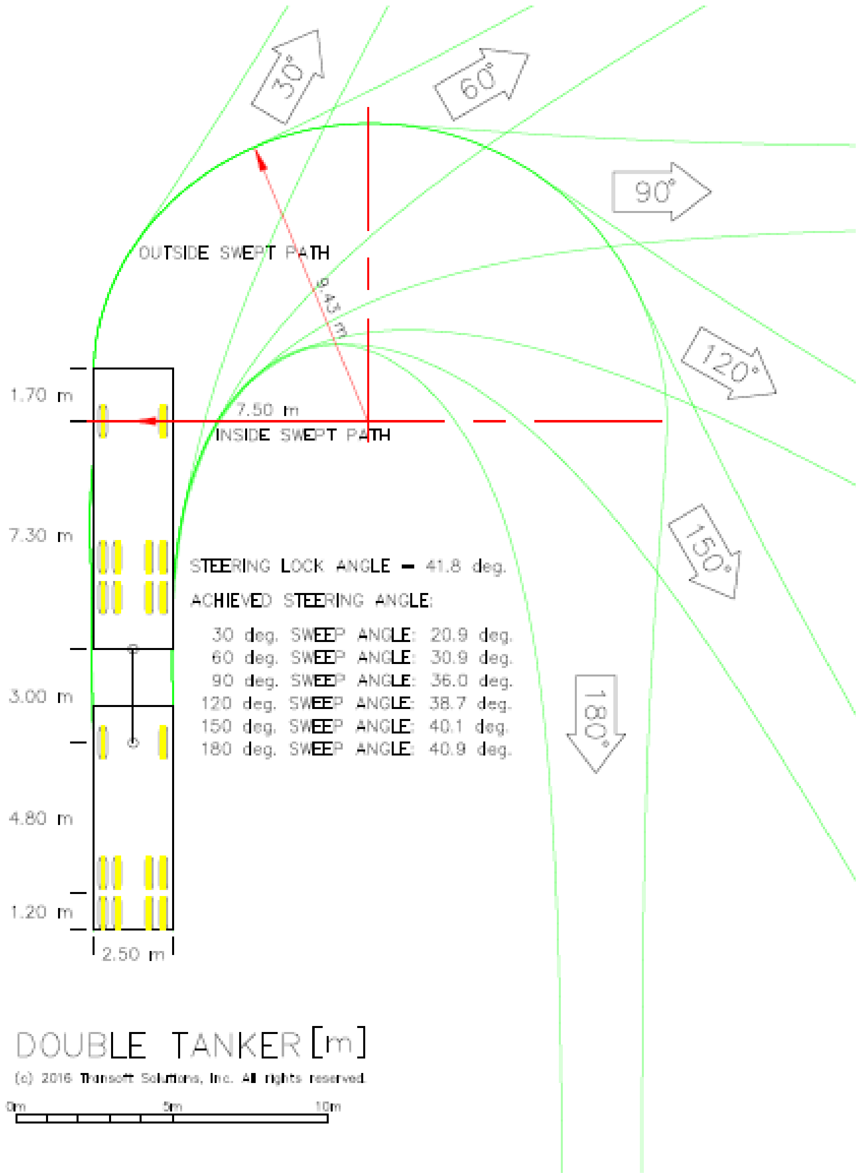
WESTERN AUSTRALIA 6005
T: +61 (0)8 9489 2598
Email: info@biogass.com.au

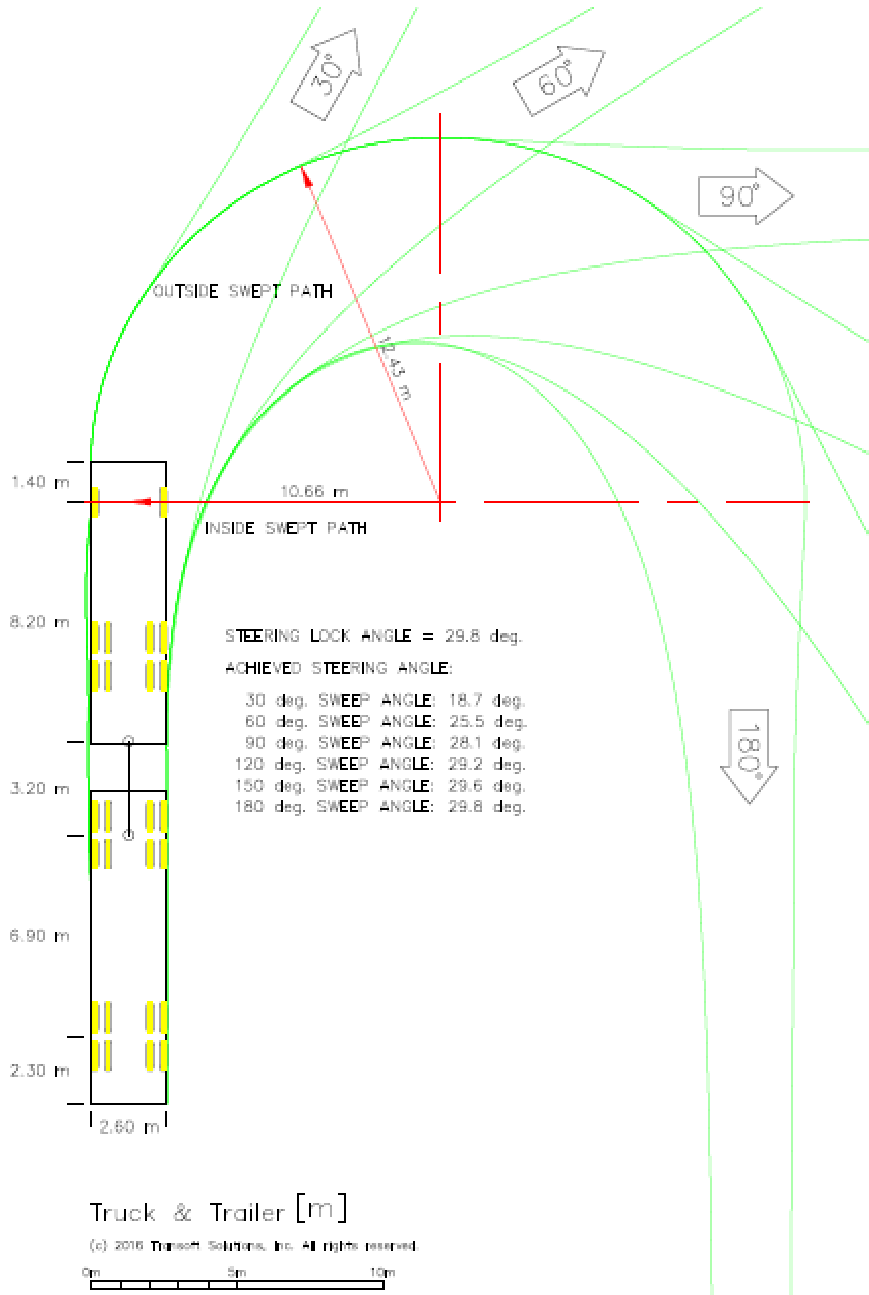
CLIENT: FOOD ENERGY
PROJECT NO: J116

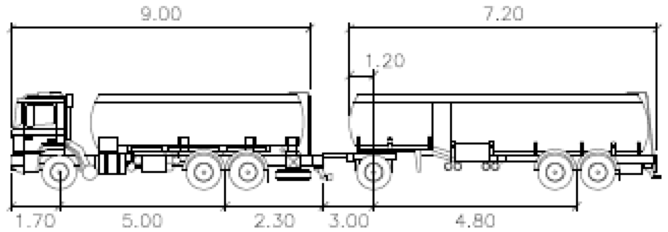
TITLE: SALISBURY AD PLANT
SITE ACCESS DIAGRAM

ALL DIMENSIONS IN mm | SCALE 1:800 | DWG NO. J116-002 | SHEET NO. 11 OF 15 | REV 1

Appendix 2: Vehicle Turning Paths (Swept)

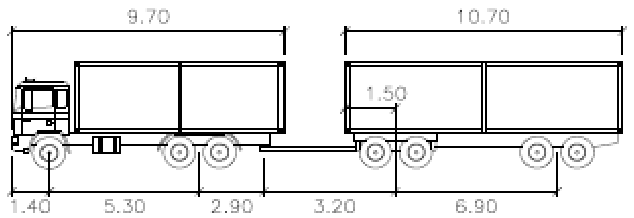






DOUBLE TANKER meters

First Unit Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 41.8
First Unit Track	: 2.20	Articulating Angle	: 90.0
Trailer Track	: 2.20		

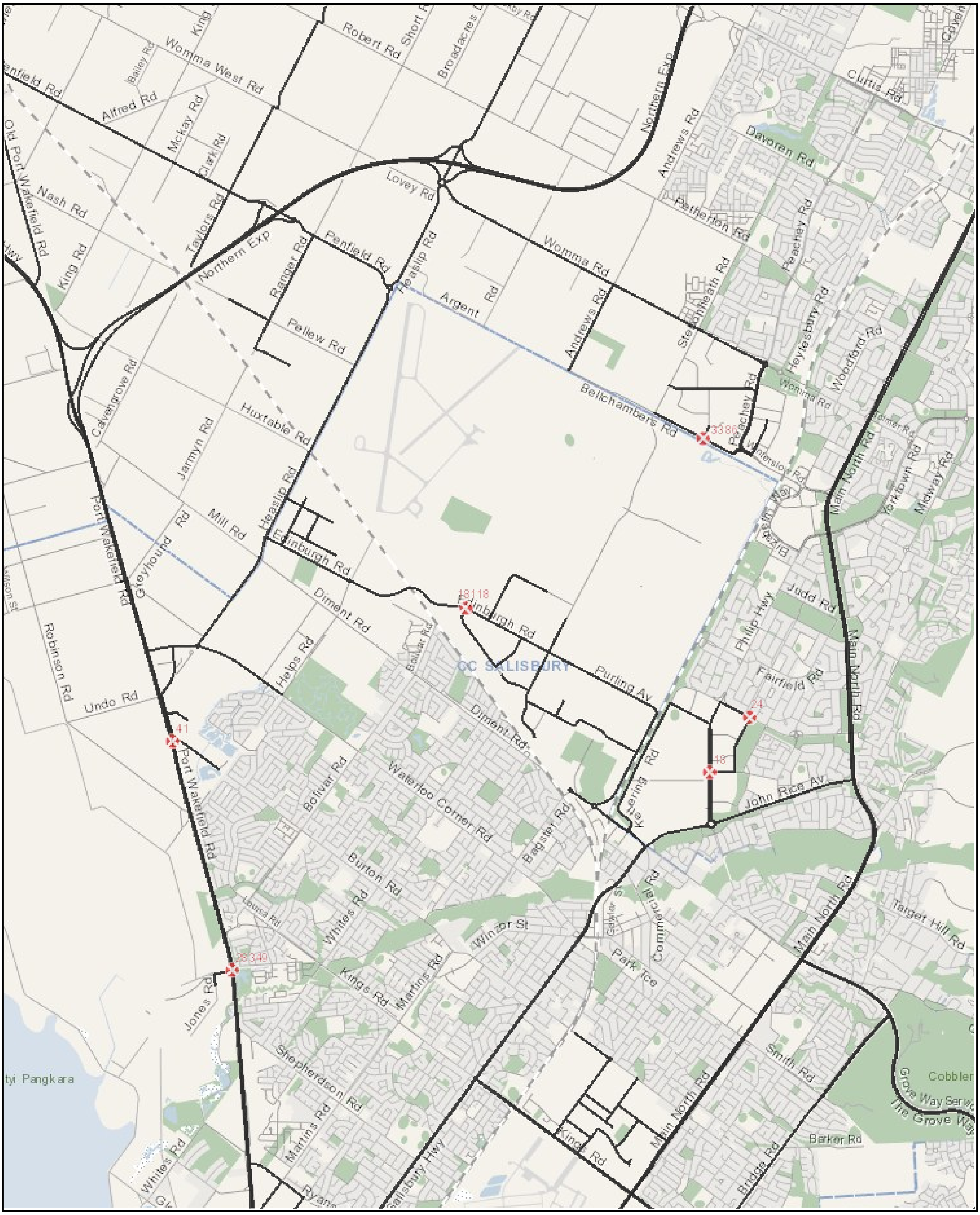


Truck & Trailer meters

First Unit Width	: 2.60	Lock to Lock Time
Trailer Width	: 2.60	Steering Angle
First Unit Track	: 2.60	Articulating Angle
Trailer Track	: 2.60	

Appendix 3: *RAVNet Map for 26m B Double (GML)*

RAVNet Map for 26m B Double (GML)



Legend

- 26m B Double (GML)
- Restriction
- Star Restriction
- LGA with Restrictions
- DPTI Safe T Cam Site

N

1km

Scale- 1:72,224 (at A4 print size)

Government of South Australia
Department of Planning, Transport and Infrastructure

DISCLAIMER
The information provided above is not represented to be accurate, current or complete at the time of this report. The government of South Australia accepts no liability for the use of this data, or any reliance placed upon it.

Restrictions

Ref	Restriction Information
41	No right turns into and out of Burton Rd Left Turn Only
18	No right or left turn onto Oldham Rd. Left turn onto Philip Highway only
3386	Right turn onto Bellchambers Road only
18118	No right turn from Kaurna Ave onto Edinburgh Rd allowed
28349	Right turn out of Hodgson Rd onto Port Wakefield Rd and right turn into Hodgson Rd from Port Wakefield Rd not permitted
24	Right turn only from Hogarth to Trimmer