Appendix E. Desktop Heritage Technical Note

JACOBS

Memorandum

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Subject	**Desktop Heritage Register Review**	**Project Name**	Port Spencer Grain Export Terminal
Attention	Scott Snedden	**Project No.**	IW219900
From	Andrew Wilkinson		
Date	20 August 2019		
Copies to	**Alana Horan, Rose Overberg, Alistair Carr**		

1. Project background

Jacobs Group (Australia) Pty Ltd (Jacobs) has been engaged by Peninsula Ports to prepare a Desktop Review of heritage register listings for the Port Spencer Deep Water Port Facility (DWPF), (the Project).

The Project is located at Sheep Hill on Eyre Peninsula, South Australia, approximately 21 kilometres (km) north east of Tumby Bay, within the Tumby Bay District Council area.

The proposed works include grain storage facilities, loading facilities, site office and equipment storage, associated access roads, car parking, stormwater drains, jetty and other ancillary structures.

Development of the site was previously proposed by Centrex Metals Ltd for a multi-user bulk export ore and grain facility and was approved as a 'Major Development' project on 6 January 2011. This project did not proceed; however Peninsula Ports has proposed to develop a grain terminal in the same location.

A Desktop Cultural Heritage Assessment was completed in 2008 (Wood and Westall). Due to the length of time that has passed since the initial study, a Desktop Heritage Register Review is required to inform of any changes in heritage places within the Project area.

2. Scope of this Desktop Review

This Desktop Heritage Register Review aims to provide updated information on the known Aboriginal and historical heritage constraints for the Port Spencer DWPF.

This report provides an update of the heritage register search results component of the Desktop Cultural Heritage Assessment previously completed for Golder Associates Pty Ltd (Wood and Westall 2008).

The following methodology was used during preparation of the Desktop Review:

- Review of the previous Cultural Heritage Assessment Report prepared by Wood and Westall (2008)
- A search of the South Australian Central Archive (SACA) and Register of Aboriginal Sites and Objects (the Register)
- A search of the Australasian Underwater Cultural Heritage Database (AUCHD)

- A search of South Australian Heritage Places Register (SAHPR), the Commonwealth Heritage List (CHL), National Heritage List (NHL), and World Heritage List (WHL).

2.1 Limitations

This assessment was limited to an updated review of the Aboriginal and non-Aboriginal registers.

3. Summary of previous Cultural Heritage Assessment

Vivienne Wood and Craig Westall completed a cultural heritage assessment including desktop assessment and 'reconnaissance' for the Project area (2008). The investigation included a search of archival records and heritage registers; review of literature; interviews with local residents and historical societies; and a site visit of the project area.

It was noted in the literature review that no previous archaeological studies (Aboriginal or Non-Aboriginal) had been completed in the project area; however, a number of studies (Edmonds 1990; Martin 1988; Nicholson 1991; 1994; Walshe *et al.* 1997; Westell *et al.* 2000) conducted in the region were available for a comparative study.

3.1 Aboriginal assessment

The Cultural Heritage Assessment identified two Aboriginal sites (SHPF_01 (Aboriginal Affairs and Reconciliation Department (AARD) no. 6129-3038) and SHPF_03) (Wood and Westall 2008, p. 61). There is confusion in numbering of sites within the report for SHPF_02 and SHPF_03, however the map (Figure 10 on page 63) indicates the second Aboriginal site should be SHPF_03.

No consultation was undertaken with Aboriginal community representatives. The Barngarla were identified in the report as the Native Title holders for the area.

A number of potential archaeologically sensitive areas were identified in the assessment.

- The first Aboriginal site (SHPF_01 (AARD 6129-2038)) is outside the current proposed project area. No details of the site were available as AARD advised that this information is held by the relevant Aboriginal organisation (Wood and Westall 2008, p. 58).
- The second Aboriginal site (SHPF_03) comprised a low density artefact scatter of stone artefacts which included quartz, granite and chert material types, and items of flakes, hammerstones and cores. A shell midden was also identified as part of the same site. No formal recording was undertaken of Aboriginal archaeological materials located during the site visit. It is unclear from the report why formal recording was not undertaken. It was concluded that these, and other isolated stone artefacts, highlighted the archaeological sensitivity of the coastal region.

Outside the current Project area previous studies have identified Aboriginal cultural heritage such as coastal camp sites (Nicholson 1991; 1994) and fish traps (Martin 1988). Vanessa Edmond's assessment of an optic fibre alignment (1990) identified one site (AARD 6129-3038) approximately 6 km from the current Project area. The site was located in an exposed section in the bank of Salt Creek and comprised a surface scatter of 21 quartz artefacts in a 25 metre (m) x 5 m area.

3.2 Non-Aboriginal (historical) assessment

The Cultural Heritage Assessment identified one site of non-Aboriginal heritage (SHPF_02) – Shearing shed and yards. This site is located immediately adjacent to Swaffers Road, and centrally located within the Project area's proposed access corridor. The site incorporates a complex of

shearing shed, yards, ramp and chicken house extending over an area of 75 m x 40 m. The site was assessed as local heritage significance.

A number of potential archaeologically sensitive areas were identified in the assessment. The majority of these were located outside of the development boundary or were assessed as having no specific heritage value. These sites comprised various refuse dumps containing farm machinery and building materials, a former water reserve, and a former stock route (Wood and Westall 2008, p. 60, 62).

3.2.1 Underwater cultural heritage assessment

The assessment also identified the correct location of the *Three Sisters* wreck 40 m north of Lipson Cove Jetty, which had a registered location coordinate south of the proposed Centrex Metals wharf.

3.3 Recommendations

Recommendations in the assessment included:

- That potential impacts to these sites be mitigated through appropriate project design
- That a thorough archaeological investigation for Aboriginal and non-Aboriginal cultural heritage be undertaken
- A detailed anthropological study and consultation with relevant Aboriginal groups (the Barngarla) be undertaken.

4. Results of Desktop Review

A search of the heritage registers (listed below) was undertaken by Andrew Wilkinson (Project Archaeologist, Jacobs) on 9 August 2019. The request to Aboriginal Affairs and Reconciliation (AAR)for a search of the South Australian Central Archive database was made on 16 August 2019. Results of the register searches are listed in Table 4.1.

Table 4.1: Results of register searches and legislative requirements

Register	Result
South Australian Central Archive (Aboriginal)	Results of the South Australia Central Archive register search were received from AAR (Formerly AARD) on 30 August 2019. · There are no entries for Aboriginal sites within 5 km of the coordinates 616207 E, 6209572 N, Zone 53. · Aboriginal group(s) that may have interest in the area are: Barngarla Determination Aboriginal Corporation (Chairperson – Emma Richards). Full contact details are in Appendix A. The advice received, notes that sites or objects may exist in the proposed development area, even though the Register does not identify them and that all Aboriginal sites and objects are protected under the *Aboriginal Heritage Act* 1988, whether they are listed on the Central Archive or not.
South Australian (SA) Heritage Places Database	The Foreshore Lipson Cove and Wallaby Sam Monument (16556; H9230019) are located south of the Lipson Road, and abuts the southern boundary of the Project area. This item is listed as of local heritage significance. Planning approvals may be required from the Tumby Bay District Council if this place is to be impacted by the Project.

Register	Result
Australian Underwater Cultural Heritage Database	*Three Sisters* sailing vessel, wrecked 1899. The wreck location was updated in 2005 and is 42 m north of the concrete slipway at Lipson Cove, 20 m north of the jetty remains. The wreck is approximately 750 m south of the project area. A *Permit for Entry* into a Protected Zone or a *Permit to Impact Underwater Cultural Heritage* may be required if this place it to be impacted by the Project.
CHL NHL WHL	No heritage items for the area were identified in these registers.

5. Recommendations

5.1 Aboriginal cultural heritage

Within South Australia, the main legislation covering the protection of Aboriginal heritage sites and objects is the *Aboriginal Heritage Act* 1988 (the Act). Penalties apply for failure to comply with the Act.

Section 20 of the Act requires that any Aboriginal sites, objects or remains, discovered on the land, need to be reported to the Minister.

a) An Aboriginal site is defined by the Act as being **an area of land** that is of significance according to Aboriginal tradition; OR

b) that is of significance to Aboriginal archaeology, anthropology or history.

An Aboriginal object is defined by the Act as an **object**:

a) that is of significance according to Aboriginal tradition; OR

b) that is of significance to Aboriginal archaeology, anthropology or history.

All Aboriginal sites and objects are protected under the Act, whether they are listed in the Register or not. Aboriginal groups may maintain their own cultural heritage databases.

Land lying beneath inland waters or the sea, or within 200 m of a watercourse, and associated overflow areas, are areas of high cultural sensitivity.

Further assessment is required in order to determine if Aboriginal cultural heritage places are held by Registered Aboriginal Representative Bodies/Aboriginal traditional owners. The advice from AAR is that Aboriginal groups that may have interest in the area may include the Barngarla Determination Aboriginal Corporation (Appendix A).

A site survey and consultation is required to determine if there will be impacts to any identified or previously unidentified Aboriginal heritage items within the Project area.

It is recommended that any identified Aboriginal cultural heritage be properly recorded in consultation with, and in accordance with, the wishes of the Barngarla Determination Aboriginal Corporation and Aboriginal groups with interest in the Project area.

5.2 Historical heritage

The *Heritage Places Act* 1993 provides protection for archaeological artefacts even if not registered as a State Heritage Place. If a person is of the opinion that a place has sufficient heritage significance

to justify its preservation the SA Heritage Council may issue a Stop Order under section 30 of the *Heritage Places Act* 1993 in order to protect the place and allow further evaluation of the heritage significance.

Additional assessment is required to determine if there are any previously unidentified built heritage items or historical archaeological sites within the Project area. This assessment will determine if a significance assessment of any identified historical archaeological sites are required, and if a heritage impacts assessment is required for any items impacted by the Project works.

An application for a planning permit to impact a heritage place may be required from the Tumby Bay District Council should the works impact the Foreshore Lipson Cove and Wallaby Sam Monument (16556; H9230019).

5.3 Underwater Cultural Heritage

The *Underwater Cultural Heritage Act* 2018 (Underwater Heritage Act) replaced the *Historic Shipwrecks Act* 1976 and came into effect 1 July 2019. The Underwater Heritage Act continues to protect shipwrecks, however also now covers sunken aircraft and other types of underwater cultural heritage.

Additional assessment may be required to determine if there are any previously unidentified underwater cultural heritage or submerged archaeological sites as defined under section 15 of the Underwater Heritage Act within the Project area. Assessment may include underwater inspection of the seafloor of the proposed jetty and associated infrastructure.

6. References

Edmonds, V. 1990 *An archaeological survey of two optical fibre cable routes on the Eyre Peninsula, South Australia*. A report to Telecom, Adelaide.

Martin, S. 1988 *Eyre Peninsula and west coast - Aboriginal fish trap survey*. South Australian Department of Environment and Planning, Adelaide.

Nicholson, A.F. 1991 *Archaeology on the Anxious Coast: Archaeological investigations on the West Coast of teh EYre Peninsula, South Australia*. A report to the Heritage Branch, South Australian Department of Environment and Planning, Adelaide.

Nicholson, A.F. 1994 *Archaeology of an Arid coast: Environment and cultural influences on subsistence economies on the West Coast of South Australia*, Australian National University, Canberra.

Walshe, K., C. Westall, V. Wood and S. Anderson 1997 *Site conservation strategy, Zone 9: West Coast/Nullarbor*. Report to the Department of Aboriginal Affairs, South Australia, Adelaide.

Westell, C., P. Fitzpatrick and V. Wood 2000 *Gawler Ranges Archaeological Survey*. Report to the Australian Heritage Commisson, National Estate Grants Program, Adelaide.

Wood, V. and C. Westall 2008 *A desktop cultural heritage assessment of the proposed Centrex Metals Ltd Sheep Hill Port Facility, Eyre Peninsula, South Australia*. Report to Golder Associates Pty Ltd, Adelaide.

Appendix A: Aboriginal Heritage Sites results

ABORIGINAL HERITAGE SITES

Government of South Australia
Department of the Premier and Cabinet

Andrew Wilkinson
Jacobs
121 King William St
Adelaide 5000 South Australia

Dear Andrew

Thank you for your request dated 16 Aug 2019. The search was based on the coordinates provided: 616207 E, 6209572 N, Zone 53, with a 5000m buffer. Your reference is 757.

I advise that the central archive, which includes the Register of Aboriginal Sites and Objects (the Register), administered by Aboriginal Affairs and Reconciliation (AAR), has no entries for Aboriginal sites within 5000m of this location.

The applicant is advised that sites or objects may exist in the proposed development area, even though the Register does not identify them. All Aboriginal sites and objects are protected under the *Aboriginal Heritage Act 1988* (the Act), whether they are listed in the central archive or not. Land within 200 metres of a watercourse (for example the River Murray and its overflow areas) in particular, may contain Aboriginal sites and objects.

Pursuant to the Act, it is an offence to damage, disturb or interfere with any Aboriginal site, object or remains (registered or not) without the authority of the Premier. If the planned activity is likely to damage, disturb or interfere with a site, object or remains, authorisation of the activity must be first obtained from the Premier under Section 23 of the Act. Section 20 of the Act requires that any Aboriginal sites, objects or remains, discovered on the land, need to be reported to the Premier. Penalties apply for failure to comply with the Act. It should be noted that this Aboriginal heritage advice has not addressed any relevant obligations pursuant to the *Native Title Act 1993*.

Please be aware in this area there are Aboriginal groups/organisations/traditional owners that may have an interest. These may include:

Barngarla Determination Aboriginal Corporation
Chairperson: Emma Richards
Address: c/- 44 Dublin St, Port Lincoln
Telephone:
Email: karkalla75@hotmail.com
Contact Officer:
Telephone:
Email:

If you require further information, please contact the Aboriginal Heritage Team on telephone (08) 8226 8900 or send to our generic email address dpc-aar.heritagesites1@sa.gov.au

Yours sincerely,

Perry Langeberg
SENIOR INFORMATION OFFICER (HERITAGE)
ABORIGINAL AFFAIRS & RECONCILIATION

30 August 2019

Aboriginal Affairs and Reconciliation| Date: Fri Aug 30 2019 13:29:51 GMT+0930 (ACST)
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Appendix F. Socio-Economic Assessment

Port Spencer Grain Export Terminal

Peninsula Ports

Socio-Economic Assessment

IW219900-0-NP-RPT-0002 | Rev 0

2 October 2019

Port Spencer Grain Export Terminal

Project No:	IW219900
Document Title:	Socio-Economic Assessment
Document No.:	IW219900-0-NP-RPT-0002
Revision:	Rev 0
Date:	2 October 2019
Client Name:	Peninsula Ports
Client No:	
Project Manager:	Scott Snedden
Author:	Nicole Sommerville
File Name:	J:\IE\Projects\06_Central West\IW162800\10 Project Management\Proposal_Design Development and Enviro\Social Impact Assessment Folder\Port Spencer Socio-economic assessment Rev 0.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
C	2/10/19	Draft for internal review	NS	AH	AH
D	2/10/19	Draft for client comment	NS	AH	SS
0	8/11/19	Final	AH	AH	DM

Contents

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs was to undertake a socio-economic assessment for the proposed grain export terminal at Port Spencer, South Australia, in accordance with the scope of services set out in the contract between Jacobs and the client, Free Eyre Limited (FEL). That scope of services, as described in this report, was developed by Jacobs.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and / or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

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1. Methodology

An assessment of the socio-economic benefits and impacts of the Proposed Amendment was undertaken to enable comparison with the Evaluated Project.

The study area comprises those communities that have potential to experience changes due to the construction and operation of the proposal. The project is located on the Eyre Peninsula between the towns of Tumby Bay and Port Neill within the District Council of Tumby Bay local government area (LGA).

The primary study area for this assessment is shown in Figure 1-1 and comprises the Australian Bureau of Statistics (ABS) defined Tumby Bay (DC) LGA (LGA47910). Benefits and impacts of the Proposed Amendments construction and operation would also be experienced by regional communities. As such, this assessment also considers a secondary study area comprising the Eyre Peninsula and South West Statistical Area Level 3 (SA3)[1].

The methodology for this socio-economic assessment involved:

- Scoping of the likely socio-economic issues for the Proposed Amendment, based on the review of the socio-economic assessment prepared for the Evaluated Project and updated information for the Proposed Amendment
- Describing existing socio-economic conditions and values in the study area, including population and demography, business and industry, social infrastructure and community values
- Identifying and assessing potential benefits and impacts of the Proposed Amendment on socio-economic values, and comparison of these against the socio-economic benefits and impacts identified for the Evaluated Project
- Identifying additional measures to mitigate identified socio-economic impacts.

1.1 Data sources

Socio-economic data presented in this assessment principally draws on information from the ABS 2016 Census of Population and Housing. Data is presented for the primary and secondary study areas, with information on South Australia provided as a comparison. This was supplemented with information and data from:

- Government agencies such as the South Australian Department of Planning, Transport and Infrastructure.
- Tumby Bay District Council publications, reports and websites
- Website and literature reviews
- Previous investigations undertaken for the Port Spencer Stage 1 PER and Sheep Hill Marine Port Facility Socio-Economic Baseline Study.

[1] Socio-economic data for the Evaluated Project was based on the 2006 Census of Population and Housing. Changes have been made to the geographies used by the ABS since the 2006 Census. The primary and secondary study areas represent the closest ABS geographies to the Tumby Bay Statistical Local Area (SLA) and Eyre Statistical Division (SD) used for the Evaluated Project.

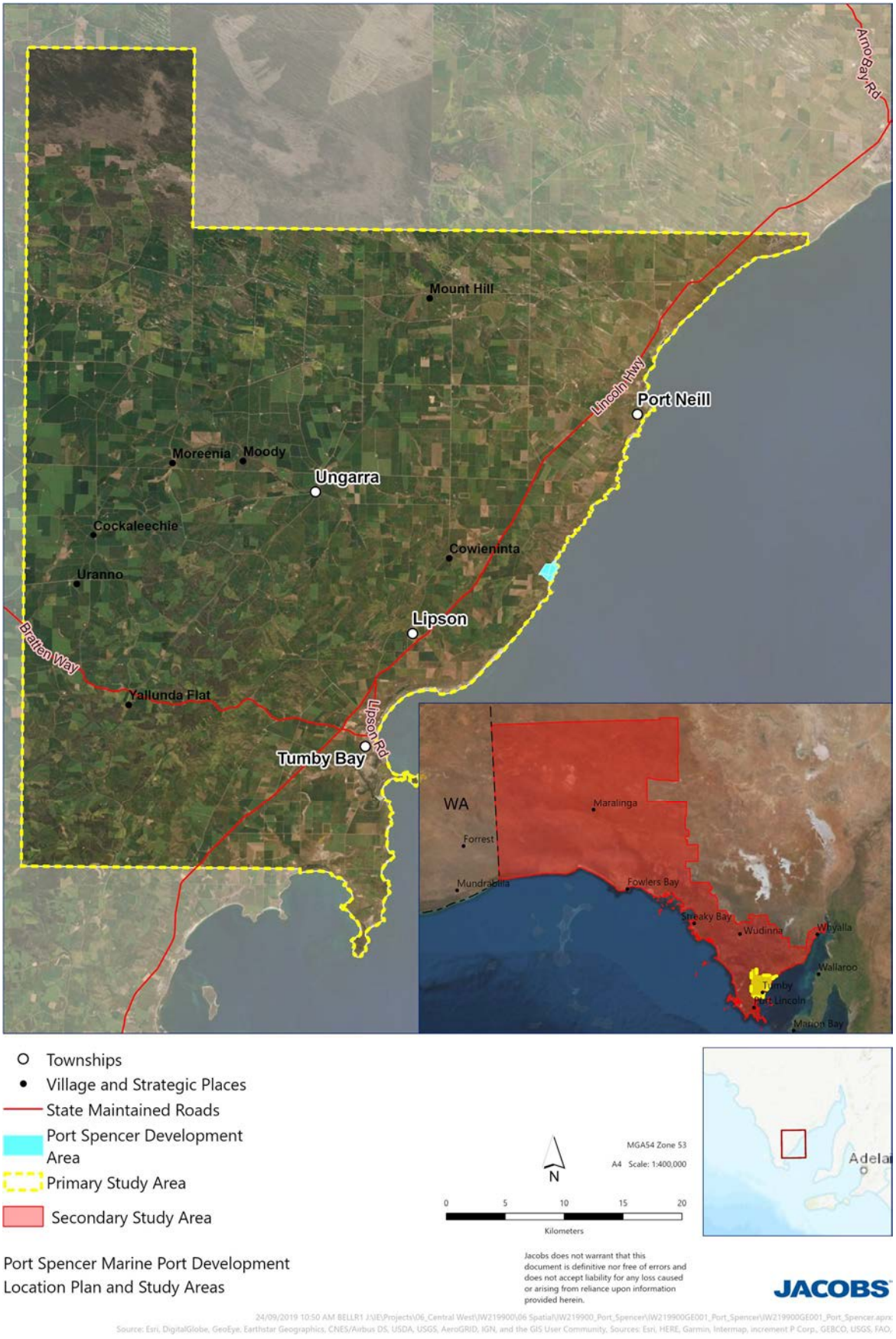


Figure 1-1: Socio-economic assessment study area

2. Existing socio-economic environment

This section describes existing socio-economic values and features in the study area, including population and demography, business and industry, social infrastructure and community values.

2.1 Regional social context

The Tumby Bay LGA is situated on the Spencer Gulf on the eastern coast of Eyre Peninsula. The LGA covers an area of about 2,670 square kilometres and had an estimated resident population of about 2,688 people in 2017.

The proposal is located at Lipson Cove, about 20km north of the town of Tumby Bay. The town of Tumby Bay is the largest town in the LGA and major population and service centre for the surrounding district. The town is a popular retirement location due to its relaxed lifestyle, safe community environment and coastal amenity. Other towns within the Tumby Bay LGA and near the proposal include:

- Port Neill, located about 20km north of the proposal, which is a small coastal town surrounded by mainly agricultural land, and which is a popular tourist destination.
- Ungarra, located about 24km west of the proposal, which is a small agricultural community surrounded by cropping and grazing uses
- Lipson, located about 12km south-west of the proposal, which is a small historic farming town based on mixed cropping and sheep farming (District Council of Tumby Bay, undated).

The Tumby Bay LGA's economy is based on agricultural industries such as mixed cropping, sheep and beef grazing. Tourism is also an important industry for the LGA with many visitors attracted to the area for recreational opportunities associated with the coastal location (District Council of Tumby Bay, undated).

The Eyre Peninsula extends from the Spencer Gulf in the east to the Great Australian Bight in the west, and to the Gawler Ranges in the north. Major population centres for the Eyre Peninsula include Whyalla, Port Lincoln and Ceduna. Port Lincoln is located about 45 kilometres south of the town of Tumby Bay and is the major service centre for the Lower Eyre Peninsula communities.

Agriculture (particularly sheep and grain), aquaculture and tourism are key industries for the regional economy. In 2018/2019, the Eyre Peninsula region produced about 2.18 million tonnes of grain from a crop area of about 1.24 million hectares. This represented about 39% of the State's grain production with the main crops being wheat, barley, and canola (PIRSA, 2019). The Eyre Peninsula is a major contributor to the State's aquaculture activity, with activity in tuna, marine finfish, oysters, mussels, abalone and 'other aquaculture' concentrated in the Eyre Peninsula region. In 2017/2018, the Eyre Peninsula contributed about 90% of the State's total aquaculture production, including 100% of the State's southern bluefin tuna, marine finfish and mussels production (BDO EconSearch, 2019).

Between December 2016 and December 2018, the Eyre Peninsula attracted about 423,000 visitors annually, of which about 95% were domestic visitors and about 70% were 'leisure visitors' (ie on holiday or visiting friends and relatives). In 2016/2017, the tourism industry contributed about $227 million to the regional economy of the Eyre Peninsula (Tourism SA, 2017).

The Eyre Peninsula currently has four ports at Thevenard, Port Lincoln, Whyalla and Port Bonython. The road network across the Eyre Peninsula includes a National Highway, state roads and local roads. Major regional airports are located at Port Lincoln, Ceduna and Whyalla.

2.2 Community profile

2.2.1 Population and demography

In 2018 the primary study area had an estimated resident population of 2,688 people (Table 2-1). Over the 10 years to 2018, the primary study area experienced population growth below the South Australian average,

with an average annual population growth of 0.29% compared to 0.89%. More recently, population growth in the primary study area between 2013 and 2018 grew at a higher rate than the 10-year average. This is compared to a slowing in the growth rate for South Australia as a whole. At a regional level, the population growth of the secondary study area was about half that of the primary study area, with the secondary study area experiencing a decline in population between 2013 and 2018. Population projections are only available for the secondary study area. The population of the secondary study area is projected to remain relatively stable with no population growth projected over the 25 years to 2041.

The primary study area generally has an older population. Compared to South Australia, the primary study area recorded a higher median age, lower proportions of children and working aged people, and higher proportions of older people aged 65 years or over at the 2016 Census. This is likely to reflect the popularity of Tumby Bay as a retirement location and the trend for younger people to move away from rural and regional areas for education or work. At a regional level, the age profile of the secondary study area was similar to South Australia as a whole.

The primary and secondary study areas generally displayed relatively low levels of cultural diversity compared to South Australia, with levels of overseas born people and non-English speaking people well below the South Australian average at the 2016 Census. The primary study area had proportions of people who reported as Aboriginal and/or Torres Strait Islander similar to South Australia. At a regional level, the secondary study area had relatively high proportions of Aboriginal and/or Torres Strait Islander communities, which reflects the presence of Aboriginal communities across the Eyre Peninsula.

Communities in the primary study area generally display lower levels of population mobility, with higher proportions of people who lived at the same address both 12 months and five years prior to the 2016 Census. This is likely to reflect the older population profile and predominantly rural nature of the primary study area.

Table 2-1: Key population and demographic characteristics

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Population and growth			
Estimated resident population (2018)*	2,688	57,823	1,736,422
Average annual change in ERP (2008-2018)*	0.29%	0.14%	0.89%
Average annual change in ERP (2013-2018)*	0.36%	-0.12%	0.77%
Population projection (2041)**	-	58,448	2,046,747
Average annual change in projected population (2016-2041)**	-	0.00%	0.71%
Age profile* **			
Median age (years)	50	42	40
0-14 years	16.6%	19.4%	17.5%
15-64 years	56.4%	62.4%	64.2%
65+ years	27.0%	18.2%	18.3%
Cultural diversity* **			
Aboriginal and/ or Torres Strait Islander people	2.0%	5.6%	2.0%
Overseas born	5.1%	11.2%	22.9%
Speaks language other than English at home	1.3%	4.7%	16.5%
Population mobility* **			
Same address one year previously	83.2%	78.5%	79.2%
Same address five years previously	63.9%	59.6%	57.6%

*Sources: Based on *ABS ERP by LGA (ASGS 2017), 2001 to 2017 dataset and ERP by SA2 and above (ASGS 2016), 2001 onwards. ** Department of Planning, Transport and Infrastructure (2019) Population Projections for South Australia and Regions, 2016-41. ***2016 Census Quickstats and General Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).*

2.2.2 Families and housing

There were 705 families in the primary study area at the 2016 Census, of which nearly 56% comprised couple families without children (Table 2-2). Consistent with many rural and regional areas across Australia, this reflects the trend for young people moving out of rural areas to urban locations for education and employment opportunities.

At the 2016 Census, there were 1,452 dwellings in the primary study area of which 74.2% were occupied. The level of occupancy in the primary study area was below the average for South Australia, which is likely due to the presence of holiday houses and visitor accommodation in coastal towns such as Port Neill.

Nearly 90% of houses in the primary study area were separate houses, which was well above the proportion of this dwelling type in South Australia as a whole and is likely to reflect the predominantly rural nature of the primary study area. At a regional level, the proportion of higher density dwellings such as semi-detached houses, townhouses, flats and apartments in the secondary study area is similar to the South Australian average, which is likely to reflect the greater mix of housing types in major regional centres such as Port Lincoln, Whyalla and Ceduna.

Compared to South Australia, the primary study area had higher proportions of houses that were owned outright and lower proportions of houses that were owned with a mortgage or being rented. This is typical of many rural locations and is likely to reflect the primary study area's older population, lower levels of population mobility, lower housing costs and more affordable housing options (refer to Table 2-2).

Table 2-2: Family and housing characteristics, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Families			
Couple family with no children	55.9%	44.6%	40.2%
Couple family with children	33.9%	37.9%	41.6%
Total families	705	14,545	443,733
Housing			
Total private dwellings	1,452	27,703	731,036
Occupancy rate	74.2%	78.8%	87.4%
Dwelling type			
Separate houses	89.0%	75.0%	77.8%
Semi-detached, townhouse, flat, apartment, etc	8.2%	23.1%	21.4%
Other dwelling type	1.8%	1.3%	0.5%
Housing tenure			
Owned outright	49.7%	32.4%	32.2%
Owned with a mortgage	23.7%	31.0%	35.3%
Rented	23.3%	32.9%	28.5%
Housing costs			
Median monthly mortgage repayments ($)	1,170	1,257	1,491
Median weekly rental costs ($)	170	180	260

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Households paying more than 30% of their income on rent costs	6.4%	9.1%	10.2%
Households paying more than 30% of their income on mortgage costs	4.1%	4.5%	6.6%

Sources: Based on 2016 Census Quickstats data and General Community Profiles for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE)

At the 2016 Census, there were 251 dwellings in the primary study area that were being rented (Table 2-3). Compared to South Australia, the primary study area had lower proportions of dwellings that were being rented from real estate agents and State housing authorities, and higher proportions of dwellings that were being rented from a family member or other person; housing co-operative, community or church group; or 'other landlord type' such as caravan park, marina or employer.

About half of rental dwellings in the primary study area were being rented from a parent, relative or other person, almost double the average for South Australia. A further 9.6% of rental dwellings were being rented from a landlord such as a caravan park, marina or employer.

Table 2-3: Rental dwellings, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Real estate agent	21.5	30.7	45.5
State or territory housing authority	3.6	32.5	18.4
Person not in same household	51.0	24.4	26.2
Housing co-operative/community/church group	6.4	2.8	3.7
Other landlord type (including caravan parks, marinas, and employers)	9.6	6.5	4.2
Landlord type not stated	7.6	3.2	1.9
Total	251	7,174	182,180

2.2.3 Tourist accommodation

The primary and secondary study areas include a range of accommodation options including holiday houses, caravan parks, hotels, motels and serviced apartments. In 2016, the Eyre Peninsula region had 26 accommodation establishments with 15 or more rooms offering a total of 987 rooms. Average occupancy rates for the 12 months to June 2016 ranged from a low of 47% in the winter months to a peak of 53% in October (Tourism SA, 2017).

There are 12 accommodation businesses, including caravan parks, holiday flats, motels, hotels and serviced apartments (Tumby Bay District Business Directory, 2019a). A search of accommodation websites such as Stayz (https://www.stayz.com.au/) and Airbnb (https://www.airbnb.com.au/) also identified additional holiday houses and apartments available for short-term rent in Port Neill and Tumby Bay. A range of visitor accommodation options are also available in Port Lincoln, which is about a 50-minute drive from the project site at Lipson Cove.

2.2.4 Education and employment

At the 2016 Census, residents in the primary and secondary study areas generally had lower levels of non-school qualifications, with 47.8% of people aged 15 years and over in the primary study area and 51.8% in the secondary study area reporting to have a qualification compared to 56.3% in South Australia (Table 2-4). Compared to South Australia, the primary study area had lower proportions of people with diploma, bachelor and post-graduate level qualifications and proportions of certificate level qualifications similar to the South Australia average.

Table 2-4: Education, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Bachelor Degree level and above	8.9%	9.1%	18.5%
Advanced Diploma and Diploma level	6.4%	6.1%	8.3%
Certificate Level III and IV	16.6%	20.2%	16.7%
Certificate Level (total)	20.5%	23.9%	20.1%
Proportion of people aged 15 years and over with non-school qualification	47.8%	51.8%	56.3%

Source: Based on General Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

2.2.5 Employment and income

At the 2016 Census, communities in the primary and secondary study area generally had lower personal and household incomes compared to South Australia as a whole. The primary and secondary study areas also had higher proportions of households on lower incomes and lower proportions of households on higher incomes. This is likely to reflect the older population of the study area and lower proportion of working aged people.

The primary study area recorded a lower level of workforce participation at the 2016 Census, with about 52% of people aged 15 years or over in the primary study area working or looking for work, compared to 58.3% in South Australia. Again, this reflects the older population of the primary study area, with about 27% of the population aged 65 years or over.

At the 2016 Census, the primary study area generally had a relatively low rate of unemployment (at 3.8%) compared to South Australia (at 7.5%).

Table 2-5: Employment and Income, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Income			
Median weekly personal income ($)	570	576	600
Median weekly household income ($)	966	1,073	1,206
Households with income <$650 per week	27.4%	25.5%	21.6%
Households with income >$2,500 per week	9.1%	12.4%	15.3%
Employment			
Total labour force	1,127	25,854	806,589
Participation rate (%)	51.9	56.7	58.3
Unemployment (%)	3.8	7.7	7.5

Source: 2016 Census Quickstats and Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

Agriculture, forestry and fishing were key industries of employment for the primary study area, employing about 28% of residents aged 15 years or over at the 2016 Census. In particular, 'other grain growing' and 'grain – sheep or grain – beef cattle farming' were the top two industries of employment in the primary study area (refer to Table 2-6). Other key industries of employment in the primary study area included supermarket and grocery stores, primary and secondary education, and hospitals (except psychiatric hospitals).

Table 2-6: Industry of employment, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Employment Industries			
Main industries of employment (top 5)	· Other grain growing (13.4%) · Grain-sheep or grain-beef cattle farming (7.4%) · Supermarket and grocery stores (4.1%) · Combined primary and secondary education (3.7%) · Hospitals (except psychiatric hospitals) (3.6%)	· Iron smelting and steel manufacturing (4.3%) · Other grain growing (3.7%) · Hospitals (except psychiatric hospitals) (3.5%) · Supermarket and grocery stores (3.5%) · Grain-sheep or grain-beef cattle farming (2.9%)	· Hospitals (except psychiatric hospitals) (4.1%) · Aged care residential services (3.0%) · Supermarket and grocery stores (2.9%) · Primary education (2.2%) · Cafes and restaurants (2.1%)

Source: 2016 Census Quickstats data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

2.3 Economic profile

2.3.1 Business and industry

In June 2018, there were 325 businesses in the primary study area, of which about half comprised agriculture, forestry or fishing businesses. Construction related businesses were the next largest group of businesses in the primary study area, comprising about 10% of total businesses, followed by rental, hiring and real estate services (9.8%) and retail trade and professional, scientific and technical services, both at 4.3% (ABS,2019).

Retail, services, accommodation and eatery businesses are mainly concentrated in Tumby Bay. These generally serve the day-to-day needs of residents within Tumby Bay and surrounding areas and include such things as a supermarket, food and grocery outlets (eg butcher, bakery, takeaway shops and cafes), pharmacy, post office, hardware and farming and garden supplies, services businesses (eg hairdresser, banks, post office, real estate, and car repairs), and tourist accommodation businesses. Businesses in Port Neill generally include a service station, post office and tourist accommodation businesses.

2.3.2 Agriculture

Agriculture (particularly sheep and grain) is a key industry for the regional economy. In 2018/2019, the Eyre Peninsula region produced about 2.18 million tonnes of grain from a crop area of about 1.24 million hectares (Table 2-7). This represented about 39% of the State's grain production with the main crops being wheat (1.45 million tonnes), barley (468,000 tonnes), and canola (126,620 tonnes). In relation to proportion of total South Australia production, the Eyre Peninsula produces 58% of the State's lupin, about 49% of the State's wheat and 45.4% of South Australia's canola (PIRSA, 2019).

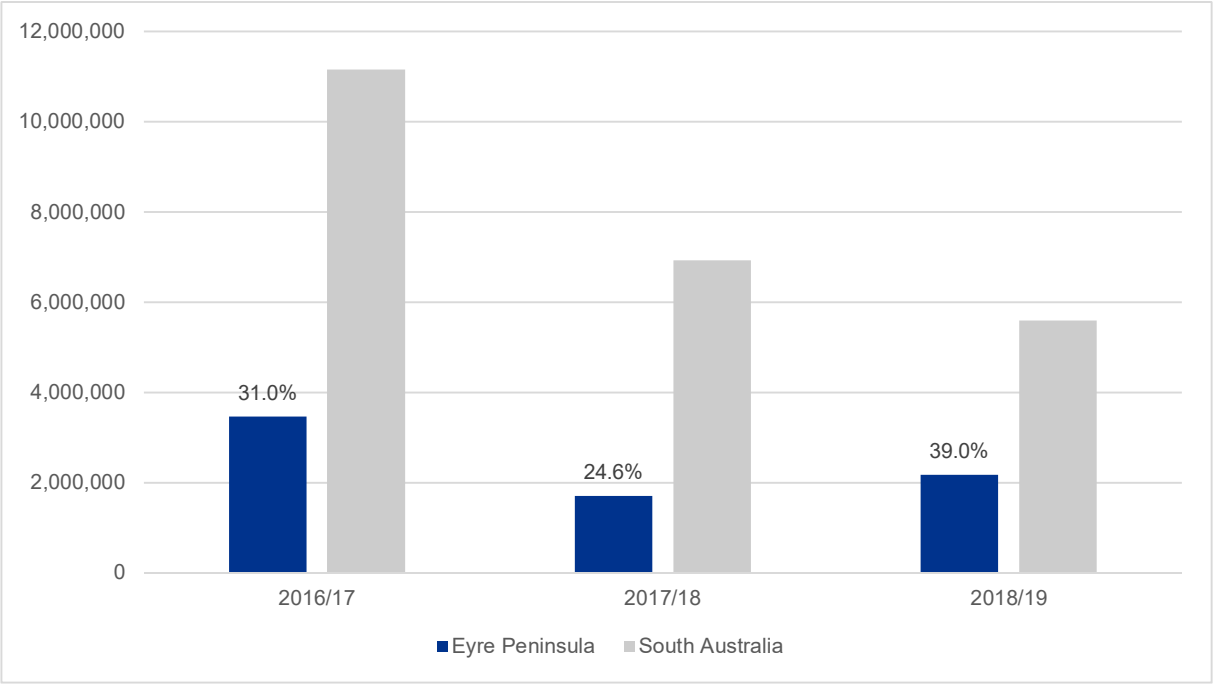
Table 2-7: Crop production, 2018/2019

Commodity	Measure	Eyre Peninsula	South Australia	Proportion of South Australian production
Wheat	Hectares	879,000	1,943,200	45.2
	Tonnes	1,469,000	2,993,700	49.1
Barley	Hectares	191,000	807,800	23.6

Commodity	Measure	Eyre Peninsula	South Australia	Proportion of South Australian production
	Tonnes	468,000	1,687,300	27.7
Oats	Hectares	22,000	74,700	29.5
	Tonnes	23,500	118,500	19.8
Triticale	Hectares	1,400	29,400	4.8
	Tonnes	2,320	32,970	7.0
Peas	Hectares	9,900	65,700	15.1
	Tonnes	9,650	53,120	18.2
Lupins	Hectares	29,000	61,000	47.5
	Tonnes	34,750	59,950	58.0
Beans	Hectares	5,900	63,100	9.4
	Tonnes	10,200	79,680	12.8
Chickpeas	Hectares	600	33,600	1.8
	Tonnes	670	23,870	2.8
Lentils	Hectares	6,100	149,800	4.1
	Tonnes	7,550	177,870	4.2
Vetch	Hectares	6,400	28,400	22.5
	Tonnes	1,450	5,760	25.2
Canola	Hectares	83,600	200,100	41.8
	Tonnes	126,620	278,900	45.4
Hay (not in total)	Hectares	39,000	436,000	8.9
	Tonnes	111,000	1,297,000	8.6
TOTAL (excluding hay)	Hectares	1,239,800	3,503,300	35.4
	Tonnes	2,176,140	5,583,690	39.0

Source: Based on PIRSA, 2019

Figure 2-1 shows total grain production for the Eyre Peninsula between 2016/2017 and 2018/2019. Total grain production over the three years ranged from 1.70 million tonnes in 2017/2018 to about 3.46 million tonnes in 2016/2017 (PIRSA, 2017, 2018, 2019).



Source: PIRSA, 2017, 2018, 2019

Figure 2-1: Grain production, 2016/17 to 2018/19

2.3.3 Fishing and aquaculture

The Eyre Peninsula is a major contributor to the State's aquaculture activity, with activity in tuna, marine finfish, oysters, mussels, abalone and 'other aquaculture' concentrated in the Eyre Peninsula region. In 2017/2018, the Eyre Peninsula contributed about 90% of the State's total aquaculture production, including 100% of the State's Southern Bluefin Tuna, marine finfish and mussels production. The value of aquaculture value from the Eyre Peninsula in 2017/2018 was $184.36 million, of which $126 million was from Southern Bluefin Tuna and $29.87 million from marine finfish (BDO EconSearch, 2019).

In 2017/2018, the aquaculture industry directly and indirectly generated about 1,157 full-time equivalent (FTE) jobs in the Eyre Peninsula, contributing about $78.9 million to household income (BDO EconSearch, 2019).

Tumby Bay and the surrounding district well known by locals and visitors for its recreational fishing opportunities, with key fishing locations including:

- Sir Joseph Banks Group of Islands
- Inshore boating at Tumby Bay and Port Neill.
- Second Creek tidal estuary south of Tumby Bay
- Ski Beach and Back Beach located at the southern end of Tumby Bay
- Beach and rock fishing from variety of locations along the coastline
- Tumby Bay Marina
- Lipson Cove located approximately 15 kilometres north of Tumby Bay
- Port Neill beaches
- Jetties at Port Neill and Tumby Bay (https://www.tumbybay.sa.gov.au/page.aspx?u=319).

2.3.4 Tourism

Tourism is a key contributor to the local and regional economy with tourists attracted to the region by a number of unique and diverse nature-based visitor experiences related to coastal recreation, adventure tourism, ecotourism and the area's scenic landscapes (DPTI, 2012).

Between December 2016 and December 2018, the Eyre Peninsula attracted about 423,000 visitors annually who stayed for a total of about 1.82 million nights. About 95% of visitors were domestic visitors, of which about 74% were from South Australia and 26% from interstate. The average length of stay for all visitors was four nights, with international visitors staying for an average of seven days. Accommodation options such as 'Hotel/resort/motel or motor inn' and 'caravan park or commercial camping ground' were used by about 39% of domestic visitors and 40% of international visitors (Tourism SA, 2017).

About 70% of visitors visit the Eyre Peninsula for holiday or to visit family and relatives. Business travellers comprise about 25% of total visitors. The most popular activities undertaken by visitors included eating out or visiting friends or relatives, although going to the beach, sightseeing and fishing were also key activities undertaken by visitors (Tourism SA, 2017).

Within the primary study area, visitors are attracted to natural and recreational features associated with the local environment including Rogers Beach, Lipson Cove and the Lipson Island Conservation Park. Rogers Beach is located approximately 1,500 metres north of Lipson Cove and is popular for swimming, beach and rock fishing, boating and occasionally surfing (Beachsafe, 2019). Lipson Cove is an isolated sandy beach which is valued for fishing and swimming activities, and its topographic and natural features, tranquillity and picturesque views (Eye on Eyre Tumby Bay, 2018; Caravan on Tour, 2019; Beachsafe, 2019). The Lipson Cove campground is located on the foreshore, with visitors undertaking recreational activities such as swimming, dolphin watching, nature trails, boating and fishing (Without a Hitch, 2017, Beachsafe, 2019). The Lipson Island Conservation Park contains Lipson Island and its surrounding waters. Lipson island is located approximately 170 metres from the mainland, can be walked to a low tide and is known for its wildlife and topographic features (Eye on Eyre Tumby Bay, 2018).

2.4 Social infrastructure

The primary study area has a range of social infrastructure that caters for the needs of local communities, including education facilities; health, medical and emergency services; sport, recreation and leisure facilities; and community facilities (refer to Table 2-8). Communities in the study area also access higher order community services and facilities in regional centres such as Port Lincoln and Whyalla.

Table 2-8: Social infrastructure in the primary study area

Facility	Tumby Bay	Port Neill	Ungarra
Hospital	·		
Community health centre	·		
General practice	·		
Police	·		
Ambulance	·	·	
Fire and rescue	·		
Country Fire Service (CFS)	·	·	·
Kindergarten	·		
Primary school		·	·
Area school	·		
Tertiary education			

2.4.1 Health, medical and emergency services

A range of health and medical services are located at Tumby Bay, including a hospital with 24-hour emergency department, a community health centre and a general practice. The Tumby Bay hospital offers a range of allied health services, primary health care services, residential aged care, and outpatient services. Port Lincoln Hospital is a larger hospital offering 50 beds with obstetrics, renal dialysis, operating facilities and 24-hour accident and emergency department.

There are no medical facilities available in the smaller townships of Port Neill and Ungarra.

Emergency services in the primary study area include ambulance stations at Tumby Bay and Port Neill and fire and police services at Tumby Bay. Country Fire Service (CFS) brigades are located at Lipson, Port Neill, Tumby Bay and Ungarra, providing volunteer fire and rescue services.

2.4.2 Recreation and community facilities

There are a number of recreation and community facilities and organisations provided in the primary study area, with these mainly focused on Tumby Bay and Port Neill including netball, football, cricket, bowling, tennis basketball, croquet, darts and yachting.

Lipson Cove Campground is located on Lipson Cove Road at Lipson Cove south of the project area. The campground has several camp sites and offers basic facilities and beach access. Lipson Cove is also a popular location for swimming and rock and beach fishing, which is used by local and travellers during the summer months. The beach is one of only a few publicly accessible beaches between Port Neill and Tumby Bay and offers access for boat launching (https://beachsafe.org.au/beach/sa/tumby-bay/lipson/lipson-cove).

2.4.3 Education

Primary schools in the primary study area are located at Ungarra, Port Neill and Tumby Bay (Tumby Bay Area School). The Tumby Bay Area School also offers secondary education to Year 12. A kindergarten is also located at Tumby Bay.

2.5 Community values

Community values are those things held as important to communities for quality of life and wellbeing. They include physical elements that contribute to such things as amenity and character, and intangible qualities such as sense of place and community cohesion.

2.5.1 Amenity and lifestyle

The amenity and lifestyle values of the primary study area reflect the area's rural and coastal landscapes and towns and localities that support the area's traditional agricultural and rural pursuits and tourism activities.

The town of Tumby Bay is the largest town in the LGA and major population and service centre for the surrounding district. The town is a popular retirement and holiday location and is valued for its relaxed lifestyle, safe community environment and coastal location. Port Neill is also a popular tourist destination and is valued by residents and visitors for its access to coastal environments (District Council of Tumby Bay, undated).

Communities in the primary study area value the quality of the coastal and marine environment and natural landscapes, with these offering a range of landscape, ecological, scenic amenity, recreational and cultural values. The study area's coastal and marine environment are also important to the region's economy with many visitors attracted to the region's beaches, rocky shores, sheltered bays and offshore islands as well as recreational opportunities such as fishing, diving, and bird watching (Department of Environment and Natural Resources, 2010).

Consultation undertaken for the Evaluated Project identified the 'quietness of the area' and 'small-town lifestyle' as being important to local communities, with the area's rural character, overall geographic beauty, Lipson

Island Conservation Park and unspoilt beaches including Roger's Beach identified as key features important to local communities (Golder Associates, 2009). Preservation of the primary study area's unique natural heritage and environment for current and future generations and ensuring growth does not compromise the lifestyle and amenity that residents enjoy and value are important to local communities (District Council of Tumby Bay, undated).

2.5.2 Community cohesion and sense of community

Communities in the primary study area value a community where residents are safe and an inclusive community, with 'a safe and welcoming community', 'well-staffed medical centre and hospital', emergency services and high standard of community facilities identified as key advantages (District Council of Tumby Bay, undated).

The primary study area demonstrates a strong sense of community, with a high standard of community services and facilities, high volunteer participation and 'a community that works well together' identified as key strengths for communities in the study area (District Council of Tumby Bay, undated). The primary study area also has a broad range of community clubs and organisations such as sporting clubs, environmental groups, cultural organisations, and residents associations, that also foster community interaction and provide the sense that community is an important aspect of the primary study area.

Previous consultation undertaken for the Evaluated project identified that local communities value the community spirit of the area and the 'interaction and kinship that comes with living in a small community' (Golder Associates, 2009).

Industries such as agriculture and aquaculture are important to local communities and contribute to the identity of local communities. Many people across the primary study area are employed in agricultural and aquaculture industries and similar to many rural areas across Australia, it is likely that many farming families have farmed the area over many generations. Sustaining and enhancing success of the Tumby Bay LGA's existing industries is important to communities in the primary study area (District Council of Tumby Bay, undated).

2.5.3 Community health and safety

Local residents in the primary study area value the safe and welcoming community environment, relaxed lifestyle and affordable property. Having a safe and crime free community was identified as 'extremely important' by community members during consultation for the District Council of Tumby Bay Strategic Plan (District Council of Tumby Bay, 2019b). These characteristics are further supported by previous community consultation undertaken for the Evaluated Project, with community members indicating they valued the low levels of crime and high levels of safety; and clean, relaxed and stress-free environment (Golder and Associates, 2009).

2.5.4 Access and connectivity

The primary and secondary study areas are serviced by a range of transport infrastructure, including roads, ports and airports.

Key roads servicing the primary and secondary study areas include:

- Eyre Highway, which forms part of the National Highway and connects from Norseman in Western Australia to Port Augusta at the top of Spencer Gulf
- Lincoln Highway, which connects Whyalla and Port Lincoln along the east coast of Eyre Peninsula
- Flinders Highway, which connects Ceduna and Port Lincoln along the west coast of Eyre Peninsula
- Tod Highway, which connects the Eyre and Flinders Highways
- Birdseye Highway, which connects Elliston on the west coast of Eyre Peninsula to Cowell on the east coast of Eyre Peninsula (SMEC, 2019).

The primary study area also includes a number of local roads that provide connections to major highways, local centres and rural areas. These include Lipson Cove Road, which is an unsealed road connecting Lincoln Highway to Lipson Cove.

There are four ports located across the Eyre Peninsula including:

- Thevenard, located approximately three kilometres from Ceduna on the west coast of Eyre Peninsula, which mainly provides for gypsum, grains and seeds, salt and mineral sands (https://www.flindersports.com.au/ports-facilities/thevenard/)
- Port Lincoln, located on the south-east coast of Eyre Peninsula, which generally provides for grains and seeds, petroleum products and fertilisers (https://www.flindersports.com.au/ports-facilities/port-lincoln/)
- Whyalla, which caters for iron ore products from SIMEC's mining operations
- Port Bonython, located near Whyalla on the east cost of Eyre Peninsula, which is used for the export of naphtha, crude oil, propane and butane (https://www.santos.com/what-we-do/activities/south-australia/port-bonython/port-bonython-processing-facility/).

The primary and secondary study areas are serviced by three regional airports at Port Lincoln, Whyalla and Ceduna. The airports cater for daily air services to and from Adelaide by Regional Express and Qantaslink (http://www.eyrepeninsula.com/getting-here). The District Council of Tumby Bay also owns and maintains the Tumby Bay Aerodrome.

3. Impact assessment and mitigation

The PER identified a range of socio-economic impacts and opportunities of the Evaluated Project for communities closest to the development, the Eyre Peninsula region and South Australia. This section assesses changes to the socio-economic impacts and opportunities identified for the Evaluated Project due to the construction and operation of the Proposed Amendment.

3.1 Comparison of key inputs and assumptions

The Evaluated Project and the Proposed Amendment propose to develop the project site for a bulk shipping land use. Key aspects of the Proposed Amendment that are likely to result in changes to the socio-economic impacts are described in Table 3-1.

Table 3-1: Comparison between Evaluated Project and Proposed Amendment relevant to socio-economic assessment

Evaluated Project	Proposed Amendment
Construction	
Peak construction workforce of more than 200 people. Construction is expected to occur over 24-month period.	Peak construction workforce of approximately 150 people. Construction expected to occur over an 18-month period.
On-site living accommodation proposed for construction workers in Tumby Bay.	The accommodation workforce would be accommodated locally (eg rental housing, tourist accommodation, etc).
Haul road transport and infrastructure access corridor – from the Lincoln Highway and generally following the alignment of Swaffers Road.	Access corridor from the Lincoln Highway via Lipson Cove Road.
Operation	
Operational workforce of 70 people, comprising 30 who would be directly employed to operate the project and up to 40 employed by operators of the grain and hematite operations on-site. The project would continue to operate throughout the year.	Operational workforce of 10-30 people, during operation of the port, with the peak occurring during the October – December harvest season when most grain deliveries are anticipated.
Hematite in-loading and storage facilities.	No iron ore in-loading or storage facilities proposed.
Operation would involve up to 140 ore truck movements per day from the proposed mine site, with an additional 70 truck movements per day attributable to grain deliveries. Haulage route from Lincoln Highway and generally following the alignment of Swaffers Road.	The catchment area for grain to be transported to site would extend across the central Eyre Peninsula region. Haulage route from Lincoln Highway via Lipson Cove Road.

3.2 Amended impact assessment for socio-economic impacts

Table 3-2 identifies potential impacts considered for the Evaluated Project and summarises the main changes in socio-economic impacts of the Proposed Amendment.

Table 3-2: Summary of potential socio-economic impacts for the Evaluated Project and Proposed Amendment

Element	Change in socio-economic impact
Construction	
Construction workforce	· Population and demographic impacts · Changes in local employment opportunities.
Construction workforce accommodation	· Changes to demand for rental housing and visitor accommodation during construction, and subsequent impact on tourists and rental households.

Element	Change in socio-economic impact
Haul road transport and infrastructure access corridor	· Changes to impact in sensitive receivers (eg farm houses at Lipson Cove Road).
Operation	
Operational workforce and timing of operations	· Changes in employment opportunities during operation. · Changes in demand for worker accommodation during the three-month operational period and subsequent impacts on tourists and rental households.
In-loading and storage facilities	· Changes to community values relating to visual amenity.
Operational haulage	· Possible changes to roads used for haulage of grain. · Changes to impact in sensitive receivers (eg farm houses at Lipson Cove Road).

3.2.1 Construction phase

Population and demography

It is anticipated that up to 150 people would be directly employed by the Proposed Amendment during the construction phase, compared to more than 200 people for the Evaluated Project.

While the peak construction workforce for the Proposed Amendment is expected to be below that of the Evaluated Project, potential impacts on population and demography are expected to be similar to those identified for the Evaluated Project. This includes the potential for an increase in the percentage of males and younger people residing in the study area during the construction phase and more itinerant workers moving in and out of the study area in search of better position. The provision of local employment and training opportunities through the construction phase may also provide opportunities for young people to remain in the primary study area rather than moving away for employment.

Housing and accommodation

The Evaluated Project proposed that construction workers would generally be accommodated in a worker accommodation camp in Tumby Bay. The Proposed Amendment would not include the establishment of a worker accommodation camp, with construction workers from outside of the region generally be required to source local accommodation such as rental housing or temporary visitor accommodation.

Similar to the Evaluated Project, it is likely that a large portion of the workforce for the Proposed Amendment would need to be sourced from outside of the study area, due to the qualifications or experience required and the availability of local workers with the required skills. It is likely that demand for accommodation for the construction workforce would generally be in towns closest to the project, for example Tumby Bay and Port Neill, although it is possible that some construction workers may choose to commute further and live in a larger centre such as Port Lincoln.

Increased demand for rental housing during the construction phase may put pressure on rental prices resulting in increased rents. This would have the greatest impact on affordable rental housing access, resulting in potential increase in housing stress for households on low or fixed incomes, or requiring low income households to find alternate rental accommodation in other locations. As indicated in Section 2.2.2, households in the primary study area displayed relatively low levels of housing stress in relation to rental housing, with 6.4% of households paying more than 30% of their income on rent costs, compared to 10.2% in South Australia, possibly reflecting the more affordable housing in the primary study area. However, the primary study area had higher proportions of households with lower incomes, and higher proportions of older people, who may be at risk of housing stress.

The construction phase is also expected to increase demand for temporary accommodation options, such as motels and other ‘guest’ accommodation. As indicated in Section 2.2.3, average room occupancy rates for

tourist accommodation in the Eyre Peninsula in 2016 ranged from about 47% to 53%, suggesting that there would be some capacity in existing tourist accommodation to accommodate construction workers for the Proposed Amendment. The use of some of the available, under-utilised tourist accommodation for temporary workforce accommodation would provide economic benefits for the owners of tourist accommodation by providing a base load demand and would help to ease demand for private rental accommodation.

In peak demand periods (e.g. September to November and April), the use of nearby tourist accommodation by construction workers may impact on the availability of short-stay accommodation and demand for tourist accommodation may impact on the flexibility of the tourism sector to meet peak demands. Consultation with tourism representatives about peak construction worker demand periods will be important to manage potential impacts on tourism in the study area and avoid potential for any residual impacts post-construction.

Employment and training

It is anticipated that up to 150 people would be directly employed by the Proposed Amendment during the construction phase, compared to more than 200 people for the Evaluated Project. While the peak construction workforce for the Proposed Amendment is expected to be below that of the Evaluated Project, potential impacts on employment and training are expected to be similar to those identified for the Evaluated Project.

Similar to the Evaluated Project, the Proposed Amendment is also expected to create indirect opportunities for employment through local businesses that supply goods and services to the construction phase. This may include businesses that offer services such as transportation, sub-contract skills (e.g. electrical, fencing, road building), equipment hire, fuel supplies and accommodation. These benefits are likely to be occur within the primary and secondary study areas and across South Australia.

Business and industry

During construction, the Proposed Amendment is expected to provide opportunities for local business and industry through the direct supply of goods and services to construction activities (e.g. vehicle and equipment hire, fuel supplies, administrative services) and flow-on impacts for businesses such as restaurants, shops and other services that provide for the day-to-day needs of construction workers. These benefits would be similar to the Evaluated Project and are expected to benefit businesses within the primary and secondary study areas and across South Australia.

Construction of the Proposed Amendment has potential to impact on tourism in the primary study areas. Increased demand for tourist accommodation by construction workers may impact on the availability of short-term accommodation in the primary study area, potentially causing tourists to travel to other towns and locations within the Eyre Peninsula. This may have a flow on effect for other tourism related businesses such as tour operators, visitor attractions and restaurants/ cafes. This may also have residual effects post-construction if some visitors are dissuaded from returning in the future.

Potential impacts on nature-based and recreation-based tourism activities due to changes in visual and environmental amenity during construction are expected to be similar to the Evaluated Project. Further information about potential impacts on ecological values, air quality, noise and visual amenity is provided in Appendix C, Appendix H, Appendix I and Appendix L, respectively, of the Review of Evaluated Project document.

Social infrastructure

During construction, potential impacts of the Proposed Amendment on social infrastructure are expected to be similar to the Evaluated Project. In particular, an influx of people during construction and construction activities is likely to create additional demand for some local support services and facilities such as medical and emergency services, potentially impacting on the availability of these services for local residents.

Community values

Potential impacts during construction of the Proposed Amendment on community values are expected to be similar to the Evaluated Project. In particular, construction activities have potential to impact on community values relating to such things as scenic amenity, natural environment, local amenity and health and safety.

The Proposed Amendment proposes to use Lipson Cove Road for construction haulage. This is a change from the Evaluated Project, which proposed the use of Swaffers Road for haulage access. While this would avoid potential impacts for users and rural residents of Swaffers Road, an increase in haulage vehicles using Lipson Cove Road has potential to impact on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users (eg visitors to Lipson Cove campsite). Further discussion about construction traffic impacts is provided in Chapters 2.8 and 3.7 and Appendix B of the Review of Evaluated Project document. The upgrade of Lipson Cove Road, including the intersection with Lincoln Highway, widening and sealing, may also result in temporary amenity impacts for near sensitive receivers.

An influx of construction workers to the primary study area during the construction phase has potential to impact on community cohesion and sense of community for towns closest to the project, such as Tumby Bay and Port Neill. Potential impacts on community cohesion and sense of community associated with an influx of construction workers have potential to be slightly greater with the Proposed Amendment given construction workers will be accommodated in private rental housing and short-term tourist accommodation, rather than a worker's accommodation camp proposed with the Evaluated Project.

Access and connectivity

During construction, potential impacts of the Proposed Amendment on regional roads such as the Lincoln Highway are expected to be similar to the Evaluated Project. Potential changes in local access and connectivity would mainly be associated with the use of Lipson Cove Road rather than Swaffers Road. Lipson Cove Road provides access to rural properties, including three rural dwellings, and to recreational uses at Lipson Cove including the beach and Lipson Cove campground.

An increase in traffic using Lipson Cove Road, including heavy vehicles, has potential to impact on perceptions of road safety for local communities and road users. The upgrade of Lipson Cove Road to support construction activities, including upgrade of the intersection with Lincoln Highway, widening and sealing, have potential to cause temporary delays and disruptions for road users. The implementation of traffic management measures would help to mitigate potential impacts of construction traffic on local road users.

3.2.2 Operation phase

Population and demography

It is anticipated that during operation, up to 30 people would be directly employed by the Proposed Amendment for a period of about three months. This would generally coincide with the harvest period (October to December), when most grain deliveries would occur. Outside of this period, approximately 10 workers are expected to be present at the port site, for ship-loading and maintenance activities. This is a change from the Evaluated Project, which was expected to generate jobs for about 30 full-time workers, in addition to those employed by the mine and grain operators to manage material transport and handling.

While it is likely that some workers would come from local communities or from communities across the Eyre Peninsula, it is likely that some workers may come from other areas. While this may result in a small temporary increase in the local population, this is not expected to impact on the wider population and demography of the primary study area.

Housing and accommodation

The Evaluated Project anticipated that operational workers would generally live in surrounding local communities, if they were not already residing in the region. As the workforce for the Proposed Amendment would peak for a period of up to three months each year, it is likely that any non-local workers would be

accommodated in temporary visitor accommodation, providing temporary economic benefits for some owners of tourist accommodation near the project.

As indicated in Section 2.2.3, average room occupancy rates for tourist accommodation in the Eyre Peninsula in 2016 ranged from about 47% to 53%, with September to November identified as peak occupancy periods. While this period partly coincides with the peak operational period of the project, demand for worker accommodation is generally expected to be low given the size of the workforce and there is expected to be capacity in the tourist accommodation. As such, potential impacts on temporary visitor accommodation or local rental housing during operation are generally expected to be negligible.

Employment and training

Similar to the Evaluated Project, the Proposed Amendment would provide benefits for local and regional communities through the provision of local employment opportunities. However, potential employment opportunities with the Proposed Amendment would less than the Evaluated Project (i.e. 10 jobs peaking to 30 jobs during grain harvest season rather than 70 jobs).

The Proposed Amendment is also expected to provide opportunities for indirect employment through local businesses that supply goods and services to the operation phase. Overall these benefits are expected to be minor.

Business and industry

Similar to the Evaluated Project, the Proposed Amendment would have positive impacts on grain producers within the Eyre Peninsula by reducing haulage distances and subsequent transport costs. During operation, it is anticipated that about a third of grain haulage traffic that currently accesses the port at Port Lincoln would be redirected to Port Spencer. Potential impacts for local businesses and industry in Port Lincoln and along haulage routes (both to Port Lincoln and Port Spencer) associated with this shift in haulage traffic are expected to be similar to those described for the Evaluated Project.

During operation, the Proposed Amendment is expected to provide opportunities for local business and industry through the direct supply of goods and services to support the port's operation. Flow-on impacts for businesses are also likely to result from increased spending by employees of the port (eg at restaurants, cafes, retail outlets). While these benefits would be similar to the Evaluated Project, the scale of benefits for local business and industry from the operation of the port would generally be reduced given the smaller scale of operations Proposed Amendment (i.e. 10 jobs peaking to 30 jobs during grain harvest season rather than 70 jobs).

As indicated in Section X, tourism is an important industry for the primary study area, particularly for coastal towns such as Port Neill. Overall, the Proposed Amendment is expected to have minimal impact on tourism activities in centres such as Tumby Bay and Port Neill. While the Lipson Cove campsite would continue to operate, the presence of port infrastructure may impact on the use and enjoyment of the campsite for some people. Short-term demand for temporary visitor accommodation by non-local workers during the three-month peak operation period of the Proposed Amendment is expected to have benefits for some accommodation providers in towns closest to the project.

Social infrastructure

Similar to the Evaluated Project, potential impacts of the Proposed Amendment on local services such as medical and emergency facilities are expected to be minor, given the relatively small workforce.

As previously indicated, the port operations would generally peak during the grain harvest season (October – December), which is a change to the Evaluated Project. As such, the Proposed Amendment is not expected to result in an influx of new permanent residents to the primary study area or changes to enrolments at local schools.

The presence of port infrastructure and operation of the port may impact on the use of Lipson Cove campsite and deter some people from using this site, particularly during the three-month period the port is operating.

Community values

Potential impacts of the Proposed Amendment's operation on community values are expected to be similar to the Evaluated Project, particularly in relation to such things as scenic amenity, natural environment, local amenity and health and safety.

The Proposed Amendment proposes to use Lipson Cove Road for access to the port, which is a change from the Evaluated Project. While this would avoid potential impacts for users and rural residents of Swaffers Road, an increase in heavy vehicles using Lipson Cove Road during peak operation of the port has potential to impact on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users. Overall, these impacts would be less than the Evaluated Project given the shorter operating period and the reduced number of haulage vehicles with the removal of the mining related vehicles.

The presence of vessels and heavy vehicles and general port operations for the Proposed Amendment has potential to impact on recreational values associated of Lipson Cove, such as camping and fishing. However, compared to the Evaluated Project, impacts of the Proposed Amendment on these values are expected to be less given the shorter grain delivery period (eg three months compared to year-round grain and ore deliveries) and reduced number and size of vessels.

Access and connectivity

Potential impacts of the Proposed Amendment's operation on regional roads such as the Lincoln Highway are expected to be similar to the Evaluated Project, although the scale of these impacts are likely to be reduced given the shorter grain delivery period (eg three months compared to year-round grain and ore deliveries).

Potential changes in local access and connectivity would mainly be associated with the use of Lipson Cove Road rather than Swaffers Road. Lipson Cove Road provides access to rural properties, including three rural dwellings, and to recreational uses at Lipson Cove including the beach and Lipson Cove campground. An increase in traffic using Lipson Cove Road, including heavy vehicles, has potential to impact on perceptions of road safety for local communities and road users during the three-month grain delivery period. The upgrade of Lipson Cove Road to support the Proposed Amendment's operation would improve access and road safety for local communities and visitors to Lipson Cove.

3.3 Summary and conclusion

Potential benefits and impacts of the construction and operation of the Proposed Amendment are generally expected to be similar to the Evaluated Project.

During construction, potential changes in socio-economic benefits and impacts of the Proposed Amendment would mainly be associated with increased demand by construction workers for rental housing and temporary visitor accommodation in towns near the construction works, such as Tumby Bay and Port Neill. While this is likely to have benefits for owners of tourist accommodation and rental properties, increased demand for accommodation has potential to impact on:

- levels of housing stress for some households on low or fixed incomes
- flexibility of the tourism sector to meet peak tourist demands
- tourism industry in the primary study area due to some people choosing to travel o other towns and locations within the Eyre Peninsula
- community cohesion and sense of community for towns closest to the project, due to workers accommodated in private rental housing and short-term tourism accommodation rather than a workers accommodation camp.

The use of Lipson Cove Road for construction also has potential to impact on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users.

During operation, potential changes in socio-economic benefits and impacts of the Proposed Amendment would mainly be associated with the reduced operating period of the port, from year-round grain and ore delivery to most grain deliveries occurring during harvest season (October – December). While this would provide benefits for local employment and local businesses that supply goods and services to the operating port, the scale of the benefits compared to the Evaluated Project are likely to be less. Other changes to socio-economic impacts associated with the Proposed Amendment, would mainly relate to:

- increased short-term demand by the operational workforce for visitor and tourism accommodation during the port's peak operating period, providing benefits for some owners of tourist accommodation
- increase in heaving vehicles using Lipson Cove Road, potentially resulting in temporary impacts on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users during the port's three-month peak grain delivery period
- reduced benefits for local services such as schools, given an influx of new residents is not expected
- reduced impacts on recreational values of Lipson Cove due to the shorter grain delivery period of the Proposed Amendment (i.e. up to three months compared to year-round) and reduced number and size of vessels.
- improved access and road safety for local communities and visitors to Lipson Cove from the upgrade of Lipson Cove Road.

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Appendix G. Greenhouse Gas Calculations

Port Spencer Grain Export Terminal

Greenhouse Gas Assessment

IW219900-0-NN-RPT-0002 | 0

8 November 2019

Peninsula Ports

Document history and status

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Port Spencer Grain Export Terminal

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Contents

Executive Summary

A greenhouse gas assessment was undertaken for the proposed Port Spencer Grain Export Terminal on the east coast of the Eyre Peninsula, South Australia. The proposed facility will provide a localised grain storage and export option for grain growers of the lower and eastern regions of the Eyre Peninsula. The facility will be capable of handling peak harvest loads of up to 30,000 tonnes of grain each day and offers the ability for up to one million tonnes of grain to be exported annually.

The Port Spencer site was originally proposed by Centrex Metals Limited in 2011 as a deep-sea port facility for the export of iron ore from their Eyre Iron Joint Venture Project (Centrex, 2012). The site was owned by Centrex Metals and the Port Spencer Stage 1 Project successfully received provisional development authorisation to export both iron ore and grain from the site. Under the current proposal (the Proposed Amendment), only grain would be exported from the Port Spencer site; i.e., not minerals, and Peninsula Ports is seeking to amend the existing development authorisation under Section 47 of the *Development Act 1993*.

The key objective of the GHG assessment was to estimate the GHG emissions for the proposed grain facility and compare it with the GHG emissions inventory developed for the original Centrex project. Where possible, the same assessment boundaries were applied.

The study involved the calculation of emissions associated with both the construction and operations phases of the proposed facility. Emissions were calculated in accordance with the National Greenhouse Emissions Reporting Scheme Technical Guidelines (NGER, 2017). Key emission sources were:

- Construction – emissions from diesel combustion (heavy mobile equipment, diesel generator and site vehicles) and land clearing
- Operations – emissions from diesel combustion (heavy mobile equipment, diesel generator and site vehicles)

A summary of the calculated GHG emissions associated with the construction and operations phases of the proposed grain facility are provided in Table 1. All emissions are Scope 1 emissions. There are no Scope 2 emissions.

Table 1: Summary of GHG emissions for the proposed Port Spencer grain storage and export facility

GHG emissions	Units	Estimated CO_2-e emissions (Scope 1)	
		Current project	Centrex PER (2012)
Construction phase			
Diesel combustion	t CO_2-e	21,700	33,500
Land clearing	t CO_2-e	2,600	0
Total construction emissions	**t CO_2-e**	**24,300**	**33,500**
Operations phase			
Diesel combustion	t CO_2-e / yr	7,300	7,340
Total operations emissions	**t CO_2-e / yr**	**7,300**	**7,340**

The construction emissions estimated as part of the Proposed Amendment are significantly lower than that for the original Centrex project. This is most likely a result of reduced inventory of heavy mobile equipment required for the current assessment compared to the Centrex project.

The calculated GHG emissions for the operation of the Proposed Amendment are similar to that calculated for the original Centrex project.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide the greenhouse gas assessment for the proposed Port Spencer Grain Export Terminal in accordance with the scope of services set out in the contract between Jacobs and the Client, Peninsula Ports.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report using various information sourced from Peninsula Ports and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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This report has been prepared on behalf of, and for the exclusive use of Peninsula Ports and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and Peninsula Ports. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Abbreviations

ACCUs	Australian carbon credit units
AGEIS	Australian Greenhouse Emissions Information System
CERT	Carbon Estimate and Reporting Tool
CH_4	methane
CO_2-e	Equivalent carbon dioxide emissions. Incorporates CO_2 as well as other GHG gases, converted to CO_2 equivalency using respective global warming potentials.
DoEE	Department of Environment and Energy (Commonwealth)
EPA	Environment Protection Authority (South Australia)
ERF	Emissions Reduction Fund
FEL	Free Eyre Limited
GHG	Greenhouse gas
GJ	Gigajoules (10^9 joules)
g/sec	Grams per second
ha	Hectare (10,000 m^2)
HFC	Hydrofluorocarbons
kt	Kilotonnes (1000 tonnes)
MW	Megawatt (1 million watts)
m^3/sec	Metres cubed per second
mg/m^3	Milligrams (1 x 10^{-3} grams) per cubic metre
µg/m^3	Micrograms (1 x 10^{-6} grams) per cubic metre
NGA	National Greenhouse Account
NGER	National Greenhouse Emissions Reporting
PER	Public Environment Report
PFC	Perfluorocarbons
N_2O	Nitrous oxide
SA	South Australia
SF_6	Sulphur hexafluoride
t	Tonne (1000 kg)
TJ	Terajoules (10^{12} joules)
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

1. Introduction

1.1 Project Background and Objectives

Port Spencer (the site) was originally proposed by Centrex Metals Limited in 2011 as a deep-sea port facility for the export of iron ore from its Eyre Iron Joint Venture Project (Centrex, 2012). The project was declared a Major Development under the *Development Act 1993* and it was determined that the project would be subject to a Public Environment Report (PER) process. The Port Spencer site was owned by Centrex Metals and the Port Spencer Stage 1 Project (the Evaluated Project) successfully received provisional development authorisation to export both iron ore and grain from the site. At this time, Free Eyre Limited (FEL) was the preferred grain supplier and was closely involved in the planning for the project.

The provisional development authorisation granted to Centrex Metals in 2012 and extended in 2014 currently remains active and was transferred to Peninsula Ports (a subsidiary of FEL) in mid-2019 following purchase of the land from Centrex Metals. Given Peninsula Ports only intends to export grain from the Port Spencer site; i.e., not minerals, Peninsula Ports is seeking to amend the existing authorisation under Section 47 of the *Development Act 1993.* The amendment process is required to take account of alterations to the Evaluated Project and to update the PER due to the length of time, nearly 9 years, that has passed since the PER was prepared.

This greenhouse gas assessment has been undertaken in order to support the development of the proposed grain storage and export facility at Port Spencer.

1.2 Description of Port Spencer Facility Operations

The Port Spencer Grain Export Terminal will provide a localised grain storage and export option for grain growers of the lower and eastern regions of the Eyre Peninsula. The facility will be capable of handling peak harvest loads of up to 30,000 tonnes of grain each day and offers the ability for up to one million tonnes of grain to be exported annually. It is expected that almost all of the grain will be transported from the grain facility by cargo ship. The project includes the construction of an approximately 600-metre long jetty to cater for Panamax cargo ships.

The construction phase is expected to be carried out within an 18 month period. During this time, key activities will include: land clearing, site establishment and civil works, construction of the grain storage bunkers, construction of the silo area and all associated roads and buildings (workshops, administration, etc.), and building of the causeway and jetty.

During operations, trucks will enter and exit the facility from the Lincoln Highway via Lipson Cove Road. The grain will be unloaded from the trucks at hopper bays located at the end of each of eight grain storage bunkers, and then stockpiled at the bunker via conveyors. From the bunkers, the grain will be reclaimed and transferred via conveyors to the silo area, from where it will either be stored or transferred via conveyor to the ships' cargo holds.

The harvest season at Eyre Peninsula will represent a period of intense grain delivery at the proposed facility and is expected to last for approximately 2 months between mid-October and mid-December. During this time, there will be a high number of trucks entering and leaving the site during the day and until approximately 10 pm. For the remaining 10 months of the year, the activity at the site is expected to be considerably less with operational hours during the day only (9 am until 5 pm).

1.3 Geographical Summary

The proposed Port Spencer Grain Export Terminal is located approximately 20 km north-east of Tumby Bay, South Australia, and approximately 65 km north-east of Port Lincoln.

The Port Spencer site location is shown in Figure 1-1. The site area within the site boundary is approximately 135 hectares.

Figure 1-1: Proposed Site Location

1.4 Project Greenhouse Gas Emissions

The key emissions associated with the construction and operation of the proposed facility relate to the combustion of diesel. Diesel will be used for stationary diesel power generator and to fuel heavy mobile equipment for civil works, construction of the causeway and jetty, and construction of infrastructure including the silos, bunkers, and various buildings (workshops, amenities, etc.). Diesel will also be used for staff and contractor site vehicles. Land clearing will also contribute to GHG emissions.

Similarly, the key emissions during ongoing operation of the grain facility will be diesel combustion emissions associated with power generation, mobile heavy equipment and site vehicles.

Details of emissions sources and quantity estimates are provided in Section 4.

1.5 Greenhouse Gases and Climate Change

The GHG inventory has been calculated in accordance with the principles of the *Greenhouse Gas Protocol* (GHG Protocol) by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), WBCSD; WRI 2004.

Greenhouses gases include:

- Carbon dioxide (CO_2) – by far the most abundant GHG, primarily released during fossil fuel combustion
- Methane (CH_4) – from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills)
- Nitrous oxide (N_2O) – from industrial activity, fertiliser use and production
- Hydrofluorocarbons (HFCs) – commonly used as refrigerant gases in cooling systems
- Perfluorocarbons (PFCs) – used in a range of applications including solvents, medical treatments and insulators
- Sulphur hexafluoride (SF_6) – used as an insulator in heavy duty electrical switch gear.

The key GHGs relevant to this assessment are CO_2, CH_4 and N_2O.

The GHG emissions that form the inventory can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the GHG Protocol and can be summarised as follows:

- Scope 1 – Direct emissions from sources that are owned or operated by a reporting organisation (examples – combustion of coal for the generation of electricity, combustion of diesel in company-owned vehicles or used in on-site generators)
- Scope 2 – Indirect emissions associated with the import of energy from another source (examples – import of electricity or heat)
- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (examples include business travel (by air or rail) and product usage).

Figure 1-2 shows graphically the different GHG emission scopes.

The initial action for a greenhouse gas inventory is to determine the sources of GHG emissions, assess their likely significance and set a provisional boundary for the study.

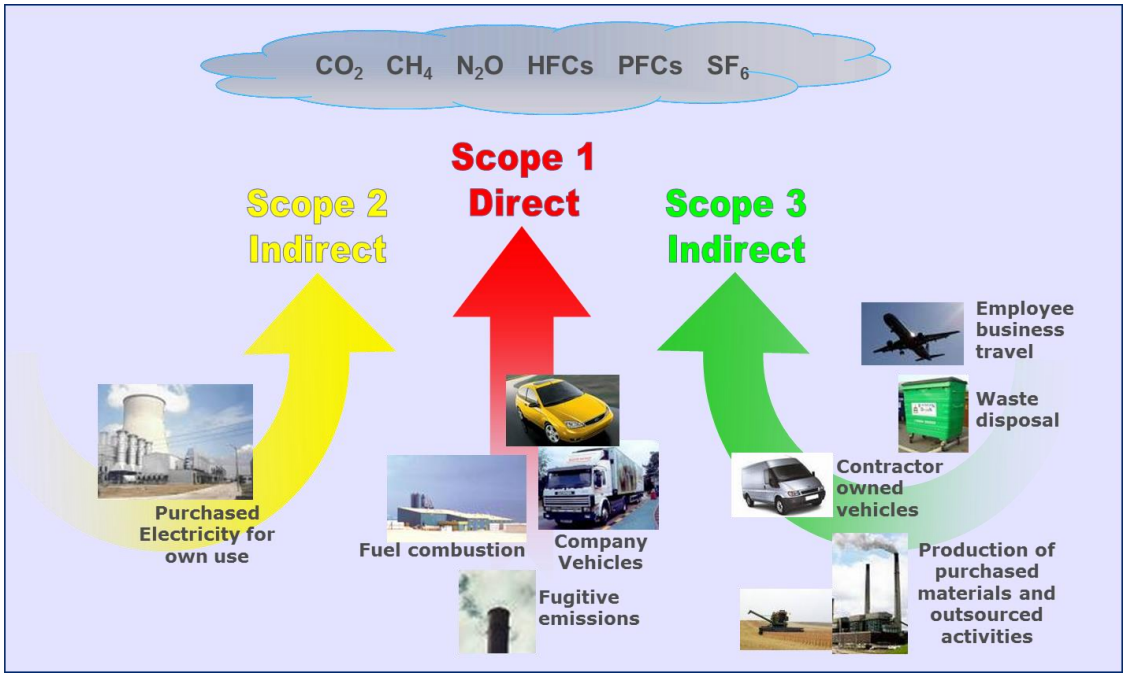

Figure 1-2 : Sources of greenhouse gases

2. Legislation, Policy and Guidelines

This section presents the regulatory requirements against which South Australia Environment Protection Authority (EPA) assesses compliance with GHG policy and legislation.

2.1 Commonwealth Greenhouse Gas Policy

2.1.1 Overview

Since the original PER (Centrex, 2012), the Australian government repealed the carbon tax in 2014 and introduced the 'Direct Action Plan', which incorporates an Emissions Reduction Fund (ERF). Similarly, the Energy Efficiency Opportunities Act 2006 was also repealed in 2014. The current climate change management legislation, including reporting requirements, is centred on the National Greenhouse and Energy Reporting Act 2007 and the ERF.

2.1.2 National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) provides for the reporting and dissemination of information related to GHG emissions, GHG projects, energy production and energy consumption.

Reporting requirements under the NGER Act are triggered when the GHG emission and/or energy use of corporations and/or individual facilities owned and operated by constitutional corporations meet specific criteria.

For individual facilities, the following thresholds apply:

- emissions of 25,000 tonnes or more of greenhouse gases (CO_2-e) (scope 1 and scope 2 emissions)
- production of 100 TJ or more of energy, or
- consumption of 100 TJ or more of energy.

For corporate groups, thresholds are GHG emissions of greater than 50,000 t CO_2-e per year (Scope 1 and Scope 2 emissions), production of 200 TJ or more of energy per year, or consumption of 200 TJ or more of energy per year.

Peninsula Ports is a wholly owned subsidiary of Free Eyre Limited (FEL). FEL do not currently report GHG emissions to the Clean Energy Regulator and it is expected that FEL would be required to report emissions specifically for the Port Spencer facility, if the individual facility threshold is triggered.

2.2 South Australia

The Climate Change and Greenhouse Emissions Reduction Act 2007 made South Australia the first Australian state to legislate targets to reduce greenhouse emissions (Govt. SA, 2019).

The legislation sets out three targets:

- reduce greenhouse gas emissions within the state by at least 60% to an amount that is equal to or less than 40% of 1990 levels by 31 December 2050 as part of a national and international response to climate change
- increase the proportion of renewable electricity generated so it comprises at least 20% of electricity generated in the state by 31 December 2014
- increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the state by 31 December 2014.

Although the targets are from the Government of South Australia website (Govt. SA, 2019), the second and third listed above are no longer relevant as they relate to targets to be achieved by the end of 2014.

There are no state specific reporting requirements for GHG emissions in South Australia. Reporting requirements are governed by the NGER Technical Guidelines. These guidelines embody the latest methods for estimating emissions and are based on the National Greenhouse and Energy Reporting (Measurement) Determination 2008 as amended through the periodic public consultation and review process. The Technical Guidelines provide additional guidance and commentary to assist reporters in estimating greenhouse gas emissions for reporting under the NGER system. The most current publication applies to the 2017-2018 reporting year (NGER, 2017).

3. Assessment Methodology

3.1 Overview

This section outlines the scope and boundary of the study, outlines the methodology, details emissions factors used and the process of calculating emissions for the project. The greenhouse gas inventory has been prepared in accordance with:

- The GHG Protocol by the WBCSD and the WRI.
- National Greenhouse and Energy Reporting Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia (NGER, 2017). The NGER Technical Guidelines outline calculation methods and criteria for determining greenhouse gas emissions, energy production, energy consumption and potential greenhouse gas emissions embodied in natural gas.
- National Greenhouse Gas Accounts Factors (DoEE, 2019b). This document provides methods for companies and individuals to estimate greenhouse gas emissions. It is not published for the purposes of reporting under the NGER Act but provides tools to calculate estimates for a broader range of GHG inventories.

Where possible, the emissions estimates for this project have been prepared to facilitate comparison with the Evaluated Project (Centrex, 2012). Although the proposed facility location and footprint have not changed, there are differences between the Evaluated Project and the current proposed facility which can impact the GHG emissions; these are provided in Table 3-1. The key change is the removal of the storage and export of hematite from the Evaluated Project. The current proposed facility will store and export grain only.

Table 3-1: Comparison of Centrex project (2012) and current proposed grain facility

Centrex project (2012)	Current proposed facility
Storage and export capacity: Hematite ore: up to 2 million tonnes of ore per annum Grain: up to 1 million tonnes per annum	Storage and export capacity: Hematite ore: 0 tonnes (removed) Grain: up to 1 million tonnes per annum
Industrial ship loader, suitable for loading ore and grain material into Cape class and Panamax sized vessels with an approximate loading capacity of 5,000 ton per hour (t/h) for iron ore and 1,400 t/h for grain.	Industrial ship loader, suitable for loading grain into Panamax sized vessels with an approximate loading capacity of 2,000 t/h.
A hematite in-loading shed.	No iron ore in-loading proposed.
A hematite storage shed, with a storage capacity of up to 240,000 t and an in-loading shed, site office, site warehouse for equipment storage.	No iron ore storage proposed.
Grain in-loading shed, site office and warehouse for equipment storage. Grain storage shed (60 kt) One bunker style grain storage area (60 kt) Three 20 kt grain storage silos	The bulk of the storage will be in up to nine bunkers, each with the ability to be split for multiple grades of grain. Grain in-loading will primarily occur at the bunkers to accommodate concurrent loading and stacking. Up to 60 kt of silo storage for blending, buffer storage, etc.
5 MW diesel generator for on-site electricity generation.	2 x 1.5 MW diesel generators (one duty, one standby) for on-site power generation

3.2 Methodology

3.2.1 Assessment boundaries and limitations

For this project, Scope 1 emissions are the key GHG emissions associated with both the operations and construction phases. A summary of the relevant emission source types for each phase are provided in Table 3-2. Emission estimates for each of these sources is are included in the greenhouse gas estimates (see Section 4).

Table 3-2: Construction and Operations phase Scope 1 emissions

Project phase	Emission	Scope	Sources
Construction	Emissions released from the combustion of liquid fuel (CO_2, N_2O and CH_4)	Scope 1	Stationary fuel combustion sources (diesel generator) Construction mobile equipment (bulldozers, graders, etc.) Construction site vehicles (passenger, light commercial vehicles, etc.) ***Note 1***
	Removal of sequestered carbon in soils/vegetation (CO_2 only)	Scope 1	Land clearing
Operations	Emissions released from the combustion of liquid fuel (CO_2, N_2O and CH_4)	Scope 1	Stationary fuel combustion sources (diesel generator) Operations mobile equipment (front end loaders, small trucks, etc.) Operations site vehicles (passenger, light commercial vehicles, etc.) ***Note 1***

Notes

1. All fuel combusted for both the construction and operations phase will be diesel.

There are no Scope 2 emissions as there will be no electricity (or heat) imported to the facility. All power will be provided by on-site diesel generators for both operations and construction phases.

Scope 3 emissions are not reported as part of the NGER scheme and reporting is optional under the legislation as described in Section 2. However, methods for estimating Scope 3 emissions are provided in the National Greenhouse Account (NGA) Factors (DoEE, 2019b). Discussion of the relevance of Scope 3 emissions associated with the grain export facility project as part of the GHG assessment are provided below. Scope 3 emission sources with potential relevance to the Port Spencer Grain Export Terminal would include:

Construction phase

- Fuel life cycle emissions associated with the combustion of fuel for the construction phase, as listed in Table 3-2.
- Embodied carbon emissions, i.e. emissions associated with the extraction, production, and transport of purchased materials or goods (e.g. construction materials).
- Waste disposal (solid waste to landfill and liquid waste to wastewater treatment plants).
- Employee transport to and from site.

Operations phase

- Transport of grain by others to the proposed facility.
- Transport of grain from the proposed facility to export destinations.
- Fuel life cycle emissions associated with the combustion of fuel for the operations phase, as listed in Table 3-2.
- Waste disposal.
- Employee transport to and from site.

Of the Scope 3 emissions, those of potential significance would be emissions associated with transfer of grain (by others) to the proposed facility and the export to international ports. These emissions would vary depending on the selected location of the facility and storage capacity. Specifically, the location has the potential to impact emissions associated with transport (fuel combustion) of the grain. The storage capacity of the proposed facility can impact how much grain needs to be stored at additional storage locations across the Eyre Peninsula, thereby resulting in possible 'double-handling' of the grain.

As part of the original PER which was provided by Centrex (Centrex, 2012) and approved by the South Australian Government for development, Scope 3 emissions were not included in the assessment, except for a comparison of Scope 3 emissions associated with two options for the export of the grain product from the site. These two options were:

- Option 'G1': Transport of 500,000 tonnes of grain 11,800 km by sea in Panamax vessels from Port Spencer to Qingdao, China. This represented the proposed transport option provided by the project. This option was noted to be essentially the same as the operation at the time (2011) where the grain was primarily exported from Port Lincoln. The distance of approximately 70 km between Port Spencer and Port Lincoln by road or sea was considered negligible compared to the estimate overland transport distances from either port to Port Adelaide and the shipping route distances to China.
- Option 'G2': Transport of 500,000 tonnes of grain 700 km by road from Port Spencer to Port Adelaide, then 12,250 km transport in Panamax vessels to Qingdao, China.

The options were included in the assessment for comparison only.

It is considered unlikely that 500,000 tonnes of grain would be road freighted 700 km to Adelaide for ship export instead of being exported via ship from Port Lincoln (which is considerably closer to the grain supply regions than Port Adelaide). Instead, a more relevant comparison would be the assessment of current operations, whereby grain is transferred to central 'upcountry' storage sites, and then road freighted to Port Lincoln for export. This is discussed qualitatively in Section 4.

Of the other Scope 3 emissions listed above, waste disposal and fuel cycle emissions are expected to be relatively small compared to the total emissions for the site. These emissions were not previously included in the PER and are not included in the current assessment.

Emissions arising from employee transport to and from the site were also not included in the original PER. Selection of a different location for the facility is not expected to result in a material difference in GHG emissions as the workforce is most likely to be sourced locally. As such, these emissions have not been included in the current assessment.

Embodied emissions are a result of GHG emissions from the extraction, production, and transport of purchased materials or goods such as concrete, aggregate, steelwork, piping, etc. These emissions have the potential to be large for a project with significant infrastructure and civil works. For the current proposal, the quantities of materials required for construction are not yet available. These details will become available as the design is progressed. When available, the estimated embodied emissions attributable to construction could be compared

with potential savings in GHG emission over the lifetime of the operation of the grain facility, e.g. resulting from reduced road freight emissions (compared to current operations) for the transport of the grain to the new facility. Emission savings can be made by the selection of raw materials and products with lower embodied carbon, and this should be considered as part of the overall purchasing strategies for the project.

3.2.2 Emission factors and calculations

Combustion of diesel

The NGER methodologies for the calculation of GHG emissions provide four methods of calculation, Method 1 to Method 4, where Method 1 is the simplest, and applies default emission factors.

Method 1 specifies the use of designated emission factors in the estimation of emissions. Emissions factors are used to determine emissions of greenhouse gases from processes or activities, where it is impractical to directly measure (or model) emissions. These emission factors are national average factors determined by the Department of the Environment and Energy. Method 1 is most applicable where the source of emissions is relatively homogenous, such as from the combustion of standard liquid fossil fuels, as is the case for this application.

Emissions factors for the combustion of diesel are presented in Table 3-3.

Table 3-3 : Emissions factors and energy content

Activity	Emissions factors (kg CO_2-e / GJ)				Reference
	CO_2	CH_4	N_2O	CO_2-e	
Diesel combustion – liquid fuels for stationary energy purposes (non-transport)	69.9	0.1	0.2	70.2 (Scope 1)	Scope 1 – NGER Technical Guidelines (NGER, 2017)
Diesel combustion – fuel used for transport energy purposes	69.9	0.1	0.5	70.5 (Scope 1)	Scope 1 – NGER Technical Guidelines (NGER, 2017)

NGER Technical Guidelines (NGER, 2017) set out the methodology for calculation of GHG emissions from combustion of liquid fuels using Method 1 for stationary energy emissions. The following formula is used:

$$E_{ij} = \frac{Q_i \; x \; EC_i \; x \; EF_{ijoxec}}{1000}$$

where:

E_{ij} is the emission of gas type (j), being carbon dioxide, methane or nitrous oxide, from the combustion of liquid fuel type (i), measured in $CO_{2\text{-}e}$ tonnes.

Q_i is the quantity of fuel type (i) (cubic metres)

EC_i is the energy content factor of fuel type (i) (GJ per cubic metre). If Q_i is measured in GJ, then EC_i is 1.

EF_{ijoxec} is the emission factor for each gas type (j) (which includes the effect of an oxidation factor) for fuel type (i), measured in kg $CO_{2\text{-}e}$ per GJ of fuel type (i), a as provided in Table 3-3.

Land clearing

At the start of the construction phase, vegetation will be removed from the site in preparation for civil works. Greenhouse gas impacts associated with land clearing arise from the reduction in the amount of 'carbon sink' which would otherwise sequester carbon dioxide from the environment, as well as the carbon removed at the time of the land clearing. These impacts can be quantified and are classified as direct impacts, i.e. Scope 1 greenhouse gas emissions.

GHG emissions associated with land clearing were not included in Centrex PER. However, they are included in this assessment for completeness of the Scope 1 GHG estimates.

The estimate of GHG emissions associated with land clearing follows the methodology provided in the 'Greenhouse Gas Assessment Workbook for Road Projects' by the Transport Authorities Greenhouse Group (Transport, 2013). This methodology involves the identification of the maximum potential biomass ('maxbio') class for the proposed site, assesses the areas and type of vegetation to be removed, and uses emission factors to calculate the associated GHG emissions. The maxbio class is derived from the Australian Greenhouse Office and estimates the maximum tonnes dry vegetation matter per hectare for a specific location.

The methodology assumes that:

- All carbon pools (i.e. woody, non-woody, debris and soil) are removed.
- All carbon removed is converted to carbon dioxide and released to the atmosphere.
- Sequestration from revegetation of the project site is not included.

4. Emission Estimates

4.1 Emission sources and GHG estimates

4.1.1 Construction phase

The duration of the construction phase is expected to be approximately 18 months. During this period, there will be various mobile equipment operating, as well as site vehicles. Power will be provided by a diesel generator at the site; there will be no grid electricity imported. The proposed site will be cleared of vegetation at the start of the construction period.

Diesel combustion

A range of equipment types (mobile and stationary) and vehicles will be used to carry out the civil works, structural works, and the construction of the causeway and jetty. All equipment and vehicles will use diesel fuel. A list of the equipment and vehicles expected to be used during construction are shown in Table 4-1.

Table 4-1: List of equipment to be used during construction period

Mobile equipment	Stationary equipment	Site vehicles
Graders	Diesel power generator – 1 MW	Passenger vehicles (cars, utilities)
Scrapers	Portable crushing and screening plant	Light industrial vehicles (vans, small trucks)
Excavators	Water pump	
Bulldozers	Compressors	
Trucks	Welding sets	
Front end loaders		
Cranes (including for pile drilling and driving)		
Rollers		
Stabilisers		
Pavers		
Water carts		
Boats		

The following assumptions and notes apply to the calculation of the construction phase emissions attributable to diesel consumption:

- There will be no asphalt or concrete batch plants on site – these materials will be imported to the facility.
- The estimates for the number of equipment items and vehicles, operating hours and duration of operation are preliminary estimates only and will need to be confirmed as the design of the project is developed. The type of equipment items and vehicles expected at site are based on the Project Management Plan for civil and marine works (Bardavcol, 2019).
- The heavy mobile equipment is expected to be required for a period of 12 months within the construction period and will operate up to 12 hours per day, 7 days per week. Although the total construction phase is expected to be carried out over 18 months, the operation of the specific

equipment items is expected to be over 12 months, working at different phases within this 18 month period.

- The site vehicles were assumed to operate for 18 months, 7 days per week and 12 hours per day. The average distances travelled per day were assumed to be 30 km for passenger vehicles and 20 km for light commercial vehicles.
- All heavy mobile equipment and site vehicles will use diesel fuel. The estimates of fuel usage rates for each mobile equipment and vehicle type were sourced from the Carbon Estimate and Reporting Tool (CERT, 2017).
- The boats were assumed to be approximately 30 foot size work boats, powered by diesel fuel.
- The welding sets, water pump and compressors will be powered by the on-site diesel generator.
- The diesel generator will have a capacity of 1.0 MW. It will operate 24 hours per day: 8 hours at maximum capacity, and 16 hours at 50% load. The fuel use rates at different loads were based on potential supplier technical information (DSS, 2019).
- The energy content of diesel fuel and the emission factors for stationary energy purposes (heavy mobile equipment, boats, and the power generator) and for transport purposes (site vehicles) were sourced from the NGER Technical Guidelines (NGER, 2017); see Section 3.2.

The total diesel consumption and estimated CO_2-e emissions are summarised in Table 4-2.

Table 4-2: Calculated GHG emissions from diesel combustion during construction

Activity	Diesel consumption	Energy content	Emission factors	Total Scope 1 GHG emission
	kL	GJ/kL	kg CO_2-e GJ	t CO_2-e
Stationary equipment	2,386	38.6	70.2	6,464
Mobile equipment	5,808		70.2 Note 1	15,738
Site vehicles	44		70.5	120
Total – diesel consumption	8,238			22,322

Notes

1. Emission factors for stationary energy purposes are to be applied to the heavy mobile equipment as these items are not expected to be registered for road use (NGER, 2017).

Land clearing

The ‘maxbio’ class for the proposed site was identified as ‘Class 1’ (Transport, 2013). The vegetation to be cleared and calculated GHG emissions are shown in Table 4-3.

Table 4-3: GHG emissions (Scope 1) associated with land clearing

Vegetation type to be cleared	Area to be cleared	Vegetation class	Emission factor	Scope 1 GHG emissions
	hectares		t CO_2-e / ha	t CO_2-e
Open shrubland	0.44	G	113	50
Heathlands	2.15	H	115	247
Grassland - Hummock grassland	0.28	I	110	31
Grassland - Sedgeland	0.14	I	110	15
Grassland - Herbland	20.6	I	110	2,261
Total	23.6			2,604

4.1.2 Operations phase

During the operation of the Grain Export Terminal, GHG emissions will be a result of the combustion of diesel fuel associated with the following activities:

- Operation of mobile equipment – front end loaders will be used to maintain the bunker storage area, a bulldozer, and trucks for general duties (including water cart to address fugitive emissions from any unsealed areas).
- Operation of site vehicles – cars, utilities and light commercial vehicles (vans and small trucks).
- Operation of diesel generator – a 1.5 MW generator will be used to supply power at site; for building lighting, heating and cooling, conveyors, ship loaders, etc.

The following assumptions and notes apply to the calculation of the operations phase emissions attributable to diesel consumption:

- The site vehicles were assumed to operate 7 days per week and up to 12 hours per day. The average distances travelled per day were assumed to be 16 km for passenger vehicles and 10 km for light commercial vehicles.
- There will be 4 front end loaders, 1 bulldozer and 3 trucks (including a water cart) used during operations to maintain the storage bunkers and carry out other miscellaneous tasks.
- All heavy mobile equipment and site vehicles will use diesel fuel. The estimates of fuel usage rates for each vehicle type were sourced from the Carbon Estimate and Reporting Tool (CERT, 2017).
- The diesel generator will have a capacity of 1.5 MW. It will operate 24 hours per day: 2 hours at maximum capacity, 6 hours at 75% load and 16 hours at 50% load. The fuel use rates at different loads were based on supplier technical information (Kohler, 2019).
- The energy content of diesel fuel and the emission factors for stationary energy purposes (heavy mobile equipment and the power generator) and for transport purposes (site vehicles) were sourced from the NGER Technical Guidelines (NGER, 2017).
- There will be no electricity sourced from the grid network, i.e. no electricity imports to the site.

The total diesel consumption and estimated CO_2-e emissions associated with annual operation of the grain facility are summarised in Table 4-4.

Table 4-4: Scope 1 GHG emissions – Annual operations

Activity	Diesel consumption	Energy content	Emission factors	Total Scope 1 GHG emissions
	kL / yr	GJ/kL	kg CO_2-e / GJ	t CO_2-e / yr
Stationary equipment	1,898	38.6	70.2	5,143
Mobile equipment	799		70.2	2,166
Site vehicles	5		70.5	14
Total – diesel consumption	2,702			7,323

Transport of grain

Under current operation, most of the grain produced on Eyre Peninsula is transported to Port Lincoln (Boston Bay port) for export to Asian and Middle Eastern markets. The second largest grain export port is at Thevenard on the far north-western coast of Eyre Peninsula. The port at Port Lincoln can only receive certain grains and grades at harvest time and is limited by its storage capacity. The key advantages, relevant to GHG emissions, of the proposed Port Spencer Grain Export Terminal compared to the current grain export operating system are:

- The Port Spencer facility will reduce the total grain freight required, i.e. from grain production site to the export port. This is a result of a reduction in the average distance from grain production site to the port site (e.g. currently from farm to Port Lincoln or Thevenard for the majority of grain harvested).

- The Port Spencer facility will reduce the amount of 'double-handling' of grain. Due to the limited grain storage capacity at Port Lincoln, upcountry facilities are currently used for the intermediate storage of grain. These storage facilities are scattered across the Eyre Peninsula. The harvested grain is road freighted from the production site to the upcountry storage and is then road freighted from here to the Port Lincoln (or other) export site. The proposed Port Spencer grain facility will have a storage capacity of approximately 800,000 tonnes of grain, thereby facilitating the transport of grain direct from production site to the export port, eliminating the 'double-handling'.

These two advantages are expected to result in reduced transport fuel combustion emissions, and hence reduced GHG emissions compared to current grain transport operations.

With the implementation of the proposed Port Spencer Grain Export Terminal, there will also be changes to the emissions from the shipping transport of grain to international ports. Due to the typical large distances, e.g. approximately 10,000 km between Eyre Peninsula and the Qingdao port in China, the difference in shipping distance between Port Spencer and Port Lincoln of approximately 50 km is very small. The corresponding differences in Scope 3 GHG emissions attributable to changes of the shipping export port location are expected to be negligible.

5. Summary

A summary of the GHG emissions associated with the construction and operations phases of the proposed Grain Export Terminal are provided in Table 5-1. All emissions are Scope 1 emissions. There are no Scope 2 emissions.

Table 5-1: Summary of GHG emissions for the proposed Port Spencer grain storage and export facility

GHG emissions	Units	Estimated CO_2-e emissions (Scope 1)	
		Current proposal	Centrex PER (2012)
Construction phase			
Diesel combustion	t CO_2-e	21,700	33,500
Land clearing	t CO_2-e	2,600	0
Total construction emissions	**t CO_2-e**	**24,300**	**33,500**
Operations phase			
Diesel combustion	t CO_2-e / yr	7,300	7,340
Total operations emissions	**t CO_2-e / yr**	**7,300**	**7,340**

The estimated construction emissions estimated as part of the current proposal are significantly lower than that for the Evaluated Project. Although the detailed GHG emissions calculations for the Evaluated Project are not available, the difference is considered most likely a result of reduced inventory of heavy mobile equipment required for the current assessment compared to the Evaluated Project. The Evaluated Project included infrastructure for the storage and handling up to 2 million tonnes of hematite ore per year, and up to 1 million tonnes of grain. With the removal of the mining related component under the current proposal, the extent of construction works is expected to be reduced.

The calculated GHG emissions for the operation of the Port Spencer Grain Export Terminal are similar to that calculated for the Evaluated Project. As the footprints of the current proposed facility and the Evaluated Project are matched, the number of mobile equipment required to maintain the port facility is expected to be similar for each assessment. Although details of the estimated power use requirements for the Evaluated Project are not available, i.e. for individual equipment users, the power use for the operation of a hematite storage shed, and higher ship loading rates; 5,000 t/hr for iron ore, compared to 2,000 t/hr for the current proposal, would intuitively be expected to result in higher power use overall. However, the current proposed design incorporates extensive use of extraction fans (for total air flow rate of approximately 400,000 m^3/hr) for the ventilation and treatment of dust at various locations at the silo storage area. This will require significant power use, and this design feature for the proposed Port Spencer Grain Export Terminal may be contributing to the reason for the estimated power load being similar to that for the Evaluated Project.

The annual GHG emissions for South Australia for financial year 2017 were 22.1 Mt CO_2-e (DoEE, 2019c). The estimated operations phase emissions for the grain facility represent 0.03% of this inventory and the construction phase emissions (annualised) represent 0.07% of the state's emissions. On a national basis, the grain facility emissions represent 0.001% and 0.003% of Australia's total GHG emissions for 2017 for operations and construction phases, respectively.

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Appendix H. Air Quality Assessment

Port Spencer Grain Facility

Air Quality Assessment

IW219900-NN-RPT-001 | Rev 01

11 November 2019

Peninsula Ports

Document history and status

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Port Spencer Grain Facility

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Contents

Figures and Tables

Executive Summary

An air quality assessment was undertaken for the proposed Port Spencer Grain Facility on the Eyre Peninsula, South Australia. The nominated site is located approximately 20km north-east of Tumby Bay and approximately 65 km north-east of Port Lincoln. The proposed facility will provide a localised grain storage and export option for grain growers of the lower and eastern regions of the Eyre Peninsula. The facility will be capable of handling peak harvest loads of up to 30,000 tonnes of grain each day and offers the ability for up to one million tonnes of grain to be exported annually.

The key objective of the study was to assess the potential dust impact, arising from emissions generated by various operational activities at the grain facility, on the region surrounding the site. The study involved the generation of the dust emissions inventory for operations at the grain facility, meteorological modelling using TAPM and CALMET, followed by air dispersion modelling of dust emissions using CALPUFF. The potential impact of the methyl bromide emissions, resulting from the occasional fumigation of the silos, was also assessed. The assessment methodology was carried out in accordance with the SA EPA 'Ambient air quality assessment' guidelines (EPA, 2016b). The predicted ground level concentrations (GLCs) for PM_{10}, $PM_{2.5}$ and methyl bromide at sensitive receptor locations beyond the site boundary were compared with the criteria set out in the South Australia Environment Protection (Air Quality) Policy (EPP) (2016a). The predicted dust deposition levels were compared with criteria provided by the NSW Environment Protection Authority (NSW EPA, 2017).

Activities expected to generate dust emissions are: the unloading of grain from trucks entering the facility, conveying and handling of the grain, loading of the grain product to ships, exhaust gas from bagfilters and the diesel power generator, and wind erosion from grain storage bunkers. Of these activities, the unloading of trucks during the harvest season, i.e. mid-October to mid-December, was found to be the largest contributor to the site dust emission rates.

Emissions of methyl bromide are expected to occur on completion of fumigation of grain in a silo, when the gas from the silo is released to atmosphere.

The air quality impact assessment determined that the highest potential dust impact is expected for the nearest sensitive receptor to the site, located approximately 450 m north of the boundary. For the assessment of the 24-hour average PM_{10} and $PM_{2.5}$, exceedences of the EPP criteria were predicted at this receptor. Analysis of the model results indicated that the exceedences occurred only during the harvest period and during low wind conditions in the evening hours, typically between 6 pm and 10 pm, and with southerly winds blowing dust from the site towards SR#1. Subsequent dispersion modelling demonstrated that the exceedences could be adequately managed by temporarily restricting the operational hours for truck unloading during the harvest period. Mitigation options include implementing restrictions based on forecast meteorological conditions, real-time wind monitoring, and/or ambient dust monitoring, as part of an overall dust management plan.

The dust deposition results predicted conformance with the NSW EPA criterion at all sensitive receptor sites, except at SR#1, for which the result was equal to the criterion. The model results of the scenario with restricted operating hours during harvest demonstrated compliance with the dust deposition criterion.

Exceedences of the $PM_{2.5}$ annual average EPP criteria were also predicted by the model for the closest sensitive receptor site. To address these exceedences, refinement of the estimated annual average $PM_{2.5}$ emissions, nominally by further investigation of the dust emissions expected from the exhaust gas of the bagfilters in the first instance, is recommended.

Due to the uncertainty in the emission rate of methyl bromide from the grain silo on venting to atmosphere after fumigation, dispersion modelling was used to assess the expected maximum emission rate in an hour from a single grain silo above which exceedences of the EPP criterion at sensitive receptor sites would be expected. It is recommended that a detailed monitoring and management plan be generated for the venting of the silo gas following fumigation to ensure the EPP criterion is not exceeded.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide air dispersion modelling and air quality assessment services for air emissions estimates determined for the proposed Port Spencer Grain Facility site in accordance with the scope of services set out in the contract between Jacobs and the Client, Peninsula Ports.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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Abbreviations and Definitions

AFAS	The Australian Fumigation Accreditation Scheme
AG	Australian Government
AWS	Automatic weather station
BoM	Bureau of Meteorology
BPIP	Building Profile Input Program. A software tool used to estimate the projected building dimensions for 36 wind directions calculated at 10 degree intervals
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPA	Environment Protection Authority (South Australia)
EPP	Environment Protection (Air Quality) Policy (SA Government, 2016)
FEL	Free Eyre Limited
GLC	Ground level concentration
g/sec	Grams per second
MGA94	Map grid of Australia 1994
m^3/sec	Metres cubed per second
mg/m^3	Milligrams (1 x 10^{-3} grams) per cubic metre
$\mu g/m^3$	Micrograms (1 x 10^{-6} grams) per cubic metre
PER	Public Environment Report
PM	Particulate matter
PM_{10}	Particulate Matter 10 – mass concentration of airborne particulate matter comprising a collection of particles with aerodynamic diameters less than 10 microns.
$PM_{2.5}$	Particulate Matter 2.5 – mass concentration of airborne particulate matter comprising a collection of particles with aerodynamic diameters less than 2.5 microns.
RH	Relative humidity
SA	South Australia
TAPM	The Air Pollution Model (CSIRO)
TSP	Total suspended particulate

1. Introduction

1.1 Project Background and Objectives

Port Spencer (the site) was originally proposed by Centrex Metals Limited in 2011 as a deep-sea port facility for the export of iron ore from their Eyre Iron Joint Venture Project (Centrex, 2012). At this time, Free Eyre Limited (FEL) was the preferred grain supplier and was closely involved in the planning for the project. The project was declared a Major Development under the *Development Act 1993* and it was determined that the project would be subject to a Public Environment Report (PER) process. The Port Spencer site was owned by Centrex Metals and the Port Spencer Stage 1 Project (the Evaluated Project) successfully received Provisional Development Plan consent to export both iron ore and grain from the site.

The provisional development authorisation granted to Centrex Metals in 2012 and extended in 2014 currently remains active and was transferred to Peninsula Ports (a subsidiary of FEL) in mid-2019 following purchase of the land from Centrex Metals. Given Peninsula Ports only intends to export grain from the Port Spencer site; i.e., not minerals, Peninsula Ports is seeking to amend the existing Development Plan consent under Section 47 of the *Development Act 1993.* The amendment process is required to take account of alterations to the Evaluated Project and to update the PER due to the length of time, nearly 9 years, that has passed since the PER was prepared.

This air quality assessment has been undertaken in order to support the development of the grain storage and export facility at Port Spencer.

The air emissions were assessed comparing modelled ground level concentrations of various air pollutants with assessment criteria set out in the South Australia Environment Protection (Air Quality) Policy 2016 (SA Government, 2016; Version 1.6.2019).

1.2 Description of Port Spencer Facility Operations

The Port Spencer Grain Facility will provide a localised grain storage and export option for grain growers of the lower and eastern regions of the Eyre Peninsula. The facility will be capable of handling peak harvest loads of up to 30,000 tonnes of grain each day and offers the ability for up to one million tonnes of grain to be exported annually. It is expected that almost all of the grain will be transported from the grain facility by cargo ship. The project includes the construction of a 530-metre long jetty to cater for Panamax cargo ships.

Trucks with up to 70 tonne capacity will enter and exit the facility from the Lincoln Highway via Lipson Cove Road. The grain will be unloaded from the trucks at hopper bays located at the end of each of eight grain storage bunkers, and then stockpiled at the bunker via conveyors. From the bunkers, the grain is reclaimed and transferred via conveyors to the silo area, from where it is either stored or transferred via conveyor to the ship's cargo holds.

The harvest season at Eyre Peninsula represents a period of intense grain delivery at the proposed facility and is expected to last for approximately 2 months between mid-October and mid-December. During this time, there will be a high number of trucks entering and leaving the site during the day and until approximately 10 pm. For the remaining 10 months of the year, the activity at the site is expected to be considerably less with operational hours during the day only.

The key air emissions expected from the grain facility are dust emissions resulting from the unloading, storage, handling and ship loading operations. In addition, there will occasionally be emissions of methyl bromide gas from the silos as a result of fumigation of the grain. Methyl bromide is used as a pest control treatment for grains which is applied at storages prior to export.

1.3 Geographical Summary

The proposed Port Spencer Grain Facility is located approximately 20km north-east of Tumby Bay, South Australia, and approximately 65 km north-east of Port Lincoln. The location of the proposed site is shown in Figure 1-1.

Figure 1-1: Proposed Site Location

2. Air Quality Standards

Schedule 2 of the South Australia Environment Protection (Air Quality) Policy (EPP), (EPA, 2016a) provides criteria for ground level concentrations (GLCs) of ambient air pollutants. Compliance with the EPP is primarily assessed by comparison of the model-predicted ambient concentrations with the EPP GLC criteria. GLC criteria are provided for both PM_{10} and $PM_{2.5}$.

No SA EPA criteria are provided for the protection of amenity and potential sensitive receptors from deposited dust – for the assessment of deposited dust for this project, the NSW Environment Protection Authority criteria for deposited dust were adopted (NSW EPA, 2017). The use of NSW (or similarly the Victorian) assessment criteria for deposited dust is common practice for assessments in SA; e.g., CEIP (2015); Jacobs (2019).

The relevant assessment GLCs for PM_{10} and $PM_{2.5}$ for this modelling study are summarised in Table 2-1 and assessment deposited dust levels in Table 2-2. The criterion for methyl bromide is shown in Table 2-3.

The assessment criteria apply to sensitive receptors, if identified.

Table 2-1: SA EPA GLCs for assessment of pollutant concentrations

Pollutant	Averaging period	SA EPP GLC, µg/m^3
PM_{10}	24 hour	50
$PM_{2.5}$	24 hour	25
	Annual	8

Table 2-2: Criteria for deposited dust (NSW EPA, 2017)

Pollutant	Averaging period	NSW EPA criteria g/m^2/month	Notes
Dust# deposition	Annual	2	Maximum increase in deposited dust level
	Annual	4	Maximum total deposited dust level

'Dust' means Total Suspended Particulates (TSP).

Table 2-3: SA EPA GLC for methyl bromide

Pollutant	Averaging period	SA EPP GLC, mg/m^3
Methyl bromide	3-minute (based on toxicity)	0.69#

Also the EPP quotes 0.17 ppm, which is obtained for the temperature 15^{o}C.

3. Existing Environment

3.1 Topography

Topographical features can influence local meteorology such as wind speeds and direction, which can in turn affect the dispersion of pollutants. To understand these interactions, a review of terrain features was completed for the site, and terrain data was incorporated in the model inputs.

The proposed Port Spencer grain facility is located on the west shore of the Spencer Gulf (see Figure 1-1), at the base the south-west facing slopes of Sheep Hill. The highest point of Sheep Hill is 130m above sea level.

A depiction of the topography around the site is displayed below in Figure 3-1 with the project site marked, and vertical scale exaggerated. The view displayed is facing west-north west toward the coastline (eastings in metres on left axis, northings in metres on bottom axis).

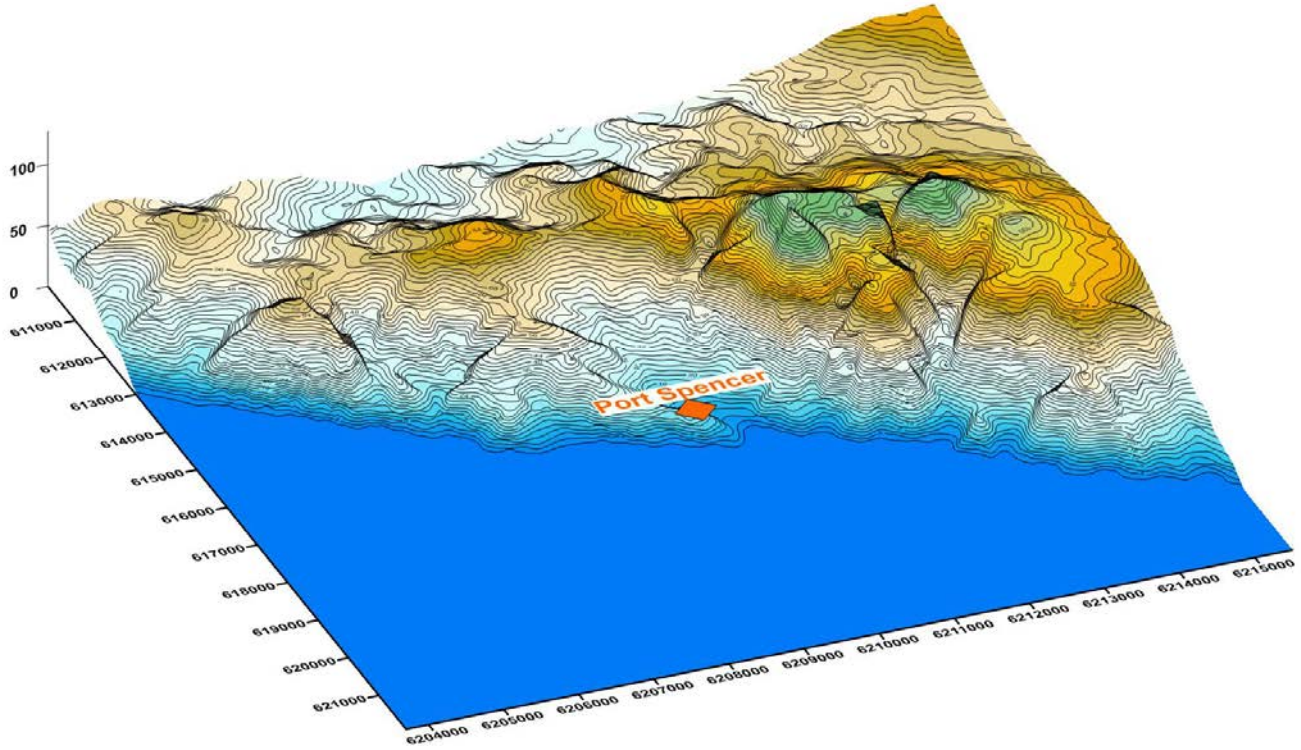


Figure 3-1 Site topography

3.2 Sensitive Receptors

The base map used for the air dispersion modelling study, for overlaying the CALPUFF modelling results, is shown in Figure 3-2. The base map design was in accordance with the guidance set out in 'Ambient air quality assessment' guidelines (EPA, 2016b). The co-ordinate system used is Map Grid of Australia 1994 (MGA94). The pink markers shown represent the locations of the identified sensitive receptors in the vicinity of the proposed facility. The red line shows the proposed site boundary.

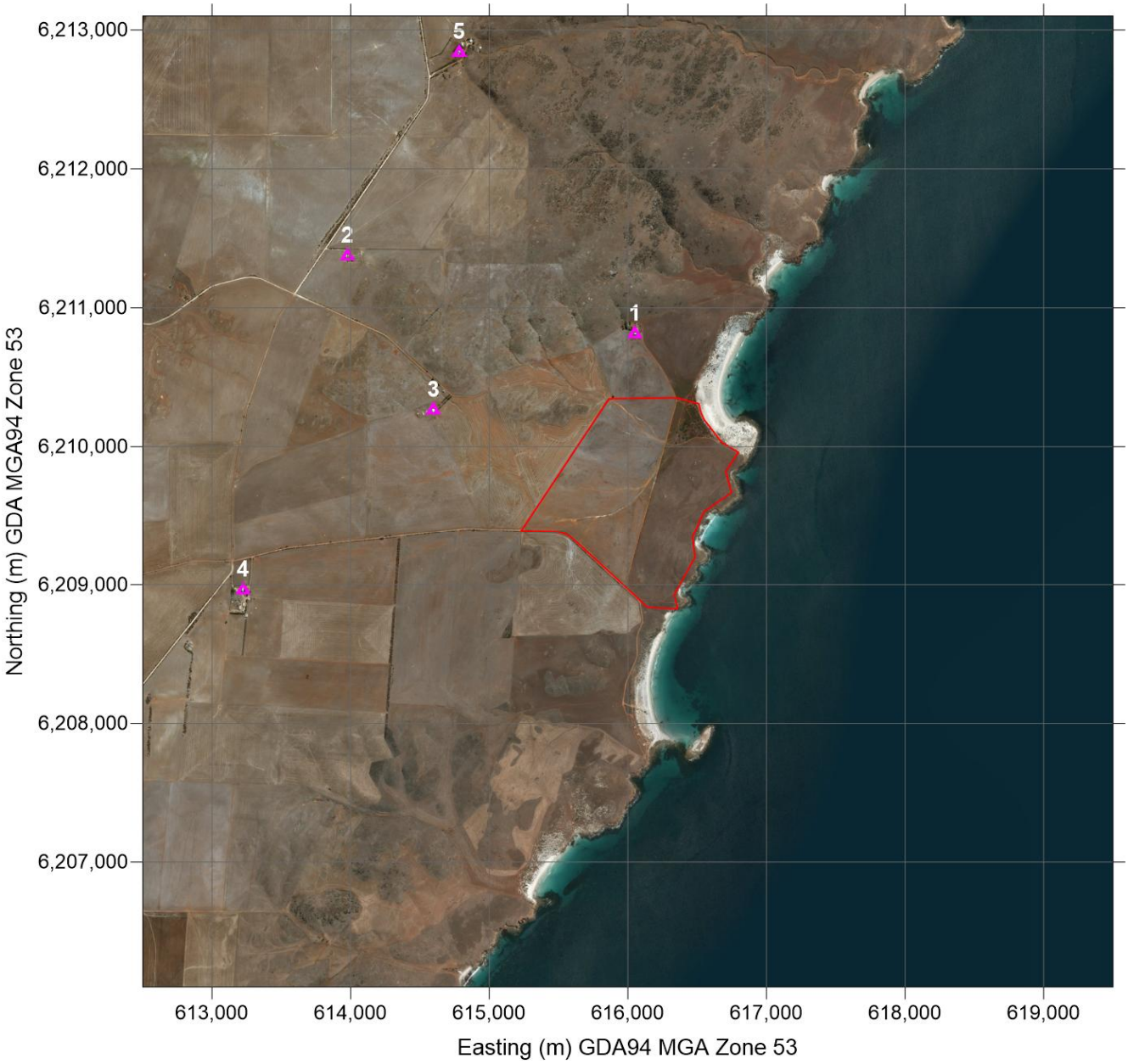


Figure 3-2: Sensitive Receptors

The distances between each of the identified receptors and the approximate centre of the emissions sources are shown in Table 3-1.

Table 3-1: Sensitive Receptor Summary

Sensitive Receptor	Receptor Type Note 1	Distance from Emissions (m)
SR1	House	930
SR2	House	2,580
SR3	House	1,625
SR4	House	3,100
SR5	House	3,265

Notes:

1. The receptor type has been identified from satellite imagery only, i.e. not from site inspection. As such, the type of receptor, e.g. house, has not been confirmed.

3.3 Existing Air Quality

The background concentrations shown in Table 3-2 were calculated from 24-hour averaged PM_{10} and $PM_{2.5}$ data observations from 2015 to 2018, inclusive. These observations were taken from the SA EPA Whyalla Schulz Reserve Air Quality monitoring station (137.53°E, -33.02°S), and the Western Adelaide Netley Air Quality monitoring station (138.54°E, -34.94°S) (EPA, 2019). The estimates for background are compared with concentrations used for the Port Spencer Air Quality Assessment as part of the Centrex PER (Centrex, 2011).

Table 3-2: Background concentrations for Port Spencer region

Particulate Matter	Averaging period	Background concentration	Comment
PM_{10}	24-hour	20 µg/m^3	Highest 70th percentile value from 24 hourly data, for years 2015 – 2018 inclusive, Whyalla monitoring station. This value is more conservative than Centrex PER value (previously used 18 µg/m^3).
$PM_{2.5}$	24-hour	10 µg/m^3	Highest 70th percentile value from 24 hourly data, from years 2015 – 2018 inclusive, Netley monitoring station. No $PM_{2.5}$ data is recorded at Whyalla. More conservative than Centrex value (previously used 7.2 µg/m^3).
	annual	7 µg/m^3	Adopted same value as other studies in region, i.e. Leigh Creek Copper Mine dust modelling assessment (Jacobs, 2019) and Central Eyre Iron Project, Port assessment (CEIP, 2015). In general, monitoring shows that annual average background $PM_{2.5}$ levels are just below the air quality standard; see Table 2-1.
Dust Deposition	annual	2 g/m^2/month	Same value as other previous projects in the region, i.e. Leigh Creek Copper Mine dust modelling assessment (Jacobs, 2019) and Central Eyre Iron Project, Port assessment (CEIP, 2015).

With the exception of the proposed grain facility, there are no other known sources of methyl bromide emissions in the area. The background concentration applied in the modelling is 0 mg/m^3.

3.4 Local Meteorology

3.4.1 Overview

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements for an air dispersion model typically include hourly records of wind speed, wind direction, temperature, atmospheric stability class and mixing layer height.

This section provides climatological summaries of meteorological parameters representative of the Eyre Peninsula based on Bureau of Meteorology (BoM) observations.

For air quality assessments, a minimum one year of hourly data is usually required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the simulations. The closest BoM weather station with hourly data is Port Lincoln AWS (station number 018192, 135.88°E, 34.60°S), which is located approximately 50 km south-west of the Port Spencer site. This station is along the same coast line as the proposed Port Spencer grain facility and is considered to provide the most representative set of hourly wind data observations for assessment of the Port Spencer site.

The following sub-sections provide summaries of long term meteorological data for the Port Lincoln AWS.

3.4.2 Temperature

Monthly mean daily maximum and daily minimum temperatures for Port Lincoln AWS for 1992-2018 are shown in Figure 3-3.

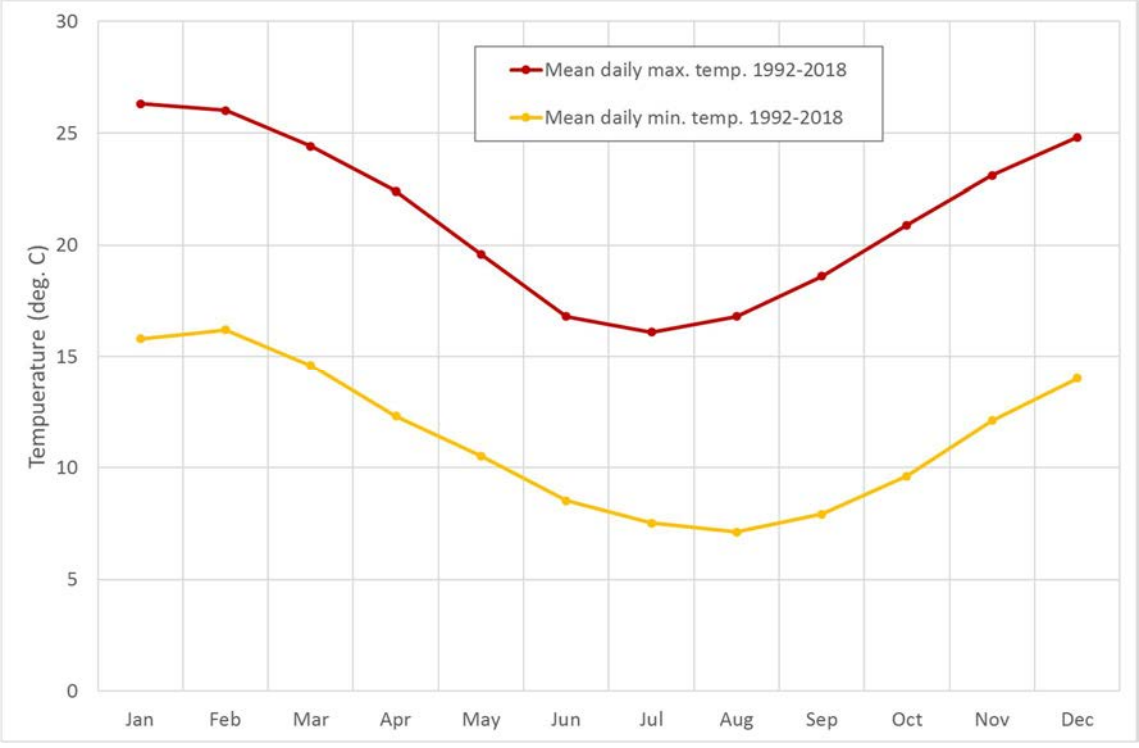


Figure 3-3: Mean daily maximum and mean daily minimum temperature - Port Lincoln AWS, 1992-2018

3.4.3 Rainfall and Relative Humidity

Monthly rainfall statistics for Port Lincoln AWS are shown in Figure 3-4, and monthly mean 9am and 3pm relative humidity (RH) for Port Lincoln AWS for are shown in Figure 3-5.

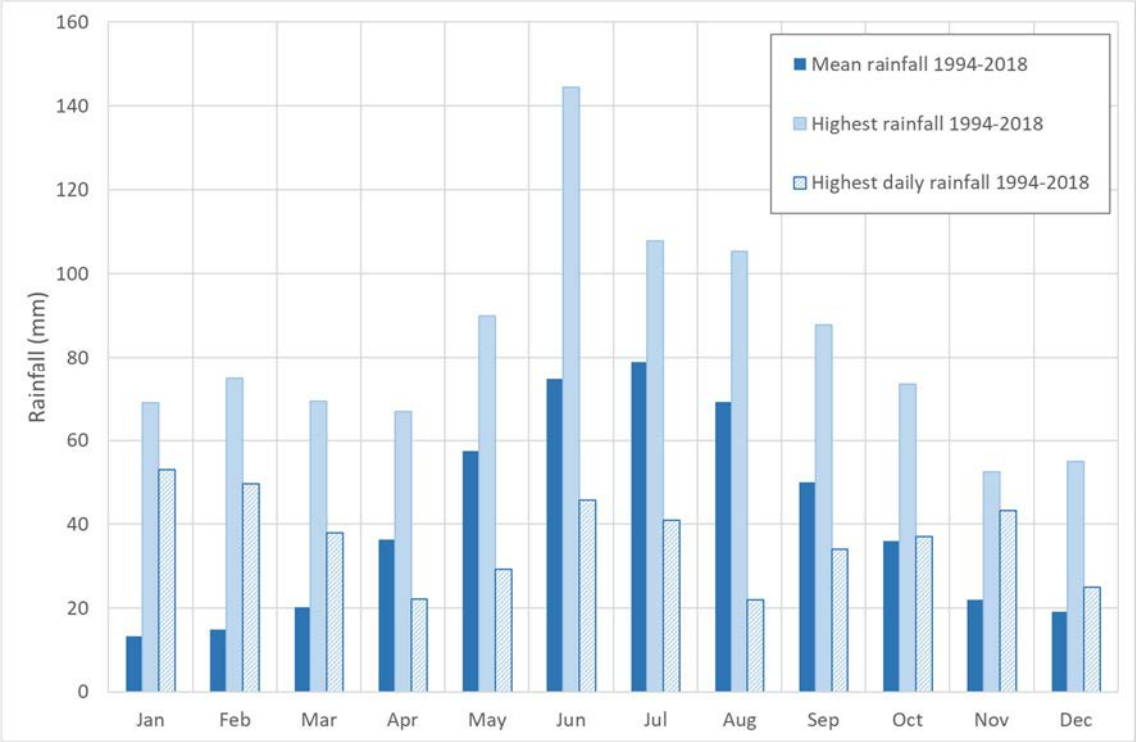


Figure 3-4: Monthly mean, monthly maximum, and highest daily rainfall - Port Lincoln AWS 1994-2018

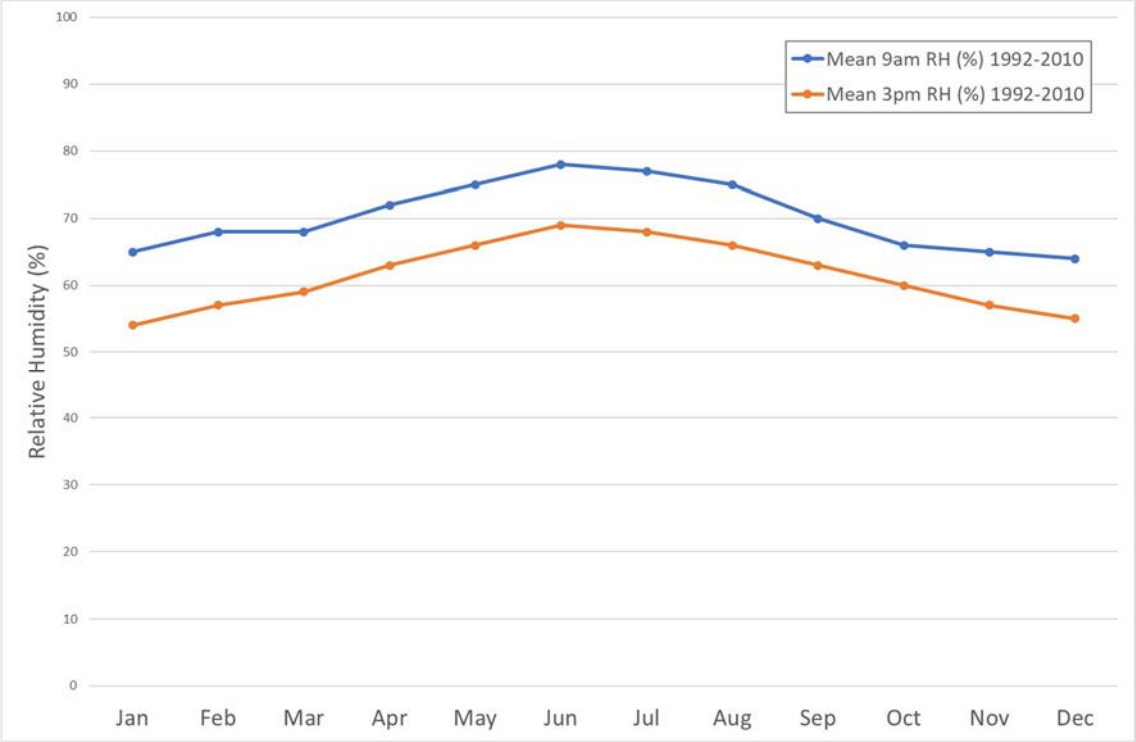


Figure 3-5: Monthly mean 9am and 3pm relative humidity - Port Lincoln AWS 1992-2010

3.4.4 Wind Speed and Wind Patterns

Monthly mean daily wind speeds and maximum wind gusts for Port Lincoln AWS are shown in Figure 3-6.

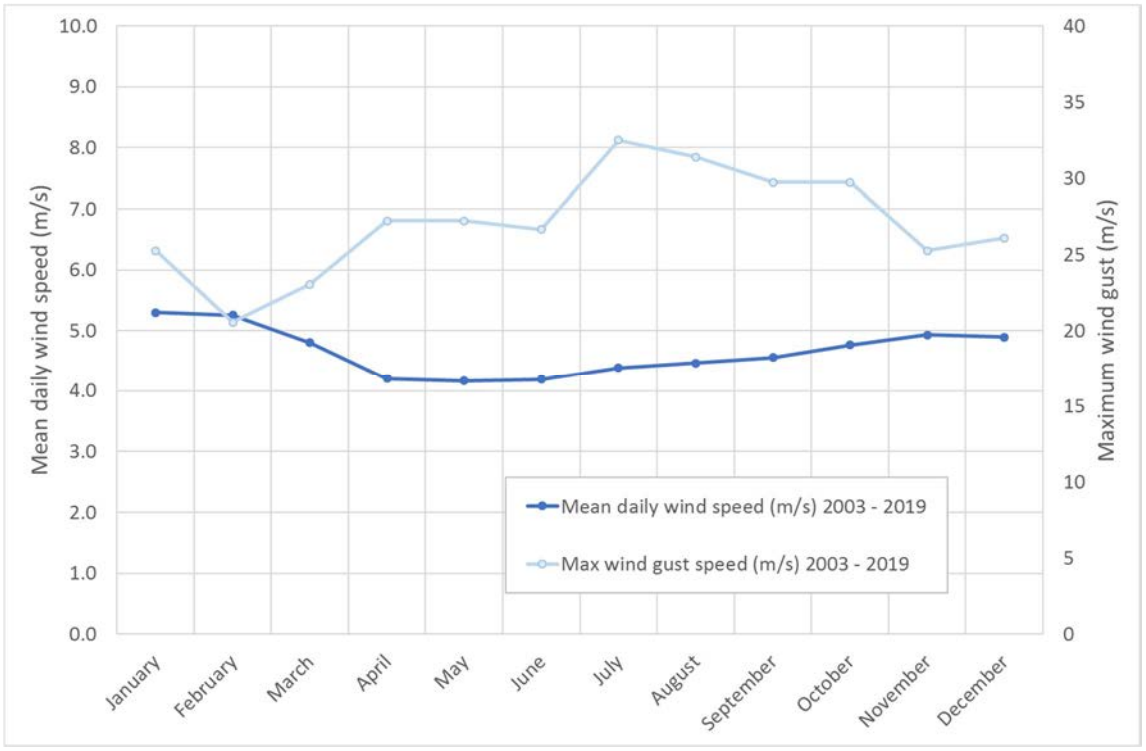


Figure 3-6: Monthly mean daily wind speed and maximum wind gust - Port Lincoln AWS, 2003 – 2019

Long-term wind roses for Port Lincoln AWS showing average wind conditions for 9 am and 3 pm over 1992-2019 are shown in Figure 3-7. Seasonal wind roses are provided in Appendix A.

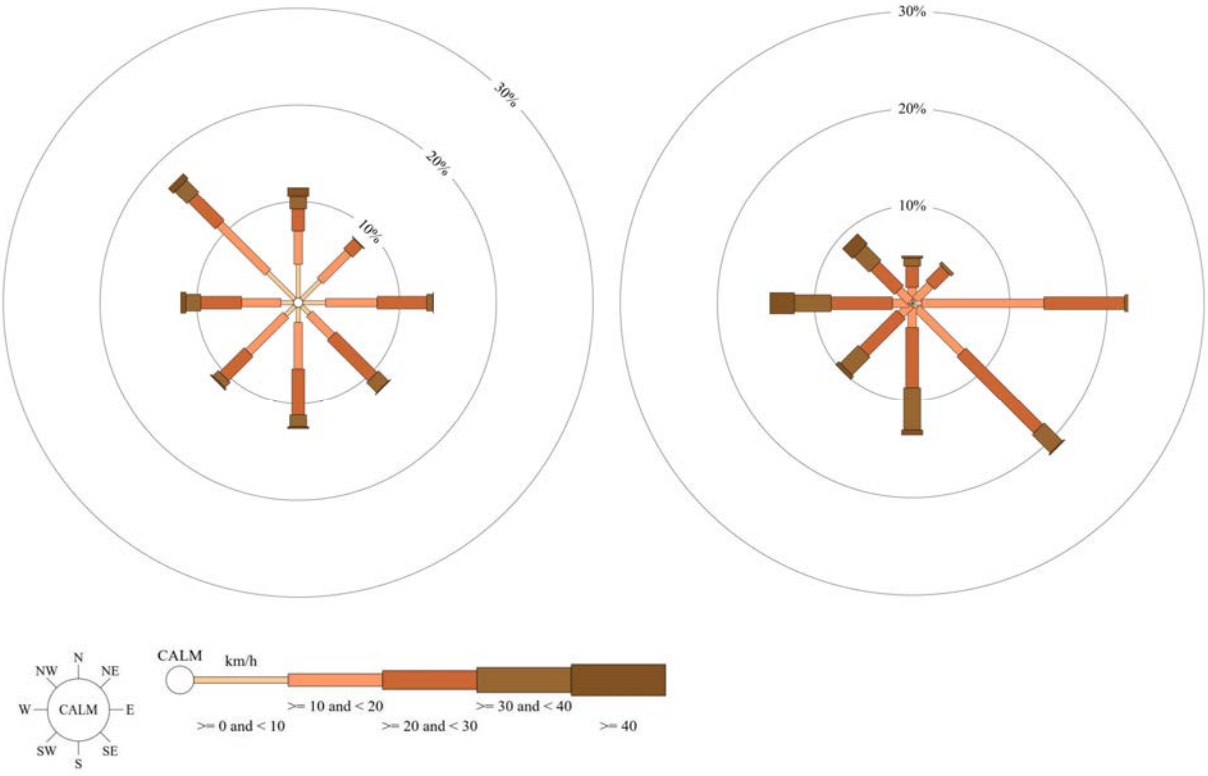


Figure 3-7: Port Lincoln AWS long term wind roses, 1992 - 2019: 9 am (left), 3 pm (right)

4. Assessment Methodology

4.1 Overview

This section of the report sets out the methodology of the air quality impacts assessment.

The EPA South Australia takes a risk-based approach to protecting the environment, in balance with social needs, sound business and economic development targets (EPA, 2016a). There are different tools for evaluating air quality impacts of proposals: atmospheric modelling and monitoring, with an emphasis on adverse effects on human health and well-being, and where appropriate, impacts on vegetation, within the context of economic and social factors.

To demonstrate that no adverse effects will occur at ground level due to emissions from a proposed or existing facility, the EPA advises that owners/operators or proponents of facilities should initially use appropriate conservative models to predict the maximum GLCs of pollutants. In some instances, results of modelling may indicate the need for further investigation of ground level impacts, including monitoring.

Owners/operators or proponents are required by the EPA to demonstrate that these maximum concentrations are less than the GLCs of pollutants specified in Schedule 2 of the EPP at sensitive receptor(s). The GLCs are levels of specific pollutants or odours, below which environmental risk can be considered to be acceptable.

GLCs adopted under the EPP may be based on public health or amenity or may relate to other environmental values, where applicable. Safety factors are built into each GLC to provide an added level of protection for sensitive members of the community such as children and the elderly.

The EPA requires that existing ambient background concentrations of pollutants are also included in the assessment process, so that total concentrations of specific pollutants are less than their respective GLC.

4.2 Meteorological modelling

4.2.1 Overview

The site is located on the eastern coast of the Eyre Peninsula. The local meteorology is affected by synoptic scale meteorology, convective processes, and coastal effects such as sea breezes.

It is important that the complex mechanisms that affect air movements are incorporated into dispersion modelling studies for accurate predictions of dust (and other pollutant) concentrations. This was achieved using the prognostic model known as TAPM (‘The Air Pollution Model’) to generate the initial wind field. The initial wind field information was then adjusted with the use of CALMET, and further inputs of land use and terrain data, to generate a detailed three-dimensional meteorological data set for the modelling domain.

4.2.2 Selection of model year

Port Lincoln BoM hourly wind data for 2012-2018 were analysed for the selection of a suitable model year. Low wind speeds are important as they typically represent low atmospheric turbulence and hence poor dispersion of pollutants. High wind speeds can be important if there are emission sources which are influenced by wind speed, such as wind erosion. For this application, although wind erosion of the exposed bunker areas is included (see Section 5), the mass emission rates for wind erosion are minor compared to the total emissions for the site. As a result, the focus of the selection year was based on assessment of the low wind speeds. This basis was later confirmed by analysis of the highest predicted model GLC results and review of contemporary wind observations.

The low wind speed distributions for each year (up to 2 m/s) were compared with the average over all years. The comparison was done for all wind directions, and also for winds blowing from a direction of 45 degrees clockwise around to 225 degrees, i.e. blowing onshore and towards the closest sensitive receptor north of the

site boundary. The objective was to select a year with a higher than average frequency of these low wind speeds, so that the dispersion modelling reflects worst case meteorological conditions.

From the analysis of the 2012 – 2018 data, year 2017 was selected on the basis that it had the highest frequency of low wind speeds in the direction which is most likely to impact sensitive receptor sites around the Port Spencer grain facility boundary. Years 2014, 2015 and 2016 were also found to have a high percentage of onshore light winds. The seasonal wind roses obtained from the hourly Port Lincoln AWS site for the selected model year, 2017, are shown in Figure 4-1. A high frequency of winds from the south and south-east can be seen in summer.

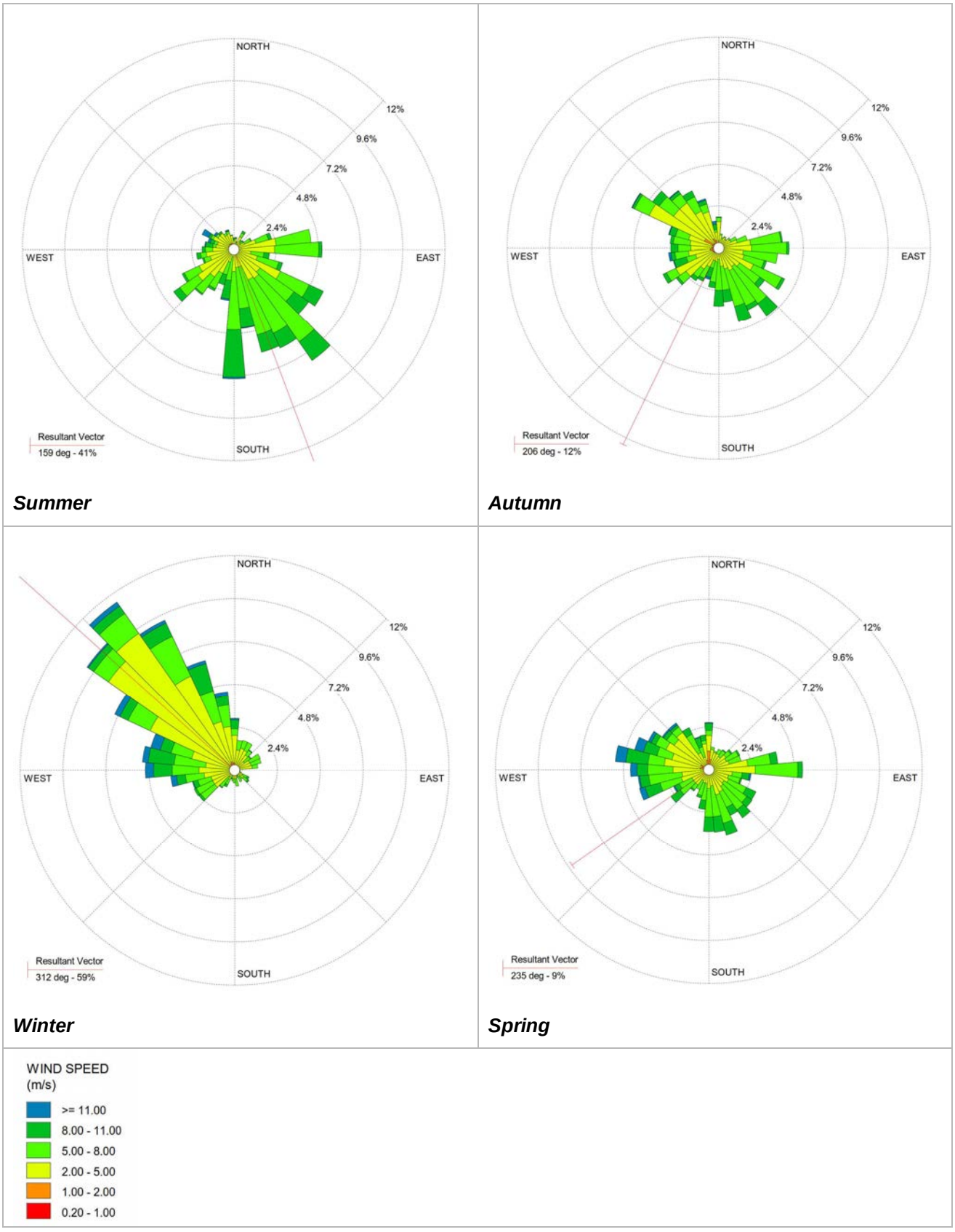


Figure 4-1: Port Lincoln AWS seasonal wind roses for 2017

4.2.3 TAPM / CALMET Model Inputs

The TAPM prognostic meteorological and dispersion model developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO); see Hurley (2008), was used to generate an 'initial guess' three dimensional meteorological field for the project site region. The modelling used 2017 data from the CSIRO's surface and synoptic datasets, centred around the proposed grain facility. Input data for the TAPM meteorological model are summarised in Table 4-1.

Table 4-1: TAPM setup parameters

TAPM Parameter	Model Values
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	31 (west-east) x 31 (north-south) x 25 (vertical)
Period of analysis	1 January 2017 – 31 December 2017 (8760 hours)
Centre of analysis	Port Spencer Site: 615,866 m (easting) 6,209,408 m (northing)
Meteorological observation data assimilation	None

TAPM generated meteorological data was output for a location near to the Port Lincoln AWS site (North Shields) and the Port Spencer grain facility site and compared to the Port Lincoln AWS data for the model year. Refer to Section 6.1.

Using the gridded prognostic meteorological data from TAPM as the initial guess wind field in combination with terrain and land use data, refined wind fields were then generated using CALMET v6.5.0.

Shuttle radar topography mission (SRTM) terrain data of horizontal resolution approximately 30 metres was obtained from Geoscience Australia (2019), for use on this project. Surrounding land use was divided into generic land use classifications specified in CALPUFF Modelling System Version 6 User Instructions, (Scire, 2011), using publicly available, online vertical imagery.

Table 4-2 summarises the CALMET setup parameters applied for the project.

Table 4-2: CALMET setup parameters

CALMET parameter	Model Values
Meteorological grid domain	12 km (east-west) by 12 km (north-south)
Vertical levels	11 vertical layers up to 2900m
Run Type	'No observations' mode
Meteorological grid resolution	200 metres
'Initial guess' wind field	3-dimensional meteorological output from TAPM
Terrain elevations	Included in model. SRTM one second database obtained from Geoscience Australia.
Land use types	Agricultural land (unirrigated) – code 20 Large water body – code 55

4.3 Dispersion modelling

The CALPUFF (version 7.3.1) model was used to predict ambient pollutant GLCs for the estimated dust and methyl bromide emissions associated with the operation of the grain facility.

CALPUFF is a variable-trajectory dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs, emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional (simpler) Gaussian plume models in that it models spatially varying wind and turbulence fields that are important in complex terrain, for long-range transport, and near calm conditions. Also, the TAPM-CALMET-CALPUFF combination is expected to provide higher quality results for the project's coastal location.

The modelling has been performed using the meteorological information provided by the CALMET model, and the particulate emission estimates for the proposed Port Spencer facility. There are no other significant existing particulate emission sources in the region which would be expected to influence the existing baseline particulate concentrations at the site. An exception may be smoke particles from controlled burning and other fires. However, these emissions are not normally included in air quality assessments for individual projects, and in any case the estimates for background $PM_{2.5}$ and PM_{10} would include some effects from smoke.

The CALPUFF model was used in this study to predict the pollutant concentrations at a set of ground-level receptors covering the region surrounding the proposed site, both land and over water. Use of a grid receptor spacing of 200 metres across a domain of 12.0 km by 12.0 km led to a total of 3,600 gridded receptors in the horizontal plane being used. Five sensitive receptor sites within this domain were also included.

The particulate emission sources for the port operations (e.g. grain truck unloading, conveying and transfers, ship-loading activities) were represented using individual volume emission sources. Emissions from the bagfilters, diesel generator, and venting of the silos after fumigation, were represented as point emission sources. Time-varying emissions were incorporated to represent the seasonal and diurnal variation of operations, as described in Section 5.

The predicted pollutant GLCs and dust deposition results are provided in Section 6.

5. Emissions

The key air emission expected from the operation of the port facility is dust associated with the handling, transfer and storage of grains. The amount of dust generated from grain handling facilities is dependent on the type of grain being handled, the quality of the grain, the moisture content, the design and operation of the handling infrastructure (conveyors, reclaimers, etc.), and the extent and efficiency of dust mitigation equipment. The dust generated and released from the grain comprises approximately 70% organic material. The dust may include particles of grain kernels, small amounts of spores of smuts and moulds, insect debris, pollens and filed dust (US EPA, 2003).

The emissions estimates for the port facility assessment are largely based on the emissions information provided in the US EPA 'AP-42' document, Chapter 9.9.1 for Grain Processing (US EPA, 2003). Emission factor details are provided in Section 5.2.

In addition to dust emissions, there will be emissions of methyl bromide gas which will be used occasionally to fumigate the grain within the silos for pest control, prior to export.

5.1 Key air emission sources

The operations expected to result in dust emissions at the port facility are described below.

Truck unloading – During the harvest season, 70 tonne trucks will enter the facility and unload grain at the end of each of the 8 storage bunkers between the hours of 6 am and 10 pm each day of the week. The truck unloading intensity will be high during this period with truck unloading cycles of 10 minutes, resulting in 6 trucks unloading every hour at the end of each bunker. This is a total of 48 trucks unloading every hour for the site during these times.

Outside of the harvest period, i.e. 'non-harvest', there will be up to 4 trucks unloading at any one time between 9 am and 5 pm daily. The unloading cycle is assumed to be the same as that during harvest, i.e. 10 minutes. A total of up to 24 trucks (each with 70 tonne grain cargo) will be unloaded for each hour during the non-harvest period.

Trucks will unload the grain into a hopper equipped with Burnley Baffles. These consist of a series of metal blades which allow the passage of grain to the hopper below and close automatically to prevent dust release when the grain has passed through the baffles. An example of these is shown in Figure 5-1.

Figure 5-1: Example of Burnley Baffle technology used for dust mitigation at truck unloading bays

In addition to the Burnley Baffles, wind break walls will be implemented each side of the truck unloading bays to further reduce potential dust impact.

Grain handling and transfers – Following unloading of the grain into the hoppers at the end of each bunker, the grain will be transferred via conveyors for discharge into the bunkers.

From the bunkers, the grain is reclaimed and transferred via conveyors to the silo area (see 'Silo area bagfilters' below).

Ship loading – The grain from the silo area will be loaded to the ship via a bucket elevator and conveyor along the jetty to the ship's hold. All conveyors and transfer points will be enclosed. From the conveyor, the grain enters the hold via a telescopic chute. Ship loading can occur 24 hours a day, at any time of the year.

Wind erosion of bunker storage – There will be 8 bunkers at the site for the storage of grain brought to the site by the delivery trucks. The bunkers will be up to 40 m wide, 8 metres high, and up to approximately 880 metres long. Each bunker will be covered with the exception of a small length, up to 15 metres long at each bunker, for unloading purposes. The generation of dust may occur during medium to high wind speeds for the exposed area.

Silo area bagfilters – Each of the potential dust emission sources at the silo area including conveyors, transfer points, bucket elevators, silo vents, will be covered and equipped with forced ventilation. The extracted air will be treated at several dedicated bagfilters, with the treated air emitted to atmosphere via stacks. The bagfilters will consist of carbon steel vessels fitted with polyester bags through which the dust-laden air is forced. The dust particles are collected on the surface of the bags, reducing the concentration of dust emitted to atmosphere.

Diesel generator – There will be two 1.5 MW diesel generators, operating in duty/standby mode, which will be used to provide power to the site. There will be no grid-supplied electricity. The combustion of diesel will generate air emissions, including dust, which will consist predominantly of very fine particles, i.e. $PM_{2.5}$. In addition to dust emissions, the diesel generators will also emit other air pollutants including carbon monoxide, oxides of nitrogen, volatile organic compounds, and sulphur dioxide. The potential ambient air impact from these pollutants is expected to be relatively minor compared to the dust emissions due to there being limited mass emission rates. Although there will be contributions of these pollutants from site vehicles, i.e. cars and utility vehicles, the traffic intensity at the site combined with the generator emissions are expected to be considerably less than that within a built up urban area, e.g. metropolitan Adelaide.

In addition to the above dust particle emissions, there will also be particulate emissions from the use of site vehicles during the operation of the port facility. The potential ambient air impact of these emissions is allowed for by the application of the background particulate concentrations applied as part of the assessment (see Section 3.3).

Grain silo fumigation – Occasionally, the grain in the silos will need to be fumigated using methyl bromide for the control of pests prior to export. This is expected to be required if/when: grain from the farm is to be loaded directly onto a ship, grain is to be shipped to a port in India or another port which has similar grain import quarantine restrictions, or another event within the port which warrants fumigation. It will not be a routine procedure but will be applied on an 'as needs' basis. Methyl bromide is a fast acting and highly effective fumigant (DoEE, 2019) though is also an ozone depleting substance and is toxic to human health. Its use as a fumigant in grain silos is regulated by the Australian Government standard *AFAS Methyl Bromide Fumigation Standard* (DAWR, 2015) which is provided as part of the Australian Fumigation Accreditation Scheme (AFAS). Anyone who uses methyl bromide must keep a record of the details of every fumigation performed.

The fumigation procedure involves circulating gas containing a specified concentration of methyl bromide through the silo containing grain for a period of between 12 and 30 hours (depending on grain type, ambient conditions, etc.). The duration is indicative only and will be dependent on the final silo and ventilation system design. At the end of the fumigation period, the silo gas is released to atmosphere and the silo is purged to reduce the concentration of methyl bromide. The highest methyl bromide emission rate is expected to occur during the initial venting, i.e. within the first hour.

The design features and operation activities which affect the dust and methyl bromide emission rates are summarised in Table 5-1.

Table 5-1: Summary of key grain facility information and assumptions for assessment

Dust source	Notes
Truck unloading	Occurs at northern end of bunkers. All trucks are 'straight trucks', i.e. tip and unload grain via tail gate, with grain capacity of 70 tonnes. During harvest period [Note 1]: 8 trucks unload simultaneously, between hours of 6 am and 10 pm. Non-harvest period: 4 trucks unload simultaneously, between 9 am and 5 pm. For both the harvest and non-harvest periods, 6 trucks will unload sequentially, i.e. 10 minute unloading cycle, within each hour at the end of each of the 8 bunkers. This has been applied for every hour of the year and is considered 'worst case' in terms of dust emission rates. In practice, it is expected that this level of intensity of dust emissions will occur infrequently. The scenario modelled assumes there will be 48 trucks unloading every hour between 6 am and 10 pm during harvest. During non-harvest period, there will be 24 trucks unloading each hour between 9 am and 5 pm. Dust mitigation to be achieved using Burnley Baffles on the receival hoppers and wind breaks either side of the truck.
Grain handling	Includes emissions associated with transfer of grain via conveyors, loading the bunkers, reclaiming the grain and transfer to the silo area. Dust mitigation includes enclosure of conveyors and transfer points. Transfer and handling emissions occur 6 am – 10 pm during harvest, and 9 am – 5 pm during the non-harvest period.
Ship loading	Ship loading assumed to occur 24 hours per day, all year. Although this will not occur, this modelling input enables the potential impact of ship loading to be applied for any hour of the year. Loading of grain to the ship hold to be via telescopic chute to reduce dust emissions.
Wind erosion from grain storage bunkers	Dust emissions from wind erosion of bunker stockpiles can occur 24 hours per day, all year. Width of each bunker is up to 40 metres. Majority of bunkers will be covered to protect grain quality and minimise dust emissions. The maximum exposed area of the bunker at any one time assumed to be 15 m long; to permit loading of the grain. Wind erosion will only occur when wind speeds are greater than 5.1 m/s.
Diesel generator emissions	1.5 MW diesel generator Assumed to operate 24 hours per day, all year. No mitigation of dust emissions included in modelling.
Bagfilter exhaust gas	19 bagfilters at grain silo area, each operating 24 hours per day, all year. Each bagfilter has dedicated vent stack, with stack gas exit velocity of 15 m/s, 20 degrees Celsius.
Silo fumigation	Only one silo vented at any time Ventilation rate of 15 m^3/sec, exit velocity 20 m/s. Methyl bromide concentration at start of venting period of 15 g/m^3

Dust source	Notes
	Initial hour of silo venting occurs between 9 am and 3 pm

Notes:

1. Harvest period modelled as November and December, i.e. 2 months.

The emission rates of methyl bromide from the silo during venting, i.e. after the fumigation of the grain, are highly variable and difficult to predict for any given silo, ventilation system design and operation (grain type, ambient conditions, grain volume to be fumigated, etc.). For the purposes of this assessment, estimates for the rate of decrease of methyl bromide concentration in the vent stream and an average concentration across the first hour of release have been made. These inputs are preliminary only and will need to be assessed once further definition of the fumigation and venting procedure are available.

For each operational activity at the grain facility, dust particle emission rates were estimated and used as input to the modelling. The key design basis material movement data which was used as input to the emissions calculations is summarised in Table 5-2.

Table 5-2: Grain facility dust emissions input data

Emissions input data	Units	Value
Truck unloading rate – during harvest period	t/hr	3,360
Truck unloading rate – outside of harvest period	t/hr	1,680
Grain handling rate at bunker area	t/hr	600
Ship loading rate	t/hr	2,000
Wind erosion of bunkers – exposed area	ha	0.48
Dust collectors dust emission concentrations TSP PM_{10} $PM_{2.5}$	mg/Sm^3	 45 10 10 Note 1
Diesel generator power use	kWhr/day	36,000

Notes:

1. The $PM_{2.5}$ concentration in the bagfilter exhaust stream is preliminary and is expected to be a conservative (i.e. high) estimate.

5.2 Dust emission factors

A summary of the emission factors for each of the emission sources is provided in Table 5-3. For each source shown, with the exception of wind erosion and the diesel generator, the emission factors from US EPA (2003) were applied.

For wind erosion, emission factors provided in the National Pollutant Inventory Emission estimation technique manual (NPI EETM) for Mining (AG, 2012) were applied; US EPA (2003) provided no applicable factors.

For the diesel generator, the emission factors from the NPI EETM for Combustion Engines (AG, 2008) were applied.

Emissions control factors are not provided in US EPA (2003) for grain processing. Estimated emission reductions resulting from the implementation of controls were determined using the NPI EETM for Mining (AG, 2012) document, where applicable.

Table 5-3: Emission factors and dust controls

Activity	Emission Factors			Control Factors
	TSP	PM_{10}	$PM_{2.5}$	
Truck unloading (harvest and non-harvest)	0.090 kg/t	0.030 kg/t	0.005 kg/t	70% for use of Burnley Baffles at grain receival hoppers Note 1 30% for use of wind break walls, positioned either side of truck unloading bay (per NPI EETM for Mining)
Grain handling and transfer	0.031 kg/t	0.017 kg/t	0.003 kg/t	Enclosure of conveyors and transfer points – 70% (per NPI EETM for Mining)
Ship loading	0.024 kg/t	0.006 kg/t	0.001 kg/t	Telescopic chutes – 50% (NPI EETM for Mining)
Wind erosion of bunkers	0.400 kg/hr/yr	0.200 kg/hr/yr	0.034 Note 2 kg/hr/yr	No wind erosion emissions for wind speeds less than 5.1 m/s Note 3
Diesel generator	0.43 g/kWhr	0.43 g/kWhr	0.42 g/kWhr	N/A

Notes:

1. The control factor of 70% for the use of Burnley Baffles was the same as that used for the Centrex PER. Equipment supplier brochure for Burnley Baffles indicates 75% dust mitigation (Mideco, 2019).

2. The emission factor for $PM_{2.5}$ wind erosion was assumed to be 17% of PM_{10} (US EPA, 2003).

3. Emissions caused by wind erosion to occur only when wind speeds are greater than 5.1 m/s (default wind speed category in CALPUFF). The use of approximately 5 m/s is based on Equation 22 of Section 1.1.17 of AG (2012), which infers that there are no dust emissions from wind erosion for wind speeds less than 5.4 m/s.

5.3 Particle size distribution

The selection of particle size for air dispersion modelling of smaller particles such as those that fit within the PM_{10} and $PM_{2.5}$ size classes is not critical, as these small particles exhibit behaviour not dissimilar to that of a gas. The fall velocities of small particles are very slight; the particles can be transported over very large distances. Sensitivity tests undertaken using CALPUFF for a two-day test at the port site confirmed that results for PM_{10} Ground Level Concentrations (GLCs) were not affected significantly by the selection of particle size. Therefore, for this assessment the nominal particle size of 6.0 microns (µm) was selected to represent PM_{10} and 1.4 µm to represent $PM_{2.5}$.

The selection of the particle size distribution (PSD) for particles approximately 10 µm and larger is important, as larger particles from dust emissions near ground level re-deposit to the surface over relatively short distances. These larger particles have a significant effect on the predicted dust deposition and therefore on the (depleted) TSP GLCs. The TSP particle size data for grain dust was sourced from a study carried out by Boac et al in 2009 (Boac, 2009). For wheat dust, the geometric mean diameter averaged 13.6 µm.

The particle size parameters used in the modelling are shown in Table 5-4.

Table 5-4: Particle size input data

Particle type	Geometric mass mean diameter (GMMD), microns	Geometric standard deviation (GSD), microns
TSP	13.6	2.8
PM_{10}	6.0	0
$PM_{2.5}$	1.4	0

5.4 Summary of air pollutant emission rates

5.4.1 Dust emissions

The dust emissions estimates were based on design maximum hourly tonnages of grain moved and the input data provided in Section 5.1 and 5.2. A summary of the dust emission rates is provided in Table 5-5.

Table 5-5: Summary of dust emission rates

Dust emission source	Mass emission rates (g/sec) Note 1		
	TSP	PM_{10}	$PM_{2.5}$
Grain unloading			
Harvest	17.7	5.79	0.98
Non-harvest	8.84	2.90	0.49
Grain handling and transfers	1.53	0.85	0.15
Ship loading	6.68	1.67	0.31
Wind erosion	0.022	0.011	0.002
Diesel generator	0.179	0.179	0.175
Bagfilter exhaust stack emissions (total) Note 2	5.24	1.16	1.16
Total of all sources			
Harvest	31.3	9.67	2.77
Non-harvest	22.5	6.77	2.28

Notes

1. The emission rates shown incorporate the dust control factors shown in Table 5-3.
2. The emission rates for each of the 19 bagfilters are shown in Appendix B.

5.4.2 Methyl Bromide emissions

The emission rate of methyl bromide as part of the silo fumigation procedure will be variable over time, with the highest emission rate occurring within the first hour. Due to the high level of uncertainty associated with the emission rate during venting, the current assessment approach involved the estimation of the maximum methyl bromide rate which could occur in the first hour while achieving compliance with the EPP criterion.

The methyl bromide emission rate applied was 90 g/sec (average across one hour). This was based on the fumigation of 10,000 tonnes of grain, with ventilation rate of 15 m^3/sec. The estimate incorporated an initial gas concentration of 15 g/m^3 which would be occur for the first 15 minutes of venting, before reducing rapidly.

5.5 Comparison with Centrex PER emission rates

The total dust emission rates applied in the air quality assessment for grain handling as part of the Centrex PER in 2011 are shown in Table 5-6 (Centrex, 2011).

Table 5-6: Summary of Centrex PER total grain handling dust emissions

Dust emission source	Mass emission rates (g/sec)	
	PM_{10}	$PM_{2.5}$
Volume sources	1.083	0.186
Point sources	0.322	0.261
Total	1.405	0.447

The PM_{10} and $PM_{2.5}$ dust emissions applied in the 2011 assessment are significantly lower than those calculated for the current assessment. There are several causes of the differences between the two inventories; the key contributing factors are:

- There are several more dust collectors for the current assessment compared to the 2011 assessment, some with significantly higher particulate mass emission rates, e.g. the silo vents.
- The 2011 assessment assumes a single 11.6 tonne payload of material will be unloaded over a period of 10 minutes, resulting in approximately 70 tonnes of grain unloaded every hour for the site. This is significantly less than the current assessment which has up to a total of 3,360 tonnes of grain unloaded every hour during the harvest period.

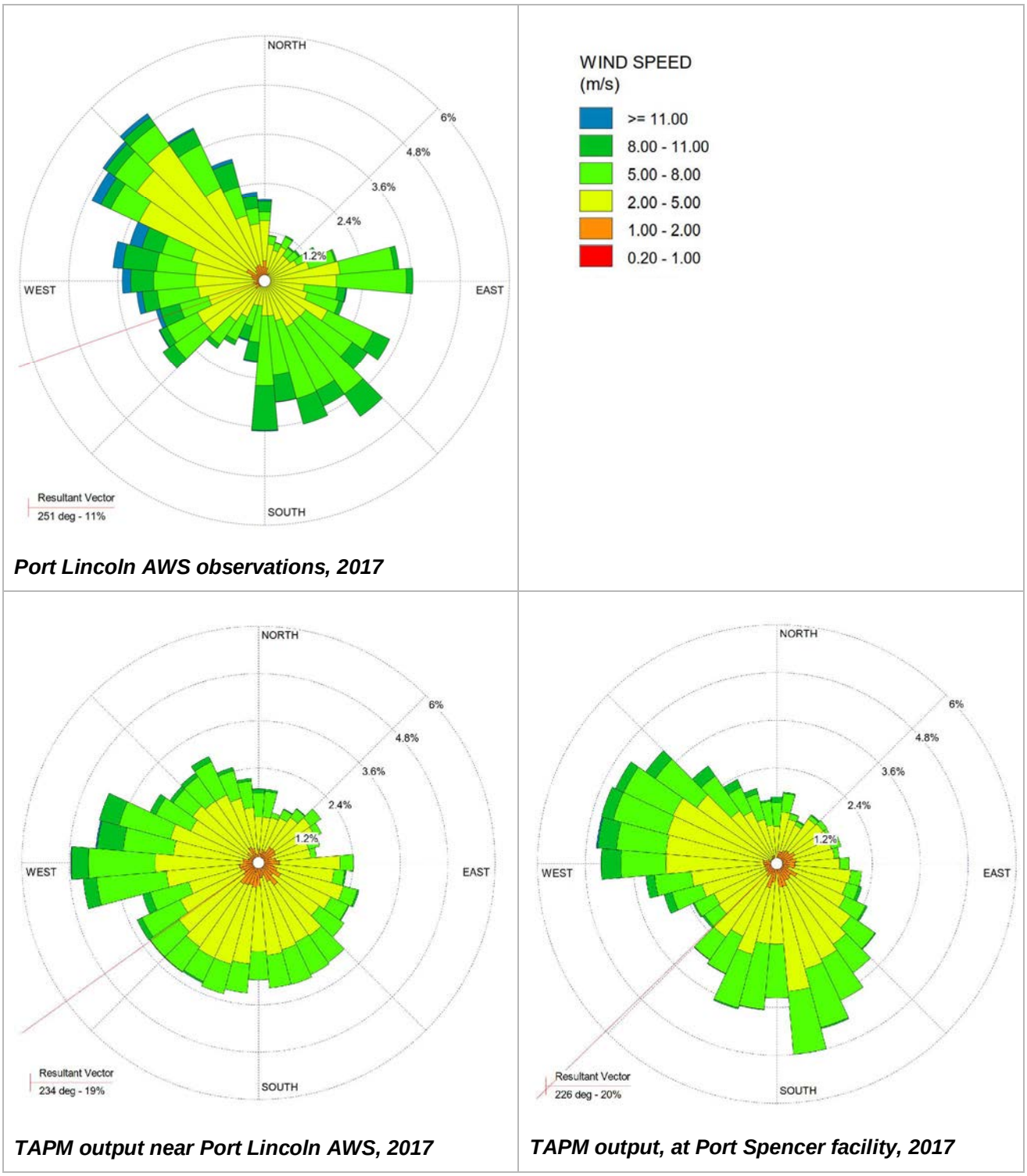
Emissions of methyl bromide were not assessed as part of the Centrex PER.

6. Results

6.1 Meteorological modelling

As part of the quality review of the meteorological data, assessment of the TAPM results was carried out to determine whether the TAPM output was sufficient for use with CALMET. The closest BoM weather station with hourly data which could be used for comparison is Port Lincoln AWS. The conditions at this station were considered to be representative of those at Port Spencer; see Section 3.4.

The 8,760-hourly Port Lincoln AWS observation dataset for 2017 was compared with TAPM meteorological data predicted at the AWS site and at the proposed Port Spencer site for 2017. The resulting annual wind roses generated from the hourly data for the Port Lincoln AWS observations and TAPM outputs are shown in Figure 6-1.



Port Lincoln AWS observations, 2017

TAPM output near Port Lincoln AWS, 2017

TAPM output, at Port Spencer facility, 2017

Figure 6-1: Wind roses for model year 2017; Port Lincoln BoM observations and TAPM outputs

The TAPM output for a location near the Port Lincoln AWS (North Shields) shows a more even distribution of wind direction frequencies than that for the AWS observations. However, the resultant wind direction vector is similar for each. The TAPM output predicted a greater frequency of low wind speeds, which is considered to introduce conservatism to the model (see Section 4.2.2). The TAPM output at the Port Spencer facility indicated

a high frequency of winds from the west north-westerly direction, as well as from the south south-easterly direction which aligns with the observations at Port Lincoln AWS.

The TAPM outputs for Port Spencer location were considered to provide a sufficient initial wind field guess for input to CALMET. The CALMET output for model year 2017 at the Port Spencer location is shown in Figure 6-2. The average wind speed for the CALMET output is 4.3 m/s, compared to the average for the Port Lincoln AWS (for 2017) of 5.0 m/s.

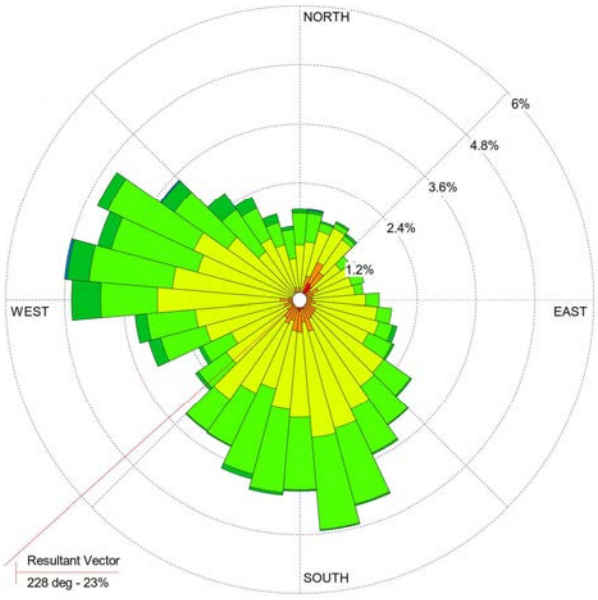


Figure 6-2: CALMET output, Port Spencer location, 2017 all hours

6.2 Dispersion modelling

This section provides the dispersion modelling outputs for the dust emissions at the Port Spencer grain facility. Results are compared with the EPP concentration criteria for PM_{10} and $PM_{2.5}$, and the NSW EPA (2017) criteria for dust (TSP) deposition (Section 2). Each of the model outputs incorporates the respective background concentrations (see Section 0). The Ambient Air Quality Assessment guideline (EPA, 2016b) requires predicted pollutant concentrations to be less than the EPP criteria at sensitive receptor sites. In each output plot, the site boundary is depicted by the red line and the sensitive receptor sites are shown by the pink triangles.

6.2.1 Maximum 24-hour average PM_{10} GLC

CALPUFF results for maximum 24-hour average PM_{10} GLCs (µg/m^3) are provided as contour plots in Figure 6-3. The yellow contour indicates where the model results are equal to the relevant EPP concentration criterion of 50 µg/m^3.

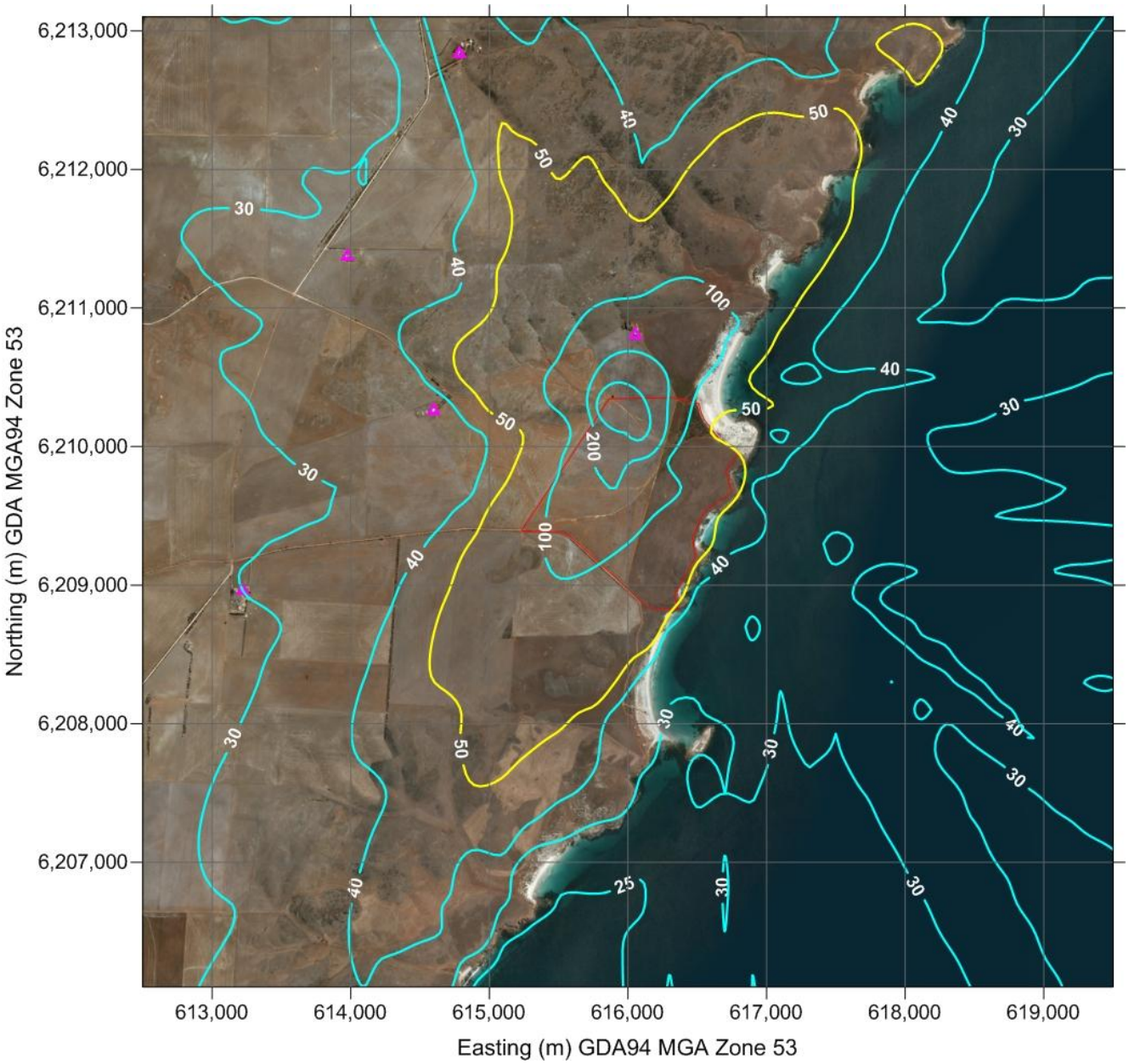


Figure 6-3: Maximum 24-hour average PM_{10} GLC (µg/m^3), including background concentration

The results indicate exceedences of the 50 µg/m^3 EPP criterion at SR#1 to the north of the site boundary. At this receptor, exceedences of the PM_{10} 24hr average criterion are expected for 13 separate days in the year, each during the harvest season (November and December).

An option to mitigate these exceedences is to reduce the intensity of truck unloading, particularly in the evening hours. Modelling was repeated for the scenario with truck unloading restricted to the hours of 6 am to 6 pm during harvest (instead of 6 am to 10 pm). The results of this model are shown in Figure 6-4.

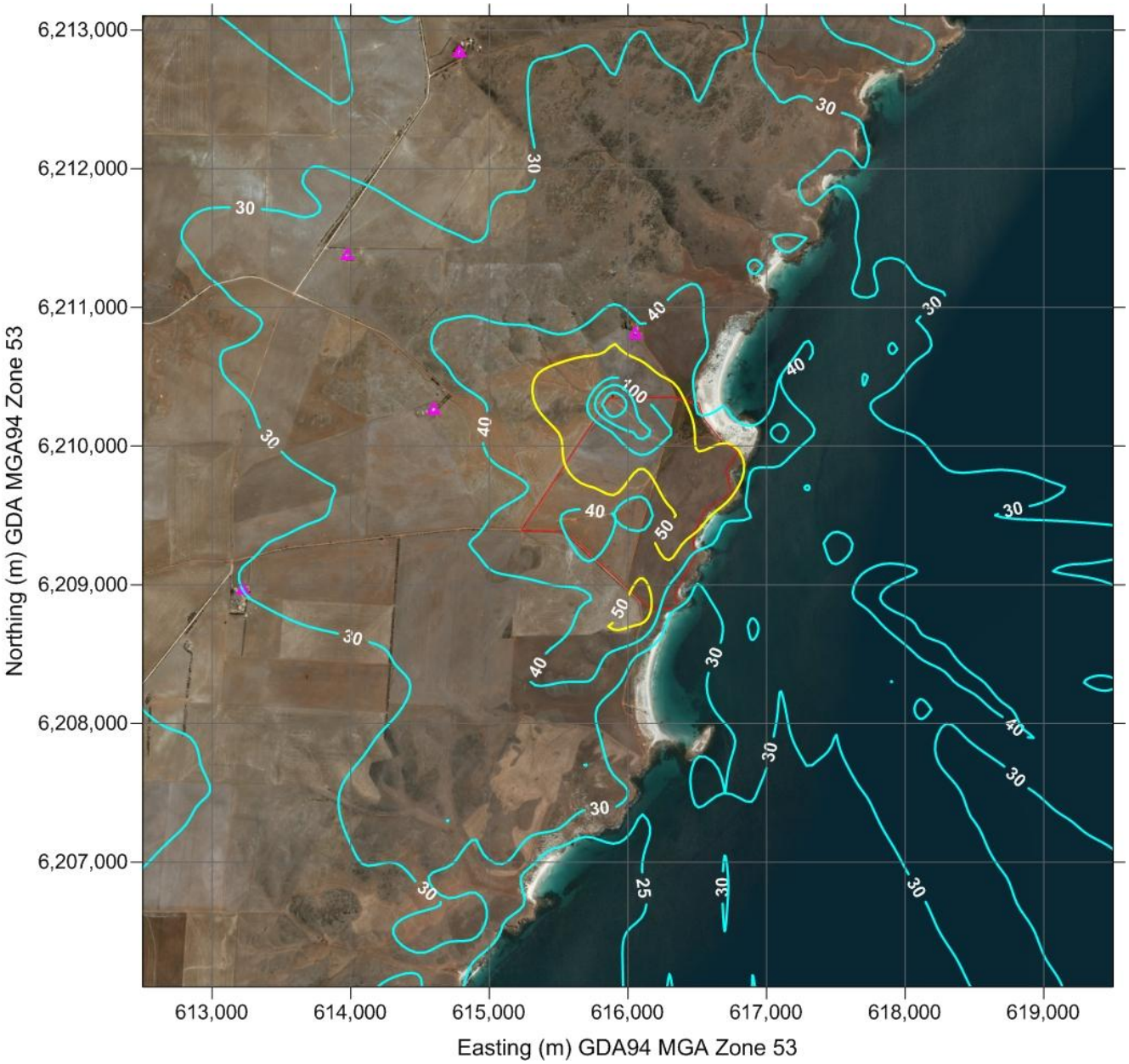


Figure 6-4: Maximum 24-hour average PM_{10} GLC ($\mu g/m^3$) – restricted operating hours during harvest

Under restricted operating hours during the harvest period, the model predicts no exceedences of the PM_{10} 24-hour criterion at any of the sensitive receptor sites. This demonstrates that effective mitigation could be undertaken by limiting operation when the wind direction is blowing grain dust towards SR#1. Unfortunately, southerly winds are more prevalent in summer, during the harvest.

6.2.2 Maximum 24-hour average $PM_{2.5}$ GLC

CALPUFF results for the maximum 24-hour average $PM_{2.5}$ GLCs (µg/m^3) are provided as contour plots in Figure 6-5. The yellow contour indicates the EPP criterion of 25 µg/m^3.

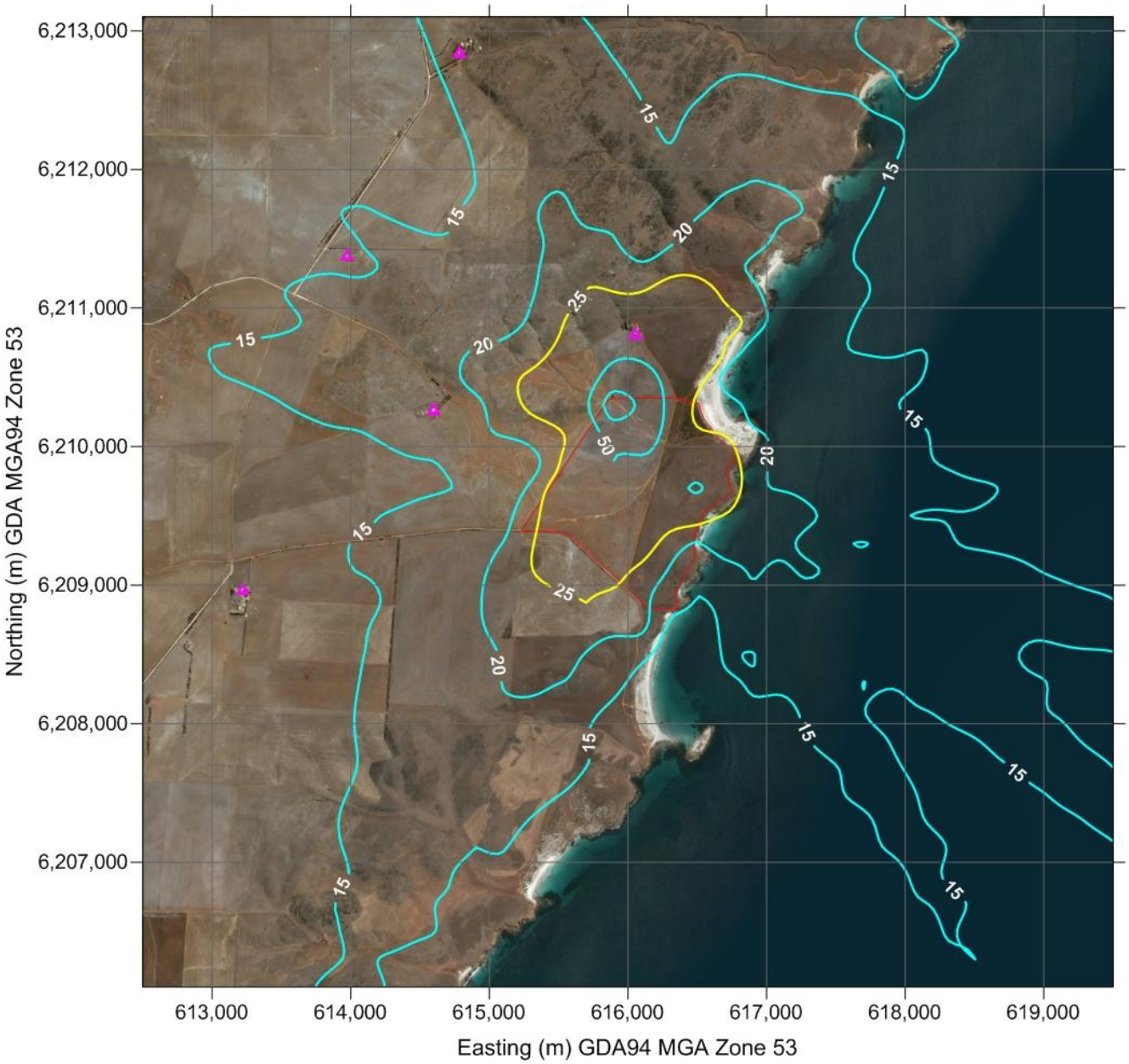


Figure 6-5: Maximum 24-hour average $PM_{2.5}$ GLC (µg/m^3), including background concentration

Again, the results indicate exceedences of the relevant EPP criterion, 25 µg/m^3 in this case, at the closest sensitive receptor (SR#1). At this receptor location, exceedences of the $PM_{2.5}$ 24-hour criterion are predicted to occur for 7 days in the model year, with all exceedences occurring during the harvest season.

If the hours during which truck unloading is permitted to occur is restricted to 6 am to 6 pm in the harvest season, as discussed in Section 6.2.1, the model-predicted $PM_{2.5}$ 24-hour GLCs reduce significantly. The model output for this scenario is shown in Figure 6-6.

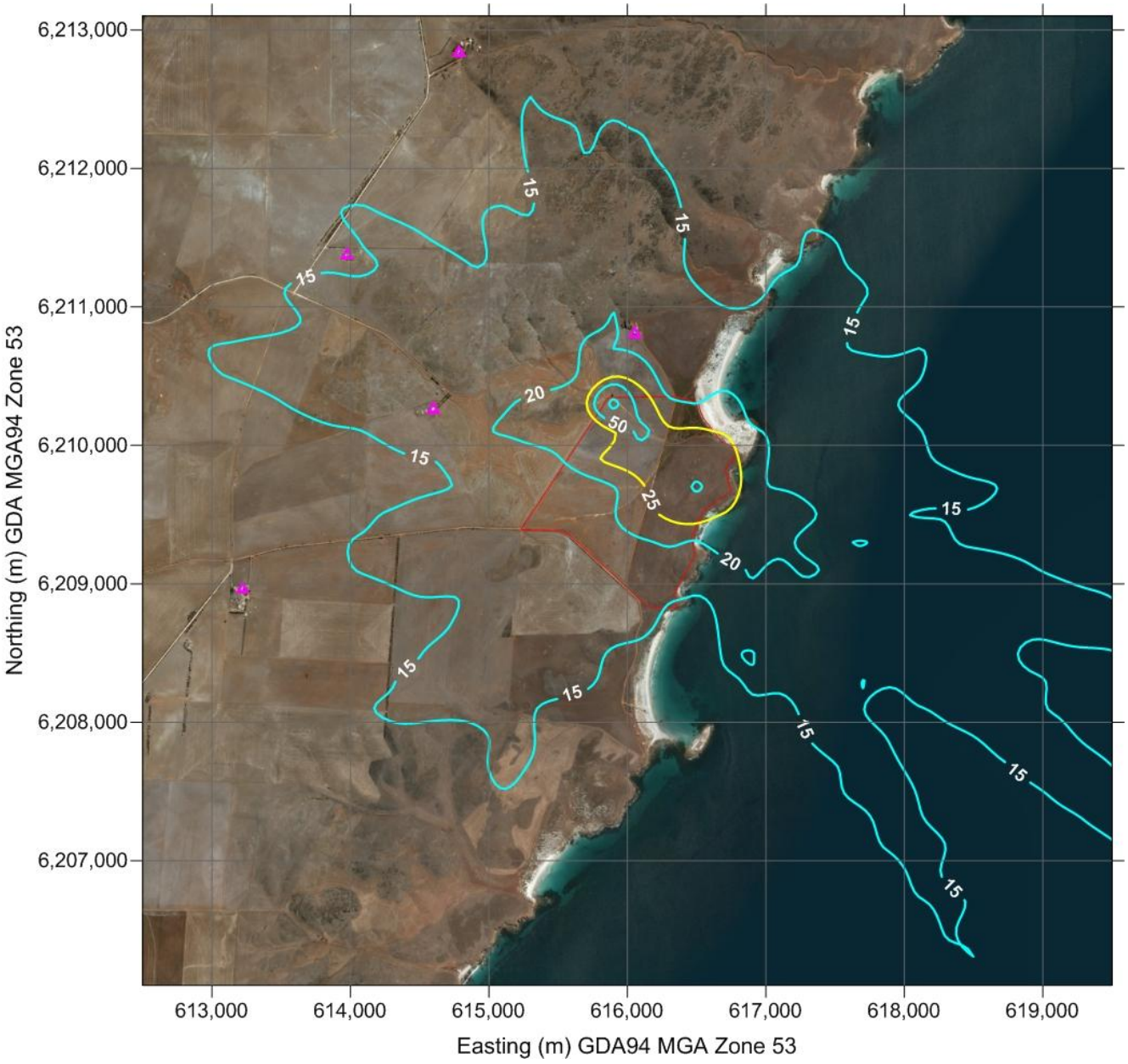


Figure 6-6: Maximum 24-hour average $PM_{2.5}$ GLC (µg/m^3) – restricted operating hours during harvest

Under restricted operating hours during the harvest period, the model predicts no exceedences of the $PM_{2.5}$ 24-hour criterion at any of the sensitive receptor sites.

6.2.3 Annual average $PM_{2.5}$ GLC

CALPUFF results for annual average $PM_{2.5}$ GLCs (µg/m^3) are provided in Figure 6-7. The yellow contour indicates the EPP criterion of 8 µg/m^3. The primary reason for these high results for annual average $PM_{2.5}$ is the existing high background level; see Section 3.3.

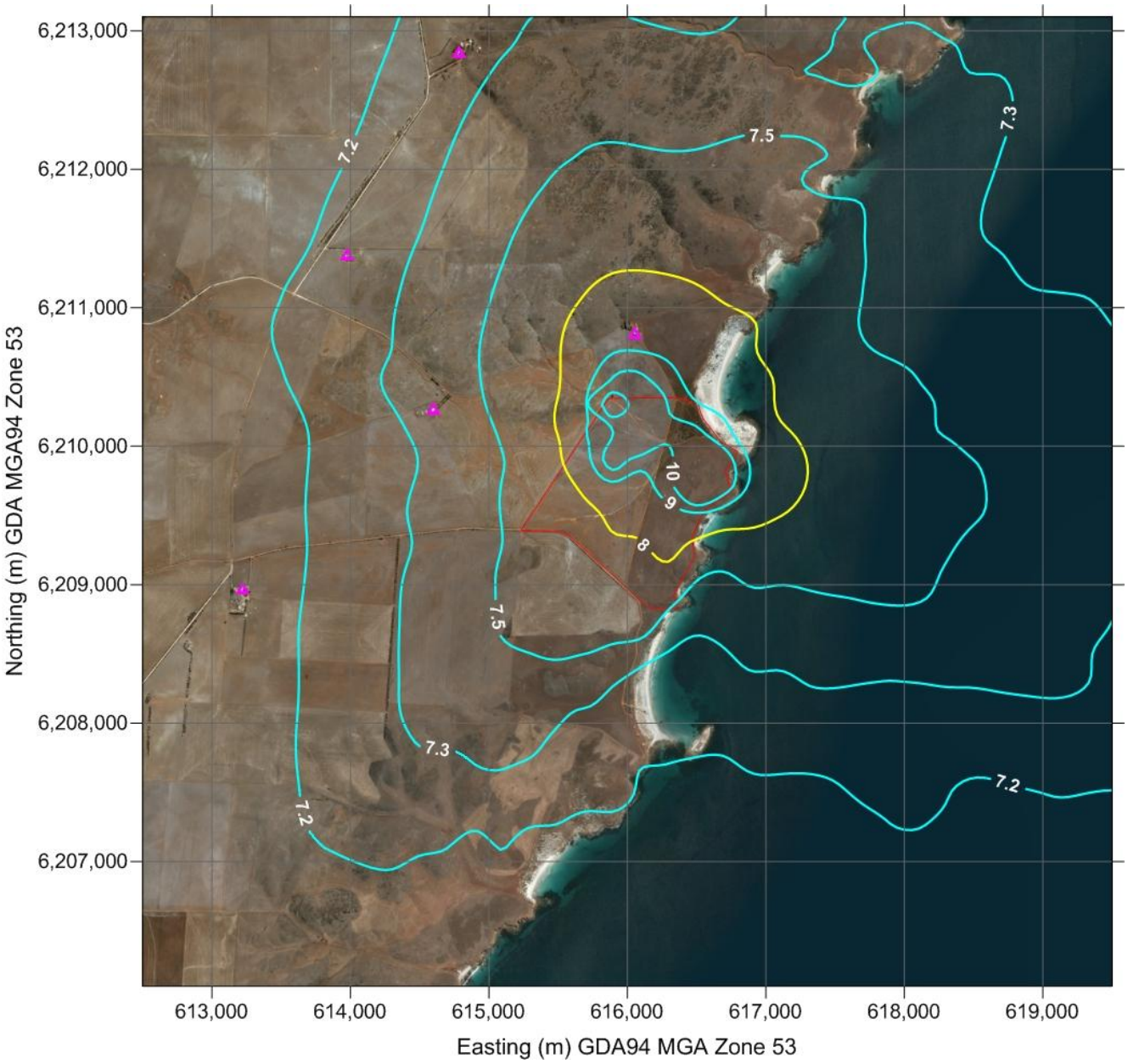


Figure 6-7: Annual average $PM_{2.5}$ GLC (µg/m^3), including background concentration

The results indicate exceedences of the 8 µg/m^3 EPP criterion at the closest sensitive receptor, SR#1, to the north of the site boundary.

The dust emission rates, as set out in Section 5, represent the 'worst case' dust emissions under normal operation. Specifically, for the truck unloading operations, the maximum rate of emissions which represents the peak grain unloading rate is assumed to occur for each hour of the day between 9 am and 5 pm during non-harvest period, and between 6 am and 10 pm during harvest. In practice, the annual average rate of emissions will be less than that modelled because the unloading rates will vary from day to day depending on the number of trucks entering the facility and will not consistently be at the peak rate. During the 10-month non-harvest

period, the average number of trucks unloaded was estimated to be two trucks every 10 minutes, instead of four trucks every 10 minutes. Similarly, throughout the 2-month harvest period, on an average basis for the period it is expected that the trucks may take 15 minutes to unload instead of 10 minutes, thereby reducing the number of trucks unloaded each hour from 6 to 4 at the end of each of the 8 bunkers. In addition, under normal operating conditions, it is expected that only two of the silo ventilation and bagfilter systems will be operational at a time (instead of 4) and the $PM_{2.5}$ concentration of the bagfilter exit gas would be 3 mg/m^3 (lower than the $PM_{2.5}$ concentration of 10 mg/m^3 assumed in the 'worst case' models). A summary of the refinements to better reflect $PM_{2.5}$ emissions on an annual basis is provided in Table 6-1.

Table 6-1: Summary of model refinements to reflect annual average emissions for $PM_{2.5}$

Model input parameter	Worst case (peak hourly) condition	Annual average condition
Truck unloading – harvest period (2 months)	8 trucks simultaneously, every 10 minutes	8 trucks simultaneously, every 15 minutes
Truck unloading – non-harvest period (10 months)	4 trucks simultaneously, every 10 minutes	2 trucks simultaneously, every 10 minutes
Truck unloading emission rate		
Harvest (g/sec)	0.98	0.65
Non-harvest (g/sec)	0.49	0.25
Ventilation of 12 kt silos	4 simultaneously	2 simultaneously
Bagfilter exit gas $PM_{2.5}$ concentration	10 mg/m^3	3 mg/m^3
Total $PM_{2.5}$ emission rate from dust collectors (g/sec)	1.16	0.21
Total site $PM_{2.5}$ emission rate		
Harvest (g/sec)	2.77	1.49
Non-harvest (g/sec)	2.28	1.08

When adjusting estimated dust emissions to better reflect the annual average emissions, there may be particular hours throughout the year when the actual emissions are higher than the estimated annual average. If these emissions occur during unfavourable wind conditions, i.e. light southerly wind blowing towards SR#1, then the model would be underpredicting the impact for these hours and underpredicting the annual average impact. However, the same applies when emissions are less than the estimated average. Overall, the refinements set out above are expected to enable assessment of a typical year, in addition to the worst case model outputs shown in Figure 6-7.

The CALPUFF results for the annual average $PM_{2.5}$ GLCs (µg/m^3), representing typical operation by the application of adjusted emissions shown in Table 6-1 are provided in Figure 6-8.

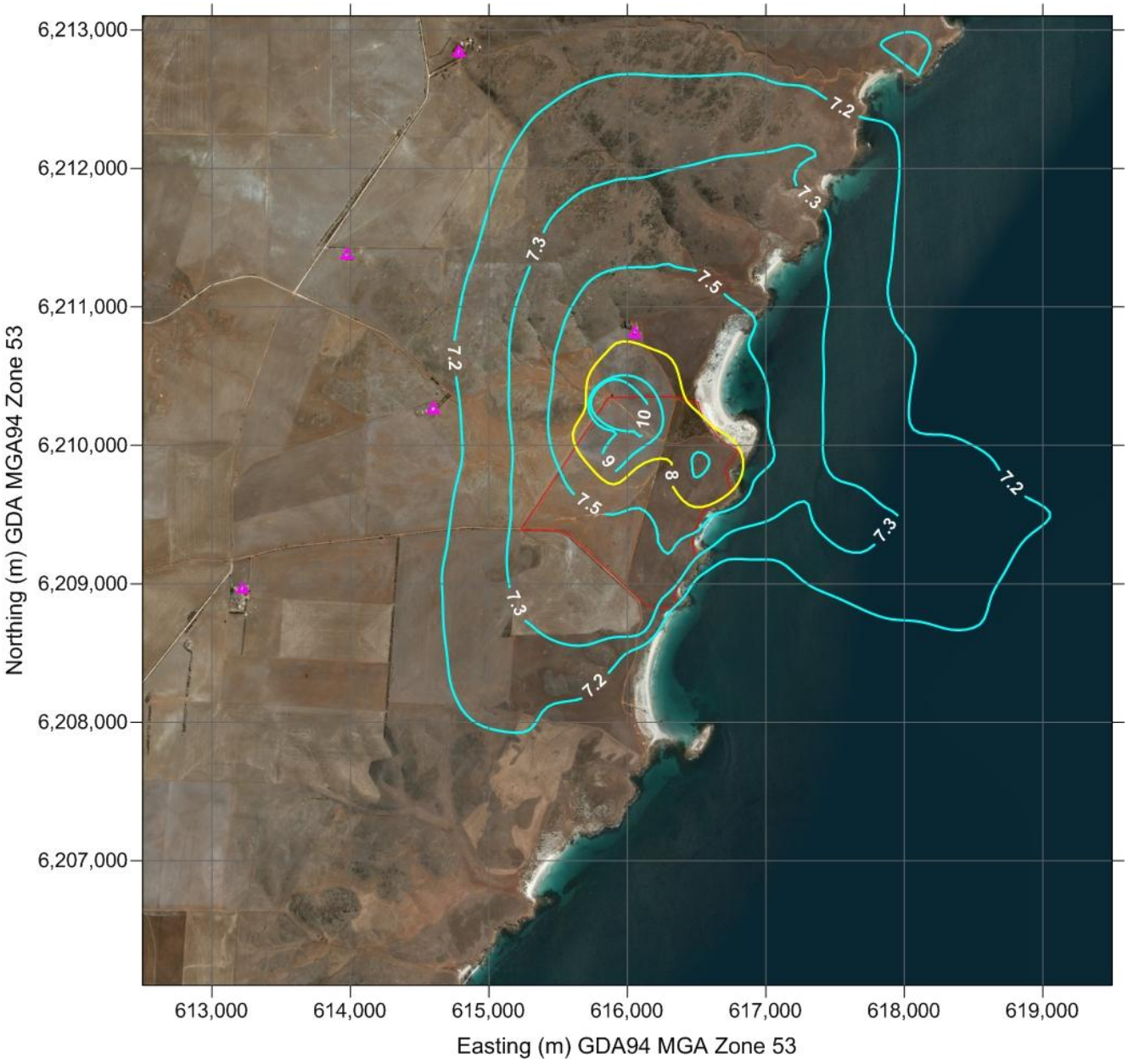


Figure 6-8: Annual average $PM_{2.5}$ GLC (µg/m^3) – adjusted annual average emissions to represent typical operation

The model results indicate a contraction of the $PM_{2.5}$ contours and compliance with the EPP criterion at the nearest sensitive receptor, SR#1, is predicted. The predicted annual average $PM_{2.5}$ concentration at SR#1 is 7.9 µg/m^3, compared to the EPP criterion of 8 µg/m^3. Note that this output represents typical operation, not the worst case operation under normal conditions, as provided in Figure 6-7.

6.2.4 Average annual dust deposition

CALPUFF results for annual average dust (or TSP) deposition (g/m^2/month) are provided as contour plots in Figure 6-9. The yellow contour indicates the NSW EPA criterion of 4 g/m^2/month.

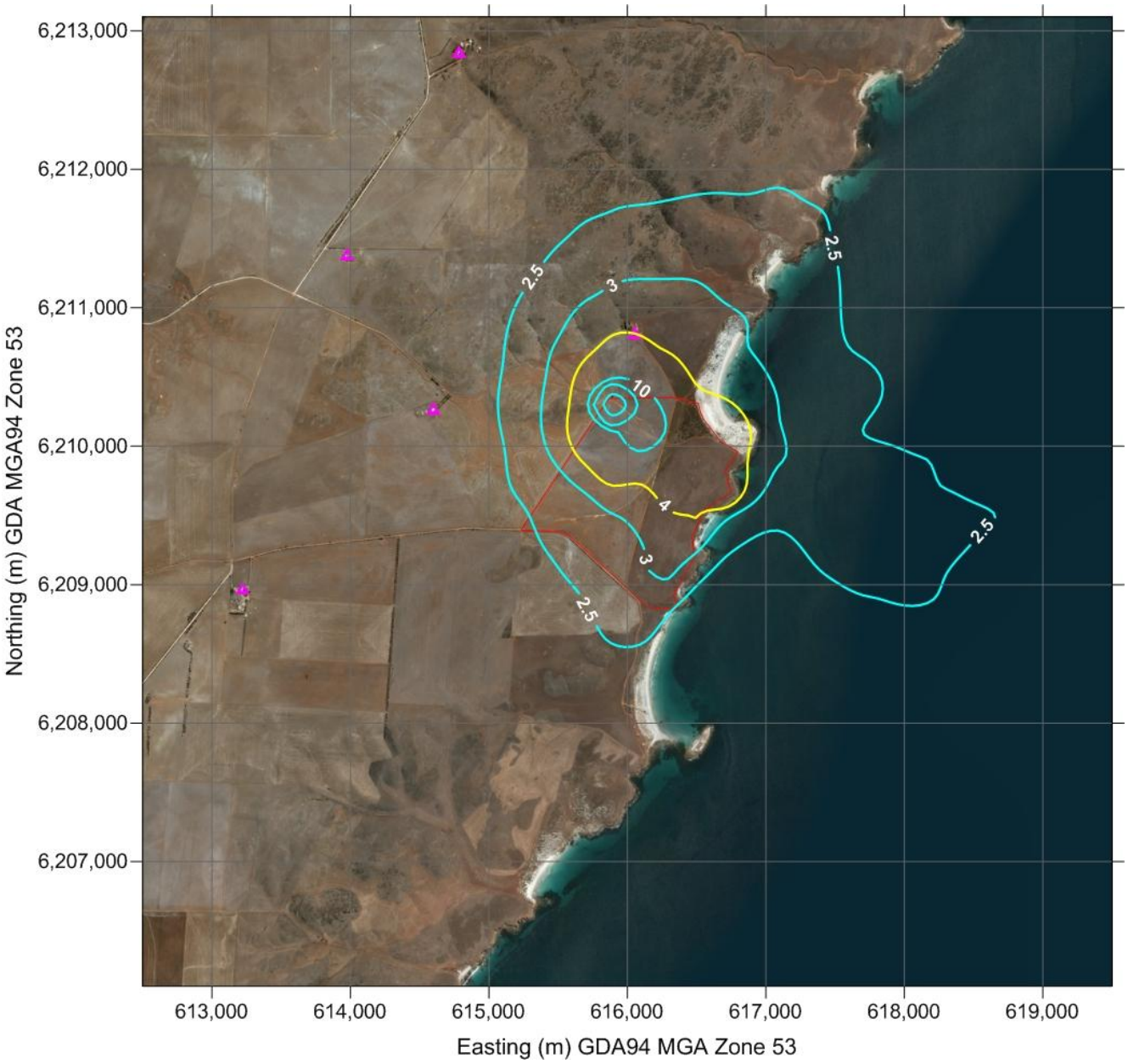


Figure 6-9: Annual average TSP deposition (g/m^2/month), including background concentration

The results predict conformance with the 8 g/m^2/month NSW EPA criterion at all sensitive receptor sites, except the result at SR#1 of 4.0 g/m^2/month, which is equal to the criterion.

The model results of the scenario with restricted operating hours during harvest (6 am – 6 pm) are shown in Figure 6-10. These results demonstrate compliance with the NSW dust deposition criterion can be 'just achieved' with restricted operating hours during the harvest period.

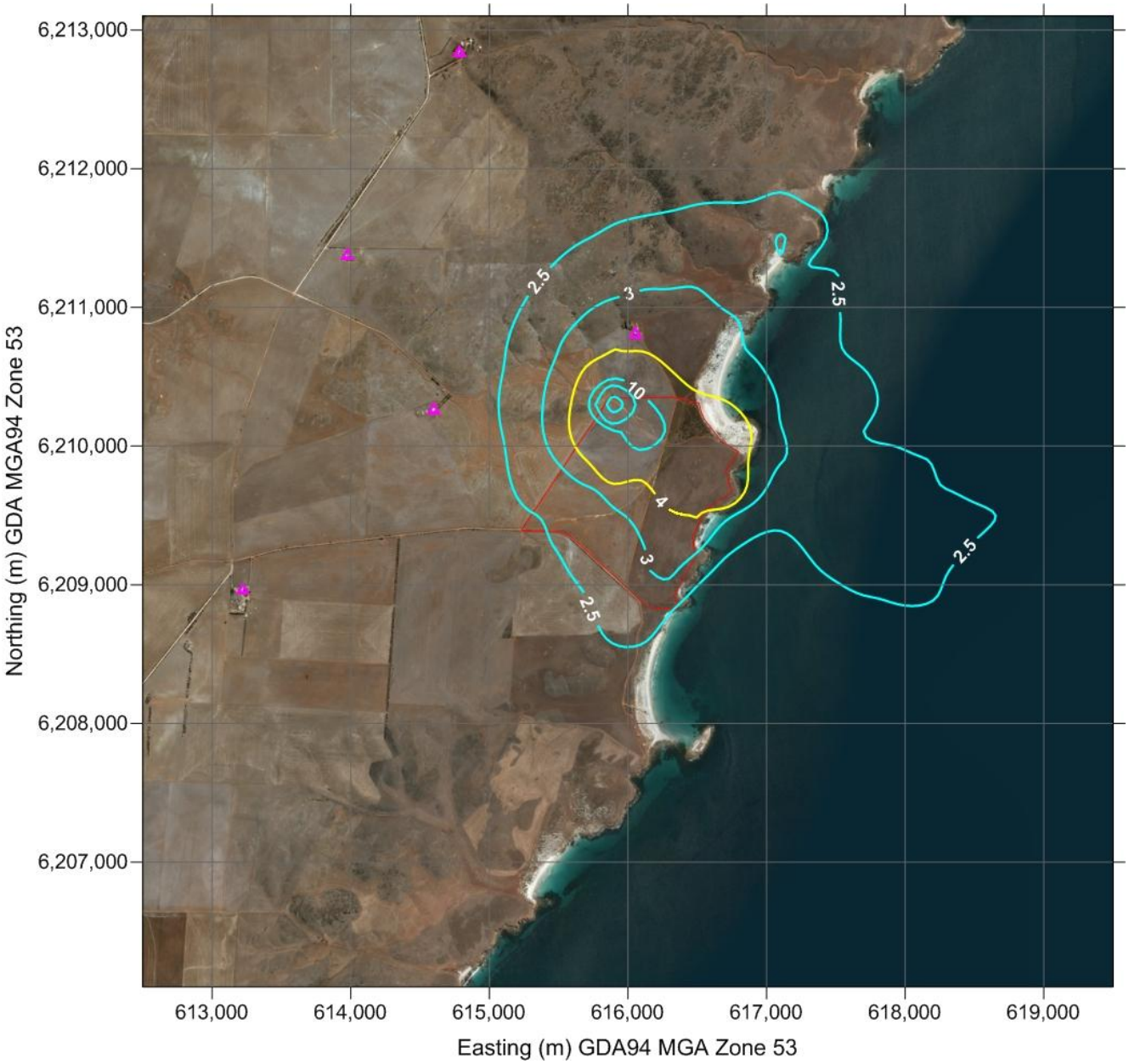


Figure 6-10: Annual average TSP deposition (g/m^2/month) – restricted operating hours during harvest

6.2.6 Maximum 3-minute average methyl bromide GLC

CALPUFF results for the maximum 3-minute average methyl bromide GLCs (mg/m^3) are provided as contour plots in Figure 6-5. The yellow contour indicates the EPP criterion of 0.69 mg/m^3. The background concentration applied for methyl bromide is nil.

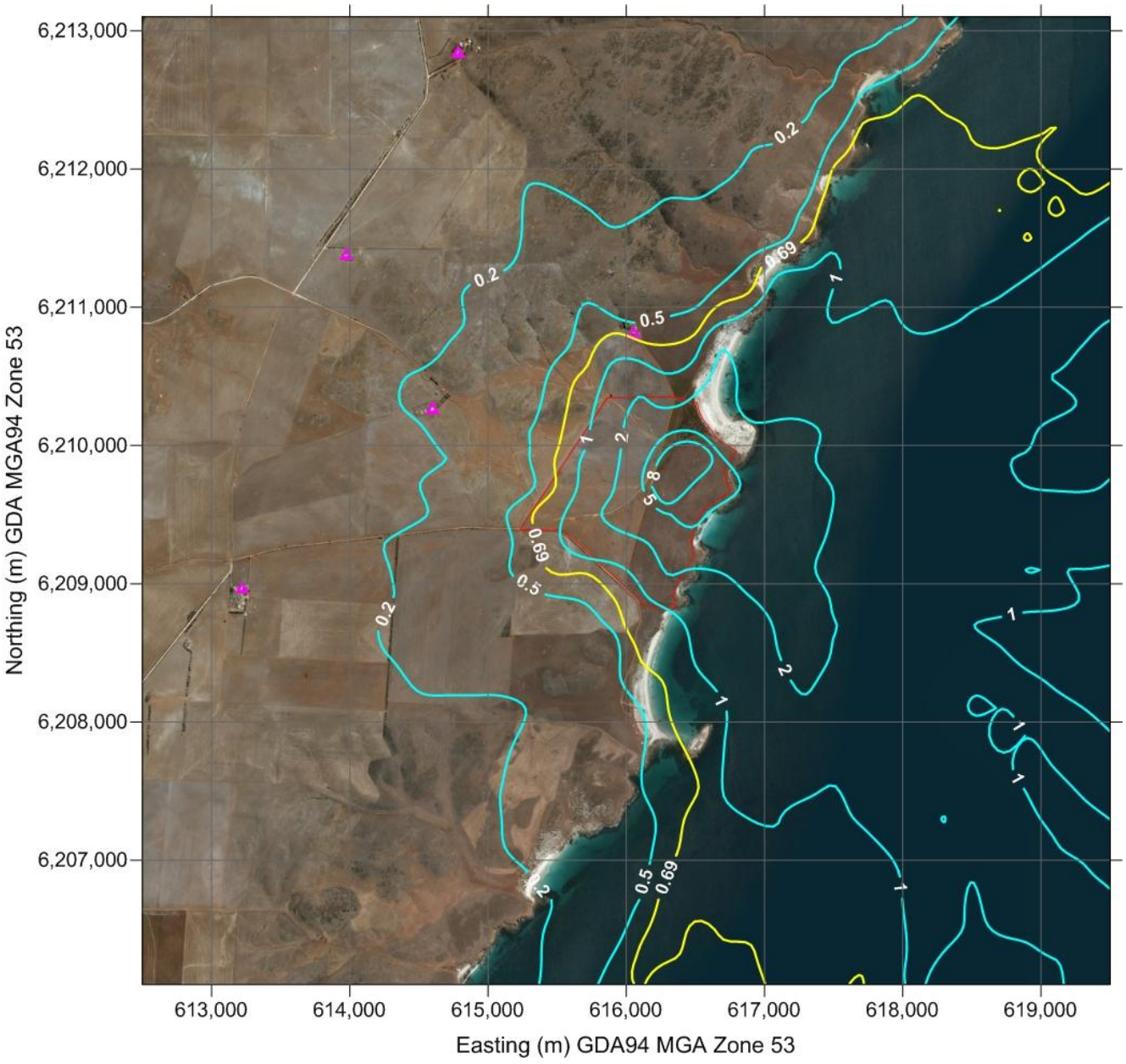


Figure 6-11: Maximum 3-minute average methyl bromide GLC (mg/m^3)

For the methyl bromide emission rate of 90 g/sec, the model predicts no exceedences of the EPP criterion of 0.69 mg/m^3 at any of the sensitive receptor sites.

6.3 Results Summary

A summary of the CALPUFF model results for maximum predicted airborne concentrations (µg/m^3) and dust deposition (g/m^2/month) are provided in Table 6-2.

Table 6-2: Summary of CALPUFF results

Pollutant	Averaging Period	EPP criterion (µg/m^3)	Maximum Grid Result	Max GLC at SRs – NO operating restrictions	Max GLC at SRs – WITH operating restrictions
PM_{10} (µg/m^3)	24-hour	50	771	156 (exceedences on 13 days)	43.4
$PM_{2.5}$ (µg/m^3)	24-hour	25	137	35.7 (exceedences on 7 days)	18.9
$PM_{2.5}$ (µg/m^3)	Annual	8	28.2	8.7	7.9 Note 2
Dust deposition (g/m^2/month)	Annual	4 Note 1	76.5	4.0	3.6
Methyl bromide (g/m^3)	3-minute	0.69	13.0	n/a	0.63

Notes:

1. No SA EPA criteria are provided for the protection of amenity and potential sensitive receptors from deposited dust in the EPP. Criteria for deposited dust (as determined from deposition of modelled TSP emissions), are adopted from NSW EPA (2017), as per Section 2.
2. Emissions adjustments for $PM_{2.5}$ annual average scenario include application of expected typical annual average dust emissions rates which incorporate reduced grain truck unloading frequencies and reduced bagfilter exhaust gas $PM_{2.5}$ emission rates.

7. Conclusions

The air quality assessment for the Port Spencer grain facility involved the generation of the dust emissions inventory for the site, followed by CALPUFF dispersion modelling to predict the potential impact of the dust emissions on the surrounding area.

The unloading of the grain from trucks at the end of each of the bunkers during the harvest season was found to be a significant contributor to the dust emissions at the site. The dispersion modelling indicated that these emissions also had a significant impact on the predicted ambient dust GLCs, particularly for the PM_{10} and $PM_{2.5}$ 24-hour averages. With truck unloading occurring between 6 am and 10 pm every day during the harvest period of November and December, exceedences of the EPP criteria for PM_{10} and $PM_{2.5}$ 24-hour average were predicted at the closest sensitive receptor site (SR#1), located approximately 450 m north of the site boundary. There were no exceedences predicted for the other sensitive receptor sites. Analysis of the model results indicated that these exceedences occurred only during the harvest period and during low wind conditions in the evening hours, typically between 6 pm and 10 pm, and with southerly winds blowing dust from the site towards SR#1.

The exceedences of the criteria at SR#1 were predicted to occur on 13 separate days in the year for PM_{10} 24-hour average and 7 days in the year for $PM_{2.5}$ 24-hour average. Subsequent modelling demonstrated that restricting the hours during which truck unloading occurs to 6 am to 6 pm (instead of 6 am to 10 pm) during the harvest period could eliminate the predicted exceedences of the EPP criteria. This indicates that, during the harvest period, forecasting of meteorological conditions at the site could be used to assist in decisions to temporarily restrict truck unloading operations, thereby reducing the likelihood of dust impact at any of the sensitive receptor sites. A meteorology station at the site would be required to facilitate this. Also, other dust management systems could be considered, for example, monitoring ambient dust emissions outside of the site boundary for the purposes of providing data to inform decisions of operational restrictions.

The CALPUFF dispersion modelling predicted that the criterion for annual TSP deposition would be met at all sensitive receptor sites if the same operating time restrictions were applied as for PM_{10} and $PM_{2.5}$. The highest contributor to TSP emissions were estimated to be from the truck unloading operations during the harvest period.

The model outputs for $PM_{2.5}$ annual average indicated that exceedences of the EPP criterion were expected at the nearest sensitive receptor, SR#1. The largest source of $PM_{2.5}$ dust was estimated to be the exhaust gas from the bagfilters, which operate continuously throughout the year, followed closely by the truck unloading emissions during the harvest period. To better represent annual average $PM_{2.5}$ emissions, the peak truck unloading frequency and the bagfilter exhaust $PM_{2.5}$ emissions were adjusted to reflect expected annual average emissions, rather than peak hourly emission rates. The modelling for this scenario demonstrated compliance with the EPP criterion at SR#1.

Due to the uncertainty in the emission rate of methyl bromide from the grain silo on venting to atmosphere after fumigation, CALPUFF dispersion modelling was used to assess the expected maximum emission rate in an hour from a single grain silo (between the hours of 9 am and 3 pm) above which exceedences of the EPP criterion at sensitive receptor sites would be expected. Fumigation of the grain silos is to be undertaken according to the AFAS methyl bromide fumigation standard (DAWR, 2015). This requires monitoring of the methyl bromide concentration during the fumigation process. It is recommended that a detailed monitoring and management plan be generated for the venting of the silo gas as part of the fumigation process at the site to ensure the EPP criterion is not exceeded.

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Appendix A. Port Lincoln AWS long term seasonal wind roses

The seasonal wind roses for hourly data collected by the Port Lincoln AWS between 2012-2018, inclusive, are presented below in Figure A-1.

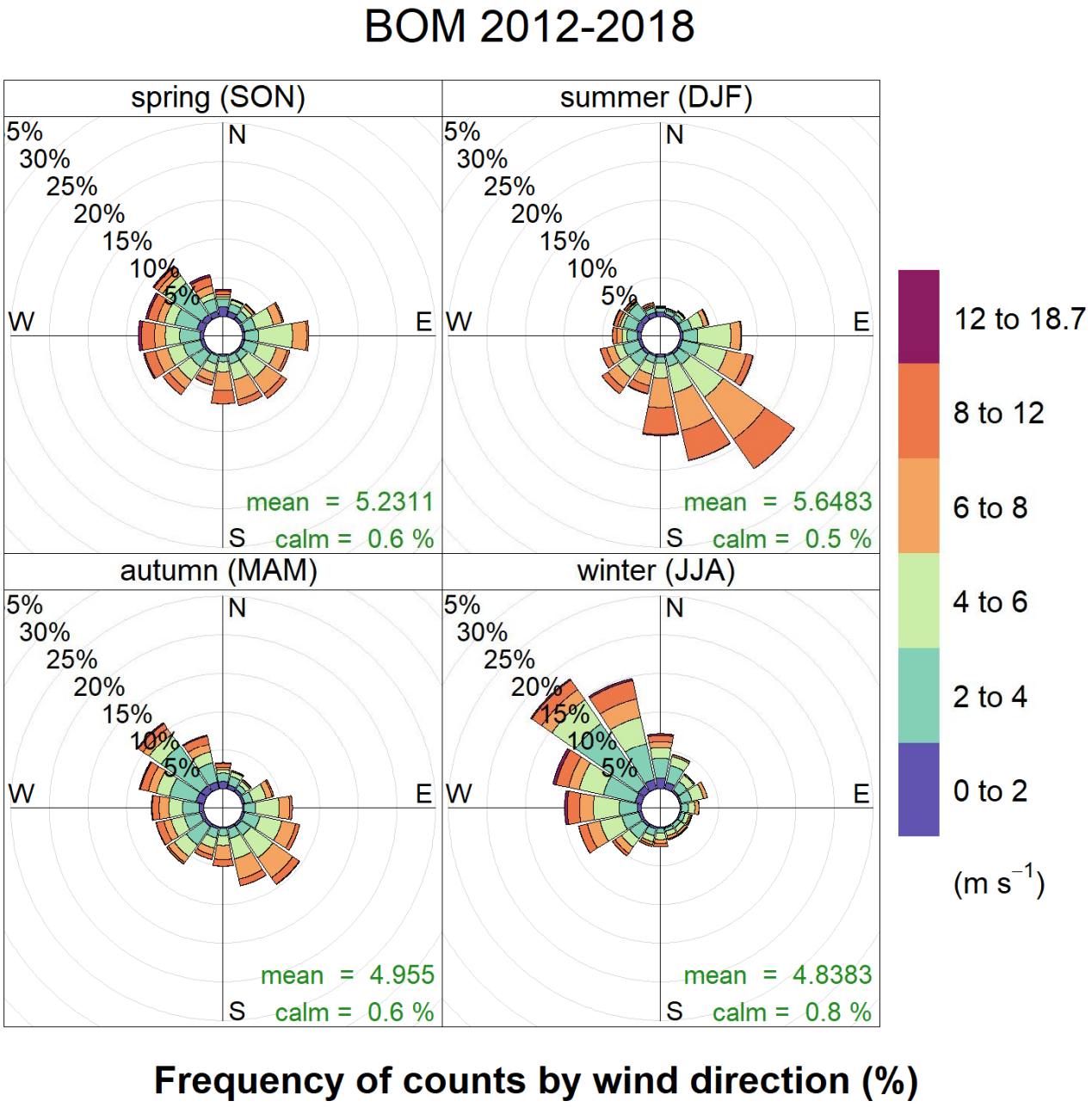

Figure A-1: 2012-2018 Seasonal windroses for BoM Port Lincoln AWS, 2012 - 2018

Appendix B. Bagfilter air emissions

Bagfilter ID	Gas flow rate	Dust emission rates (g/sec)		
	m^3/hr	TSP	PM_{10}	$PM_{2.5}$
DUC1	24,848	0.312	0.069	0.069
DUC2	5,021	0.063	0.014	0.014
DUC3	12,510	0.157	0.035	0.035
DUC4	2,008	0.025	0.006	0.006
DUC5	2,008	0.025	0.006	0.006
DUC6	2,008	0.025	0.006	0.006
DUC7	2,008	0.025	0.006	0.006
DUC8	5,002	0.063	0.014	0.014
DUC9	2,008	0.025	0.006	0.006
DUC10	2,008	0.025	0.006	0.006
DUC11	2,008	0.025	0.006	0.006
DUC12	2,008	0.025	0.006	0.006
DUC13	2,008	0.025	0.006	0.006
DUC14	2,008	0.025	0.006	0.006
DUC16	84,400	1.059	0.234	0.234
DUC17	84,400	1.059	0.234	0.234
DUC18	84,400	1.059	0.234	0.234
DUC19	84,400	1.059	0.234	0.234
DUC20	12,510	0.157	0.035	0.035

Appendix I. Noise Assessment

Port Spencer Grain Handling and Export Facility

Lipson Cove Rd, Lipson

Environmental Noise Assessment

S6136C4

October 2019

sonus.

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Document Title	:	Port Spencer Grain Handling and Export Facility Environmental Noise Assessment
Document Reference	:	S6136C4
Date	:	October 2019
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Reviewed By	:	Jason Turner, MAAS

TABLE OF CONTENTS

1 INTRODUCTION

An environmental noise assessment has been made of the proposed Port Spencer grain handling and export facility development on Lipson Cove Rd, Lipson, South Australia.

Planning approval already exists over the site for a facility to export iron ore and grain. The subject proposal seeks to amend the existing approval to export grain only.

The amended facility comprises grain receival, bunker and silo storage, and ship loading components. Grain receival is anticipated to occur over a 17 hour day (6:00am to 11:00pm) during peak harvest, which generally occurs between late October and late December. Outside of peak times, minimal demand is anticipated for grain receival. The ship loading component is expected to operate 24 hours per day, with approximately 20 ships expected per annum. Each ship is anticipated to take around 2 days to load. Outside of these times, operations on-site are expected to be minimal, and confined to normal operating hours of 9:00am to 5:00pm. Access to the site from the Lincoln Highway is via Lipson Cove Road and it is understood that the existing unsealed road will be upgraded for this purpose as part of the project.

The nearest noise sensitive receivers (**dwellings**) to the site comprise isolated rural dwellings to the north and west of the site, at a distance of approximately 600 metres and 1 kilometre from the site boundary, respectively. The nearest dwellings to the Lipson Cove Road access route are approximately 200 metres from the road alignment.

The subject site (boundaries shown in yellow) and surrounding locality is shown in Figure 1 below. The nearest dwellings to the site and to the road alignment are indicated by Red markers and are labelled “A” through “E”.

This noise assessment has conducted the following to ensure the amenity at the nearest dwellings is not unreasonably impacted upon:

- review of the Tumby Bay Council Development Plan (the **Development Plan**) to determine the relevant noise provisions for the development;
- establishment of assessment criteria provided by the *Environment Protection (Noise) Policy 2007* (the **Policy**), in accordance with the Development Plan;
- prediction of the worst-case (highest) noise levels at the dwellings from the proposed daytime and night-time operations at the development; and,
- comparison of the predicted noise levels against the established assessment criteria and determination of treatments to ensure compliance.

Figure 1: *Subject site and surrounding locality*

The assessment has been based on the following:

- Preliminary drawing set *"Port Spencer Grain Export Facility"*, prepared by Jacobs, drawing numbers IW219900-0000-CI-DWG-0001 to 0005, Revision A, dated 4 October 2019;
- *"Port Spencer Grain Terminal: Functional operating Description"*, prepared by Andvare, reference AVE0103-FOD-ME-001, Revision B dated 14 August 2019;
- *"Port Spencer Grain Terminal: General Design Requirements",* prepared by Andvare, reference AVE0103-SPE-G-002-B, Revision B dated 16 August 2019 (the **Design Requirements**);
- *"Free Eyre Sheep Hill Terminal Shiploader and Transfer Conveyor",* prepared by Engineering Applications, job number PEN00001, revision A dated 13 August 2019;
- *"Free Eyre Preliminary Equipment Schedule"*, prepared by Allied Grain Systems, Revision 1 dated 19 August 2019;
- noise measurement data available in Sonus' database of noise sources, developed from a range of other grain loading facilities;
- the ship loading activity at the facility operating 24 hours a day, 7 days a week, and;
- the grain receival activity operating predominantly during the daytime only, between 7am and 10pm with reduced operations between 6am and 7am and after 10pm (refer to the assessment section for further detail).

2 DEVELOPMENT PLAN

The proposed Export Facility and all nearby dwellings are located within the Primary Production Zone (PrPro) in the Development Plan (consolidated 6 March 2018). The Development Plan has been reviewed and particular regard has been given to the following provisions:

Council Wide – Bulk Handling and Storage Facilities

OBJECTIVES

1. *Facilities for the bulk handling and storage of agricultural and other commodities sited and designed to minimise adverse impacts on the landscape and on and from surrounding land uses.*

PRINCIPLES OF DEVELOPMENT CONTROL

1. *Facilities for the handling, storage and dispatch of commodities in bulk should be:*
   …
   (b) sited, designed and operated to minimise risks of contamination to the environment and adverse impacts on nearby sensitive land uses and from surrounding land uses.
   …

Council Wide – Interface between Land Uses

OBJECTIVES

1. *Development located and designed to minimise adverse impact and conflict between land uses.*
2. *Protect community health and amenity from adverse impacts of development.*
3. *Protect desired land uses from the encroachment of incompatible development*

PRINCIPLES OF DEVELOPMENT CONTROL

1. *Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:*
   …
   (b) Noise
   …
2. *Development should be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality.*

Noise Generating Activities

8. *Development that emits noise (other than music noise) should include noise attenuation measures that achieve the relevant Environment Protection (Noise) Policy criteria when assessed at the nearest existing noise sensitive premises.*

9. *Development with the potential to emit significant noise (e.g. industry) should incorporate noise attenuation measures that prevent noise from causing unreasonable interference with the amenity of noise sensitive premises.*

3 CRITERIA

3.1 Operational Noise

Council Wide Interface between Land Uses Principle of Development Control 8 references the *Environment Protection (Noise) Policy 2007* (the Policy).

The Policy is based on the World Health Organisation Guidelines to prevent community annoyance, sleep disturbance and adverse impacts on the amenity of a locality. Therefore, compliance with the Policy will also satisfy the subjective requirements of the relevant provisions in the Development Plan.

The Policy establishes goal noise levels to be achieved at dwellings based on the Development Plan Zones in which the development and the dwellings are located, and the land use that the zones principally promote.

For development and dwellings located within a Primary Production Zone, the Policy provides goal noise levels of 52 dB(A) during the day (7am to 10pm) and 45 dB(A) at night (10pm to 7am).

3.1.1 Character Penalties

When measuring or predicting levels for comparison with the goal noise levels of the Policy, penalties may be applied if the noise exhibits any of the "annoying" characteristics of tone, impulse, low frequency and modulation. A 5 dB(A) penalty is applied if the noise exhibits one characteristic, 8 dB(A) for two characteristics, and 10 dB(A) for three or four characteristics. To apply a penalty, the characteristic must be dominant when considered within the context of the existing acoustic environment.

The noise from grain receival will modulate due to the dominance of truck movements in comparison to other sources. Automated grain reclamation and shiploading will be dominated by constant mechanical equipment and will therefore not attract a penalty. Nonetheless, a 5 dB(A) penalty has been applied to the assessment for all scenarios in the interests of consistency, simplicity and conservatism. This effectively reduces the goal noise levels to 47 dB(A) (day) and 40 dB(A) (night).

3.2 Noise from Vehicle Movements

There are no specific objective noise criteria that address the introduction of additional vehicles onto a public road and in many circumstances vehicles on a public road network would not be further assessed. Notwithstanding; further consideration has been given to the impacts of additional truck activity in the area.

In order to objectively assess any adverse impact, reference is made to the Department of Planning, Transport and Infrastructure (DPTI) *Road Traffic Noise Guidelines 2016* (the **Guidelines**).

The Guidelines have been developed to provide DPTI with the process and criteria for the assessment of changes to the South Australian road network. The Guidelines are considered to be the most relevant objective criteria for the assessment of increased traffic flow along the proposed haul route.

The Guidelines specify outdoor noise level targets, separated into the day (7am to 10pm) and night time (10pm to 7am) periods. The noise level targets are dependent on the type of project (either a 'new' road or 'redeveloped' existing road), and are presented in Table 1 below.

Table 1: *Road traffic noise outdoor noise level targets*

Project Type:	**Applicable situation:**	**Noise Criteria**[1]	
		Day ($L_{Aeq, 15hr}$)	**Night** ($L_{Aeq, 9hr}$)
New Road	Existing receivers affected by noise from a **new road**	55	50
Redeveloped Road	Existing receivers affected by noise from a **redeveloped road**	60	55
	Existing receivers affected by noise from a **redeveloped road** and where demolition of building structures or existing roadside noise walls[2] results in receivers previously shielded from traffic noise becoming exposed.	57	52

Notes:
1. *Assessed at 1 metre from the façade*
2. *Does not include property fencing*

For situations where a significant increase in noise level above the existing situation is anticipated, a *'Relative Increase Criterion'* (RIC) also applies. The RIC should be applied to receivers where it results in more stringent criteria than the criteria presented above.

The RIC is triggered where there is an increase in noise level of more than 12 dB(A) predicted. Where this occurs, the Guidelines provide the following noise criteria in a low background noise environment as in the case for Port Spencer:

Time Period:	RIC Requirement
Day (7am to 10 pm)	50 dB(A)
Night (10pm to 7 am)	42 dB(A)

4 ASSESSMENT

4.1 Operational Noise

4.1.1 Methodology

Environmental noise predictions have been made using the CONCAWE noise propagation model in the SoundPLAN three dimensional noise modelling software. The CONCAWE propagation model takes into account the sound power generated by a source, its relative location on the site, its height, topography, ground absorption, air absorption, meteorological conditions and the separation distance between the noise sources and the receivers, and has been used and accepted widely as an appropriate sound propagation model.

In accordance with the recommendations of the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* (Noise Policy Guidelines), predictions for day and night time activities have been generated for the worst-case weather conditions (corresponding to CONCAWE Category 5 and 6 respectively), resulting in the highest noise level at nearby residences for a given operational scenario. Other weather conditions will result in lower noise levels for a given operational scenario.

4.1.2 Operational Scenarios

Predictions were generated for each of the two potential concepts to be established at the site, comprising either:

- a manual grain handling facility, or;
- a fully automated grain handling facility.

For each of the above, the following three scenarios were considered:

- Grain receival (day-time operations);
- Grain receival (Prior to 7am and after 10pm), and;
- Bunker reclamation and simultaneous ship loading (both day-time and night-time).

A summary of the assumed level of activity associated with each of the above scenarios and corresponding sound power levels are provided in Appendix A and Appendix B respectively. A site plan showing the locations of all fixed noise sources and activity zones is provided in Appendix C.

4.1.3 Operational Assumptions

Day-time Operations:

- Daily grain receival of 30,000 tonnes per day (equivalent to an average of 1,765 tonnes per hour over a 17 hour working day during peak season);
- Grain receival via road transport split 80% double and 20% single trailer road transport, resulting in a total of approximately 430 movements per day;
- Site speed limit of 25km/h, with all roadways to be sealed;
- All bunkers (including two bunkers marked "optional", as shown in Appendix C) have been included in the model;
- Conveyor drive rated power based on *"Free Eyre Preliminary Equipment Schedule"* and data from previous projects;
- Reclaimers and bunker stackers for the fully automated scenario are assumed to be connected to reticulated power;
- Grain receival and stacking of all bunkers has been assumed to occur simultaneously for both day-time scenarios (i.e. manual and fully automated);
- Reclamation has been assumed to occur from two bunkers simultaneously for both the manual and fully-automated scenarios (based on discussions with Jacobs);
- Plant and equipment to be designed/selected to meet the following maximum sound pressure levels at 1-metre as per the Design Requirements:
    - Pumps, conveyor and reclaimer drives, and portable diesel generators 85dB(A);
    - Electric motors 80dB(A);
    - Fans (including dust collector fans) 75dB(A);

Night-time Operations (i.e. prior to 7am and after 10pm):

- Operation of up to four sampling stations, and three weighbridges;
- Operation of up to four fixed hoppers (i.e. any two pairs of hoppers, or four single hoppers);
- Operation of up to four mobile drive-over hopper stackers;
- For the manual scenario, all mobile tipping points to be selected such that 'line of sight' to dwellings A and B is blocked by a full or partially full bunker;
- No stopping/idling in the secondary marshalling area (i.e. drivers proceed directly to the designated tipping point);
- No restriction on location or activity with receivals within the 'optional' (eastern) bunker area.

4.1.4 Predicted Noise Levels

Results for weather conditions in accordance with the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007*) are presented below. Noise contour plots for each of the below scenarios are presented in Appendix D:

Table 2: *Predicted worst-case operational noise levels*

Scenario:	**Criteria (dB(A))**	**Weather Category**	**Predicted worst-case noise levels (L_{eq}, dB(A))**			
			Manual Scenario		**Automated Scenario**	
			Dwelling A	**Dwelling B**	**Dwelling A**	**Dwelling B**
Receival –Day Operations	47[1]	Category 5	45	40	44	41
Receival – Night Operations	40[1]	Category 6	40	37	40	37
Reclamation and shiploading	40[1]	Category 6	39	34	39	34

Notes:
1. *Includes a 5dB(A) penalty for modulating characteristic associated with dominant vehicle movements*

Based on the above, predicted noise levels from the facility achieve the goal noise levels of 47 dB(A) during the day (7am to 10pm) and 40 dB(A) at night (10pm to 7am).

4.1.5 Noise Mitigation

In order to ensure that the predicted noise levels are maintained, the following acoustic measures are recommended:

General (all scenarios):

- Ensure that all pumps, fans, motors and conveyor drives are designed/selected to meet the maximum sound pressure levels required by the Design Requirements;
- Ensure that the generators are selected with a maximum sound power level of 108dB(A) per unit, with a barrier constructed around the generator area which blocks line-of-sight to Dwelling A and extends a minimum of 1-metre above the top of the generator casing or exhaust outlet (whichever is higher);
- Front End Loaders (FELs) to be selected having a maximum rated sound power level of 102dB(A);
- Ensure that bunker conveyors are designed or selected to meet a maximum sound power of 74 dB(A) per metre. Subject to the design of the conveyors, this may require:
    - Selecting “low noise” idlers;
    - Enclosing the conveyors within a gantry or similar structure, or installing within a channel or trench such that line-of-sight to nearby dwellings is blocked at all times;
    - Ensuring that any gantry, enclosure or screen is resiliently mounted to the conveyor structure;
- Extend the northern dust barriers adjacent the fixed receival hoppers to a minimum height of 2.5 metres for an extent sufficient to block line-of-sight to Dwelling A;

Night-time Operations (i.e. prior to 7am and after 10pm):

- Limit site throughput prior to 7am or after 10pm to the following:
  - Operation of up to four sampling stations, and three weighbridges;
  - Operation of up to four fixed hoppers (i.e. any two pairs of hoppers, or four single hoppers);
  - Operation of up to four mobile drive-over hopper stackers;
  - For the manual scenario, all mobile tipping points to be selected such that 'line of sight' to dwellings A and B is blocked by a full or partially full bunker;
  - No stopping/idling in the secondary marshalling area (i.e. drivers proceed directly to the designated tipping point).

4.2 Noise from Vehicle Movements

The noise from truck movements along Lipson Cove Road has been predicted using the Federal Highway Administration (FHWA) "Traffic Noise Model" traffic noise modelling software. TNM has been widely used and accepted by DPTI for modelling road traffic noise within South Australia.

The predictions are based on:

- Lipson Cove Road being sealed, with a posted speed limit of 100km/h;
- An average of 26 vehicle movements per hour in each direction between 7am and 10pm, with remaining vehicle movements (a *total* of approximately 40 vehicle movements) occurring between 10pm and 7am.

The closest dwellings to Lipson Cove Road (D and E as shown in Figure 1 on page 5) are at distances of approximately 200m from the road, which inherently provides significant noise reduction from the road.

Predicted road traffic noise levels due to additional traffic on Lipson Cove Road associated with the development are presented below. The predicted noise levels include a +2.5dB adjustment to account for reflections from the building facade, as required by the Guidelines.

Table 3: *Predicted road traffic noise levels on Lipson Cove Road*

Scenario:	Descriptor	Criteria (dB(A))	Predicted road traffic noise levels (L_{eq}, dB(A))		
			Dwelling C	Dwelling D	Dwelling E
Day (7am to 10pm)	$L_{Aeq, 15hr}$	50	47	43	48
Night (10pm to 7am)	$L_{Aeq, 9hr}$	42	37	33	38

The predicted road traffic noise levels achieve the Guidelines.

5 CONCLUSION

Predictions have been made of the environmental noise levels at the nearest dwellings arising from the proposed grain handling and export facility.

The predicted noise levels account for the highest level of concurrent activity expected at the facility coinciding with weather conditions which are most conducive to noise propagation.

The highest predicted noise levels at the nearest dwellings are 50 dB(A) during the day and 45 dB(A) at night (including a 5dB(A) penalty where applicable), thereby achieving the day-time and night-time criteria of 52dB(A) and 45dB(A) respectively applicable under the *Environment Protection (Noise) Policy 2007* (the Policy).

It is noted that the predicted noise levels in this assessment will be lower under other weather conditions and operational scenarios and in some cases significantly so.

Based on the above, the proposal does not unreasonably interfere with the amenity and minimises adverse impacts on the locality, and therefore is considered to meet the objective and subjective noise requirements of the Tumby Bay Council Development Plan.

APPENDIX A – Operational Scenarios and Assumptions

Scenario 1 – Manual grain handling

Grain receival – Day-time Operations:

- 6 truck movements through the site in 15-minutes;
- 8 mobile drive over stackers (including engine drive);
- 8 trucks tipping throughout period;
- 6 trucks idling within the primary marshalling area;
- 6 trucks idling within the second marshalling area;
- 1 truck idling at each weighbridge (5 total);
- 1 truck idling at each sampling position (8 total);

Grain receival – Night-time Operations (prior to 7am or after 10pm):

- 3 truck movements through the site in 15-minutes;
- 4 mobile drive over stackers (including engine drive);
- 4 trucks tipping throughout period;
- 4 trucks idling waiting to tip adjacent to mobile hoppers (protected by partially filled bunkers);
- 3 trucks idling within the primary marshalling area;
- No trucks idling within the second marshalling area;
- 1 truck idling at three of the weighbridges;
- 1 truck idling at four of the sampling positions;
- Mobile hoppers located such that at least one full or partially full bunker blocks 'line of sight' to dwellings.

Reclaiming and Export:

- 4 front end loaders loading trucks continuously;
- 4 continuous truck movements between bunker and silos;
- 1 truck tipping at silo hopper;
- 1 truck waiting to tip at silo hopper;
- Conveyors, bucket elevators and drives associated with the inloading of silos;
- 2 generator sets near silos (one duty, one standby);
- Shiploading conveyors and drives;
- Shiploader;
- Shipboard auxiliary power and ventilation.

Scenario 2 – Automated/Developed Concept

Grain receival – Day-time Operations:

- 6 truck movements through the site in 15-minutes;
- 10 trucks tipping at fixed dual receival hoppers throughout period;
- 6 trucks idling within the primary marshalling area;
- 6 trucks idling within the secondary marshalling area;
- 1 truck idling at each weighbridge (5 total);
- 1 truck idling at each sampling position (8 total);
- 5 bunker conveyors and associated drives between the fixed dual receival hoppers and bunkers;
- 1 bunker stacker between each bunker conveyor and an adjacent bunker;
- 2 generator sets near silos (one duty, one standby).

Grain receival – Night-time Operations (prior to 7am and after 10pm):

- 3 truck movements through the site in 15-minutes;
- 4 trucks tipping at hoppers throughout period;
- 3 trucks idling within the primary marshalling area;
- No trucks idling within the secondary marshalling area;
- 1 truck idling at three of the weighbridges;
- 1 truck idling at four of sampling positions;
- 4 bunker conveyors and associated drives between the hoppers and bunkers;
- 1 bunker stacker between each bunker conveyor and an adjacent bunker;
- 2 generator sets near silos (one duty, one standby).

Reclaiming and Export:

- 2 bunker reclaimers;
- 2 bunker conveyors and associated drives between the bunkers and the main transfer conveyor;
- 1 transfer conveyor between the bunker area and the silos;
- Silo inloading conveyors, bucket elevators and drives;
- 2 generator sets near silos (one duty, one standby);
- Shiploading conveyors and drives;
- Shiploader;
- Shipboard auxiliary power and ventilation.

APPENDIX B – Main Noise Sources and Associated Sound Power Levels

Noise Source	SWL dB(A)
Truck movements (total)	109
Tipping grain	100
Truck idling	101
Bunker stackers (reticulated)	100
Diesel generator, attenuated	108[1]
Bunker conveyors (per metre)	74[2]
Bunker conveyor drives	95
Front End Loader	102
Reclaimers (reticulated)	100
Bucket elevator (per metre)	79
Bucket elevator drive	96
Conveyor (bunker-silo, per metre)	79

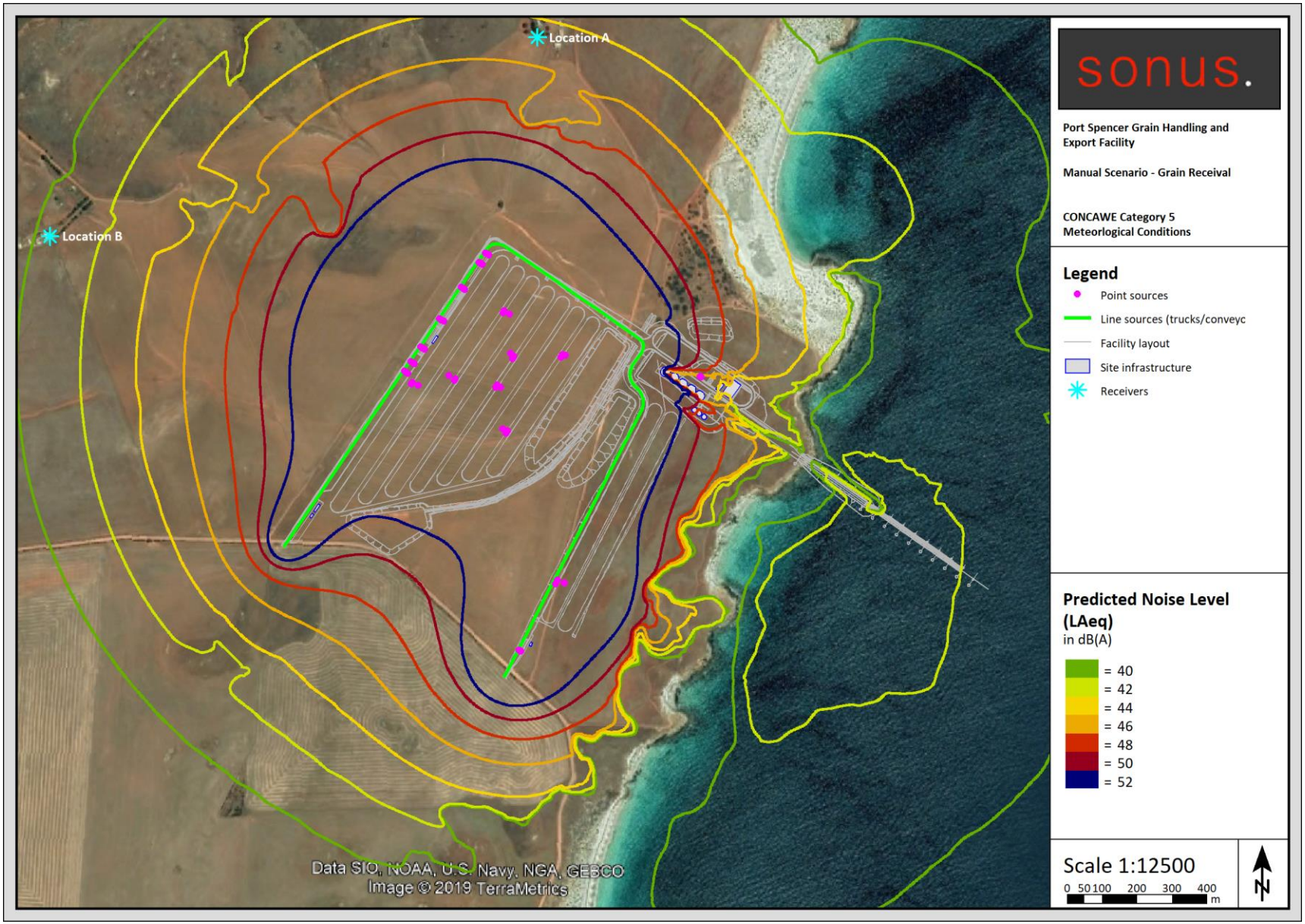
Noise Source	SWL dB(A)
Conveyor drive (bunker-silo)	96
Silo inloading conveyor (per metre)	79
Silo inloading conveyor drive	96
Over silo conveyor (per metre)	79
Over silo conveyor drive	96
Ship loading conveyor (per metre)	79
Ship loading conveyor drive	96
Ship Loader	101
Drive over hopper stacker	104
Front End Loader	102[3]
Ship in berth	106[4]

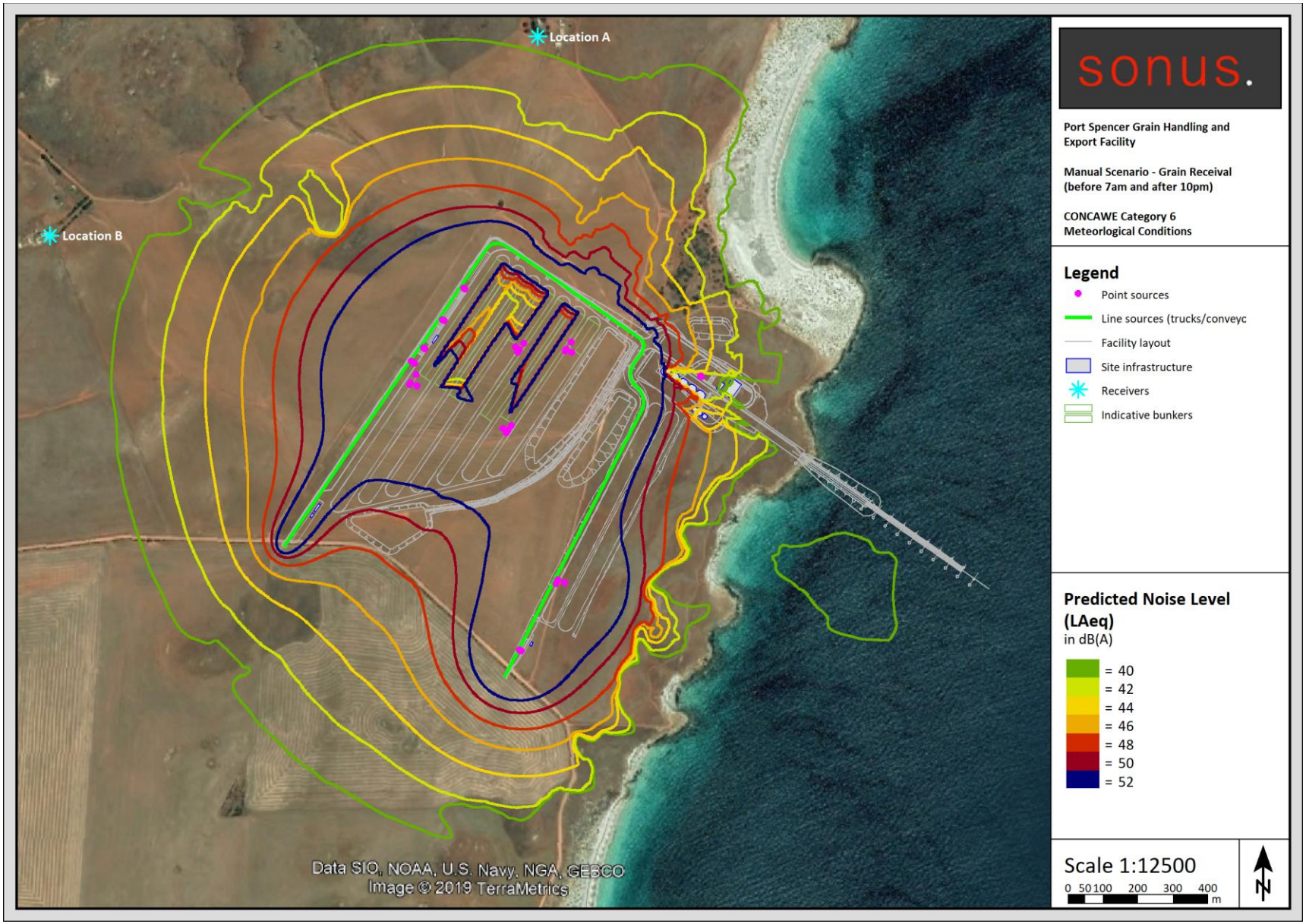
Notes:

1. Kohler KD1500-UF “Super soundproofed” version
2. To be designed to achieve a sound power level of 74 dB(A) per metre
3. To be selected to meet specified sound power level at procurement stage
4. “Handymax” size vessel, total noise emissions, based on Witte J. (2015).

APPENDIX C – Site Plan and Noise Source Locations

APPENDIX D – Noise Contour Plots




Location A
Location B
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2019 TerraMetrics
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Port Spencer Grain Handling and Export Facility
Manual Scenario - Grain Receival (before 7am and after 10pm)
CONCAWE Category 6 Meteorological Conditions
Legend
Point sources
Line sources (trucks/conveyc
Facility layout
Site infrastructure
Receivers
Indicative bunkers
Predicted Noise Level (LAeq)
in dB(A)
= 40
= 42
= 44
= 46
= 48
= 50
= 52
Scale 1:12500
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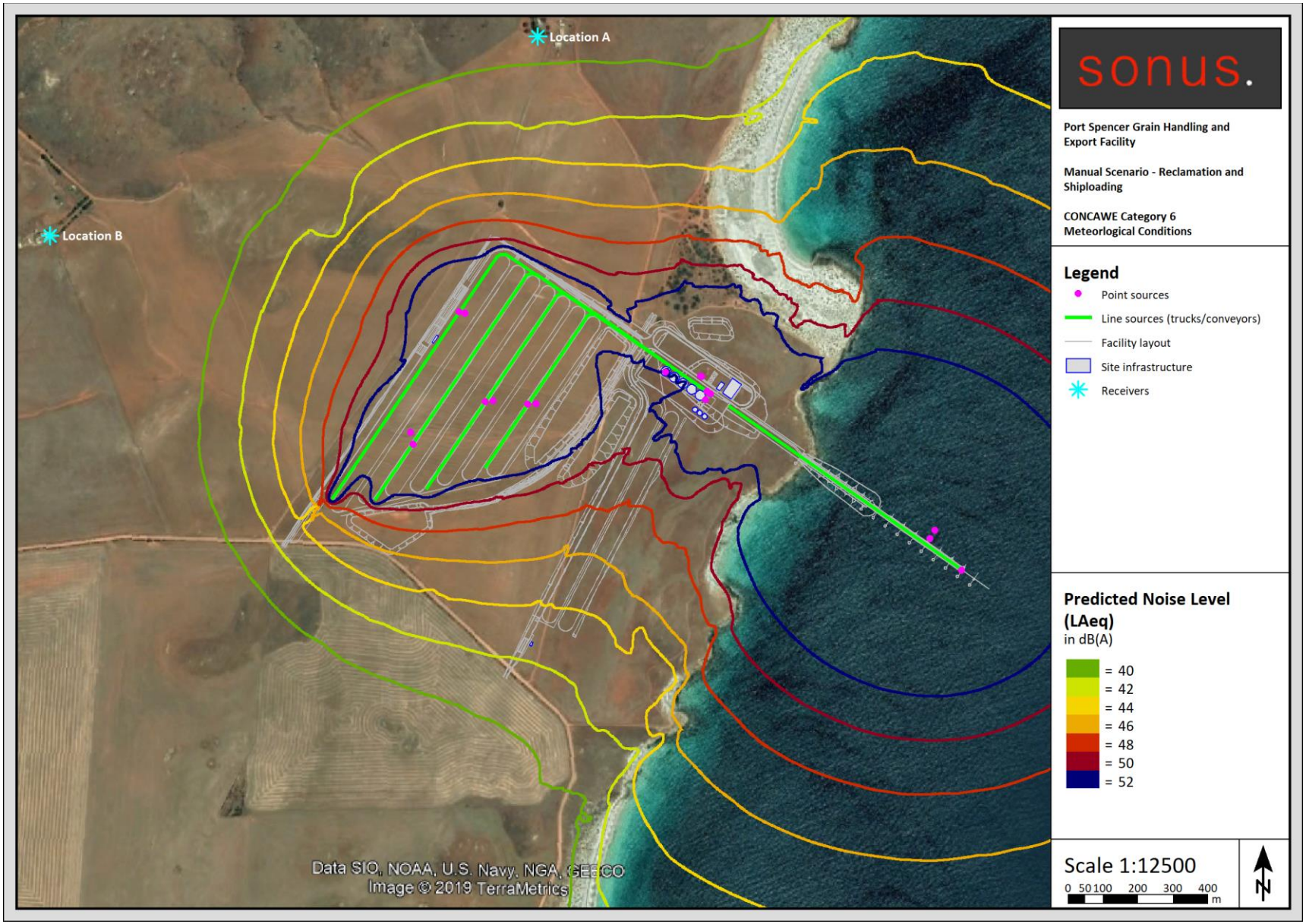
N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Location B
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2019 TerraMetrics
sonus.
Port Spencer Grain Handling and Export Facility
Manual Scenario - Reclamation and Shiploading
CONCAWE Category 6 Meteorological Conditions
Legend
Point sources
Line sources (trucks/conveyors)
Facility layout
Site infrastructure
Receivers
Predicted Noise Level (LAeq)
in dB(A)
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= 46
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= 52
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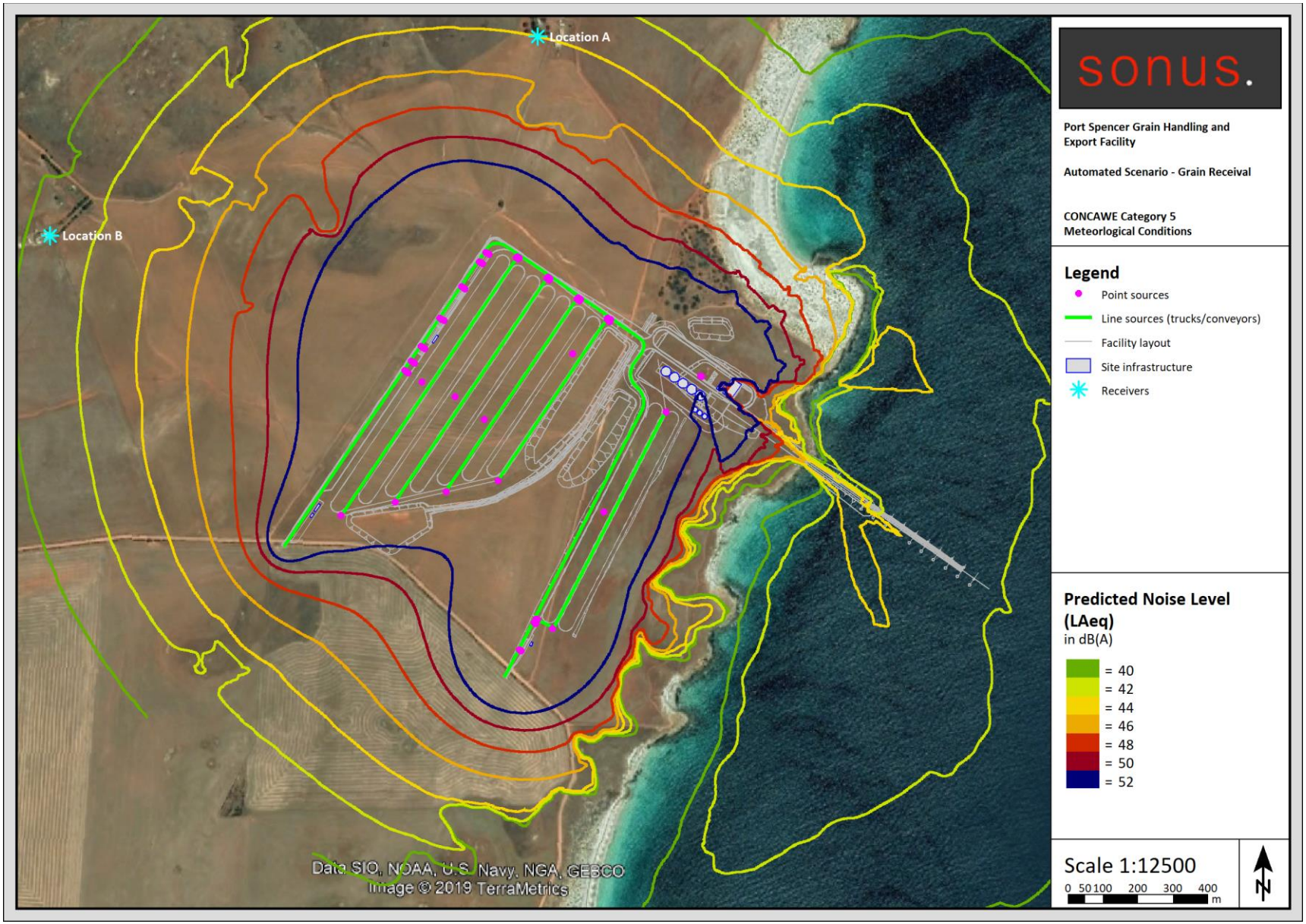
Location A
Location B
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2019 TerraMetrics
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Port Spencer Grain Handling and Export Facility
Automated Scenario - Grain Receival
CONCAWE Category 5 Meteorological Conditions
Legend
Point sources
Line sources (trucks/conveyors)
Facility layout
Site infrastructure
Receivers
Predicted Noise Level (LAeq)
in dB(A)
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= 44
= 46
= 48
= 50
= 52
Scale 1:12500
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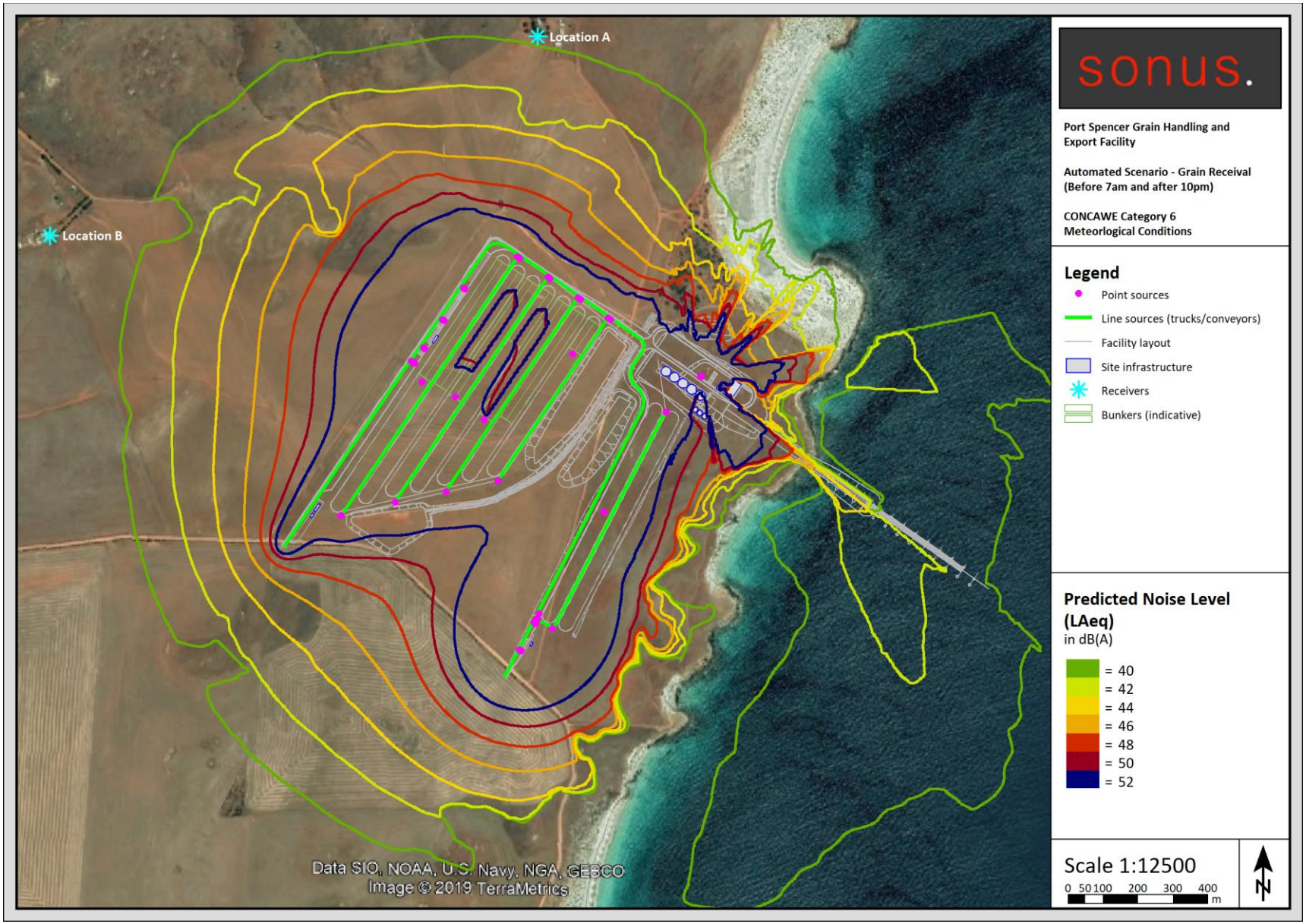
N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Port Spencer Grain Handling and Export Facility
Automated Scenario - Grain Receival (Before 7am and after 10pm)
CONCAWE Category 6 Meteorological Conditions
Legend
Point sources
Line sources (trucks/conveyors)
Facility layout
Site infrastructure
Receivers
Bunkers (indicative)
Predicted Noise Level (LAeq)
in dB(A)
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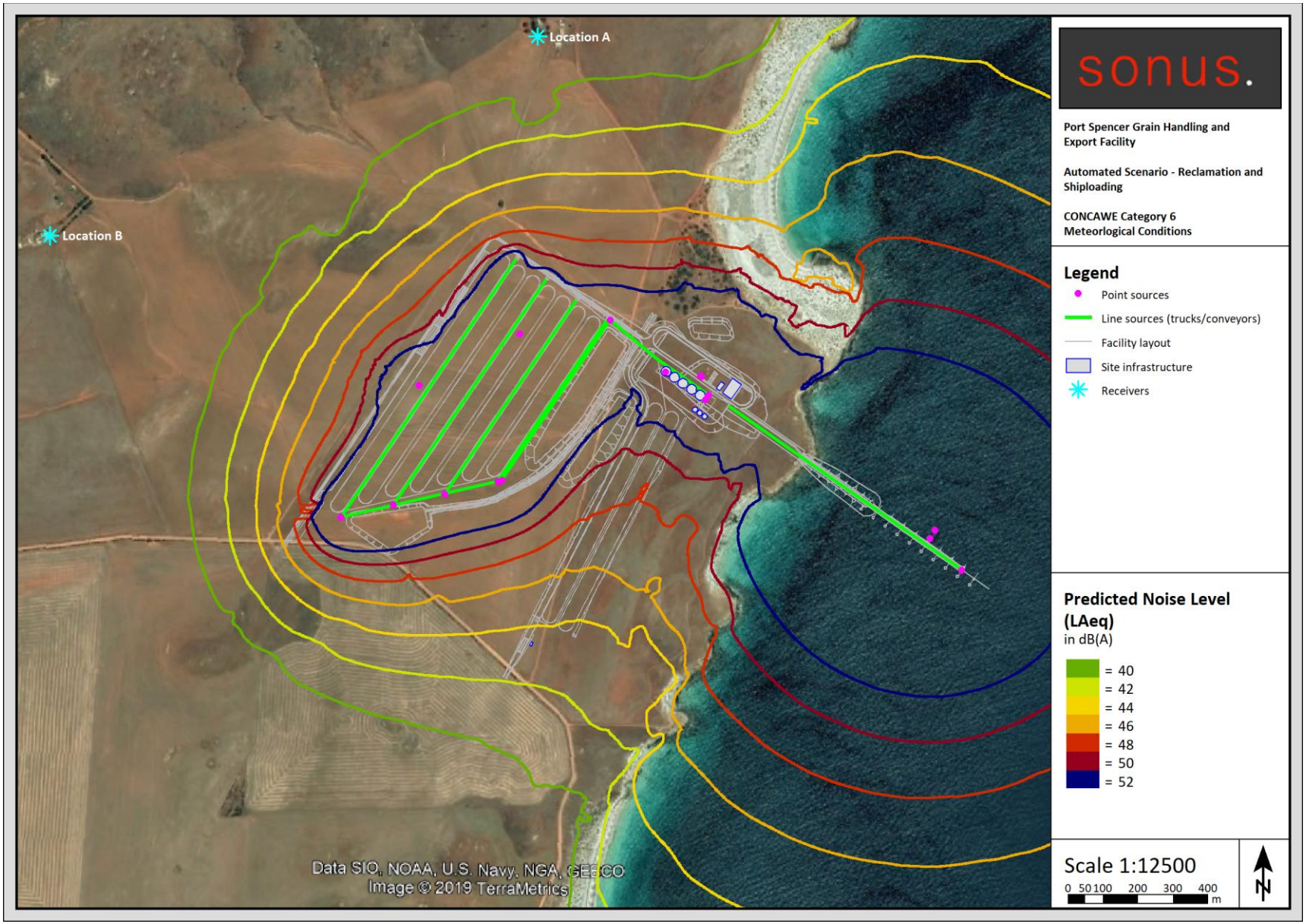
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in dB(A)
= 40
= 42
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= 52
Scale 1:12500
0 50 100 200 300 400 m
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Appendix J. Visual Amenity Assessment

Port Spencer Grain Export Terminal

Landscape and Visual Assessment

IW21990-0-NP-RPT-0005 | Rev 1

6 November 2019

Peninsula Ports

Port Spencer Grain Export Terminal

Project No:	IW219900
Document Title:	Landscape and Visual Assessment
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Client Name:	Peninsula Ports
Project Manager:	Scott Snedden
Author:	Hayden Burge
File Name:	Appenidx J_Visual Amenity Assessment

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0	25.10.19	Draft	SM	HB	RT	SS
1	6.11.19	Final	SM	HB	HB	DM

Contents

1. Introduction

Peninsula Ports is seeking approval to develop a new grain exportation port facility near Lipson Cove, South Australia. The proposed facility is to be located at a site that has prior approval for bulk handing and exportation of iron ore and grain, including a wharf and ship loading facility.

Jacobs has been engaged by Peninsula Ports to undertake an engineering design review and environmental assessments to support a variation to the current planning approval for a revised site layout and infrastructure design to support the proposal.

The subject land has been selected as the preferred site for the following reasons:

- The site is ideally located due to its proximity to the region's grain production catchment area.
- The use of the site and off-shore infrastructure have been previously approved for an iron ore and grain export wharf.

1.1 Background

Previous applications for the Port Spencer Deep Water Port were the subject of a Public Environmental Report (PER) prepared by Golder and Associates (Golder) in February 2012. This project was subsequently approved in December 2012 but has not been developed.

The PER included a visual assessment, also prepared by Golder of the then proposed material storage and handling facility which included a deep-sea wharf. The Visual Impact Assessment of the approved project can be read in full at pages 204 – 221 of the main PER.

1.2 Purpose of this report

This report will describe the proposed change between the current proposal and original approval before assessing the change in views and visual impact.

Where possible, this assessment will include relevant material, including the assessment locations, photomontages and information to support the findings of the assessment.

2. Methodology and Report Structure

This report will:

- Describe the key visual features and changes between the approved and the current project relevant to considering a change in views and visual impact;
- Confirm the study area and viewshed of the approved and the current project;
- Define the key landscape units and sensitivity relevant to undertaking a review of the approved and the current project;
- Assess the change in views and visual impact between the approved and the current project; and
- Describe the mitigation measures available to the project where required.

The resultant scale of effects ranges from Negligible to High.

2.1 Landscape mitigation

Landscape mitigation through vegetation screening or amenity improvements through landscape design is an accepted method of reducing potential visual impacts.

2.2 Photographs

The photographs, which formed the basis for the photomontages, were taken at eye level, approximately 1.6m above ground level. These photographs used as the basis for the photomontages were taken between 10:00am and 4:00pm on the 30th August 2019, a time which corresponded to mean high tide.

All photographs were taken with a Nikon D850 camera with a 24 – 300mm lens and a Nikon GPS attached to the camera. Panoramas were firstly taken with the lens set to approximately 28mm and then at approximately 70mm. Some sections of the panorama were also retaken with the lens set to 120mm. GPS locations were recorded by a Nikon GPS which recorded locations onto the picture Metadata and this GPS data was backed up with a hand-held Garmin GPS and locations recorded.

A 70mm lens on a Nikon D850 digital camera has a picture angle of 26.5 and a horizontal angle of view of approximately 21.3. https://imaging.nikon.com/lineup/dslr/basics/19/01.htm.

2.3 Photomontage Preparation

Photomontages were prepared from selected viewpoints to illustrate and assist in the assessment of the visual impact within this report.

The methodology used in the creation of the photomontages overlays the existing landscape (from a photograph) over the computer model. Boats and berthing platforms within this model are then rendered for the “after” view. Generally, the field of view for photomontages is approximately 60° horizontal and 15° vertical. The photographs used for the panoramas were the 70mm shots described previously.

It is emphasised that the small images used within this report are only for referencing comments made within the text. While technically correct, they do not accurately portray a perceptually accurate image to assess the visual impact. For this reason, larger (A3) images are appended to this report (Annexure A1) or included within the body of this report, however while these larger images are better, a proper assessment of the visual impact can only be made when the images are produced at AO sizes and held at arm’s length.

The photomontages will show the change in visibility within a 60° horizontal field of view which represents the central cone of view in which symbol recognition and colour discrimination can occur. The perceptual accuracy of the horizontal field of view is important if the photomontage images are reliably representing the change in the landscape.

One of the sheets within the photomontage set shows a wireframe view of the computer model to illustrate alignment of the model with existing features in a view. Vertical ‘poles’ or ‘cylinders’ within this wireframe are merely points on the landscape such as a group of trees, a corner of a planted hedgerow or a structure, which allow the computer model and the photograph to be accurately aligned. This ensures that the project is accurately located within the photograph. Once aligned the terrain model is removed and the visible portions of the project are then rendered into the image.

Photomontages are discussed later in this report and are appended to this report (Refer Annex A1 for A3 size photomontages). It is recognised that the photographs included in the assessment and the A3 photomontages included the appendices, whilst technically accurate are not perceptually accurate. A0 Size reproductions of the photomontages provide a clear indication of the actual visual impact – these are perceptually accurate.

3. Project Description

The site is located on the Eyre Peninsula approximately 20 km north of Tumby Bay and 20 km south of Port Neill.

3.1 Project location

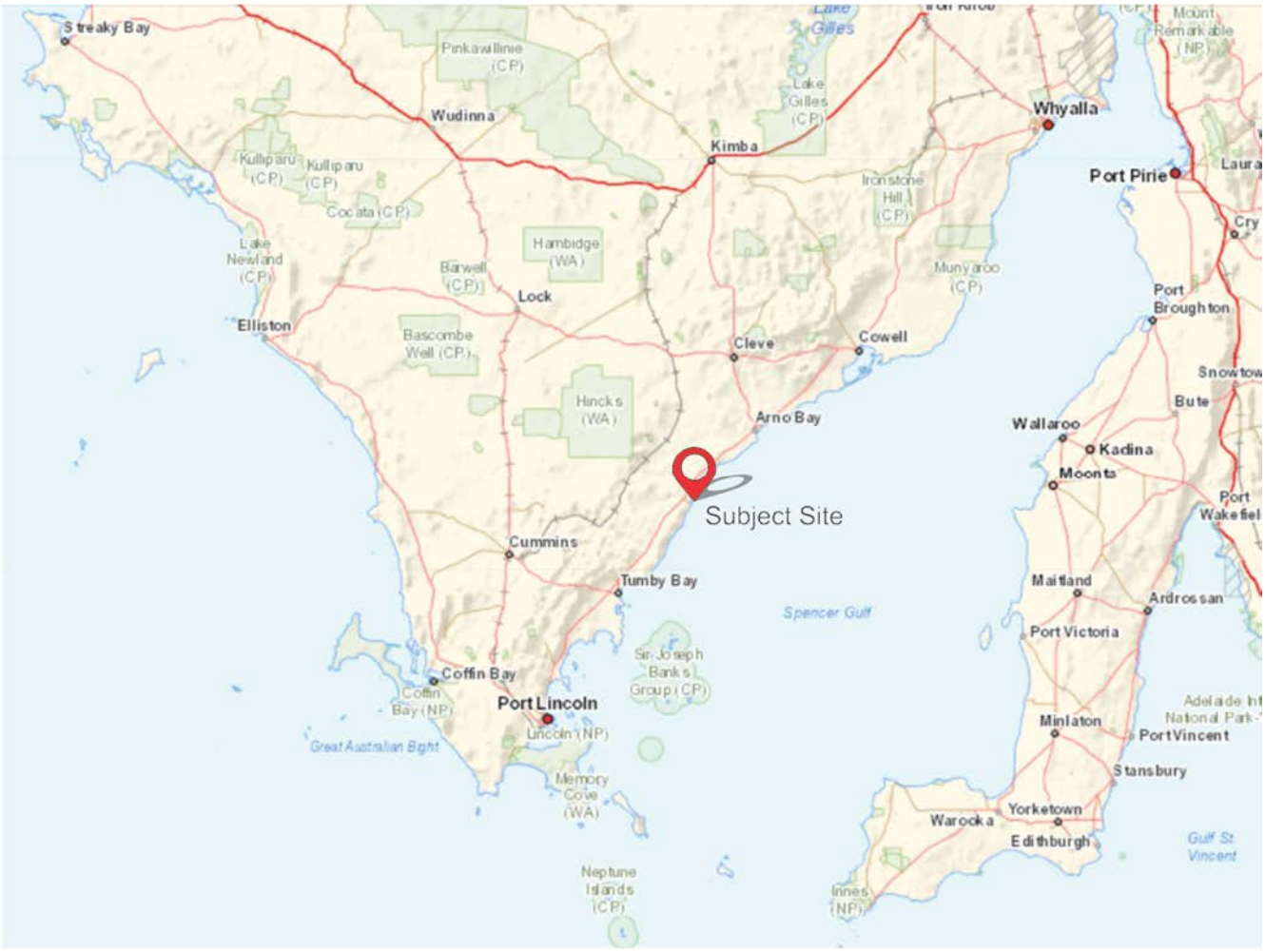


Figure 3-1 Locality Plan (Source https://location.sa.gov.au/viewer/)

In a more local context, the site is approximately 5.0 km east of the Lincoln Highway, 1.0 km north of Lipson Cove which has free public camping, beach access and a boat ramp.

Figure 3-2 Site area map (Source https://location.sa.gov.au/viewer/)

The current approved works and development at the site including the onshore material storage and handling areas, material storage and processing equipment as well as wharf facilities establish a visual context and setting for what is considered visually acceptable at the site.

This section will firstly describe the key features and infrastructure of the approved development to establish a baseline of the visual context and setting of the site before describing the current proposal for the use and development of the site.

3.2 Prior Approval

The approved project allowed for the establishment of:

- 240,000t bulk mineral storage sheds with separate in-loading shed, with separate site office and warehouse for equipment storage.
- One grain storage shed of 60,000 t capacity, or three 20,000 t grain storage silos with a maximum height of 30 m, and/or bunker style grain storage area with a capacity of approximately 60,000 t.
- Grain in-loading shed, site office and equipment storage.
- Site administration/office building, and amenities.
- Enclosed conveyor galleries for proposed ore and grain in-loading and out-loading conveyor.
- Sampling station for sampling of minerals, iron ore and grain.
- 5.0 km long haul road from the Lincoln Highway following the alignment of the ungazetted Swaffers Road.
- Truck weighbridge station located at Swaffers Road site entrance.
- Electrical switch room; approximate dimensions 12 m long x 5 m wide x 4 m high.
- Two fuel storage tanks, comprising 68,000 L and 10,000 L.

- 515 m long jetty extending south-east from the shoreline, with a 345 m x 55 m wharf at 90 degrees to the main jetty.
- Ship loader located on the berth stand capable of loading Cape class and Panamax sized vessels.
- Light vehicle access is proposed from Lipson Cove Road to the south of the site.
- Fire service tanks and pump systems.
- Car parking, and
- Stormwater management works including dams and detention basins, culverts and swales.

Figure 3-3 shows the approved development footprint, buildings and works.

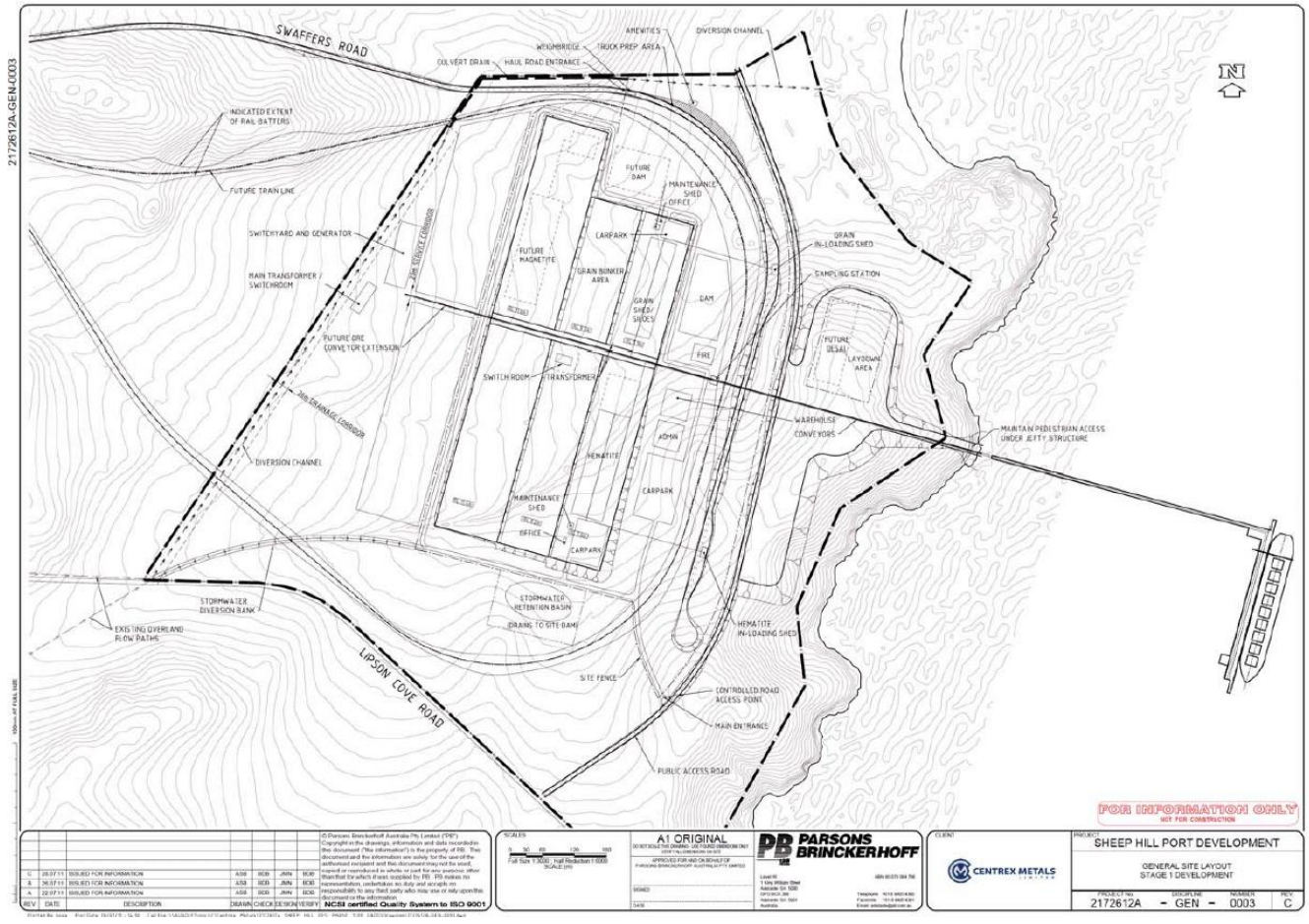


Figure 3-3 Approved layout and development (Source *Port Spencer Executive Summary and Public Environmental Report – February 2012)*

The main activities at the site would include:

- Bulk delivery of grain and minerals entering by road trains from Swaffers Road to the north west of the site;
- Passenger vehicle access and parking via Lipson Cove Road to the south;
- Unloading of material within enclosed buildings;
- Storage of grain and minerals within enclosed buildings; and,
- Material handling and transfer via conveyor belts.

Figure 3-4 shows an axonometric view of the proposed development looking generally north west.

Figure 3-4 Approved layout and development - Aerial view (Source *Port Spencer Executive Summary and Public Environmental Report – February 2012*)

3.3 Proposed Layout

The proposed development at the site is to be entirely within the approved development footprint and will comprise of the following:

- Five 12,000 t grain storage silos with a maximum height of 30 m, and bunker-style grain storage with a combined capacity of approximately 880,000 t;
- Rock causeway structure of approximately 240 m crest length;
- 600 m long jetty (inclusive of causeway) extending south-east from the shoreline;
- Industrial ship loader, suitable for loading grain into Panamax sized vessels;
- Maintenance workshops and equipment storage;
- Site administration/office building, and amenities;
- Enclosed conveyor galleries for grain in-loading and out-loading conveyor;
- Four, double-sided sampling stations adjacent the western boundary of the land;
- Truck weighbridge station located adjacent the Lipson Cove Road site entrance;
- Electrical switch room; approximate dimensions 12 m long x 5 m wide x 4 m high;
- Fuel storage tanks, totalling 40,000 L in capacity;
- Light vehicle access and car parking adjacent to Lipson Cove Road;
- Potable water and fire service water tanks and pump systems; and
- Stormwater management works including dams and detention basins, culverts and swales.

Figure 3-5 shows the current site layout and project infrastructure.

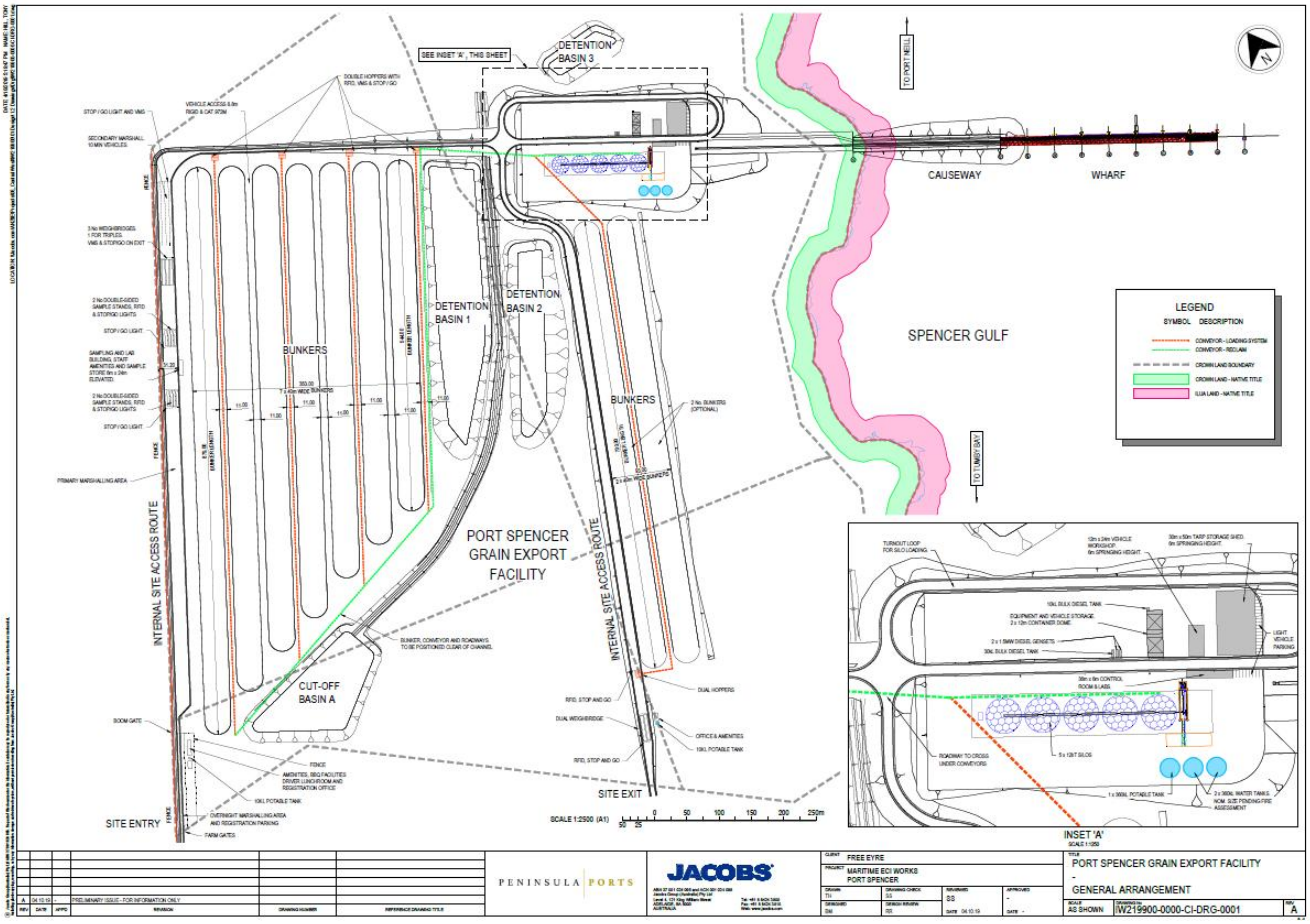


Figure 3-5 Current layout (IW219900-0000-CI-DRG-0001 - Date 4/10/19)

The site area and proposed infrastructure will be comparable for both the approved and the current project. Both projects proposed lighting for safety and navigation purposes.

The largest vessel option in the approved project was a Cape class. The current proposal seeks to cater for a Panamax class as the largest vessel, which accommodates approximately half the capacity of a Cape class vessel, and would provide for direct material loading, reducing handling time and therefore berthing time for shipping.

The area of the greatest potential for visual change is the configuration of the wharf which proposes to change the orientation of ships in the loading area from being generally north – south and roughly parallel to the shore line to generally east – west and perpendicular to the coast line.

The arrangement of the grain silos will also bring about a visual change between the approved and the current Project. The silo configuration for the Project comprises up to five (5) 12,000 t silos with an overall height of up to 30 m, the same as those within the approved project.

The proposed silos will be:

- Approximately 170 m east of the approved silo location, and the
- Ground level approximately 3.1 m higher than the approved silos; and
- Orientated generally north-west to south-east and, perpendicular to the coast line.

3.4 Construction

It is anticipated that construction will take 18 months. In addition to the permanent infrastructure, there will be the requirement for additional contractor equipment, including:

- Cranes (approx. 3);
- Frannas for small lifts and rigging;
- Trucks and utes;
- Piling gates (frames for holding piles in place);
- Hydraulic hammer;
- Reverse circulation drill; and
- End tipper trucks and dozers (to construct the causeway).

Construction impacts will be temporary in nature and, by and large cannot be mitigated. Impacts that can, such as dust suppression, site cleanliness, light spill and mud tracking onto surrounding roads will be managed by way of the Construction and Environmental Management Plan (CEMP) and other project management measures.

4. Landscape Character and Sensitivity

Landscape character defines areas with similar visual characteristics with respect to topography, vegetation, land use and geological features such as creeks, drainage lines and volcanic cones. Landscape Character also considers relevant studies of landscape character types.

4.1 Topography

The topography within the view shed is predominantly gently undulating with low rises and incised water ways. The topography to the north east, east and south east of the site comprise a mixture of wide flat beaches, undulating sand dunes, rock outcrops and cliff faces.

4.2 Vegetation

The majority of the landscape within the view shed is cleared farmland with exotic pasture grasses. Native grasses and heathy scrub are located along the dune structures and cliff tops to the east of the site. Taller vegetation is scattered across the landscape often along roadside verges, water courses, windbreaks and boundary planting.

4.3 Land use

The predominant land use in the area is farming. Free beach-front camping, serviced by toilets and water points, are located to the south. Un-serviced and publicly accessible beach front camping areas are also to the north-east and further north of the site.

A coastal walk runs along the eastern boundary of the site between Lipson Cove to the south and Port Henry to the north.

4.4 Landscape Units

There are two predominant landscape units within the project view shed.

4.4.1 Landscape Unit 1 - Farmland

Landscape Unit 1 - Farmland areas are those areas within the view shed that have been predominantly cleared of native vegetation, are used for farming purposes and are predominantly under private ownership and therefore have limited to no general access. These areas are usually flat to gently undulating framed by planted shelter belts and wind breaks along boundaries.

Public access is permissible along the walking trail and foreshore areas of farming properties that extend to beach fronts and cliff tops.

4.4.2 Landscape Unit 2 – Reserves (Trail and Beach Fronts)

Landscape unit 2 – Reserves include publicly accessible areas that are of high amenity or recreational value. These areas include the formal and informal camping areas such as Lipson Cove and Rogers Beach, the dune structures to the north east of the site, beach fronts and the walking trail. Elevated cliff tops provide panoramic views over the rocky outcrops, open water or along the coastline.

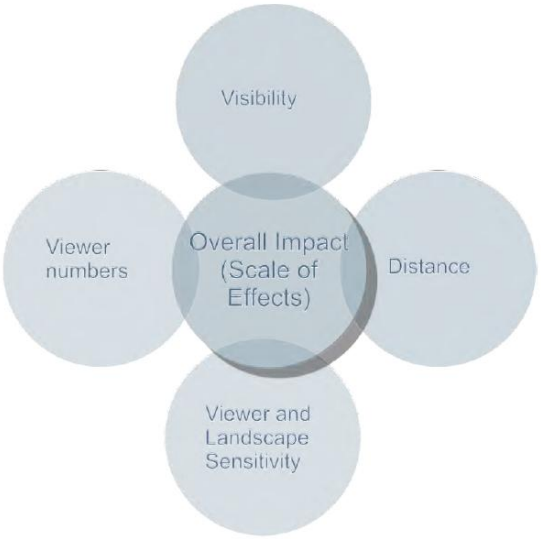
There may be sub-sets of these landscape units that may further distinguish between camping areas, beach fronts and trails, however for this project, the sensitivity of these sub landscape units would remain high.

5. Visual Assessment

When assessing the visual impact of the development from the public domain, the assessment is based on four criteria, namely visibility, distance, landscape character & viewer sensitivity and the number of viewers.

- **Visibility**: The visibility of project elements can be affected by intervening infrastructure, vegetation and topography.
- **Distance:** Visibility decreases as distance from the project site increases. Determining the Zones of Visual Impact (ZVI) gives an indication of the impact based solely on distance. This cannot be considered in isolation or disregard other criteria such as landscape character and visibility through screening.
- **Landscape Character:** A landscape character assessment considers the character of the surrounding landscape both at the proposed development site and around the viewpoint locations. Sensitivity may be determined by previous landscape modifications (e.g. cleared farmland has a lesser sensitivity to landscape change than a pristine landscape such as a national park), as well as the land use type (e.g. residential sites will always be rated a sensitivity value of 'high', whereas industrial areas may be rated as 'low' sensitivity)
- **Viewer numbers:** The level of visual impact decreases where there are fewer people able to view the Project. Alternatively, the level of visual impact may increase where the viewing location is a known vantage point, such as a lookout. Viewer numbers from a recognised vantage point would be rated as 'high'.

These four criteria must be considered in the assessment of each viewpoint. However, the ratings of each criterion are not numerically based and cannot be simply added together and averaged to arrive at an overall rating.



5.1 Scale of effects

The scale of effects for evaluating the overall visual impact of the proposed project from a publicly accessible viewpoint may range from Nil to Positive. A negative impact is ranked between Negligible to High.

5.1.1 Negligible Visual Impact

Negligible – minute level of effect that is barely discernible over ordinary day-to-day effects. The assessment of a 'negligible' level of visual impact is usually based on distance. That is, the port is at such a distance that, when visible in good weather, it would be a minute element in the view within a modified landscape or will be predominantly screened by intervening topography, vegetation or buildings and structures.

5.1.2 Low Visual Impact

Low - visual impacts are those where the project is noticeable but that will not cause significant adverse impacts. The assessment of a "low" level of visual impact will be arrived at if the rating of any one or more of the four criteria (visibility, distance, viewer numbers and landscape sensitivity), are assessed as low. Therefore, an additional piece of infrastructure in a landscape which is human-modified, and which already contains many examples of existing infrastructure, may be rated as a low level of visual impact.

5.1.3 Medium/Moderate Visual Impact

Medium/Moderate - visual impact may occur when several of the four assessment criteria are considered as higher than "low" or the visual effects are able to be mitigated / remedied from an initial rating of High. This will of course be moderated by the context of the existing view and the modifications within the landscape.

5.1.4 High Visual Impact

High or unacceptable adverse effect – extensive adverse effects that cannot be avoided, remedied or mitigated. The assessment of a "high or unacceptable adverse effect" from a publicly accessible viewpoint requires the assessment of all criteria to be high. For example, a highly sensitive landscape, viewed by many people, with the proposed port in close proximity and largely visible, would lead to an assessment of an unacceptable adverse effect.

5.2 Comparative Photomontages

The visual impact assessment of the approved project was undertaken based on computer generated imagery similar in process to the preparation of photomontages. While these images lack the perceptibility of the project in actual views from each assessment location, they do provide a sense of scale and theoretical project visibility.

Comparative photomontages are useful to determine the change in impacts that might be expected for approved projects that has not yet been built but is contemplating a change of use.

This process allows for a qualitative representation that is based on a prior approved visual change that was considered acceptable when approving the project.

This assessment will be based in part on new photomontages prepared from similar locations to those included in the PER which show the location height and scale of the current project.

The visual impact assessment of the approved project included within the Public Environmental Report was based upon Landscape Model Viewpoints (simulations) from five (5) publicly accessible viewing locations. These included

- two views (VP 4 and 5) from Coast Road to the west of the site,
- one view (VP 1) from the area of Rogers Beach to the north,
- one view (VP 3) from Lipson Cove to the south; and
- one (VP2) from the open water to the east of the site.

The location of these selected viewpoints is shown in Figure 5-1 below.

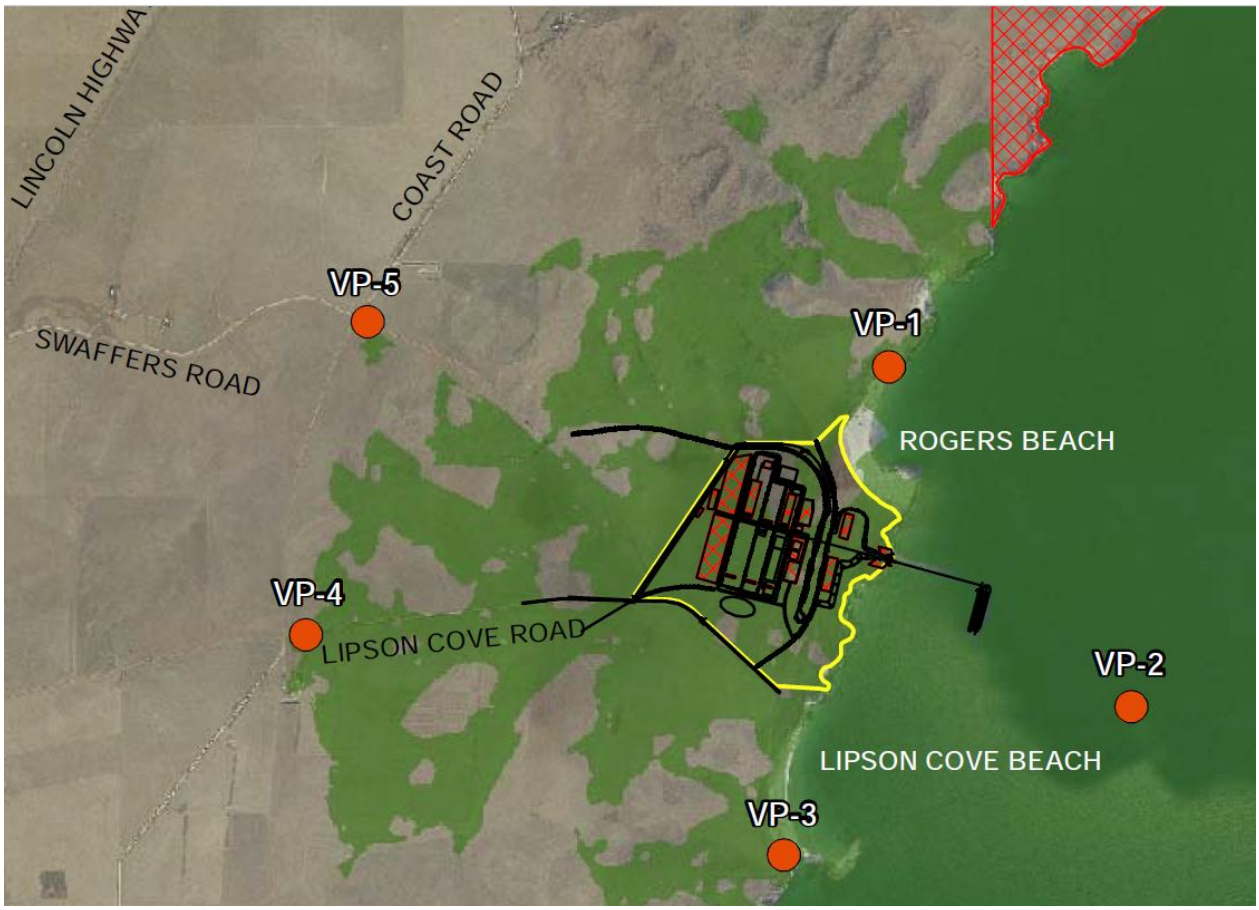


Figure 5-1 PER Viewpoint locations (Source *Port Spencer Executive Summary and Public Environmental Report – February 2012*)

The location of each viewpoint could not be accuracy located as the GPS coordinates were not included within the report.

This assessment will re-assess the viewpoints VP1- Rogers Beach, VP3 Lipson Cove Beach, VP4 Coastal Road #1 and VP5 Coastal Road #2. VP 2 is of limited use as an assessment location as it would be accessible to very few people who will take in this view, these views are temporal only, are dynamic and take in many other modifications along the shore line.

During the site visit, there were 23 locations visited and photographed. In addition to the four land-based viewpoints included in the approved PER, there is one further viewing location from Lipson Cove Road that may of benefit to provide for the range, nature and distance of views of the proposed project from publicly accessible locations.

The location and proximity of the viewpoints assessed in this report are shown in Figure 5-2 below.

Figure 5-2 Viewpoint assessment locations

5.3 Recreation Location Viewpoints

Viewpoint 1 considers the views and visual impact from the Lipson Cove campground and beach to the south of the site.

5.3.1 Viewpoint 01 – Lipson Cove (PER VP03)

Viewpoint 1 is located approximately 750 m south of the nearest site boundary and 1.6 km south of the wharf. This viewpoint is similar to Viewpoint 3 included in the PER.

Formal campsites are located behind the beach approximately 200 m to the west of this location.

Users of the site currently enjoy uninterrupted views along the coast line, spanning from the north to the south and includes view towards the project (in a north-north-easterly direction).

Figure 5-4 shows the view from the elevated turnaround area at the southern end of the campground looking north towards the project.

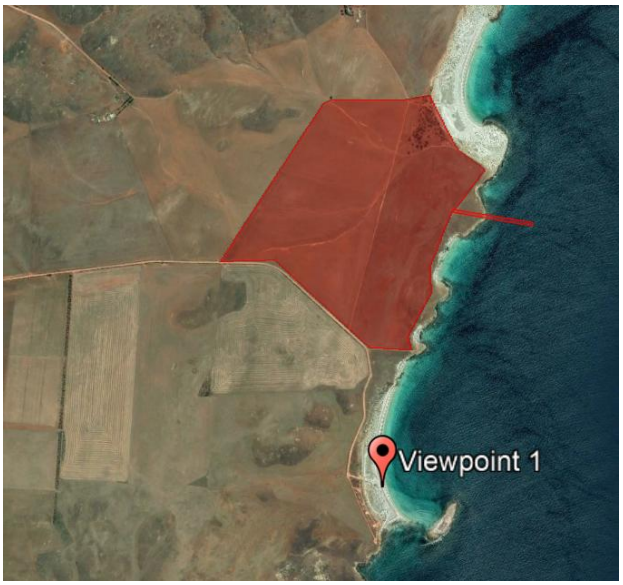


Figure 5-3 GPS Coordinates: 53 H, 616168.00 m E, 6208079.00 m S

Figure 5-4 View from the turnaround bay looking north

Figure 5-5 below shows the view from the existing campsite and amenities facility also looking north.

Figure 5-5 View from the main campsite area looking north

The visual impact assessment from this location was undertaken from the beach and based on a theoretical computer model. Figure 5-6 shows the existing view taken from a similar location along the beach front directly to the east of the main camping area.

Figure 5-6 Existing View

Currently this view includes the farming areas in the location of the approved project, the white beach and shoreline, and the open water to the north-east and east. The remnants of the historical pier can also be seen in the foreground of this view.

Figure 5-7 shows the photomontage included in the PER that formed the basis for the assessment of this viewing location.

Figure 5-7 (Source PER Feb 2012) Viewpoint from Lipson Cove (VP-3) Looking Towards the Project

The most noticeable change in the approved view and as assessed in the PER is the wharf and ship loading infrastructure.

Figure 5-8 Shows a photomontage of the same view seen in Figure 5-6 with the current project superimposed into the view.

Figure 5-8 Photomontage – Current

The most noticeable change in the view from the current project would be the orientation of vessels when berthed at the wharf, and possibly the visibility of the grain silos projecting above the farmland directly to the north.

The movement of the grain silos further east and to a platform with a height of 3.1 m higher than the approved platform will likely result in a visual change from this viewpoint. This is evident when comparing the approved and current photomontages. The current photomontage shown in Figure 5-8 shows partial visibility of four silos behind the elevated hill in the background at approximately 6-12 degrees from north. Whilst they will be noticeable, the distance from this viewpoint and the screening by existing topography will not result in the silos forming a dominant element in this view

This change is only apparent when the photomontages of the approved and current project are compared in parallel.

The change in views and visual impact brought about by the current project in the context of the approved view would be negligible to low for most viewers. This is due to the greatest change in views having already been approved.

Landscape screening installed along the Projects southern boundary may assist to filter or screen views to the silos brought about by the layout changes proposed by the current project.

5.3.2 Viewpoint 02 – Rogers Beach (PER VP01)

Viewpoint 2 is located approximately 170m north of the nearest site boundary and 750 m north of the wharf. This viewpoint is similar to Viewpoint 1 of the PER.

There are no formal campsites in this area, however it is apparent that camping does occur in the dunes behind the beach front. The coastal walk between Lipson Cove and Port Henry is to the east of this location.

A photomontage of the current project has been prepared from the coastal walk just north of Rogers Beach looking over the beach and camping area towards the site.

The shallow profile of the beach also allows for launching of small boats and personal water craft, making this a popular area in warmer months.

Users of the site currently enjoy uninterrupted views along the coast line to the north, and views of the elevated dunes and subject site to the south and in the direction of the project.

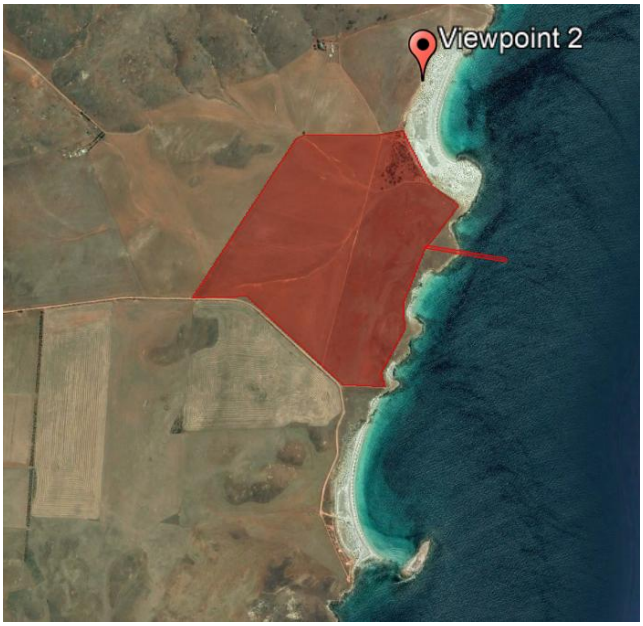


Figure 5-9 GPS Coordinates: 53H, 616597.00 m E, 6210675.00 m S

The visual impact assessment included in the PER from this location was undertaken from the beach and was based on a theoretical computer model. Figure 5-10 shows the photomontage included in the PER report that formed the basis for the assessment of this viewing location.

Figure 5-10 (Source PER Feb 2012) Viewpoint from Rogers Beach (VP-1) Looking Towards the Project

Figure 5-11 shows the existing view from a similar location assessed in the PER. This viewpoint is from the beach front directly to the east of the main camping area.

Figure 5-11 Existing Beach View

Currently this view includes the farming areas in the location of the approved project, the white beach and shoreline, and the open water to the north-east and east.

Figure 5-12 shows the view from the coastal walk looking south over Rogers Beach. This photomontage is at a higher angle than the image included in the PER and has been expanded to include the location of the wharf.

Figure 5-12 View from walking trail looking south over Rogers Beach

Figure 5-13 shows a photomontage of the view from the walking trail with the current project superimposed into the view.

Figure 5-13 Photomontage – Current

The most noticeable change in this view would be the visibility of the grain silos projecting above the farmland directly to the south and the change in ships orientation when berthed at the wharf. This change however would only apparent if photomontages of the approved and current project were to be compared in parallel. The visual impact is not brought about by the scale or number of elements in the view. The visual impact is brought about largely by the initial introduction of constructed elements in a view, similar to those within the approved project.

The greatest change in views from this location would be brought about by the approved project. The change in views and visual impact of the current project in the context of this approved view would be negligible to low to most viewers.

5.3.3 Viewpoint 03 – Corner Coastal and Lipson Cover Road (PER VP04)

Viewpoint 3 is located at the intersection of Lipson Cove Road and South Coast Road, approximately 2.0 km west of the site. This location is similar to Viewpoint 4 included in the original PER.

Lipson Cove Road is the only public access to Lipson Cove Beach and camping area.

Figure 5-15 shows the existing view looking east towards the site. This intersection is elevated above the site.

The road in both directions is currently unsealed.

Figure 5-14 GPS Coordinates: 53H, 613153.00 m E, 6209155.00 m S

Figure 5-15 Existing View

Existing vegetation in the road reserve filters views of the site. This vegetation will assist to filter and screen views of the project.

Currently this view is over the nearby farming areas to the west of the approved project. Distant views include the open waters of Spencer Gulf.

Figure 5-16 shows the photomontage included in the PER report that formed the basis for the assessment of this viewing location.

Figure 5-16 (Source PER Feb 2012) Viewpoint from Corner Lipson Cove Road and Coastal Road (VP-4) Looking Towards the Project

This view does not capture the existing vegetation seen in Figure 5-15**,** which is of a size and scale that would filter, if not screen the majority of the approved project.

This photomontage also shows that whilst the approved project would be visible, it would not be a dominant feature in views due largely to the overall distance to the project and in the background of the cropping land. Although it would not be visually dominant, the silos and conveyors would be noticeable through their contrast against the backdrop of sky and open water.

The greatest change in views from this location will be brought about by the approved project. The change in views and visual impact of the current project in the context of this approved view would be negligible to low to most viewers.

5.3.4 Viewpoint 04 – Corner Swaffers and Coastal Road (PER VP05)

Viewpoint 4 is located approximately 2.3 km west of the nearest site boundary. This viewpoint is similar to Viewpoint 5 included in the PER.

The viewpoint is located at the intersection of South Coast Road and Swaffers Road. Both roads are unsealed.

Swaffers Road heading east toward the project from this viewpoint is a no-through road for private property access.

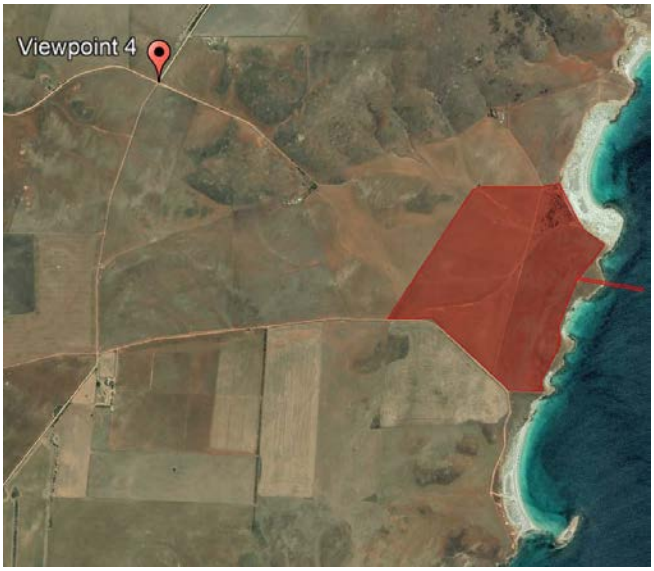


Figure 5-17 GPS Coordinates: 53H 613608.00 m E, 6211110.00 m S

Figure 5-18 Existing View

Currently this view includes the farming areas in the location of the approved project and Spencer Gulf, which is framed between rolling hills and is visible within the background of this view. Roadside vegetation is also present along the verge of Swaffers Road.

Figure 5-19 below shows the photomontage included in the PER report that formed the basis for the assessment of this viewing location.

Figure 5-19 (Source PER Feb 2012) Viewpoint from Swaffers Road (VP-5) Looking Towards the Project

The most noticeable change in this view would be the visibility of the grain silos projecting above the farmland to the east, and bunkers situated before the framed views to the bay. The majority of project infrastructure will be screened by the undulating hills that sit either side of the view to the bay. The project elements that will be visible will be at such a distance that they do not form visually dominant elements within the view, albeit they will be noticeable through their contrast against the backdrop of sky and open water.

The greatest change in views from this location will be brought about by the approved project. The change in views and visual impact of the current project in the context of this approved view would be negligible to low to most viewers.

5.3.5 Viewpoint 05 – Lipson Cove Road (New Viewpoint)

Viewpoint 5 is located directly south of the project boundary on Lipson Cove Road adjacent to the approved light vehicle entrance and proposed site entrance.

Lipson Cove Road is the only entrance to Lipson Cove Beach and the formal campground.

Figure 5-4 shows the existing view looking east towards the beach and over the project.

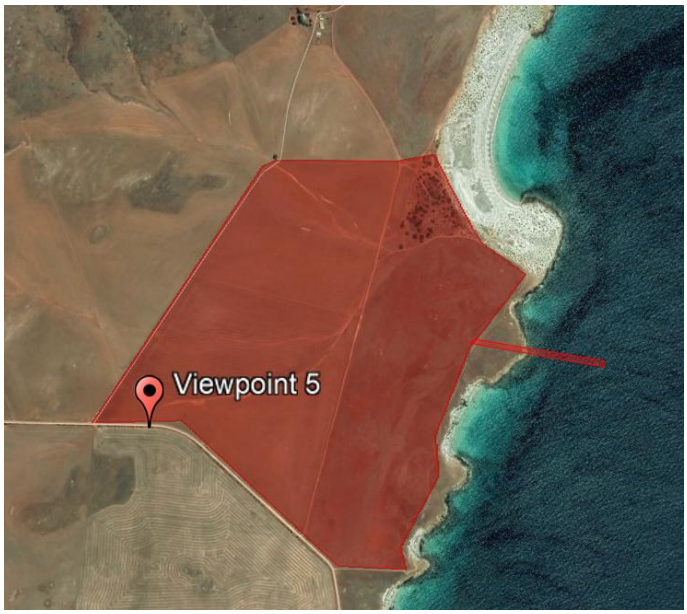


Figure 5-20 GPS Coordinates: 53H 615436.00 m E, 6209385.00 m S

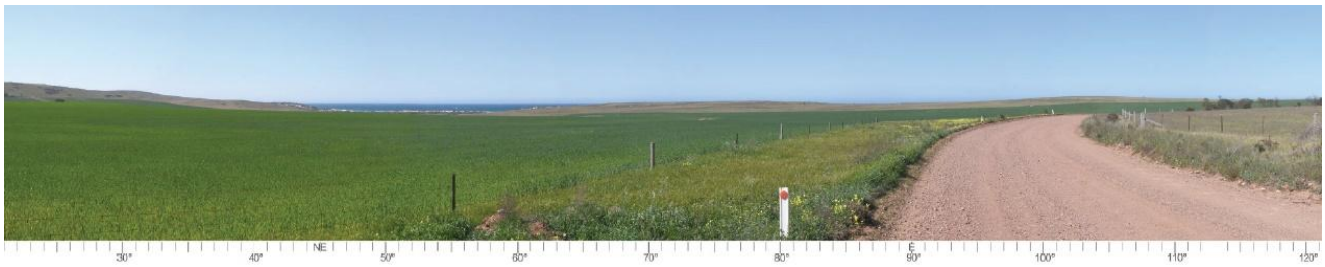


Figure 5-21 Existing view looking east

The existing view over the site is over cleared farm land towards the area of Rogers Beach and the informal camping area. The rear dunes are just visible beyond the verdant green pastures and between the local headlands.

This location was not assessed in the 2012 PER therefore a comparative view is not available. Figure 5-22 shows the same view with the current project superimposed into the view.

Figure 5-22 Proposed view looking east

The existing view is over cleared farming land towards Rogers beach and the shoreline.

The silos, bunkers and grain handling infrastructure will be highly visible and will screen existing views of the beach, dunes and open water beyond. The use of this area would also change from one of farming to bulk materials handling and export.

As demonstrated in the previous view assessments, the change in views and visual impact would be similar to that of the already approved project. In this context, the change in view between what has already been approved and the current project would be negligible to low for most viewers.

6. Conclusion

This assessment has reviewed the change in views between that of an already approved development and the current proposal.

The approved project allows for the development and use of the site for bulk materials storage, handling and export via a deep-sea wharf.

This assessment has undertaken a review of similar viewing locations included in the visual impact assessment of the approved project, and through several comparative photomontages considered the potential for a change in views and visual impact. This assessment has shown that the:

- Site is currently undeveloped but is modified for agricultural purposes.
- Area surrounding this site is of high recreational value and scenic amenity.
- Views from most locations of the approved and current project would be set within a backdrop of either open water, beach and foreshore areas or cleared farmland.
- Use and development of this site has the potential for a high level of visual impact, which has already been approved.
- Proposed change brought about by the current project is similar in use, scale and proposed infrastructure to that of the already approved project.
- The visual impact of the proposed change in use from that which has already been approved would be negligible to low for most viewers.
- Landscape Mitigation may be useful in ameliorating visual impacts.

Appendix A. Photomontages

Free Eyre

View looking north west - north east

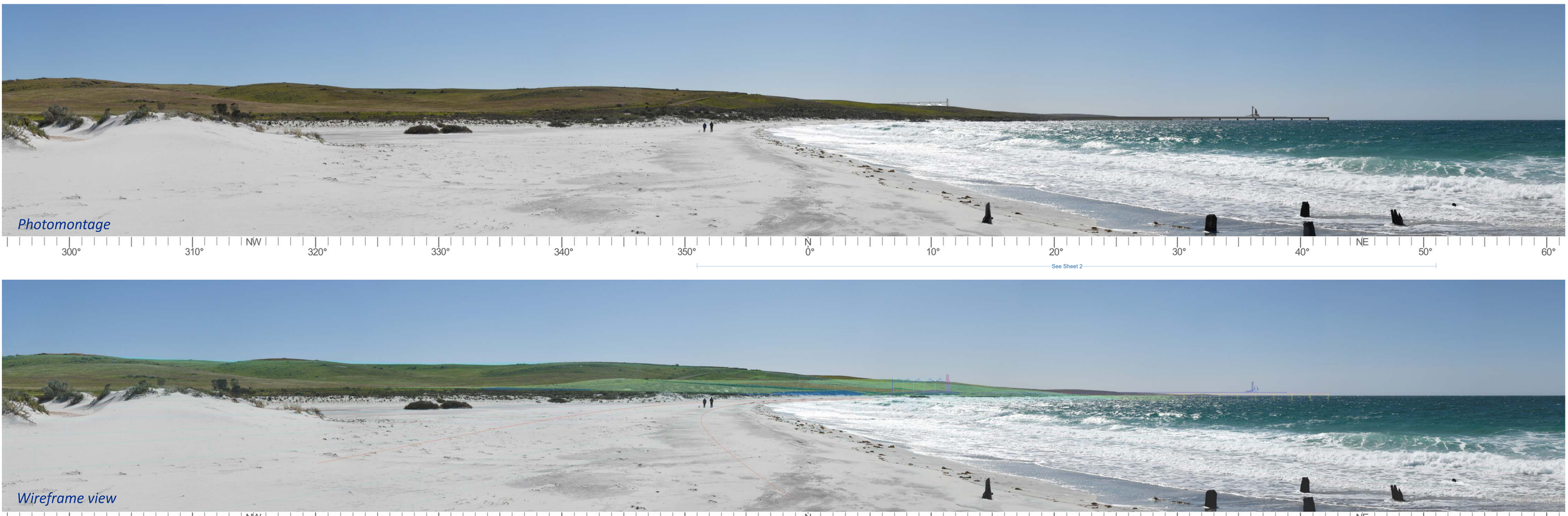
VIEWPOINT 1 - Lipson Cove

(GPS 53 H, 616168.00 m E, 6208079.00 m S

Existing view

300° 310° NW 320° 330° 340° 350° N 0° 10° 20° 30° 40° NE 50° 60°

See Sheet 2



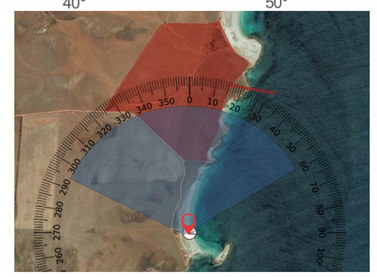
Photomontage

300° 310° NW 320° 330° 340° 350° N 0° 10° 20° 30° 40° NE 50° 60°

See Sheet 2

Wireframe view

300° 310° NW 320° 330° 340° 350° N 0° 10° 20° 30° 40° NE 50° 60°



Viewpoint Map

Distance to Project:
1.6km North

Viewpoint location and orientation

JACOBS

DATE: 22/10/2019
PREPARED BY: HB
SHEET: 1/2

Free Eyre

VIEWPOINT 1 - Lipson Cove

View looking north west - north east

(GPS 53 H, 616168.00 m E, 6208079.00 m S

Existing view

Photomontage

View angle - 60°

JACOBS

DATE: 22/10/2019
PREPARED BY: HB
SHEET: 2/2

Free Eyre

VIEWPOINT 2 - Rogers Beach

View looking south east to south west

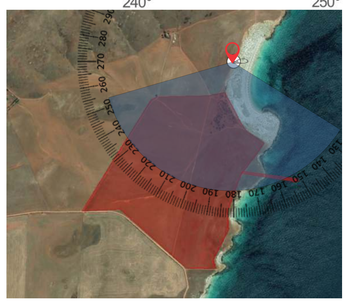
(GPS 53H, 616597.00 m E, 6210675.00 m S

Existing view

Photomontage

Wireframe view

Viewpoint Map



Distance to Project:
Approximately 170m to Site Boundary

Viewpoint location and orientation

JACOBS

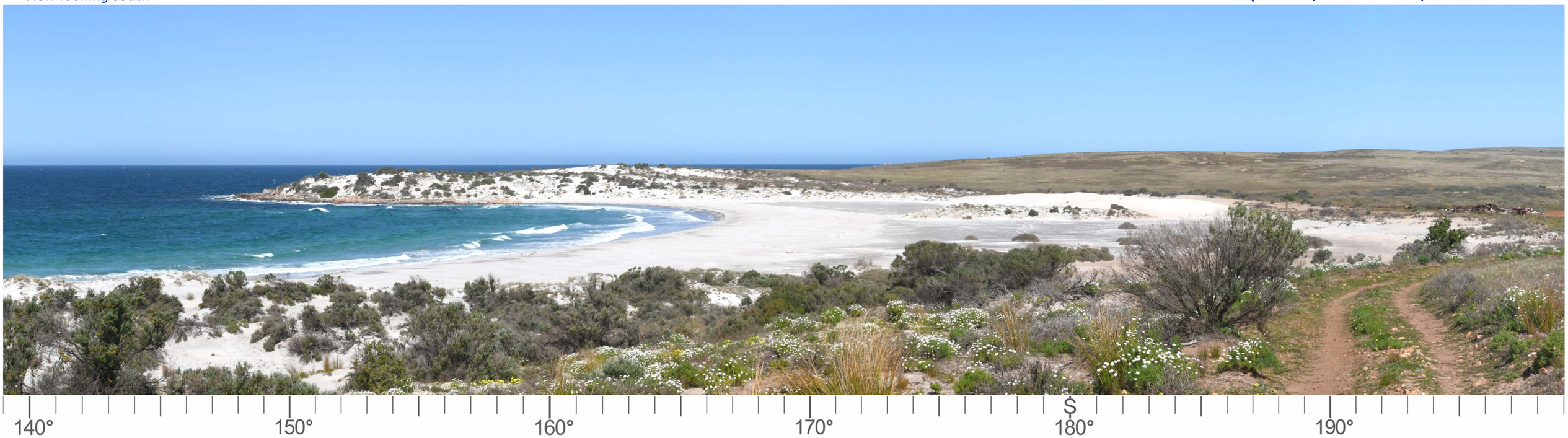
DATE: 23/10/2019
PREPARED BY: HB
SHEET: 1/3

Free Eyre

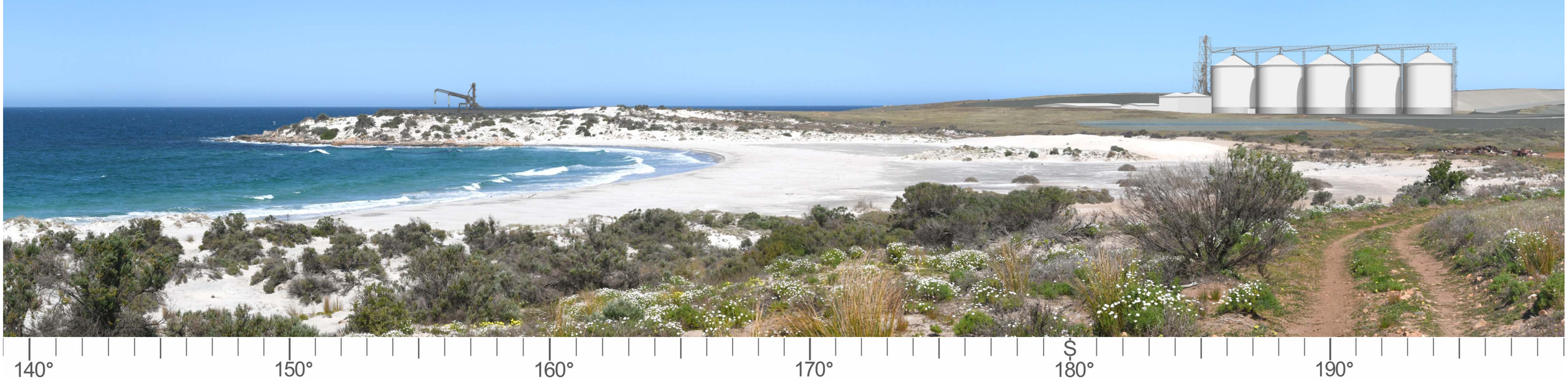
VIEWPOINT 2 - Rogers Beach

View looking south

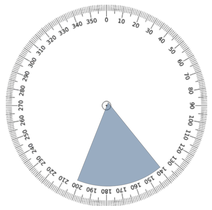
(GPS 53H, 616597.00 m E, 6210675.00 m S



Existing view



Photomontage



View angle - 60°

JACOBS

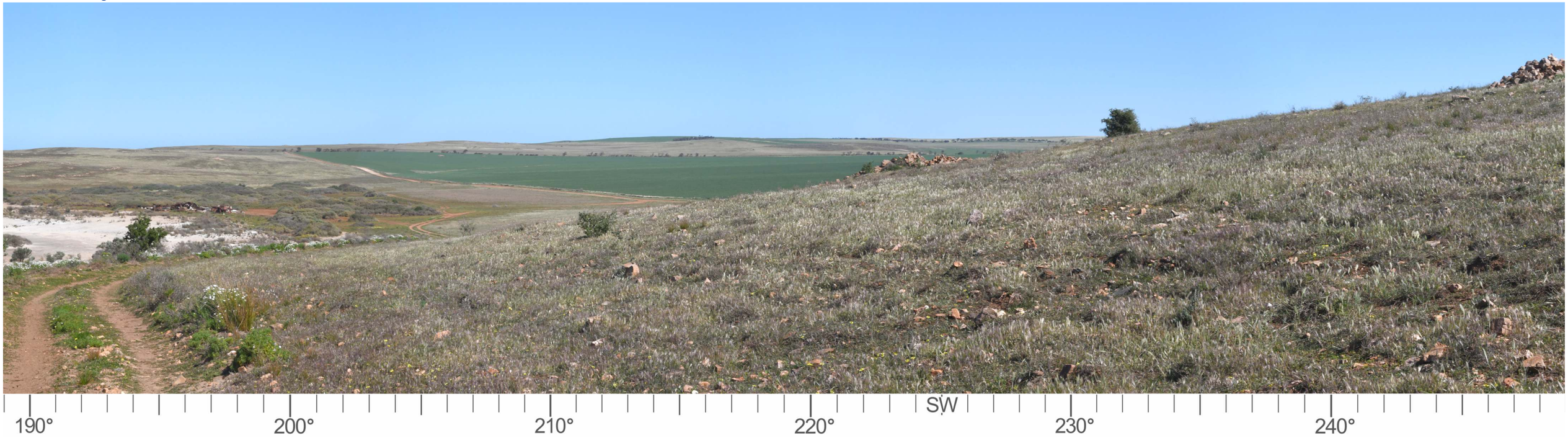
DATE: 23/10/2019
PREPARED BY: HB
SHEET: 2/3

Free Eyre

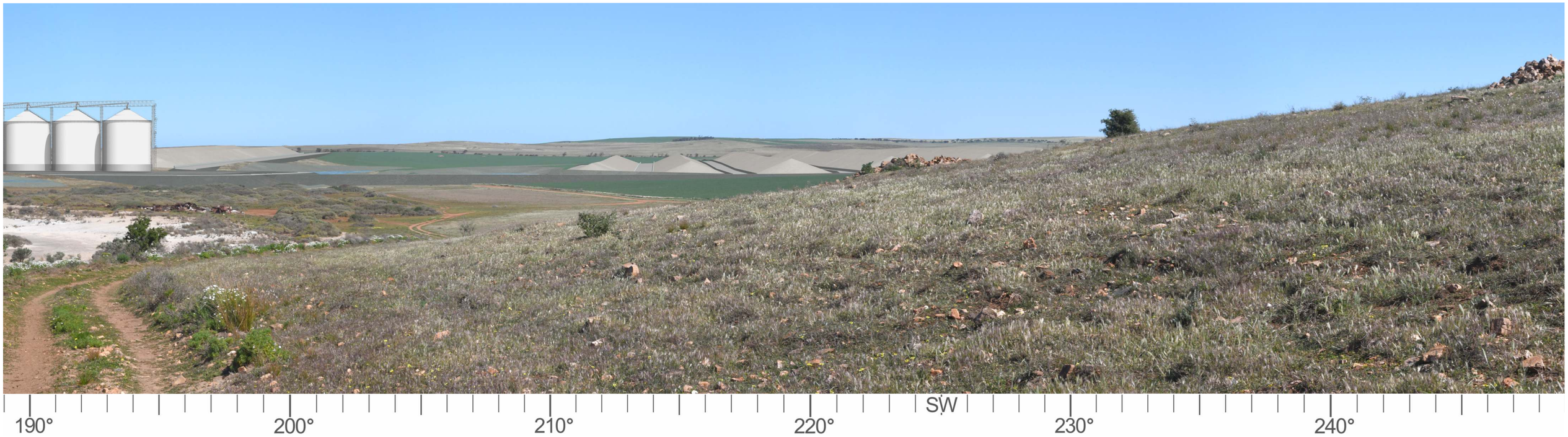
VIEWPOINT 2 - Rogers Beach

View looking south west

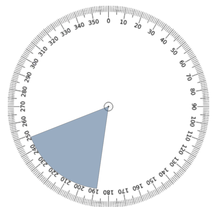
(GPS 53H, 616597.00 m E, 6210675.00 m S



Existing view



Photomontage



View angle - 60°

JACOBS

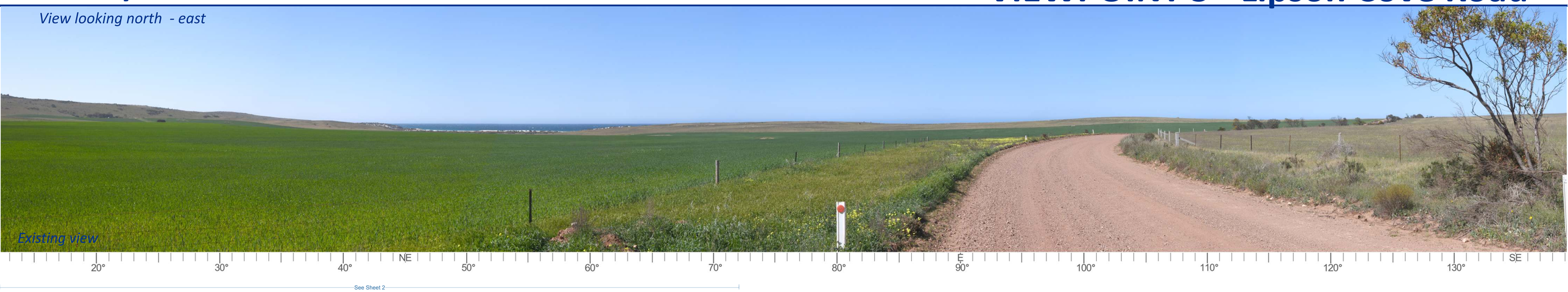
DATE: 23/10/2019
PREPARED BY: HB
SHEET: 3/3

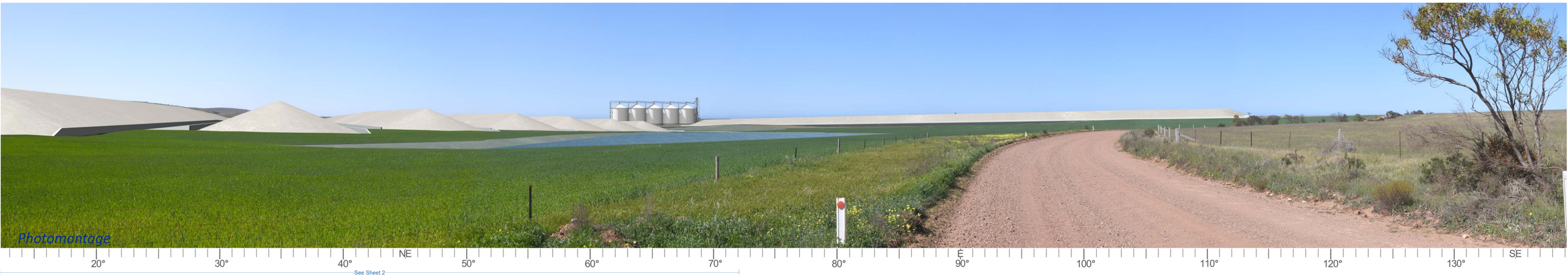
Free Eyre

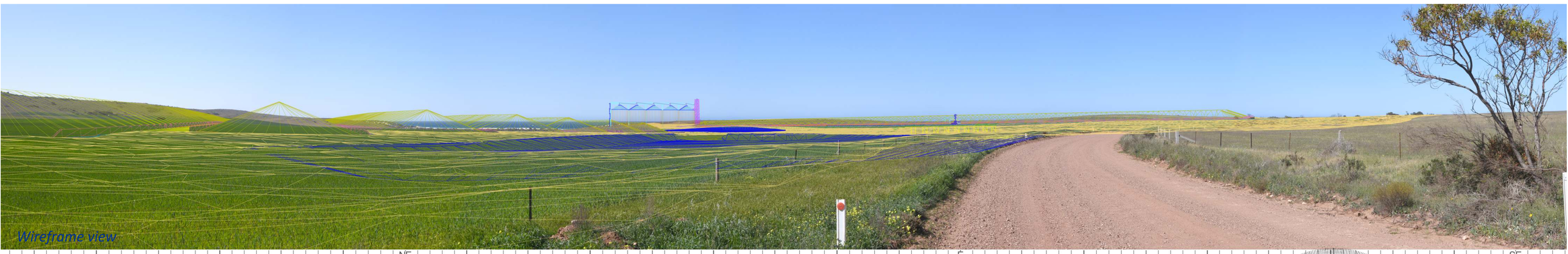
(GPS 53 H, 615436.38 m E, 6209385.38 m S

VIEWPOINT 5 - Lipson Cove Road

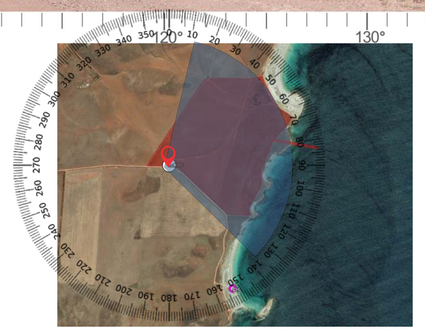
View looking north - east







Distance to Project:
>50m



Viewpoint Map

JACOBS

DATE: 23/10/2019
PREPARED BY: HB
SHEET: 1/3

Free Eyre

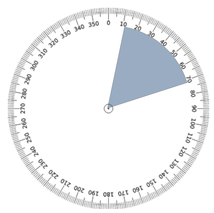
VIEWPOINT 5 - Lipson Cove Road

View looking north east

(GPS 53 H, 615436.38 m E, 6209385.38 m S

Existing view

Photomontage



View angle - 60°

JACOBS

DATE: 23/10/2019
PREPARED BY: HB
SHEET: 2/3

Free Eyre

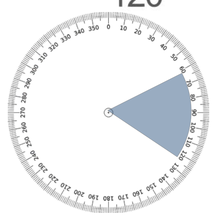
VIEWPOINT 5 - Lipson Cove Road

View looking east

(GPS 53 H, 615436.38 m E, 6209385.38 m S

Existing view

Photomontage



View angle - 60°

JACOBS

DATE: 23/10/2019
PREPARED BY: HB
SHEET: 3/3