

APPENDIX F – DUST MANAGEMENT PLAN



SERS
Site Environmental and
Remediation Services

DUST MANAGEMENT PLAN FOR SAND AND CLAY EXTRACTION

LOTS 5 & 6 (NO. 1728) GREAT NORTHERN HIGHWAY,
BULLSBROOK, CITY OF SWAN

DECEMBER 2017



BRIKMAKERS

PREPARED FOR:

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CONTENTS

EXECUTIVE SUMMARY	v
1 INTRODUCTION	1
1.1 PURPOSE	1
1.2 EPA OBJECTIVE.....	1
1.3 RELEVANT LEGISLATION, POLICY AND GUIDELINES	1
2 SITE BACKGROUND	2
2.1 SITE HISTORY	2
2.2 SOILS	2
2.3 CLIMATE	2
2.4 TOPOGRAPHY	4
2.5 SENSITIVE RECEPTORS	5
3 PROPOSED WORKS AND POTENTIAL IMPACTS	6
3.1 SOURCES OF DUST	6
3.2 POTENTIAL IMPACTS OF DUST.....	6
3.3 ASPECT AND IMPACT ANALYSIS	8
4 DUST MONITORING PROGRAM.....	10
4.1 MONITORING METHODS.....	10
4.2 PERFORMANCE CRITERIA	10
5 DUST MANAGEMENT PROGRAM	12
5.1 SUMMARY OF DUST MANAGEMENT REQUIREMENTS	12
5.2 SUMMARY OF DUST MANAGEMENT CONTROLS	16
5.3 RELEVANT STAKEHOLDERS	16
5.4 ROLES AND RESPONSIBILITIES.....	16
5.5 COMPLAINTS MANAGEMENT	17
6 CONCLUSION	17
7 REFERENCES	17
Figure 2 – Site Location	19
Figure 3 – Surrounding Land Uses.....	20
Figure 4 – Site Layout.....	21
Figure 5 – Sensitive Receptors and Buffer Distances	22
APPENDIX A - Risk Matrix.....	23
Risk Treatment Table	25
APPENDIX B – Wind Roses for Summer and Winter	26
APPENDIX C – Dust Incident Register	27

ABBREVIATIONS:

ABS	Australian Bureau of Statistics
SERS	Site Environmental Remediation Services Pty Ltd
DEC	Department of Environment and Conservation
DER	Department of Environmental Regulation
DMP	Dust Management Plan
EPA	Environmental Protection Authority
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection (Ambient Air Quality) Measure
DMIRS	Department of Mines, Industry Regulation and Safety
PM	Particulate Matter

EXECUTIVE SUMMARY

This Dust Management Plan has been generated in support of an application to approve the extraction of Sand and Clay from 1729 (Lots 5 & 6) Great Northern Highway, Bullsbrook. The proponent, Brikmakers, are leasing the site and seek relevant permissions and approvals to extract the abundant sand and clay resource from the site.

This application examines the aspects and impacts of the proposed extraction operations in relation to dust generation.

The site is located in a rural location beyond the suburban fringe of the Perth Metropolitan Area. The site is not presently used for an active rural purpose and there is no residential dwelling currently within the property.

There are eight sensitive receptors in a 500m radius of the site boundary. Two of these receptors are categorised as caretaker's residences' due to the nature of the premise.

SERS has provided Brikmakers with a series of management methods that aim to reduce the generation of dust to an acceptable limit, following standards outlined in the *Environmental Protection Act 1986*.

1 INTRODUCTION

1.1 PURPOSE

This Dust management plan has been generated by Site Environmental and Remediation Services (SERS) on behalf of Brikmakers Pty Ltd in support of the development application to approve sand and clay extraction on Lots 5 & 6 (1728) Great Northern Highway, Bullsbrook (Figure 2). The site and surrounding areas have been historically cleared, and are classified as 'rural' under the Metropolitan Regional Scheme (MRS) (refer to Figure 3 for MRS zoning).

Brikmakers are a major brick manufacturer in the Perth Metropolitan area. The use of resource from this site will provide a portion of the required resources to facilitate ongoing brick manufacturing. The site will be managed in accordance with Brikmakers management procedures used on similar sites and to industry best practises.

The standard Brikmakers process comprises the periodic excavation of material which is then appropriately stockpiled onsite. Sand that is extracted from the site will not be stockpiled and instead, carted out to immediate projects. Brikmakers is applying for License and Planning approval for sand and clay extraction for a period of 10 years.

The proposed extraction area is included in the Western Australian Planning Commissions (WAPC) Statement of Planning Policy No.10. Basic Raw Materials, as a Priority Resource Location.

This document outlines the proposed works, risks associated and the dust management controls to be implemented in conjunction with this project.

1.2 EPA OBJECTIVE

The EPA's environmental objective for the factor Air Quality is: "To maintain air quality and minimise emissions so that environmental values are protected" (EPA, 2016).

1.3 RELEVANT LEGISLATION, POLICY AND GUIDELINES

Relevant Legislation, guidelines and policies to the Dust Management Plan are as follows:

Legislation:

- National Environmental Protection (Ambient Air Quality) Measure 1994
- Environmental Protection Act 1986

Guideline:

- A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (DEC, 2011)
- Environmental Factor Guideline – Air Quality (2016)

Policy:

- Formerly the Shire of Swan (currently the City of Swan) By-law Relating to Extractive Industries (1982)

2 SITE BACKGROUND

2.1 SITE HISTORY

The site is located approximately 30 kilometres from the Perth CBD and is bounded by Walyunga Road to the north and Great Northern Highway to the west. Vehicle access to the site is via Great Northern Highway and Walyunga Road (Figure 4).

The site was historically used for the grazing of cattle. Therefore, the majority of the site has been previously cleared of vegetation. Several stands of native trees are located mostly to the west of Lot 5 and to the north of Lot 6. The remainder of the site consists of cleared paddock (grassed) areas. Several trees have been planted in the southern portion of the site. One small dam is located near the western boundary of the site. However, this dam does not contain surface water and will not be used as part of the project activities. There is a shed with a building attached which is located in the southern part of the site. The shed and building will be retained for use by a caretaker (Figure 4).

2.2 SOILS

The site is located within the Pinjarra Zone (Map Unit 213) (DPIRD, 2017). The Pinjarra Zone consists of alluvial deposits between the Bassendean Dunes Zone and the Darling Scarp, colluvial and shelf deposits adjacent to the Darling Scarp. Soils of the Pinjarra Zone are often described as clayey to sandy alluvial soils with wet areas (DPIRD, 2017).

Soils in the project area are part of the Forrestfield System (Map Unit 213Fo) (DPIRD, 2017). The Forrestfield System is described as undulating foot slopes of the Darling and Whicher Scarps. The soils of the project area are described as duplex, sandy gravels, pale deep sands and grey, deep sandy duplexes (DPIRD, 2017). These soils are sometimes considered to be alkaline (DPIRD, 2017). Soils in the project area may also be described as semi-wet to wet soils, with grey deep or pale deep sands and loams (DPIRD, 2017). As the majority of the overlying soils are sandy and free-draining, there is an extremely low probability of occurrence of acid sulphate soils (CSIRO, 2017).

Landforms of the Bullsbrook area are described as coastal plain with swamps and low slopes of <10% gradient (DPIRD, 2017). The geology of the site consists of unconsolidated sediments over sedimentary rocks (DPIRD, 2017).

2.3 CLIMATE

The distribution and frequency of dust emissions is dependent on climate and wind conditions of the area. Perth weather is described as a Mediterranean climate, experiencing cold, wet winters and hot, dry summers (ABS, 2012). Dust lift is known to be more prevalent in hot, dry conditions.

Pearce RAAF base (site number 009053) is the closest BOM weather station, and sits approximately 8km north-east from the site. The site has been recording data from 1937. Annual recorded rainfall ranges between 348.2mm and 985.2mm (BoM, 2017). The mean annual rainfall over the duration of the data collection (1937-2017) is 653.1mm (BoM, 2017).

The mean 9am wind speed annually is 14.2km/h, highest wind speeds are seen in the summer months from November – March (Refer to Figure 1A) (BoM, 2017). The mean 3pm wind speed



is 17.7km/h, the highest wind speeds at 3pm are in the summer between November – February (Refer to Figure 1B) (BoM, 2017).

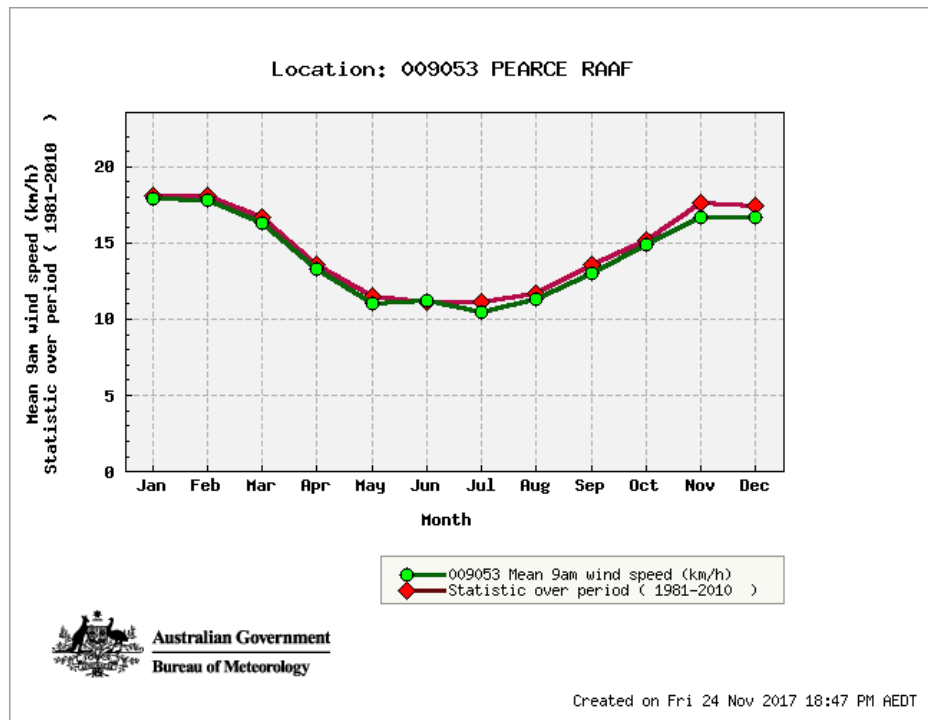


FIGURE 1A: MEAN 9AM WIND SPEED DATA FROM PEARCE RAAF BASE (BoM, 2017)

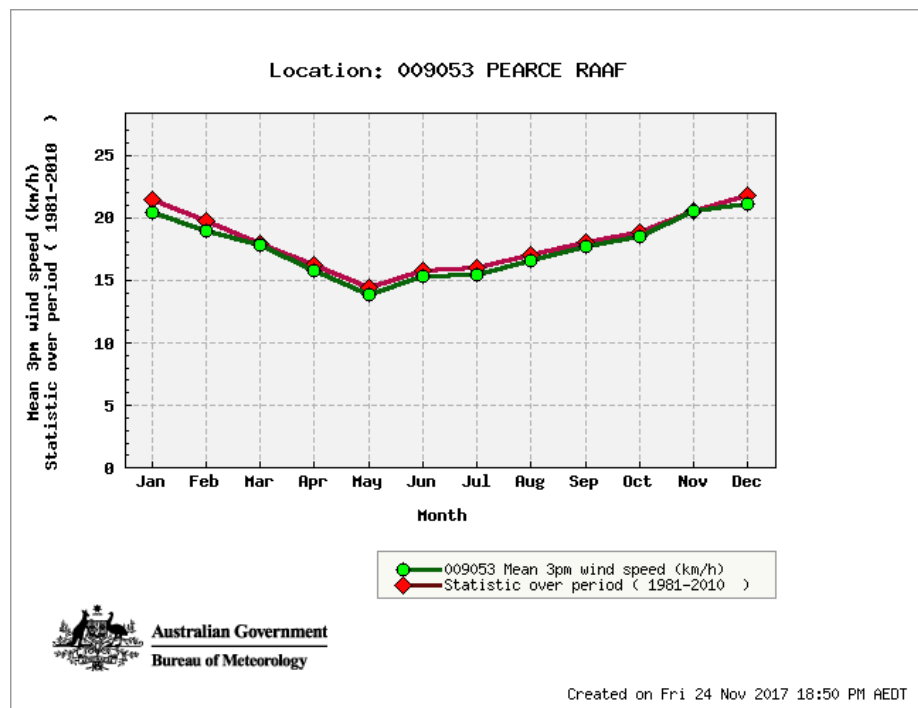


FIGURE 1B: MEAN 3PM WIND SPEED DATA FROM PEARCE RAAF BASE (BoM, 2017)

The nearest BoM monitoring site with recorded wind rose data is Perth Airport (site number 009021). Perth Airport is approximately 25kms south of the site, and experiences a similar prevailing wind regime to the project area. The wind data from Perth Airport demonstrates

the differences in wind speed and direction during winter and summer. Summer and winter wind roses were compiled from BoM data recorded during the period 1944 to 2016. The data presents morning (9am) and afternoon (3pm) wind conditions (Appendix B).

Summer:

Summer mornings (9am) generally have strong winds (>20km/h but <40km/h) in an easterly direction (BoM, 2016). Winds from the south had an approximate wind speed >10km/h and <20km/h (BoM, 2016). Winds from the north, north-west and west occur less frequently and reach speeds between 0km/h and <20km/h (BoM, 2016). Wind roses, as supplied by BoM, are shown in Appendix B.

Summer afternoons (3pm) generally have strong winds (>20km/h and <40km/h) from the south-west (BoM, 2016). Winds from the west had an approximate wind speed >20km/h and <40km/h (BoM, 2016). Winds from the north, north east, north-west, south and south-east occur less frequently and reach speeds between >10km/h and <30km/h (BoM, 2016). Wind roses, as supplied by BoM, are shown in Appendix B.

Winter:

Winter mornings (9am) generally have moderate winds (>10km/h and <20km/h) from the north-east (BoM, 2016). Winds from the north and east has an approximate wind speed >10km/h and <30km/h (BoM, 2016). Winds from the south-east, south, south-west, west and north-west occur less frequently and reach speeds between >10km/h and <30km/h (BoM, 2016). Wind roses, as supplied by BoM, are shown in Appendix B.

Winter afternoons (3pm) generally have moderate winds (>10km/h and <30km/h) from the west (BoM, 2016). Winds from the north, north-east, east, south, south-west and north-west had an approximate wind speed >10km/h and <30km/h (BoM, 2016). Winds from the south-east occur less frequently and had an approximate wind speed >10km/h and < 20km/h (BoM, 2016). Wind roses, as supplied by BoM, are shown in Appendix B.

Summary of Wind Conditions

Winds are stronger during summer, having higher gust strengths in comparison to winter. Summer morning winds are received primarily from the east, while afternoon winds are received primarily from the south-west (BoM, 2016). Winter morning winds are received primarily from the north-east, while afternoon winds are variable in direction (BoM, 2016). Dust will have to be managed more strenuously in summer due to higher wind speeds (BoM, 2016).

2.4 TOPOGRAPHY

The site slopes naturally downwards towards the west. The highest point being in the south-eastern corner of the site. The lowest point is on the western boundary near Great Northern Highway.

The site currently has an elevation of approximately 60 metres AHD on the eastern side of the site (Lot 6) to an elevation of approximately 25 metres AHD on the western side of the site (Lot 5). The highest elevation is on the south-eastern corner.

2.5 SENSITIVE RECEPTORS

Eight sensitive receptors are located within 500 m of the site. Sensitive receptors have been identified in Figure 5. Although rural structures are included in Figure 5, the residential properties have been assessed within this dust management plan. EPA indicates that a buffer distance of 300m-500m is recommended between extraction activity and sensitive receptors (EPA, 2005). A 300m – 1,000m buffer zone has been included in Figure 4 to show the proximity of receptors within the area. Only receptors within the 300-500m zone were assessed. The proximity of these sensitive receptors to the boundary of the site are identified in Table 1. Note that the distance between sensitive receptors and operational areas (extraction pits) are greater than distance between sensitive receptors and the site boundary, these are included in Table 1.

TABLE 1: SENSITIVE RECEPTOR DISTANCES FROM SITE BOUNDARY

Receiver	Description	Location	Proximity to site boundary	Proximity to operations
1	Residential	1849 Great Northern Highway, Bullsbrook WA 6084	350m	620m
2	Residential	1825 Great Northern Highway, Bullsbrook WA 6084	200m	440m
3	Residential	1799 Great Northern Highway, Bullsbrook WA 6084	270m	380m
4	Residential	1763 Great Northern Highway, Bullsbrook WA 6084	400m	530m
5	Residential	1721 Great Northern Highway, Bullsbrook WA 6084	180m	270m
6	Residential	1683 Great Northern Highway, Bullsbrook WA 6084	470m	610m
7	Residential	151 Walyunga Road, Bullsbrook WA 6084	485m	650m
8	Industrial*	91 Walyunga Road, Bullsbrook WA 6084	105m	170m
9	Industrial	1686 Great Northern Highway, Upper Swan 6069	270m	330m

*1686 Great Northern Highway, Upper Swan operates as a salvage yard, recycling and reselling materials with a caretaker residing in the center of the property. 91 Walyunga Road, Bullsbrook operates as an industrial site with sand and clay extraction similar to the proposed project. Due to the nature of operations on these lots the residences within are considered to be caretakers.

3 PROPOSED WORKS AND POTENTIAL IMPACTS

3.1 SOURCES OF DUST

Dust is a term used to describe solid airborne particles generated and dispersed into the air through processes such as handling organic materials and stockpiling of materials and windblown dust (DEC, 2011). Airborne particles are classified by size defined below as Particulate Matter (PM), PM₁₀, PM_{2.5} and Total Suspended Particles (TSP).

- PM₁₀: Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 10 µg/m³
- PM_{2.5}: Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 2.5 µg/m³
- TSP: All particles suspended in the atmosphere including fine, respirable particles (PM₁₀ and PM_{2.5}) and larger size particles settling out of the air causing nuisance impacts, usually measured as having an aerodynamic diameter of 50 µg/m³

(Source: EPA, 2008)

Dust and PM is a sub-factor pollutant to air quality and requires monitoring and management (EPA 2008). There are many anthropogenic sources of dust. The sources of dust in relation to the excavation and screening of materials are listed but not limited to;

- Earthmoving such as land clearing and construction activities;
- Stockpiling materials (clay);
- Vehicle movements on unsealed;
- Quarrying activities;
- Handling extraction materials;
- Material extraction, transfer, storage (loading) and transportation.

(Source: DEC, 2011)

3.2 POTENTIAL IMPACTS OF DUST

Dust has the potential to impact local amenity and cause nuisance to surrounding land users. Nuisance dust has a larger particle size causing it to settle out of the air (EPA 2008). Generally, nuisance dust has an aerodynamic diameter is >50µm (EPA 2008). It is possible that dust can impact visual amenity of effected locations through suspension in the air influencing visibility. Dust is reliant on climate for dispersal, particularly wind factors. Wind can cause dust to disperse into the surrounding environment and cause environmental and health impacts.

Dust can impact the environment through settling on flora and influencing its photosynthesis, transpiration and respiration potential (Farmer, 1993). A particles effect on flora and fauna is dependent on its chemical composition. Exposure of large quantities of PM to ecosystems may deplete the nutrients in soil, influence nutrient concentration within water bodies and may influence the diversity of ecosystems (EPA, 2016).

PM_{2.5} to PM₁₀ are inhaled in the upmost part of the airways and lungs. PM_{2.5} and smaller are inhaled more deeply and can lodge in the alveolar region, particles of this size are deemed respirable dust (DEC, 2011). The World Health Organisation (WHO) and United States Environmental Protection Agency (USEPA) have identified increased respiratory symptoms to be a potential human health impact of dust exposure. The National Environmental Protection Council (NEPC) has developed the following regulation standards for pollutant particulate

matter concentrations within the National Environmental Protection (Ambient Air Quality) Measure (NEPM):

TABLE 2: NEPM EXCEEDANCE CRITERIA FOR PM₁₀ AND PM_{2.5}

Pollutant	Averaging Period	Maximum concentration standard	Maximum allowable exceedances
PM ₁₀	1 day	50 µg/m ³	None
	1 year	25 µg/m ³	None
PM _{2.5}	1 day	25 µg/m ³	None
	1 year	8 µg/m ³	None

(Source: DEPC, 2016)

3.3 ASPECT AND IMPACT ANALYSIS

Nuisance dust is large dust particle fractions (PM₁₀ – PM₅₀) that can cause amenity impacts by settling on surfaces and causing soiling and discolouration (DEC, 2011). The below aspects and impacts table identifies dust generating aspects of the project and the environmental, health and amenity impacts potentially associated. Duration of the activities have been generated based on timeframes indicated within the Shire of Swan By-laws (1982). Risk ratings have been generated based on the Risk Matrix in Appendix A.

TABLE 3: ASPECTS AND IMPACT ANALYSIS OF THE PROJECT

Activity	Timeframe	Aspect	Impact	Risk Rating
Land clearing	1 week	Clearing of vegetation exposes topsoil to wind erosion	Exposed topsoil and wind erosion may impact nearby sensitive receptors by causing nuisance dust impacting rural which may impact rural amenity.	Medium
Topsoil stripping	2 weeks	Removing topsoil disturbs soil profiles and exposes profile to air	Stripping of topsoil may cause dust to disperse into the air, as it is exposed to wind.	High
Excavation of Sand	10 years	Excavating sand from its profile may cause airborne dust	Excavating may cause dust to disperse into the air, as sand particles become exposed to wind. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	High
Excavation of Clay	10 years	Excavation process of extracting and lifting the clay from the geological profile may cause particles to enter the air	Excavating may cause dust to disperse into the air, as clay particles become exposed to wind. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	Medium
Stockpiling of materials	10 years	Stockpiling of sand and clay materials may cause the release of dust particles into the air	Loading materials into stockpile locations may cause dust to disperse into the air, as clay particles become exposed to wind. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	Medium



Loading of excavated materials	Intermittent	Loading the sand and clay into trucks may cause dust particles to become airborne	Loading materials into vehicles may cause dust to disperse into the air, as sand and clay materials become exposed to wind. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	High
Transport of excavated materials	Intermittent	Transport of sand and clay on unsealed roads within the site may cause dust particles to become airborne	Tyre movement on unsealed roads may cause dust to disperse into the air. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	High
Remediation of campaigns	Progressive	Recontouring the earth from previous excavation campaign may cause disturbance and generate airborne particles to be released	Recontouring and earthworks may cause dust to disperse into the air. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	Medium
		Fill material being unloaded to the site releases dust particles into the air	Unloading of fill materials may cause dust to disperse into the air. Dust may become a nuisance and cause loss of amenity to surrounding land uses.	Medium

4 DUST MONITORING PROGRAM

4.1 MONITORING METHODS

It is a requirement within the NEPM to monitor, assess and report particles as PM_{2.5} or PM₁₀ in accordance with the outlined protocol within the measure. Visual monitoring will be completed by all employees on site. When airborne dust has the potential to cause a nuisance by decreasing visibility on site, or clearly extending over the site boundary, employees will notify the site manager. The site manager will either cease works or implement more strenuous dust management methods depending on the severity of the dust incident.

Supervisors on shift are additionally responsible for identifying nuisance dust and notifying the site manager to implement management methods. Site employees will be required to identify and record any excessive dust as a result of their works and notify the site manager to ensure remediation of dust is immediate. The site manager will be responsible for recording details of all nuisance dust events in the Dust Incident Register located in the site office.

As meteorological conditions have a direct influence on dust generation, meteorological data will be monitored daily by accessing the BoM website. Wind direction and strength will be taken into consideration, in addition to temperature and rainfall conditions. If combined conditions look to be unfavourable for works, operations will cease for a recommended period of time.

In the event that a nuisance dust occurrence takes place, the following information will be recorded and stored within the Dust Incident Register located in the site office data base:

- Frequency of nuisance dust occurrence
- Intensity of occurrence (quantity of dust)
- Duration of dust nuisance occurrence (date and time)
- Location of dust nuisance occurrence
- Mitigation strategies implemented

(Refer to Appendix C for Dust Incident Form)

Registers of these events will provide indication of developing trends associated with the time and works, in addition to ensuring that the dust remedial methods remain effective. This will ensure remediation techniques are implemented at the best possible time.

In the event that several community concerns have been raised and the project operations have caused a nuisance to surrounding land uses, there is potential to install dust monitors within the site. If this is the case, the City of Swan (CoS) will be contacted regarding the additional monitoring and management strategies.

4.2 PERFORMANCE CRITERIA

The proponent will ensure that best practice measures are implemented to prevent or minimise the generation of dust throughout the duration of the project. The effectiveness of the Dust Management Plan will be reviewed against the following criteria:

- Compliance with the relevant legislation (Refer to section 1.3)
- Number of complaints received in relation dust
- Number of dust incidents recorded

- No airborne dust being dispersed from internal access roads
- Absence of nuisance dust originating from cleared works area
- Level of impact on haul roads, access tracks and works area.

Continuous review of dust management procedures and controls will be implemented following the above performance criteria to ensure dust is managed within and outside the project area.

5 DUST MANAGEMENT PROGRAM

5.1 SUMMARY OF DUST MANAGEMENT REQUIREMENTS

By implementing a series of integrated dust management methods, the potential impacts of dust generated from the project will be minimised. A summary of the dust management controls, their associated risk and the roles and responsibilities of those employing them is in Table 4.

TABLE 4: SUMMARY OF DUST MANAGEMENT REQUIREMENTS

Item	Risk	Control Method	Responsibility	Revised Risk Matrix
1	Clearing of regrowth vegetation exposing topsoil to wind erosion	Where possible remaining vegetation on the lot will be retained. Compaction, Grading & Watering of area while pre-works operations occur to prevent dust uplift.	Proponent and Site Manager	Low
2	Removal of topsoil dispensing errant airborne dust	Water cart shall make regular passes along the excavation area. Wind direction and speed monitoring analysis undertaken before works to ensure suitability.	Proponent and Site Manager	Low
3	The excavation process creating errant airborne dust	Water cart shall make regular passes along the excavation area. Wind direction and speed monitoring analysis undertaken before works to ensure suitability. Bunding will be established around work activity areas.	Site Manager	Medium
4	Stockpiling causing errant airborne dust	Stockpiling area located away from the Site boundary. Materials will be stockpiled using a wheeled loader and earthmoving equipment. Stock piles shall be limited to be within excavated works area to prevent wind and visual effects for short periods prior to moving to stockpile areas. Bunding is retained around works area while stockpiles reside there.	Employees to alert Site Manager	Low



5	Recontouring of earth causing disturbance to soil and generating errant airborne dust	Water cart shall make regular passes along the excavation area. Wind direction and speed monitoring analysis undertaken before works to ensure suitability. Bunding will be established around work activity areas.	Site Manager	Low
6	Unloading fill material causing errant airborne dust	Unloading of fill material will be completed within excavated activity area surrounded by bunding to contain dust.	Site Manager	Medium
7	Loading excavated materials into trucks causing errant airborne dust	Loading of trucks will be completed within excavated activity area surrounded by bunding to contain dust.	Employees to alert Site Manager	Medium
8	Transport of materials on unsealed internal roads may cause errant airborne dust	Compaction, Grading & Water of gravel roads and sweeping of bitumen roads to prevent dust uplift. 10km/hour speed limit throughout site, supported by signage. Speed limit conveyed to drivers and operatives at the site. Truck loads will be securely covered with canvas material to prevent any dust escaping	Site Manager	Low
9	Site access and egress may cause errant airborne dust	Compaction, Grading & Water of gravel roads and sweeping of bitumen roads to prevent dust uplift. 10km/hour speed limit throughout site, supported by signage. Speed limit conveyed to drivers and operatives at the site. Truck loads will be securely covered with canvas material to prevent any dust escaping	Employees entering and leaving the site to alert Site Manager	Low
10	Geological elements of soil and their potential to	Compaction, Grading & Watering of area while pre-works and excavation occurs to prevent dust uplift. Water carts will water-down excavation works area regularly ¹ .	Proponent	Low

¹ The top profiles of soil throughout the site are classified as “sandy-silt” making them more prone to becoming errant airborne dust (Refer to 2.2.1 for geological features)



	become 'nuisance dust' when disturbed			
11	Minimal screening for dust as land has been previously cleared	Where possible remaining vegetation on the lot will be retained. Earth bunds will be created to shield surrounding receptors from the stages of excavation (creation of screening).	Proponent	Low
12	Large area >10ha being extracted, potential for more nuisance dust to become airborne	Earth bunds will be created to shield surrounding receptors from the stages of excavation. Compaction, Grading & Watering of area while excavation occurs to prevent dust uplift. Only area that has been analysed to have resources (sand and clay) is being excavated, therefore no unnecessary area is being disturbed.	Proponent	Low
13	Type of works (extraction) is known to disturb soil profiles and create errant airborne dust	Earth bunds will be created to shield surrounding receptors from the stages of excavation. Compaction, Grading & Watering of area while excavation occurs to prevent dust uplift.	Proponent	Medium
14	Impact to rural amenity of sensitive receptors 100m – 500m away from extraction area	Earth bunds will be created to shield surrounding receptors from the stages of excavation. Wind direction and speed monitoring analysis undertaken before works to ensure suitability of the works. Water cart shall make regular passes along the excavation area. Compaction, Grading & Water of gravel roads and sweeping of bitumen roads to prevent dust uplift. 10km/hour speed limit through site to prevent dust uplift from trucks. Community consultation to record any complaints or comments in register.	Site Manager	Low
15	Strong south-westerly winds in the summertime may affect the rural amenity of lots to the east of the site	Wind direction and speed monitoring analysis undertaken before works. More strenuous watering down of the area will be implemented depending on the strength of the winds, works	Site Manager	Low



		will be ceased dependent on the results of regular monitoring. Earth bunds will be created to shield surrounding receptors from the stages of excavation.		
16	Easterly winds in Autumn may affect rural amenity of sensitive receptors west of the extraction site	Wind direction and speed monitoring analysis undertaken before works to ensure suitability. More strenuous watering down of the area will be implemented depending on the strength of the winds, works will be ceased dependent on the results of regular monitoring. Earth bunds will be created to shield surrounding receptors from the stages of excavation.	Site Manger	Low

5.2 SUMMARY OF DUST MANAGEMENT CONTROLS

In order for dust to be successfully mitigated onsite and offsite the following controls will need to be implemented:

- Retaining vegetation where possible;
- Limiting areas of exposed soil;
- Compacting and grading of soil for internal access roads;
- Applying water to increase moisture in soil and prevent dust uplift (Water carts);
- Minimising distance of works to site egress route;
- Timing of earthworks in relation to wind speed, wind strength, rainfall and temperature (daily and seasonally);
- Consideration of wind direction and strengths during excavation;
- Appropriate implementation of earthworks (bundling appropriate to shielding sensitive receptors).

Water needed for dust suppression will be sourced from the adjacent water retention pit located at Lot 5 (91) Walyunga Road, Bullsbrook. Brikmakers have an agreement with the landowner at the adjacent site to utilise excess water located in the retention basin. As there is a copious water source and availability of watercarts, it is expected that dust will be suppressed in the associated processes. In the event that dust monitors are required and installed (refer to 4.1 for conditions), the NEPM air quality standards will be followed and reports will be generated in regard to the exceedance criteria for PM₁₀ and PM_{2.5}.

5.3 RELEVANT STAKEHOLDERS

Stakeholders are all parties who have an interest in the project. It is a requirement of formerly Department of Environment Regulation (DER), currently Department of Water and Environment Regulation, for proponents to carry out community engagement for sites that pose a risk to human health, the environment, environmental values, or potentially impact sensitive off-site receptors (DER, 2014). The relevant stakeholders of this project include:

- Sensitive receptors within 500m of the project area
- Residents of the Bullsbrook area
- Indirectly affected members of the public
- City of Swan
- Government Departments (e.g. DWER, DoH)

The Council may forward notice onto landowners and occupiers within 500m of the site boundary, which will advise of the proposed excavation and specify that they may object to or make representations in writing in respect of the issue of a License by the Council (Shire of Swan, 1982).

5.4 ROLES AND RESPONSIBILITIES

The roles and responsibilities associated with the implementation of dust management controls have been outlined within the Table 4 in section 5.1

5.5 COMPLAINTS MANAGEMENT

Information regarding any complaints of nuisance dust events from community members or employees and contractors must be documented and passed onto the site manager for review and action as soon as possible. A record of complaints will be kept within a register in the site office. Refer to Dust Incident database in Appendix C.

6 CONCLUSION

It is the opinion of SERS, in consultation with Brikmakers, that the implementation of control measures outlined in this document, when implemented, will successfully mitigate dust generation on-site. The Dust Management Plan is subject to ongoing review, and it is the aim of Brikmakers to achieve continuous improvement in this area of operation. Implementation of the controls discussed in this report shall reduce the risk of dust onsite.

7 REFERENCES

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FIGURE 2 – SITE LOCATION



FIGURE 1: Site Location



Legend



Site Boundary

FIGURE 3 – SURROUNDING LAND USES

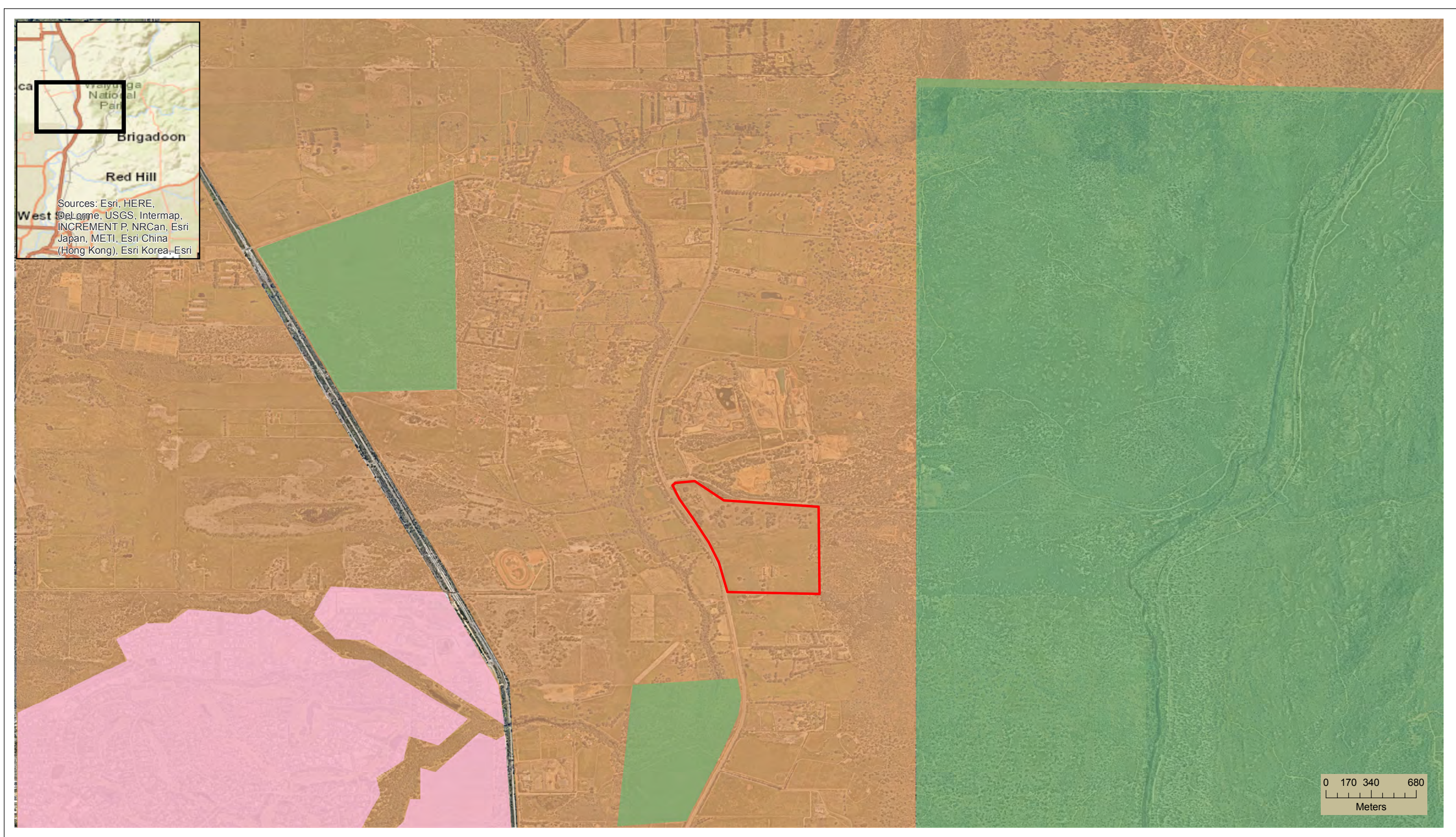


FIGURE 2: Surrounding Land Uses







 SERS Site Environmental and Remediation Services	Job No: 004-08	Scale: 1:10,000	Date drawn: 21/11/2017		Legend  Site Boundary  Land Use: Residential  Land Use: Parks and Recreation  Land Use: Rural
	Client: Brikmakers	Original size: A3	Revision: 0		
	Address: 1728 Great Northern Highway, Bullsbrook, WA 6084.	Imagery from: 20/10/2017	Drawn by: A.C		
	Source: Nearmaps	Checked by: R.M			
© This plan must not be reproduced without the permission of SERS					
File: N:\A SERS\GIS\Projects\ MXD\					

FIGURE 4 – SITE LAYOUT

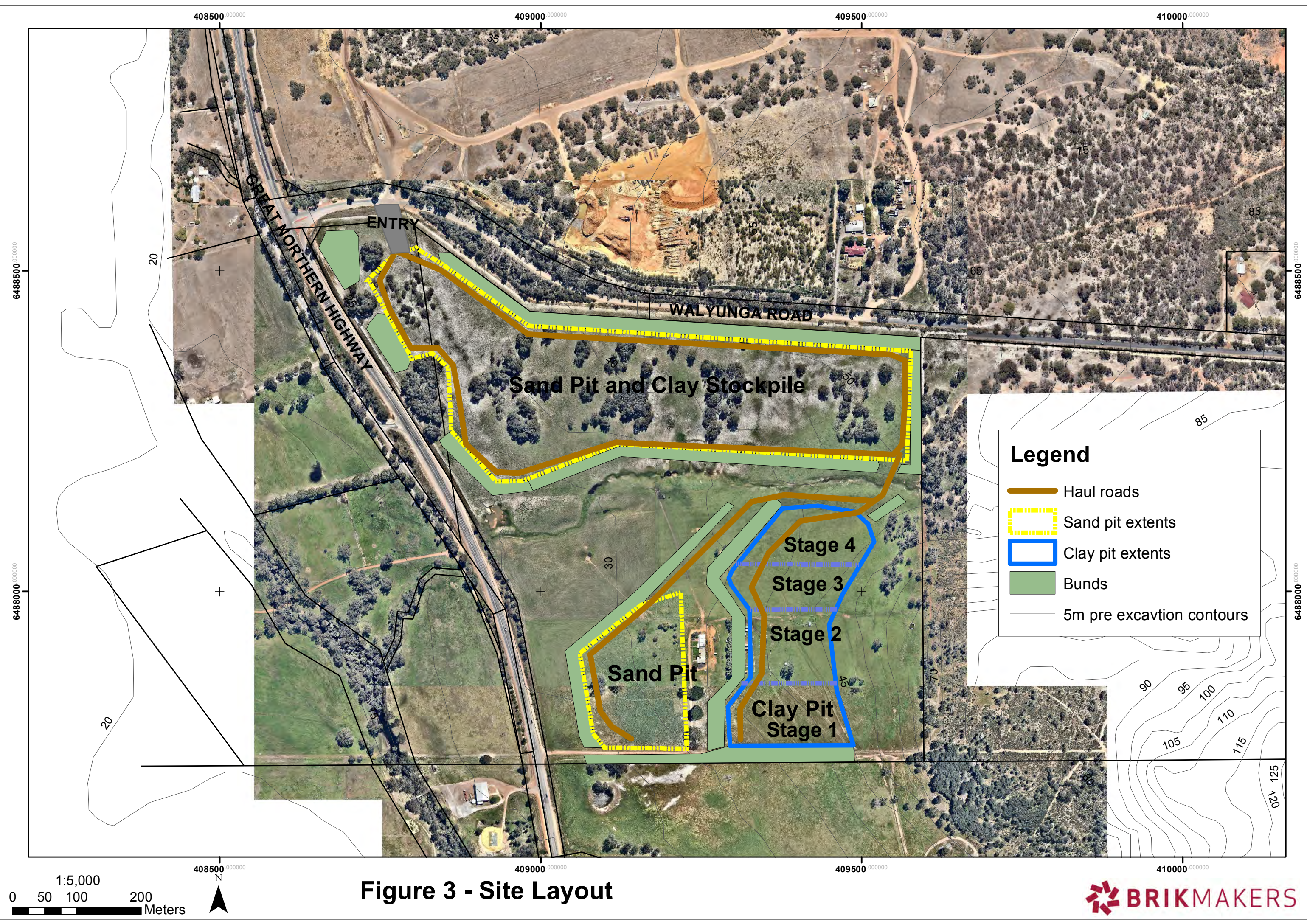


Figure 3 - Site Layout

FIGURE 5 – SENSITIVE RECEPTORS AND BUFFER DISTANCES

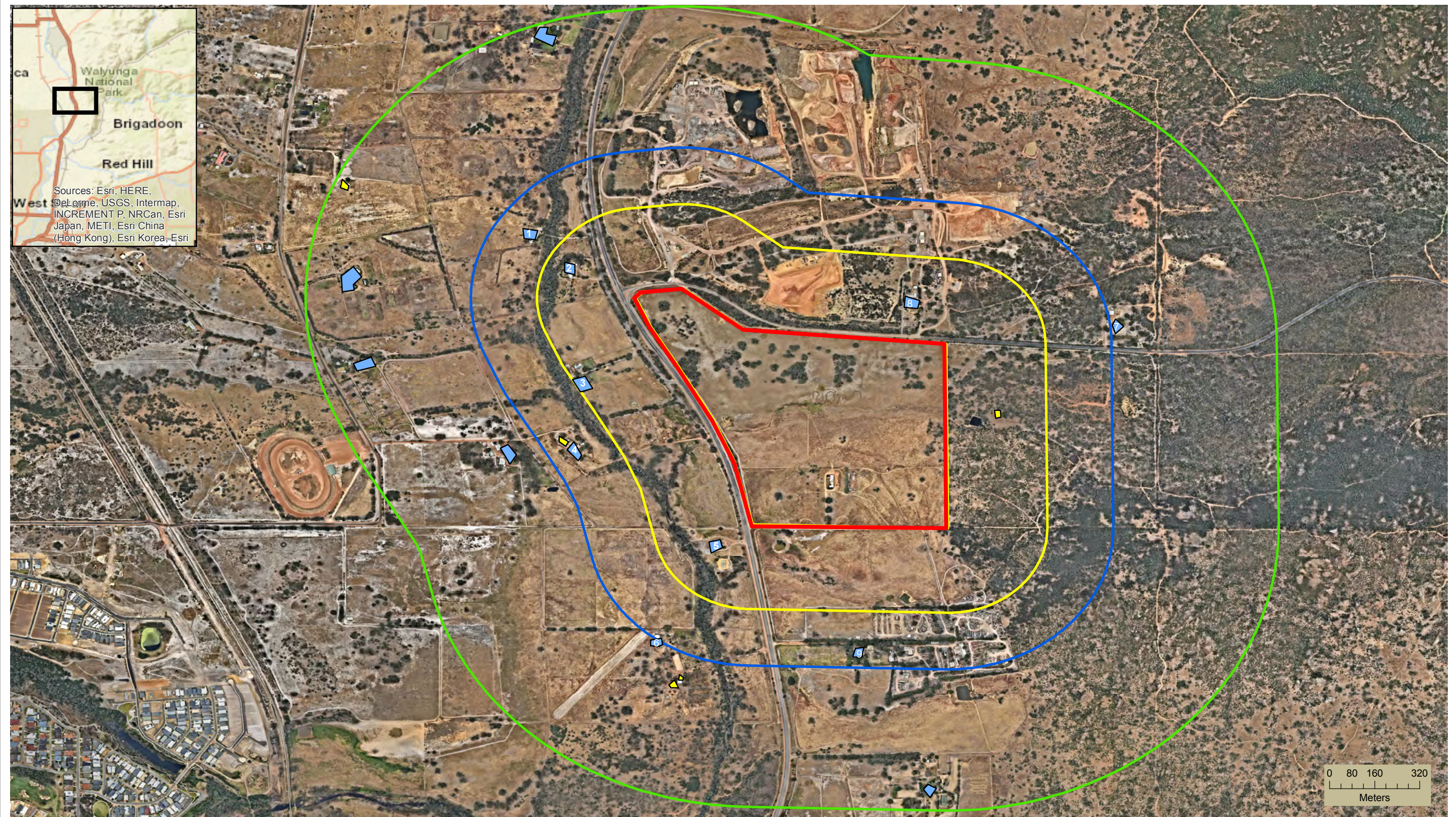


FIGURE 5: Buffer Zones for Sensitive Receptors



Legend



Residential



Site
Boundary



300m Buffer



500m Buffer



1,000m
Buffer



Rural

APPENDIX A - RISK MATRIX



Consequence					
Likelihood	Slight 1	Minor 2	Moderate 3	Major 4	Severe 5
Almost Certain A	Medium	High	High	Extreme	Extreme
Likely B	Medium	Medium	High	High	Extreme
Possible C	Low	Medium	Medium	High	Extreme
Unlikely D	Low	Medium	Medium	Medium	High
Rare E	Low	Low	Medium	Medium	High

(Source: DER, 2017)

RISK TREATMENT TABLE

Rating of Risk Event	Acceptability	Treatment
Extreme	Risks unacceptable	Risks associated are impossible to manage
High	Acceptable if control methods are outlined and implemented to remediate risks	Multiple regulatory control methods are outlined and implemented to decrease associated emissions, outcome and management based conditions will be considered.
Medium	Acceptable if control methods are outlined and implemented to remediate risks, risks of this category are generally tolerable subject under general controls	Regulatory controls outlined and implemented but risk is generally tolerable, outcome based controls are required for treatment
Low	Acceptable	No treatment needed, risk is acceptable

APPENDIX B – WIND ROSES FOR SUMMER AND WINTER

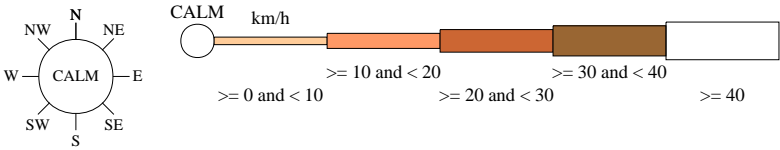
Rose of Wind direction versus Wind speed in km/h (01 May 1944 to 05 Apr 2016)

Custom times selected, refer to attached note for details

PERTH AIRPORT

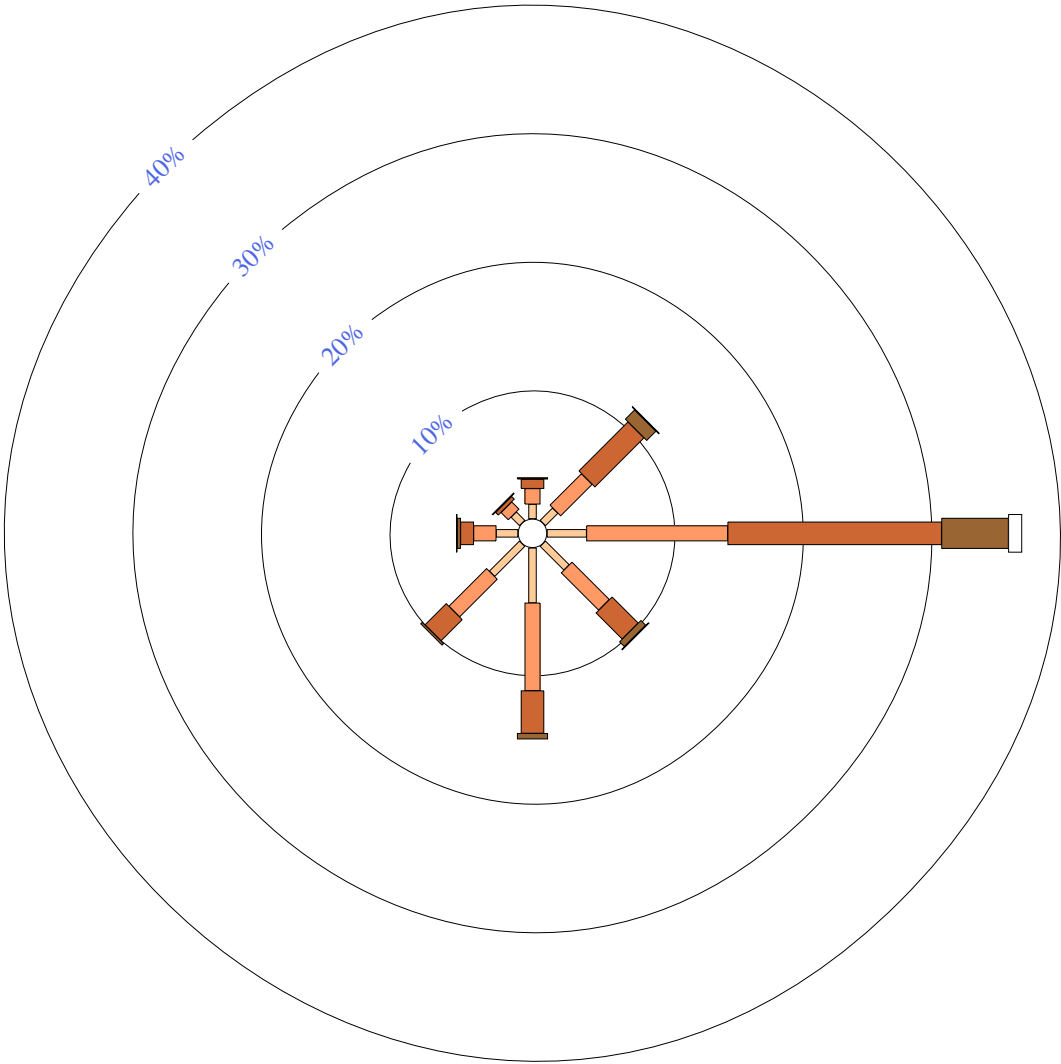
Site No: 009021 • Opened Jan 1944 • Still Open • Latitude: -31.9275° • Longitude: 115.9764° • Elevation 15.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am Summer
6495 Total Observations

Calm 6%



Rose of Wind direction versus Wind speed in km/h (01 May 1944 to 05 Apr 2016)

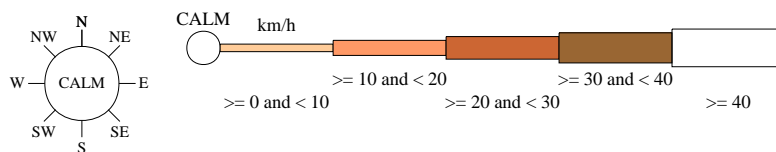
Custom times selected, refer to attached note for details

PERTH AIRPORT

Site No: 009021 • Opened Jan 1944 • Still Open • Latitude: -31.9275° • Longitude: 115.9764° • Elevation 15.m

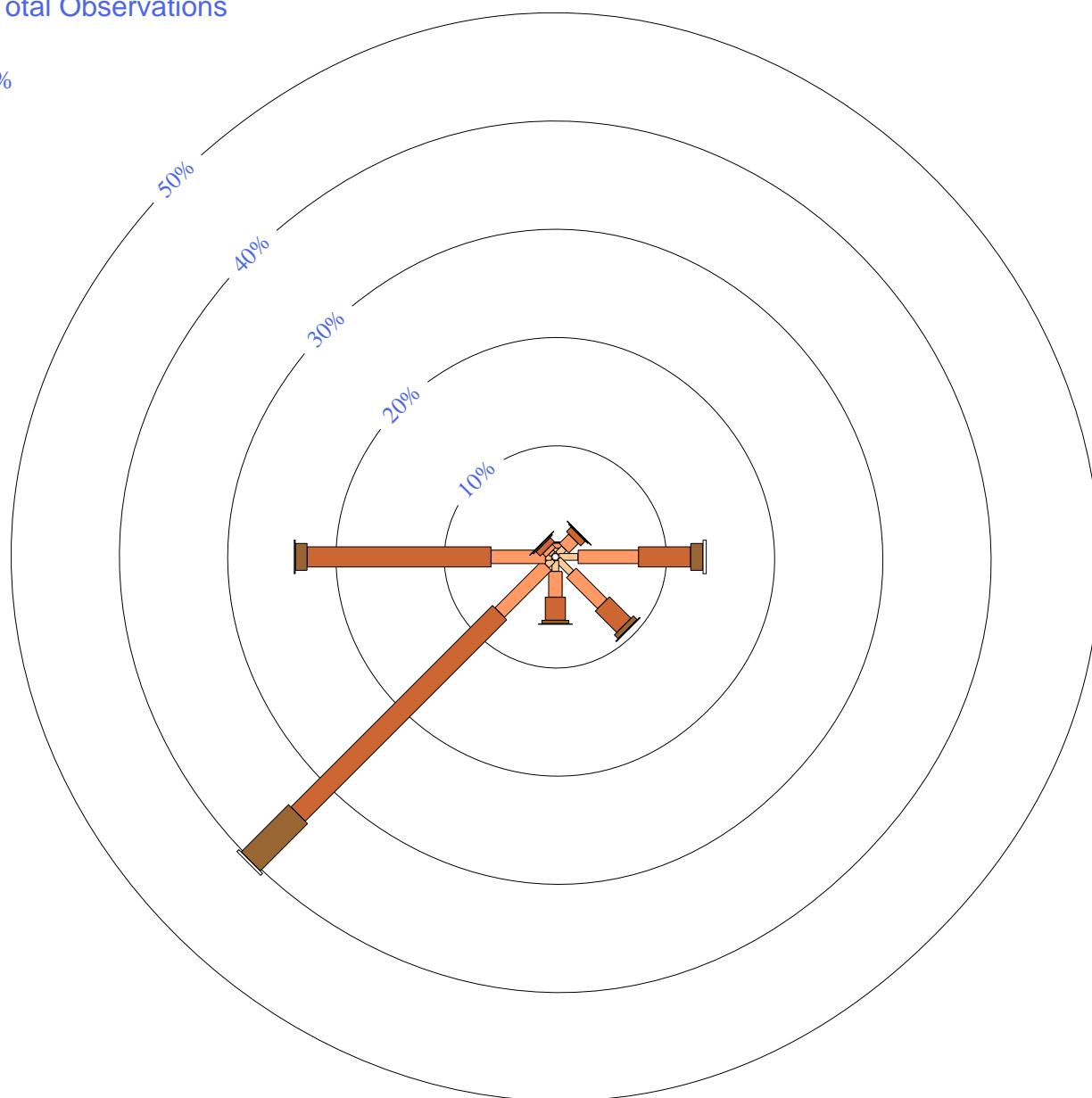
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Summer
6488 Total Observations

Calm 2%



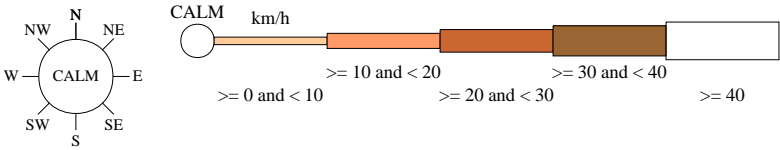
Rose of Wind direction versus Wind speed in km/h (01 May 1944 to 05 Apr 2016)

Custom times selected, refer to attached note for details

PERTH AIRPORT

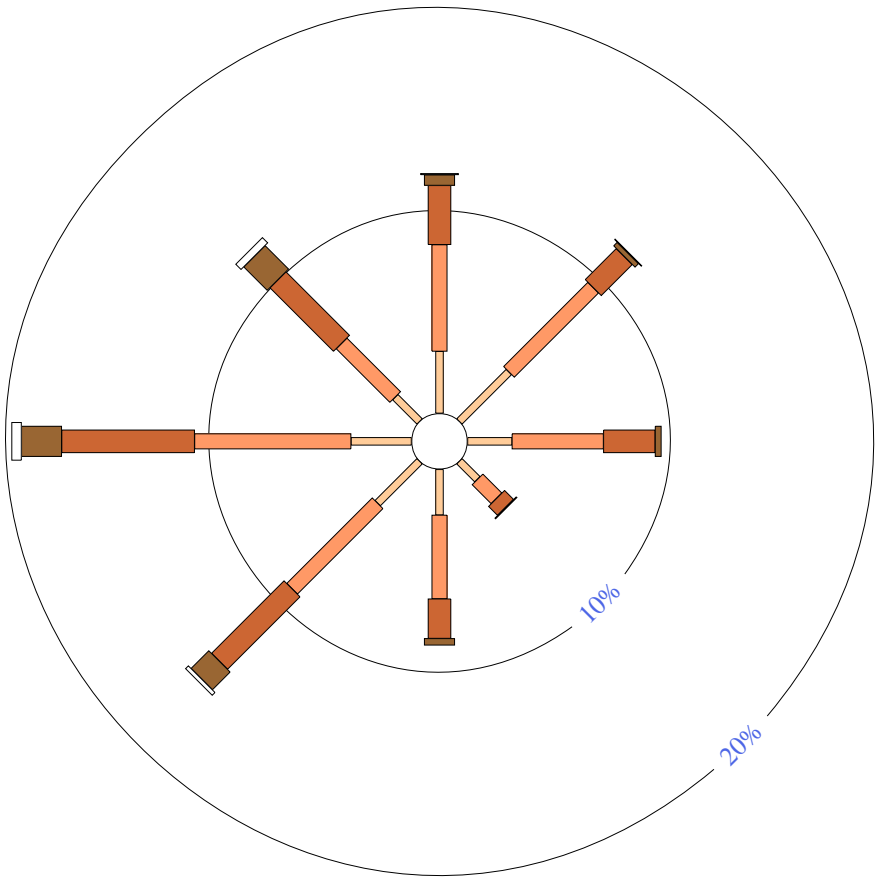
Site No: 009021 • Opened Jan 1944 • Still Open • Latitude: -31.9275° • Longitude: 115.9764° • Elevation 15.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Winter
6624 Total Observations

Calm 7%



Rose of Wind direction versus Wind speed in km/h (01 May 1944 to 05 Apr 2016)

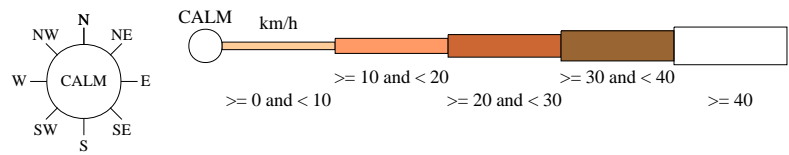
Custom times selected, refer to attached note for details

PERTH AIRPORT

Site No: 009021 • Opened Jan 1944 • Still Open • Latitude: -31.9275° • Longitude: 115.9764° • Elevation 15.m

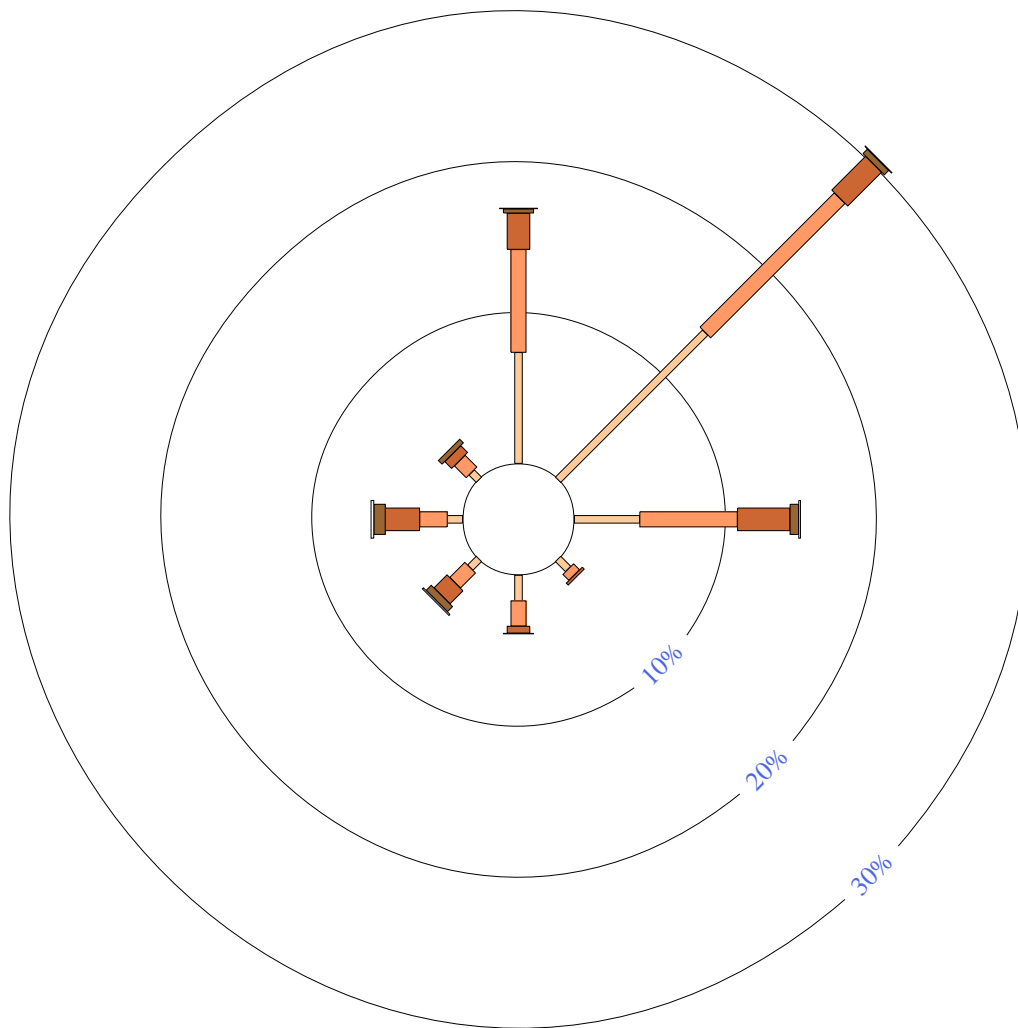
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Winter
6622 Total Observations

Calm 19%



APPENDIX C – DUST INCIDENT REGISTER



Incident Date	Reported By (Name & Contact Details)	Duration of Incident	Description of Incident	Location of Incident	Management Controls Employed	Date Completed
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					
	Name:					
	Contact Number:					