



Application for Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L9025/2017/1
Applicant	Austral Bricks (WA) Pty Ltd
ACN	079 711 603
File Number	DER2017/000089
Premises	Cardup Brickworks Lot 101 on Plan 42930; Certificate of Title Volume 2593 Folio 602, Byford 6122 Lot 21 on Diagram 49238; Certificate of Title Volume 1433 Folio 325, 146 Nettleton Road Byford 6122 Lot 7 on Diagram 10840; Certificate of Title Volume 1482 Folio 83, Byford 6122 Lot 51 on Diagram 52746; Certificate of Title Volume 1988 Folio 428, 101 Kiln Road Byford 6122 Lot 50 on Diagram 52748; Certificate of Title Volume 1506 Folio 326, Byford 6122 Lot 10 on Diagram 26892; Certificate of Title Volume 1482 Folio 80, Byford 6122 Lot 12 on Diagram 52677; Certificate of Title Volume 1580 Folio 66, 69 Kiln Road Byford 6122 Lot 53 on Diagram 4790; Certificate of Title Volume 1580 Folio 67, Byford 6122 Lot 30 on Plan 404710; Certificate of Title Volume 2908 Folio 776, Byford 6122
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1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
Applicant	Austral Bricks (WA) Pty Ltd
AS4323.1	AS 4323.1—1995 Stationary source emissions Method 1: Selection of sampling positions
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
combined acid gas	means total of the concentrations of hydrogen fluoride (HF), hydrogen chloride (HCl), sulphur dioxide (SO ₂) and sulfuric acid mist (SO ₃ and H ₂ SO ₄)
CS Act	<i>Contaminated Sites Act 2003 (WA)</i>
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EP Regulations	<i>Environmental Protection Regulations 1987 (WA)</i>
GLC	ground level concentration
NEPM	National Environmental Protection Measure
Noise Regulations	<i>Environmental Protection (Noise) Regulations 1997 (WA)</i>
NSW Clean Air Regulations	<i>Protection of the Environment (Clean Air) Regulations 2010 – New South Wales Legislation</i>
PM	Particulate Matter
PM ₁₀	used to describe particulate matter that is smaller than 10 microns (µm) in diameter
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Primary Activities	as defined in Schedule 2 of the Revised Licence
Risk Event	As described in <i>Guidance Statement: Risk Assessment</i>
SO ₂	means Sulphur Dioxide
TDS	Total dissolved salts
TSS	Total suspended solids
µg/m ³	micrograms per cubic metre

2. Purpose and scope of assessment

Austral Bricks (WA) Pty Ltd (Austral) submitted an application for a new licence to conduct brick manufacturing activities at Cardup Brickworks. Cardup Brickworks is an existing brick manufacturing premises that was placed in care and maintenance in May 2012.

Works Approval W5925/2015/1 was granted in January 2016 to construct a new limestone scrubber for kiln 3, upgrade existing infrastructure and commission new and existing infrastructure.

This assessment considers commissioning reports and data submitted in accordance with requirements of W5925/2015/1 along with emissions and discharges associated with ongoing operations at the premises.

2.1 Application details

An application for a new licence was received by the Department on 9 January 2017 including an application form and supporting documentation. Assessment of this application was placed on hold, pending completion of works and commissioning to upgrade the infrastructure at the premises pursuant to Works Approval W5925/5925/1.

The Applicant provided compliance certification on 6 January 2017, confirming that construction works were completed in accordance with the works approval application and supporting documentation. The Applicant notified DWER on 5 April 2018 that commissioning had been completed and emissions verification reports were received by the Department on 26 April 2018.

The key documents and guidance statements which inform this assessment are outlined in Appendix 1.

3. Background

The Applicant previously held a licence granted under Part V of the EP Act for category 41: clay bricks and cement products manufacturing, at the premises. Cardup Brickworks was placed under care and maintenance in May 2012. The previous Licence, L6407/1967/9, ceased to have effect on the 1 January 2015.

Table 2 lists the prescribed premises category that has been applied for.

Table 2: Prescribed Premises Categories

Classification of Premises	Description	Approved Premises production or design capacity or throughput
Category 41	Clay bricks or ceramic products manufacturing: premises on which refractory products, tiles, pipes or pottery are manufactured.	200,000 tonnes per annual period

4. Overview of Premises

4.1 Operational aspects

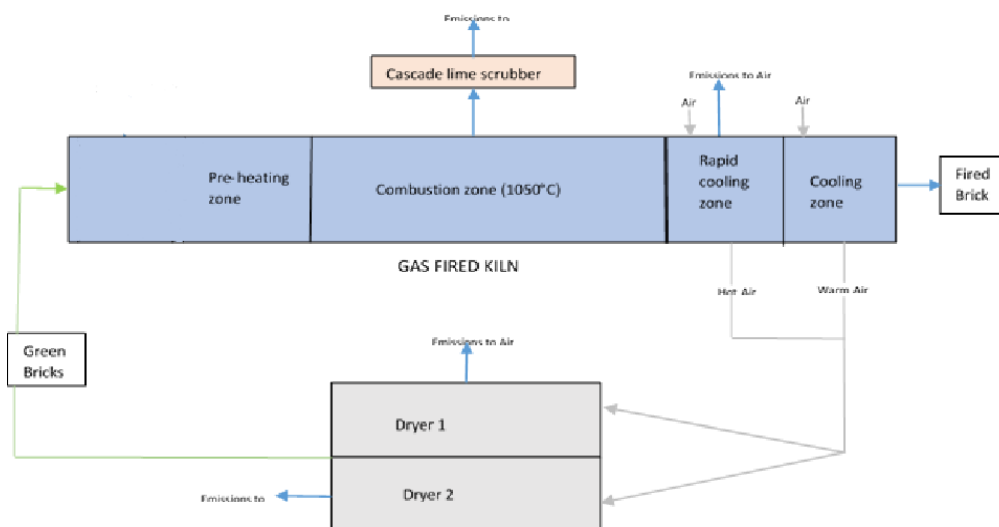
The manufacture of bricks and tiles involves the following stages:

1. Clay preparation: includes the grinding and crushing of clays and shale, blending of different clay types and addition of water. Materials to improve the mechanical properties and colour of the finished product such as limestone, lime, sand and sugar may be added.

2. Product shaping: the shaping of raw material mix into shapes using moulds or by extrusion, forming green bricks. During or after shaping, additives (such as saw dust or pigments) may be applied to the surface of the raw clay shapes to achieve desired colour or texture effects. Green bricks are stacked onto kiln cars ready for drying.
3. Drying: Green bricks enter a dryer which is heated by hot air from the cooling zone of the kiln. Dryer temperatures reach a maximum of 210°C. Exhaust gases from the dryer are discharged to atmosphere by respective dryer vents.
4. Firing: Bricks pass through a high temperature tunnel kiln. The first zone is preheating at 750°C, followed by firing in the combustion zone at approximately 1050°C. The maximum kiln firing temperature is approximately 1180°C. The firing process is the main source of air emissions as fluoride, chloride, oxides of sulphur and other elements naturally present in clay are released into the air of the kiln, along with water vapour. The fluoride release rate varies over the firing cycle and peaks at temperatures of approximately 800°C, depending on the raw material, product and kiln conditions. Some of the raw material additives are also burnt off during firing.
5. Fired bricks are rapidly cooled to approximately 700°C by air injection in the rapid cooling zone. High temperature (HT) take off air from the rapid cooling zone is fed to the dryer. Excess HT take off air is discharged to atmosphere via a roof top exhaust stack.
6. Solid materials such as bricks that do not meet the quality control criteria and prepared clays that have not been fired are recycled in the process or transferred to the Applicant's other brick manufacturing plants for use as raw material for brickmaking.

An outline of the process is shown in Figure 1

Figure 1: Schematic of Brick Manufacture



Kiln exhaust gas emissions pass through a cascade scrubber dosed with limestone. Potential air pollutants include acid chloride and fluoride gases, oxides of nitrogen, oxides of sulphur, low levels of Volatile Organic Compounds (VOCs) and particulates may be emitted. Other potential emissions during operation include fugitive dust, odour, discharge of potentially contaminated stormwater and noise.

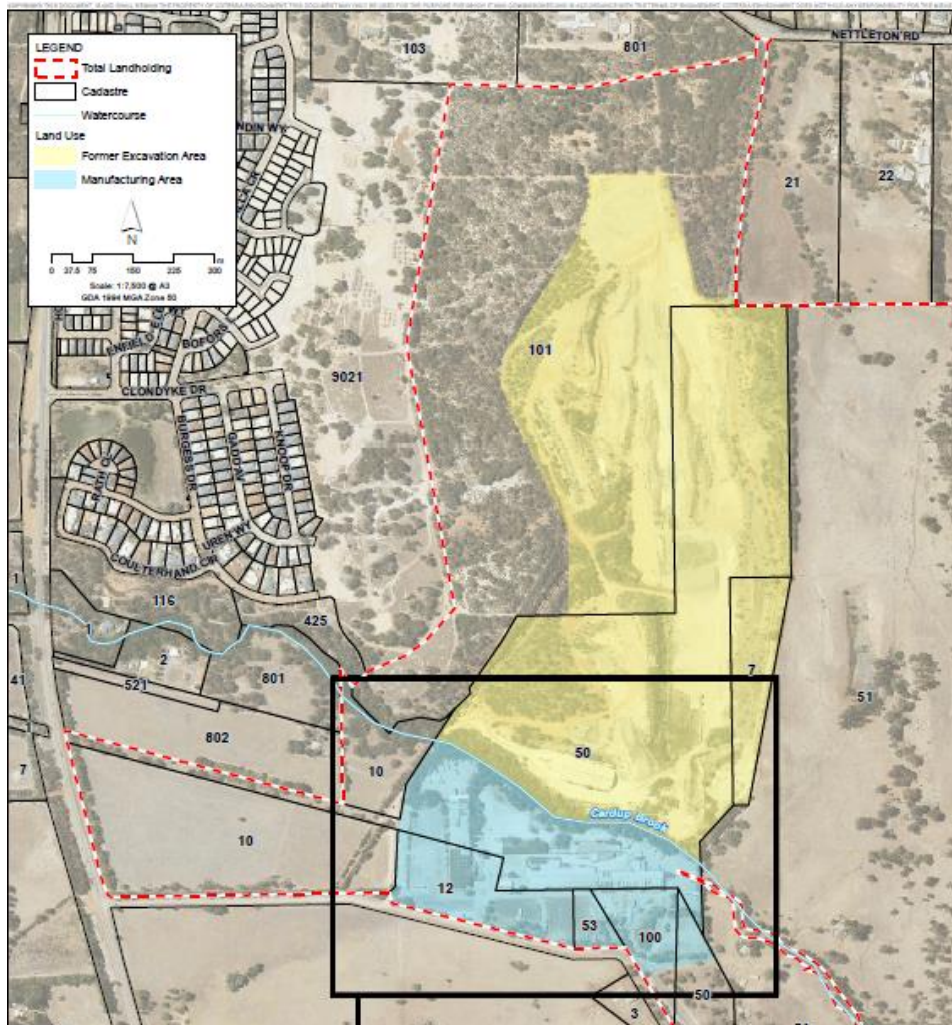
The balance of airflows through zones within the kiln is critical for efficient operation and emission control. The correct balance ensures required combustion conditions in the firing zone, cooling airflows to deliver the required product quality, and the heat flow in the dryer and preheat zones to ensure optimal conditions can be achieved in the firing zone (Strategen, 2015). Furthermore, the appropriate balance of air flows through the kiln ensures the majority of waste

gases produced in the firing zone, therefore containing highest concentrations of contaminants, are directed through the cascade scrubber prior to discharging to atmosphere.

Figure 2 and Figure 3 show the layout of the plant.

Austral intends to operate Kiln 3 for 20 years at an expected throughput of 200,000 tonnes of clay products per year.

Figure 2: Plan showing former extraction area and manufacturing area



4.2 Infrastructure

The Cardup brickworks infrastructure, as it relates to Category 41 activities, is detailed in Table 3.

Table 3: Cardup brickworks Category 41 infrastructure

	Infrastructure
	Prescribed Activity Category 41
1	Clay storage. Stockpiles located on in-situ soils and clay storage shed.
2	Clay preparation area
3	2 x Dryers with hot air flues
4	Gas fired tunnel kiln
6	Cascade lime scrubber
7	Stack exhausts;
9	Water catchment, swales and settling ponds

5. Legislative context

Table 4 summarises approvals relevant to the assessment.

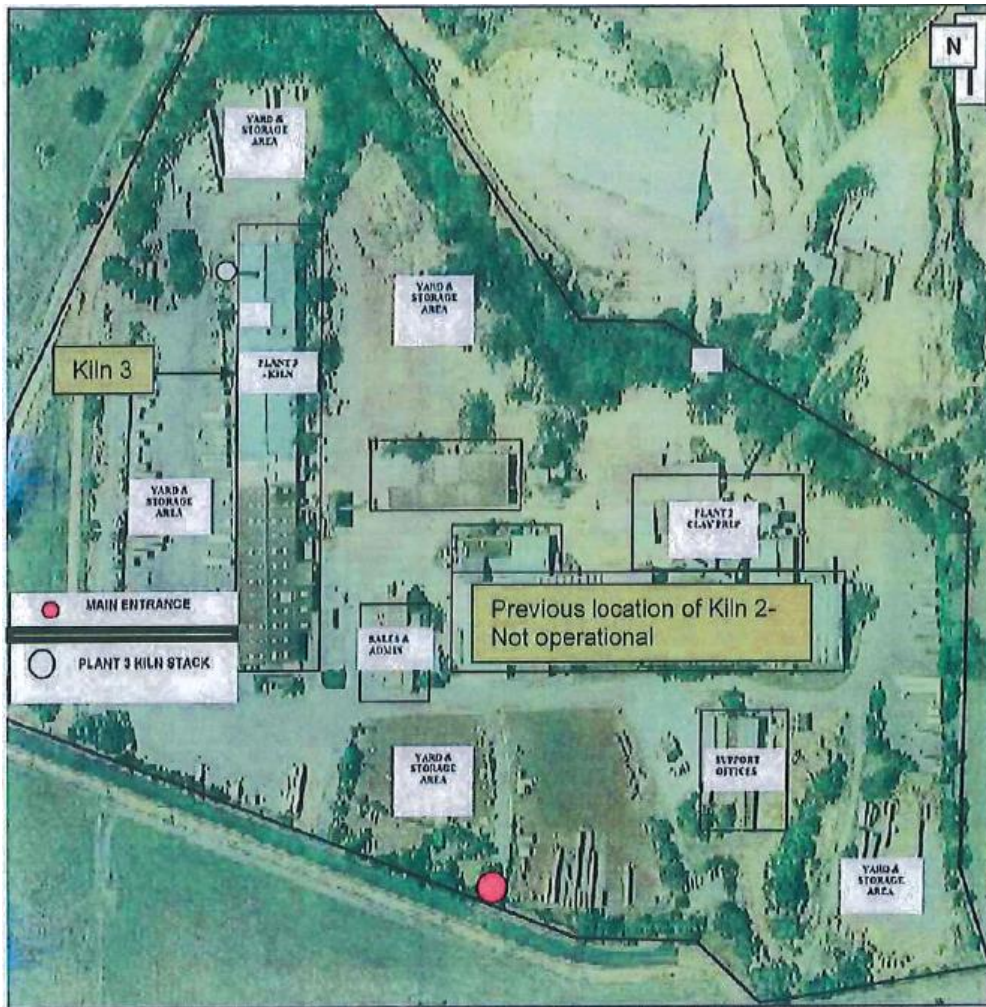
Table 4: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
<i>Rights in Water and Irrigation Act 1914</i>	GWL 152807	Austral Bricks (WA) Pty Ltd	Approves the extraction of up to 100,000kL of groundwater from <i>the Byford 3 combined fractured rock aquifer</i> west aquifer in the Serpentine groundwater area. The water is used for the manufacturing process.

5.1 Contaminated sites

Lot 50 has been classified as potentially contaminated investigation required while the other lots included in the premises have not been reported as contaminated sites under the provisions of the Contaminated Sites Act.

Figure 3: Layout of the premises manufacturing area



5.2 Other relevant approvals

5.2.1 Planning approvals

The premises are located on land zoned as Special Use: Extraction/storage shale and clay under the Shire of Serpentine-Jarrahdale Town Planning Scheme No 2. The site has not held an Extractive Industries Licence since July 2013.

The Shire of Serpentine-Jarrahdale confirmed that the existing use of the premises is compliant with the special use definition of the Shires Town Planning Scheme No 2 for the *Extraction and storage of shale and clay manufacture, storage and distribution of masonry or related products* and there are no further approvals required (email 8 February 2017).

5.3 Part V of the EP Act

5.3.1 Works approval and licence history

Table 4 summarises the works approval and licence history for the premises.

Table 4: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L6407/1967/9	26/11/2010	Licence for ongoing operation of Cardup brickworks. Ceased to have effect in 1/1/2015 due to non-payment of annual fees. Premises were in care and maintenance and Licence Holder did not apply for a new licence.
W5925/2015/1	28/01/2016	Refurbishment of Kiln 3 and associated brick manufacturing infrastructure, including the installation of a cascade lime scrubber.
W5925/2015/1	14/6/2017	Amendment Notice No 1 - extends the commissioning timeframe of Kiln 3 from six to nine months.
W5925/2015/1	16/10/2017	Amendment Notice No 2 – extends the commissioning timeframe of Kiln 3 from nine to 12 months.
W5925/2015/1	4/01/2019	Amendment Notice No 3 – extended the expiry date of the works approval of Kiln 3 to 30 April 2019
W5925/2015/1	29/4/2019	Amendment Notice No 3 – extended the expiry date of the works approval of Kiln 3 to 30 June 2019
L9025/2017/1	18 June 2019	Application received 9 January 2017 and put on hold until the completion of commissioning completed under W5925/2015/1. Subject of this assessment.

5.3.2 Key and recent works approvals

This assessment considers the refurbishment of Kiln 3 and associated brick manufacturing infrastructure, including the installation of a cascade lime scrubber, constructed under works approval W5925/2015/1. The Works Approval Holder submitted a compliance certificate on 6 January 2017 to confirm construction was in accordance with the requirements of works approval conditions. Commissioning reports were submitted on 26 April 2018 to verify air and noise emissions predicted in the works approval application. An updated Stormwater Management Plan was also received on 20 January 2017, following recommendations made in the works approval assessment. The information included in these reports has been considered in the risk assessment (refer to section 9).

The assessment was also informed by a visit and inspection of the plant by DWER officers on 12 October 2018.

5.3.3 Compliance inspections and compliance history

Cardup Brickworks was inspected by the Department on 3 October 2013. This inspection was conducted to determine compliance with conditions of previous licence L6407/1967/9 while the site was in care and maintenance prior to closure. Non-compliances were identified regarding late submission of reports and failure to complete air emissions monitoring. Given the sites operating status, these non-compliances were assessed as minor.

DWER received a notification from the Applicant on 3 August 2018, identifying a potential discharge of contaminated stormwater. The Department deemed the incident low risk due to the minor quantities and response from the Applicant and no further action was required.

6. Modelling and monitoring data

6.1 Monitoring of emissions to air

The Applicant completed point source monitoring of the kiln off-gases and dryers during commissioning and subsequent operation of the kiln. The kiln off-gases were monitored pre and post scrubber to determine its efficiency (refer to Table 5 and Table 6). The scrubber has been effective in reducing HF, however it has only achieved an average 52% reduction, less than the 82% which was predicted.

Monitoring results show an increase in HCl and SO₂ across the scrubber, which is unexpected as an alkaline material (lime) should reduce these acid gases. The reason for this increase is not as yet fully resolved. The applicant in a submission received 29 May 2019 suggested the difference may be caused by a non-ideal (not able to be compliant with AS4323.1) sampling location for the pre-scrubber monitoring tests.

Monitoring data since commissioning is detailed below in Table 5 and Table 6.

Table 5: Point source monitoring results – kiln stack pre scrubber

Date	HCl		HF		SO ₂		PM	
	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)
29/3/2017	180	2.6	58	0.83	67	0.92	25	0.36
25/7/2017	230	2.9	65	0.8	78	0.95	16	0.2
8/11/2017	170	1.8	37	0.41	48	0.51	8	0.09
1/3/2018	190	2.2	55	0.65	60	0.74	20	0.24
15/5/2018	81	1.2	34	0.51	45	0.71	<1.4	<0.02
27/9/2018	0.54	0.72	110	1.8	59	0.96	4.2	0.072
18/3/2018	120	2.2	42	0.78	49	0.9	<0.9	<0.02

Note 1: where duplicate tests were completed averages are presented; and

Note 2: results are at STP and corrected to 18% O₂

Table 6: Point source monitoring results – kiln stack post scrubber

Date	HCl		HF		SO ₂		PM	
	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)
29/3/2017	260	3.5	5.8	0.08	90	1.2	57	0.78
25/7/2017	230	3.9	31	0.52	76	1.3	18	0.3
8/11/2017	120	2.1	15	0.27	53	0.97	5.7	0.1
1/3/2018	150	2.3	22	0.34	41	0.64	11	0.18
16/5/2018	120	1.9	23	0.35	52	0.79	35	0.053
27/9/2019	71	1.3	39	0.72	54	0.98	9.6	0.18
18/3/2019	150	2.7	23	0.4	54	0.98	15	0.28

Note 1: where duplicate tests were completed averages are presented;

2: results are at STP and corrected to 18% O₂; and

3: Average efficiency is based on emission rates monitored pre and post scrubber for 4 rounds of testing.

Point source monitoring results for the dryers are displayed in Table 7 and Table 8.

The Applicant advised that emissions from the dryers are insignificant when considering the site as a whole. As such, the emissions modelling did not include the point source emissions from the two dryers.

Table 7: Point source monitoring – East Dryer

Date	HCl		HF		SO ₂		PM	
	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)
19/4/17	0.83	0.0091	0.034	0.00038	NT		ND	
4/5/17	NT		NT		0.053	0.00054	NT	
26/7/17	3.1	0.038	0.11	0.0014	0.45	0.0055	ND	
8/2/18	2.6	0.03	NT		NT		ND	
28/2/18	3.1	0.036	0.28	0.0033	0.31	0.0038	ND	

Notes: ND = Not detected
NT = Not tested

Table 8: Point source monitoring – West Dryer

Date	HCl		HF		SO ₂		PM	
	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)	(mg/m ³)	(g/s)
19/4/17	1.6	0.016	0.033	0.00033	NT		ND	
4/5/17	NT		NT		0.088	0.0009	NT	
26/7/17	4.9	0.055	0.38	0.0043	0.15	0.0017	ND	
8/2/18	8.8	0.099	NT		NT		ND	
28/2/18	4	0.045	0.31	0.0034	0.36	0.0042	ND	

Notes: ND = Not detected
NT = Not tested

6.2 Modelling of emissions to air data

The Applicant conducted air emissions modelling to predict ground level concentrations (GLCs) of acid gases, particulates and combustion gases in its 2015 application for works approval. The modelled emission rates and concentrations were based on design specifications for the scrubber and were consistent with other brickworks with similar emission control technologies. The original modelling used the predicted emission concentrations of:

- HF 130 mg/m³;
- HCl 200 mg/m³; and
- SO₂ 200 mg/m³

Modelling considered the predicted ground level impact of emissions at nearby receptors, which

included residential receptors and significant vegetation. Normal and non-normal operations were modelled which included scrubber bypass events. The highest predicted GLCs compared to relevant ambient criteria are presented in Table 9.

The Department's assessment in determining to grant for works approval W5925/5925/1 considered point source acid gas and particulate emissions to be moderate risk, based on expected concentrations and emission rates. Point source monitoring of the kiln stack (including pre and post scrubber) and the dryers was required during commissioning to verify predicted air emissions.

The Department's Air Quality Services provided the Delegated Officer with re-modelled GLC predictions using Applicant's measured emissions data obtained post-works. The predicted worst-case GLCs at sensitive receptors are listed in Table 9. Based on the emission data provided, the results suggest the ground level concentration of combined acid gas would meet the Department of Health (DoH) guideline of 100 µg/m³ on a 24 hour average at the sensitive receptors in line with the pre-works modelling...

The modelling results also show that the guideline is exceeded at non-receptor locations on the grid, which may have implications for future development of land. Due to these uncertainties the Delegated Officer will give consideration to requiring updated modelling through licence requirements, subject to the risk assessment outcomes. This would include clearly stating the adopted emission rates and clarifying the terminology used when modelling grid and sensitive receptors.

The DoH has supplied guidelines for 24 hour ambient concentrations for individual and combined acid gases for protection of pulmonary function. Individual concentrations of HCl and HF should be 100 µg/m³, however the combined acid gas concentration should also not exceed 100 µg/m³.

Table 9: Delegated Officer modelling of acid gas emissions using commissioning data

Parameter	Maximum GLCs at sensitive receptors modelled with new emission data		Air quality guideline values 1 hour average.	Air quality guideline values 24 hour average.
	1 hour average	24 hour average		
	µg/m ³			
HF	18.4	3.6	-	100 (health based) ¹
SO ₂	62.4	12.2	524 ²	210 ²
HCl	179.3	35.1	-	100 ¹
Combined Acid Gas	260.1	50.9		100 ¹

1. Western Australian Department of Health Guidelines

2. Commonwealth Department of Environment (DoE) 2015, *National Pollutant Inventory Guide (NPI)*, Canberra, ACT

Key findings:

1. The maximum predicted ground level concentrations of the combined acid gases at sensitive receptors is 50.9 $\mu\text{g}/\text{m}^3$ or 51% of DoH health guidelines.
2. The maximum predicted ground level concentration of HCl 35.1 $\mu\text{g}/\text{m}^3$, is 35% of the DoH 24 hour limits for HCl of 100 $\mu\text{g}/\text{m}^3$.
3. Predicted ground level conditions for HF and SO_2 are well below health guidelines.
4. Emission limits for HCl should be set to prevent amenity impacts at sensitive receptors.
5. Subject to the risk assessment outcomes, there is an identified need for further air emissions modelling that can be required through licence conditions.

6.3 Monitoring and Modelling of Noise Emissions

A noise impact assessment report by Eco Acoustics was prepared in September 2017. The investigation included noise level measurements at the boundary of the premises, individual equipment measurements and noise logging at a representative residence. Using emitted noise levels, modelling was carried out and concluded that the plant will comply with the Noise Regulations.

6.4 Monitoring of surface water quality

Surface water quality has been monitored at the site since 21 October 2004. Initially 4 parameters were measured, pH, TDS, TSS and hydrocarbons. Turbidity was also measured after 31 May 2011.

Upstream and downstream samples were collected as well as a range of samples from different catchments across the site. The sampling took place when the brook was flowing and occurred from one to three times a year in this period.

Historical results for pH, TDS and hydrocarbons are within ANZECC guidelines for aquatic ecosystems. There was also little to no variation between the upstream and downstream samples.

The average (2004 to 2016) TSS measured at the upstream monitoring point is 16 mg/L with a range of 1 to 88 mg/L. At the downstream monitoring point the average is 40 mg/L with a range of 5 to 300 mg/L.

The difference between upstream and downstream TSS results has markedly reduced since 2013. This may be a result of improved Stormwater management on site including a revegetation program commenced in 2012. However it is also notable that the plant went into care and maintenance in May 2012.

7. Consultation

The application was advertised in the West Australian newspaper on 13 February 2016 seeking public comment. Letters inviting the then Department of Water and the Shire of Serpentine Jarrahdale were sent 7 February 2017.

The Shire replied clarifying the planning status of the proposal on 8 February 2017.

The Department of Water replied on 1 March 2017 addressing the Stormwater Management Plan.

8. Location and siting

8.1 Siting context

The site is located on the Swan Coastal Plain near the edge of the Darling Scarp approximately 10kms south of Armadale and approximately 35kms south of Perth CBD. The surrounding land uses include rural, bush forever, residential and special purposes. Cardup Brook flows through the premises and is tributary of the Serpentine River.

8.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 10.

Table 10: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Urban residential premises	There are approximately 26 residential dwellings within 500m of manufacturing area on Burgess Drive, Knoop Drive, Gadd Avenue and Coulterhand Circle, Byford. The closest house is 340m north west of the manufacturing area.
Rural properties	<ul style="list-style-type: none">• Farmhouse within 370m South of the manufacturing area• Three rural residential properties approximately 700m NE of the manufacturing area on Barge Drive, Byford• There are five rural residential properties between 1000m and 1200m SE of the premises, Kiln Road Karrakup There are three properties between 750-900m NE of the manufacturing area on Nettleton Road.
Wildlife Sanctuary	The Cohunu Koala Park is located north of the premises boundary but 1200m from the brick manufacturing area. The wildlife sanctuary contains a range of Australian faunal species including non-indigenous species (koalas) some listed as vulnerable (Baudin's Black Cockatoo) and endangered (Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .

8.3 Specified ecosystems

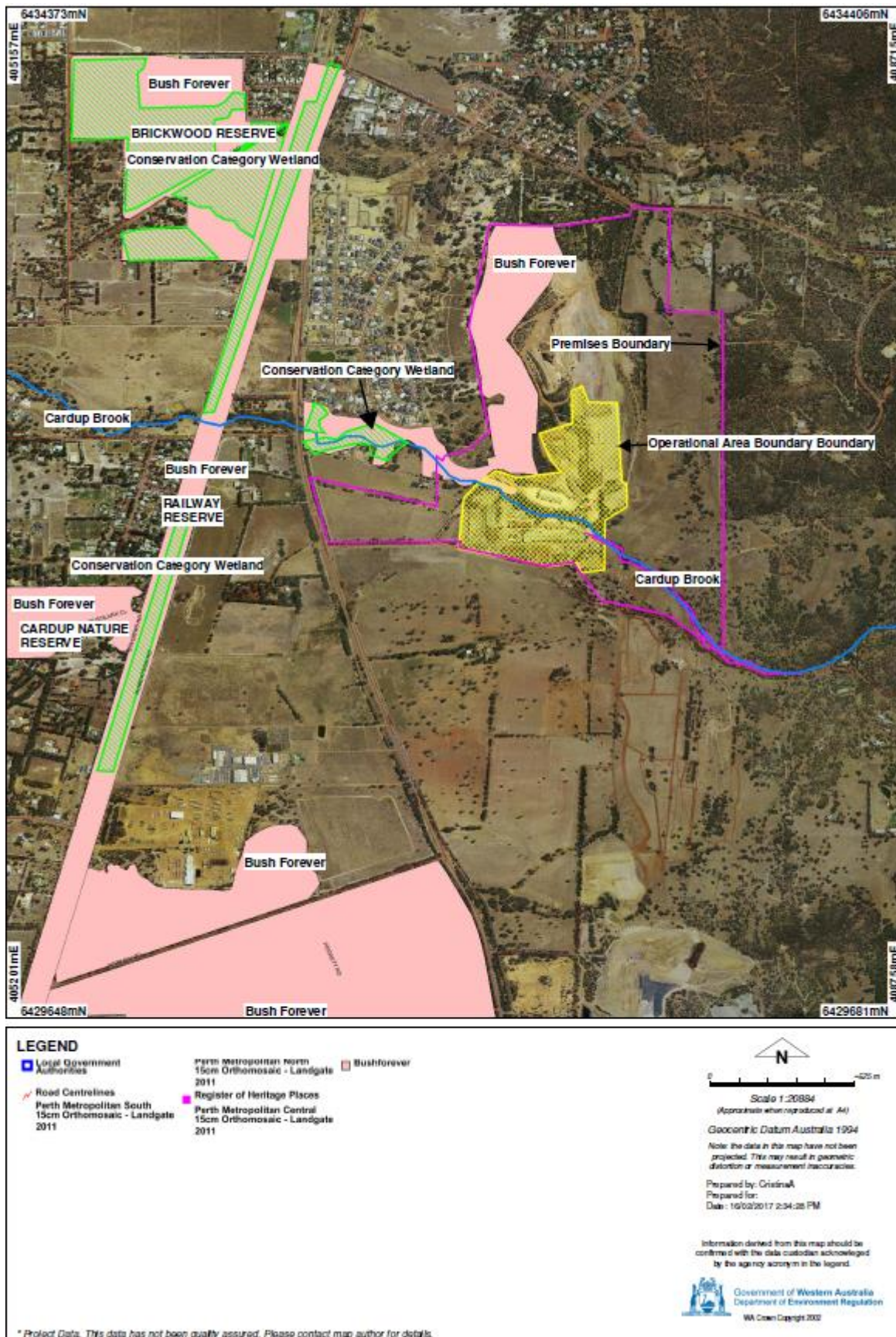
Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or emissions and discharges from the Premises. The distances to specified ecosystems are shown in Table 11. Table 11 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

Table 11: Environmental values

Specified ecosystems	Distance from the Premises
<p>Bush Forever: Regional open space or proposed regional open space</p>	<p>Bush Forever Site 271 lies adjacent to the premises. This site covers a number of land holdings including Lot 101, 10 and 50 which is within the premises boundary to the north of the operational area. Crown Reserve 48455, and part of Lots 801, 1 and 2 to the west of the premises also form part of this Bush Forever site.</p> <p>Within a 2km radius of the premises there are a number of other Bush Forever sites:</p> <ul style="list-style-type: none"> • Brickwood Reserve is Bush Forever site 321: 750m west of the premises boundary and 1400m northwest of the operational area (contains three threatened flora locations listed as priority 3 and 4 flora). • Cardup Nature Reserve is Bush Forever site 352 1250m to the west of the operational area (also Systems 6 Reserve with threatened flora locations listed as priority 2 flora). • Bush Forever Site 350: railway reserve which runs north to south 1000m to the west of the operational area (contains three registered threatened flora locations listed as priority T,T, T flora) • Bush Forever Site 361: 1400m south of the operational area. • Bush Forever Site 354: 1400m south of the operational area.
<p>Green Growth</p>	<p>The Department of Premier and Cabinet proposes new conservation reserves in the Perth and Peel Green Growth Plan for 3.5 million for the Commonwealth to meet its obligations under the <i>Environment Protection and Biodiversity Conservation Act 1999</i>.</p> <p>Bush Forever Sites 321, 350 and 354 have been identified for protection under this plan as they are recognised as having national environmental significance.</p>
<p>Conservation category wetland</p>	<p>410m to the north west of the operational area boundary and associated with a section of Cardup Brook is conservation category wetland reference number: 109778.</p> <p>Between 1100-1500m from the boundary of the operational area are conservation category wetlands associated with Bush Forever sites 321 and 350.</p>
<p>Hydrography WA 250K- Surface Water Polygons (GA2015)</p>	<p>Cardup Brook flows transversely through the premises and separates the brick manufacturing plant from the excavation and materials stockpiling areas.</p>

Specified ecosystems	Distance from the Premises
Threatened / Priority Flora	<p>Brickwood Reserve 750m west of Lot 101 and 1400m from the operational area this site has three threatened flora locations listed as priority 3,3 and 4 (Bush Forever Site 321).</p> <p>Cardup Nature Reserve is 800m west of the premises boundary and 1250m west of the operational area. It contains one location marked with flora granted a priority 2 status (Systems 6 Conservation Reserve ID 235 and Bush Forever Site 352).</p> <p>The Railway reserve lies 450m west of the premises boundary and extends north to south approximately 1000m west of the operational area. His reserve contains three registered threatened flora locations listed as priority T flora.</p>
System 6 Conservation Reserve (M83)	Systems 6 ID 235 (Bush Forever site 352 and contains priority 2 flora) and is located 800m west of the premises boundary and 1250m west of the operational area. This area is also referred to as Cardup Nature Reserve.
Acid sulphate Soils Risk map, Swan Coastal Plain	A small portion of the western edge of Lot 50 and approximately half of Lot 101 within the premises boundary are classified as having a moderate to low acid sulphate soil classification.
<i>Rights in Water and Irrigation Act 1914</i> Groundwater Areas	With the exception of the northeast corner of Lot 101, the premises lie within the geographical extent of the proclaimed Serpentine Groundwater area.
Contaminated Sites – Reported Sites	Lot 50 is listed as possibly contaminated investigation required
Other relevant ecosystem values	Distance from the Premises
Peel Harvey Environmental Protection Policy (EPP)	610m to the west of the operational area and immediately adjacent to Lot 10 the EPP area is the geographical extent to which the environmental quality objectives of the policy are applied. Cardup Brook flows into the EPP area.

Figure 4: Specified Ecosystems of significance within proximity of premises boundary



8.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 12.

Table 12: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
<p>Minor perennial watercourse- Cardup Brook.</p> <p>Cardup Brook is an ephemeral watercourse that traverses through the site from east to west direction.</p> <p>The Brook receives storm water run-off from the premises including from a significant sized drain on the premises. A sedimentation pond within the excavation area feeds the drain.</p>	<p>Cardup Brook lies within the premises boundary adjacent to the operational area. The flows onto the premises from the east and discharges the premises approximately 700m to the west.</p>	<p>Cardup Brook and flows into the Birrega Main Drain which is a tributary of the Serpentine River.</p> <p>Groundwater dependent vegetation lies along either side of the brook within the premises boundary and the vegetation has a moderate conservation value as they reduce turbidity within the brook.</p>
<p>Conservation category wetland- palus plain</p>	<p>Approximately 150m west of the premises boundary and 350m from the operational area.</p>	<p>The palus plain wetland area is part of Cardup Brook and rated with a conservation category management status to reflect the environmental values of Cardup Brook.</p>
<p>Peel Harvey EPP Area-</p> <p>Peel Inlet forms part of the Peel Yalgorup wetland system a high environmental value wetland listed under the RAMSAR Convention for its international significance</p>	<p>610m west of the premises boundary</p>	<p>Surface water flows from Cardup Brook flow into tributaries of the Peel Inlet which is approximately 40km south of the premises.</p> <p>The wetland system has a diverse range of ecosystems with a high environmental value. A number of species are dependent on the wetland during critical phases of their life cycle. Soils within the Peel Harvey EPP area have low nutrient binding properties and the EPP is designed to protect the wetland from eutrophication generated from agricultural activities.</p>
<p>RIWI Act Groundwater Areas- Serpentine Groundwater Area</p>	<p>The premises are located within the Serpentine Groundwater area.</p>	<p>Groundwater is used on site for industrial purposes and is sources from a <i>Byford 3 combined fractured rock aquifer west aquifer</i></p>

8.5 Soil type

Soils on the premises are gravelly sandy clay variable with lenses of silt and gravel. (Coterra Environment 2016)

8.6 Other site characteristics

The locations of other receptors are shown in Table 13.

Table 13: Other landscape features, relevant factors or receptors

Other receptors or areas of concern	Location
Aboriginal site of Significance	<p>There are eight aboriginal sites of significance polygons that fall entirely or partially within the premises boundary.</p> <p>This includes:</p> <ul style="list-style-type: none"> • Site Number 16108: Cardup Brook; • Site Number 16101: Artefacts/ Scatter • Site Number 16100: Artefacts/ Scatter • Site Number 16092: Artefacts/ Scatter • Site Number 16091: Artefacts/ Scatter • Site Number 16090: Artefacts/ Scatter • Site Number 16089: Artefacts/ Scatter • Site Number 16102: Artefacts/ Scatter <p>Cardup Brook is the only Site of Significance that lies within the operational area boundary. There will be no geographical change to land disturbed as part of this Licence and therefore no change to the disturbance to these sites.</p>

9. Risk assessment

9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 14.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 14 below.

Table 14: Identification of emissions, pathway and receptors during operation

Risk Events					Continue to detailed risk assessment	Reasoning	
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts			
Raw material storage	Storage of raw materials and clay	Ambient dust	-26 residential dwellings within 500m (closest 340m) Closest rural dwelling within 370m	Air/ wind dispersion	Amenity impacts Health impacts	Yes	See section 9.4
		Sediment and turbidity contaminated stormwater	Surface water ecosystem – Cardup Brook	Direct discharge	Aquatic ecosystem impacts Beneficial use	Yes	See section 9.7
				No pathway for sediment / turbidity to affect groundwater	None	No	Sediment and turbidity will not impact groundwater. No other contaminants of concern. There are no potential adverse impacts; further risk assessment is not required.

Risk Events					Continue to detailed risk assessment	Reasoning	
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts			
Brick manufacture	Clay Preparation and shaping – Crushing and grinding of raw materials, addition of water and a small amount of other additives such as colourants.	Ambient dust	26 residential dwellings within 500m (closest 340m) Closest rural dwelling within 370m	Air/ wind dispersion	Amenity impacts Health impacts	Yes	See section 9.4
		Noise			Amenity impacts	No	Brick manufacturing activities occur in sheds. Brick storage and vegetation surrounding the Premises provide a noise barrier for nearby receptors. Submitted monitoring and modelling demonstrate compliance with the Noise Regulations. The Noise Regulations will apply.
		Wastewater	Surface water ecosystem – Cardup Brook		Direct discharge	Ecosystem / Environmental impacts	Yes
	Drying – moulded bricks are dried in drying ovens supplied with hot air from the cooling zone of the kiln.	Point source - Waste gases including acid gases, odour, combustion gases and VOCs.	26 residential dwellings within 500m (closest 340m) Closest rural dwelling within 370m	Air/ wind dispersion	Amenity impacts Health impacts	Yes	See sections 9.5
	Vegetation (TEC) adjacent to the premises.		Ecosystem / Environmental impacts		Yes		

Risk Events					Continue to detailed risk assessment	Reasoning
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Firing – Tunnel kiln has differential heating zones with a maximum temperature of approximately 1050C	Point source - Waste gases including particulates, acid gases, odour combustion gases and VOCs.	26 residential dwellings within 500m (closest 340m) Closest rural dwelling within 370m	Air/ wind dispersion	Amenity impacts Health impacts	Yes Combustion gases - No Emissions of NOx and CO from the combustion of natural gases in the kiln are 37 mg/m ³ and 120 mg/m ³ respectively.. NOx emissions are 8% of the limit recommended in the NSW Clean Air Regulations which are appropriate reference values for comparison. Combustion gases are not treated by the scrubber and will not change during bypass. On review of commissioning data, the Delegated Officer does not expect impacts on receptors. Combusting gases will not undergo detailed risk assessment or be subject to licence controls. Acid gases such as HF, HCl and SO ₂ are generated from constituents of the clay during firing and will be assessed in section 9.5 Odour has historically been source of complaints and is further assessed in section 9.6
			Vegetation (TEC) adjacent to the premises.		Ecosystem/Environmental impacts	Yes
Stormwater and wastewater storage	Stormwater from the manufacturing area drains towards and discharges into Cardup Brook	Sediment, wastewater	Surface water ecosystem - Helena River	Direct discharge	Ecosystem / Environmental impacts	Yes Risk of TSS discharge is assessed in section 9.7. Risk of pH, TDS and hydrocarbons are not further assessed because the existing monitoring data indicates that these are not a significant risk.

9.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 15 below.

Table 15: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 16 below.

Table 16: Risk criteria table

Likelihood		Consequence		
The following criteria have been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
			Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	Severe	<ul style="list-style-type: none"> onsite impacts: catastrophic offsite impacts local scale: high level or above offsite impacts wider scale: mid-level or above Mid to long-term or permanent impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are significantly exceeded 	<ul style="list-style-type: none"> Loss of life Adverse health effects: high level or ongoing medical treatment Specific Consequence Criteria (for public health) are significantly exceeded Local scale impacts: permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	<ul style="list-style-type: none"> onsite impacts: high level offsite impacts local scale: mid-level offsite impacts wider scale: low level Short-term impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are exceeded 	<ul style="list-style-type: none"> Adverse health effects: mid-level or frequent medical treatment Specific Consequence Criteria (for public health) are exceeded Local scale impacts: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	<ul style="list-style-type: none"> onsite impacts: mid-level offsite impacts local scale: low level offsite impacts wider scale: minimal Specific Consequence Criteria (for environment) are at risk of not being met 	<ul style="list-style-type: none"> Adverse health effects: low level or occasional medical treatment Specific Consequence Criteria (for public health) are at risk of not being met Local scale impacts: mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	<ul style="list-style-type: none"> onsite impacts: low level offsite impacts local scale: minimal offsite impacts wider scale: not detectable Specific Consequence Criteria (for environment) likely to be met 	<ul style="list-style-type: none"> Specific Consequence Criteria (for public health) are likely to be met Local scale impacts: low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	<ul style="list-style-type: none"> onsite impact: minimal Specific Consequence Criteria (for environment) met 	<ul style="list-style-type: none"> Local scale: minimal to amenity Specific Consequence Criteria (for public health) met

[^] Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting*.

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines*.

"onsite" means within the Prescribed Premises boundary.

9.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 17 below:

Table 17: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

9.4 Risk Assessment – Fugitive dust

9.4.1 Description of fugitive dust emissions

Dust may become airborne and transferred offsite by wind, potentially impacting the amenity or health of nearby sensitive receptors.

9.4.2 Identification and general characterisation of emission

Fugitive dust may be generated from the following activities at the Premises:

- Raw materials storage;
- Crushing and screening of raw materials;
- Dust lift-off from roads and tracks generated by vehicle movement;
- Unloading of clay and raw materials from trucks;
- Dust lift-off from unsealed areas and roadways; and
- Inert waste management.

Crushing and screening may occur at any time and will be dependent to the particular brick being manufactured.

The risk of dust emission will be greater in summer when moisture content of stockpiles is likely to be lower.

9.4.3 Description of potential adverse impact from the emission

Dust has the potential to impact the amenity and health of nearby sensitive receptors particularly residential premises. Particulate matter has the potential to impact public health and affects the respiratory and cardiovascular systems following both long and short term exposures. Long-

term repeated exposure to dust is more detrimental than sporadic short-term exposure.

PM₁₀ and PM_{2.5} particulate matter has the potential to impact health while the main impact of particulate sizes greater than PM₁₀ will be to amenity. Some individuals such as those with heart or lung disease may be more sensitive to the effects of dust on health.

9.4.4 Criteria for assessment

The *National Environment Protection (Ambient Air Quality) Measure* (NEPM) for PM₁₀ and PM_{2.5} is the standard for assessing the impact of dust emissions.

The NEPM does not include a standard for total suspended particulates. Amenity impacts can be assessed as to whether the emission unreasonably interferes with the health, welfare, convenience, or comfort of anyone at receptor locations.

9.4.5 Applicant controls

This assessment has reviewed the controls set out in Table 18 below.

Table 18: Applicant's proposed controls for fugitive dust

Site infrastructure or activity	Controls
Roads and other trafficked areas	Observe speed limits, maintain vegetated areas on site boundaries and a dedicated on-site water tankers.
Unloading of raw materials	Minimise drop heights and cease non-essential operations in periods of high wind.
Clay storage	Outside storage of clays is inside an old clay pit sheltering them from the wind. Sprinklers and tanker mounted jets available to maintain moisture. Clay storage inside clay storage shed.
Crushing and screening of clays for brick making	Conducted in clay grinding sheds
Storage and handling of lime and waste lime for cascade gas scrubber.	Waste lime collected in bags, all spills to be cleaned up.
Waste and reject bricks storage and handling.	Generally not dusty however stockpile management to minimise dust risk. Crushing and recycling through enclosed works.

9.4.6 Consequence

If fugitive dust emissions impacting off-site receptor occur, then the Delegated Officer has determined that the impact of dust will be mid-level impacts on amenity. Therefore, the Delegated Officer considers the consequence of to be **Moderate**.

9.4.7 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of fugitive dust emissions would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of Risk Event 1 to be **Rare**

9.4.8 Overall rating of fugitive dust

The Delegated Officer has compared the consequence and likelihood ratings described above

with the risk rating matrix (Table 10) and determined that the overall rating for the risk of impacts from fugitive dust is **Low**.

9.5 Risk Assessment – Point source acid gas emissions

9.5.1 Description of fugitive acid gas emissions

A mixture of acid gases including hydrogen fluoride (HF), hydrogen chloride (HCl), sulphur dioxide (SO₂) and sulfuric acid mist (SO₃ and H₂SO₄), are released from components in the clay when the bricks are fired.

Acid gases are transported by air through wind and diffusion to potentially impact sensitive receptors.

The quantity and proportional concentration of different acid gases are dependent on the particular brick product being manufactured at the time.

9.5.2 Identification and general characterisation of emission

Measured emission rates and modelled ground level concentrations of acid gases are described in Section 6. Concentrations of the individual acid gases are dependent on the particular brick product being manufactured.

Brick production using a tunnel kiln, is a continuous process and acid gas emissions are uniform or characteristic of the particular type of brick product being manufactured. However the operator has some capacity to control the emission by reducing the rate at which kiln cars are pushed into the kiln.

The Applicant has submitted a by-pass management plan as part of the supporting documentation for the licence. The plan requires the Kiln Operator and the Plant Manager to ensure that the push rate of kiln cars is reduced during a scrubber by-pass to ensure HF emissions are within the limits prescribed by the licence. The plan involves applying a mass balance calculation to the particular product being fired to calculate the HF emissions and adjusting the throughput to ensure compliance with the limit. The plan does not address HCl or SO₂ because the scrubber does not reduce the emissions of these gases.

9.5.3 Description of potential adverse impact from the emission

Acid gases are irritants to nasal passages, the throat and eyes. Prolonged exposure to low concentrations may adversely affect the amenity of people exposed to them. At higher concentrations hydrogen fluoride (HF) and hydrogen chloride (HCl) can cause coughing and respiratory damage.

Sulphur dioxide (SO₂) is an irritant to people because it is oxidized in the atmosphere to form sulphur trioxide (SO₃) which may then react with moisture to form sulfuric acid mists. At higher concentrations the health effects of the oxides of sulphur are similar to HCl and HF.

Vegetation exposed to acid gases may suffer damage to foliage. Some plants are particularly sensitive to hydrogen fluoride and this sensitivity starts at very low concentrations. Injury to native plants species has been observed at levels between 0.6-1µg/m³. (National Goals for Fluoride in Ambient Air and Forage, 1990 (ANZECC Air Quality Goal)). Grape vines are also extremely sensitive to HF and should not be planted in close proximity to a brickworks.

The Works Approval Decision Document noted that previous surveys had found that visible injury attributable to hydrogen fluoride but, this was only evident within Austral Bricks' property. The Applicant has committed to conducting additional vegetation surveys during the first 12 months of re-commissioning and operation of the plant.

The Applicant's supporting documentation for Works Approval W5925/2015/1 stated the following emission concentrations were achievable:

- HF 1g/s (130 mg/m³ at 18% O₂);
- HCl 200 mg/m³ at 18% O₂; and
- SO₂ 200 mg/m³ at 18% O₂.

Predicted ground level concentrations complied with DoH guideline values at these emission concentrations.

9.5.4 Criteria for assessment

The WA Department of Health (DoH) developed an ambient guideline for acid gases in 2007. The criteria of 100µg/m³ as a 24-hour average and 500µg/m³ as a 10 minute average apply to the sum of hydrogen chloride, hydrogen fluoride and sulfuric acid mist. These ambient criteria are set at a limit designed to protect human health. In October 2017, DWER requested confirmation from DoH on appropriate individual criteria. DoH advised that appropriate health based guidelines are as follows:

- HCl 100µg/m³ as a 24-hour average;
- HF 100µg/m³ as a 24-hour average; and
- Any acid gas is 500µg/m³ as a 10-minute average.

The *National Environment Protection (Ambient Air Quality) Measure* (NEPM), 2003 sets a maximum ambient concentration for sulphur dioxide (SO₂). The prescribed standard is 0.20ppm as a 1-hour average, 0.08ppm as a 1-day average and 0.02ppm as a 1-year average. These are Australian national standards designed to achieve an ambient air quality that allows for adequate protection of human health and wellbeing.

9.5.5 Applicant controls

This assessment has reviewed the controls set out in Table 19 below.

Table 19: Applicant’s proposed controls for fugitive acid gas emissions

Site infrastructure or activity	Controls
Cascade Lime Scrubber	All kiln emissions from hot zones of the Kiln to be directed through scrubber. Scrubber to be maintained.
Emissions of fluoride during Cascade Lime Scrubber By-pass	Mass balance calculation to determine appropriate kiln car push rate to comply with emission limits.
Control of emissions by control of kiln car push rate	Mass balance calculation to ensure that HCl emissions comply with limits.

9.5.6 Key findings

The Delegated Officer has reviewed the information regarding fugitive acid gas emissions and has found:

1. The cascade lime scrubber does not reduce emissions of HCl and SO₂.
2. Health guidelines are not exceeded at sensitive receptors when proposed emission limits are met.
3. The operator can control emissions by controlling the throughput of the kiln.
4. The risk of adverse impact from SO₂ is low and the control will be emissions monitoring

9.5.7 Consequence

If acid gas emissions impacting sensitive receptors occur, then the Delegated Officer has determined that the impact will be low level impacts to amenity. Therefore, the Delegated Officer considers the consequence of acid gas emissions is **minor**.

9.5.8 Likelihood of Risk Event

The Delegated Officer has determined that the impacts from acid gas emissions will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of adverse impacts from acid gas emissions to be **unlikely**.

9.5.9 Overall rating of fugitive acid gas emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of impacts from acid gas emissions to be **medium**.

9.6 Risk Assessment – Odour

9.6.1 Description of point odour emissions

Odours are generated by the firing of bricks in the kiln and maybe present in kiln exhaust stack emissions. A characteristic burnt sugar odour can be present because sugar is used as part of the manufacturing and moulding process. This odour can be accompanied by acid gases giving it a sharp slightly irritating tone.

9.6.2 Identification and general characterisation of emission

The burnt sugar odour emission will occur continuously while products using sugar are fired. However the odour will only impact sensitive receptors during specific weather conditions. When odours have been caused in the past brickworks have been able to ameliorate the problem by using pure grades of sugar and not sources such as waste molasses.

9.6.3 Description of potential adverse impact from the emission

Odour potentially has an impact on the amenity and welfare of sensitive receptors. The potential for nuisance is dependent not only on the intensity of the odour but on the time and location that exposure to odour occurs.

9.6.4 Criteria for assessment

The general provisions of the EP Act make it an offence to cause or allow unreasonable emissions which includes emissions of odour that unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person.

9.6.5 Applicant controls

The Applicant advised in that historical odour complaints for the Cardup Brickworks occurred before 2010 when the plant was using molasses and that the management plan for the premises now requires that only pure sugar is used.

9.6.6 Consequence

If odour occurs, then the Delegated Officer has determined that the impact of odour will be a low level impact to amenity on a local scale. Therefore, the Delegated Officer considers the consequence of odour to be **minor**.

9.6.7 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of odour impacts occurring will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of Risk Event 1 to be **unlikely**.

9.6.8 Overall rating of point source acid gas emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of odour is **medium**.

9.7 Risk Assessment – Contaminated stormwater

9.7.1 Description of contaminated stormwater

All wastewater generated by brick manufacturing is re-introduced back into the process, creating a closed system.

Stormwater may be contaminated by exposed stockpiles of clay and other raw materials or waste products from brick manufacture. Raw materials are stored on in-situ soils within the disused clay pit on site.

Stormwater from the processing area generally flows

9.7.2 Identification and general characterisation of emission

Contaminated stormwater is likely to consist of suspended solids of high turbidity from easily dispersing clays. Containing components naturally occurring in such as trace metals and salts. These contaminants are present in the clays stored on site.

9.7.3 Description of potential adverse impact from the emission

Inadequate control of stormwater run-off from the Premises may cause turbid water discharge to Cardup Brook. Turbidity and sediment can harm fish, crustacean and other aquatic life by preventing photosynthesis and thereby reducing food supply. Suspended solids can also affect gill function.

Turbid water discharges also significantly degrade the aesthetic value of watercourses and wetlands.

9.7.4 Criteria for assessment

Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000 (ANZECC Guidelines), are designed to protect freshwater and marine ecosystems.

ANZECC Guidelines provide trigger values for physical and chemical stressors on slightly to moderately disturbed ecosystems. They also provide guidelines for recreational water quality and aesthetics.

9.7.5 Applicant controls

The works approval required an updated Stormwater Management Plan be prepared and submitted including calculations of retention capacity of ponds and sediment traps and catchment areas within the plant, and locations of engineered discharge points to Cardup Brook.

The plan was prepared by Coterra Environment and submitted in July 2016 and provides a historical assessment of surface water monitoring discussed in Section 6.4.

The clay storage in the extraction area is not part of 2016 management plan but is addressed in an earlier plan, also prepared by Coterra Environment submitted in 2011 when the area was still operating under an Extractive Industries Licence.

The site stormwater strategy seeks to minimize stormwater discharge to Cardup Brook and provide a high level of water quality where discharge occurs. A site plan provided in the Management Plan showing drainage swales on the manufacturing area and discharge points to Cardup Brook is depicted in Figure 5.

A second plan depicting proposed storage areas is shown in Figure 6.

The former clay extraction area contains a large settlement basin at the centre of site and 6 smaller basins. The main basin has a capacity of approximately 30,500 m³ and there is an additional 4,000 m³ in the other basins. If the main basin overflow in periods of high rainfall it will drain via a gully running roughly northeast to south west on the western side of the premises and discharging near point A in Figure 6. The gully is traversed by V-notch weirs to remove coarser particles and vegetated to filter finer suspended solids. Historical monitoring shows that discharges to Cardup Brook from the excavation area are rare with most water that isn't used on site will either evaporate or infiltrate. The monitoring also showed that TSS with the discharge gully is low if the gully is maintained. The applicant has also indicated that flocculants will be used if a discharge from the main basin is to occur as required by a previous Extractive Industries Licence granted by the Shire of Serpentine Jarrahdale.

The Applicant's proposed management actions to prevent discharge of suspended solids from the manufacturing area to Cardup Brook are:

- sweeping of bitumen paved areas;
- annual sediment removal from swales, open channels and sediment ponds;
- cattle grids in material movement areas to shake down vehicles
- retention of 10 year 2 hour ARI event;
- filtration of pollutants provided by vegetated water storage areas;
- rock pitching (or similar) to prevent erosion of discharge points;
- water quality monitoring for TSS and turbidity; and;
- annual review of controls to determine effectiveness of stormwater management.

The management plan includes trigger levels for TSS and turbidity. The trigger level for TSS are:

where the upstream concentration is higher than 25 mg/L then downstream levels must not exceed upstream levels by greater than 10%, and where the upstream concentration is less than 25 mg/L then the downstream concentration must not exceed 25 mg/L.

The trigger levels for turbidity are taken from ANZECC Guidelines 2000 and are defined:

If upstream turbidity units are higher than 20 NTU then downstream turbidity levels must not exceed upstream levels by greater than 10% and if upstream levels are less than 20 NTU then downstream must not exceed 20 NTU.

Comment from the then Department of Water which replied on 1 March 2017 stating that they were satisfied with the management plan and recommending that monitoring and trigger levels outlined in the plan be implemented as conditions of licence.

9.7.6 Key findings

The Delegated Officer has reviewed the information regarding contaminated stormwater and has found:

1. Historical monitoring data shows suspended solids being discharged to Cardup Brook from the site.
2. There was a substantial reduction in the discharge after the plant went into care and maintenance in May 2012.
3. Effectiveness of management controls has not yet been demonstrated and monitoring will be required in the new licence.

9.7.7 Consequence

If contaminated stormwater run-off occurs, then the Delegated Officer has determined that there will be low level impacts on a local scale. Therefore, the Delegated Officer considers the consequence of contaminated stormwater runoff to be **moderate**.

9.7.8 Likelihood of Risk Event

The Delegated Officer has determined that with Cardup Brook running through the site and stormwater discharging to the brook from parts of the site, contaminated stormwater runoff could occur at some time. The Delegated Officer therefore considers that the likelihood of contaminated stormwater run-off is **possible**.

9.7.9 Overall rating of contaminated stormwater

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of contaminated stormwater runoff is **medium**.

Figure 5: Drainage catchments, swales and discharge points to Cardup Brook

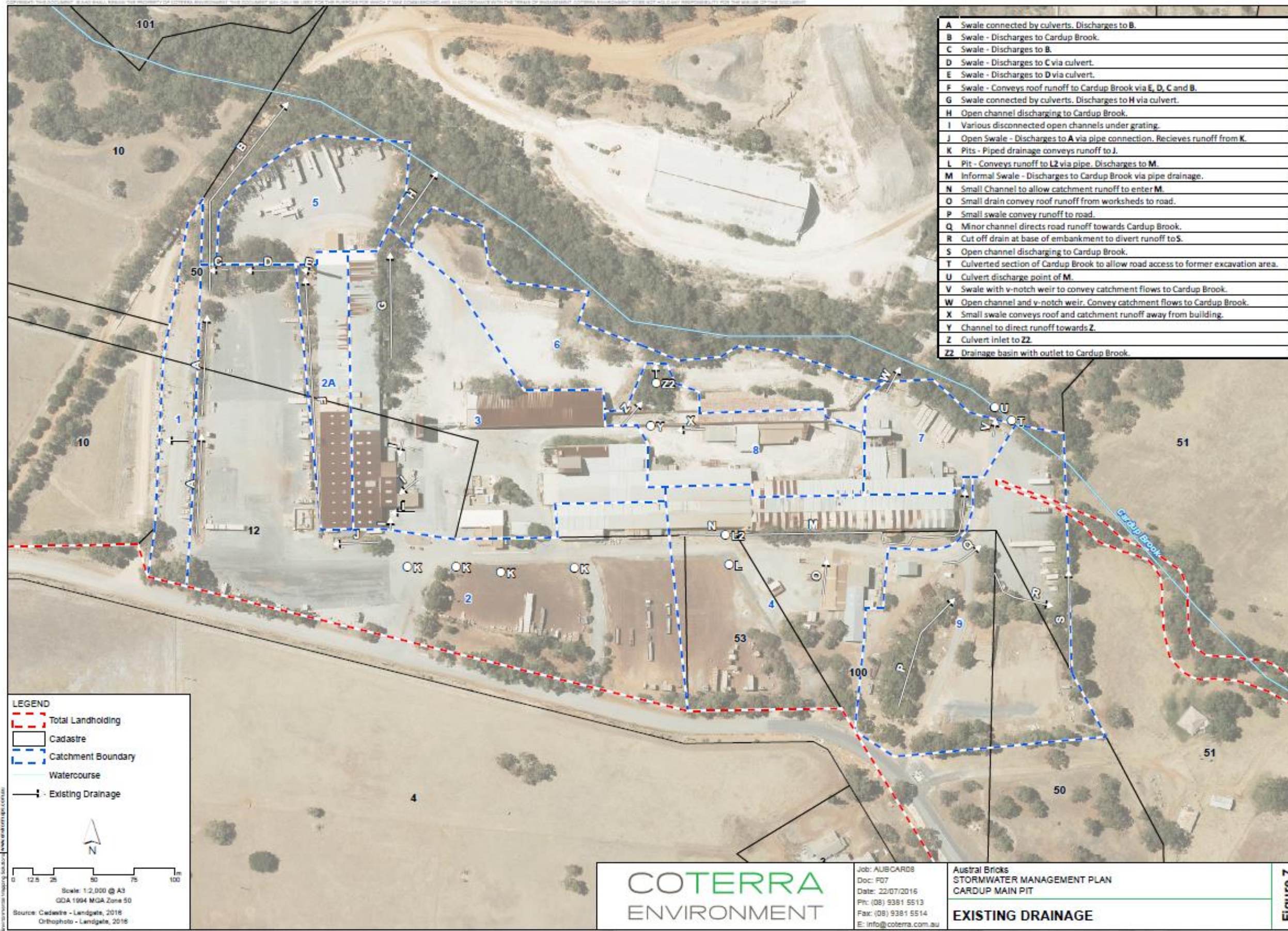


Figure 6: Management Plan storage areas and points of direct discharge of stormwater to Cardup Brook

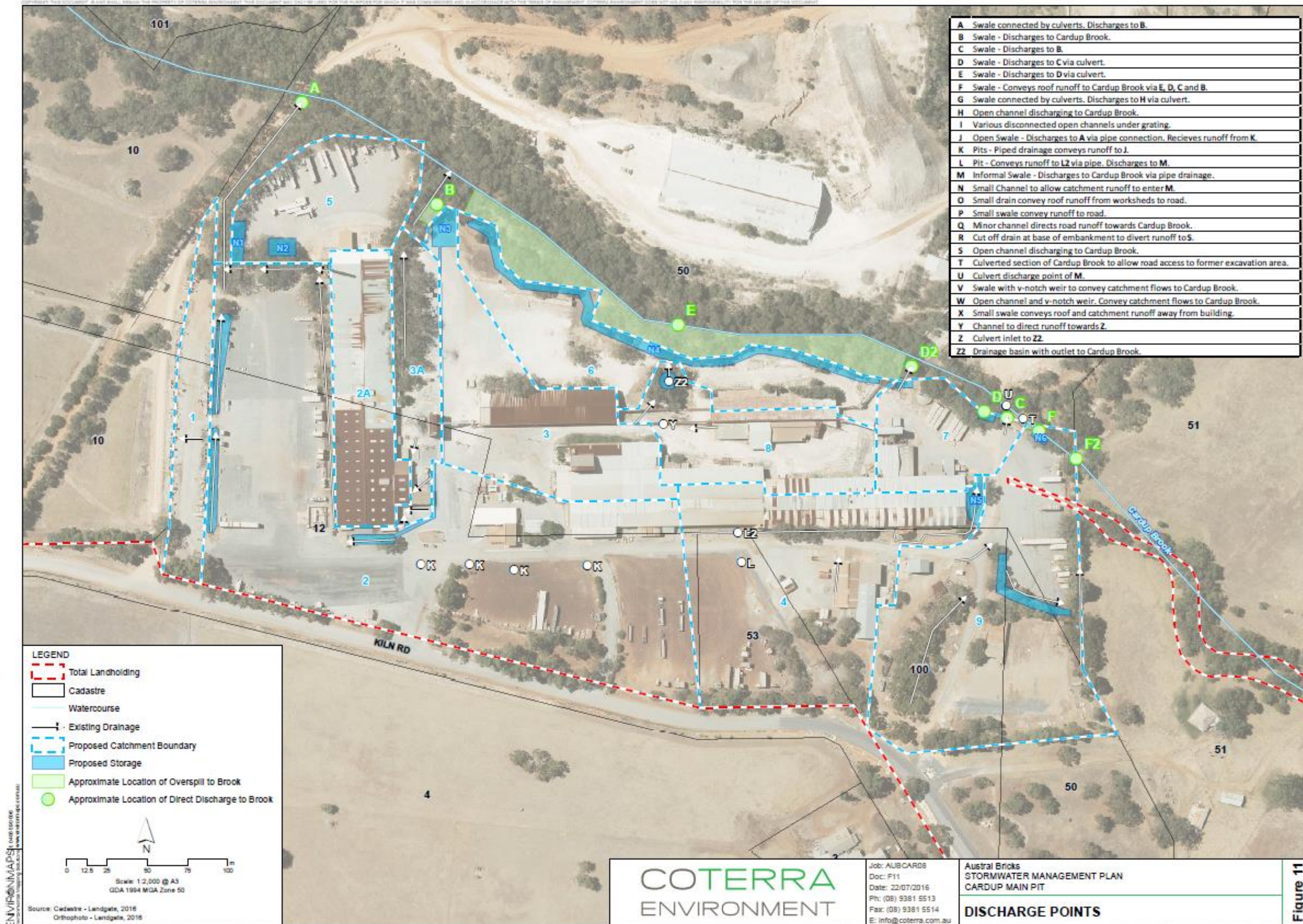


Table 20: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	Source	Pathway/ Receptor (Impact)			
1.	Fugitive Dust	Raw material stockpiles, crushing and grinding, unloading, lift off from unsealed areas and roads, inert waste management	Air/wind to sensitive receptor causing health or amenity impacts	Dust Management Plan - water cart, speed limits on site, cessation of non-essential operations during excessively windy conditions	Moderate consequence Rare likelihood Low Risk	Acceptable subject to proponent controls and licence conditions
2.	Point source and fugitive emissions including particulates, acid gases and odour	Kiln exhaust stack, hot exhaust stack, dryer exhaust stacks and door openings	Air/wind to sensitive receptor causing health or amenity impacts.	Cascading lime Scrubber on kiln exhaust stack Management Controls – adjustment of push rate during bypass and balance of air flows throughout the kiln.	Minor consequence Unlikely Medium risk	Acceptable subject to proponent controls and licence conditions – monitoring required
3.	Contaminated stormwater discharged off site	Stockpiles, water course crossovers, stormwater retention areas runoff from paved areas	Direct discharge offsite to land or Cardup Brook	Infrastructure – catchment and settlement ponds	Minor consequence Possible Medium Risk	Acceptable subject to proponent controls and licence conditions – monitoring required

10. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 21. The risks are set out in the assessment in section 9 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the *Licence Holder*. The conditions of the Licence will be set to give effect to the determined regulatory controls.

Table 21: Summary of regulatory controls to be applied

		Controls (references are to sections below, setting out details of controls)			
		Infrastructure and equipment	Monitoring	Specified action	Reporting
Risk Items (see risk analysis in section 9)	1. Fugitive dust from stockpiles and transfer of raw materials	●		●	
	2. Point source emissions from Kiln Exhaust Stack	●	●	●	●
	3. Fugitive emission and odour impacts			●	
	4. Contaminated stormwater causing an offsite impact	●	●	●	●

10.1 Licence controls

10.1.1 Dust infrastructure and equipment

Environmental controls based on the Licence Holders Dust Management Plan and DWER's assessment of dust generating activities which pose a risk to nearby receptors.

The following conditions are included on the licence:

- Infrastructure and equipment should be maintained and operated onsite for dust management;
- Minimise drop heights and cease non-essential operations in periods of high wind;
- Crushing and screening conducted in Clay Storage Shed;
- Water sprays or other dust suppressant to be used on operational unsealed areas;
- Waste lime collected in bags, all spills to be cleaned up; and,
- Clay storage in designated areas with dust suppression using water available

10.1.2 Emission control infrastructure and equipment

Limits

The waste gas stream generated during the brick manufacturing process requires treatment for acid gases and particulates. Treatment of acid gas emissions inherently minimises the risk of point source odour emissions from the Premises. The Cascade Lime Scrubber installed at the Premises is designed to maintain emissions of HF below the licence limits but does not reduce HCl and SO₂ greatly. Licence limits have been set for emissions from the Kiln Exhaust Stack to ensure emissions are maintained at acceptable level. The prescribed limits are:

Discharge Point	Parameter ¹	Averaging Period	Limit
Kiln Exhaust Stack	HCl	1-hour	200 mg/m ³
	HF	1-hour	1 g/s
	PM	1-hour	50 mg/m ³

The Licence limits are based on modelled predictions of ground level concentrations and DoE 2005 brickwork emissions policy.

Investigations

Analysis of the submitted modelling showed a lack of clarity and terminology and did not include a consideration of acid gas emissions from the dryer stacks. The Applicant is required to provide updated modelling to resolve these issues.

10.1.3 Stormwater infrastructure and equipment

The premises have a watercourse running through the centre which is potentially impacted by the activities on site. Stormwater infrastructure is to be maintained.

10.1.4 Specified actions

Bypass Events

The cascade lime scrubber is only rarely going to be bypassed and in the event of a bypass lasting longer than 30 minutes the operator is required to use adjustments to the kiln car push rate to achieve compliance with the emission limits.

10.1.5 Monitoring requirements

Quarterly stack testing is prescribed for emissions to air.

Monitoring of upstream and downstream water quality of Cardup Brook is required.

10.1.6 Monitoring reports

The Licence Holder is required to complete an Annual Environmental Report and Compliance Report against the conditions of licence. These are standard reporting requirements which enable the Department to assess compliance and determine ongoing suitability of regulatory controls.

10.2 Determination of Licence conditions

The conditions in the issued Licence in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the issued licence expires in 20 years from date of issue.

Table 20 provides a summary of the conditions to be applied to this licence.

Table 22: Summary of conditions to be applied

Condition Ref	Grounds
Environmental compliance Condition 1	Environmental compliance is a valid, risk-based condition to ensure appropriate linkage between the licence and the EP Act.
Infrastructure and equipment Condition 2	This condition are valid, risk-based and contain appropriate controls.
Materials handling Conditions 3 and 4	These conditions are valid, risk-based and contain appropriate controls.
Discharges to Air Conditions 5 to 13	These conditions are valid, risk-based and contain appropriate controls.
Ambient monitoring of surface Water Condition 14 and 15	This condition is valid, risk-based and consistent with the EP Act.
Record keeping Conditions 16 and 17	These conditions are valid and are necessary administration requirements to ensure compliance.
Investigation Conditions 18, 19 and 20	These conditions are valid, risk-based and consistent with the EP Act.
Reporting Conditions 21 to 24	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the licence under the EP Act.

11. Applicant's comments

The Applicant was provided with the draft Decision Report and draft Licence on 22 March 2019. The Applicant provided comments on 17 April 2019 and after a meeting with DWER on 2 May 2019 supplied further comments and additional emissions data on 29 May 2019. The Applicants comments are summarised, along with DWER's response, in Appendix 2

12. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

This assessment was also informed by a site inspection by DWER officers on 12 October 2018.

Based on this assessment, it has been determined that the Issued Licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Paul Byrnes

MANAGER, PROCESS INDUSTRIES

Delegated Officer under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	Availability
1.	Austral Bricks Pty Ltd Application for a Licence	DWER records A1355784
2.	Works Approval W5925/2015/1	DWER records A1041135
3.	Shire of Serpentine Jarrahdale advice regarding planning status of premises	DWER records A1374315
4.	Austral Bricks Bellevue Environmental License Improvement Program – IR3 and IR4	DWER records A1589339
5.	Stormwater Management Plan Cardup Brickworks, Byford Coterra Environment July 2016	DWER records A1367688
6.	Email from applicant and attached report: Stormwater Discharge Assessment Report Austral Bricks – Cardup Main Pit Coterra Environment March 2011	DWER records A1747991
7.	Letter from Department of Water regarding stormwater management and Cardup Brook	DWER records A1386073
8.	Department of Environment Updated Brickworks Emissions Policy Position April 2005	DWER records A686888
9.	Health Department advice letter 6 April 2009 – Ambient Guidelines for Acid Gas	DWER records A1151316
10.	Health Department advice email 23 October 2017 – RE: DoH advice regarding acid gas assessment criteria	DWER records A1571015
11.	Letter L9025/2017/1 – Draft Instrument and Decision Report	DWER records DWERDT153668
12.	Letter L9025/2017/1 Cardup Brickworks Additional Information received 29 May 2019	DWER records A1715633
13.	DER, July 2015. <i>Guidance Statement: Regulatory principles.</i> Department of Environment Regulation, Perth.	accessed at www.dwer.wa.gov.au
14.	DER, October 2015. <i>Guidance Statement: Setting conditions.</i> Department of Environment Regulation, Perth.	
15.	DER, August 2016. <i>Guidance Statement: Licence duration.</i> Department of Environment Regulation, Perth.	
16.	DER, February 2017. <i>Guidance Statement: Risk Assessments.</i> Department of Environment Regulation, Perth.	
17.	DER, February 2017. <i>Guidance Statement: Decision Making.</i> Department of Environment Regulation, Perth.	

Appendix 2: Summary of applicant's comments on risk assessment and draft conditions

Condition Draft/Final	Summary of Applicant comment	DWER response
Applicant's comments received 17 April 2019		
1	Delete reference to vestibule exhaust because kilns at Cardup do not have vestibule.	Agreed
2	Delete reference to vestibule in infrastructure table. Clarify that the clay shed is included in the clay storage area. Clarify that product shaping does not occur in clay preparation area.	Agreed, wording has been changed.
3	Is not practicable to keep active face of clay stockpile to 2 metres or less because of the need to stockpile enough clay in the dry months to last through wet months.	Agreed condition has been deleted.
4 /3	Correct wording of Condition 4 from non-operational unsealed areas to operational unsealed areas	Agreed
7/6 and 8/7	Conditions require that kiln car push rates are adjusted to ensure that licence limits for HCl and SO ₂ are met based on a mass balance calculation for the particular bricks being produced. There is no limit for SO ₂ . Condition is unclear as to whether push rates are applicable during standard operations of scrubber bypass.	The Delegated officer has agreed to remove this condition requiring a calculation of mass balance for HCl after considering the lower emissions in the stack testing results submitted on 29 May 2019 showing emissions will meet proposed limits in Condition 7.
9/8	The averaging period for the limits is not consistent with the requirements specified in Schedule 3 Table 9. Averaging period should be amended to 30 minutes for HF and HCl	Agreed averaging periods have been amended.
18/16	Clarify the meaning of the investigation by amending "from the scrubber" to "from the kiln stack exhaust under normal operating conditions" Remove reference to proposed dryer stacks because while they have been discussed with DWER no final decision has been made to install additional dryers and stacks	Agreed wording has been changed

Condition Draft/Final	Summary of Applicant comment	DWER response
20	<p>The intent of the condition is unclear. The works approval was extended to investigate apparent inefficiency of the scrubber and the final two rounds of emissions testing has demonstrated that the scrubber is working as intended for HF and ongoing monitoring will ensure the continued efficient operation of the scrubber.</p> <p>An additional submission from the Applicant on 29 May 2019 advised that the apparent increase in HCl across the scrubber was due to sampling problems for pre-scrubber sample because the sample location is not compliant with AS4323.1.</p>	<p>The Delegated Officer has agreed to delete this condition because more recent testing results submitted on 29 May 2019, indicates that HCl emissions are within guidelines.</p>
23/19 and 25/21	Request that reporting periods align with other licences held by the Applicant	Agreed
25/23	Correct cross reference conditions relating to reporting	Agreed
Table 9	<p>Remove H₂SO₄ from Table 9 to be consistent with Table 4</p> <p>Change 30 minute averaging period to 30 minute minimum for HF and HCl.</p>	<p>Agreed in part, both tables amended to say total oxides of sulphur as SO₂ consistent with other brickworks licences. Averaging period has been amended.</p>
Applicants comments received 29 May 2019		
14/12	Wording of required frequency for surface water monitoring is not practical. Amend the condition to undertake monitoring in May, June, July and August and at other times during high rainfall events where there is a potential for offsite discharge.	Agreed.
Conditions relating to investigations into air emissions	Amend dates where appropriate to allow for the additional consultation time.	Agreed

Attachment 1: Issued Licence L9025/2017/1