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Stockton Sand Quarry Dredging | State Significant Development

ENVIRONMENTAL IMPACT STATEMENT

Prepared for Boral Resources (NSW) Pty Ltd | February 2020

Stockton Sand Quarry Dredging

STATE SIGNIFICANT DEVELOPMENT | ENVIRONMENTAL IMPACT STATEMENT

Prepared for Boral Resources (NSW) Pty Ltd
21 February 2020

PR63

	Prepared by	Reviewed by
Name	Luke Farrell	Mark Roberts
Company	Element Environment	Element Environment
Position	Senior Environmental Consultant	Senior Environmental Consultant
Project Role	Lead EIS Author	Technical Reviewer
Signature		
Date	18 February 2020	19 February 2020

DOCUMENT CONTROL

Revision	Date	Description	Prepared by	Reviewed by
0	23 September 2019	For Boral review	Element Environment	Boral Resources (NSW) Pty Ltd
1	18 December 2019	For submission to DPIE	Element Environment	Boral Resources (NSW) Pty Ltd
2	21 February 2020	Revised following DPIE adequacy review	Element Environment	Boral Resources (NSW) Pty Ltd

Environmental Impact Statement Certification

Submission of Environmental Impact Statement (EIS) prepared under Part 4 of the *New South Wales Environmental Planning and Assessment Act 1979*.

Aspect	Details	
Name	Luke Farrell	Mark Roberts
Position	Senior Environmental Consultant	Senior Environmental Consultant
Project role	Lead EIS Author	Technical Reviewer
Qualifications	Bachelor of Environmental Science	Bachelor of Environmental Science
Address	Element Environment Pty Ltd PO Box 1563, Warriewood, NSW, 2012	
In respect of	Stockton Sand Quarry Dredging, State Significant Development – Environmental Impact Statement	
Applicant name	Boral Resources (NSW) Pty Ltd	
Responsible person/applicant	Rachael Snape	
Responsible person/applicant address	Triniti 2, 39 Delhi Road North Ryde, NSW, 2113	
Proposed development	Stockton Sand Quarry Dredging	
Land to be developed	The Stockton Sand Quarry (the quarry) covers approximately 246 hectares and will be on land identified as: ▪ Lot 1 DP 1006399; ▪ Lot 2 DP 1006399; and ▪ Lot 3 DP 664552. Access to the quarry is via a Crown land title (Lot 7300 DP 1130730) under licence agreement with the NSW Department of Planning, Industry and Environment. The development will cover approximately 37 hectares and be restricted to a former sand extraction area within Lot 1 DP 1006399 and Lot 3 DP 664552.	
Proposed development description	Boral is seeking approval through a State significant development application to extract sand from the inland vegetated dunes. Initial extraction will occur by front-end loader/excavator to relative level (RL) 4 m Australian Height Datum (AHD) within Stage 1 followed by dredging to RL – 15 m AHD of Stages 2 – 6 inclusive. Boral seeks to increase the site wide transportation limit to 750,000 tpa per year until the windblown project lapses in 2028 when transportation limits will reduce to 500,000 tpa.	
Environmental assessment	This EIS addresses all matters in accordance with Part 4 of the NSW *Environmental Planning & Assessment Act 1979*.	
Preparation	This EIS has been prepared by Element Environment Pty Ltd on behalf of Boral. In preparing the EIS, Element Environment Pty Ltd has relied on data, designs and plans and other information provided by Boral and other individuals and organisations referenced herein.	
Declaration	Pursuant to clause 6(f), Part 3, Schedule 2 of the NSW Environmental Planning and Assessment Regulation 2000, I declare that this EIS: ▪ has been prepared in accordance with the requirements of the NSW *Environmental Planning and Assessment Act 1979*, NSW Environmental Planning and Assessment Regulation 2000, and the Secretary's environmental assessment requirements (SEARs) (SSD-9490) dated 16 November 2018; ▪ contains all available information that is relevant to the environmental assessment of the proposed development to which the document relates; and ▪ is true in all material particulars and does not, by its presentation or omission of information, materially mislead.	

Aspect	Details	
Signature		
Name	Luke Farrell	Mark Roberts
Date	18 February 2020	19 February 2020

Executive Summary

Introduction

Due to current and future demand for sand in the Hunter and Sydney regions, Boral Resources (NSW) Pty Ltd (Boral) is seeking development consent for a State significant development (SSD 9490) to continue and expand operations at its Stockton Sand Quarry (the project).

Stockton Sand Quarry is owned and operated by Boral and is legally described as Lots 1 and 2 in Deposited Plan (DP) 1006399 and Lot 3 DP 664552 (the site).

The site is approximately 246 hectares (ha) and has been used for the purposes of extractive industries (sand quarrying) since the 1970s. There site currently supports an active quarry on the windblown (transgressive) sand dunes of Stockton Bight which produces up to 500,000 tonnes per annum (tpa) of sand for use in landscaping and construction (the existing operation).

The project will involve the progressive extraction of sand from the inland vegetated dunes of the site using both dry and wet extraction methods. Stage 1 will involve removal of sand by front-end loader/excavator to a depth of 4 metres (m) Australian Height Datum (AHD) all subsequent stages (2 to 6) dredging from 4 m AHD to -15 m AHD.

The development application seeks to increase the site-wide transport limit to 750,000 tpa (i.e. the windblown sand extraction area and the project operations combined) until 2028, after which the site wide limit will reduce to no more than 500,000 tpa.

This environmental impact statement (EIS) has been prepared for submission to the Department of Planning, Industry and Environment (DPIE) to satisfy the provisions of Part 4 of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act).

Description of the site and surrounds

The site (refer to **Figure E.1**) is in Fullerton Cove, approximately 9.8 kilometres (km) north-north-east of the Newcastle central business district (CBD) and is located in the Port Stephens local government area (LGA).

The site is accessed via Coxs Lane, a local road which connects with a private road over the adjacent Crown reserve. Coxs Lane intersects Nelson Bay Road, a major arterial road which links the Newcastle CBD to Newcastle Airport, Nelson Bay and the wider Port Stephens area to the north.

The project is in the central portion of the site and contains all areas to be disturbed by project operations and covers an area of approximately 37 ha.

The site is zoned RU2 – Rural Landscape under the Port Stephens Local Environmental Plan (LEP) 2013 and extractive industries are permitted with consent.

Access to the site is via a road over an adjacent parcel of Crown land. This lot is zoned RE1 - Public Recreation. No physical works are proposed within the Crown reserve and Boral has an existing licence for access with Crown Lands.

Land to the north, south and east of the site is zoned E1 – National Parks and Nature Reserves, and this land comprises the environmental conservation areas of Stockton Bight. A portion of land adjacent to the north-east of the site is also zoned as E3 – Environmental Management.

Figure E.1
Regional context

Source: LPI (2018), Boral (2018), Cambium Group (2020).

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Project overview

Sand was formerly removed from the inland dunes under a previous consent that ceased in 2008. Under this consent, sand was only extracted to 5 m AHD.

The project seeks to undertake extraction generally within the area of previous disturbance to access an estimated 9 million tonnes of sand resource from the existing ground level (5 m AHD) to a depth of -15 m AHD. As extraction will intercept the groundwater table (at 1-2 m AHD) the primary method of sand extraction will be dredging.

The project is outlined in **Figure E.2**, which also depicts the location of the existing operations at the site and the location of the project site in comparison to these existing operations.

The project seeks a site wide dispatch limit of 750,000 tpa (i.e. the windblown sand extraction area and the project operations combined) up to 2028, after which the site wide limit will reduce to no more than 500,000 tpa. The increase in the site wide dispatch limit is sought to permit maximum flexibility across the existing and proposed sand extraction areas (located on the same quarry site). Boral is seeking consent to operate the SSD for 25 years to account for fluctuations in demand.

The project will continue to operate in accordance with existing operating hours.

The project involves progressive extraction of sand over six operational stages as illustrated in **Figure E.3**. Site preparation will involve clearing and grubbing of established vegetation from previous rehabilitation and possible screening of accumulated leaf litter and organic matter. Cleared vegetation will be mulched or stockpiled on-site for later use in rehabilitation. Similarly, any stripped topsoil will be retained for use in rehabilitation.

Stage 1 will involve dry extraction to a depth of 4 m AHD. The sand will then be screened and stockpiled before a front-end loader loads road trucks in-pit with screened raw sand for transport off-site via the weighbridge.

A pond will be created in the area of Stage 2 following initial dry extraction of sand in Stage 1. The pond will be large enough to float a dredge and accommodate freshwater pumping for the proposed wash plant. The dredge will move progressively through the extraction area in a south-westerly direction in a staged process. Extraction will then move to the east and culminate with relocation of the proposed processing and stockpile area to a confined area in Stage 1 and subsequent dredging of most of the Stage 1 extraction area (to be known as Stage 6).

Sand will be extracted to approximately -15 m AHD.

Minimal site establishment works are required given existing operations, infrastructure and services. New or augmented infrastructure will be established in Stage 1 and will comprise:

- Construction of a new entry road. The new road will link to the existing haul road in the south-eastern extent of Stage 1 and enable continued access to the windblown sand extraction area. The road will be two-way and a separated exit road will be constructed to allow exiting vehicles to cross the weighbridge.
- A pad for the wash plant and diesel generators will be constructed after vegetation removal and sand extraction in the northern portion of Stage 1. The wash plant pad will generally have a fixed location during Stages 2 to 5, after which, it will be relocated in Stage 6 to allow for extraction from the remaining body of Stage 6.
- Relocation of the existing parking area to the south and relocation of the security gates northward across the entry road which will enclose the parking area and the new entry road. The docketing kiosk registering vehicles entering the site will also be relocated.

The existing site depot will also be reconfigured to support the project and will comprise:

- installation of a new prefabricated office building;

- relocation of onsite materials storage;
- replacement of roofing for the workshop; and
- installation of a 30,000 litre water storage tank for potential firefighting efforts.

A processing and stockpile area will be established in the Stage 1 area. The area will be used to stockpile topsoil, vegetation and sand.

Extracted sand will be transported to the Stage 1 area and screened for immediate sale, or stockpiled. Stockpile volume and duration will be minimised to limit the loss of resource.

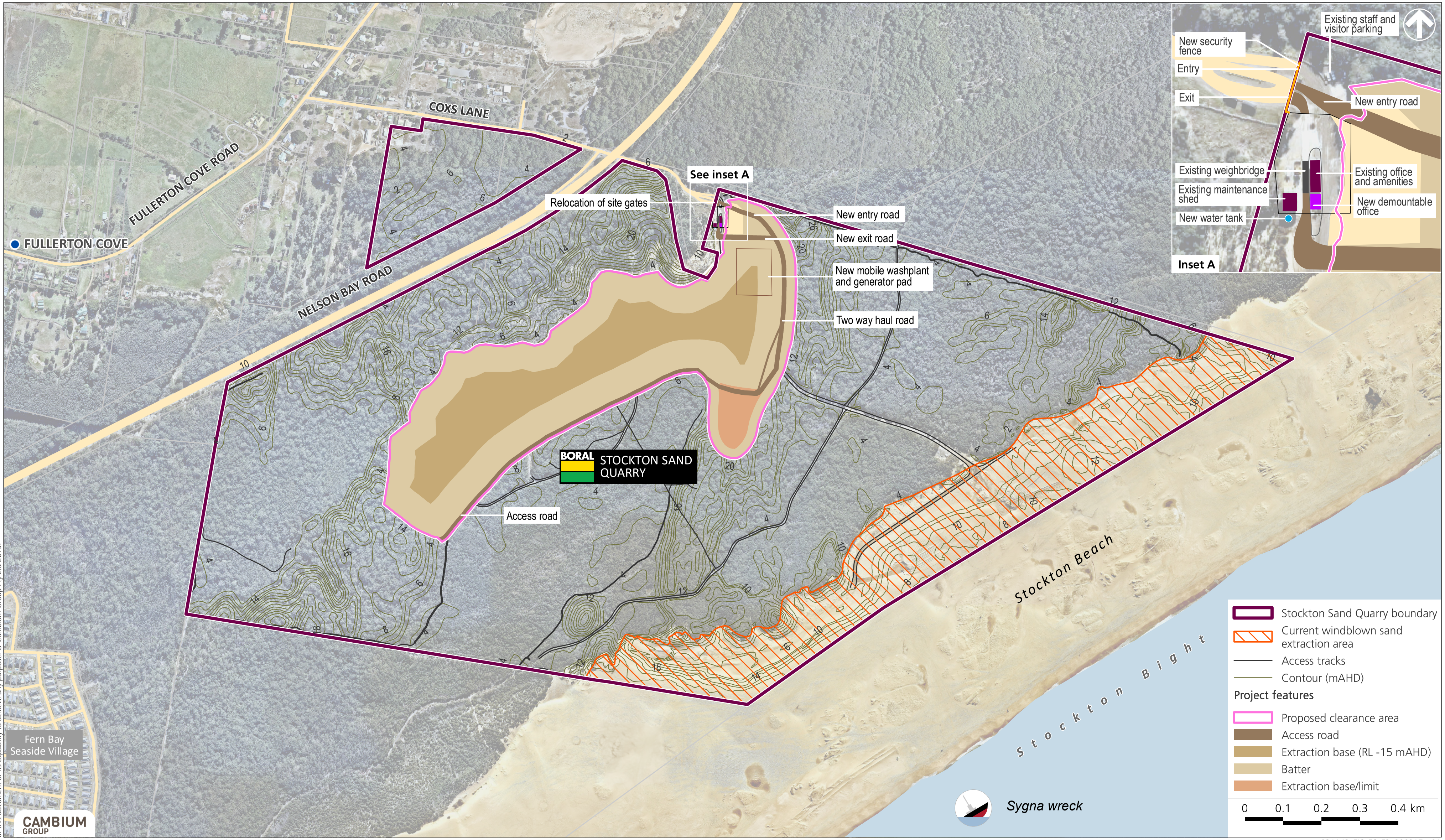
Sand/water pumped from the dredge will be passed over an initial screen in the wash plant to separate oversize organic matter or debris and into a large wash tank to float out any fines (<75 micrometres). After washing, the sand will be pumped through a cyclone and stockpiled for further dewatering.

Dewatered sand will be loaded with a front-end loader and/or excavator into trucks for dispatch.

The project will provide continued direct employment for existing employees and provide additional employment opportunities, including flow on employment opportunities for numerous Boral and customer truck drivers and service personnel.

Figure E.2
The Project

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



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Source: LPI (2017), Photomapping Services (2018), Nearmap (2019, Boral (2019), Cambium Group (2020).

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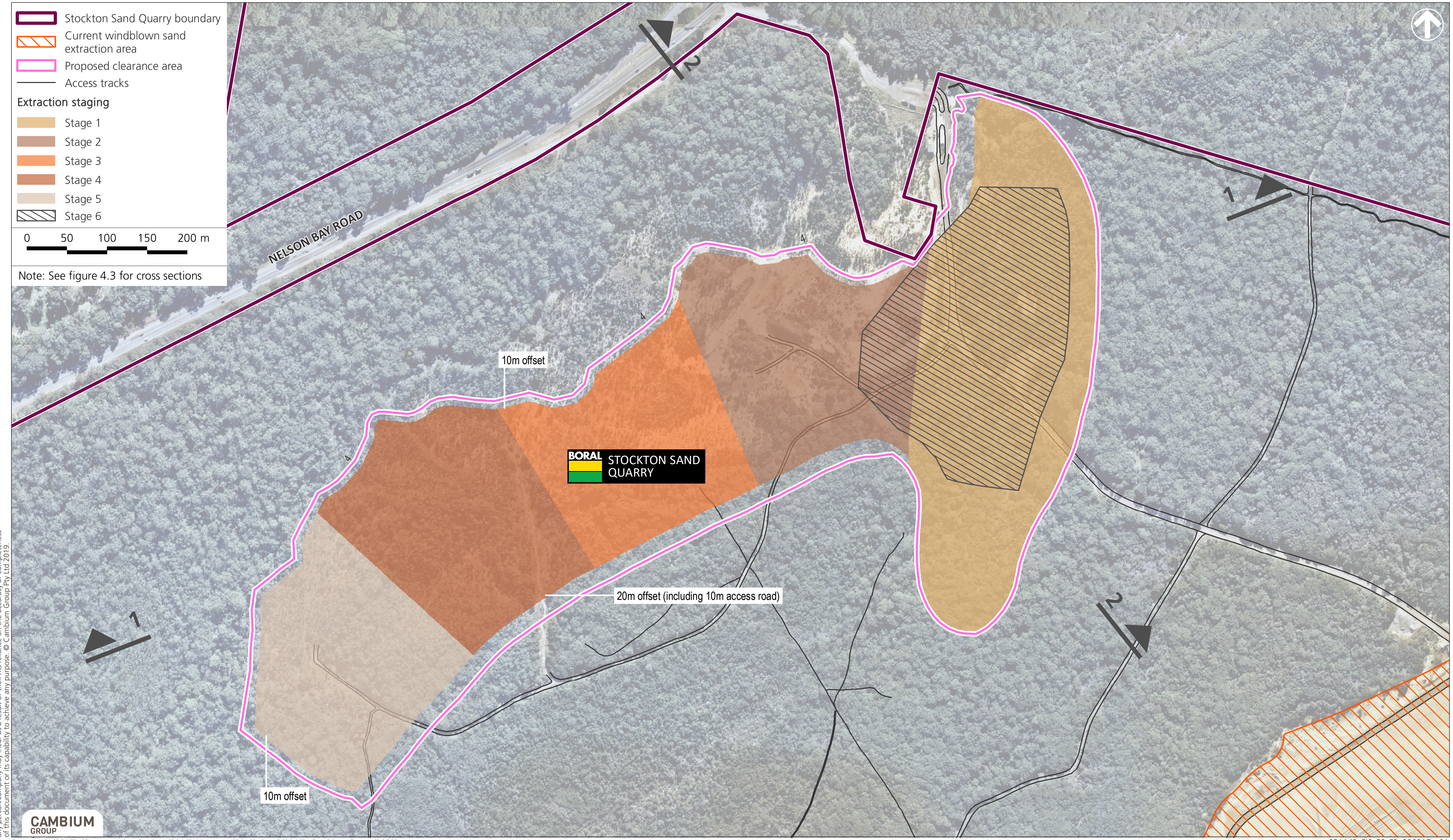
Figure E.3
Extraction staging plan

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



CAMBIUM GROUP

Source: LPI (2017), Photomapping Services (2018), Nearmap (2019), Boral (2019), Cambium Group (2020).

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Impact assessment

The project has undergone extensive environmental assessment from a range a technical specialists informed by government policy, consultant and community feedback.

Groundwater

Hydrogeological investigation was undertaken to establish the baseline environment for the Stockton Sandbeds and Tomago Sandbed aquifer systems including definition of water balance for the aquifer to determine the potential effect of the project on the groundwater system under varying climatic conditions.

The baseline environment was established through reviews of existing data supplemented by a field investigation of the project site comprising:

- installation of a groundwater monitoring bore network;
- physical aquifer testing on installed bores to determine aquifer parameters; and
- changes in groundwater levels and chemistry in monitoring data over time under varying climatic conditions were determined.

The findings of the investigations are set out in the Hydrogeological Impact Assessment (HIA) report.

The HIA concluded that potential physical impacts to the aquifer will be minor to negligible as the project site represents a small contribution to the overall catchment water balance, and there are no potential receptors to groundwater discharge down-gradient of the project site other than the ecosystems of the Pacific Ocean and Fullerton Cove.

The existing groundwater management plan for the site will be updated to include the management and monitoring measures in the HIA.

Biodiversity

A Biodiversity Development Assessment Report (BDAR) was prepared in accordance with Office of Environment and Heritage’s (OEH) (2017) *Biodiversity Assessment Method* (BAM). This comprised assessing the project site’s landscape features, native vegetation and threatened species and populations, followed by an impact assessment considering avoidance and minimisation of impacts, impact and offset thresholds and offset requirements.

Public databases, vegetation mapping and the BAM Calculator were used to predict the threatened flora and fauna species, and threatened ecological communities, which could exist in or frequent the project site.

Field surveys for the project confirmed vegetation in the project site mainly comprised native regeneration associated with rehabilitation of the former inland extraction area. The project site was found to comprise two plant community types (PCT):

- PCT1646 - Smooth-barked Apple/Blackbutt/Old Man Banksia woodland on coastal sands of the Central and Lower North Coast; and
- PCT1644 - Coast Tea Tree - Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast.

No threatened ecological communities (TEC) as defined by the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been identified at the project site.

The following direct impacts would result from the project:

- clearing of native vegetation and associated habitat, conservatively estimated to be 35.66 ha, including 32.75 ha of previously rehabilitated areas;
- clearing of approximately 2.48 ha of exotic vegetation; and
- clearing of 26.59 ha of associated species credit fauna habitat for the Squirrel Glider.

Mitigation and management measures will be implemented to avoid or minimise impacts to biodiversity in and adjacent to the project site. Additionally, a strategy will be developed to offset the vegetation clearing impacts on biodiversity, which will be based on the following credit requirements:

- Ecosystem credit requirements:
  - 396 ecosystem credits to offset removal of the Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast PCT; and
  - 37 ecosystem credits to offset removal of the Coast Tea Tree - Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast PCT.
- Species credit requirements:
  - Squirrel glider (*Petaurus norfolcensis*) – 521 credits.

Air quality

An air quality impact assessment was undertaken to consider from the effects of the project on nearby sensitive receivers. The assessment included the contribution of existing local emission sources and was undertaken in accordance with the NSW Environment Protection Authority's (EPA) (2017) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Total suspended particulates, deposited dust, PM_{10} and $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 10 µm and 2.5 µm or less) will be the primary emissions from the project. Other air pollutants potentially associated with the project are nitrogen dioxide (NO_2) and sulphur dioxide (SO_2), which could be generated by vehicle emissions.

Worst case pollutant generation scenarios for the project were assessed using emissions reduction factors, which assume the application of management measures.

The project, in combination with other local emissions sources, will not result in exceedances of particulate matter and dust deposition criteria at any privately-owned sensitive receivers. The assessment of cumulative 24-hour average PM_{10} concentrations found that the project, in conjunction with surrounding third-party extractive operations, will not increase the number of days above the 24-hour average criteria for $PM_{2.5}$ and PM_{10} at any sensitive receiver.

An air quality management plan will be prepared prior to the start of project operations. The plan will outline the measures to manage dust emissions at the site and include key performance indicators, response mechanisms, compliance reporting and complaints management.

Noise

A noise assessment was undertaken to determine the potential effect of the project on nearby sensitive receivers. The assessment was undertaken in accordance with the EPA (2017) *Noise Policy for Industry* (NPI), the former NSW Department of Environment, Climate Change and Water's (DECCW) (2011) Road Noise Policy (RNP), and considered the requirements of the existing environment protection licence (EPL) for the established quarry.

The worst case scenario for the project was identified as being the operating periods between 7 am and 6 pm (day time) and 6 am to 7 am (night time). In accordance with the NPI, project 'trigger levels' (operating noise criteria) were developed for the project and potential noise generation modelled, using details of machinery and its location on site. This assessment also incorporated noise enhancing weather conditions as it was determined that given the project will involve commencement of dredging operations prior to 7 am, which is the morning shoulder of the night period, the project will be subject to temperature inversions, which occur during the night time, as well as prevailing winds which occur during the evening and night periods.

The assessment determined that predicted noise levels for proposed day time and morning shoulder operations will comply with the operational noise trigger levels at all locations. The highest predicted noise level during the morning shoulder, which could interrupt sleep at the nearest receiver, was estimated to be less than the maximum noise trigger level. As such, the project would not disturb sleep.

The project will achieve compliance with all road traffic noise criteria.

The residual noise impact is the exceedance of the project noise trigger level after all feasible and reasonable mitigation measures have been considered. No residual impacts are predicted at any privately-owned receivers and, therefore, receiver-based treatments or controls are not required.

Boral will continue its noise compliance monitoring and community consultation and will implement measures if an exceedance is detected or a complaint is received from a member of the community.

Traffic and transport

A traffic assessment was undertaken to determine the potential effect of the project on the capacity of the local and regional road network. A road safety audit was also completed.

Boral currently operates an existing quarry from the site, this quarry has consent to dispatch up to 500,000 tonnes per annum. The project seeks to increase this limit to a maximum of 750,000 tpa across both quarries (the project area and the existing windblown project). The increase in volumes is sought until 2028 when the existing quarry operation will cease.

Accordingly, the traffic assessment was based on the maximum potential traffic generation associated with the dispatch of up to 750,000 tpa and 70,000 tpa of Virgin Excavated Natural Material. The projected change in maximum traffic volumes on a peak day is summarised in **Table E.1**.

Table E.1: Comparison of traffic generation between existing quarry operations and the project.

Element	Existing (windblown sand extraction area)	Project to 2028 (windblown sand extraction and project)	Project beyond 2028 (project only)
Tonnes transport per annum	500,000	750,000	500,000
VENM imports per annum	Nil	70,000	70,000
Vehicle movements (in/out)	152	284	208

Up to 284 two-way heavy vehicle trips could occur in the maximum or peak day to 2028. This will be an increase of 132 two-way heavy vehicle trips per day compared to the existing operation. Up to 56 additional two-way heavy vehicle trips could occur from the maximum or peak day after 2028.

The project will generate 30 inbound and 30 outbound heavy vehicle trips during the maximum hour of operation for product transport and VENM importation (60 two way heavy vehicle trips).

Traffic modelling has indicated that the project will maintain the existing level of service at all intersections along transport routes to be used by Boral.

All intersections along transport routes to be used by Boral will have sufficient capacity for background traffic growth as well as project related traffic for the next 10 years.

The project will not result in any negative impacts to other road users, and will not require any upgrades to road infrastructure.

Social impacts

State significant resource projects can have both positive and negative social influence on receiving communities. To determine the nature of influence likely to arise as a consequence of the project a social impact assessment (SIA) was undertaken in accordance with the Guidelines published by DPIE. The SIA considered the potential for the project' to change people's way of life; community; access to and use of infrastructure, services and facilities; culture; health and wellbeing; surroundings; personal and property rights; decision making systems; and fears and aspirations.

The community was extensively consulted in 2018 and 2019 via correspondence, meetings, the media and social media to understand attitudes towards the existing quarry,project, and issues of most importance to the community. Issues of concern to the community were general in nature and predominantly associated with road safety and traffic impacts. The majority of community members consulted were unaware of the existing quarry and as such had no concerns around acoustic or visual amenity.

A social impact scoping exercise was undertaken using a variety of methods to determine how the project would interact with the human or natural environment, whether these interactions would generate an impact (positive or negative), how the potential impacts may be assessed and they degree of assessment required.

In the context of Stockton, the scoping exercise was based on the feedback received through early engagement with stakeholders. This process identified six areas of potential social impact including amenity, access, built environment, heritage, community and economics.

It was determined that some of these potential impacts required detailed assessment of impacts without management measures in the form of consultation with residents (noise, visual and dust impacts), consultation with Aboriginal stakeholders (heritage impacts), visual impact assessment, ethnographic content analysis (ECA – traffic impacts), participant observation (unauthorised access to the site) and interviews with stakeholders (visual impacts).

The project was predicted to have a positive impact on personal and property rights, specifically mitigation of a shortfall in natural sand supply for the local and regional economies, and employment benefits for employees and their households.

The following negative impacts were predicted:

- Access to and use of infrastructure, services and facilities – cumulative and perceived risk of increased traffic volumes and impact to the condition of roadways.
- Health and wellbeing – perceived personal safety risks for members of the public who access the site without authority.

All potential social impacts associated with the project will be managed via the implementation of mitigation, monitoring and management measures set forth in this EIS, coupled with ongoing community consultation and liaison, including notification of the exhibition of the EIS to potentially affected landowners.

Soils and land resources

The EIS has investigated the soil and land resources to determine the potential for acid sulfate soils (ASS) to occur on site, soil type with respect to agricultural capacity combined with changes in landform and topography as a result of the project.

Soils in the project site are mapped as containing a risk of ASS. The potential for ASS to occur in the project site was assessed including the drilling of four boreholes and subsequent soil sampling. Of the 44 soil samples collected and analysed from the project site only one had a moderate risk of ASS.

The risk for ASS was identified at a depth between 2.0 m to 2.5 m below the ground surface. Soil samples obtained above and below this depth in the borehole did not indicate ASS potential, and as such it was concluded the potential for ASS at the identified depth was a localised occurrence. The remainder of the project site was not identified to be at risk of ASS.

An ASS management plan will be prepared and implemented for the project in accordance with ASSMAC's (1998) *Acid Sulfate Soils Assessment Guidelines*.

The extraction of sand will alter existing landform and topography in the project site. As it would not be possible to reinstate the pre-existing landform and topography of the project site following completion of the project, the final land use objectives of the project site will aim to ensure that all landforms are adequately stabilised.

The project will not impact the beach, foredune, deflation basin and mobile transverse dunes of Stockton Bight as the project site is physically removed from, and downwind of these environments.

The majority of the project will be on land with Class 8 land and soil capability. Land in this class has extremely low capability and is incapable of agricultural land use. The central southern portion of the project is mapped as Class 5, with moderate to low capability and potential for limited agricultural land use such as grazing land.

The project will have minimal negative impact on the overall land capability given it will be in a previously disturbed quarry pit and on land with low land and soil capability and use of the site for extractive industry will not detract from other agricultural land use.

The potential for contamination is considered low given historical land use at the project site, which comprised vegetation clearing and sand extraction. Following which, the disturbed area was rehabilitated when sand extraction ceased in 2008 and any introduced fill material was verified as VENM.

Notwithstanding, there could have been localised spills and leaks from equipment. However, as vehicle movements are typically contained to existing haul roads and this material, if removed prior to extraction of Stage 1, would not be reused on or off site.

Based on the low risk of contamination combined with a known and continuing use of the land for extractive industry, no further assessment of contaminated land or land remediation is considered necessary.

Aboriginal heritage

The project site is generally consistent with the footprint of an earlier quarrying operation. Previous archaeological investigations undertaken to support this earlier project indicated a low potential for subsurface Aboriginal archaeological material in the project area. Since that time, the project site was quarried to 5 m AHD and was considered to be highly disturbed with no Aboriginal archaeological sites known to be present within the project site.

Notwithstanding the above, an Aboriginal Cultural Heritage Assessment (ACHA) was undertaken to determine the likelihood for Aboriginal archaeological sites and artefacts to occur within the project area.

As part of the ACHA, the Aboriginal Heritage Information Management System (AHIMS) was searched for previous records of sites in and adjacent to the project site, combined with surveying the project site for new Aboriginal objects and consulting Aboriginal parties.

Surveying of the project site included visual inspection by the archaeologist and Aboriginal parties to confirm the extent and nature of previous disturbance. Previously disturbed areas had little to no archaeological potential given the previous removal of the dune mass.

Therefore, it was concluded that no further detailed investigation (test excavation) was warranted.

Aboriginal objects are known to occur in adjacent landforms and these are to be avoided by all project operations. The boundary of the project site will be clearly delineated and Aboriginal heritage avoidance measures will be included in Boral's existing environmental management strategy for the site.

Visual

The project site is located approximately 700 m from the nearest public vantage point and 480 m from the nearest sensitive receiver. The topography of the site and surrounds can be described as undulating with dunes reaching up to 20 metres in height. In comparison the project area sites at 5 m AHD.

Due to factors of distance from common boundaries, topography and vegetation, the project site remains predominantly visually obscured. The potential for visual impact associated with the project considered key vantage points and concluded the following:

- the project site will not be visible from Nelson Bay Road or surrounding residential areas; and
- the project may be partially visible from one vantage point immediately adjacent to Boral's seaward boundary, in particular those people accessing the top of the remnant hind dune on Stockton Beach.

From the vantage point at the remnant hind dune, users would be looking through Boral's existing quarry on the transgressive dunes. The change in the landscape and visual amenity would be transient and short term with impacts likely to dissipate following the completion of Stage 1 (expected to last up to two years dependant on the rate of extraction). As the project progresses and excavation reduces the ground level will retreat below the sight line of those using the dunes.

Notably, business operators who use this section of Stockton Bight for recreational ventures were consulted during the social impact assessment process and provided feedback that they had grown accustomed to Boral operations associated with the windblown sand extraction area and did not envisage that the project will have any negative implications for their business.

Surface water management

Surface water runoff from the project site will infiltrate the porous sandy soils to the underlying aquifer or directly drain to the newly formed dredge pond. There will be no discharge of surface water off the project site.

Given that rainfall infiltrates into the sandy soils quickly, the potential for erosion is negligible. However, access roads and the embankments of the proposed dredge pond will require VENM or other engineering fill that contain clays and other soil types of smaller particle sizes that are more erodible than existing sand material at the project site.

Erosion and sediment controls will be required for areas where VENM or other erodible material are imported to limit sediment movement into the dredge pond or into adjoining native vegetation.

Water demands for the project including dust suppression and drinking water will continue to be sourced via a water cart contractor, which sources water supply from the potable water network. Rainwater captured in an existing water storage tank will continue to be stored for on-site ablutions, which will be sufficient to supply water for the site depot.

The water balance comprised the following:

- direct water consumption and wastewater generation at the site depot;
- water consumption for dust suppression as required over the project site; and
- alterations to landscape conditions, primarily comprising removal of vegetation and transformation of dune areas to a dredge pond, as well as losses associated with the moisture content of extracted material leaving the quarry.

Water leaving the project site will include water lost to the atmosphere via evaporation of the dredge pond and water exported from the site as moisture content in the outgoing sand.

The quantity of water extracted will generally increase over time as the dredge pond surface area expands, peaking at an average 100 megalitres per annum (ML/y) in the final years of the project. As the dredge pond is created, direct rainfall to the aquifer will increase, as will evaporation and moisture losses in the exported sand.

The water balance model demonstrated the net extraction of water is more likely than net import to the aquifer from above average rainfall. Generally, the project will only contribute a net import of water to the Stockton Groundwater Source in years when rainfall is at or above the 90th percentile.

The project will expose the aquifer and result in extraction of groundwater resources via evaporation of the open dredge pond and outgoing moisture content of dispatched sand products. Groundwater extraction and aquifer interference activities are permitted via an aquifer interference approval under Section 91 of the NSW *Water Management Act 2000* (WM Act), and require an authorisation under the water sharing plan (WSP) via a water access licence (WAL) or some form of exemption.

The project will comprise a minimal impact on the quantity of the Stockton Groundwater Source. The available water in the Stockton Groundwater Source is 14,000 ML/y and after existing landholder rights and allocations are accounted for approximately 12,000 ML/y remains. The estimated annual extraction associated with the project is approximately 1% of the available allocations from the Stockton Groundwater Source.

Boral has previously been issued a WAL under the WM Act for the site, however, it has a zero share allocation for the Stockton Groundwater Source. Boral will therefore be required to obtain sufficient water share allocations from DPIE prior to the commencement of the project to account for the projected quantity of water extraction. These allocations can be obtained either through the trading of existing allocations, or through application for new allocations under Section 65 of the WM Act.

Mitigation and management measures, including monitoring regimes, would be implemented to ensure appropriate surface water management at the project site. Boral will ensure that the project is licensed under the WM Act, and implement strategies to minimise the quantity of water lost to evaporation and reduce the quantity of groundwater resource removed from the Stockton Groundwater Source for other potential users under the water sharing plan.

Historic heritage

Commonwealth, State and local heritage databases were searched to determine the presence of registered historic heritage items in the project site and surrounds. The project will not impact a registered heritage item/place protected under the NSW *Heritage Act 1977* or Port Stephens LEP.

The only listed heritage item within 500 m of the project is the ‘Stockton Beach Dune System’, which is listed on the Port Stephens LEP and is directly adjacent (north-east and south-east) to the quarry boundary. Despite proximity to the Stockton beach dune system, the project will not impact the beach, foredune, deflation basin and mobile transverse dunes of Stockton Bight as the project site is physically removed from, and downwind of these environments. As such, the project will not impact upon the natural landscape features comprising the listing.

The project site has been subject to previous surface disturbance and is unlikely to contain any unknown historic heritage items.

Waste management

The project will not generate significant quantities of general solid, hazardous or liquid waste. Any waste that is generated will be managed in accordance with the waste hierarchy in the NSW *Waste Avoidance and Resource Recovery Act 2001*.

Hazards and risks

The project will present some minimal hazards and risks, including storage and management of hazardous substances and dangerous goods.

The site will continue to store fuels associated with the operation of plant. All fuels will be stored safely in self-bunded areas and refuelling of plant only occurs within the depot site to reduce the incidence of spills impacting on soil and water health.

Hazardous substances to be used at the site were screened against the thresholds in DPE's (2011) *Applying SEPP 33* to determine if the project will be hazardous or offensive development under State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33). The quantities of dangerous goods proposed to be stored and handled at the project will be below the thresholds in *Applying SEPP 33*. Therefore, the project will not be a hazardous development.

The project site is on bushfire prone land. Detailed assessment has identified several points of upgrade to ensure protection of the site as well the provision of infrastructure to support firefighting efforts by the NSW Rural Fire Service. The implementation of these measures will protect Boral assets and improve protection of surrounding land.

Boral will update the existing pollution and incident response management plan, along with emergency and bushfire management procedures to reflect the project, which will continue to be implemented at the site to reduce hazards and risk associated with the continuation of sand extraction operations.

Economics

The project was considered for economic effects at a local and regional scale. The methods of determining economic effects were a cost benefit analysis (CBA) model that included consideration of the project not proceeding and the site operations ending in 2028.

CBA is concerned with whether the incremental benefits of the project exceed the incremental costs and, therefore, whether the community would, in aggregate, be better off 'with' the project compared to 'without' it. The CBA compared the production and environmental costs with the production benefits, such as the value of the sand resource and residual land values at the end of the project.

The CBA determined the project will have net social benefits to Australia of $41 million (M) and to NSW of $17 M including employment benefits and a 7% discount rate. Any unquantified residual impacts of the project after mitigation, offset and compensation would need to be valued at greater than these amounts for the project to be questionable from a national and NSW economic efficiency perspective.

Given this would not be the case, the project is desirable and justified from an economic efficiency perspective.

Rehabilitation

The project site is generally consistent with the footprint of the previous inland extraction area, which has and continues to be subject to rehabilitation in accordance with the *Rehabilitation and Landscape Management Plan* (ERM, 2010). The rehabilitation and landscape management plan outlines rehabilitation methods comprising species selection, weed and pest management measures, and monitoring and reporting requirements for rehabilitated areas.

A project specific rehabilitation strategy has been formulated, which aims to integrate the successful aspects of previous rehabilitation efforts at the site.

Upon completion, the project site will be left as a freshwater pond and rehabilitation will comprise:

- rehabilitating the pond edge, to provide additional habitat for native fauna;
- plant species planted along the edges of the pond will be selected to maximise the bank stability; and
- stabilising re-profiled areas as soon as possible, minimise potential erosion and degradation of areas of exposed topsoil.

In the initial phases of work, rehabilitation will primarily aim to stabilise the edge of the pond and where necessary continued use of a poly pipe to form a floating boom system at the exposed pond edge to minimise erosion.

Disturbed areas will be progressively rehabilitated to achieve the final landform. The general rehabilitation objectives are:

- rehabilitated land will be geotechnically stable and will not present a greater safety hazard than surrounding land to land-users, the public and native fauna accessing or transiting the post-quarried area;
- land capability will, as far as possible, be returned to a class similar to that existing prior to project commencement (class 5 or 8).
- rehabilitated landforms will be visually compatible with the surrounding natural landscape;
- rehabilitated landforms will be designed to drain surface runoff without causing excessive erosion or increasing downstream sedimentation;
- re-establishment of vegetation community which reflects the endemic ecology of the region and minimises the potential for weed invasion or vegetation community collapse; and
- rehabilitated landforms will not negatively impact visual amenity for nearby residents, thoroughfare motorists of Nelson Bay Road, or recreational users of Stockton Bight.

The objectives set out above would be reflected in an appropriate rehabilitation and landscape management plan.

Justification and conclusion

The Stockton Sand Quarry is a strategically important asset for Boral, as it supplies natural sand which has unique structural characteristics when compared to manufactured sand and is essential to meet design specifications on many infrastructure projects in Sydney, the Hunter region and other parts of NSW.

The project will provide the following benefits:

- supply of essential natural sand to major infrastructure and associated development projects;
- continued employment of four full time employees, one casual employee and truck/transportation drivers, with an additional two full time positions and two casual positions also created along with further employment benefits created through flow-on effects;
- optimal use of a regionally significant resource; and
- economic benefits to the nation, State and local community, including net benefits of $41 M and $17 M to NSW, along with employment benefits.

All potential amenity impacts from the project on sensitive receivers, comprising noise, air quality, visual and traffic impacts, will be below relevant criteria or have low residual impacts. The project will not have significant impacts on biophysical aspects such as surface and groundwater, and soil resources. However, the project will have residual impacts on terrestrial biodiversity, which will be compensated through the proposed biodiversity offset strategy.

The project will also have low residual impacts on groundwater quality and bushfire risk.

The project will have significant economic and social benefits and is in the public interest.

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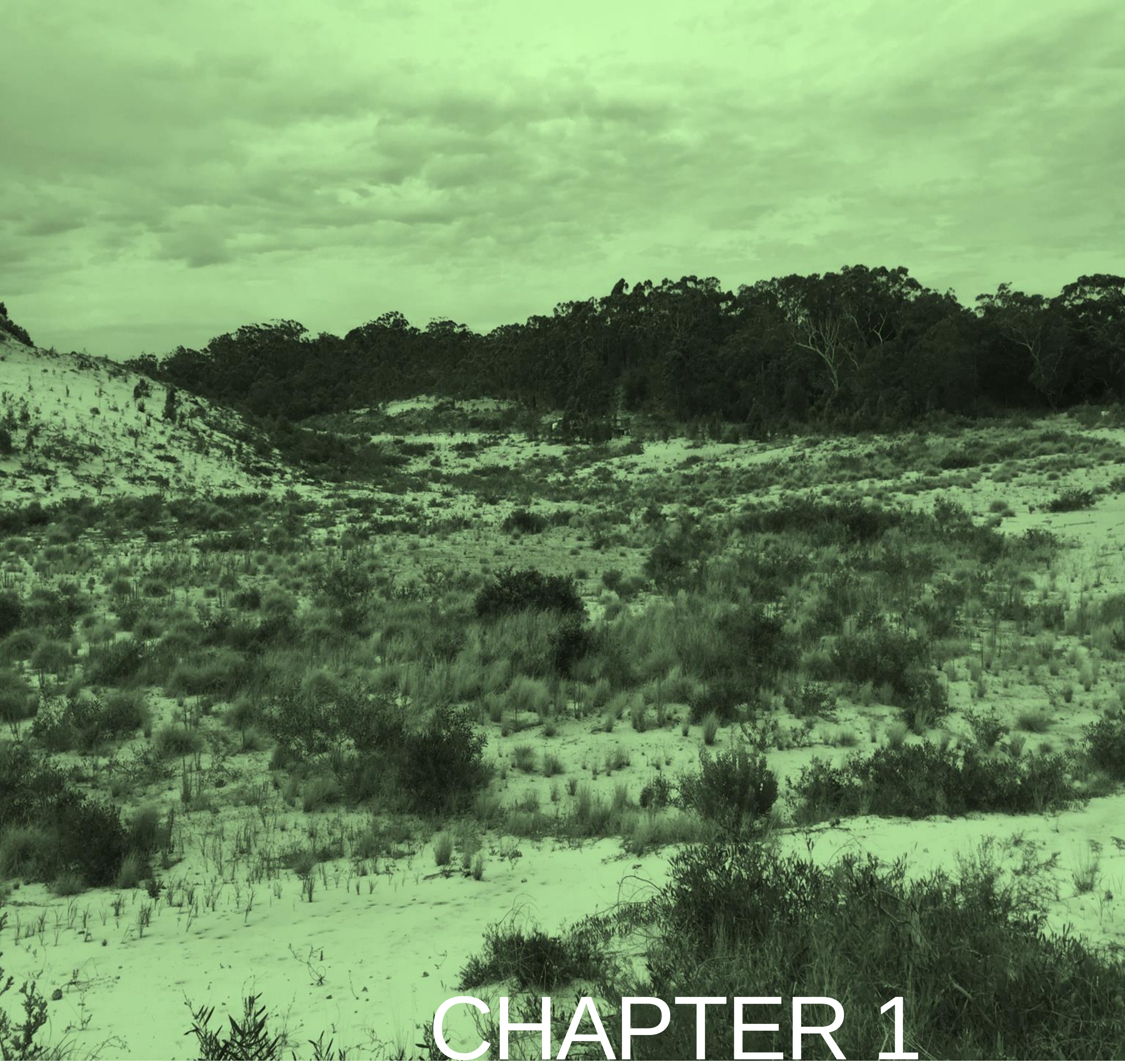


CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 Overview

Stockton Sand Quarry, located on Coxs Lane, Fullerton Cove is owned and operated by Boral Resources (NSW) Pty Ltd (Boral) and is legally described as Lots 1 and 2 in Deposited Plan 1006399 and Lot 3 DP 664552 (‘the site’).

The site has an area of approximately 246 hectares (ha) and has been used for the purposes of extractive industries (sand quarrying) since the 1970s. At present there is an existing quarry located on the windblown (transgressive) sand dunes of Stockton Bight which transports up to 500,000 tonnes per annum (tpa) of sand product for use in the building, landscaping and construction (the existing operation).

Due to current and future demand for sand in the Hunter and Sydney regions, Boral is seeking approval for continued and expanded operations at the site through a State significant development (SSD) application.

The proposed development (the ‘project’) involves the extraction of sand from the inland vegetated dunes of the quarry in a staged process by front-end loader/excavator to a depth of 4 metres (m) Australian Height Datum (AHD) in Stage 1 and subsequent dredging from 4 m AHD to -15 m AHD in stages 2-6.

The ‘project site’ contains all areas to be disturbed by project operations and covers an area of approximately 37 ha.

The application seeks permission for a site-wide increase on the transport limit to 750,000 tpa (i.e. the windblown sand extraction area and the project operations combined) until 2028, after which the site wide limit will reduce to no more than 500,000 tpa. The project will operate up to 25 years.

This environmental impact statement (EIS) has been prepared by Element Environment Pty Ltd (Element), on behalf of Boral for submission to the Department of Planning, Industry and Environment (DPIE) to satisfy the provisions of Part 4 of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act).

1.2 Project need, justification and alternatives

This section outlines the strategic need and justification for the project, and describes the alternative options considered during conception of the project.

1.2.1 Need and justification

Boral is a leading producer and supplier of building and construction materials in the country. Accordingly, a significant amount of development in NSW, including many of NSW’s best known structures, are underpinned by Boral-supplied concrete, cement, asphalt and construction materials such as natural sand.

The leading suppliers of natural sand are under pressure to meet increased demand from approved infrastructure projects in Sydney, Newcastle and other parts of NSW as natural sand has unique structural characteristics to manufactured sand and is essential to meet design specifications on many infrastructure and associated development projects.

The project will provide:

- supply of essential natural sand to major infrastructure and associated development projects;

- continued employment of four full time employees, one casual employee and truck/transportation drivers, with an additional two full time positions and two casual positions also created along with further employment benefits created through flow-on effects;
- optimal use of a regionally-significant resource; and
- economic benefits to the nation, State and local community, including net benefits of $41 million (M) and $17 M to NSW, along with employment benefits.

Resource quality

Sand suitable for use in the construction and foundry industries occurs in the Stockton Bight dunes. Although the entire sand unit possesses some potential for a particular use, there are optimum areas from which these materials can be obtained. Previous resource investigations carried out at the quarry in 2013 and 2016 confirm the sand within Boral's land holding comprises a fine to medium grained sand suitable for use as a fine aggregate in concrete.

Sand suitable for concrete use must comply with relevant Australian Standards, and factors such as grain shape, composition and grading of the sand must be considered. The sand must be clean, fine to medium grained, and free of deleterious materials including friable particles, organic impurities, structurally weak substances, and alkali reactive materials. The sand in Boral's land holding meets these requirements and the main use proposed for the sand is concrete production within Boral's own concrete plants in the Hunter region and NSW beyond.

Leaching of the upper layers of vegetated dune sands, by organic acids, produces white, low iron sand below the organically enriched sandy topsoil layer. The leached white sand layer on Boral's property is of variable thickness but is generally thin. Below this thin white sandy capping there is a zone of iron enrichment, the sandy material within this zone being commonly termed ‘coffee rock’ or ‘waterloo rock’. This material varies in character from a thin crusty layer of loosely bound iron coated sand grains to a thick layer of moderately iron stained amber-brown sand. ‘Coffee rock’ or ‘waterloo rock’ is unsuitable for concrete production and (where it occurs) is blended with the thin white sand layer above (where it occurs) to produce a fill sand or is reused elsewhere on site for the purposes of rehabilitation. .

Fill sand is used in numerous construction applications, including use as a support filler under house slabs, as a filter material for pipe bedding and as a drainage layer under roads. Sand used for this purpose does not have to conform to the rigid specifications outlined for specialised sands. The sand, however, needs to be reasonably 'clean' (some impurities such as charcoal, shell material, and iron-staining can be tolerated) and not too fine grained.

In the manufacture of concrete, the fine aggregate component is achieved by blending fine sand with a coarse sand. In Boral’s case, the coarse sand is manufactured sand, which is a made from further processing of quarry dust which is a by-product of the crushing process.

Stockton fine sand is ideally matched to manufactured sand from Boral’s Peppertree Quarry, which supplies most of Boral’s concrete production requirements in the Hunter and Sydney regions. This means that Stockton sand allows the greatest utilisation of manufactured sand in the concrete blend, and therefore better utilises this scarce resource over a greater volume of total production than would otherwise have been produced with a less superior grading.

In this regard, Boral’s Stockton sand resource reduces the natural fine sand usage, and avoids the need to find and develop a more resource intensive source of fine sand.

Locational factors

In terms of weight and volume, more sand products have to be quarried and transported to construction sites than any other type of resource material. It is for these reasons that extractive sand sources need to be located as close as possible to the point of usage. The value to weight ratio is very low, making transport costs to the market highly sensitive.

Establishing sand extraction operations close to the construction market represents considerable savings in terms of construction and associated transport costs for projects in the Hunter region and greater Sydney that are to be serviced by the quarry. Over the life of the quarry this represents a significant benefit to the local community and the state in terms of reduced transport and associated infrastructure maintenance costs.

Alternative materials

Minor quantities of manufactured sand are derived from quarrying and processing of hard rock (quarry dust). Manufactured sand is assisting to prolong the life of the natural sand reserves, however manufactured sand is generally not suitable for use in concrete on its own and is typically either used in road base or blended with natural sand to produce an acceptable grade concrete sand.

Future demand

The demand for construction materials in major infrastructure and construction projects in the Lower Hunter Region and Sydney has been high in recent years and is expected to be strong for the foreseeable future.

Fine sand is a major component of concrete, particularly for domestic applications. For example, an average three bedroom brick veneer home on a concrete slab foundation, with concrete paths and driveways, consumes in the order of 50 cubic metres (m^3) of concrete, which contains 13 tonnes (t) of fine sand.

Boral uses sand extracted from the site as the fine sand component in concrete production. The future demand for fine grained sand will correlate with anticipated growth in residential development, commercial development, and major infrastructure and construction projects in the Hunter Region and Sydney during the next 15-20 years.

The growth of development in the Hunter region is driven by the Hunter Regional Plan 2036 (NSW Department of Planning and Environment, 2016). As detailed in the plan, the Hunter region is the largest regional economy in Australia, with the population of the region expected to grow by approximately 600,000 people over 20 years. The plan estimates an additional 70,000 dwellings would be required by 2036 to house the expanding population, together with forecast major commercial and health infrastructure development including proposed expansions of the University of Newcastle and John Hunter Hospital, and upgrades to transport infrastructure at Newcastle Airport, Port of Newcastle and strategic road networks (e.g. Nelson Bay Road duplication and extension of the Newcastle Inner City Bypass).

These projects would be reliant on concrete and other construction materials, of which fine sand resources, such as those to be extracted at the site, are a vital component.

Life of operation

Boral proposes to extract approximately 9 million tonnes (Mt) of sand for up to 25 years.

Taking into account the site’s existing operation, Boral is seeking a maximum site transport limit of 750,000 tpa (over the two projects) to 2028 when the extraction on the transgressive dunes is due to cease. At this time the transport limit will reduce to 500,000 tpa.

To allow for flexibility between the two projects, the project has been assessed based on a site wide maximum extraction and transport rate of 750,000 tpa.

1.2.2 Project alternatives

The following options were considered during formation of the preferred project.

Do nothing

Sand extracted from the quarry is used in the Hunter and Sydney regions. Boral's sand resource across all assets have been substantially depleted due to sustained demand across the building and construction industry.

The quarry will cease to operate in approximately three years' time if the project is not approved due to demand trends for natural sand products. This will result in loss of employment, reduced revenue to local service providers, reduced regional expenditure in the Port Stephens and Newcastle local government areas (LGA), sterilisation of a valuable resource and shortages of raw materials for essential infrastructure projects in the Hunter and Sydney regions, including provision of concrete and raw sand for road and rail upgrades, industrial development, and commercial and residential developments to be driven by the Hunter Regional Plan 2036.

The sand deposit at the site is highly suitable for use in concrete and is close to the source of demand.

Given that local demand for natural construction sand is unlikely to diminish, and the site is ideally located at the southern end of Stockton Bight to supply the Lower Hunter and Sydney market, it is most likely that other Stockton Bight sand suppliers further to the north will take up a shortfall in Boral's production if the quarry closes. As such, there is a possibility that sand will be purchased from elsewhere, likely further away from the end use. In this case, it is likely that road transport impacts will be compounded, and will increase the cost of sand and concrete.

Additionally, Boral will be required to purchase sand from other approved or yet to be approved Stockton Bight quarries. While it is not possible to clearly compare environmental impacts in this case, the project has a limited environmental effect as it is confined to an area which has been disturbed by quarrying operations in the past.

Additionally, because of the likelihood of alternate supply source being of a different grading, there is a greater likelihood that more fine sand will be required for extraction and transport in order to produce one cubic metre of concrete, when compared to the combination of fine sand resource extracted from Stockton Sand Quarry combined with Boral's manufactured sand source.

In summary, should the project not proceed, Boral will close the quarry in due course and have to rely on other sand sources locally or further afield, depleting those resources sooner. Importantly, not proceeding will mean that the community will lose the opportunity to allow the further development of an existing quarry operation with minimal environmental impacts. Conversely, alternative developments may require the disturbance of greenfield land parcels with more inherent environmental risks.

Alternative locations

As outlined earlier, the quarry is one of Boral's few remaining natural sand quarries. Boral's natural sand quarries are operating at full capacity in response to the significant increase in demand for natural sand.

The quarry is an ideal site to meet current and predicted future demand for natural sand as it has a substantial remaining natural sand resource and is relatively close to Boral's existing Hunter and Sydney supply contracts.

Other sand resources on Stockton Bight lie on Crown lands and, to a lesser extent, on freehold lands. Most sand deposits on freehold lands are already owned or being extracted by the construction sand industry. A few isolated sand bearing properties remain but the size of the sand deposits are generally too small for economical development.

Many millions of tonnes of sand lie on Crown lands on Stockton Bight but are unavailable for extraction by virtue of environmental protection zoning. Sand on Crown lands closer to Anna Bay which have appropriate zoning for extraction is generally too fine grained for concrete, being more suited to foundry applications and glass manufacture.

The dune sands on Stockton Bight need little or no processing to produce a grain size grading suitable for concrete manufacture. The only other source of sand in the region is the processing of soft rock. Friable sandstones at Blackhill, matrix sand from conglomerates at Teralba and overburden sediments in coal mines are examples, but in each of these cases, the cost of extraction and processing to produce suitably graded sand will be considerably higher than extracting the loose, naturally graded sands of Stockton Bight.

There are millions of tonnes of remaining sand suitable for production of concrete at the site. Several alternative scenarios were explored for the development of this remaining sand, culminating in the conclusion that the project represents the most environmentally, socially and economically sensible option.

Alternative materials

There are few alternative materials to replace natural sand in the production of concrete. Alternative materials are emerging, which represent viable supplements to natural sands, but not as replacements to natural sands. In recognition of the value of such alternatives, Boral is increasing its recycling and production of manufactured sand.

Manufactured sand created from quarry dust generated by the crushing of hard rock. Quarry dust is mainly blended into road bases, but many quarries process some of the dust to produce coarse sand for blending with finer grained natural sands to produce acceptable grade concrete sand.

Therefore, the alternative manufactured sand option is already being used to extend the life of natural fine grained sand sources. The inability of manufactured sand to be a complete replacement for natural sands is due to several factors. Quarry dust generally has a particle shape that is angular and often elongated, making concrete flow and concrete workability very difficult. Quarry dust also tends to be deficient in the fine end of the particle range and the addition of fine grained natural sand is required to fill out the grading. The addition of fine grained natural sand also helps concrete workability as the natural sands are often rounded.

Barmac crushing can be used to produce a dust with a better particle shape, but this in turn produces greater volumes of dust. A compromise is usually made, which invariably requires the use of natural sand to even out grain shape and particle size deficiencies.

Boral is engaged in ongoing research and development into the production of manufactured sand to supplement the natural sand market. In the immediate term Boral is investigating options to utilise glass sand or recovered sand from virgin excavated natural material (VENM). However, these sources are yet to receive approvals.

In the case of glass sand, commercial production levels are low (as a new recovered resource and burgeoning industry) and the planning approvals necessary to permit the importation and blending of these materials to create building products is not widely accepted by consent authorities.

Additionally, recovered sand product from processing VENM does not typically yield the same high-quality product as that proposed to be extracted from the quarry. Cumulatively this will impact on the production of key building materials, in particular the production of concrete which will have wider implications for the building and construction industry in the Hunter and Sydney regions.

Alternative non-naturally occurring materials exist which can substitute to some extent for the naturally occurring construction sand sources. Examples are recycled building and demolition waste, granulated blast furnace slag and fly ash from coal fired power stations. However, these alternatives generally have high handling, transport and processing costs, although they are commonly used for road base and other applications.

Boral is actively involved in construction and demolition recycling with a major plant at Wetherill Park in Sydney and approved operations at Somersby on the Central Coast and Kooragang Island. The products from these operations supplement the natural sand market.

Whilst new innovation in alternative materials is emerging, the need for constant supply of fine natural sands for concrete production remains integral.

Alternative project design

Various options were considered when formulating the preferred concept of the project. Such options included:

- Extension of the extraction footprint beyond the 1996 development consent boundary, and subsequent extraction and dredging of this footprint. This option will maximise access to sand resource but increase the degree of environmental impacts from the site.
- Extension of the extraction footprint beyond the 1996 development consent boundary, inclusive of sand extraction to 4 m AHD with no dredging operations. This option will reduce the degree of ground disturbance as is experienced with dredging but will also increase the area of environmental impact and fail to maximise use of the sand resource beneath 4 m AHD.

Confinement of the project to the previously disturbed inland extraction area development consent boundary will result in the least environmental and social impacts.

There are no standardised industry guidelines that inform sand quarrying methods, and as such there is no definitive source that advocates dry extraction methods over wet extraction methods. The method employed is driven by the accessibility, quality and location of an identified resource.

To date, dry extraction methods have typically been adopted to extract sand from the site and other operating sand quarries within the Port Stephens and Newcastle LGAs. However, despite this localised dominance of dry extraction methods, in land sand dredging (i.e. dredging outside marine, estuarine or river environments) is an accepted approach to quarry operations and can be undertaken to achieve ‘best practice’. An example of this is Boral’s Dunmore Sand and Soils has been operating on the south coast of NSW for over 30 years without incident.

In relation to the project, the quarrying approach or method has been developed and selected with the view to avoiding impacts where possible. This avoidance strategy has informed the analysis and identification of options at every step of the project from site selection to plant material identified for use on site. The project approach adopted by Boral in the context of the site is considered to be reflective of best practice.

Table 1.1 outlines the various options considered for the project design and reasoning as to why the preferred project was selected.

Table 1.1: Project design considerations

Project element	Options	Considerations	Why the preferred option?
Source/location of works	Existing site; New site; or Land based extraction or marine extraction	There are several other sand reserves and operations within proximity to the site. These are currently owned by Boral competitors and are not viable options. Boral has and continues to investigate alternative resource sites across NSW. Investigations have not been identified as suitable alternative to date due to the following: ▪ capital costs; ▪ availability of an alternate site with the appropriate sand quality; and ▪ legal and planning framework. Marine based sand extraction is not currently supported by existing legal frameworks.	Investigations of the south coast of NSW failed to identify a new site or resources that were suitably zoned or located near transport infrastructure or customers. On balance, there was a lack of availability of viable new sites. Accordingly, Boral selected to progress an option to maximise the use and value of an existing asset. The benefits of utilising the existing site include: ▪ maximisation of an existing asset; ▪ permissible/consistency with established planning framework; and ▪ previous disturbance on the site results in reduced potential for new or additional impacts, particularly in relation to archaeology/biodiversity etc.
Extraction methodology	Dry extraction or wet extraction	To obtain the same volume of sand resource using dry extraction would require works to stay at RL 4 m AHD, thereby requiring removal of approximately 106 ha of vegetation. This alternate footprint would expand to include areas to the west of the preferred project site, extending towards Nelson Bay Road and east south east along the shared Worimi lands boundary towards Stockton Bight and the existing windblown sand extraction area. The majority of this land has not been previously disturbed by earlier extractive industries. Increasing the disturbance footprint would increase the environmental impacts (e.g.	Wet extraction techniques support a reduced disturbance footprint that can be contained to an area that has been previously disturbed. The smaller footprint avoids unnecessary harm to biodiversity and potential archaeology, and minimises visual amenity, noise, air quality and social impacts. Wet extraction techniques generally have less residual environmental impacts involving minimal truck movements to extract the material, and minimal air emissions as wet stockpiled material does not generate dust.

Project element	Options	Considerations	Why the preferred option?
		vegetation removal, noise, air quality, visual impacts, social, heritage/archaeology). Increased use of water required to minimise windblown sand. Visual impacts – to achieve the same volume of resource, dry extraction techniques would require an increase in the area of land cleared.	
Wet extraction methods	Possible methods for wet extraction: ▪ dredge; or ▪ dewater aquifer (to support dry extraction).	The option to dewater the aquifer would have increased impacts by lowering the aquifer by pumping water from the aquifer for storage in water tanks or similar. These techniques remove water from the aquifer until dry extraction methods can be used, thereby compounding the potential for adverse and increased environmental and social impacts. The range of impacts that could arise from a dewatering method would include those associated with lowering of the water table including, increased potential for the generation of ASS, impact on groundwater dependent ecosystems, impact on other groundwater users, and impact on groundwater and surface water recharge and the water cycle.	It is evident from the potential array of impacts likely to result from dewatering that dredging is the best outcome based on the reduced potential for adverse environmental impact. It also presents as the most practical option, as the water is not required to removed and stored elsewhere while operations progress.
Dredge type	There are multiple dredge types, including: ▪ mechanical; ▪ hydraulic; and/or ▪ electric.	Mechanical – not appropriate for fine sand material types, increased costs; noise from heavy plant; intensity of operation (management issues). Hydraulic dredge better than mechanical when working with fine material. However, requires the use of more oils and required to be stored on a pontoon in the dredge pond. The option to use an electric dredge reduces the need to introduce oils to water there by reducing the potential for water pollution.	The electric dredge will not reduce the need to use oils and lubricants that can pose a potential impact to groundwater quality. This type of dredge is also well suited to working with fine grained sand material.
Electric dredge types	Options considered: ▪ suction dredge; or	Cutter-suction dredges are typically used on hard surface materials such as gravel. The cutting action increases noise generation and	The fine to medium grained sand material present at the site is better suited to the use of a suction dredge as it

Project element	Options	Considerations	Why the preferred option?
	▪ cutter suction dredge	contributes to increased turbidity (lowering water quality). Use of a cutter-section dredge is not suitable for the material type due to free flowing nature of sand not requiring cutting.	is relatively free flowing and does not require cutting. The suction dredge, in part due to the material, will have low noise operating levels and will not increase turbidity in the same manner.
Wash plant	Options considered: ▪ cyclone (dewater); ▪ screw (dewater); and/or ▪ dewatering screen.	The process of washing sand ensures a higher quality of product allowing the resource to be used for a broader range of end uses. The following matters were considered in identifying the preferred washplant/dewatering plant: ▪ Product quality; ▪ Efficiency of the plant and capacity to remove excess moisture from product; and ▪ Cost of maintaining and operating plant **Screw/sludge dewatering** relies on gravity for water and sand to be separated. The resultant moisture content in the sand tends to be higher, requiring longer stockpiling times and potentially increases the volumes of trucks required to move product (as a higher moisture content will increase the weight thereby reducing product volume able to be moved).	The preferred wash/dewatering plant is the pre-screen; cyclone dewatering screen. The method of washing the sand has been selected with the aim of improving the quality of the end resource as well as removing as much water/moisture content as possible. Dewatering using cyclone is more efficient achieves a lower moisture content than screw or gravity dewatering process. Allowing for material to be removed and dispatched faster while negating the need to stockpile large quantities of material for long periods of time (thereby avoiding material being lost through wind erosion or affecting local air quality).
Utilities (power)	Diesel generators or electricity network supply	The depot is currently connected to the local power grid. Investigations were made into extending power further into the site to reduce reliance on diesel, which would have an improved emissions outcome and reduce the volume of and use of fuels on site. However, in the short term this option is not financially viable.	In the short term use of diesel fuels to support the generators and operation of the dredging plant will be implemented. To ensure the protection of the underground aquifer refuelling techniques including handfilling will be adopted, which are known to have a reduced incidence of spillages.

Project element	Options	Considerations	Why the preferred option?
		Furthermore, dependant on the alignment of the electricity conduits there is potential for increased impact on vegetation.	All refuelling of mobile plant will occur within the depot where there is permanent, impervious surface and bunding to prevent the migration of fuels through sand to the aquifer.
Stacker options, used to stockpile product (affixed to the washplant)	Options considered included: ▪ telescopic stacker (fully automated); and/or ▪ radial/fixed stacker.	Radial fixed stackers stockpile material in a standard conical fashion with the arm of the stacker static over a single position until the stockpile height is achieved. This method results multiple conical stockpiles and in issues of product segregation (course to medium material located at the base and around the edges with finer grain material centralised to the centre conical), thereby resulting in a poorly blended and degraded material. Radial fixed stackers also result in higher levels of dust as re-blending is typically required. The process of re-blending would result in increased environmental impacts associated increased vehicle movements and formation of the stockpiles (separated finer material at the top is more susceptible to windblown losses). Less vehicle movements would be required as no double handling (reduced vehicles; reduced dust so improved air quality).	The telescopic stacker stockpiles in specification material and limits the need for re-blending. This in turn reduces the generation of dust and improves air quality as the product is not unnecessarily moved around or 'processed'. The telescopic conveyor builds layered windrows to minimise material segregation, and can increase stockpile capacities by 30%.
Waste management – screened material	Options considered included: ▪ Dispose off-site; and/or ▪ Reuse on site.	Option to reuse on site as road base on haul roads (maintenance and construction) or direct to landfill off-site. Disposing of material off-site contributes to increased costs, truck volumes and associated noise and potential traffic impacts.	Reuse is the most practical and viable outcome in relation to avoiding unnecessary costs in terms of disposal and transportation. Reuse avoids unnecessary environmental impacts associated with additional truck movements, noise, dust and the like.
Vegetation clearing	Options considered: ▪ clear all vegetation in a single stripping campaign; or	Increased areas of clearing have the potential to increase the rate of erosion by wind, impacting on air quality, local amenity and resource quantities.	Undertaking clearing efforts progressively reduces potential air quality impacts and prevents loss of resource.

Project element	Options	Considerations	Why the preferred option?
	▪ progressive campaign vegetation removal.		

1.3 Project objectives

The project has the following main objectives:

1. enable the continuation of sand extraction at a long standing quarry in an environmentally, socially and economically sustainable and ethical manner;
2. ensure the continued supply of essential natural sand to major infrastructure and associated development projects in the Hunter and Sydney regions;
3. continue the employment of four full time employees, one casual employee and truck/transportation drivers, with an additional two full time positions and two casual positions also created, along with further employment benefits created through flow-on effects;
4. promote optimal use of a regionally-significant resource; and
5. facilitate economic benefits to the local community through the purchase of goods and services and local expenditure both directly and indirectly through employee wages.

1.4 Project overview

The project is summarised in **Table 1.2** and described in detail in **Chapter 4**.

Table 1.2: Project summary

Project component	Summary of the project
Extraction method	Sand will be extracted from the inland vegetated dunes of the quarry to a depth of 4 m AHD in Stage 1 and subsequent dredging from 4 m AHD to -15 m AHD in Stages 2-6.
Resource	Approximately 9,032,138 tonnes of sand will be extracted.
Project site	The project site contains all areas to be disturbed by project operations plus ancillary areas such as the depot upgrades. It covers approximately 37 ha.
Transport (dispatch) limit	Up to 750,000 tpa of sand will be dispatched until 2028 when transport limits will reduce to 500,000 tpa.
Project life	25 years.
General infrastructure	The existing quarry comprises access and haul roads, administration offices and visitor/employee car parking facilities, weighbridge, electricity supply and distribution, utility infrastructure, workshop, stores and ablution buildings. New or augmented infrastructure will be constructed in Stage 1 will comprise: ▪ Construction of a new entry road. ▪ Construction of pad for the wash plant and diesel generators after vegetation removal and sand extraction in the northern portion of Stage 1. ▪ Relocation of the parking area and the security gates northward across the entry road to enclose the parking area and the new entry road. The docketing kiosk registering vehicles entering the site will also be relocated. Reconfiguration of the existing depot, to include: ▪ installation of a new prefabricated office building; ▪ relocation of onsite materials storage; ▪ replacement of roofing for the workshop; and ▪ installation of a 30,000 litre (L) water storage tank for firefighting.
Water use	Water will be supplied as follows: ▪ Water used for dust suppression purposes will be supplied via a water cart contractor from the potable water supply;

Project component	Summary of the project
	▪ Rainwater will be stored in a 10,000 L yank and used for on-site ablutions. It will be supplemented with purchased water supplied in bulk, as required; and ▪ drinking water will be imported to site in 20 L containers. The long-term average water use for existing dust suppression is approximately 12 megalitres (ML) per annum. However, there may be additional water use for dust suppression when there are higher than average dry days and the length of internal haul roads increase. A 30,000 L tank will be purchased to provide water for firefighting. Surface water runoff from active operational areas will infiltrate through the porous sandy soils to the underlying aquifer or directly drain to the newly formed dredge pond.
Operational workforce	Six full time and three casual employees.
Hours of operation	The project will continue to operate in accordance with the following approved hours of operation in the 2006 development consent: ▪ Monday to Friday – 6:15 am to 5:00 pm; ▪ Saturday – 6:15 am to 12 noon; and ▪ no operation on Sundays or Public Holidays. The site is also approved to operate extended hours during major supply contracts as follows: ▪ Monday to Friday – 6:15 am to 6:00 pm; ▪ Saturday – 6:15 am to 3:00 pm; and ▪ no operation on Sundays or Public Holidays.
Key environmental impacts and mitigation measures	The following potential key project impacts have been assessed: ▪ surface water and hydrology; ▪ groundwater; ▪ air quality; ▪ noise; ▪ Aboriginal heritage; ▪ biodiversity; ▪ traffic; ▪ economics; ▪ acid sulfate soils (ASS); and ▪ social. These assessments have identified environmental management and mitigation measures which will be implemented during establishment and operational phases of the project, to minimise environmental, social and economic impacts associated with the project.
Capital investment value	$3.43 million.

1.5 The applicant

Boral Resources (NSW) Pty Ltd is a wholly owned subsidiary of Boral Limited and is the applicant for the project. Boral Limited is an international building and construction materials group, headquartered in North Sydney, Australia. Boral's competitive position is underpinned by being a market leader in cement and construction materials in Australasia, Plasterboard in Australia and Asia and Cladding and Roof Tiles in the USA.

The Boral Australia division employs over 5,000 employees in its quarry, concrete, asphalt, concrete placing and cement operations. The business is a major supplier of products to the dwelling, commercial construction, and roads and engineering.

Boral Australia operates over 110 quarries producing products such as concrete aggregates, crushed rock, asphalt and sealing aggregates, road base materials, sand and gravels for the Australian construction materials industry.

1.6 Document purpose

The project is SSD pursuant to Schedule 1 of State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). Accordingly, approval is required under Part 4, Division 4.2 of the EP&A Act.

This EIS has been prepared by Element on behalf of Boral to support the SSD application for development consent under Section 4.12(8) of the EP&A Act. It has been prepared in accordance with the form and content requirements in clauses 6 and 7 of Schedule 2 of the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

The primary objective of this EIS is to inform the public, government authorities and other stakeholders about the project and the measures that will be implemented to mitigate, manage and/or monitor potential impacts, together with a description of the remaining (residual) social, economic and environmental impacts.

It addresses the specific requirements in the Secretary's environmental assessment requirements (SEARs) issued by DPIE on 16 November 2018. The SEARs are in **Appendix A** along with a table identifying where each requirement has been addressed in the EIS. The EIS has also been prepared with input from several technical specialists.

1.7 Secretary's environmental assessment requirements

The SEARs and references to the relevant chapter and/or section of the EIS where they have been addressed are listed in **Table 1.3**. The requirements relevant to each environmental aspect are also provided at the introduction of each chapter for ease of reference. The SEARs (including government agency requirements) are reproduced in **Appendix A**.

Table 1.3: Project SEARs

SEARs	EIS reference/section
GENERAL	
The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. In particular, the EIS must include:	Section 6.3.6
▪ a standalone executive summary;	Executive Summary
▪ a full description of the project, including: - a summary of the regional and local geology;	Chapter 2
- the history of past production undertaken in proximity to the proposed development	Chapter 3
- the resource to be extracted, including the amount, type, quality and composition;	Section 1.2.1 and 4.3
- the site layout and extraction plan, including cross sections;	Chapter 4

SEARs	EIS reference/section
- the production process and processing activities, including the in-flow and out-flow of materials and points of discharge to the environment;	Chapter 3 and 4
- surface infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);	Chapter 2, 3 and 4
- a waste (overburden, rejects, tailings etc) management strategy;	Chapter 19
- a water management strategy;	Chapter 17
- a rehabilitation strategy to apply during, and after completion of, extraction operations, and proposed final use of site;	Chapter 22
- the likely interactions between the development and any existing, approved or proposed development in the vicinity of the site; and	Chapter 3 and 4
- a proposed production and transportation cap based on the maximum annual tonnage extracted;	Section 4.2.8
▪ a strategic justification for the development focussing on site selection and suitability of the proposed site;	Section 1.2
▪ a list of any approvals that must be obtained under any other Act or law before the development may commence;	Section 6.5
▪ an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including:	Chapters 8-22
▪ a description of the existing environment likely to be affected by the development, using sufficient baseline data;	Chapter 2
▪ an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	Chapters 8-22
▪ a description of the measures that would be implemented to mitigate and/or offset the potential impacts of the development, and; an assessment of: - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;	Chapters 8-22, Chapter 23
- the likely effectiveness of these measures; and	As above
- whether contingency plans would be necessary to manage any residual risks;	As above
▪ a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	Chapter 23
▪ a consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS;	Chapter 23
▪ consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007); and	Chapter 6
▪ the reasons why the development should be approved having regard to:	Section 1.2, Section 6.3.2, Chapters 8-22
- relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act;	Section 6.3.1
- the biophysical, economic and social impacts of the project, including the principles of ecologically sustainable development;	Chapter 13 and 21, Section 6.3.2
- the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses;	Section 6.4.1

SEARs	EIS reference/section
- feasible alternatives to the development (and its key components), including the consequences of not carrying out the development;	Section 1.2
▪ a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	EIS Certification
While not exhaustive, Attachment 1 of the DP&E SEARS contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the: ▪ capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and	To be provided to DPIE separately to this EIS.
The EIS must address the following key issues:	
WATER	
▪ a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;	Chapter 8 and 17, Appendix D and L
▪ identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*;	
▪ demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan;	
▪ a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo; and	
▪ an assessment of any likely flooding impacts of the development;	
▪ an assessment of the likely impacts on the quality and quantity of existing surface and ground water resources (having regard to the Williamtown RAAF Base Contamination Broader Management Zone), including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives;	
▪ a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	
AIR QUALITY	
▪ detailed air quality impact assessment (AQIA) of potential construction and operational impacts, in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, and with a particular focus on dust emissions including PM2.5 and PM10, and having regard to the Voluntary Land Acquisition and Mitigation Policy.	Chapter 11, Appendix F
NOISE	
▪ a detailed assessment of the likely construction, operational and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy.	Chapter 10, Appendix G
BIODIVERSITY	
▪ accurate predictions of any vegetation cleared on-site;	Chapter 9, Appendix E

SEARs	EIS reference/section
▪ a detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report; and	
▪ a strategy to offset any residual impacts of the development in accordance with the offset rules under the Biodiversity Offsets Scheme.	
HERITAGE	
▪ an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and	Chapter 15, Section 5.4
▪ identification of historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1 of the DP&E SEARs.	Chapter 18
VISUAL	
▪ an assessment of the potential visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to any new landforms.	Chapter 16
TRAFFIC AND TRANSPORT	
▪ accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;	Chapter 12, Appendix H
▪ a detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road network, paying particular attention to the intersections of Nelson Bay Road (MR108) / Coxs Lane (local road) and Nelson Bay Road / Seaside Boulevard (local road) (using SIDRA or a similar traffic model), including a road safety audit;	
▪ a description of the measures that would be implemented to mitigate any impacts;	
LAND RESOURCES	
▪ potential impacts on the broader coastal environment and dune system;	Section 14.2.2
▪ potential impacts on soils and land capability (including potential erosion and land contamination);	Section 14.1, Section 14.2.3, Section 14.2.4
▪ potential impacts on landforms (topography), paying particular attention to the long term geotechnical stability of any new landforms;	Section 4.2.5 and Section 14.2.1
▪ the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007; and	Section 6.6.1
▪ impacts to any Crown land including Crown roads, reserves and tenures;	Section 6.5.2
HAZARDS	
▪ identification of contamination hotspots;	Section 14.2.4
▪ an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks (including the identification of potential ignition sources during construction and operation) and	Chapter 20

SEARs	EIS reference/section
the transport, handling, storage and use of any chemicals, fuels and, hazardous or dangerous goods; and	
▪ proposed bushfire protection measures including vegetation management, fire suppression capabilities and operational access for firefighting appliances to the site;	Section 20.3
WASTE	
▪ estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams;	Chapter 19
SOCIAL	
▪ a detailed assessment of the potential social impacts of the development that builds on the findings of the Social Impact Assessment Scoping Report, in accordance with the Social impact assessment guideline for State significant mining, petroleum production and extractive industry development, paying particular consideration to:	Chapter 13, Appendix I
- the full range of categories of potential social impacts identified in Section 1.1 of the SIA guideline;	
- how impacts (positive and negative) may be distributed among different groups in the affected communities;	
- the principles in Section 1.3 of the SIA guideline;	
- ensuring that the person preparing the SIA has appropriate qualification and experience as outlined in the Box 4 of the SIA guideline; and	
- the review questions in Appendix D of the SIA guideline.	
ECONOMICS	
▪ a detailed assessment of the likely economic impacts of the development, in accordance with the Guidelines for the economic assessment of mining and coal seam gas proposals 2015, paying particular attention to:	Chapter 22, Appendix N
- the significance of the resource;	
- the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and	
- the demand for the provision of local infrastructure and services.	
REHABILITATION	
▪ the proposed rehabilitation strategy for the site having regard to the key principles in the Strategic Framework for Mine Closure, including:	Chapter 22, Appendix O
- rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;	
- nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and	
- the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.	
STAKEHOLDER CONSULTATION	
During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners.	Chapter 5

SEARs	EIS reference/section
▪ in particular, you must consult with: - affected landowners; - community groups; - Port Stephens Council; - Office of Environment and Heritage (including the Heritage Branch); - Environment Protection Authority; - Division of Resources and Geoscience within the Department; - Department of Primary Industries (including NSW Forestry, Agriculture and Fisheries); - Department of Industry (including the Crown Lands and Water Division); - Hunter Local Land Services; - Hunter Water; - NSW Health; - NSW Rural Fire Service; and - Roads and Maritime Services; and	Chapter 5, Appendix B
▪ The EIS must	
- identify where the design of the development has been amended and/or mitigation proposed to address issues raised; and	Section 5.2
- describe the issues raised;	Section 5.2
- describe the consultation process used and demonstrate that effective consultation has occurred;	Section 5.2
- otherwise demonstrate that issues raised have been appropriately addressed in the assessment.	Section 5.2 and 5.3

1.8 Document structure

This EIS includes the main report that describes the project in the context of the existing environment, the planning framework, key environmental issues, potential impacts, proposed mitigation measures and residual impacts. It is informed by the technical assessment reports in the appendices and summarises these documents.

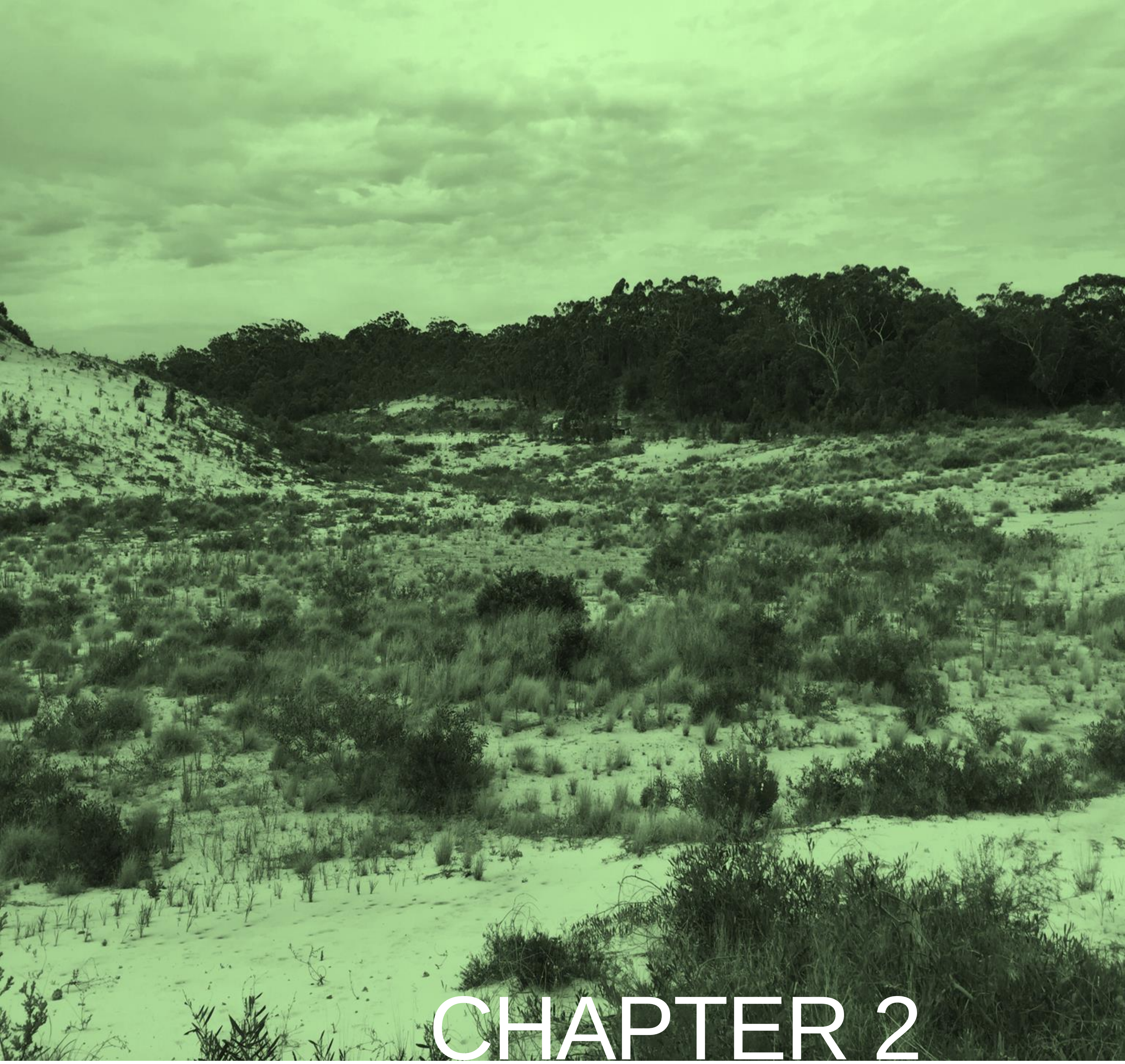
The structure of the EIS is summarised in **Table 1.4**.

Table 1.4: EIS structure

Chapter	Description
Main report	
Preliminary	▪ EIS certification. ▪ Executive summary.
Chapter 1: Introduction	▪ Discusses the background to the project. ▪ Introduces the project and the applicant. ▪ Discusses the justification for the project. ▪ Provides the document structure. ▪ Provides an overview of the approval process and SEARs issued for the project.
Chapter 2: Context and site analysis	▪ Provides an outline and description of the existing site status, location, land use and a description of the surrounding environment.
Chapter 3: Background and site operations	▪ Provides a description of the historical site ownership, planning approval history, existing quarry operations and current environmental management system.

Chapter	Description
Chapter 4: The project	▪ Describes the project including construction and operational parameters.
Chapter 5: Stakeholder engagement	▪ Discusses the engagement strategies of the project. ▪ Details how consultation has been addressed in the EIS.
Chapter 6: Legislative framework	▪ Identifies the applicable local and regional environmental planning instruments, the relevant State and Commonwealth environment and planning legislation and regulations and discusses other approvals and permits that may be applicable to the project.
Chapter 7: Environmental assessment approach	▪ Introduces the approach taken by the project team to identify key environmental, social and economic issues associated with the project and how these issues were considered in the environmental assessment process.
Chapter 8-22: Environmental impact assessment	▪ These chapters assess key environmental issues, and the potential impact of the project. ▪ Describes the management measures proposed to mitigate and reduce potential adverse environmental risk of the project and/or offset any unavoidable impacts.
Chapter 23: Environmental management, monitoring and reporting	▪ Provides a consolidated summary of all recommended management and mitigation measures identified by the EIS, and outlines Boral's approach to responsible environmental management, monitoring and reporting of the project.
Chapter 24: Conclusion	▪ Draws conclusions based on the overall impacts and benefits of the project.
Chapter 25: References	▪ Contains references used throughout this EIS.
Chapter 26: Abbreviations	▪ Abbreviations.
Appendices	
Appendix A: SEARs and Government Agency Requirements	▪ Secretary's environmental assessment requirements (November 2018) including Government Agency response letters to the preliminary environmental assessment (PEA) and SEARs. ▪ Table summarising SEARs and government agency comments in response to the SEARs and references to where requirements are addressed in the EIS.
Appendix B: Stakeholder Consultation	▪ Correspondence to and responses from government agencies consulted for the project.
Appendix C: Desktop and background searches	▪ Results of public environmental database searches.
Appendix D: Hydrogeological Impact Assessment Report	▪ Hydrogeological Impact Assessment Report (EES 2019a).
Appendix E: Biodiversity Development Assessment Report	▪ Biodiversity Development Assessment Report (Niche 2019).
Appendix F: Air Quality Impact Assessment Report	▪ Air Quality Impact Assessment Report (TAS 2019).
Appendix G: Noise Impact Assessment Report	▪ Noise Impact Assessment Report (Wilkinson Murray 2019).
Appendix H: Traffic Impact Assessment Report	▪ Traffic Impact Assessment Report (TUP 2019).
Appendix I: Social Impact Assessment Report	▪ Social Impact Assessment Report (Element 2019).

Chapter	Description
Appendix J: Acid Sulfate Soil Impact Assessment Report	▪ Acid Sulfate Soil Impact Assessment Report (EES 2019b).
Appendix K: Aboriginal Cultural Heritage Assessment Report	▪ Aboriginal Cultural Heritage Assessment Report (KNC 2019).
Appendix L: Surface Water Impact Assessment Report	▪ Surface Water Impact Assessment Report (Southeast 2019)
Appendix M: Bushfire Hazard Assessment Report	▪ Bushfire Hazard Assessment Report (NBC 2019).
Appendix N: Economics Assessment Report	▪ Economics Assessment Report (Gillespie 2019).
Appendix O: Rehabilitation Strategy Report	▪ Rehabilitation Strategy (EES 2019c).



CHAPTER 2

CONTEXT AND SITE ANALYSIS

2 CONTEXT AND SITE ANALYSIS

2.1 Location

The site is in Fullerton Cove, approximately 9.8 kilometres (km) north-north-east of the Newcastle central business district (CBD) and in the Port Stephens LGA (refer to **Figure 2.1**).

The site is on Coxs Lane, a local road which connects with a private road over the adjacent Crown Reserve. Coxs Lane intersects Nelson Bay Road, a major arterial road which links the Newcastle CBD to Newcastle Airport, Nelson Bay and the wider Port Stephens area to the north (refer to **Figure 2.2**).

2.2 Land ownership

The site is owned and operated by Boral and covers approximately 246 ha. The land which comprises the site is defined in **Table 2.1** and shown on Figure **2.2**.

Table 2.1: Land comprising the site

Legal description	Location	Area (ha)	Ownership
Lot 1 DP 1006399	Eastern side of Nelson Bay Road, and a small portion on the western side of Nelson Bay Road	234	Boral
Lot 2 DP 1006399	Western side of Nelson Bay Road, with a small portion on the eastern side of Nelson Bay Road (formerly Part Lot 167, Part Portion 167)	10.4	Boral
Lot 3 DP 664552	Eastern side of Nelson Bay Road	1.6	Boral

Access to the site from Coxs Lane is over a Crown land title, legally described as Lot 7300 DP 1130730, with access permitted via licence agreement with the Crown Lands Division of DPIE.

2.3 Land use and zoning

Most of the site is zoned RU2 – Rural Landscape under the Port Stephens Local Environmental Plan (LEP) 2013. The portion of Crown land is zoned RE1 - Public Recreation, in which extractive industry is prohibited. The quarry is wholly located on land zoned RU2. The permissibility of the project and relevant aims and objectives of the RU1 and RE1 zones are discussed in **Section 6.3.1**.

Land to the north, south and east of the site is zoned E1 – National Parks and Nature Reserves, and this land is associated with environmental conservation areas of Stockton Bight. A portion of land adjacent to the north-east of the site is also zoned as E3 – Environmental Management.

Figure 2.3 shows the zones near the site.

2.4 Existing operations

Boral currently extracts sand from the transgressive dunes, referred to as the windblown sand extraction area (refer to **Figure 2.8**). Sand extraction commenced in 2008 in accordance with development consent DA 140-6-2005.

The development consent permits transportation of up to 500,000 tpa of sand products over 20 years.

The approved scope of works and method comprise:

- extraction of sand through regular harvesting of windblown sand and dry excavation of the dune mass;
- processing at the pit face by mobile power screen;
- maintenance of the haul road to transport sand from extraction area;
- transportation of 500,000 tonnes of sand from the site per year;
- haulage of product from existing depot/weighbridge to Nelson Bay Road and the wider road network; and
- progressive rehabilitation of extraction areas.

2.4.1 Site depot

There is a fenced depot at the site which contains:

- an amenities/office building providing an office, lunchroom, toilet and shower;
- weighbridge;
- designated parking area for employees and visitors; and
- maintenance shed for the front-end loader and 4,200 L above ground bunded fuel tank.

Power and telecommunications are connected to the depot and water is collected in rainwater tanks and wastewater is collected in a septic system.

2.4.2 Hours of operation

The site operates in accordance with the following approved hours of operation in DA 140-6-2005:

- Monday to Friday – 6:15am to 5:00pm;
- Saturday – 6:15am to 12 noon; and
- no operation on Sundays or Public Holidays.

The quarry is also approved to operate extended hours during major supply contracts as follows:

- Monday to Friday – 6:15am to 6:00pm;
- Saturday – 6:15am to 3:00pm; and
- no operation on Sundays or Public Holidays.

2.4.3 Site access and product transport

As highlighted in **Section 2.1**, access to the site is via Nelson Bay Road and Coxs Lane. Coxs Lane is a local roadway which terminates at the entrance to the quarry.

Boral transports up to 500,000 tpa of sand products by road from the quarry to local and regional consumers.

Boral uses the following transport routes:

1. **Newcastle supply contracts –** trucks exit the site and travel south along Nelson Bay Road towards Kooragang Island and Newcastle via Cormorant Road and Tourle Street.
2. **Central Coast, Sydney and Hunter Valley supply contracts –** trucks exit the site and travel south along Nelson Bay Road to the intersection with Seaside Boulevard, where the trucks perform a U-turn at the roundabout before travelling north along Nelson Bay Road, west along Cabbage Tree Road and Tomago Road, and then left onto the Pacific Highway and M1 south towards Sydney via Hexham. Trucks may also proceed via the New England Highway and/or Hunter Valley Expressway to the Hunter Valley and beyond.
3. **North Coast supply contracts –** trucks exit the site and travel south along Nelson Bay Road to the intersection with Seaside Boulevard, where the trucks perform a U-turn at the

roundabout before travelling north along Nelson Bay Road, and Medowie Road, and then right onto the Pacific Highway northbound.

4. **Port Stephens supply contracts –** on rare occasions (approximately 5% of supply contracts), trucks exit the site and travel south along Nelson Bay Road to the intersection with Seaside Boulevard, where the trucks perform a U-turn at the roundabout before proceeding north and then east along Nelson Bay Road towards Port Stephens.

2.4.4 Plant and equipment

Mobile equipment operated at the site comprises:

- a front-end loader (capacity nine tonnes);
- a dozer (part time);
- a water truck (13,000 L capacity); and
- a mobile screen (20 millimetre (mm) mesh screen and a 5 m^3 capacity receiving bin).

2.4.5 Employment

Boral employs four full time staff along with one casual staff member in the operation of the existing quarry. The existing operation also provides employment opportunities for numerous Boral and customer truck drivers and associated service personnel.

Figure 2.1
Regional context

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT

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Source: LPI (2018), Boral (2018), Cambium Group (2020).

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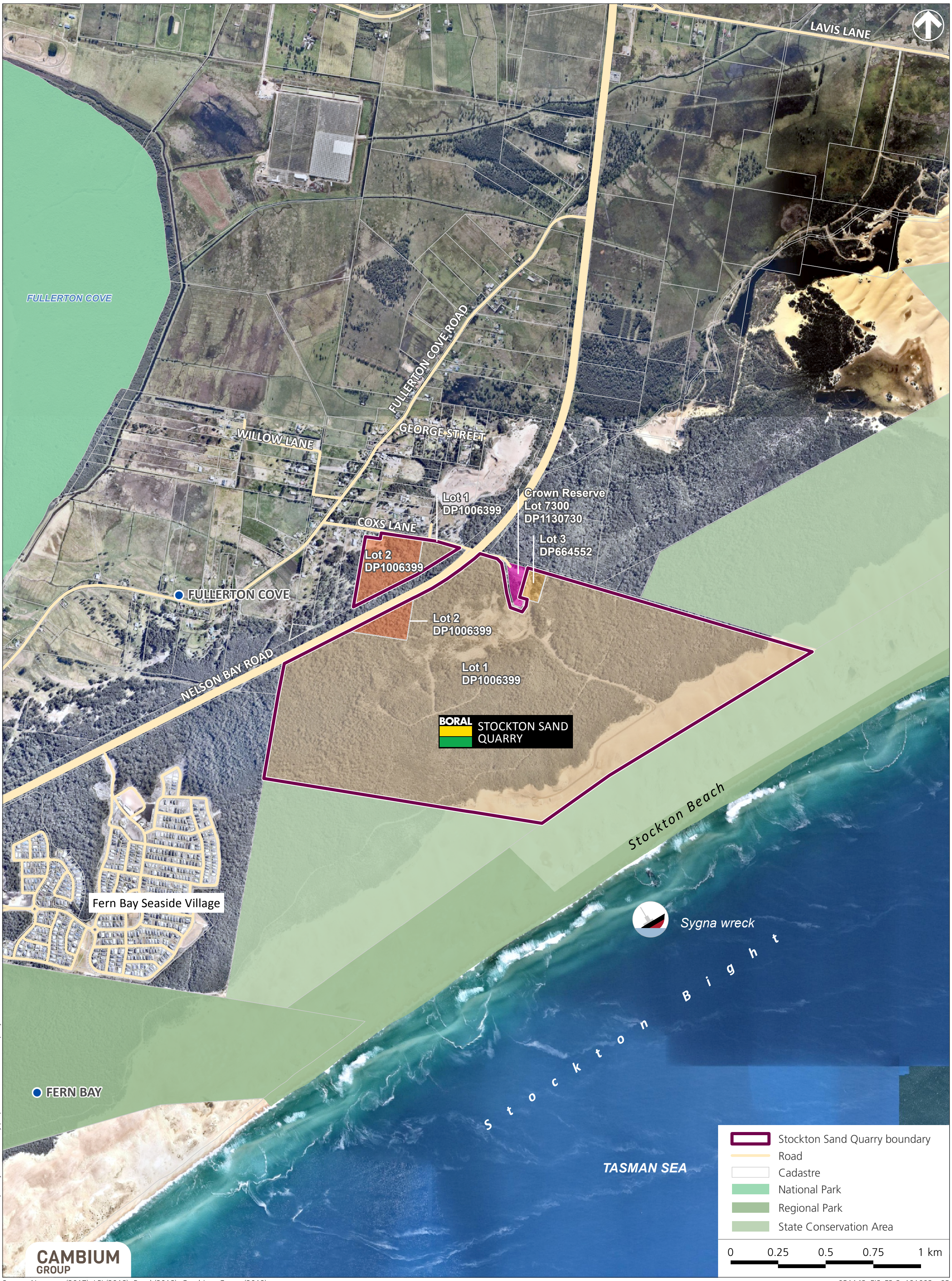
Figure 2.2
Local context

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: Nearmap (2017), LPI (2018), Boral (2018), Cambium Group (2019).

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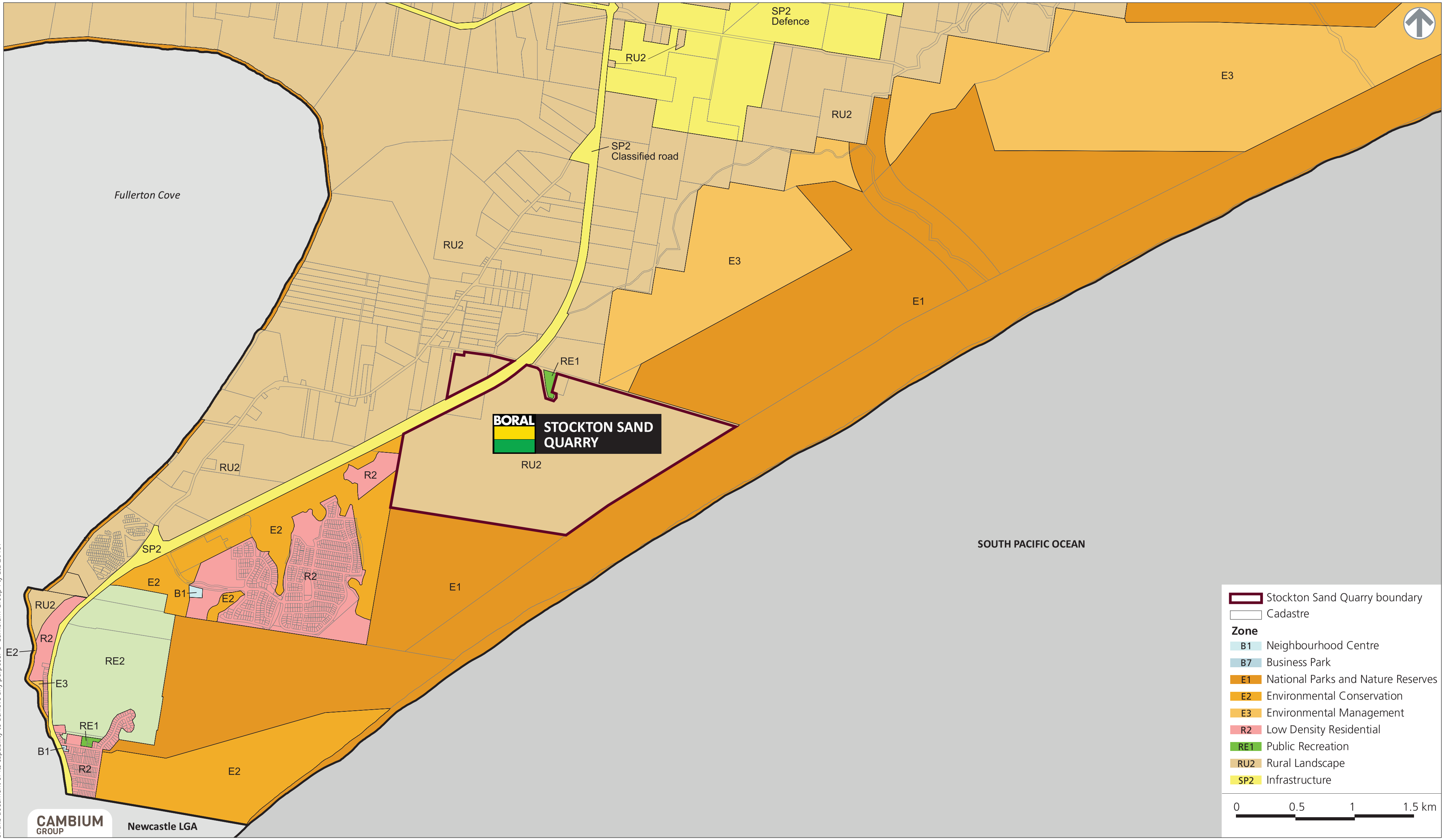
Figure 2.3
Zoning

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: Port Stephens Council. LZN_004 (Amendment No 15) and LZN_004A (Amendment No 9).

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2.5 Biophysical factors

2.5.1 Climate

Rainfall and temperature data were obtained from Bureau of Meteorology (BoM) Station 061055 (Newcastle Nobbys Signal Station), located approximately 8.3 km to the south-west of the quarry.

The mean maximum and minimum temperature reaches their peak in January (25.6ºC and 19.3ºC respectively), while the mean maximum and minimum temperature are lowest in July (16.8ºC and 8.5ºC respectively).

Average annual rainfall is 1127.8 mm. A review of 149 years of rainfall data indicates rainfall is relatively evenly spread over the first six months of the year, with average rainfall ranging from 89.0 mm in January to 119.2 mm in March. The latter half of the year is typically drier, with average rainfall ranging from 70.9 mm in November to 92.3 mm in July.

A review of 2018 rainfall data indicated the highest monthly rainfall for the year was 301.4 mm in June. The total 2018 rainfall of 968 mm was below the historical annual mean of 1127.8 mm.

2.5.2 Air quality

The main influences of ambient air quality in the area include agricultural, extractive industry and heavy industrial land uses, commercial activities, motor vehicle exhaust, and natural sources such as the local sand dunes and wave break from Stockton Bight. The dominant influence for air quality at the site is the presence of sea salt aerosol from wave break along Stockton Bight.

Atmospheric pollutants in the region may include:

- deposited dust;
- total suspended particulate (TSP) matter, which is nominally taken to be less than 30 micrometres (µm) in diameter and refers to all suspended particles in the air;
- PM_{10}, which is a subset of TSP and have a diameter of 10 micrograms (µm) or less;
- $PM_{2.5}$, which is a subset of TSP and have a diameter of 2.5 µm or less;
- crystalline silica; and
- pollutants generated through the combustion of fuel in vehicle engines (oxides of nitrogen and sulfur (NO_2 and SO_2), PM_{10} and $PM_{2.5}$).

There is no air quality monitoring data for the site. Therefore, background levels for the project site were estimated as part of the air quality impact assessment (refer to **Chapter 8**) using data from the Stockton, Beresfield and Wallsend monitoring stations, which are maintained by DPIE (formerly OEH) and are in in areas similar to/representing the quarry. Whilst there are other monitoring stations in Newcastle, these stations are subject to local industrial and urban sources, which are not typically representative of the project site.

The ambient air quality monitoring data indicated that:

- PM_{10} annual average levels were below the criterion of 25 µg/m³ with the exception of the Stockton monitor which exceeded the criterion in each year reviewed. The 24-hour average PM_{10} levels were on occasion above the criterion of 50 µg/m³;
- PM_{10} concentrations peak in spring and summer, with the warmer weather raising the potential for drier ground and elevating the occurrence of windblown dust. Elevated PM_{10} concentrations at the Stockton monitor were attributed to heavily salt laden air or particulates blowing from the east along the surf break of Stockton Bight, and occasional bushfires;
- Annual average $PM_{2.5}$ levels were below the advisory reporting standard of 8 µg/m³ with the exception of the Stockton monitor, and the Beresfield monitor in 2008. The 24-hour average $PM_{2.5}$ levels were on occasion above the criterion of 25 µg/m³;

- $PM_{2.5}$ concentrations were relatively consistent throughout the year, with elevated $PM_{2.5}$ concentrations at the Stockton monitor also attributed to heavily salt laden air or particulates blowing from the east along the surf break of Stockton Bight, along with occasional bushfire events; and
- Annual average and maximum one hour nitrogen dioxide (NO_2) levels were below the criteria of 62 and 246 µg/m³ respectively.

2.5.3 Noise

The site is adjacent to rural and environmental conservation land uses, which contain the following background noise sources:

- natural (e.g. wave break along Stockton Beach, birdsong, insects, road noise and livestock);
- extractive industry (Fullerton Cove Quarry to the north-west);
- residential (Fern Bay Seaside Estate to the south-west); and
- infrastructure (Nelson Bay Road to the north-west, and aircraft noise from nearby RAAF Base and Newcastle Airport).

Unattended noise monitoring was conducted between 3 and 17 December 2018 at representative locations to establish the ambient noise environment at the nearest sensitive receivers.

The rating background levels (RBLs) were determined using these noise levels in accordance with the EPA's (2017) *Noise Policy for Industry* (NPI). The ambient noise levels are in **Table 2.2**.

Table 2.2 : Ambient noise levels

Monitoring location	Address	Time of day[1]	Noise levels (dBA)	
			RBL	L_{Aeq}
M1 (Receiver R11)	4 Coxs Lane, Fullerton Cove	Morning shoulder (5 am – 7 am)	38	48
		Day	41	56
		Evening	36	47
		Night	33	46
M2	157 Cabbage Tree Road, Williamtown	Morning shoulder (5 am – 7 am)	48	67
		Day	46	66
		Evening	41	62
		Night	33	62
M3	1051 Nelson Bay Road, Fern Bay	Morning shoulder (5 am – 7 am)	49	71
		Day	55	71
		Evening	47	67
		Night	38	66

[1] Daytime (7.00am-6.00pm); evening (6.00pm-10.00pm); night time (10.00pm-7.00am) (NPI).

2.5.4 Topography

Elevations of the dunes adjacent to the quarry range from 8-16 m AHD, with some in excess of 20 m AHD, while the lowest interdunal areas are approximately 4 m AHD (RPS, 2016).

Topography in the project site forms the shape of a basin, reflective of former sand extraction in this area. Topography ranges from 2.0-5.5 m AHD in the centre of the project site and is enclosed by higher topography ranging from a maximum of 29 m AHD (north), 8.8 m AHD (south), 27 m AHD (east) and 12 m AHD (west).

2.5.5 Geology and soils

Geology

The site is part of a dual sand barrier system known as the Stockton Bight.

Stockton Bight is a wide south facing coastal embayment bordered by Nobbys Head at Newcastle in the south, and Birubi Point at Anna Bay in the north. The beach is approximately 32 km long and extends up to 10 km inland (ERM 2005).

The bedrock of Nobbys Head and the higher relief of Newcastle CBD border the southern side of Stockton Bight. The rocks consist of Permian aged coal measures and some sandstone. The Hunter River has been deflected to the south by the Stockton Bight sand barrier system and enters the sea at Nobbys Head.

The Bight sediments abut the sedimentary Permian rocks of the Tomago coal measures and Mulbring siltstone between Raymond Terrace and Big Swan Bay, and at the northern end of the Bight abut the Carboniferous Nerong Volcanics at Birubi Point. Between the Stockton training wall of the Hunter River and Birubi Point is the Stockton sand barrier system (ERM, 2005).

Soils

The site contains three soil landscapes, described as Stockton Beach soil landscape, Boyces Track soil landscape and Hawks Nest soil landscape. Most of the project area is confined to the Boyces Track soil landscape unit, with the central southern portion of the project site encompassing the Hawks Nest soil landscape unit.

The soils of the area are highly susceptible to wind erosion when exposed.

The Stockton Beach soil landscape is characterised by beaches and the active unvegetated dune field in the eastern portion of the site. The soil in this landscape is deep unstratified fine to medium grained loose aeolian sand with shell fragment inclusions (ERM, 2005).

The Stockton Beach soil landscape active transgressive dune is gradually engulfing the Boyces Track soil landscape and Hawks Nest soil landscape. Boyces Track is an aeolian landscape characterised by steep Quaternary Holocene sand dunes on the Tomago Coastal Plain, with tall open forest. Soils are deep (>300 centimetres (cm)) well-drained, weakly developed podzols (ERM 2005).

The soil landscape in the low-lying swales and low dunes immediately west of the active transgressive dune is the Hawks Nest soil landscape. Hawks Nest is an aeolian landscape characterised by low Holocene sandsheets and low transgressive dunes of the Tomago Coastal Plain, with dry scrubland, woodland and tall open forest. There are small shallow swamps that occur in the low-lying, poorly drained swales and depressions. Soils are deep (>300 cm) well-drained podzols and siliceous sands and podzols on dunes (ERM, 2005).

Acid sulfate soils (ASS) generally occur in low lying areas in and around coastal swamps, estuaries, and other coastal water bodies. If these soils are disturbed or exposed to oxygen, they have the potential to oxidise over time, resulting in acidic water leaching from these soils and scalding vegetation or killing aquatic fauna. ASS can also react with concrete and steel infrastructure.

The ASS maps in the Port Stephens LEP 2013 categorise most of the project site as risk Class 4 (in which ASS is likely to be found beyond two metres depth), while pockets of the southern extent of the proposed extraction area are mapped within risk Class 3 (in which ASS is likely to be found beyond one metre depth).

The project site was also reviewed in the Port Stephens 1:50,000 Acid Sulfate Soils Map (1996) produced by NSW Department of Land and Water Conservation. The project site is in an area of low probability of ASS occurring. The southern boundary of the project site has low probability of ASS between 1–3 m Below Ground Level (BGL) whilst the remainder and majority of the project site has low probability that ASS occurs >3 m BGL.

According to the *Strategic Agricultural Land Map - Sheet STA_047* (DP&E, October 2013), the nearest BSAL is approximately 13.2 km to the north west of the project site, west of Raymond Terrace.

The project will not impact any areas of BSAL, nor land resources suited to agricultural land use.

2.5.6 Coastal sand dune system

Coastal sand dunes are wind deposited accumulations of sand blown inland from a beach, and consist of fine to medium sand, as coarser sand cannot be moved by wind. When coastal sand dunes are bare of vegetation they are arranged in shape by prevailing winds.

When the sand is at least 10 m thick they are arranged in 'transverse' dunes, being dune ridges aligned perpendicular to the wind. The ridges range from 5-20 m high and are spaced at 100- 200 m. The transverse dunes move downwind at rates ranging from 5-15 m per year and occur commonly along the Australian coast.

Stockton Bight has the largest coastal sand dune field in NSW and includes a 24 km long series of 150 transverse dunes, spaced on average 160 m apart.

The site is towards the southern end of a 32 km long coastal sand barrier consisting of Stockton Bight and the backing sand dunes that extend up to 3 km inland, which are in turn backed by a swampy inter-barrier depression (Fullerton Cove) and an inner barrier (Tomago Sands) extending up to 12 km inland (Coastal Studies, 2019).

The inner barrier was deposited by waves and wind during the last sea level high stand approximately 120,000 years ago. The modern outer sand barrier has evolved over the past 7,000 years following the inundation of Stockton Bight by the rising sea level that stabilised around its present level approximately 6,500 years ago. At that time sand was supplied to the initial beach by waves transporting material shoreward from the inner continental shelf and spreading it the length of the embayment to link the Hunter River entrance, with Birubi Point in the north.

As sand continued to be supplied to the coast, the shoreline built seaward by up to 2 km. The prograding shoreline was capped by a series of well vegetated undulating foredune ridges and swales with an elevation between 5-10 m (Coastal Studies, 2019).

The sand supply continued until about 5,000 years ago, following which was the first of three phases of dune instability and landward migration of bare mobile sand dunes and shoreline recession. The evolution of the system is summarised as follows:

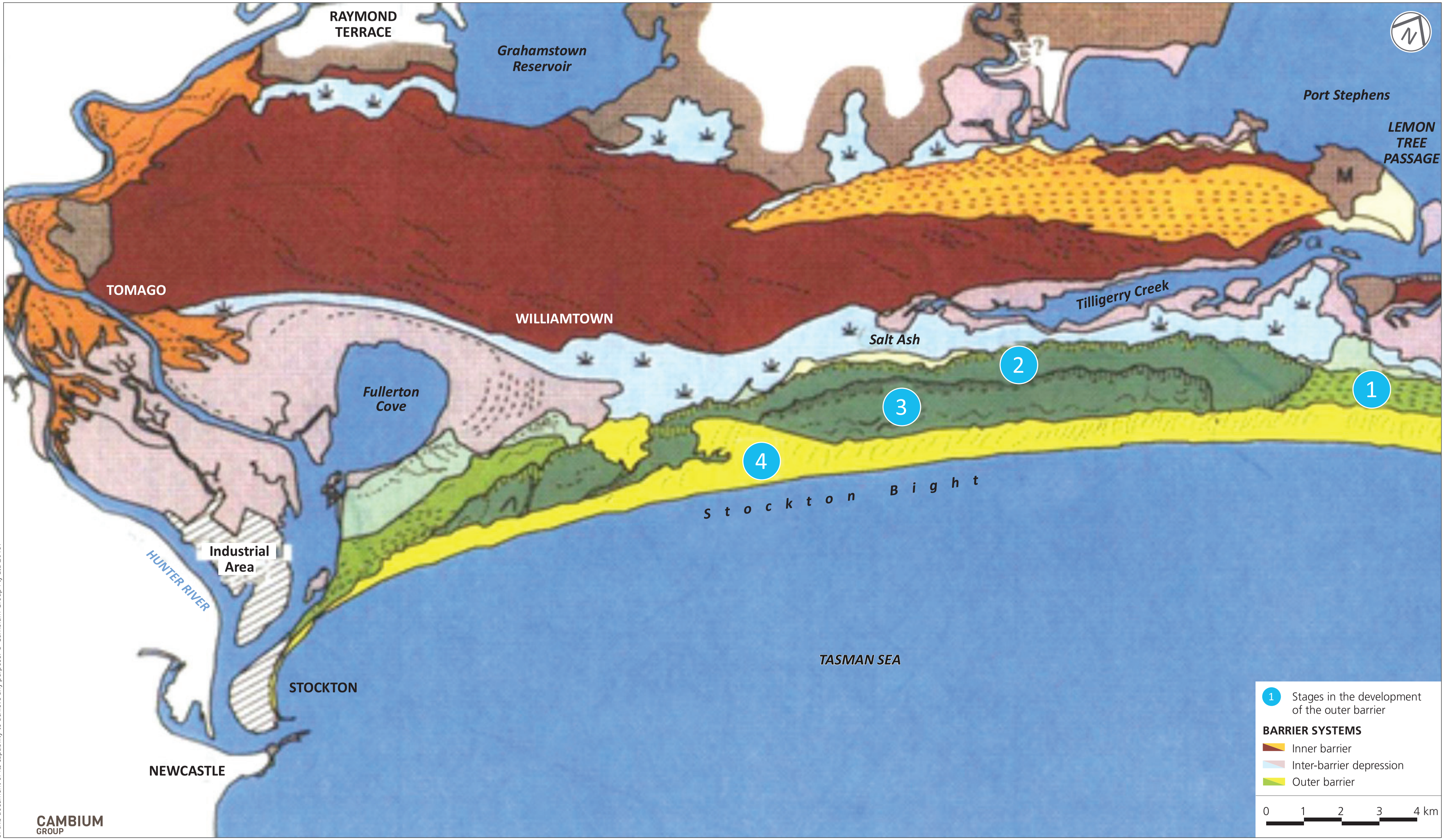
- The first phase (Phase I) of mobile dunes occurred between 5,200 and 4,000 years ago. These dunes moved up to 2 km inland and rose to elevations reaching 20 m. They moved over and completely buried the former foredune ridges, before stabilising with dense vegetation.
- The second phase (Phase II) of mobile dune activity occurred approximately 2,000 years ago. These dunes moved up to 1.5 km inland partially burying the Phase I dunes and the foredune ridges, before again stabilising with vegetation.
- The third phase (Phase III) commenced approximately 500 years ago and remains active today. The phase includes bare mobile sand extending on average several hundred metres inland (up to 2 km inland to the east of Williamtown), and occupying 12% of the total Stockton

barrier system. The remaining original foredune ridges and Phase I and II dunes (comprising 88% of the dunes), are well vegetated and stable.

Figure 2.4 presents an illustration of the geomorphology of the Stockton Bight.

Figure 2.4
Stockton Bight quaternary geomorphology

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: Thom, et al. (1992)

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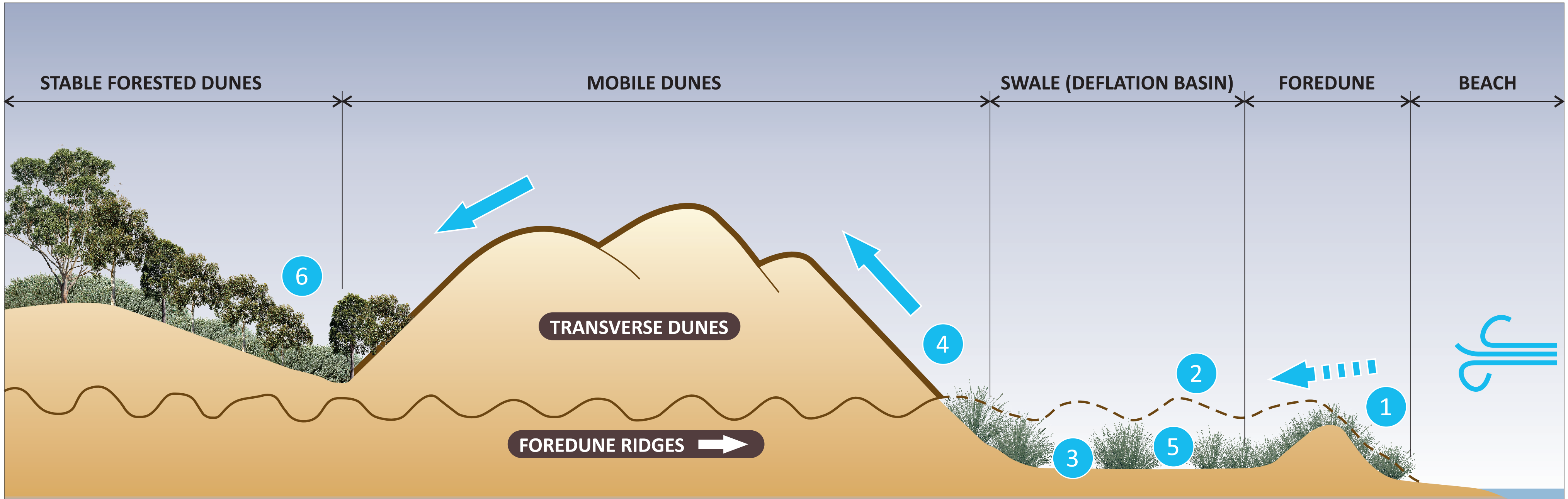
Figure 2.4 shows:

- **Stage 1 –** between 6,500-5,000 years ago waves delivered sand to the shore, and the shoreline built 3 km seaward as a series of undulating foredune ridges. The ridges extended the length of the Stockton Bight and were fully vegetated. The only ridges visible today are at the north-eastern end of the Stockton Bight.
- **Stage 2 –** most of the foredune ridges were then buried between 5,200-4,000 years ago by Phase I dunes as they migrated up to 3 km inland. The Phase I dunes were then vegetated and stabilised.
- **Stage 3 –** approximately 2,000 years ago Phase II dunes migrated approximately 2 km inland and were then vegetated and stabilised.
- **Stage 4 –** approximately 500 years ago the present Phase III dunes started moving inland as bare sand, excavating the outer foredune ridges and burying Phase II dunes. The Phase III dunes have now moved several hundred metres inland producing the present dune environment.

Components of Stockton Bight sand dunes

A schematic illustration of the Stockton Bight dune system is provided in **Figure 2.5**.

Figure 2.5
Cross section of the Stockton Bight sand dunes



The Stockton dunes are a highly dynamic system with sand moving from the beach into the dune system in the following manner.

1	2	3	4	5	6
Sand is blown from beach to foredune by strong onshore (south to southeast winds), where it is either trapped by vegetation in the foredune or blown through gaps into the deflation basin.	Sand is blown from the unstable and/or unvegetated foredune areas into the deflation basin.	During storms like the June 2016 storm, waves can wash across the beach and through gaps in the foredune to flood parts of the deflation basin. As some of this water returns seaward it can scour channels down the beach. The channels will be filled in during periods of calmer waves.	Sand is blown from the deflation basin into mobile transverse dunes, exposing the dark soil horizon which marks the crest of the buried foredune ridges.	Deflation basin is lowered/deflated until a cohesive surface is reached (shell lag, wet sand, reeds). It cannot deflate below the water table.	The strong onshore southeast winds move the transverse dunes towards the northwest and into the vegetation and burying Phase II dunes, while strong west to northwest winds move them to the northeast, parallel to the shore arranged as transverse dunes.

CAMBIUM GROUP

Source: Modified from OEH (2015): Plan of Management, Cambium Group (2019)

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Figure 2.5 shows Stockton Bight has an exposed 30-50 m wide high energy beach composed of medium to fine quartz sand. Sand from the beach is blown into the approximately 100 m wide, 4-10 m high foredune that parallels the rear of the beach, and in places, though gaps in the foredune into the 100-300 m wide deflation basin, which has an elevation between 2-6 m. Sand is exported from the deflation basin by strong southerly winds and deposited in the 5-20 m high bare mobile dune field (the Phase III dunes), which in the vicinity of the quarry are between 200-300 m wide.

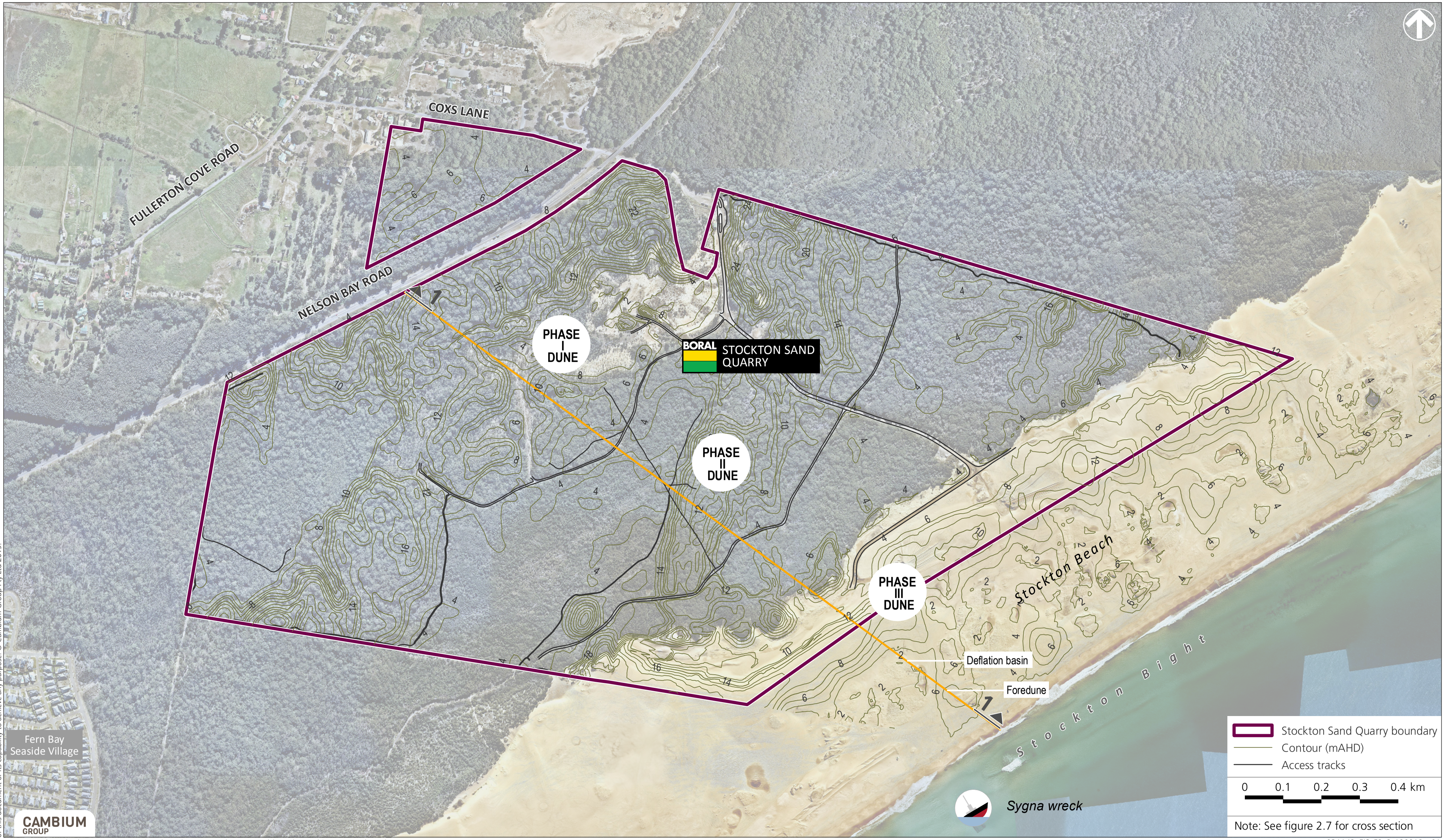
As the sand moves out of the deflation basin, it erodes the western wall of the basin, exposing the long buried foredune ridges and their buried dark soil horizon and remnant vegetation. The mobile dune field has been arranged by strong south westerly winds into transverse dunes, with crests aligned south-east to north-west.

The transverse dunes average 15 m in height and are spaced between 100-200 m apart. Strong southerly winds cause the transverse dunes to migrate to the north-east at rates between 5-15 m per year, and to the north-west at rates between 3-5 m per year. In the process, the dunes move into and bury the vegetated hind dunes (Phases II and I). This third phase of dune activity is natural and has been operating at this scale for approximately the past 500 years. However, off-road vehicle activity is presently exacerbating the dune instability in the areas it is permitted.

ERM (1994) examined the age of the dune system within the previous inland extraction area. The study identified that the majority of the inland extraction area, and hence the project site, is positioned within the dune system estimated to be between 1200- 2300 years old (Phase II transgression), with a small portion of the extraction area along the northern boundary of the quarry adjacent to Nelson Bay Road identified to be around 4500 years old (Phase I transgression). The location of Phase I, II and III dunes on the quarry property is illustrated in **Figure 2.6** and **Figure 2.7**.

Figure 2.6
Location of Phase I, II and III dunes

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: LPI (2017), Photomapping Services (2018), Nearmap (2019, Boral (2019), Cambium Group (2019).

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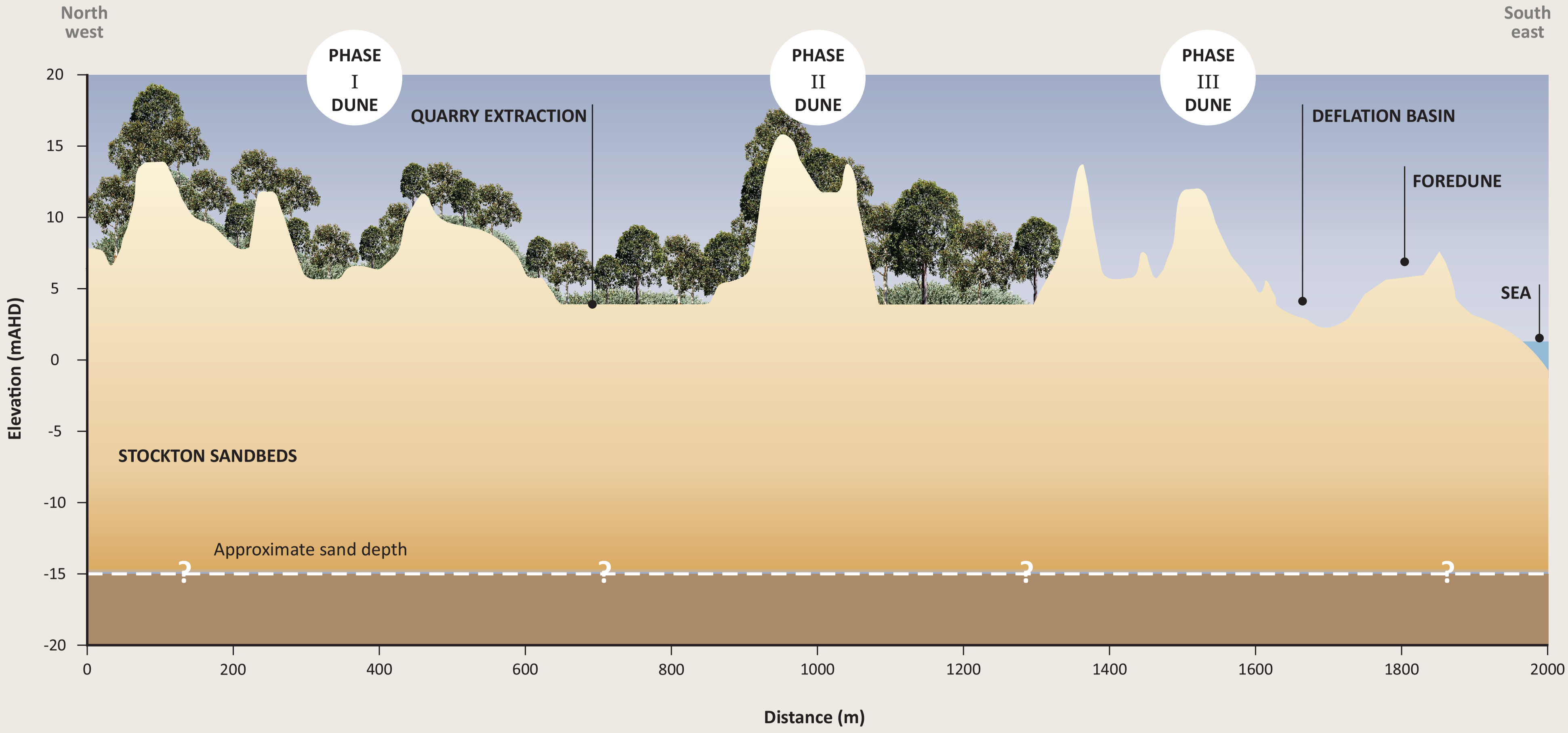
CAMBIUM GROUP

Figure 2.7
Cross section of the sand dunes at Stockton Sand Quarry

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: Boral (2019), Cambium Group (2019)

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As highlighted above, the site consists of the beach, foredune, deflation basin, transverse dunes (Phase III dune) and vegetated hind dunes (Phase I and II dunes).

2.5.7 Groundwater

The site is in the 'Stockton Sandbeds', which consists of quartzose sand deposits and forms an outer barrier dune system. The 'Tomago Sandbeds', which form the inner barrier dune system, is north-west of the site (ERM, 2005).

The site is in a north-east to south-west oriented dune ridge that forms part of the outer barrier dune system and composes a thick deposit of fine to medium sand. As such, the sand has a high infiltration capacity likely to be in excess of 100 mm per hour resulting in 90-95% of rainfall infiltrating directly to the underlying unconfined aquifer (ERM, 2005).

The Stockton Sandbeds and transgressive dune sands are the main aquifer at the quarry and comprise the Stockton Groundwater Source of the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources (RPS 2016). Underlying and hydraulically connected with the Stockton Sandbeds are the Tomago Sandbeds of the Tomago Groundwater Source.

Permeability of the Stockton Sandbeds aquifer is likely to be quite high but will be variable due to the variation in sediment size. Hydraulic properties are likely to be similar to those of the Tomago Sandbeds, which have average hydraulic conductivity around 23 m per day (RPS, 2016).

The dominant recharge of the aquifer is via direct infiltration of rainfall and surface runoff. The former NSW Department of Industry (Water) applied an average rainfall recharge component of 22% for the Stockton Groundwater Source in assessing the volume of water that percolates to the water table each year. However, localised recharge rates in dune environments with predominantly closed drainage systems are likely to be significantly higher.

Environmental Earth Sciences Pty Limited was engaged to assess the potential impacts of the project on groundwater in the project site and region, with the report attached to this EIS in **Appendix D**. The results of the groundwater assessment are summarised in **Chapter 8**.

Groundwater flow

Groundwater flow is influenced by topography, the dune system and regional recharge/discharge zones, with water draining either to Fullerton Cove to the north-west of the site or Stockton Beach to the south-east. Therefore, there is a north-east to south-west orientated groundwater drainage axis along the length of the Stockton Sandbeds aquifer. At the site, the drainage axis is approximately 1.5 km inland from the coast and is approximately in the centre of the project site.

Regional groundwater flow is primarily horizontal, with some downward flow due to the relatively high recharge rate. Groundwater is inferred to flow towards the coast to the south-east and to Fullerton Cove to the north-west of the project site.

The Tomago Sandbeds aquifer is to the west of the Stockton Sandbeds aquifer and is separated by Tilligerry Creek and associated drainage network in this low-lying estuarine region. Groundwater from both the Tomago Sandbeds aquifer and the Stockton Sandbeds aquifer discharge into this low-lying region that ultimately directs discharge to Fullerton Cove.

Groundwater in the Tomago Sandbeds Aquifer has been impacted by per- and poly-fluoroalkyl chemicals (PFAS and PFOA) associated with the Royal Australian Air Force (RAAF) base at Williamtown. As a result, a NSW Environment Protection Agency (EPA) Investigation Area has been implemented near the RAAF Base.

The 'Risk Zone C' boundary is along the low-lying drainage area that the Tomago and Stockton Sandbed aquifers drain into. The Stockton Sandbeds aquifer at the site is in a separate groundwater and surface water catchment to the RAAF base.

Saline interface

A saline interface marks the transition from predominantly fresh groundwater to predominantly saline groundwater in the Stockton Sandbeds aquifer.

The interface is likely to comprise a broad zone of dispersion and mixing that will also be dependent on the rate of flow through the aquifer.

Geoscience Australia reviewed the vulnerability of different groundwater aquifers across the nation to seawater intrusion in 2013. Coastal sand aquifers were found to be particularly vulnerable to excessive pumping due to the low amounts of groundwater storage relative to rainfall recharge. It was reported that there was no increase in salinity observed at the seaward coastline despite water having migrated southwards to the Tomago, Tomaree and Stockton Sandbeds from Tilligerry Creek as a result of an extensive drainage network on the southern banks of the estuary.

Water sources and users

There are seven bores registered within a 3 km radius of the project site, which are for domestic water supply, irrigation and extractive industry purposes.

Groundwater dependent ecosystems

A search of the Groundwater Dependent Ecosystems (GDE) Atlas in August 2019 did not identify any aquatic GDE near the project site. There are potential for terrestrial GDEs to the south and south-east (seaward) and north-west (inland) of the site.

The seaward terrestrial GDEs comprise small ephemeral and mobile shallow deflation basin lakes vegetated with a variety of grasses, sedges and reeds. These lakes provide an ephemeral habitat for several invertebrates and other species (ERM, 2005).

The inland terrestrial GDEs are primarily swamp forests in the dune swales and low-lying heath.

Groundwater monitoring

Boral installed 10 permanent groundwater monitoring wells at the quarry, which are sampled in accordance with DA 140-5-2006. Boral installed additional groundwater monitoring wells in 2017 to gain an understanding of the biophysical properties of the project site and surrounds (MW_X1 to MW_X6). These groundwater wells have provided background information for hydrogeological impact assessment of the project (refer to **Chapter 8**).

Data has been collected on the underlying aquifer from the groundwater monitoring well network since 2007, and supporting monitoring well networks since April 2017, meaning that there are at least two years of baseline data prior to the SSD application to comply with the *NSW Aquifer Interference Policy* (AIP) (NSW Government, 2012b).

Two groundwater monitoring networks are in place as part of the program to monitor:

- GDEs; and
- water quality and levels (single bores).

The GDE monitoring comprises three bores (GW2, GW3 and GW4). These bores have existed since the former mineral sands mining operations were underway. There are seven water quality and water level monitoring bores (MW1, MW2, MW5, MW6, MW7, MW8 and MW9).

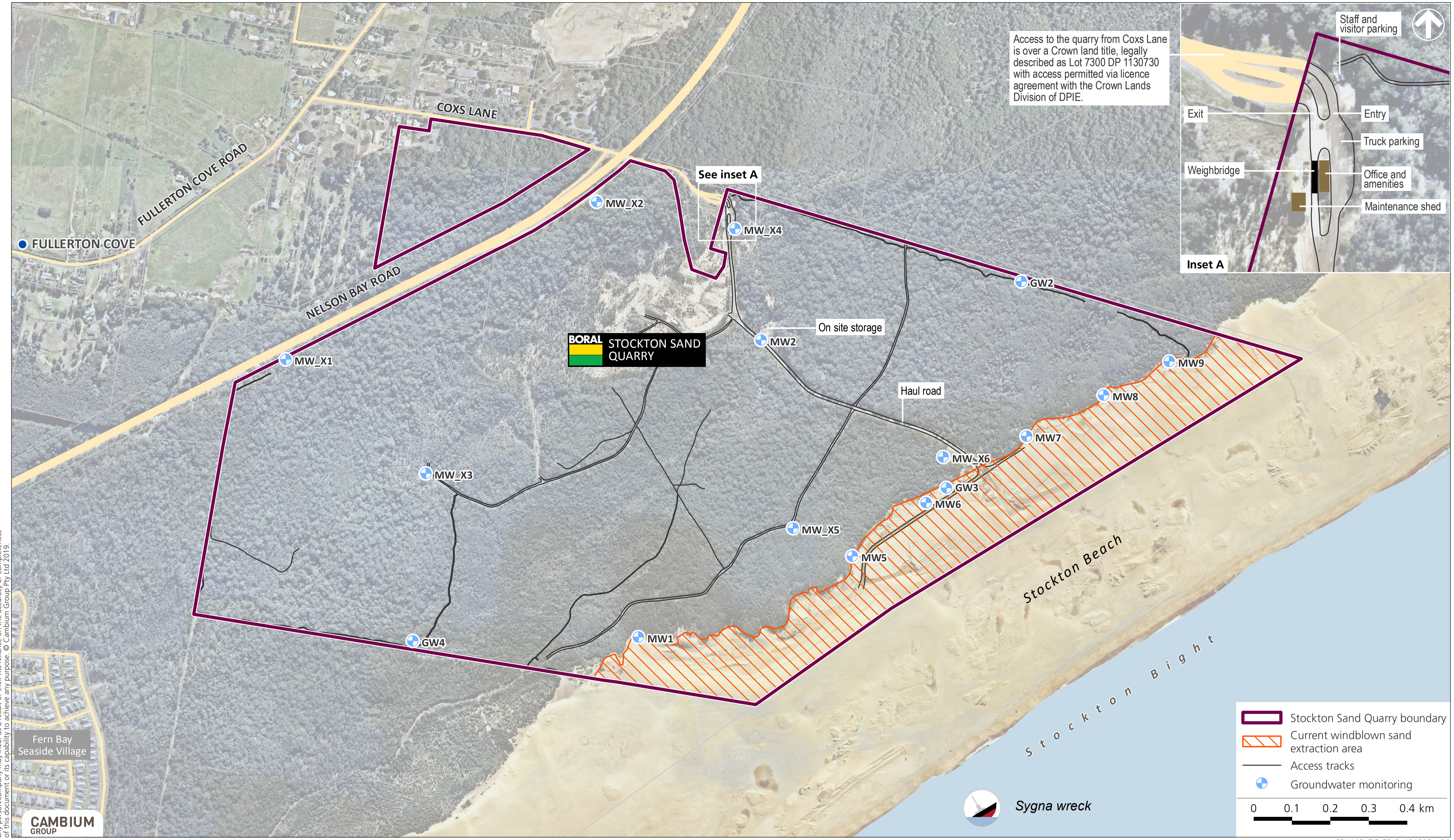
The existing groundwater monitoring locations for the quarry are shown on **Figure 2.8**.

The results of groundwater monitoring during 2018 indicate groundwater levels displayed commonality with historical trends in that levels continued to fluctuate naturally in response to rainfall recharge and seasonal patterns and were not impacted by quarrying.

Groundwater monitoring during the 2018 reporting period confirmed that the groundwater setting remained consistent with historical patterns observed to date. Minor and short-term exceedances of site-based trigger levels remain consistent with historical data.

Figure 2.8
Existing operations layout and groundwater monitoring locations

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: LPI (2017), Photomapping Services (2018), Nearmap (2019, Boral (2019), Cambium Group (2019).

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2.5.8 Surface water

There are no permanent streams or waterbodies in the site indicating that surface runoff is minimal, and infiltration occurs quickly through porous sands. This contributes to high groundwater recharge.

Some temporary ponding of water is evident in the dune system in the project site and along Stockton Bight to the south-east of the site. However, it is likely this ponding is associated with naturally low lying interdunal swales where there is interaction with shallow groundwater.

The Pacific Ocean is approximately 1.3 km east of the project site, and surface water at the quarry predominantly infiltrates to the underlying aquifer, which ultimately flows towards Fullerton Cove in the north-west or the Pacific Ocean to the south-east.

2.5.9 Biodiversity

The following section describes the existing elements of biodiversity present on the site.

Previous assessments of the site and adjacent areas were reviewed during preparation of the biodiversity development assessment report (BDAR) to characterise the existing environment and develop a flora and fauna survey strategy.

Vegetation

The site was surveyed as part of ERM (1994) and ERM (2005) to validate existing vegetation mapping and identify threatened biodiversity. The vegetation surrounding the project site was consistent with the Coastal sand apple-blackbutt vegetation community.

The BDAR confirmed the project site mainly comprised of native regeneration associated with rehabilitation of the former inland extraction area. The project site was found to comprise two plant community types (PCT):

- PCT1646 - Smooth-barked Apple/Blackbutt/Old Man Banksia woodland on coastal sands of the Central and Lower North Coast; and
- PCT1644 - Coast Tea Tree - Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast.

No threatened ecological communities (TEC) as defined by the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been identified at the site.

Threatened flora

The likelihood of threatened or significant flora occurring on the site was determined by ERM (2005) which considered the type and condition of vegetation and habitats, and analysed database records. The results of other previous ecological investigations at the site were also used in determining the likelihood of occurrence of threatened flora, in particular the threatened orchids *Diuris arenaria* and *Diuris praecox.*

Targeted surveys were undertaken during the BDAR and identified no threatened flora in the project site.

Threatened fauna

The BDAR confirmed that 16 threatened and migratory fauna species, including those specified above, are considered to have a moderate or high likelihood of occurrence within the project site, however most of these species were determined to only utilise the project site for foraging on an intermittent basis. Of these species, only the Squirrel Glider (*Petaurus norfolcensis*) was assumed to be present within the project site.

2.6 Cultural factors

The following section describes the existing heritage and archaeology context of the site, including both Aboriginal and historic heritage.

2.6.1 Aboriginal heritage

The Aboriginal Heritage Information System (AHIMS) was searched on 25 July 2019 for the *Stockton Sand Quarry Dredging Project – Aboriginal cultural heritage assessment* report (Kelleher Nightingale Consulting, 2019) (ACHA) to identify existing recorded Aboriginal sites in the area.

75 registered AHIMS sites were identified, comprising a diverse range of site types, the most common of which being open context occurrences of artefacts and shell (middens).

The presence of numerous recorded sites near the project site demonstrates that the local landscape was used by Aboriginal people in the past and that material traces of this landscape use have survived in the form of Aboriginal objects and archaeological deposit.

There are no registered AHIMS sites in the project site, although several are present on the wider quarry property. The quarry also contains one unregistered site identified during a previous survey.

The site and adjacent land have been subject to several detailed archaeological investigations for previous sand extraction activities, as well as larger scale regional studies of the Stockton Bight.

The findings of these investigations are summarised in Section 5.3 of the ACHA. Potential impacts to Aboriginal heritage are summarised in **Chapter 15**.

2.6.2 Historic heritage

The following Commonwealth, State and local heritage databases were searched to determine the presence of registered historic heritage items in the project site and surrounds:

- National Heritage Register made under the EPBC Act;
- Commonwealth Heritage Register made under the EPBC Act;
- State Heritage Register made under the NSW *Heritage Act 1977* (Heritage Act);
- Heritage and Conservation Register (s170 Register) made under the Heritage Act;
- Schedule 5 of the Port Stephens Local Environment Plan 2013; and
- State Heritage Inventory, which is a central collection of statutory heritage listings in NSW.

The only listed heritage item within 500 m of the project is the ‘Stockton Beach Dune System’, which is listed on the Port Stephens LEP and is directly adjacent (north-east and south-east) to the quarry boundary.

The heritage assessment for ERM (2005) identified no historic heritage items in the project site or along the upgraded haul road route.

A military bunker, known locally as the 'Sygna Hilton', was observed in the Boral land holding and dates from the early 1940s when the area was used for military training. The bunker is made of mass concrete and has small firing slits and twin doorways. It may have been a defensive position built to repel Japanese invaders or used for training. The bunker is located within Boral's property, near the southern quarry boundary and approximately 70 m north of the windblown sand extraction area.

The structure lies well outside the project site and will not be impacted and is not listed under any of the identified heritage registers.

2.7 Socio-economic factors

The following section describes the socio-economic profile and demographics of the surrounding community.

2.7.1 Community profile

Socio-economic data derived from the 2016 Australian Census of Population and Housing provides a snapshot of the population profile in the local area. The local area has been defined to include Fern Bay (SSC or State Suburb) and Stockton-Fullerton Cove (SA2 or Statistical Area 2) census geographies were selected as the basis of the census data analysis.

Refer to Chapter 5 of the Social Impact Assessment (**Appendix I**) for a more detailed social baseline of the surrounding community.

Socio-economic indicators

Table 2.3 provides a comparison of Fern Bay, the Stockton – Fullerton Cove and NSW populations in respect to a range of socio-economic indicators.

Table 2.3: Socio-economic indicators

Socio-economic indicator	Fern Bay	Stockton - Fullerton Cove (SA2)	NSW
Total population	2,763	566	7,467,527
Male	49.50%	49.90%	49.30%
Female	50.50%	50.10%	50.70%
Median age	53	51	38
Average children per family for families with children	1.8	1.7	1.9
Average people per household	2.2	2.3	2.6
Median weekly household income	$1,049	$1,164	$1,486
Median monthly mortgage repayments	$2,167	$2,000	$1,986
Median weekly rent	$430	$330	$380
Average motor vehicles per dwelling	1.6	1.6	1.7

The populations do not differ markedly in terms of gender. It is clear that an older population resides in the Fern Bay and the Stockton – Fullerton Cove areas, in comparison to broader NSW. The average number of children per household, people per household, incomes, and motor vehicles per dwelling are smaller when compared to NSW averages.

The median age of 53 for Fern Bay, and 51 for Fullerton Cove, suggests that the two are aging suburbs catering to established members of the workforce or retirees. This position is corroborated by the fact that 55% of community members in Fern Bay and 45.8% of community members in Fullerton Cove own their homes outright, and only 23% of homes in Fern Bay and 27.2% of homes in Fullerton Cove are owned with a mortgage.

Accordingly, the family structure of Fern Bay favours families without children (58.1%) over families with children (32.1%). This is echoed in Fullerton Cove with composition of families comprising 50.2% of couples without children compared to 34.0% of couples with children. The aging status of the community is further substantiated by the fact that 41.6% of couple families are not working in Fern Bay and 34.7% in Fullerton Cove.

Population

During 2016, the Port Stephens LGA population was 74,100, and is forecast to grow to 92,650 by 2036. Total households and implied dwellings will follow the growth trajectory predicted for the population. The rate of growth in each case is predicted to plateau slightly from 2031.

Family composition

Family composition in the LGA is compared to NSW in **Table 2.4**

Table 2.4: Family composition

Family composition	Stockton - Fullerton Cove	%	Fern Bay	%	New South Wales	%
Couple family without children	1,010	50.2	465	58.1	709,524	36.6
Couple family with children	683	34	257	32.1	887,358	45.7
One parent family	292	14.5	74	9.2	310,906	16
Other family	25	1.2	4	0.5	32,438	1.7

Across NSW there are more families (either couples or single parents) with children than in the Fullerton Cove and Fern Bay areas. These statistics underscore the older demograhic and the relatively smaller number of dependent children in the local area.

Employment

Employment status data derived from the Census and reproduced in **Table 2.5,** indicates that both Fern Bay and Stockton-Fullerton Cove residents maintain similar working patterns. The main inconsistency between the two resident groups is the proportion of residents that stated both parents in couple families were not working.

A greater proportion (41.6%) of Fern Bay residents reported this status, compared to 34.7% of the population in Stockton-Fullerton Cove. Overall, the data illustrates that smaller proportions of the Fern Bay and Stockton-Fullerton Cove residents are working, relative to the collective NSW population.

Table 2.5: Employment status

Employment Status of Parents in Couple Families	Fern Bay (%)	Fern Bay (No.)	Stockton-Fullerton Cove SA2 (%)	Stockton-Fullerton Cove SA2 (No.)	NSW (%)	NSW (No.)
Both Employed, Worked full-time	14.8	108	15.9	270	22.6	360,916
Both employed, worked part time	2.1	15	2.7	46	4.0	63,106

Employment Status of Parents in Couple Families	Fern Bay (%)	Fern Bay (No.)	Stockton-Fullerton Cove SA2 (%)	Stockton-Fullerton Cove SA2 (No.)	NSW (%)	NSW (No.)
One employed full-time, one part time	15.3	112	18.6	315	20.6	329,567
One employed full time, other not working	10.7	78	10.7	181	15.0	240,084
One employed part time, other not working	4.1	30	4.9	84	6.1	96,933
Both not working	41.6	304	34.7	590	21.0	334,742
Other (includes away from work)	4.2	31	4.8	81	5.1	80,905
Labour force not stated (by one or both parents in a couple family)	7.3	53	7.7	131	5.7	90,630

The industries that provide most employment opportunities for the Stockton - Fullerton Cove and Fern Bay workforces are identified in **Table 2.6**.

Table 2.6: Employment by industry

Industry of employment	Stockton - Fullerton Cove	%	Fern Bay	%	New South Wales	%
Defence	126	4.9	82	9.8	21,848	0.6
Aged care residential services	83	3.2	30	3.6	67,209	2
State government administration	66	2.6	25	3	45,546	1.3
Hospitals (except psychiatric hospitals)	95	3.7	22	2.6	119,350	3.5

It is clear that Defence is a strong employment industry for both local populations, given proximity to the RAAF base. The same may be said for State government administration data, presuming the base also provides administrative opportunities for the civilian population. The prominence of the Aged Care Residential Services industry is consistent with the older demographic in the area, which promotes a demand for such services.

Social disadvantage

The ABS' Index of Relative Disadvantage identifies and ranks areas in terms of people's access to material and social resources, including their ability to participate in society. The Port Stephens LGA is identified as an area with a low level of relative socio-economic disadvantage.

2.8 Surrounding Land Uses

Land use surrounding the site is a mix of rural, residential, public recreation and environmental conservation areas.

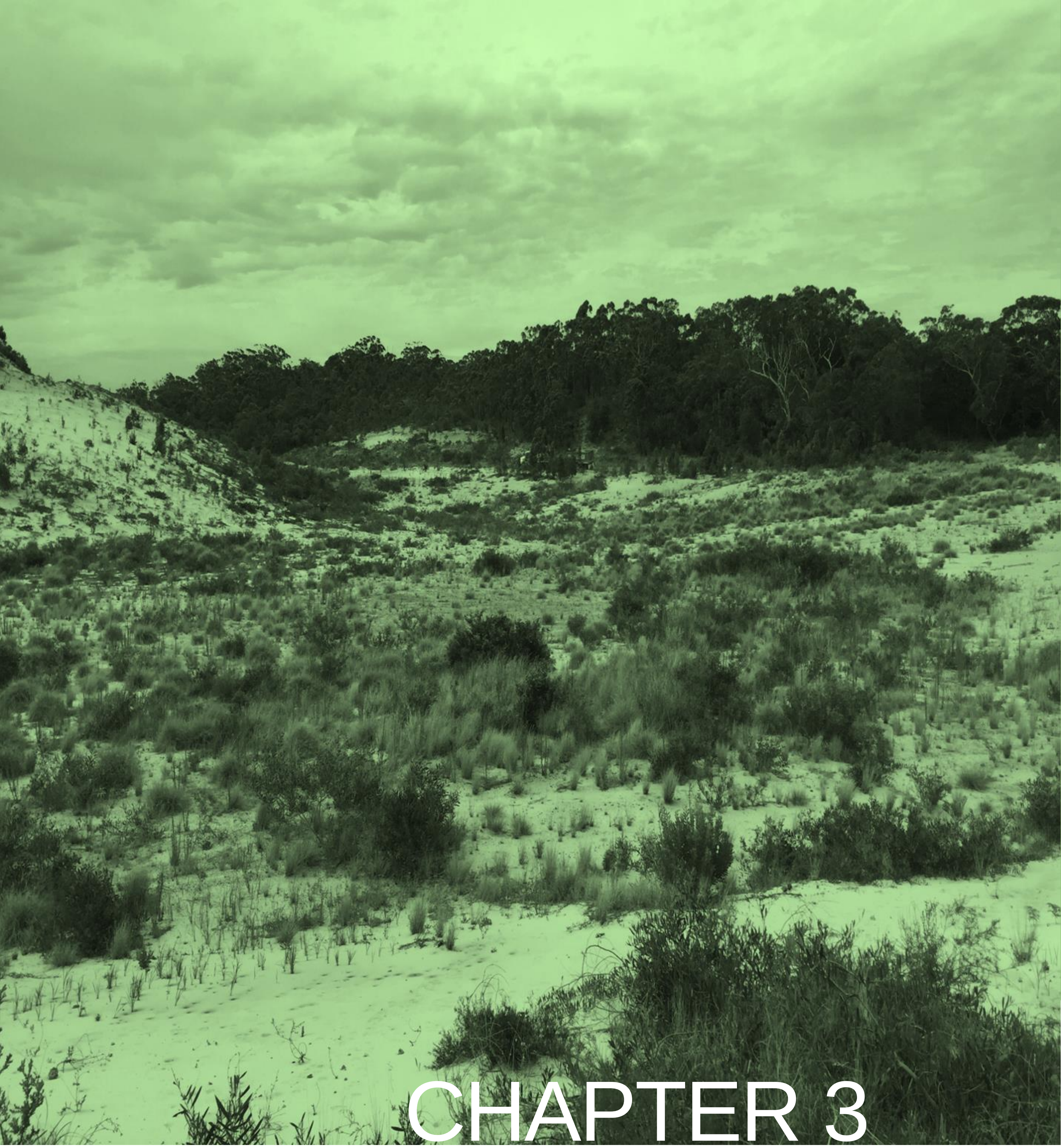
To the north-west of Nelson Bay Road is the rural residential area of Fullerton Cove, which comprises a mix of residential properties and commercial premises. The main access for these properties is via Fullerton Cove Road and Coxs Lane to and from Nelson Bay Road.

These properties are separated from the quarry by Nelson Bay Road, with the closest approximately 480 metres (m) from the entrance to the quarry. A new residential development at Fern Bay (Fern Bay Seaside Village) is approximately 1.5 km to the west-south-west of the quarry. Sensitive receiver areas are shown in **Figure 2.2**.

Most of the environmental conservation areas near the site are Crown land and extend along the Stockton Bight beach and dune system. The beach and dune area are used for recreation including fishing, four-wheel driving, quad bike riding, hiking and horse riding.

Public access to Stockton Bight dunes and beach is via Lavis Lane near Williamtown, and a new access in Seaside Estate at Fern Bay.

The former Sygna shipwreck is near the quarry and was a significant landmark visited by tourist operators. The shipwreck has recently been eroded into the sea.



CHAPTER 3

BACKGROUND AND SITE OPERATIONS

3 BACKGROUND AND SITE OPERATIONS

Sand extraction has taken place in various locations on the quarry since 1976 when G. Hawkins and Sons was initially granted consent.

The eastern (i.e. the seaward edge) section of the quarry was previously dredged for mineral sands by Mineral Deposits Limited between late 2000 and 2003, before the dredge was dismantled in early 2004.

Boral acquired the site in 1992. Under Boral's ownership there have been two primary development consents granted, namely:

- DA 2010/94: The 'inland extraction area' (also known as pits 1-6) granted by Port Stephens Council in May 1996; and
- DA 140-6-2005: The 'windblown sand extraction area' (also known as pit 7) located on the transgressive dunes adjoining Stockton Bight granted by the NSW Department of Planning in 2006.

The inland extraction operation on the vegetated dunes occurred above 5 m AHD and ceased in 2008 and rehabilitation has been ongoing. This former inland extraction area is generally consistent with the project site and is the focus of this SSD application.

The windblown sand extraction area started operations in 2008 and in accordance with Condition 5 of the development consent has 20-year life, due to cease in 2028.

3.1 Approvals history

The following section presents the licences and approvals that Boral hold to operate the quarry.

The quarry has been the subject of several more recent development consents and various licences as outlined in **Tables 3.1** and **3.2**.

3.1.1 Planning approvals

Table 3.1: Planning approval history

Development consent	Approval date	Details	Status
DA No. 140-6-2005	24 January 2006	A new extraction area on the un-vegetated windblown sand dunes (above 2.5 m AHD) adjoining the beach to the east. The site was limited to a maximum transportation limit of 500,000 tpa for 20 years following commencement of operations.	Current and operational.
	10 May 2006	Modification 1 to the 2006 development consent to remove reference to a portion of land incorrectly specified under the 2006 consent and permit extraction of windblown sand on Lots 1 and 2 DP1006399 and Lot 3 DP 664552.	Current and operational.
	24 June 2011	Modification 2 to the 2006 development consent, including more appropriate controls to manage interactions with the public in active extraction areas.	Current and operational.
	Development application submitted	Modification 3 sought to expand the 2006 windblown sand extraction area by removing a portion of the 15 m wide buffer along the seaward and part of the south- western return boundaries, allowing for the extraction of up 475,000 t of additional sand resource. The modification also includes minor amendments to the rehabilitation plan.	Under assessment by DPIE.
DA No. 2010/94	1 May 1996	Sand extraction on the vegetated dunes in the middle of the site above 5 m AHD and road transport up to 500,000 tpa for a period of 13 years. This development consent has now lapsed.	Not operational.
	6 March 2006	Modification to the original 1996 development consent was approved by Port Stephens Council. The modification amended certain administrative conditions of consent and imposed additional conditions regarding heavy vehicle movements and a restriction to extract no more than 500,000 tpa (inclusive of the DA 2010/94 and DA 140-6-2005 extraction areas).	Not operational.

3.1.2 Other licences and consents

Table 3.2 contains a summary of other licences and consents relevant the existing operation and the proposed development.

Table 3.2: Other licences

Description	Licence number and authority	Comments
Crown Land Licence	LI 196915	Licence agreement for Crown land title (Lot 7300 DP1130730).
Surface Water Licence	20AL213136	Boral received a water access licence (WAL) in January 2015 with a zero share allocation for the Stockton Groundwater Source under the WSP. The WAL permits extraction of groundwater, however as the WAL has a zero share component and all existing allocations within the source are unavailable, Boral is not yet able to extract from the aquifer. Boral intends to retain this WAL whilst it investigates water access options for the quarry, which are a requirement for the project.
Bore Licence	20BL171772	Ten monitoring bore licences issued on 4 March 2008 in perpetuity.
Environment Protection Licence (EPL)	EPL 10132	Permits the scheduled activity of 'extractive activities'. The EPL permits the extraction, storage and processing of 100,000-500,000 tpa.

3.2 Former inland extraction area (Pits 1-6)

As set out in **Table 3.1**, Boral extracted sand from the inland extraction area from 1996 to 2008 in accordance with development consent DA 2010/94. The development consent permitted extraction and transportation of up to 500,000 tpa of sand products.

The approved scope of works and method generally included the following.

3.2.1 Site clearing and preparation

A dozer was used to clear native vegetation within the extraction area. Felled vegetation was stockpiled for later re-use in rehabilitation efforts on the site. The dozer was then used to strip understorey vegetation and topsoils typically 50 m ahead of the advancing extraction area.

Topsoils from the cleared area were stripped using the dozer and initially stored in stockpiles or windrows adjoining the extraction area. The depth of topsoil removed was dependent on slope, however, typically ranged 100-300 mm.

As extraction proceeded, topsoils were spread over previously extracted areas to a minimum depth of 200 mm.

3.2.2 Sand extraction

Recycled road base from Boral's Kooragang Island recycling facility was imported where required to provide an inert stable base for haul roads and the floor of the operating extraction area.

Sand was removed via a front-end loader which pushed into the exposed sand face. As the sand was relatively free-flowing, material fell towards the front-end loader at the natural angle of repose.

The face of sand extraction was typically 150 m wide, and a 0.5 m high vegetated bund was maintained along the perimeter of the extraction area to assist with containment of stormwater runoff.

Sand was dry screened in order to remove roots and minor naturally occurring coal fragments.

A front-end loader or excavator loaded road trucks in-pit with screened raw sand for transport off-site via the weighbridge.

3.3 Existing operation: windblown sand extraction area (Pit 7)

As set out in **Table 3.1** and **Figure 2.8**, Boral currently extracts sand from the transgressive dunes, referred to as the windblown sand extraction area. Sand extraction commenced in 2008 in accordance with development consent DA 140-6-2005.

The development consent permits extraction and transportation of up to 500,000 tpa of sand products over a 20-year period.

The approved scope of works and method comprise:

- extraction of sand annually through regular harvesting of windblown sand and dry excavation of the dune mass;
- transportation of up to 500,000 tonnes of sand;
- campaign mobile screening, where required;
- maintenance of the haul road to transport sand from extraction area;
- haulage of product from existing depot/weighbridge to Nelson Bay Road and the wider road network; and
- progressive stabilisation of windblown vegetation edge.

3.4 Site infrastructure

Boral established a fenced site depot as part of its previous inland extraction area project, and this depot has been maintained for the existing operations. The fenced depot contains the following infrastructure:

- an amenities/office building providing an office, lunchroom, toilet and shower;
- weighbridge;
- designated parking area for employees and visitors; and
- maintenance shed for the front-end loader and 4,200 L above ground bunded fuel tank.

3.4.1 Utilities and services

The following section sets out the availability of existing services and utilities at the site.

Water

Rainwater tanks were installed adjacent to site buildings to capture up to 10,000 L water for use in on-site ablutions. A water truck is also used on a campaign basis to provide dust suppression.

Electricity

The site office and workshop was established and connected to mains electricity providing power to both the office and workshop and for security lighting and monitoring.

Wastewater

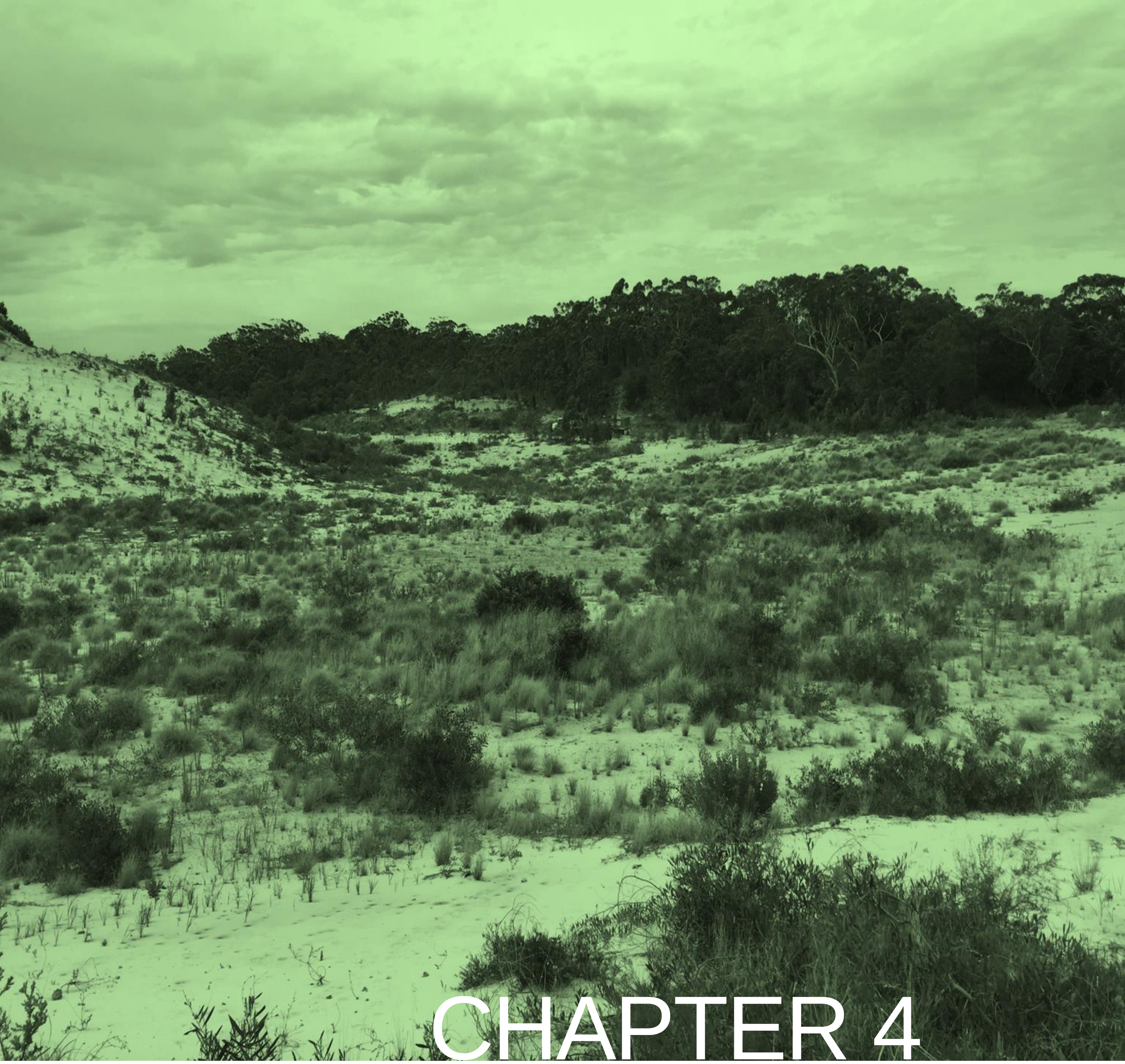
A septic tank was installed to capture wastewater generated by the site office and amenities buildings.

3.5 Environmental management

Environmental management and monitoring at the quarry is in accordance with the following documents, previously prepared and approved in accordance with DA 140-6-2005:

- *Environmental Management Strategy* (ERM, 2007a);
- *Erosion and Sediment Management Plan* (ERM, 2007b);
- *Groundwater Monitoring Program* (ERM, 2008); and
- *Rehabilitation and Landscape Management Plan* (ERM, 2007c).

The quarry has a complaints hotline, with all community or regulator complaints logged in a complaints register and investigated and actioned immediately.



CHAPTER 4

THE PROJECT

4 THE PROJECT

This chapter describes the location of the project and proposed development to be undertaken by Boral.

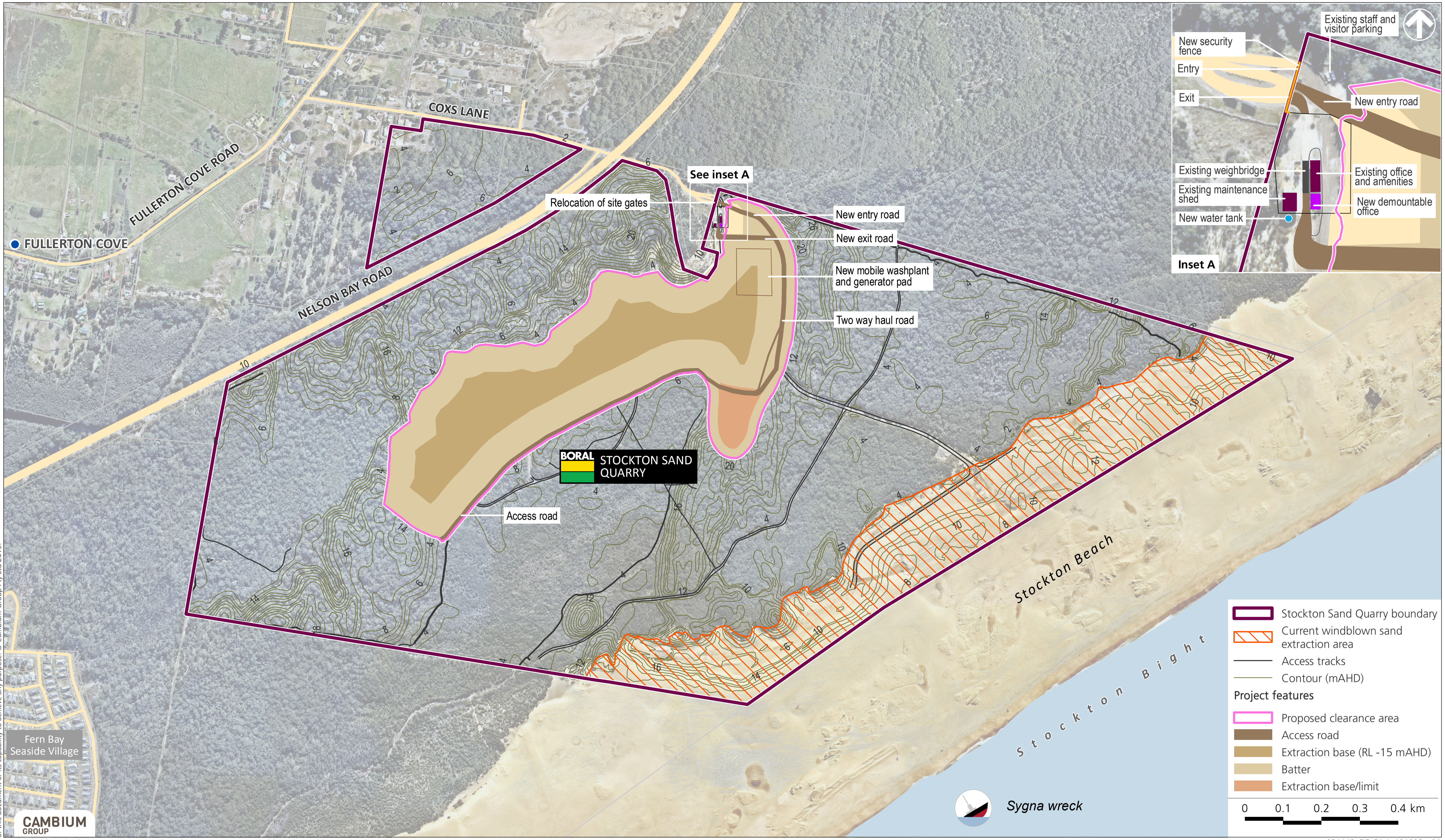
4.1 Project Site

The project site contains all areas to be disturbed by project operations and covers an area of approximately 37 ha. The 'proposed clearance area' as identified in **Figure 4.1** includes all areas to be disturbed by sand extraction operations, including areas of vegetation clearing. The project site includes the 'proposed clearance area' together with ancillary activities including alterations to the site depot.

The project site is generally consistent with the former inland extraction area footprint approved under the 1996 development consent except for areas to east and south-east of Lot 3 and along the southern edge to allow for the construction of new haul roads.

Figure 4.1
The Project

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: LPI (2017), Photomapping Services (2018), Nearmap (2019, Boral (2019), Cambium Group (2019).

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4.2 Project description

Sand from the former inland extraction area was only extracted to 5 m AHD under the original 1996 development consent. The sand resource above 5 m AHD was exhausted in 2008 and in accordance with the conditions of consent the operations have ceased.

The project involves the extraction of sand from the former inland extraction area (inclusive of pits 1-6) from the existing ground level to a depth of -15 m AHD. As extraction will intercept the groundwater table (at 1-2 m AHD) the primary method of sand extraction will involve dredging.

There is an estimated 9 Mt of sand resource in the project site. The project seeks permission for a site wide increase on the dispatch limit to 750,000 tpa (i.e. the windblown sand extraction area and the project operations combined) up to 2028, after which the site wide limit will reduce to no more than 500,000 tpa.

The increase in the site wide dispatch limit is sought to permit maximum flexibility across the two sand extraction areas (on the same quarry site).

Mobile plant and equipment will operate across both project areas and a docket system at the weighbridge will monitor outgoing product as a quarry total.

To account for fluctuations in demand, Boral is seeking consent to operate the project for 25 years.

4.2.1 Site establishment

Minimal site establishment works are required given existing operation, infrastructure and services at the site.

Where new or augmented infrastructure is required, this will be delivered as part of Stage 1 of the project and will generally include:

- construction of a new entry road. The new road will link to the existing haul road in the south-eastern extent of Stage 1 and enable continued access to the windblown sand extraction area. The road will be two way configuration (i.e. trucks moving in and out) and a separated exit road will be constructed to allow exiting vehicles to cross the weighbridge (refer to **Figure 4.1**);
- a pad for the wash plant and diesel generators will be constructed as soon as practicable after vegetation removal and sand extraction in the northern portion of Stage 1; and
- relocation of the parking area to the south and relocation of the security gates northward across the entry road which will enclose the parking area and the new entry road. The docketing kiosk registering vehicles entering the site will also be relocated.

To limit the loss of sand product, site establishment activities requiring the clearing of vegetation and removal and stockpiling of topsoil will only occur as necessary.

The existing site depot will also be reconfigured to support the project and will include the following:

- installation of a new prefabricated office building;
- relocation of onsite materials storage;
- replacement of roofing for the workshop;
- and installation of a 30,000 L water storage tank for potential firefighting efforts.

4.2.2 Internal access roads

The proposed internal access roads for the project are outlined in **Figure 4.1**.

A new haulage route will be constructed during site establishment works in Stage 1 which will extend around the north, east and southern perimeter of Stage 1 and link to the existing haul road to the windblown sand extraction area. The new road will create a one way entry and exit from the site, the rest of the road will be two-way.

The perimeter haul road around the southern edge of the formed stages 2 to 5 dredge pond will be constructed progressively as sand extraction progresses.

A turning head will be constructed at the end of the perimeter haul road to allow vehicles to turn and travel back along the perimeter haul road and out of the site via the newly constructed exit road. The exit road will pass via the existing depot and weighbridge.

The perimeter haul road will be up to 10 m wide and when complete (at the end of Stage 5) will enable movement of vehicles around the southern perimeter of the dredge pond and be used to support access for rehabilitation works and future site management.

4.2.3 Sand extraction and staging overview

The project will progress in six stages. **Figure 4.2** shows the extraction staging plan.

Site preparation will involve clearing and grubbing of established vegetation from previous rehabilitation and possible screening of accumulated leaf litter and organic matter. Cleared vegetation will be mulched or stockpiled on-site for later use in rehabilitation. Similarly, any stripped topsoil will be retained for use in rehabilitation.

Stage 1 will involve dry extraction to a depth of 4 m AHD. A front-end loader will push into the exposed sand face and as the sand is relatively free-flowing, material will fall towards the front-end loader at the natural angle of repose.

The sand will then be screened and stockpiled before a front-end loader loads road trucks in-pit with screened raw sand for transport off-site via the weighbridge.

A pond will be created in the area of Stage 2 following initial dry extraction of sand in Stage 1. The pond will be large enough to float a dredge and accommodate freshwater pumping for the proposed wash plant.

The dredge will move progressively through the extraction area in a south-westerly direction in a staged process. Extraction will then move to the east and culminate with relocation of the proposed processing and stockpile area to a confined area in Stage 1 and subsequent dredging of the majority of the Stage 1 extraction area (to be known as Stage 6).

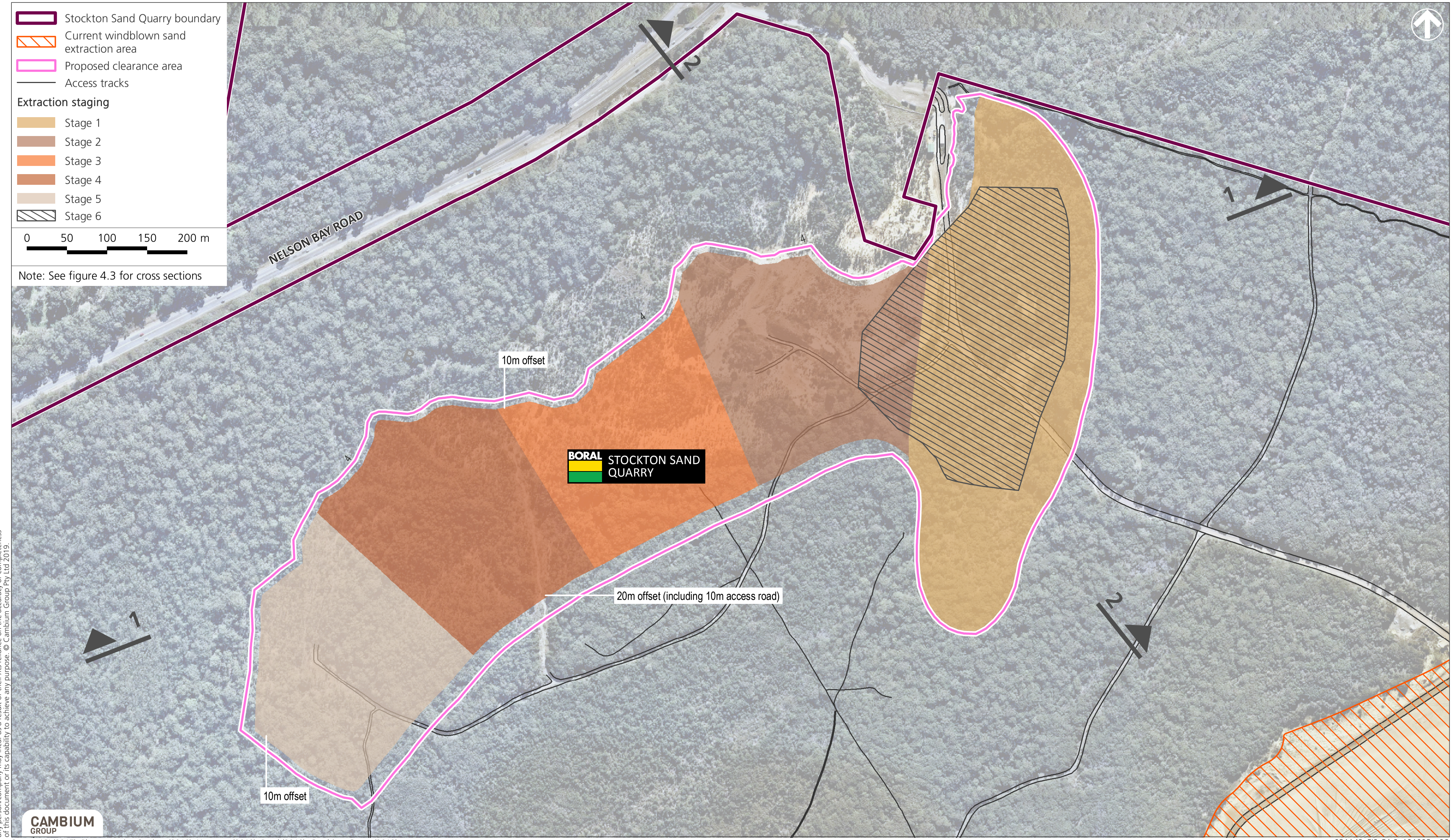
In most cases, the sand in each extraction stage will be fully extracted unless constraints are encountered.

The dredge will move backwards and forwards across the active dredge pond, sucking the underwater sand face. The sand/water mix will be pumped directly from the dredge via a pontoon-mounted pipeline to the wash plant in the processing area. The dredge will manoeuvre around the pond and its position will be stabilised by wire ropes connected to the pond banks.

Sand will be extracted to a maximum depth of approximately -15 m AHD.

Figure 4.2
Extraction staging plan

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



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Source: LPI (2017), Photomapping Services (2018), Nearmap (2019), Boral (2019), Cambium Group (2019).

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Stage 1

The Stage 1 extraction area is along the eastern portion of the project site (refer to **Figure 4.2**).

Stage 1 of the project will comprise:

- removal of vegetation from across the whole footprint of the Stage 1 extraction area and a small portion of land to the north-east of the existing depot to allow for the construction of a new haul route that will extend around the north, east and southern perimeter of Stage 1 and link to the existing haul road to the windblown sand extraction area;
- where present, stripping topsoil and store on site within designated stockpile areas;
- extraction of sand in the Stage 1 extraction area via front end loader and excavator to a depth of 4 m AHD;
- screening and stockpiling sand;
- levelling of the Stage 1 extraction area as required;
- establishing a level pad at the north-western boundary of Stage 1 and establishing the wash plant and diesel generators; and
- delivery and installation of a prefabricated office building and commencement of other alterations to the existing site depot.

The moisture content of dry extracted sand leaving the quarry will not exceed 3%.

Stage 2

As Stage 1 is nearing completion, Stage 2 will be commenced. To limit the loss of sand to wind erosion, a maximum extent of 200-300 m of vegetation and ground cover will be cleared at any one time. The general area of Stage 1 will be used for stockpiling of processed sand ready for dispatch.

The typical method for sand extraction in Stage 2 will be:

- progressive stripping of areas in 200-300 m segments across the stage;
- excavation of an initial dredge window to allow for a suitable water to sand ratio to develop, and may involve excavation from 2-6 m AHD;
- once a suitable sand/water ratio has been established the dredge will be floated. The dredge will be fixed to a pontoon which is connected to the wash plant via a pipeline;
- a sand/water mix will be dredged by suction to the wash plant, where sand will be extracted, and excess water will be returned via a separate pipeline to dredge pond;
- the wash plant will screen out oversize material in excess of 20 mm in size; and
- dredging will be to a maximum depth of 15 m below sea level.

Sand will be stockpiled once washed to allow for water to free drain back into the aquifer and reducing the moisture content to as low as possible. The moisture content of dredged sand leaving the quarry will not exceed 5%.

Stages 3-5

The method described in Stage 2 will be repeated in each subsequent stage to the completion of Stage 5.

At the completion of Stage 5 progressive rehabilitation of the Stages 2-5 dredge pond banks will commence. Initial rehabilitation will not include the Stage 1 extraction area as this will continue to be disturbed for Stage 6 of the project.

Stage 6

Except for the southern portion of Stage 1, containing the wash plant and generator, the Stage 1 extraction area will be excavated to reveal the groundwater table and subsequently dredged in an identical manner to Stages 2-5. The Stage 2-5 dredge pond will be extended into the Stage 1 extraction area and dredging of the pond will also be to a depth of 15 m below the water table.

4.2.4 Processing, blending and stockpiling

A processing and stockpile area will be established generally within area of Stage 1 of the project area. Sand extracted by front-end loader and/or excavator will be transported to the Stage 1 area, dry screened for immediate sale or stockpiled.

A pad will be created for the wash plant within the northern portion of the Stage 1 area. The location of the wash plant will be fixed during Stages 2 to 5, after which, it will be relocated within Stage 6 in order to maximise the remaining extraction from the body of Stage 6. The indicative position of the wash plant and stockpile area on **Figure 4.1** has been formulated to represent the closest point to sensitive receivers in Fullerton Cove to the north-west of Nelson Bay Road.

The wash plant will entail sand/water pumped from the dredge passing over an initial screen to separate oversize organic matter or debris and into a large wash tank to float out any fines (<75 micrometres). After washing, the sand will be pumped through a cyclone and stockpiled for further dewatering.

The proposed stockpile area is located generally within area of Stage 1 of the project area and will encompass stockpiles of topsoil, vegetation and sand products. Stockpiling of material will be limited in terms of volume and timeframe to limit the loss of resource.

Stockpiles of cleared/mulched vegetation will be minimal as this material will be reused on site for the purposes of rehabilitation on the windblown dunes and stabilisation works in other areas across the project site.

Dewatered sand will be loaded with a front-end loader and/or excavator into trucks for dispatch.

4.2.5 Stabilisation measures

The dredge pond batters will be designed as follows:

- A batter slope of 2H:1V (Horizontal:Vertical) above 4 m AHD;
- A batter slope of 3H:1V from 4 m AHD on the sides of the dredge pond to 15 m below the water table at the base. The batter slope of 3H:1V will range from 3-9 m AHD on the southern and eastern perimeters of the dredge pond and also extend to 15 m below the water table at the base.
- On the southern and eastern sides of the proposed dredge pond the perimeter haul road will follow existing topography and may require some earthworks as required to achieve 10H:1V and facilitate safe access for heavy vehicles.

Refer to **Figure 4.3** for indicative cross sections for the project.

The stabilisation of the edges of the dredge pond will rely on batters at an angle of natural repose. Preliminary geotechnical advice has been provided by Pells Sullivan Meynick Pty Ltd, which recommended regular inspection of the batters to ensure management responses are taken. Where necessary, a protective layer of appropriate VENM may be used to stabilise the embankments.

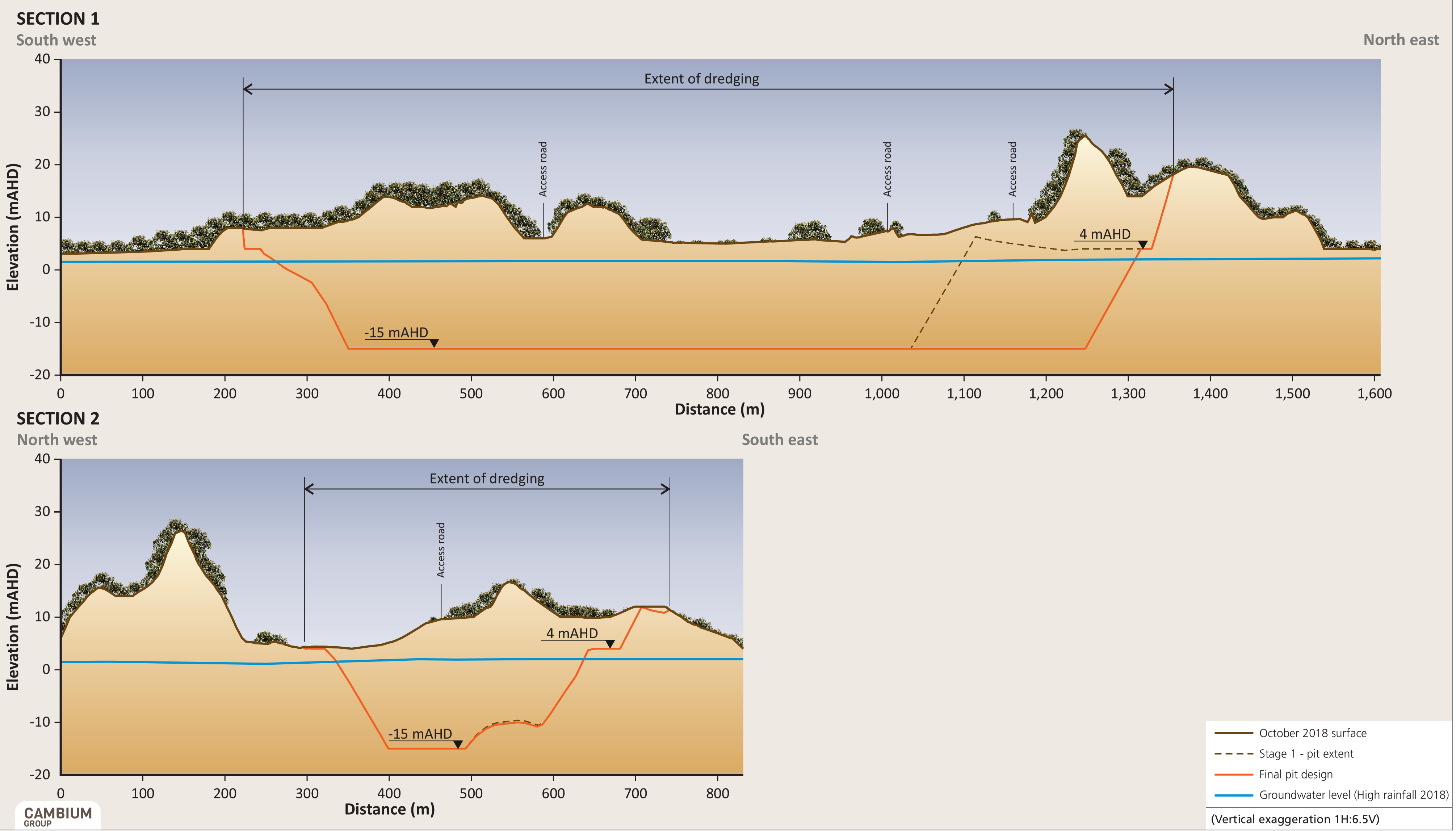
Management options for stabilisation and embankment erosion will be:

- progressive rehabilitation using planted edges; and/or
- VENM emplacement, including application of 450 mm rock (refer to **Section 4.2.7**).

In the initial phases of work, the aim will be to stabilise the edge of the pond and where necessary to prevent wave action induced erosion at the pond edge.

Figure 4.3
Sections

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: Environmental Earth Sciences (2018), Photomapping (2018), Boral (2019), Cambium Group (2019)

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4.2.6 Dust suppression

A water cart will be used to suppress dust during initial site establishment works when necessary, focussing on the existing and proposed haulage routes and the Stage 1 extraction area.

Except for Stage 1, progressive sand extraction will limit exposed ground surfaces to 200-300 m at any one time so that sand is not lost to wind.

Additional water to current demand will likely not be required for dust suppression given the reduction in sand extraction at the windblown extraction area and eventual cessation of activities in this area.

4.2.7 VENM Importation

Boral proposes to import up to 70,000 tpa of VENM by road to stabilise slopes and batters as required.

4.2.8 Dispatch limit

Boral is seeking a site wide dispatch limit (i.e. the existing windblown extraction area and proposed dredging extraction areas) of no more than 750,000 tpa. The project will not alter the directional split of traffic movements to or from the quarry, with trucks travelling both north and south along Nelson Bay Road and beyond. Most trucks will be truck and dog combination, with an average of 34 t.

Boral will limit the total exportation of product via road to 750,000 tpa until the windblown sand development consent lapses in 2028. At this point, the dispatch and transportation of product will reduce to 500,000 tpa.

4.2.9 Transport

The project will generate 30 heavy vehicle movements per hour during a maximum hour of production, equating to approximately 284 laden vehicle movements per day.

The maximum traffic generation for the project comprises 26 heavy vehicles transporting sand product per hour, and four heavy vehicles importing VENM to the project site per hour.

4.2.10 Plant and equipment

The plant and equipment currently operated at the quarry (refer to **Section 2.4.4**) will be used during the project.

In addition, the following plant and equipment will be acquired and used:

- suction dredge (as described in **Section 4.2.3**);
- a wash plant (as described in **Section 4.2.4**); and
- two diesel generators.

4.2.11 Hours of operation

The project will continue to operate in accordance with the following approved hours in the 2006 development consent:

- Monday to Friday – 6:15 am to 5:00 pm;
- Saturday – 6:15 am to 12 noon; and

- no operation on Sundays or Public Holidays.

The site is also approved to operate extended hours during major supply contracts as follows:

- Monday to Friday – 6:15 am to 6:00 pm;
- Saturday – 6:15 am to 3:00 pm; and
- no operation on Sundays or Public Holidays.

Boral seeks the continuation of the existing hours of operation including extended operations as and when required. The potential additional one hour Monday to Friday, and three hours on a Saturday allow for a limited range of flexibility in operations to meet fluctuating project demands over time.

4.2.12 Employment

The project will provide employment for an additional two full time personnel and two casual employees, bringing the total employment for the quarry to six full time and three casual employees. The quarry will continue to provide flow on employment opportunities for numerous Boral and customer truck drivers and associated service personnel.

4.2.13 Rehabilitation

Upon completion, the project site will be left as a freshwater pond and rehabilitation will comprise:

- rehabilitating the pond edge;
- plant species planted along the edges of the pond will be selected to maximise the bank stability; and
- stabilising re-profiled areas as soon as possible, minimise potential erosion and degradation of areas of exposed topsoil.

In the initial phases of work, the aim of rehabilitation will be to stabilise the edge of the pond.

4.3 Production schedule

Boral proposes to extract approximately 9 Mt of sand. At a maximum extraction rate of 750,000 tpa up to 2028 and then 500,000 tpa thereafter the reserve would last for approximately 19 years. However, as there is no guarantee that the current extraction/sales rate will be maintained due to the vagaries of the market, a 25 year consent will enable the resource to be fully extracted and account for fluctuations in the market demand.

The indicative schedule for the stages of the project is summarised in **Table 4.1**. The table is based on the extraction occurring at maximum capacity every year over each stage of the project.

Table 4.1: Production schedule

Stage	Reserve (tonnes)	Duration (years)	Approximate dates
Existing windblown sand extraction area	1,500,000 (maximum)	3-9 years	2019-2028
1	1,640,000	2-3	2020-2022
2	1,327,138	2-3 years	2022-2025
3	1,354,000	2-3 years	2025/2026-2028/2029
4	1,901,000	3- 4 years	2030- 2034

Stage	Reserve (tonnes)	Duration (years)	Approximate dates
5	1,483,000	3 years	2037
6	1,326,000	3 years	2039/40
Total (Stages 2-6)	9,032,138	19 years	-

4.4 Comparison against existing operations

A comparative summary of the key project elements in comparison to the existing windblown sand extraction operations is provided in **Table 4.2** below.

Table 4.2: Comparison against existing operations.

Aspect	Existing windblown sand operations	The project
Land use	Extractive industry	Extractive Industry
Location on site	Windblown (transgressive) dunes	Inland dunes
Hours of operation	**Standard hours:** ▪ Monday to Friday - 6.15 am to 5.00 pm; ▪ Saturday - 6.15 am to 12.00 pm (noon) ▪ Sunday and public holidays - no operations. **Extended hours:** ▪ Monday to Friday - 6.15 am to 6.00 pm; ▪ Saturday - 6.15 am to 3.00 pm; and ▪ Sunday and public holidays - no operations.	**Standard hours:** ▪ Monday to Friday - 6.15 am to 5.00 pm; ▪ Saturday - 6.15 am to 12.00 pm (noon) ▪ Sunday and public holidays - no operations. **Extended hours:** ▪ Monday to Friday - 6.15 am to 6.00 pm; ▪ Saturday - 6.15 am to 3.00 pm; and ▪ Sunday and public holidays - no operations.
Consent period	20 year life, due to cease in 2028	25 years from the date of commencement
Transport limits	500,000 tpa	750,000 tpa (inclusive of both the windblown sand operations and the project) until the windblown sand development consent lapses in 2028. At this point, the dispatch and transportation of product will reduce to 500,000 tpa.
Extraction method	Dry extraction only.	Dry extraction of the stage 1 area followed by wet extraction (dredge) stages 2 – 6 (inclusive)
Processing	Minimal – sand is typically loaded directly into trucks for dispatch	Stage 1 – as needed dry screen prior to dispatch (dependant on quality).

Aspect	Existing windblown sand operations	The project
		Stages 2 – 6 (inclusive) sand is dredged and processed through a wash plant prior to being stockpiled using a telescopic stacker
VENM Importation	Nil	70,000 tpa
Site infrastructure	Established depot at the site which contains: ▪ an amenities/office building providing an office, lunchroom, toilet and shower; ▪ weighbridge; ▪ designated parking area for employees and visitors; and ▪ maintenance shed; and ▪ 4,200 L above ground bunded fuel tank.	Retain all existing improvements and augment/upgrade to include: ▪ new prefabricated office building; ▪ relocation of onsite materials storage (currently in the footprint of proposed stage 1); ▪ replacement of roofing for the workshop; and ▪ new 30,000 L water storage tank.
Utilities	▪ depot connected to the grid; ▪ tank water; and ▪ septic system.	▪ depot connection maintained and extended to connect to the proposed office building; and ▪ two generators to power proposed wash plant and stacker.
Plant and equipment	Mobile equipment operated at the site comprises: ▪ a front-end loader (capacity nine tonnes); ▪ a dozer (part time); ▪ a water truck (13,000 L capacity); and ▪ a mobile screen (20 mm mesh screen and a 5 m^3 capacity receiving bin).	Existing mobile equipment to be retained, with additional plant and equipment to include: ▪ potential use of mobile screen; ▪ suction dredge; ▪ a wash plant; and ▪ telescopic stacker.
Truck movements	152	284 (maximum)

Boral seeks consent for the project as a standalone consent that would operate in accordance with project specific controls and criteria. Like any new and incoming development these criteria have been established taking into account all existing sources (including the windblown sand operations).

In this regard it is noted that the points of commonality or crossover occur only in relation to the following aspects of the development:

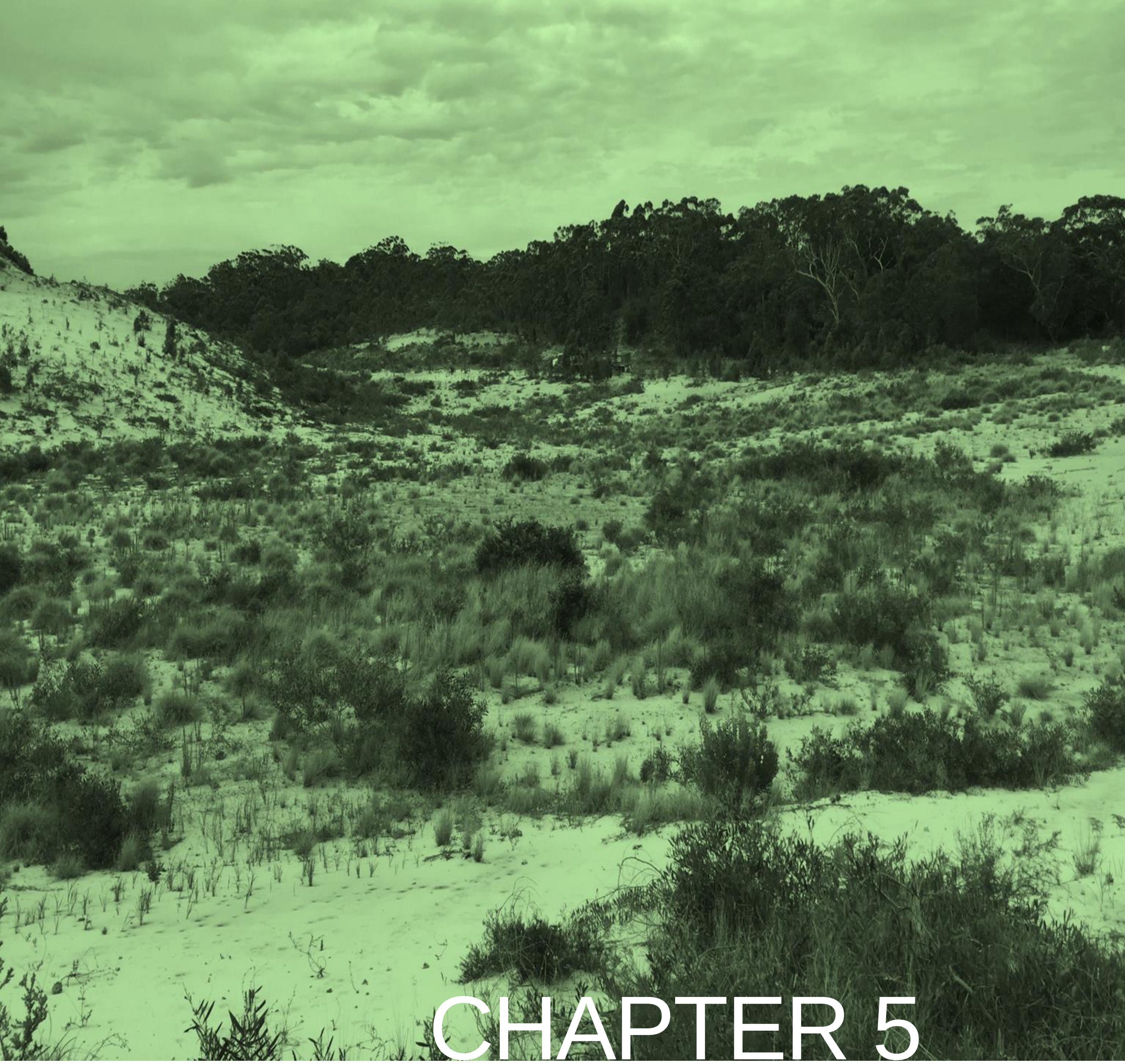
- access roads (predominately those located in the north west of the site);

- site depot amenities and infrastructure;
- fuel storage; and
- transport limits.

In all other respects the project will operate independent of the windblown sand operations. The minor nature of the shared elements are unlikely to give rise to inconsistencies in the project approvals that would impact on management of the site.

In all other respects project compliance would be tracked as individually in accordance with project specific, environmental management, compliance and reporting mechanisms.

As highlighted above, Boral will limit the total exportation of product via road to 750,000 tpa until the windblown sand development consent lapses in 2028. At this point, the dispatch and transportation of product will reduce to 500,000 tpa. This may require a minor modification to the existing windblown sand development consent prior to commencement of the project approval.



CHAPTER 5
STAKEHOLDER ENGAGEMENT

5 STAKEHOLDER ENGAGEMENT

Successful completion of the EIS required consultation with several key stakeholders. This chapter provides a summary of the stakeholders engaged for the project.

5.1 Assessment requirements

The SEARs in **Table 5.1** require consultation with relevant stakeholders during the preparation of the EIS and documentation of the outcomes of the stakeholder engagement process.

Table 5.1: Stakeholder engagement related SEARs

Requirement	Section and appendix where addressed
During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners.	Chapter 5, Chapter 13, Appendix B
in particular, you must consult with: • affected landowners; • community groups; • Port Stephens Council; • Office of Environment and Heritage (including the Heritage Branch); • Environment Protection Authority; • Division of Resources and Geoscience within the Department; • Department of Primary Industries (including NSW Forestry, Agriculture and Fisheries); • Department of Industry (including the Crown Lands and Water Division); • Hunter Local Land Services; • Hunter Water; • NSW Health; • NSW Rural Fire Service; and • Roads and Maritime Services.	Section 5.2 and 5.3, Appendix B
The EIS must: • describe the consultation process used and demonstrate that effective consultation has occurred; • describe the issues raised; • identify where the design of the development has been amended and/or mitigation proposed to address issues raised; and • otherwise demonstrate that issues raised have been appropriately addressed in the assessment.	Section 5.2 and 5.3

5.2 Stakeholder engagement strategy

Having operated the quarry for a long time, Boral has a sound understanding of the key stakeholders that have an interest in the operations. A detailed stakeholder engagement strategy and program was developed at the start of the SSD process to guide stakeholder engagement activities.

The focus of the stakeholder engagement program was to identify any relevant concerns stakeholders may have about the project, ensure these concerns are appropriately considered by the project team, and where necessary, address these through changes or refinements to the design of the project and associated infrastructure.

The SEARs also require an “assessment of the likely social impacts of the development” in accordance with the *Social impact assessment guideline – for State significant mining, petroleum production and extractive industry development* (NSW Department of Planning and Environment, 2017).

To inform the social impact assessment (SIA) for the project thorough engagement was required with potentially affected neighbours, landowners along Coxs Lane and in Fullerton Cove, non-government organisations, government agencies, Council and the general public. The SIA report in **Appendix I** and summarised in **Chapter 13** of the EIS, provide a summary of all key stakeholder engagement including:

- who was consulted;
- when they were consulted;
- what they were consulted about;
- what issues were raised;
- where follow up consultation or additional research was required to further investigate any issues raised; and
- how these issues were considered in the project design, and development of impact avoidance, minimisation and management measures.

The key community engagement activities carried out for the SIA and outcomes of this engagement are summarised in **Section 13.2.3**.

The site shares a boundary with Worimi Conservation Lands (WCL) and as such consultation with WCL has been a key focus of the stakeholder engagement strategy. WCL were consulted during the ACHA process as further detailed in **Section 5.4**. WCL participated in the site inspection for the ACHA and were invited to provide comment on the assessment methodology and draft ACHA report. No response was received from WCL. Despite this, consultation with WCL is an ongoing focus for Boral and at the time of writing, an additional meeting is being sought with WCL to discuss the project.

5.3 Government agency consultation

Table 5.2 provides a summary of government agency consultation and any key issues raised and provides a reference to where in the EIS these issues have been addressed. It captures key outputs from government agency consultation. Where no key outputs arose from government agency consultation, consultation with that government agency has not been captured.

Each government agency was issued a letter introducing the project in July 2019. The letter advised that the EIS was being prepared and the agency was invited to discuss the project, advise if it required any additional considerations beyond the SEARs in the EIS, or state whether it had no comments and would like to await exhibition of the EIS.

Table 5.2: Summary of government agency consultation

Stakeholder	Comments	Response/EIS Section Reference
DPIE	The development application was lodged with DPIE and a subsequent preliminary environmental assessment (Element, 2018) was lodged with DPIE in September 2018. The SEARs for the project were issued un 16 November 2018 by DPIE.	Refer to **Section 1.7**, **Appendix A** and the start of chapters of the EIS for DPIE SEARs and where addressed by this EIS.
Port Stephens Council (Council)	A response was received from Council (contact Emmilia Johnstone) on 23 July 2019 stating that there were no additional comments from Council and it would await exhibition of the EIS.	Refer to **Appendix A** for Council SEARs and where addressed by this EIS. Refer to correspondence from Council in **Appendix B**.
DPIE – Water, Lands and Primary Industry Division (formerly NSW Department of Industry – Water and NSW Department of Primary Industries, Agriculture and Fisheries Division)	Given there are no state forests near the quarry, it was considered that consultation with DPI Forestry was not warranted. A response was received from DPI Fisheries Division (contact Scott Carter) on 17 July 2019 stating that there were no fisheries concerns for this development application. A response was received from DPI Agriculture Division (contact Tory Lawrence) on 18 July 2019 stating that there were no comments from the Division and it would await exhibition of the EIS.	Refer to correspondence from DPI in **Appendix B**.
DPIE – Water, Lands and Primary Industries Division (formerly NSW Department of Industry, Crown Lands Division	A response was received from Crown Lands (contact Mark Grace) on 26 July 2019 highlighting the current licence agreement would require amendment to reflect the proposed access arrangements to the quarry. A meeting was held between Boral and Crown Lands on 8 August 2019 to discuss the licence agreement. Licensing arrangements will be resolved directly with Crown Lands.	Refer to correspondence from DPIE in **Appendix B**.
DPIE – Division of Resources and Geoscience (DRG)	DRG provided a response on 8 August stating that there were no additional comments and it would await exhibition of the EIS.	Refer to **Appendix A** for DRG SEARs and where addressed by this EIS. Refer to correspondence from DPIE in **Appendix B**.

Stakeholder	Comments	Response/EIS Section Reference
EPA	A response was received from EPA (contact Lisa Richards) on 31 July 2019 stating that there were no additional comments from the EPA and they would await exhibition of the EIS.	Refer to **Appendix A** for EPA SEARs and where addressed by this EIS. Refer to correspondence from the EPA in **Appendix B**.
DPIE – Environment, Energy and Science Division (formerly NSW Office of Environment and Heritage)	A response was received from DPIE (contact Steven Cox) on 2 August 2019 stating that there were no additional comments from the Division and it would await exhibition of the EIS.	Refer to **Appendix A** for DPIE – Environment, Energy and Science Division SEARs and where addressed by this EIS. Refer to correspondence from DPIE in **Appendix B**.
Hunter Local Land Services (HLLS)	A response was received from HLLS (contact Brett Miners) on 17 July 2019 stating that there were no comments from HLLS.	Refer to correspondence from HLLS in **Appendix B**.
Hunter Water	Follow up correspondence was issued to Hunter Water on 31 July 2019 and 8 August 2019. A letter response was received from Hunter Water on 15 August 2019. Hunter water recommended that extractive operations are designed and carried out in a manner which ensure protection of water sources and facilitates sustainable future land uses. Hunter Water also suggests that the EIS demonstrates how dredging operations would not adversely impact the aquifer, and recommend development of a monitoring and management program to assess and mitigate any effects on groundwater level or quality. The EIS should also demonstrate that site operations would not contaminate the aquifer and include management of wastewater and stormwater. The rehabilitation and future land use of the site to protect the aquifer as a potential source of drinking water in future should also be addressed.	Refer to correspondence to Hunter Water in **Appendix B**. The EIS has addressed Hunter Water concerns in relation to groundwater resources as detailed in **Chapter 8**, **Chapter 17**, **Appendix D** and **Appendix L**.
NSW Rural Fire Service (RFS)	Follow up correspondence was issued to RFS on 8 August 2019. Despite repeated attempts at consultation, no response was received from RFS.	Refer to **Appendix A** for RFS SEARs and where addressed by this EIS. Refer to correspondence to RFS in **Appendix B**.

Stakeholder	Comments	Response/EIS Section Reference
Roads and Maritime Services (RMS)	A response was received from RMS (contact Peter Marlor) on 22 July 2019 stating that there were no additional comments from RMS and it would await exhibition of the EIS.	Refer to **Appendix A** for RMS SEARs and where addressed by this EIS. Refer to correspondence from RMS in **Appendix B**.
NSW Health – Hunter New England Local Health District	A response was received from NSW Health on 17 July 2019 stating that there were no comments and the Department would await exhibition of the EIS.	Refer to correspondence from NSW Health in **Appendix B**.
Natural Resources Access Regulator (NRAR)	The NRAR was consulted during the preparation of the EIS and provided advice that the exposure of the aquifer to the atmosphere and subsequent direct evaporation from the aquifer must be accounted for as groundwater extraction.	Refer to **Chapter 17** for consideration of groundwater extraction quantities and water licensing requirements.

5.4 Aboriginal community groups

The Aboriginal heritage specialists (Kelleher Nightingale Consulting Pty Ltd) consulted the Aboriginal community in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010).

Each private Aboriginal organisation or individual who responded with a written request to be registered for consultation is referred to as a 'registered aboriginal party' (RAP). Government agencies who registered interest were also consulted in parallel with RAPs.

Details of consultation are provided in Appendix A and Appendix B of the ACHA (**Appendix K**).

5.4.1 Stage 1 – notification and registration of Aboriginal parties

Agency contact

A letter requesting advice on which Aboriginal parties to invite for consultation and all known heritage matters to be taken into consideration was posted to the NSW Office of Environment and Heritage on 15 February 2019.

Press advertisement

A public notice was placed in the *Port Stephens Examiner* newspaper on 7 March 2019 seeking registrations of interest from Aboriginal parties. A copy of the notice is in Appendix A of the ACHA.

Invitation to register to Aboriginal stakeholder groups

Letters were sent via post and email to the parties listed by the government agencies, inviting written registration on 19 February 2019. Those letters which did not receive a response were followed up with a phone call and email where these details were provided.

Registered Aboriginal Parties

The RAPs who registered an interest in being consulted for the project are in **Table 5.3**.

Table 5.3: List of RAPs for the project

Organisation	Contact Name
Worimi Local Aboriginal Land Council (LALC)	Jamie Merrick
Murra Bidgee Mullangari Aboriginal Corporation	Ryan Johnson
Didge Ngunawal Clan	Paul Boyd and Lilly Carroll
Merrigarn Indigenous Corporation	Shaun Carroll
Muragadi Heritage Indigenous Corporation	Anthony Johnson
Nur-Run-Gee Pty Ltd	Leonard Anderson OAM
Lower Hunter Wonnarua Cultural Services	Tom Miller
Worimi Traditional Owners Indigenous Corporation	Candy Towers
A1 Indigenous Services	Carolyn Hickey
Murrooma Incorporated	Anthony Anderson
Karuah Indigenous Corporation	David Feeney
Widescope Indigenous Group	Steven Hickey

Organisation	Contact Name
Worimi Conservation Lands (WCL Board of Management c/o Graeme Russell)	Graeme Russell
Amanda Hickey Cultural Services	Amanda Hickey
Aboriginal stakeholder (details withheld)[1]	Aboriginal stakeholder
Aboriginal stakeholder (details withheld)[1]	Aboriginal stakeholder

[1] Aboriginal stakeholder requested their details not be released in accordance with item 4.1.5 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*

5.4.2 Stages 2 and 3 – presentation of information and request for cultural information

Distribution of information

A letter presenting information about the project and describing the proposed assessment method was issued on 3 April 2019 via email to all RAPs.

Responses to the proposed assessment method were received from seven RAPs as detailed in Section 2.3 of the ACHA.

Site inspection

The RAPs were invited to attend a site inspection of the project site with the archaeologist and Boral representatives, which was on 27 June 2019.

Representatives from 13 RAPs participated in the site inspection, which included a discussion of the site history and previous quarry disturbance, further discussion of the project, proposed extraction staging, remediation and archaeological context of the local area, including location of nearby previously recorded sites.

5.4.3 Stage 4 – review of draft Aboriginal cultural heritage report

Distribution of draft report

The draft ACHA was issued to RAPs on 9 September 2019, with a 28 day review period. Towards the end of the review period telephone calls were made to the RAPs to request a response, answer questions and offer more time if required.

Response to comments

The issues raised in response to the draft report are provided in the RAP letters and consultant's responses in Appendix C of the ACHA.

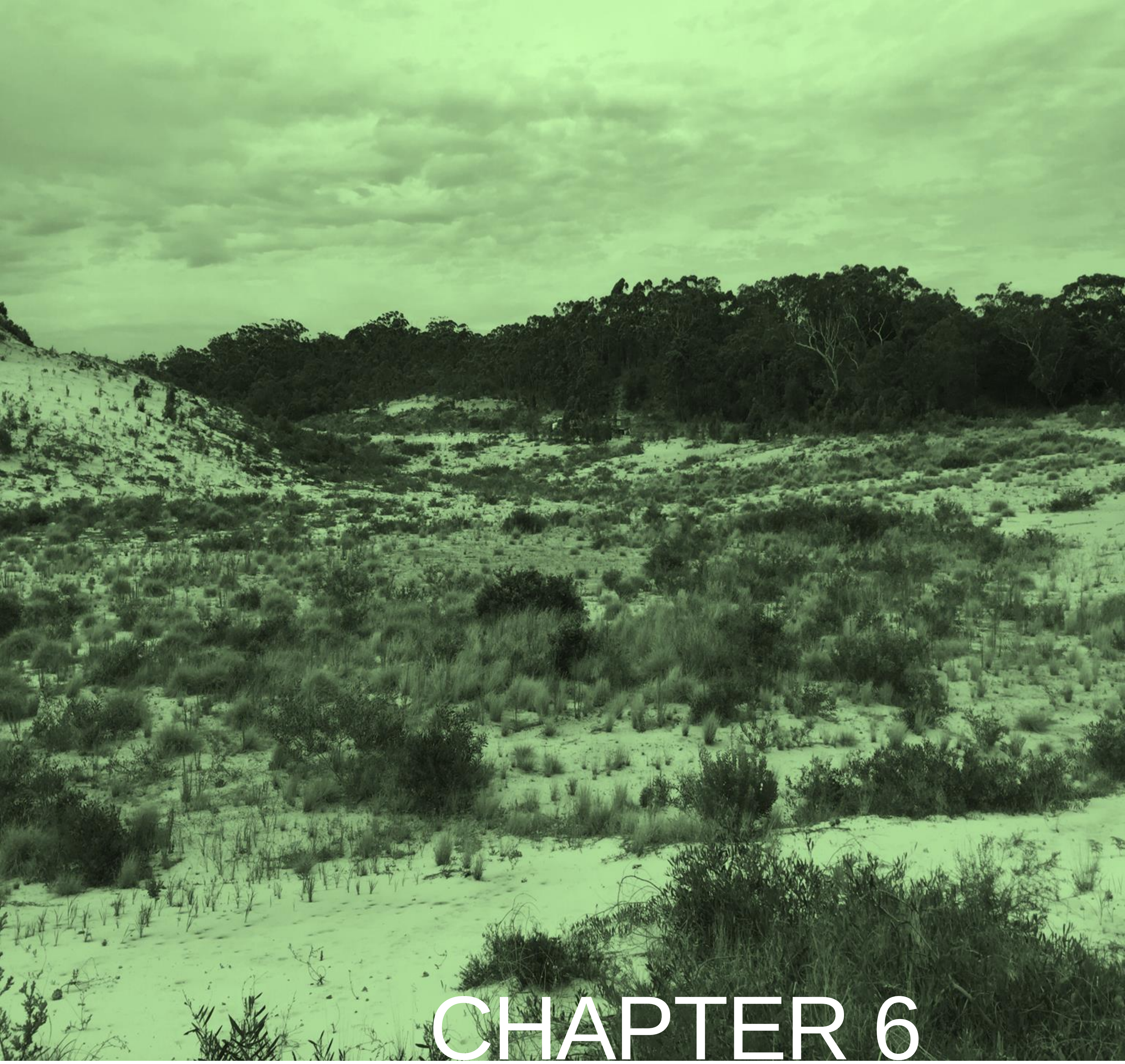
5.5 Continuation of stakeholder engagement

The EIS will be placed on public exhibition to allow for government agencies, organisations, interest groups, stakeholders and community members to review the EIS, seek clarification with Boral on the content of the EIS and provide written submissions if required.

Once the EIS has been exhibited, Boral will prepare a response to submissions report, if required, to address any written submissions, prior to determination of the SSD application.

All relevant stakeholders and the local community will be advised of the public exhibition of the EIS and will continue to be engaged during the remainder of the SSD process in accordance with the stakeholder engagement strategy and to achieve recommendations from the SIA outlined in **Chapter 13** and **Appendix I**, including that when the EIS is placed on public exhibition:

- Fullerton Cove residents will be notified in writing about exhibition of the EIS, the increased heavy vehicle volumes derived from the project, where these matters are addressed in the EIS, SIA and technical studies, how/where they can easily view the documentation, and an invitation to contact Boral to discuss any residual or additional concerns they may have; and
- Boral will place a notification on their website (and other media channels typically used throughout the SSD stakeholder engagement process) to notify of the EIS exhibition process as outlined above.



CHAPTER 6

PLANNING FRAMEWORK

6 LEGISLATIVE FRAMEWORK

This chapter summarises the Commonwealth and NSW regulatory and policy framework for SSD and identifies other approvals under State and Commonwealth legislation which are required.

6.1 Assessment requirements

The SEARs require the EIS to address legislative and policy requirements, which are listed in **Table 6.1.**

Table 6.1: Legislation and policy related SEARs

Requirement	Section and appendix where addressed
the EIS for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	Section 6.4
a list of any approvals that must be obtained before the development may commence;	Section 6.5.12
consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007);	Section 6.6.1
the reasons why the development should be approved, having regard to relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act;	Section 6.3.1

6.2 Commonwealth legislation

6.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the primary environmental legislation at the Federal level. The EPBC Act is administered by the Commonwealth Department of the Environment and Energy (DoEE), and provides a legal framework to protect and manage national and international important flora, fauna, ecological communities and heritage places, defined under the EPBC Act as matters of national environmental significance (MNES). The EPBC Act also confers jurisdiction over actions that have a significant impact on the environment where the actions affect, or are taken on, Commonwealth land.

An action that has, will have or is likely to have a significant impact on a MNES or Commonwealth land, may not be undertaken without prior approval from the Commonwealth Minister, as provided under Part 9 of the EPBC Act.

The Protected Matters Search Tool (PMST) is managed by DoEE and is used to identify MNES near or potentially impacted by a development. A 10 km radius of the site was searched for MNES in March 2019. Results of this search are presented in **Table 6.2** and **Appendix C**. This data, combined with local knowledge and records and further technical studies where relevant, has been used to assess whether the project will have, or is likely to have, a significant impact upon a MNES or on Commonwealth land.

Table 6.2: MNES considered in the EPBC Act

Matters of National Environmental Significance	Commentary
World heritage properties	There are no World Heritage properties in the search radius.
National heritage places	There are no National Heritage properties in the search radius.
Wetlands of international importance (listed under the Ramsar Convention)	The Hunter Estuary wetlands are listed under the Ramsar Convention. The Hunter Estuary wetlands are divided into two components, Kooragang Nature Reserve and the Hunter Wetlands Centre, are listed for three criteria. The Kooragang component includes wetlands at Kooragang Island and Fullerton Cove. Fullerton Cove wetlands are approximately 2.2 km west of the project site. As highlighted in **Chapter 8**, the project will not significantly impact the Fullerton Cove wetlands.
Listed threatened species and ecological communities	There are four TECs recorded in the search area, namely: ▪ Central Hunter Valley Eucalypt Forest and Woodland (critically endangered); ▪ Coastal Swamp Oak Forest of NSW and South East Queensland (endangered); ▪ Lowland Rainforest of Subtropical Australia (critically endangered); and ▪ Subtropical and Temperate Coastal Saltmarsh (vulnerable). 73 threatened species have been previously recorded in the search radius. These TECs have not been identified at the site.
Migratory species protected under international agreements	74 migratory species have been previously recorded in the search radius. Potential impacts of the project on these listed migratory species have been assessed (**Chapter 9** and **Appendix E**). No migratory species will be significantly impacted by the project.
Commonwealth marine area	There are no Commonwealth marine areas in the search radius.
The Great Barrier Reef Marine Park	The Great Barrier Reef Marine Park is not in the search radius.
Nuclear actions (including uranium)	There are no nuclear actions in the search radius.
A water resource, in relation to coal seam gas development and large coal mining development	This is not applicable to the project.

6.2.2 Commonwealth Native Title Act 1993

The Commonwealth *Native Title Act 1993* recognises that Aboriginal people have rights and interests to land and waters which derive from their traditional laws and customs. Native title may be recognised in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their traditional country. It can be negotiated through a native title claim, an indigenous land use agreement or future act agreements.

The National Native Title Register, Register of Native Title Claims, Unregistered Claimant Applications register, and Register of Indigenous Land Use Agreements were searched in August 2019 for reported native title claimants in the LGA. There were no results for declared native title in the LGA.

6.2.3 National Greenhouse and Energy Reporting Act 2007

The Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) provides a single national framework for the reporting and dissemination of information about the greenhouse gas emissions, greenhouse gas projects, and energy use and production of corporations. It makes registration and reporting mandatory for corporations whose energy production, energy use or greenhouse gas emissions meet specified thresholds.

Boral triggers the threshold for reporting under the NGER Act, and reports energy use and greenhouse gas emissions from its operations, including the quarry.

The project is anticipated to generate minimal quantities of greenhouse gas emissions due to the selected extraction methodology, minimal use of electricity for the site depot, and limited use of fuels and other combustible resources at the site. Regardless, Boral will continue to monitor and report energy use and greenhouse gas emissions associated with the project under its obligations under the NGER Act.

6.3 NSW legislation

The following sections address relevant NSW state legislation.

6.3.1 Environmental Planning and Assessment Act 1979

The EP&A Act provides the statutory framework for planning approval and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. It contains three parts that impose requirements for planning approval.

Part 4 of the EP&A Act provides for control of ‘development' that requires development consent from the relevant consent authority. A division of Part 4 (Division 4.7) provides for the assessment of SSD where the Minister for Planning (or delegate) or the Independent Planning Commission is the consent authority.

State significant development

Part 4, Division 4.7 of the EP&A Act relates to the assessment of development deemed to be significant to the State (i.e. SSD). Under Section 4.36(2) a development is SSD if it is declared by a SEPP. The relevant SEPP to the project is the SRD SEPP.

In relation to SSD, Clause 8(1) of the SRD SEPP states the following:

8 Declaration of State significant development: Section 4.36

1. *Development is declared to be State significant development for the purposes of the Act if:*
    1. *the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and*
    2. *the development is specified in Schedule 1 or 2.*

Clause 7 of Schedule 1 of the SRD SEPP declares the following development to be SSD:

1. *Development for the purpose of extractive industry that:*
    a. *extracts more than 500,000 tonnes of extractive materials per year, or*
    b. *extracts from a total resource (the subject of the development application) of more than 5 million tonnes, or*
    c. *extracts from an environmentally sensitive area of State significance.*

The project will involve sand extraction from a natural sand resource estimated at 9 Mt. Therefore, the project is SSD and Division 4.7 of Part 4 of the EP&A Act is the appropriate assessment pathway.

Under Section 4.36 of the EP&A Act, the Minister for Planning is the consent authority for SSD.

A development application (DA) for SSD must be accompanied by an EIS in accordance with Section 4.12(8) of the EP&A Act and the EIS must be prepared in accordance with the EP&A Regulation. Before preparing an EIS, an applicant must request the SEARs, which specify the issues to be addressed in the EIS. The SEARs for the project were issued by DPIE on 16 November 2018 and are provided in **Appendix A**, which also identifies the sections of the EIS where the SEARs have been addressed.

The relevant factors in the assessment and determination of the project are addressed in the following sections.

Permissibility

The project site is in the Port Stephens LGA. The project area is wholly located on land zoned RU2 – Rural Landscape under the Port Stephens LEP 2013. Extractive industries are permissible in this zone with consent.

The portion of Crown land that is used to provide access to the site is zoned RE1 - Public Recreation. No development works are proposed on this portion of land and roads are a permissible use. The use of this land is subject to a licence agreement between Boral and Crown Lands.

Objectives of the Act

The objects of the EP&A Act are specified in Section 1.3 of the Act, and seek to promote the management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The consistency of the project with the objects of the Act is considered in **Table 6.3**.

Table 6.3: Objectives of the EP&A Act

Objectives of the EP&A Act	Consistency of the project
To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The project will enable the continued use of a long established and operating quarry site that will contribute $17 M to the NSW economy and maintain direct employment for six people and indirect employment for many others.

Objectives of the EP&A Act	Consistency of the project
	The project has been assessed by a range of environmental specialists and where necessary appropriate management frameworks identified to ensure environmental conservation.
To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The project is consistent with the principles of ecological sustainable development (ESD) as outlined in **Section 6.3.2**.
To promote the orderly and economic use and development of land,	The orderly and economic use of land is best served by development which is permissible under the relevant environmental planning instruments and generally in accordance with planning controls. The project comprises a permissible development which is consistent with the statutory control and strategic planning directions. The project is also geographically separated from incompatible land uses so as to avoid potential amenity impacts. As detailed in this EIS, the project will result in positive economic impacts through continued employment and contribution of $17 M to the NSW economy. The project has been formulated to maximise re-use of existing infrastructure and thus reduce capital expenditure. Additionally, the project would be confined to areas previously disturbed thereby minimising environmental and social impacts. Potential environmental risks associated with the project have been subject to thorough and rigorous specialist assessment, including subsequent refinement of project parameters to result in beneficial outcomes. As demonstrated in this EIS, all noise and air emissions generated by the project would comply with relevant assessment criteria at all times of operation. Traffic generated by the project would not result in detrimental impact to the surrounding and arterial road network. Appropriate mitigation measures and management strategies have been proposed to reduce any adverse residual environmental and social impacts.
To promote the delivery and maintenance of affordable housing,	Not applicable to the project.
To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The project area has been sited over an area of previous disturbance to avoid, preserve and protect areas of established vegetation and fauna habitat. Detailed flora and fauna assessments have been completed and are addressed in **Appendix E** and **Chapter 9**. Despite the partial loss of two native vegetation communities and threatened species habitat in the project site, a biodiversity offset strategy has been

Objectives of the EP&A Act	Consistency of the project
	formulated to ensure compensatory land is protected into perpetuity. A residual risk of indirect impacts to biodiversity remains. However, the project has provided all possible and necessary measures to ensure the risk is as low as practicable.
To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	There are no items of non-Aboriginal heritage present within the site nor is project likely to adversely impact those located within proximity (refer to **Chapter 18).** A specialist consultant has assessed potential impacts on Aboriginal cultural heritage, as described in **Chapter 15**. As the project is contained to an area of previous disturbance it is unlikely the project would result in unsustainable management of cultural heritage (Aboriginal or non-Aboriginal). Management measures will be implemented to ensure the protection of unidentified objects.
To promote good design and amenity of the built environment,	Specialist consultants have assessed potential noise and air quality, as described in **Chapters 10** and **11**. The project has been designed in a manner which aims to avoid the potential for impacts in the first instance (e.g. positioning of the wash plant infrastructure as far as practical from the nearest sensitive receivers), and management measures are proposed to mitigate and manage residual impacts, where necessary.
To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The project will not require the construction of new buildings other than installation of a portable site office, and replacement of roofing for the maintenance shed as recommended for bushfire hazard mitigation for the site. All built structures for the project would comply with relevant building standards and be implemented to improve the health, well-being and safety of site personnel. Existing buildings at the site depot will be maintained for the project and any potentially hazardous substances managed in accordance with relevant legislation as described in **Chapter 20**.
To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The Port Stephens LEP aims to make local environmental planning provisions for land in the LGA in accordance with Section 3.31 of the EP&A Act. In doing so, the State government promotes the assessment and approval of environmental planning and development at the local government level. The project is subject to the provisions of Part 4 of the EP&A Act, and the Minister for Planning is the consent authority. Despite development consent to be granted by the State government, Port Stephens Council, as local government authority, has been regularly consulted throughout the planning phase of the project and preparation of this EIS (refer to **Chapter 5**).

Objectives of the EP&A Act	Consistency of the project
To provide increased opportunity for community participation in environmental planning and assessment.	As outlined in **Chapter 5**, Boral has consulted with government agencies, the local community and other stakeholders. Consultation is ongoing.

6.3.2 Ecologically sustainable development

One of the objects in Section 1.3 of the EP&A Act is "to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment". Section 1.4 (Definitions) of the EP&A Act defers to the NSW *Protection of the Environment Administration Act 1991* (POEA Act) for a definition of ESD. Section 6.2(2) of the POEA Act defines ESD as:

> *…ecologically sustainable development requires the effective integration of social, economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:*

1. *the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

   In the application of the precautionary principle, public and private decisions should be guided by:

   1. *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
   2. *an assessment of the risk-weighted consequences of various options,*

2. *inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
3. *conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
4. *improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:*

   1. *polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
   2. *the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
   3. *environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

The following sections set out how the project aligns with the principles of ESD and how these principles have been incorporated into the design of the project.

Precautionary principle

Where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent such damage.

As described in **Chapter 2**, baseline groundwater characteristics have been monitored at the site since 2007 to understand the condition of the existing groundwater resource at and surrounding the quarry, and to understand the environmental impacts of existing operations. This extensive baseline data has been used by the technical specialist to predict the environmental impacts of the project.

As described in **Chapter 7**, there was a preliminary assessment of environmental risks associated with the project in terms of size and duration of impact. Potential risks were rated as described in the PEA and the level of assessment detail for each risk was proportional to the risk rating.

As highlighted in this EIS, the potential noise and air emissions associated with the project would comply with relevant assessment criteria. The project is not anticipated to result in impacts to the quantity and quality of available surface and groundwater resources, and the implementation of recommended management and monitoring measures would minimise the potential for residual impacts associated with the project.

Despite the unavoidable loss of native vegetation communities and threatened fauna habitat, compensatory measures would be implemented in the form of a biodiversity offset strategy, with long term biodiversity impacts likely to be minimised via the implementation of a successful rehabilitation strategy for the project site.

Where serious or irreversible damage to the environment is likely to be unavoidable, management measures and/or compensatory measures (for example a biodiversity offset strategy) have been proposed.

Inter-generational equity

Inter-generational equity is the concept that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

As described in **Chapters 8**, **10**, **14**, and **17**, the project will not have significant impacts on surface and groundwater availability or quality, air quality or agricultural land. Therefore, the project will not detract from future generation's access to and equal enjoyment of water, air and agricultural resources.

As described in **Chapter 9**, the project will have a significant impact on habitat for a threatened species and two native vegetation communities. However, biodiversity offsets will be provided to compensate for these impacts, which protect other areas of native vegetation into perpetuity for the enjoyment of future generations.

Conservation of biological diversity and ecological integrity

This is the concept that conservation of biological diversity and ecological integrity should be a fundamental consideration.

As described in **Chapter 9**, the project will remove previously rehabilitated native vegetation and result in unavoidable impact on habitat for a threatened species and two native vegetation communities. However, biodiversity offsets will be provided to compensate for these impacts, which will assist in the conservation of biodiversity and ecological integrity for other areas of native vegetation within NSW.

The project has been designed to confine operations to a previously disturbed and rehabilitated area and avoids the disturbance of large areas of remnant vegetation. As such, the design is the most effective way to maintain biological diversity and ecological integrity at the site and surrounding locality, with alternatives considered to result in more severe biodiversity impact.

The rehabilitation strategy has been devised using similar principles of previous successful and high-quality restoration outcomes at the site in order to promote the chances of success of rehabilitation initiatives following completion of the proposed project.

Improved valuation, pricing and incentive mechanisms

This is the concept that environmental factors should be included in the valuation of assets and services.

Cost benefit analysis (CBA) was used to estimate the economic benefit of the project to Australia and NSW, which is in **Appendix N** and summarised in **Chapter 21**. It subtracted the production and environmental costs from the production benefits of the project to determine the net cost/benefit to society. The costs of water extraction, installation of additional site infrastructure and purchase and maintenance of biodiversity offsetting were included in the capital and operating costs of the project.

Other environmental aspects such as noise, air quality and visual impacts to sensitive receivers were not costed as there will not be any residual impacts related to these aspects.

The CBA determined the project will have a maximum net benefit of $41 M to Australia and $17 M to NSW. Any unquantified residual impacts of the project after mitigation, offset and compensation will need to be valued at greater than these amounts for the project to be questionable from an economic efficiency perspective.

6.4 Environmental Planning and Assessment Regulation 2000

Section 4.39 of the EP&A Act refers to the EIS form and content provisions of the EP&A Regulation. Schedule 2, Clauses 6 and 7 of the EP&A Regulation describes the requirements for the form and content of an EIS, which are considered in **Table 6.4**.

Table 6.4: EIS requirements

Details	Commentary
Clause 6 - Form of environmental impact statement: An environmental impact statement must contain the following information:	
1) The name, address and professional qualifications of the person by whom the statement is prepared;	Certification page
2) The name and address of the responsible person;	Certification page
3) The address of the land: a) in respect of which the development application is to be made, or b) on which the activity or infrastructure to which the statement relates is to be carried out,	Section 2.1
4) A description of the development, activity or infrastructure to which the statement relates;	Section 1.3, Chapter 4
5) An assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule; and	Chapters 8-22
6) A declaration by the person by whom the statement is prepared to the effect that: a) the statement has been prepared in accordance with this Schedule,	Certification page

Details	Commentary
b) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and c) that the information contained in the statement is neither false nor misleading.	
Clause 7 – Content of environmental impact statement 7) An environmental impact statement must also include each of the following:	
a) a summary of the environmental impact statement;	Executive summary
b) a statement of the objectives of the development, activity or infrastructure;	Section 1.4
c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure;	Chapter 1
d) an analysis of the development, activity or infrastructure, including: i) a full description of the development, activity or infrastructure;	Chapter 4
ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected;	Chapter 2, Chapters 8-22
iii) the likely impact on the environment of the development, activity or infrastructure;	Chapters 8-22
iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment; and	Chapters 8-22, Chapter 23
v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out.	Section 6.5.12
e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Chapter 23
f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Section 1.2, Section 6.3.2, Section 7.1
8) Not applicable to the project. 9) Not applicable to the project.	
10) The principles of ecologically sustainable development [ESD] are as follows:	Section 6.3.2
a) the **precautionary principle,** namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ii) an assessment of the risk-weighted consequences of various options.	As above

Details	Commentary
b) **Inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,	As above
c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,	As above
d) **improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as: i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, ii) the users of goods and services should pay prices based on the full lifecycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	As above

6.4.1 Section 4.15 matters for consideration

The consent authority is required to consider the matters in Section 4.15 of the EP&A Act when determining a DA for SSD. Matters relating to the project are considered in the following pages.

Environmental planning instruments

The SRD SEPP is considered in **Section 6.3.1** and other EPIs are considered in **Section 6.6**.

The regulations

The requirements of the EP&A Regulation are considered in **Section 6.4**.

Likely impacts of the development

Impacts to the natural and built environments and social and economic impacts have been assessed (**Appendices D** to **O** and summarised in **Chapters 8** to **22**). The assessments used the most recent and accurate scientific data relevant to the project and adopted conservative assumptions so the upper limit of likely impacts could be assessed.

The project will not result in significant residual impacts on most environmental aspects, including amenity impacts associated with noise, air quality and visual exposure.

The project will have residual impacts on terrestrial biodiversity; however such impacts have been minimised by focusing extraction in areas of previous disturbance and avoiding removal of established vegetation. All vegetation proposed to be removed will be offset in accordance with NSW policy. This offsetting will have the benefit of protecting areas of similar native vegetation communities into perpetuity.

The economic analysis of the project demonstrated that it will be socio-economically beneficial to the nation, State and local community. The project will have net social benefits to Australia of $41 M and to NSW of $17 M including employment benefits.

Suitability of the site

The project site is suitable for the proposed development as it contains a sand resource as described in **Section 1.2** and is the site of an existing quarry with infrastructure that will continue to be used for the project as described in **Chapters 3** and **4**.

As highlighted in this EIS, the project is in a location which maximises the use of a previously disturbed area, which is geographically separated from adjacent land uses and sensitive receivers. The project thereby minimises the potential for adverse environmental and social impacts, which would otherwise be compounded if the project were to proceed in an alternative location.

On the basis of the above, it is considered that the site is suitable for the proposed development.

Submissions

This EIS will be placed on public exhibition by DPIE and submissions will be sought from Council, government agencies and the community. Any submissions received by DPIE will be reviewed and forwarded to Boral for consideration in a response to submissions report.

Public interest

This EIS has been prepared on the basis of detailed investigations aimed at defining the current social, biophysical and economic environment. Detailed assessment undertaken by appropriate technical specialises demonstrates that on balance the proposed development is unlikely to have significant impact on the receiving environment. On this basis, the proposed development is not considered to be contrary to the public interest.

6.5 Other NSW legislation

In addition to the requirements under Part 4 of the EP&A Act, the project will require additional approvals, licences and/or authorisation under various other pieces of NSW legislation, which are summarised in this section.

6.5.1 Protection of the Environment Operations Act 1997

The POEO Act aims to protect, restore and enhance the quality of the environment in the context of ecologically sustainable development and to reduce risks to human health and prevent degradation of the environment.

Section 48 of the POEO Act outlines that an EPL is required for any scheduled activities at a premise at which Schedule 1 of the Act indicates that a licence is required.

Crushing, grinding or separating activities with a capacity to process more than 150 t of materials per day or 30,000 tpa, and land based extractive activities involving the extraction, processing or storage of more than 30,000 tpa of extractive materials, are scheduled activities under the Act.

EPL 10132 applies to existing operations at the quarry. A variation to the EPL will be required to increase the permitted limit to a maximum of 750,000 tpa.

6.5.2 Crown Lands Act 1989

The *NSW Crown Lands Act 1989* provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved, or otherwise dealt with unless authorised by this act or the *NSW Crown Land (Continued Tenured) Act 1989*.

The quarry site is accessed via a portion of Crown Reserve over which Boral has an existing and valid lease agreement with DPIE (Crown Lands Division).

Crown Lands indicated during consultation that the existing licence agreement will need to be amendment for the proposed access arrangements.

6.5.3 Water Management Act 2000

The *NSW Water Management Act 2000* (WM Act) regulates the management of water by granting licences, approvals for taking and using water, and trading groundwater and surface water. The WM Act applies to those areas where a water sharing plan has commenced. Alternatively, if a water sharing plan has not yet commenced, the *NSW Water Act 1912* (Water Act) applies. The WM Act is progressively replacing the Water Act as relevant water sharing plans are introduced across the State.

Water sharing plans (WSP) have commenced for most of NSW. Licensing of monitoring bores continues under the Water Act until a regulation for aquifer interference gives a mechanism to approve these activities. Licensing of reinjection into groundwater systems is also still currently managed under the Water Act.

Groundwater in the project site is managed under the Stockton Groundwater Source zone of the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources.

The project will expose the aquifer and result in extraction of groundwater resources via evaporation of the open dredge pond and outgoing moisture content of dispatched sand products. Groundwater extraction and aquifer interference activities are permitted via an aquifer interference approval under Section 91 of the WM Act, and require an authorisation under the WSP via a WAL or some form of exemption. As specified in Section 129A of the Water Act, as the project will require an aquifer interference approval under the WM Act, the Water Act is not applicable.

Boral holds a “zero share” WAL for the quarry and is investigating options to acquire the necessary share allocation.

The project’s water licensing requirements are discussed in **Chapter 17**.

6.5.4 Biodiversity Conservation Act 2016

The BC Act replaced the *Threatened Species Conservation Act 1995*, *Native Vegetation Act 2003* and the flora and fauna provisions of the *NSW National Parks and Wildlife Act 1979* (NPW Act).

As the project is SSD, it is required to consider biodiversity impacts in accordance with the Biodiversity Offset Scheme of the BC Act. The offset scheme requires impacts to first be avoided and then mitigated before being offset in accordance with the scheme.

A biodiversity assessment has been completed for the project and is summarised in **Chapter 9**.

A biodiversity offset strategy will be prepared in accordance with the requirements of the Biodiversity Assessment Method (2017) (BAM). Boral proposes to offset the project using one of the following options:

1. purchase of offset credits on the market, in which if credits become available Boral may pursue this option;
2. payment into the Biodiversity Conservation Fund (BCF), in which Boral would pay the equivalent credit costs into the BCF; and/or
3. utilise existing Boral landholdings to investigate potential for a biodiversity stewardship site to reduce a portion, or all the offset credits.

6.5.5 National Parks and Wildlife Act 1979

The NPW Act contains provisions for the protection and management of national parks, historic sites, nature reserves and Aboriginal heritage. The NPW Act provides statutory protection for Aboriginal objects by making it illegal to move, damage, deface or destroy a relic without written permission from DPIE.

Under Section 86 of the NPW Act, a person must not harm or desecrate an Aboriginal object or place. In cases where harm to Aboriginal objects or places cannot be avoided, an Aboriginal heritage impact permit (AHIP) may be sought under Section 90 of the Act. However, Section 4.41 of the EP&A Act, SSD does not require an AHIP.

Potential impacts to Aboriginal heritage were assessed (refer to **Chapter 15**).

6.5.6 Heritage Act 1977

Non-Aboriginal historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the *NSW Heritage Act 1977*.

The only listed non-Aboriginal heritage item located within 500 m of the project is the ‘Stockton Beach Dune System’, which has a ‘local’ heritage listed on the Port Stephens LEP. The curtilage of the heritage listing is adjacent to the north-east and south-east boundaries of the site.

As highlighted in **Chapter 18**, the proposed extraction area will not be immediately adjacent to the Stockton beach dune system and will be in the same disturbance footprint as the previous inland extraction area. As such, the project will not impact upon this listing and is unlikely to impact on any other unknown historic heritage item.

6.5.7 Roads Act 1993

Consent is required from the relevant road authority under Section 138 of the *NSW Roads Act 1993* (Roads Act) for any work in, on or over a public road.

No upgrades will be required to the local road network to accommodate the project and therefore a separate consent is not required under the Roads Act.

6.5.8 Contaminated Land Management Act 1997

The *NSW Contaminated Land Management Act 1997* (CLM Act) establishes a process for investigating, and where required remediating contaminated lands, that pose a risk to human health and the environment.

The EPA’s Contaminated Land Record and List of Contaminated Sites notified to the EPA in the Port Stephens LGA was searched in August 2019. There quarry site is not recorded or identified on the relevant registers.

6.5.9 Hunter Water Act 1991

The *NSW Hunter Water Act 1991* (HW Act) establishes the Hunter Water Corporation (Hunter Water) and a framework for the identification, protection and management of drinking water.

The drinking water catchments of Hunter Water are in the Port Stephens LGA.

Under Section 51 of the HW Act, consent authorities, including DPIE, are required to refer DAs that may significantly impact on water quality in the drinking water catchments to Hunter Water for comment.

Following the introduction of the NSW Hunter Water Regulation 2015, Hunter Water published the *Guidelines for developments in drinking water catchments* (Hunter Water, 2017) to provide guidance for development activities within the drinking water catchments and to consent authorities about matters of concern to Hunter Water regarding protection of drinking water quality.

The project site is not in a drinking water catchment. However, it is to the immediate south of the 'Stockton Sandbeds Catchment Area'. The Tomago and Stockton Sandbed aquifers which lie below the site are listed by Hunter Water as a potential water supply in times of extreme drought and may be hydrologically connected to the Stockton Sandbeds catchment area.

In accordance with the guidelines, development which warrants referral to Hunter Water under Section 51 of the HW Act include development for the purpose of extractive industries. Potential impacts to the underlying aquifers listed as a potential source of drinking water in extreme drought have been considered in **Chapters 8** and **17**.

6.5.10 Coastal Management Act 2016

The objectives of the *NSW Coastal Management Act 2016* (CM Act) are to manage the coastal environment of NSW in a manner consistent with the principles of ESD for the social, cultural and economic well-being of the people of the State.

The CM Act defines the coastal zone, comprising four coastal management areas:

1. coastal wetlands and littoral rainforests area;
2. coastal vulnerability area;
3. coastal environment area; and
4. coastal use area.

The CM Act establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

The CM Act is supported by the State Environmental Planning Policy (Coastal Management) 2018, which maps coastal zones within NSW. The site is in a mapped coastal environment area as further detailed in **Section 6.6.1**.

6.5.11 Waste Avoidance and Resource Recovery Act 2001

The purpose of the *NSW Waste Avoidance and Resource Recovery Act 2001* (WARR Act) is to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ESD. This Act provides for the making of policies and strategies to achieve this.

This Act promotes a hierarchy of avoidance of unnecessary resource consumption; resource recovery (including reuse, reprocessing, recycling and energy recovery), and disposal (as a last resort).

As described in **Chapter 19**, the following management strategies have been developed in accordance with the WARR Act:

- purchasing recycled products where appropriate;
- developing and implementing waste management procedures to minimise the generation of waste and where unavoidable, re-use waste on-site;
- recycling as many wastes as practically possible through appropriate handling, separation, storage, and collection; and
- where waste cannot be re-used or recycled, transportation and disposal of waste off-site at an appropriately licensed facility.

6.5.12 Summary of approval requirements

Licences, approvals and permits that are likely to be required for the project are summarised in **Table 6.5**.

Table 6.5: Summary of approval requirements

Legislation	Authorisation	Consent of approving authority
EP&A Act	Development consent	Minister or IPC
POEO Act	Amended EPL for extractive industries	EPA
WM Act	Aquifer interference approval	DPIE

6.6 Environmental planning instruments

Environmental planning instruments are legal documents that regulate land use and development.

6.6.1 State environmental planning policies

The relevant state environmental planning policies (SEPPs) which have been considered in relation to the project are summarised below.

State Environmental Planning Policy (State and Regional Development) 2011

The SRD SEPP, amongst other matters, defines whether a development is SSD. The applicability of the SEPP is considered in **Section 6.3.1**.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The proposed development is permissible under the local environmental planning instrument and as such does not rely of the provisions of the Mining SEPP to enable the making of an application. Notwithstanding this, the Mining SEPP contains provisions that are relevant in the assessment of an application for extractive industries. These are contained in clauses 12 and 12A.

Part 3 (Clauses 12 to 17) of the Mining SEPP stipulate matters for consideration by the consent authority before determining an extractive industry development application, which are addressed below.

Clause 12

As detailed in **Section 6.8.1**, the strategic planning for land in the Hunter Region is set out in the Hunter Regional Plan 2036 (NSW Department of Planning and Environment, 2016).

Direction 13 of the Hunter Regional Plan (HRP) identifies that, whilst ongoing investment in rural and resource industries underpins the sustainable growth, economic prosperity and ongoing productivity of the Hunter region, the continued growth of rural and resource industries can result in potential for land use compatibility issues to arise.

In particular, it identifies that there is also potential for conflict if new housing encroaches into rural and resource areas, leading to increased management costs. Conflict could also affect the potential to sustain or grow rural and resource industries. The expansion of rural and resource industries can also affect established urban activities if not managed appropriately. Land use planning can provide greater certainty for investment in rural and resource industries by establishing clear parameters and transparent processes to support new development.

Land uses near the quarry are described in **Section 2.8**, and include extractive industry, rural residential and environmental conservation. Potential impacts on these land uses have been assessed in this EIS, demonstrating that the project will not have a significant impact on existing and approved land uses around the project. Following consultation with Port Stephens Council, there are no immediate plans to establish residential land uses within immediate proximity to the site.

Clause 12A

The Mining SEPP requires consent authorities to consider applicable provisions of the Voluntary Land Acquisition and Mitigation Policy (VLAMP) before determining a DA.

The VLAMP establishes a framework for ensuring that when noise or dust impacts from a proposal exceed the relevant assessment criteria, landowners are provided with:

- a negotiated agreement between the landowner and the proponent; or
- obligations on the proponent to offer mitigation of impacts on the land, or acquisition of the land, in accordance with conditions of a project approval.

As described in **Chapters 10** and **11**, the noise and air emissions generated by the project will not exceed the relevant assessment criteria, and therefore further consideration of the VLAMP is not required.

Clause 13

Clause 13 of the Mining SEPP relates to matters a consent authority must take into consideration when determining applications for development that is:

- near an existing mine, petroleum production facility or extractive industry;
- identified on a map as being the location of State or regionally significant resources of minerals, petroleum or extractive materials; or
- identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials.

The intent of Clause 13 is to protect operating extractive industries from incompatible land uses which may be approved by relevant consent authorities.

Land surrounding the site is used for extractive industry, rural, residential and environmental conservation.

Fullerton Cove Quarry, owned by Coastal Sands Pty Ltd, is on Coxs Lane approximately 495 m to the north of the quarry, opposite Nelson Bay Road. There are no additional mining, petroleum production or extractive industries near the quarry, with the majority of extractive industry operations centred around Bobs Farm and Salt Ash further to the north. The independent continued operation of the quarry will not impact operations of Fullerton Cove Quarry or other extractive industries further to the north, nor impede access to geological resources extracted at these operations. The project is therefore compatible with other extractive industries in the region.

There are no geological deposits covered under third party exploration licences issued under the *NSW Mining Act 1992* near the quarry.

Clause 14

Clause 14(1) of the Mining SEPP requires that before granting consent for development for the purposes of extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

- that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable;
- that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable; and
- that greenhouse gas emissions are minimised to the greatest extent practicable.

The assessments of water resources and biodiversity are summarised in **Chapters 8**, **9** and **17** respectively. As highlighted in **Section 6.2.3**, the generation of greenhouse gases would be minimised during the project due to the limited use of electricity for the site depot and fuels for generators and mobile equipment.

Clause 15

Clause 15 of the Mining SEPP requires the consent authority to consider the efficiency of resource recovery.

As outlined in **Section 1.2.1**, the project has been designed to maximise the efficiency of extracting fine sand resources found at the site. The methodology and plant selected for the project is considered the most efficient method available to effective extract sand resources in a cost effective manner whilst minimising potential impacts on the environment and community surrounding the site.

Clause 16

Clause 16 of the Mining SEPP requires the consent authority to consider the implications of transport of materials from the development on public roads.

The project involves the transport of up to 750,000 tpa of materials along Nelson Bay Road, and the wider public road network including Cabbage Tree Road. Traffic impacts from road transportation are addressed in **Chapter 12** and demonstrates that the project will not have a significant impact on the road network.

Clause 17

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.

The project will be rehabilitated as described in **Chapter 22**.

State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider whether a development proposal is a potentially hazardous industry or a potentially offensive industry.

The project is not classified as hazardous or offensive industry under SEPP 33. As such, the preparation of a preliminary hazard analysis (PHA) report is not required.

State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) provides for the protection of koala habitat by ensuring that areas subject to development proposals are considered for their value as habitat or potential habitat for koalas. The Port Stephens LGA is listed under Schedule 1 of SEPP 44 as areas to which the SEPP applies.

Under SEPP 44, potential Koala habitat includes: *'areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component'*.

The BDAR found that of the trees listed in Schedule 2, only *Eucalyptus robusta* was recorded in and near the quarry. The presence of *Eucalyptus robusta* does not meet at least 15% of the total number of trees within the project site, and, therefore, the habitat present is not potential Koala habitat under SEPP 44.

Given the vegetation present within the project site does not meet the definition of potential Koala habitat, it does not meet the criteria of 'core Koala habitat' as defined under SEPP 44.

State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (SEPP KPH) was published on 20 December 2019. In accordance with Part 1, clause 2 SEPP KPH will not commence until 1 March 2020.

The key changes under SEPP KPH include:

- new definitions for both "koala habitat" and "core koala habitat";
- a revision of schedule 1 to reflect current Local Government Names and boundary changes;
- a revision and expansion of the range of feeder trees listed in schedule 2; and
- changes in the development assessment processes prescribed by Part 2.

The provisions of SEPP KPH have been considered in the BDAR prepared by Niche and it was concluded that the project site is still unlikely to provide core koala habitat. Notwithstanding the above, the savings and transitional provisions of SEPP KPH, specifically Part 4, Clause 15, provide that a development application made prior to the commencement of the instrument is to be determined as though the policy had not commenced.

State Environmental Planning Policy No 55 – Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) aims to provide a state-wide planning approach to the remediation of contaminated land and to reduce the risk of harm to human health and the environment by consideration of contaminated land as part of the planning process. Under SEPP 55, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues.

Extractive industries are listed in Table 1 of *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning, 1998) as an activity that may cause contamination.

Despite this, as described under the CLM Act above, there is no known contamination on the site and no duty to report identified contamination to the EPA under Section 60(3) of the CLM Act. If previously unidentified contaminated land is identified during construction or operation of the project, the requirements of SEPP 55 will be complied with.

State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (SEPP Infrastructure) provides a consistent planning regime for infrastructure and the provision of services across NSW, along with providing for consultation with relevant public authorities during the assessment process. SEPP Infrastructure facilitates the development of State infrastructure, including telecommunication facilities, sewerage works and storm water management, and specified when development consent is (and is not required) for such development when carried out in certain zones.

Under SEPP Infrastructure, DPIE is required to formally forward development applications to RMS for certain developments listed in Column 2 and 3 of Schedule 3 of the Policy and consider any representations made by the RMS.

The project does not trigger traffic generating development under Schedule 3 of the SEPP. Regardless, RMS has been consulted by DPIE during formation of the SEARs and further consulted by Boral during preparation of the EIS. The RMS requirements have been addressed in **Chapter 12**.

State Environmental Planning Policy (Coastal Management) 2018

The aim of the State Environmental Planning Policy (Coastal Management) 2018 (Coastal SEPP) is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the CM Act.

A review of the Coastal SEPP mapping indicates the project is adjacent to a coastal environment area in Stockton Bight and the Coastal SEPP is not directly applicable to the project. However, indirect impacts on the adjacent coastal environment area have been considered in **Chapters 8**, **9**, **14**, **16** and **17**.

In accordance with Clause 13 of the Coastal SEPP, prior to granting consent to a proposed development, a consent authority must be satisfied that the proposed development will not have an adverse impact upon:

(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,

(b) coastal environmental values and natural coastal processes,

(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,

(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,

(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

(f) Aboriginal cultural heritage, practices and places,

(g) the use of the surf zone.

Development consent must not be granted unless the consent authority is satisfied that:

(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or

(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

The project design has responded to the attributes of the site, including biophysical, social and cultural values. As set out in the environmental assessment chapters, the project will not adversely impact other attributes listed in Clause 13 of the Coastal SEPP.

Notwithstanding the above, where appropriate, management measures as outlined in this EIS will be implemented to reduce impacts to biodiversity, Aboriginal cultural heritage and hydrological regimes.

6.6.2 Port Stephens Local Environment Plan 2013

As set out in **Section 2.3**, "extractive industries" are permissible with consent in the RU2 – Rural Landscape zone under the Port Stephens LEP.

As set out in **Section 6.6.1**, the Mining SEPP applies to the land and the form of development described. In accordance with Clause 8 of the Mining SEPP the application is not subject to the provisions of the LEP nor will those provisions have any effect in the determination of the application.

Notwithstanding the above, the project has been considered against the objectives of the RU2 Rural Landscape zone in **Table 6.6**, as adopted under clause 2.3 of the LEP.

Table 6.6: Consideration of land use zone objectives

Zone objective	Consistency
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	Extractive industries are a form of primary industry involving the removal and use of raw materials. The approach and methodology adopted for the project seeks to achieve sustainable management through effect avoidance, management and mitigation of potential impacts associated with noise, dust, erosion and water quality. The development does not compromise or impact on any adjacent holdings or primary industry operations.
To maintain the rural landscape character of the land	The quarry is sited at a low point within the broader landholding surrounded by high vegetated dunes that will be maintained throughout the operation. As set out in **Chapter 16**, which considers the potential for visual amenity impacts, the operation will be largely obscured from the view of the public. As such, the landscape character of the site when viewed from adjacent public or private land will not be visibly altered. Rehabilitation works will ensure that the final landform is compatible with the landscape character.
To provide for a range of compatible land uses, including extensive agriculture	The proposed extractive industry is considered compatible with the surrounding land uses. As

Zone objective	Consistency
	demonstrated by this EIS, the development will not give rise to adverse amenity impacts or compromise/conflict with other adjacent land uses.

The LEP lists various development considerations, including provisions for heritage conservation, bushfire hazard reduction, ASS, flood planning, drinking water catchments, wetlands, essential services and public infrastructure. The aforementioned provisions have been considered in the EIS and relevant specialist studies where appropriate.

6.7 Other plans and policies

6.7.1 Strategic Regional Land Use Policy

The Strategic Regional Land Use Policy (NSW Government, 2012a) sets out a range of initiatives to better balance growth in the extractive industry with the need to protect agricultural land and water resources. The Policy includes a package of measures including the following key elements:

- the preparation of strategic regional land use plans (SRLUPs) for both the Upper Hunter and the New England North West regions of NSW which identify and map strategic agricultural land (SAL) and critical industry clusters (equine and viticulture land uses) within these areas;
- the introduction of the AIP (see below); and
- the requirement for agricultural impact statements to accompany SSD applications for mining projects that have the potential to affect agricultural resources.

The gateway process of the Strategic Regional Land Use Policy is not applicable to extractive developments.

The existing SRLUPs do not apply to the project site. Notwithstanding, matters relating to soil landscapes, land use impacts, land capability and agricultural suitability have been addressed in **Chapter 14**.

The project site does not contain any land that has been mapped as BSAL. Furthermore, there is no land area in or adjoining the project site that is used for commercial horse breeding or contains vineyards.

6.7.2 Aquifer Interference Policy

The AIP was released by the NSW Office of Water in 2012. It defines the regime for protecting and managing the impacts of aquifer interference activities (such as dredging) on water resources. The AIP seeks to strike a balance between the water needs of towns, farmers, industry and the environment.

The AIP clarifies water licensing and impact assessment requirements for aquifer interference activities under NSW legislation, principally the Water Act and WM Act. This includes defining criteria or ‘minimal impact considerations’ for water table, pressure and quality that are to be applied in assessing the potential impacts of aquifer interference activities on water resources. That is, to evaluate whether more than minimal impacts might occur to a water-dependent asset as defined in the AIP, for example a water supply work or high priority groundwater dependent ecosystem.

The AIP also sets out the information that must be provided by the applicant to enable appropriate assessment of the activity by the Minister for Lands and Water.

The project has been assessed in accordance with the AIP, as described in **Chapter 8**.

6.7.3 Port Stephens Development Contributions Plan 2007

The Port Stephens Development Contributions Plan 2007 applies to all 'industry, rural industry, extractive industry and mining' development in the LGA. The plan requires these developments to contribute to a road maintenance levy for the upgrade and maintenance of roads within the LGA.

Boral's existing windblown project that has consent to transport 500,000 tonnes of product by road annually has previously been granted an exemption from the payment of contributions by Port Stephen's Council. The exemption was granted as other than the short section of Coxs Lane, the Boral fleet utilise the state road network. Given the project will utilise the same road network and involves a site wide increase of 250,000 tpa. It is proposed that this exemption continue to the applied.

6.7.4 Port Stephens Koala Plan of Management

The Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) has been prepared by Port Stephens Council and the Australian Koala Foundation (AKF) for the Port Stephens LGA. The CKPoM has an aim to '*encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline*'.

The CKPoM includes a Koala habitat map for the Port Stephens LGA, which classifies Koala habitat into different categories based off a range of attributes and survey results. The project site is mapped as 'Supplementary' Koala habitat. This habitat is regarded in the CKPoM as 'important to the long-term conservation of Koalas in Port Stephens and thus also requires protection, albeit with less restrictions on development than 'Preferred Koala Habitat'.

The CKPoM also includes performance criteria to assist development applications in the Port Stephens LGA to demonstrate that developments are consistent with the objectives associated with the CKPoM. Given the project is SSD rather than a local government development application, the performance criteria are not relevant to the project, however Boral has considered the aims and objectives of the performance criteria to minimise potential impact to the Koala as detailed in the BDAR.

Given the project will predominantly impact upon the rehabilitated inland extraction area, and will avoid decreasing the width of a wildlife corridor along Nelson Bay Road, the project is not anticipated to result in an impact to a Koala population in the Port Stephens LGA. The project will also implement a series of management and mitigation measures to avoid any potential indirect impacts to surrounding habitat.

6.8 Strategic planning policies

6.8.1 Hunter Regional Plan 2036

By 2036, an additional 600,000 people are expected to be living in the Hunter region (NSW Department of Planning and Environment, 2016). The HRP aims to guide the delivery of homes, jobs, infrastructure and services to support the growing and changing needs of the Hunter. The HRP provides an overarching framework to guide development and investment in the Hunter region to 2036.

In preparing the HRP, the NSW Government has acknowledged the growing importance of Greater Newcastle and set the following regionally focused goals:

- the leading regional economy in Australia;

- a biodiversity-rich natural environment;
- thriving communities; and
- greater housing choice and jobs.

The Hunter region has an estimated 322,000 jobs and this is projected to increase to 384,000 by 2036. The HRP aims to strengthen the region's economic resilience, protect its well-established economic and employment bases and build on its existing strengths to foster greater market and industry diversification.

In particular, the completion of the Pacific Highway upgrade has cut travel times offering opportunities for industries to expand and supply products to Greater Newcastle and Sydney. This will act as a catalyst for employment growth. Attracting new industries and growing existing industries that can leverage the accessibility provided by the Pacific Highway will support economic growth. To this effect, by establishing the project, Boral is seeking to further invest in the regional economy by contributing to direct and indirect employment opportunities, and contributing $17 M to the NSW economy

As detailed in the HRP, the Hunter region is the largest regional economy in Australia. In order to house the expanding population, the HRP estimates an additional 70,000 dwellings would be required by 2036, together with forecast major commercial development including proposed expansions of the University of Newcastle and John Hunter Hospital, and upgrades to transport infrastructure at Newcastle Airport, Port of Newcastle and strategic road networks (e.g. Nelson Bay Road duplication and extension of the Newcastle Inner City Bypass).

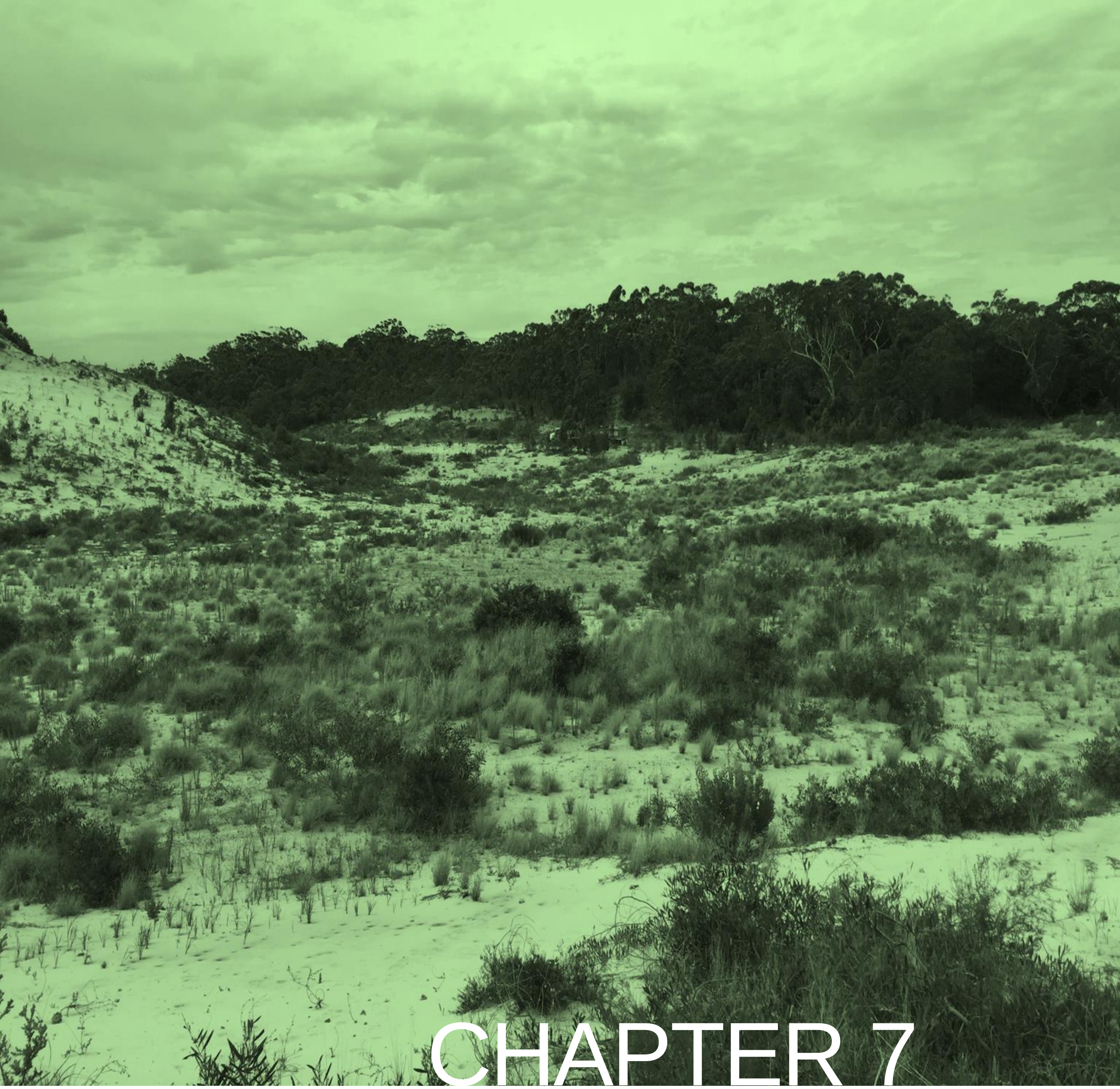
The aforementioned residential, commercial and infrastructure projects would all be reliant upon concrete and other construction materials, of which fine sand resources, such as those to be extracted at the site, are a vital component. As such, Boral plays a part in a larger supply chain to delivering essential services that will support the delivery of key infrastructure, jobs and housing in the region.

The project is consistent with the relevant directions and actions associated with Goal 1 of the HRP, in that it would play a part in promoting the Hunter region to be the leading regional economy in Australia.

Direction 6 of Goal 1 aims to grow the economy of the Port Stephens LGA by promoting the growth of industries that can leverage the accessibility of the Pacific Highway corridor. The project will achieve this directive given that outgoing sand products will be transported via the Pacific Highway corridor, particularly south towards the Lower Hunter Valley and Sydney regions.

Direction 14 of the HRP identifies the need to protect biodiversity and connect natural areas. The HRP promotes protection of biodiversity by maintaining and, where possible, enhancing the existing protection of high environmental value areas; implementing appropriate measures to conserve validated high environmental value areas; developing local strategies to avoid and minimise the impacts of development on areas of high environmental value and biodiversity corridors; and identifying offsets or other mitigation measures for unavoidable impacts. Thorough assessment of biodiversity values of the site has been carried out for the project, including identification of opportunities to avoid or reduce harm to biodiversity, and where impacts are unavoidable implement offsetting initiatives for cleared vegetation. By positioning the project in an area previously disturbed as part of the inland extraction area, impacts to remnant vegetation would be avoided and ensure that areas of high environmental value continue to be protected.

Direction 15 of the HRP identifies the need to protect the quality and security of the region's water supplies. Planning to manage development is a priority within the Hunter's drinking water catchments to balance the needs of growing towns and villages, and rural and resource industries. The site is located adjacent to the Stockton Sandbeds Catchment Area drinking water catchment, and a comprehensive assessment of water quality has been undertaken to ensure no adverse impacts to the water supply will result from the project.



CHAPTER 7

ENVIRONMENTAL ASSESSMENT APPROACH

7 ENVIRONMENTAL ASSESSMENT APPROACH

This chapter outlines the approach taken to assess the potential environmental and social impacts of the project.

7.1 Environmental risk assessment

It is integral to consider the environmental impacts of a proposed development early in the planning of the project. Careful planning of the development can avoid, or reduce, the likelihood of a significant impact on the environment. Where possible and practical, it is best to avoid impacts. If impacts cannot be avoided, they should be minimised or mitigated as much as possible.

The purpose of the environmental impact assessments of the project were to determine whether the project will result in significant impacts to the environment. Where a significant impact is likely, the project needs to be planned to avoid, manage, mitigate or offset this impact.

As such, the approach for the environmental impact assessments have considered the hierarchy of avoid, manage, mitigate and offset. Specifically:

- during preliminary planning, where environmental features with high value and significance or areas of potential sensitivity were identified that could be avoided, Boral revised the project design to avoid impacts to these areas by refining the disturbance footprint and relocating infrastructure (such as moving the processing plant to an area within the site that is further to the north, away from the nearest sensitive receivers and to support improved operational outcomes); and
- where environmental features could not be avoided and will be directly impacted, it was assumed that these areas will be impacted, and the EIS prepared on this basis with a view to identify best practice measures to manage, mitigate or offset the impact.

Chapters 8–22 summarise the assessments of key environmental issues, including the SEARs issued by DPIE, assessment methods, results of site surveys, potential construction and operational environmental impacts, and the proposed management and mitigation measures to be implemented for the project in order to minimise the potential for adverse environmental impacts or risks.

7.1.1 Preliminary environmental risk analysis

Potential environmental risks associated with the project were summarised in *Stockton Sand Quarry Dredging Preliminary Environmental Assessment* (Element Environment, 2018). The preliminary risk analysis was informed by, early stakeholder and community engagement, early project planning and specialist study desktop research and site-based investigations.

Environmental risks were assessed with rankings allocated to each environmental issue based on the likelihood of occurrence and the perceived consequence of effects if left unmanaged. The preliminary analysis did not consider the potential outcomes of specialist technical assessments and the application of mitigation measures to manage the environmental issue. In most cases, suitable mitigation measures are likely to minimise any potential impacts.

For those environmental factors that achieved a high or medium risk rating, further assessment was proposed to be undertaken as part of this EIS, generally in the form of specialist technical investigations. For those environmental factors that achieved a low risk rating, no further specialist technical assessment was required, as these non-key issues could largely be addressed using appropriate environmental safeguards and management measures, as detailed in this EIS.

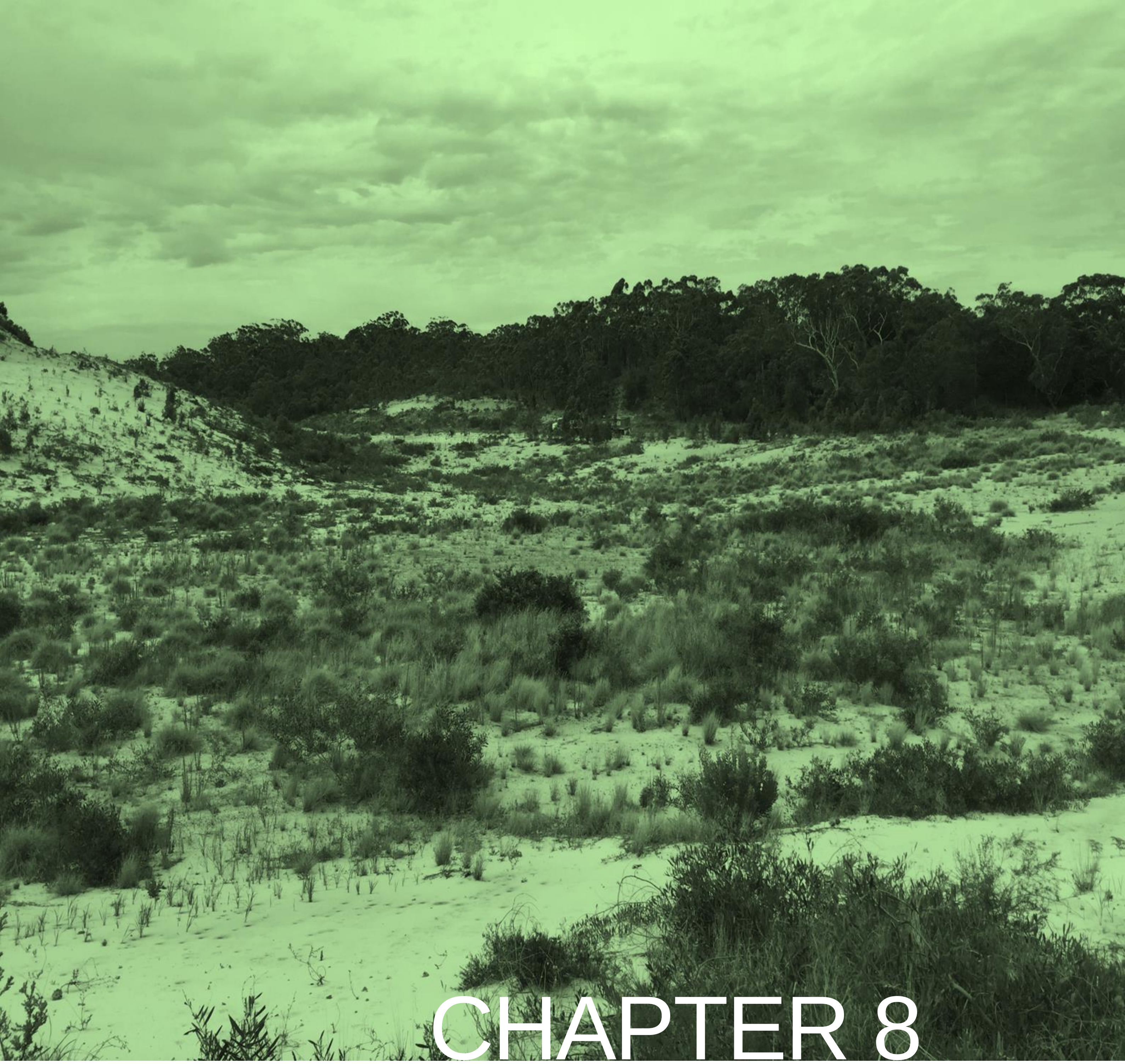
7.2 Structure of environmental assessment

The SEARs state that an assessment of the likely impacts of the development on the environment, focussing on the key identified issues, must be undertaken, and include:

- a description of the existing environment likely to be affected by the development, using sufficient baseline data;
- an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;
- a description of the measures that will be implemented to mitigate and/or offset the potential impacts of the development, and an assessment of:
  - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;
  - the likely effectiveness of these measures;
  - whether contingency plans will be necessary to manage any residual risks; and
- a description of the measures that will be implemented to monitor and report on the environmental performance of the development if it is approved.

Where relevant, existing environment and baseline data for the project site and surrounding areas is summarised in **Chapter 2**.

The environmental impact assessment chapters set out the findings of key investigations into those elements of the project that were identified as having a high to medium risk rating. The assessment chapters summarise the relevant legislation, guidelines, policies and plans relevant to each key environmental aspect, desktop and site investigations, assessments of the potential construction and operational impacts of the project prepared by technical specialists to address the regulatory requirements. Where suitable, the project design has been adapted to avoid impacts and reduce risk ratings, where unavoidable impacts have been identified management and mitigation measures have been developed that will be implemented by Boral to ensure any residual environmental impacts are minimised.



CHAPTER 8

GROUNDWATER

8 GROUNDWATER

8.1 Introduction

This section summarises the hydrogeological impact assessment (HIA) report, which is in **Appendix D**. It describes the potential impacts on groundwater resources from the project and provides mitigation and management measures to minimise impacts.

The hydrogeological setting of the project site is summarised in **Section 2.5.7**.

8.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on groundwater (**Table 8.1**).

Table 8.1: Groundwater related SEARs

Requirement	Section and appendix where addressed
a detailed site water balance, including a description of site water demands and intakes, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and, water storage structures	8.3.1, Appendix D
identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*	6.5.3, Appendix D
an assessment of the likely impacts on the quality and quantity of existing surface and ground water resources (having regard to the Williamtown RAAF Base Contamination Broader Management Zone), including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives	8.4, Appendix D
a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts	Section 8.5

The following guidelines were used during the assessment:

- NSW Aquifer Interference Policy (NSW Government, 2012b);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council, 2000);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality: National Water Quality Management Strategy (Australian and New Zealand Governments, 2018).

8.2 Field investigation

8.2.1 Data collection and review

Existing data for the Stockton Sandbed and Tomago Sandbed aquifer systems was reviewed and a water balance for the aquifer determined. Potential impacts from proposed works under varying climatic conditions were assessed.

The review of existing data was supplemented by a field investigation of the project site comprising:

- installation of a bore network;
- physical aquifer testing on installed bores to determine aquifer parameters; and
- review of the ongoing groundwater monitoring program to assess changes in groundwater levels and chemistry over time under varying climatic conditions.

Four bores were drilled in March 2018 to provide baseline groundwater data for the project site and investigate potential ASS (refer to **Chapter 14**). The bore data supplemented historical data from Boral's groundwater monitoring program elsewhere on the quarry (refer to **Section 3.5**).

Groundwater was encountered in all bores at shallow depths between 1.5-5.5 m below ground level (BGL), or 0.59-1.25 m AHD.

Submersible data loggers were installed in eight bores outside the project site to provide continuous monitoring data of groundwater levels across the quarry, and assess groundwater level responses to climatic conditions.

Water samples were obtained from bore MW_X3 in March 2018 and analysed in the field for:

- oxidation reduction potential (ORP);
- pH;
- dissolved oxygen (DO);
- electrical conductivity (EC); and
- temperature.

Groundwater samples collected from bore MW_X3 were sent to a National Association of Testing Authorities (NATA) accredited laboratory and analysed for the following parameters:

- full ionic balance suite – pH, total dissolved solids (TDS), cations (Na, Ca, Mg, K), anions (Cl, SO_4, HCO_3, PO_4, F) and nutrients (NH_3, NO_3 and NO_2); and
- dissolved metals / metalloids including aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni) and zinc (Zn).

8.2.2 Hydraulic parameter testing

As part of the groundwater monitoring program, 'slug-tests' (or falling head tests) were undertaken at the two bores at MW_X3 in March 2018. Slug tests require piezometers to have the screens fully submerged beneath the piezometric surface. This method was used to determine the *in situ* hydraulic conductivity (K).

The tests involve causing an instantaneous change in water level in a section of the piezometer by introducing a known volume (i.e. a 'slug') and then measuring the recovery of the water level over time.

Values for hydraulic conductivity, transmissivity and groundwater velocity were determined for the aquifer using the data from these tests.

8.3 Results

8.3.1 Recharge rates and water balance

The aquifer is recharged by direct infiltration from the surface.

As highlighted in **Section 2.5.7**, groundwater flows either to the north-west towards Fullerton Cove and the Tomago Groundwater Source, or south-east towards Stockton Beach and the Pacific Ocean. Groundwater which flows towards Tomago Groundwater Source may also be intercepted by surface waterbodies such as the Ten Foot Drain and then divert towards Fullerton Cove.

An average of 416 ML of rain falls on the 37 ha project site per annum, 30% of which (126 ML) recharges the aquifer. Evapotranspiration is approximately 70% of recharge (88 ML).

During the project, when the dredge pond is at its maximum extent, recharge to the aquifer via groundwater inflow and direct rainfall will be an estimated 303 ML per year. Evaporation from the dredge pond is estimated at 322 ML per year, with evapotranspiration an additional 33 ML per year. The moisture content in outgoing sand product will also result in an estimated loss of 15 ML per year from the aquifer.

A water balance is summarised in **Table 8.2**. This water balance is supplemented by an additional surface water balance summarised in **Chapter 17**. The surface water balance examines groundwater extraction associated with the dredge pond evaporation and outgoing moisture content only and does not consider natural outflow of the aquifer system or evapotranspiration elsewhere on the quarry. As such, the two balances differ in assumptions, however, both conclude a deficit to the aquifer. Given that the net deficit predicted by the surface water balance is higher, this would form the licensing requirements for the project under the WM Act.

Table 8.2: Groundwater balance

Parameter	Inflow (ML/annum)	Outflow (ML/annum)
Existing conditions		
Recharge	126	-
Groundwater inflow	219	-
Evapotranspiration	-	88
Groundwater outflow	-	219
Total	**345**	**307**
Project conditions		
Recharge	303	-
Groundwater inflow	219	-
Evaporation	-	322
Evapotranspiration	-	33
Sand extraction	-	15
Groundwater outflow	-	219
Total	**522**	**589**

As highlighted above, under existing conditions there is an estimated 38 ML net inflow to the aquifer per year, however, during the peak of the project, there will be an estimated 67 ML annual outflow from the aquifer.

As sand extraction proceeds, the extraction of groundwater is expected to be altered gradually over time as recharge increases due to direct rainfall onto the dredge pond, offset by increased direct evaporation from the surface water body.

Calculations indicate that the water extracted from the aquifer in outgoing sand product contributes approximately 4% of total groundwater outflows, with the moisture content replacing a portion of the natural groundwater discharge (outflow) from the project site towards either the north-west or south-east. As up to half of this discharge is to the ocean, it could be viewed that such extraction of groundwater is only partially impacting on downgradient surface water ecosystems given it is partially recharging a marine water body.

8.3.2 Groundwater chemistry

Results of the field chemical assessment are provided in Appendix E of the HIA and correlate well with field observations.

The data indicate a distinction between groundwater within the south-east of the quarry (east of the groundwater flow divide) and in the north-west of the quarry (west of the groundwater flow divide).

To the west of the groundwater flow divide (bores GW1, GW2, GW4, MW_X1, MW_X2, MW_X3 and MW_X4) the groundwater chemistry is sodium and chloride dominant, with a typically more acidic with a pH range between 4.2 and 6.3.

A neutral to slightly alkaline pH range of 6.8 – 7.8 was reported for the bores east of the groundwater divide (MW_X5 and MW_X6). A relationship exists between pH and salinity in these bores due to the presence of carbonate material (marine shells and other exoskeletons) in the aquifer, resulting in higher pH to the south-east of the project site, and deeper in the aquifer.

The following observations are made based on a review of historical monitoring data across the quarry:

- Salinity (EC) between monitoring locations varies significantly, with average salinities ranging from 330 microsiemens per centimetre (µS/cm) at bore MW1 to 805 µS/cm at bore MW11.
- Salinity also varies significantly per monitoring location, with bore MW5 showing a range of 796 µS/cm over the past three years.
- It is noted that the largest increases in salinity occur following significant rainfall events and are inferred to be due to recharge flushing salt from above the water table.
- The pH values are shown to typically range from 6.0 to 8.0. A few readings below pH 6.0 are noted at bores MW5, MW9 and MW1 in the past. The pH values are otherwise relatively stable. A slight increasing trend over the last three years is noted at bores MW5 and MW9 (moving toward a more neutral pH).

Comparison to water quality criteria

The groundwater samples collected from the unconfined aquifer were also analysed for 11 heavy metals and PFAS compounds.

The shallow bores to the east of the groundwater flow divide (MW_X3 and MW_X4) reported acidic pH ranges that exceeded the Australian and New Zealand Government (2018) guideline values for 95% protection of freshwater aquatic ecosystems. As established in **Section 2.5.5**, acidic soil groups are a feature of the natural environment at the project site and it is deemed that groundwater results reflect this.

All concentrations of total dissolved solids (TDS) across the monitoring network within the data review period were reported below the guidelines.

Arsenic exceeded guidelines for drinking in bore MW_X6, however this is considered a natural occurrence and this area is not within a drinking water zone. Dissolved metals including Al, Cu, Zn, As and Pb exceeded guideline values for ecosystem protection (freshwater and marine). Elevated concentrations of dissolved metals may also be associated with natural background concentrations.

All analysis for PFAS compounds at bores MW_X1, MW_X2, MW_X7 and GW4 reported no concentrations above the laboratory limit or reporting between January and June 2018.

Two water samples were analysed in December 2018 for radium, uranium and thorium, with no positive result above the limit of reporting recorded.

The groundwater quality results are generally considered to be representative of baseline groundwater quality in the project site and will provide a good basis for comparison against results for monitoring throughout the life of the project and into closure.

8.3.3 Groundwater usage and receptors

The groundwater resource beneath the site is of relatively useful yield and quality, and is therefore suitable for a number of potential beneficial uses.

Potential beneficial uses of an aquifer are directly associated with potential yield (sustainable or otherwise) and quality. All groundwater, regardless of yield or quality, is required to be protective of the natural ecosystem within which it resides and in particular discharges to, including any GDEs. There are no aquatic GDEs within the quarry, however terrestrial GDEs are located within the quarry within proximity to the project site.

The HIA determined that the relevant beneficial users of groundwater from a risk assessment perspective (in order of priority and importance) are:

- the freshwater and marine ecosystems of local surface water features and nearby ephemeral creek systems;
- stock watering;
- recreational, direct contact and aesthetic use;
- possible irrigation; and
- project use (dust suppression).

Ecosystem protection is the primary beneficial use of the aquifer, as swamps and wetlands down gradient of the project to the north-west are receptors for groundwater discharge.

The local groundwater is not considered to have potential beneficial use as drinking water or recreational use, whilst use for irrigation is not currently occurring and is considered unlikely.

8.4 Potential impacts

The nature of the groundwater flow system (i.e. a local flow system discharging to the Pacific Ocean and Fullerton Cove) means that all potential impacts of the project are locally constrained.

8.4.1 Site establishment

Physical impacts

Once vegetation is cleared from the project site there will be increased opportunity for direct recharge of rainfall to the water table via established high infiltration rates of sandy soils.

The mechanism for water table recharge (i.e. direct infiltration of surface water) will be improved which, along with reduced evapotranspiration following vegetation removal, may result in localised water table elevations beneath the project site and vicinity. The consequence of such an impact will be minor to negligible and may even be beneficial by increasing groundwater flow rates from the project site towards Fullerton Cove to the north-west.

Chemical impacts

Due to the reduction of evapotranspiration rates following the removal of vegetation and the potential resultant localised water table elevations beneath the project site, chemical impact from the establishment of the project is expected to be limited to potential increases in freshwater recharge to the aquifer. Any chemical alteration is therefore likely to be beneficial.

8.4.2 Dredging operations

Physical impacts

The extraction of groundwater via evaporation and outgoing moisture content in sand product will have very little physical impact on the Stockton groundwater source, due to the fact that the disturbance footprint of the project makes up a small proportion (<0.1%) of the overall 39,100 ha (391 km^2) Stockton Sandbeds catchment.

Whilst the likelihood of any change in water table levels as a result of dredging and consequent alteration of recharge and discharge mechanisms for groundwater at the project site is possible, the consequence is minor. This is because the groundwater inflows and outflows are not expected to alter significantly, primarily as the proposed sand extraction will not alter the water table gradient, nor permeability or porosity of the sediments outside the project site, and as a result groundwater flux will remain stable. Changes in the water table level in the immediate vicinity of the dredge pond will not have a physical consequence for the aquifer or its potential receptors.

Potential terrestrial GDEs south-east of the project site include mobile and ephemeral vegetated deflation basins consisting of a variety of reeds, grasses and sedges, which provide habitat to invertebrates. Swamp forests, dunes swales and low-lying heath are the primary GDEs north-west of the project site. It was concluded that given the proposed depth of sand extraction and maintenance of water levels of the aquifer, the risk of physical impacts to these GDEs will be low.

Chemical impacts

The removal of alluvial sediments by excavation and dredging has the potential to chemically impact on the groundwater resource by reducing the water table and exposing reduced inorganic sulfides to oxygen, which may generate acid. The alteration of groundwater chemistry also has the potential to result in indirect impact to the terrestrial GDEs within the quarry.

As highlighted in **Section 14.2.2**, sulfides may be encountered in a portion of the project site between 2.0 m – 2.5 m BGL, and as such the maintenance of water table levels in the project site is an important consideration for the project.

As dredging activities will see most of the water drain back into the dredge pond, there is low risk of oxidation of potentially localised instances of Potential Acid Sulfate Soils (PASS). Returning the water to the dredge pond during the dredging process will prevent lowering of the groundwater table and exposing of PASS to air. Furthermore, recharge is rapid in the dune lithology, further preventing impacts to the groundwater table in and across the project site and beyond. Despite this, the project has low potential to expose PASS, and monitoring of water table and pond levels (as well as management procedures to mitigate any acid production) will be necessary throughout the duration of the project and into closure.

The contaminants of potential concern associated with regional groundwater impacts stem from the Williamtown RAAF base, chiefly PFAS/PFOA, which are known to have impacted the Tomago Sandbeds aquifer.

It can be estimated from water balance calculations that the water table will not be expected to drop significantly as a result of the project. In addition, the regional groundwater discharge zone of Tilligerry Creek and Fourteen Foot Drain means that the movement of groundwater is away from the quarry, to the north and west towards Fullerton Cove, and subsequently north towards Cabbage Tree Road and the Williamtown RAAF base. Additionally, no indication of PFAS compounds has been recorded via monitoring at the quarry to date, and it is therefore considered there will be no risk of the project interacting with PFAS from the RAAF base and associated management zone.

Given the above, the risk of chemical impact to groundwater will be minimal.

8.4.3 Rehabilitation

Physical impacts

The rehabilitation of the project site as a wetland is considered to have a low level of overall risk, as the wetland is expected to facilitate direct water table recharge and return to natural conditions.

Further to the project taking minimal water from the aquifer, combined with the creation of an enhanced groundwater recharge zone in the form of a pond, the water table will not be lowered in the project site post closure, and increased recharge rate will mean movement of groundwater away from the quarry is maintained into the future.

Chemical impacts

The rehabilitation of the project site is considered to have a low level of overall risk, as the wetland will be expected to facilitate direct water table recharge and return to natural conditions, without a deterioration to the chemical composition of the groundwater.

8.4.4 Summary of potential impacts

As detailed above, all consequences associated with potential physical impacts to the aquifer will be minor to negligible. This is primarily because the project site makes such a small contribution to the overall catchment water balance, and that there are no potential receptors to groundwater discharge down-gradient of the project site other than the ecosystems of the Pacific Ocean and Fullerton Cove.

The major risk of chemical impact is likely to be as a result of oxidation of natural *in-situ* sulphides within the existing soil profile. However, potential chemical risks associated with PASS will be minimised during operation of the project, as:

- despite encountering the water bearing zone, the dredging operations are considered unlikely to alter the groundwater level as water extracted during dredging activities is returned to the dredge pond via a closed system; and
- dredging activities include the sieving of sand material, so that fines (materials finer than sand) are separated and immediately returned below the water table.

8.5 Mitigation and management measures

8.5.1 Groundwater monitoring

The following measures will be formalised in an update to the existing *Stockton Sand Quarry Groundwater Management Plan* (GWMP) (Jacobs, 2017) to encompass the project site. The GWMP was prepared in accordance with Schedule 3(12) for Development Consent DA 140-6-2005, and describes the objectives of groundwater management and monitoring along with the proposed types and locations of monitoring. It also describes the monitoring observations which will trigger actions, and the proposed action and/or mitigation should triggers be exceeded.

Monitoring network

The boreholes located outside the project site will form a monitoring network to be periodically sampled. The bores to be included are MW_X1, MW_X2, MW_X5, MW_X6, MW_X7, GW2, GW4 and MW2. Once extraction progresses below the water table, the dredge pond surface will be surveyed so that the relative height of water in the pond over time can be accurately measured.

All bores have been surveyed for relative height to AHD with at least 0.001 m accuracy, so that relative groundwater levels can be compared.

Physical assessment of groundwater and dredge pond levels

Standing groundwater levels (SWL) from all eight bores, and the water level (m AHD) of the dredge pond will be measured monthly during dredging operations. The measurement of SWL from bores will continue during rehabilitation works.

Following rehabilitation, all bores will be incorporated into the existing quarterly groundwater monitoring program for the quarry.

Chemical assessment of groundwater and surface water

All eight bores and the dredge pond will be tested for pH on a monthly basis during dredging operations. The measurement of pH will be performed in the field with a hand-held electronic meter that is 2-point calibrated.

In addition to the above recommended measurement for pH, all bores will be incorporated into the GWMP, which will be updated following approval of the project.

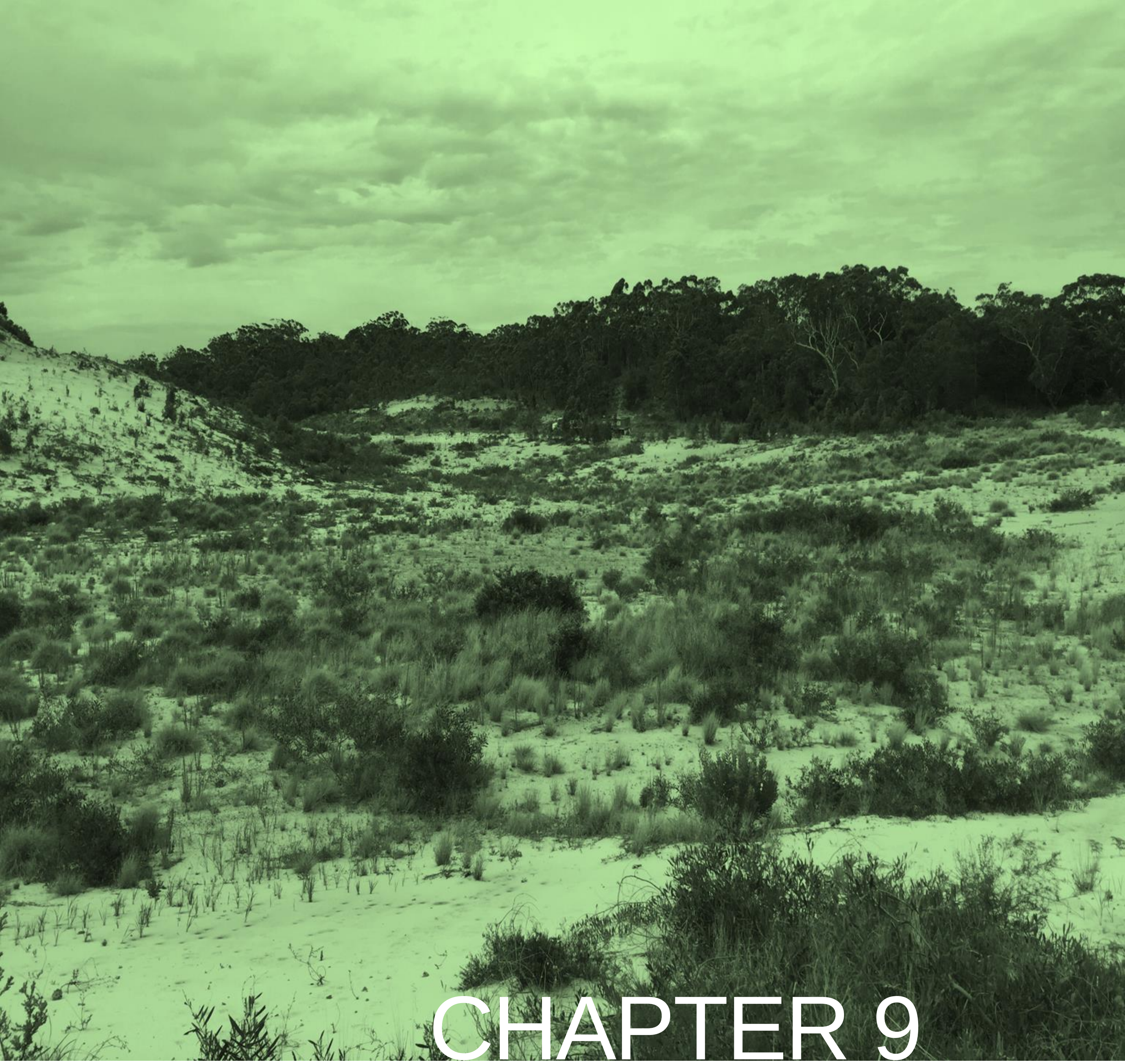
Groundwater bores will be sampled on a monthly basis for SWL and pH, and tested quarterly for the following analytical suite:

Field measurement of:

- pH, EC, ORP, SWL, DO and temperature.

Laboratory analysis for:

- full ionic balance suite pH, TDS, cations (Na, Ca, Mg, K), anions (Cl, SO_4, HCO_3, PO_4, F) and nutrients (NH_4, NO_3, NO_2, Total N); and
- dissolved metals / metalloids including aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni) and zinc (Zn).



CHAPTER 9

BIODIVERSITY

9 BIODIVERSITY

9.1 Introduction

This section summarises the BDAR, which is in **Appendix E**. It describes the ecological context of the project site, study methods, flora and fauna discovered during surveys, potential impacts and mitigation measures where impacts are unavoidable.

9.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on biodiversity values (**Table 9.1**).

Table 9.1: Biodiversity related SEARs

Requirement	Section and appendix where addressed
Accurate predictions of any vegetation to be cleared on site.	9.3, Appendix E
A detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report.	9.3, Appendix E
A strategy to offset any residual impacts of the development in accordance with the offset rules under the Biodiversity Offsets Scheme.	9.6, Appendix E

9.1.2 Overview of assessment methods

Biodiversity impacts were assessed in accordance with DPIE's Biodiversity Assessment Method (BAM) using the BAM Calculator, which comprises two stages:

- Stage 1 – biodiversity assessment, involving determination of:
  - habitat value through assessment of landscape features;
  - native vegetation; and
  - threatened species and populations.
- Stage 2 – impact assessment, involving consideration of:
  - how to avoid and minimise impacts on biodiversity values;
  - impact and offset thresholds; and
  - offset requirements.

The following subsections set out how this information was collected and classified for the purposes of informing the assessment set out in **Section 9.3**.

Landscape assessment

Landscape assessment focuses on determining habitat values by comparing the current state of key landscape features with the likely state of the same key landscape features should the project proceed. The following features were considered, with information sourced from aerial photographs, maps, database searches and site observations:

- native vegetation cover;
- rivers, streams and estuaries;
- areas of geological significance; and
- habitat connectivity.

Native vegetation

Previous records of threatened flora within a 10 km radius of the project site were retrieved from the NSW Bionet Atlas and the EPBC Act PMST.

The PCT mapping in DPIE's Vegetation Information System was used to determine potential biodiversity constraints on the project. The PCTs were validated with fieldwork in September 2017 using the BAM.

The assessment involved observing vegetation attributes in the project site using vegetation quadrats, transects and 'walking meanders' to identify flora species and confirm the PCTs and their condition. High threat and priority weeds were also recorded during the fieldwork.

The validated PCTs were mapped and it was determined if any TEC were present in the project site.

The BAM Calculator was used to predict the presence of threatened flora in the project site, which were targeted during the fieldwork. The list of potential threatened flora was refined after the fieldwork based on previous records within the search radius, observed PCTs, their condition and habitat features. Then a determination was made on the likelihood of threatened flora occurring in the project site.

Threatened species and populations (fauna and habitat)

The NSW Bionet Atlas and EPBC Act PMST were also searched for records of threatened fauna within a 10 km radius of the project site. The results were considered during fieldwork planning and the likelihood of occurrence analysis.

Fauna and habitat fieldwork focussed on threatened species (species credit fauna) and comprised:

- survey of the project site in July 2017, comprising spotlighting, call playback, habitat-based assessment and bird surveys; and
- 'Anabat' bat detection analysis in September 2017.

The habitat assessment recorded:

- slope, aspect and landscape position;
- geology and soil type;
- dominant vegetation communities including their composition, structure and condition;
- form, quality and location of water sources;
- presence, size, number and condition of habitat features such as tree hollows; and
- level of disturbance.

Impacts

Direct, indirect and cumulative impacts to native vegetation and habitat were assessed. Serious and irreversible impacts were assessed in accordance with the BAM, which provides criteria to determine if a project will have serious and irreversible impacts on biodiversity.

Biodiversity which will be seriously and irreversibly impacted by a project requires offsetting, which is determined by using the Biodiversity Credit Calculator to calculate ecosystem and species offset credits. The credits are retired by establishing a biodiversity stewardship site or payment into the Biodiversity Conservation Trust Fund (BCT).

9.2 Results

9.2.1 Native vegetation and flora

Plant community types

The field survey confirmed that the project site consisted predominately of rehabilitation comprising native vegetation, mainly tubestock and some native seeding that had occurred over the past decade.

As detailed in the OEH (2018) Biodiversity Assessment Method Operational Manual, *'Planted native vegetation is treated in the same way as native vegetation if it meets the definition of native vegetation in Section 5A of the Local Land Services Act 2013. Where the vegetation is a mix of local and non-local planted species the assessor should consider the best matching PCT based on the local species present'*.

As such, areas that have been rehabilitated were attributed to two PCTs which likely occurred in the project site prior to clearing, or contain a structure similar to that of the rehabilitated land.

The PCTs validated during fieldwork are summarised in **Table 9.2** and presented in **Figure 9.1**.

The PCTs identified are not listed as a TEC under the BC Act or EPBC Act.

Table 9.2: Summary of PCTs in project site

PCT	TEC	% cleared	Area (ha)
PCT1646 - Smooth-barked Apple/ Blackbutt/ Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	-	45	31.75
1644 - Coast Tea Tree - Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast	-	96	3.91
Non-native vegetation	-	-	2.48
		Total	**38.14**
		Total native vegetation	**35.66**

High threat weeds

The former Office of Environment and Heritage (OEH), now Environment, Energy and Science (EES), has a list of 'High threat weeds' which were taken into consideration in the BDAR.

High threat weeds recorded in the BDAR as occurring at the site include:

- Farmer's Friend (*Bidens pilosa*);
- Panic Veldtgrass (*Ehrharta erecta*); and
- Africa Lovegrass (*Eragrostis curvula*).

The high threat weed species were distributed across the project site and concentrated near existing disturbance.

These species, while required to be identified as “high threat”, are not listed as “high risk” species under the NSW *Biosecurity Act 2015.*

Threatened flora

The BAM calculator predicted the 21 threatened flora species in Appendix 1 of **Appendix E** could occur in the project site. This list was refined following initial field survey, with no threatened flora species observed or recorded in the project site.

Figure 9.1
Vegetation communities

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT

Source: LPI (2017), Photomapping Services (2018), Boral (2019), Niche Environment and Heritage (2019), Cambium Group (2019).

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9.2.2 Fauna and habitat

Fauna habitat

The field survey observed a clear difference in fauna habitat across the project site, attributed to the age of rehabilitation vegetation.

Areas of relatively recent rehabilitation contained scattered logs, generally sparse ground cover and lacked a mid and canopy stratum. Conversely, older rehabilitation areas had a developing canopy and midstorey cover. As such, the remnant and older patches of rehabilitation will offer greater foraging habitat for a variety of fauna, including that of nectivorous birds and the Squirrel Glider.

The survey of rehabilitated areas did not identify trees mature enough to contain hollows, and as such, roosting and breeding habitat for a range of hollow-dependent species, such as microbats, was absent. Limited hollows within adjoining areas of the remnant vegetation occur, none of these had any evidence of owl usage.

Logs have been scattered throughout the rehabilitation areas which provide habitat for reptiles and small ground-dwelling mammals, and foraging resources for birds.

The ground cover of rehabilitated areas is particularly sparse, however the sandy substrate may provide habitat for small to medium-sized mammals to create burrows for shelter.

No habitat in the form of bush rock or rock platforms were identified, nor was there any permanent or ephemeral aquatic habitats on the site.

Habitat connectivity

The project adjoins a large native vegetation corridor which extends along Stockton Bight to Anna Bay in the north, and Stockton in the south. The stretch of the vegetation corridor encompasses Worimi Regional Park and Worimi State Conservation Area.

The west of the site, connectivity of this corridor is fragmented by Nelson Bay Road and the contiguous areas of cleared rural agricultural lands. These existing intrusions form a barrier to fauna movement in the area.

The removal of vegetation (predominantly tubestock plantings within the former inland extraction area) and habitat within the project site will not reduce the amount of important habitat features (e.g. hollow bearing trees) within the corridor to the degree that fauna roosting and foraging habitat will be significantly impacted.

The removal of the vegetation within the project site is unlikely to restrict fauna movement along the corridor extending from Stockton Beach to Anna Bay given the following:

- the area to be disturbed is centred on the former inland extraction area which was historically cleared;
- vegetation would be retained along Nelson Bay Road and towards Stockton Beach allowing continued fauna movement along the corridor; and
- the haul road that is currently in operation for the windblown sand extraction area would not be widened as part of the project and as such no changes to existing fauna movement are likely.

Threatened fauna

The BAM Calculator, based on the identified PCT, predicted the potential for 85 threatened fauna species (refer to Appendix 1 of **Appendix E**) to occur in the 10 km search radius. A total of 21 of these were identified as 'candidate' fauna species (i.e. species credit species). The list of candidate species was then reduced to the Squirrel Glider after validation via fieldwork.

The 28 species listed in Appendix 5 of **Appendix E** were recorded during surveys of the proposed disturbance areas and other areas in and adjacent to the project site. Results comprised three reptile, four mammal and 21 bird species.

The following threatened species were observed, or recorded via Anabat analysis during fieldwork:

- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii*); and
- White-bellied Sea Eagle (*Haliaeetus leucogaster*).

The locations of the threatened species recorded at the project site and areas of potential habitat for the Squirrel Glider are shown on **Figure 9.2**.

The Eastern Bentwing-bat and White-bellied Sea Eagle are 'species credit' fauna which require biodiversity offsetting if their habitat is present and/or habitat will be impacted by the project. These species are 'dual credit' species with the species credit component only triggered if breeding habitat is present. No breeding habitat was detected for the two species in the project site.

The remainder of the species are 'ecosystem credit' species, which are assumed to have habitat in the vegetation types of the project site.

Migratory species

No migratory species listed under the EPBC Act were observed adjacent to or in the project site.

Eight migratory species could occur in or adjacent to the project site. These species could occur due to the presence of opportunistic foraging habitat.

The extensive native vegetation to the north and south of the quarry in Worimi Regional Park and Worimi State Conservation Area contains more habitat for the species.

The dredge pond may provide habitat for some migratory species.

Figure 9.2
Survey type, recorded threatened species and fauna habitat

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT

Source: LPI (2017), Photomapping Services (2018), Boral (2019), Niche Environment and Heritage (2019), Cambium Group (2019).

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DISCLAIMER

9.3 Impact assessment

9.3.1 Avoidance and minimisation

The following options were considered during design of the project to avoid or minimise impacts:

- Extension of the extraction footprint beyond the previous inland extraction area, and subsequent extraction and dredging of this footprint. It was determined that this option would maximise access to sand resource, however, would increase the clearing of remnant vegetation and habitat compared to the project, and subsequently increase offsetting requirements. Therefore, this option was not investigated further from a biodiversity perspective.
- Extension of the extraction footprint beyond the previous inland extraction area, inclusive of sand extraction to 4 m AHD with no dredging operations. It was determined that this option would reduce the degree of ground disturbance as is experienced with dredging, however, would also increase the area of environmental impact (vegetation clearing, noise, and dust emissions) and fail to maximise use of the sand resource beneath 4 m AHD.

With the above considered, confinement of the project to the previously disturbed inland extraction area was considered to result in the most favourable biodiversity outcomes.

9.3.2 Direct impacts

The project will directly impact biodiversity during site establishment and operation. Most impacts on biodiversity will occur during establishment of the extraction areas, associated with clearing of native vegetation and removal of habitat.

The following direct impacts will result from the project:

- clearing of native vegetation and associated habitat, conservatively estimated to be 35.66 ha, including 32.75 ha of previously rehabilitated areas;
- clearing of approximately 2.48 ha of exotic vegetation; and
- clearing of 26.59 ha of associated species credit fauna habitat for the Squirrel Glider.

Eight species listed under the EPBC Act may be impacted by removal of potential foraging habitat. Therefore, 'assessments of significance' were undertaken for these species (refer to Appendix 7 of **Appendix E**). The assessments of significance concluded the project will not significantly impact these species and no referral under the EPBC Act to DoEE is required.

9.3.3 Indirect impacts

Indirect impacts will mostly occur during the establishment of the project and will be short term and largely confined to the project site and immediate surrounds.

The primary indirect impacts may include:

- increased noise and dust from the construction and operation of the project;
- increased edge-effects for surrounding vegetated areas;
- potential alteration to groundwater levels and flows, and possible flow on effects to terrestrial GDEs at the quarry;
- provision of potential sources of ignition leading to a bushfire event (e.g. vehicles driving through dry grassland during warmer months);
- erosion and sedimentation in areas adjoining construction and operational activities; and
- spread of weed propagules, which could lead to invasion of native vegetation by weeds.

9.4 Mitigation and management measures

The following mitigation measures will be implemented to avoid or minimise impacts to biodiversity in and adjacent to the project site.

9.4.1 Fencing and signposting

Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the project site.

Conservation areas will be signposted to restrict entry and reduce incidental interactions with threatened species (e.g. speed limit signage along access roads to reduce potential for fauna vehicle strikes).

9.4.2 Education and training

Employees and contractors will be educated and required to implement the following controls to avoid or minimise potential indirect biodiversity impacts:

- minimise the extent and time that bare sand is exposed and by implementing appropriate dust suppression
- implement procedures for the management of hydrocarbon and/or chemical spills throughout the project site, including the requirements for vehicles to carry spill kits;
- ensure vehicles remain on designated roads and tracks and abide by site speed limits, through use of signposting and driver education during the induction process, and in ongoing project discussions; and
- management and removal of all waste material from the project site.

9.4.3 Vegetation clearing protocols

The vegetation clearing protocol in the *Stockton Transgressive Dune Quarry Rehabilitation and Landscape Management Plan* (ERM, 2010) will continue to be implemented for the project. The following will be implemented:

- Ecologists will survey for ground dwelling fauna prior to clearing of native vegetation and remove any fauna/fauna habitats to adjacent areas not proposed to be disturbed.
- Ecologists will supervise felling of remnant hollow-bearing trees or habitat trees located within Stage 1 of the project area. All hollow-bearing trees that are accessible safely from the ground will be checked and fauna relocated. Hollows higher up and not accessible from the ground will be identified and trees felled gently by an excavator or dozer and left overnight to allow fauna to relocate.
- Fauna displaced during clearing will be captured where possible and relocated to designated areas by trained personnel.
- NSW Wildlife Information, Rescue and Education Service will be contacted to collect injured fauna.

9.4.4 Dust management

The management and mitigation measures listed in **Section 10.3** would be implemented to minimise the potential for dust generation and distribution via winds to adjacent woodland areas.

9.4.5 Groundwater management

As detailed in **Section 8.4**, the project is not anticipated to result in impacts to GDEs at the site.

The management and monitoring measures outlined in **Section 8.5** would be implemented for the project to minimise the potential for adverse impacts to groundwater levels and quality.

9.4.6 Rehabilitation

Disturbed areas will be progressively rehabilitated in accordance with a rehabilitation management strategy (refer to **Chapter 22**) to create a stable landform that does not result in sediment laden runoff or fugitive dust emissions, blends well with the adjacent natural landscapes and re-establishes native bushland.

The *Stockton Transgressive Dune Quarry Rehabilitation and Landscape Management Plan* will be updated to reflect biodiversity management measures to protect and manage biodiversity values. The existing plan contains commitments to threatened species management, pest and weed management, fire management and site hygiene practices, which are to continue for the project.

9.4.7 Pest and weed management

The existing rehabilitation and landscape management plan will be updated to include a section on pest and weed management, including management protocols for the identification of noxious or environmental weeds within areas to be cleared (in order to avoid transporting the weeds to rehabilitation areas or other parts of the quarry).

9.4.8 Fire management

Boral's (2010) *Stockton Transgressive Dune Quarry Environmental Management Strategy* includes a bushfire management plan, which contains fire prevention and suppression measures including maintenance of access roads to prevent potential ignition of grassland by vehicle exhaust. This plan will be updated to reflect the findings of the Bushfire Hazard Assessment for the project (refer to **Chapter 20**).

9.5 Residual impacts

The project will not have 'serious and irreversible impacts' (as defined by the BAM) on any threatened species.

The project will impact PCTs to be cleared as summarised in **Section 9.2.1**. These impacts will require offsetting under the BC Act.

The ecosystem credits required to offset vegetation and habitat impacts are:

- 396 ecosystem credits to offset removal of the Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal s ands of the Central and Lower North Coast PCT; and
- 37 ecosystem credits to offset removal of the Coast Tea Tree - Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast PCT.

521 species credits are required to offset the impacts of the removal of 26.59 ha of foraging habitat for the threatened Squirrel Glider.

9.6 Biodiversity offset strategy

Under the BAM, an offset strategy is not required to be submitted with the BDAR, as the credits are to be formally retired with the establishment of a stewardship site, or payment into the BCT.

However, as noted in the SEARs for the project, a biodiversity offset strategy is required to be included in the BDAR.

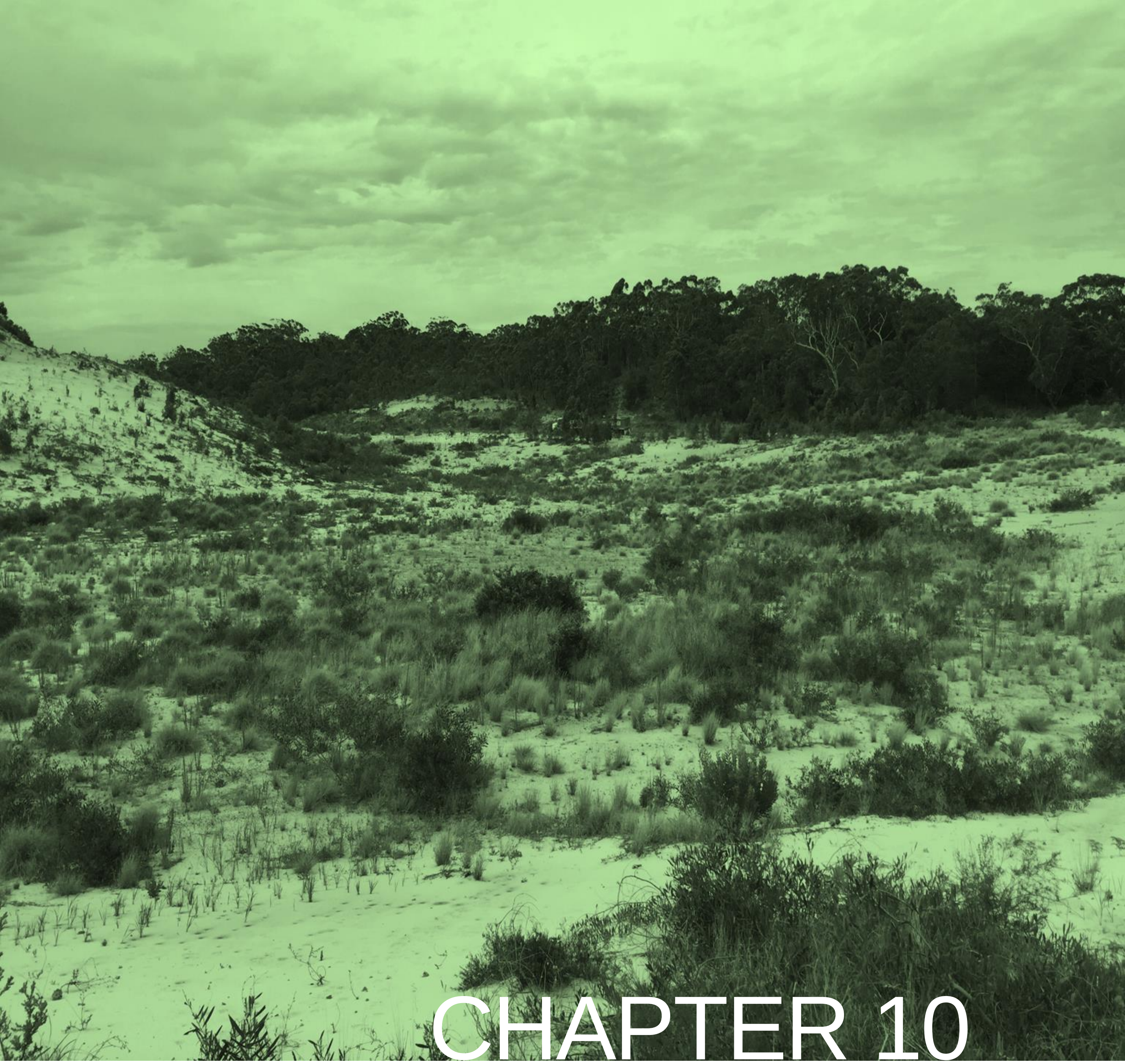
Under the BAM, the biodiversity offsets must provide benefits to biodiversity to compensate for the adverse impacts of an action. Biodiversity offsets assist in achieving long-term conservation outcomes while providing development proponents with the ability to undertake actions that have unavoidable impacts on biodiversity.

Unavoidable impacts to biodiversity are those impacts that are residual (i.e. impacts that remain after impact avoidance, management and mitigation measures are employed to reduce the type or magnitude of biodiversity impacts).

Boral has identified a range of options to offset the project using one or a combination of the following:

1. purchase of offset credits on the market, in which if credits become available Boral may pursue this option;
2. payment into the BCT, in which Boral would pay the equivalent credit costs; and/or
3. use existing Boral landholdings to investigate potential for a biodiversity stewardship site to reduce a portion, or all of the offset credits.

In reference to the above options, given that Boral has the option to pay into the BCF to satisfy the offset requirement, there is minimal risk for Boral not to meet the offsetting liability.



CHAPTER 10

AIR QUALITY

10 AIR QUALITY

10.1 Introduction

This chapter summarises the air quality impact assessment (AQIA) report, which is in **Appendix F**. It describes the air quality assessment criteria which apply to the project, potential air emission sources, modelling method and results, potential impacts and mitigation measures where impacts are unavoidable.

10.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on air quality (**Table 10.1**).

Table 10.1: Air quality SEARs

Requirement	Section and appendix where addressed
A detailed air quality impact assessment (AQIA) of potential construction and operational impacts, in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, and with a particular focus on dust emissions including PM2.5 and PM10, and having regard to the Voluntary Land Acquisition and Mitigation Policy.	10.2, Appendix F

10.1.2 Overview of assessment methods

The objective of the AQIA was to identify and assess the potential for adverse operational air quality impacts which may result from the project.

The following atmospheric pollutants are likely to be generated by the project:

- deposited dust;
- total suspended particulate (TSP) matter, which is nominally taken to be less than 30 micrometres (µm) in diameter and refers to all suspended particles in the air;
- PM_{10}, which is a subset of TSP and have a diameter of 10 micrograms (µm) or less;
- $PM_{2.5}$, which is a subset of TSP and have a diameter of 2.5 µm or less;
- crystalline silica;
- pollutants generated through the combustion of fuel in vehicle engines (oxides of nitrogen and sulfur (NO_2 and SO_2), PM_{10} and $PM_{2.5}$).

Dispersion of air pollutants was modelled using the ‘CALPUFF Modelling System’, which combines estimated emission rates, neighbouring emission sources, proposed mitigation measures and local meteorology to predict incremental and cumulative air quality impacts.

10.1.3 Assessment criteria

Particulate matter

Dust emissions from the project were estimated by applying emissions factors developed by the United States EPA to the potential dust generating activities. The emissions factors (dust generated by project activities) were used in the dispersion modelling to predict incremental emissions (emissions from the project only) and cumulative emissions (emissions from the project combined with ambient dust levels, which will comprise emissions from other operations in the area) at the receivers.

The project specific air quality criteria in **Table 10.2** were established in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2017).

Table 10.2: Project specific air quality criteria

Particulate matter	Averaging time	Criterion
TSP	Annual	90 micrograms per cubic metre (µg/m³)
PM_{10}	24-hour	50 µg/m³
	Annual	25 µg/m³
$PM_{2.5}$	24-hour	25 µg/m³
	Annual	8 µg/m³
Deposited dust	Annual	Maximum incremental (project only) increase of 2 g/m²/month Maximum total (project and other sources) of 4 g/m²/month

Nitrogen dioxide

The air quality goals for nitrogen dioxide (NO_2) in (NSW EPA, 2017) relevant to the project are summarised in **Table 10.3**.

NO_2 forms when fuel is burned at high temperatures or from blasting and is reddish-brown in colour (at high concentrations) with a characteristic odour and can irritate the lungs and lowers resistance to respiratory infections such as influenza.

SO_2 commonly arises in industrial emissions due to the sulphur content of the fuel and can have impacts upon human health and the habitability of the environment for flora and fauna.

Table 10.3: NSW EPA air quality impact assessment criteria – NO_2

Pollutant	Averaging period	Criterion
NO_2	1 hour	246 µg/m³
	Annual	62 µg/m³

NSW Voluntary Land Acquisition and Mitigation Policy

Voluntary acquisition rights may apply where, even with best practice management, the development contributes to exceed the criteria in **Table 10.4** from the VLAMP (NSW Government, 2018), at any residence, workplace or on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls (vacant land).

Table 10.4: Particulate matter acquisition criteria

Pollutant	Averaging period	Criterion	Impact type
TSP	Annual	90 µg/m³*	Amenity

Pollutant	Averaging period	Criterion	Impact type
PM_{10}	Annual	20 µg/m³**	Human health
	24 hour	50 µg/m³**	
$PM_{2.5}$	Annual	8 µg/m³*	Human health
	24 hour	25 µg/m³**	
Deposited dust	Annual	2 g/m²/month**	Amenity
		4 g/m²/month*	

* Cumulative impact (increase in the concentration due to the development plus background concentrations due to all other sources).
** Incremental impact (increase in concentrations due to the development alone), with up to five allowable exceedances of the criteria over the life of the development.

Crystalline silica

Silica occurs in nature in a crystalline or amorphous form and may be synthetically produced in amorphous forms. Silica is commonly found in soil and rocks, the most common form is quartz, followed by cristobalite and tridymite. The crystalline form of silica has potential to cause adverse health effects in humans. Occupational exposure to respirable crystalline silica could cause silicosis.

Various jurisdictions have developed criteria for acceptable levels of exposure to crystalline silica. These include the Victorian criterion adopted from Californian reference exposure level values, and occupational standards. There are no criteria in NSW for crystalline silica and as such, **Table 10.5** presents the Victoria Environment Protection Authority impact assessment criteria, which is the most stringent available standards for respirable crystalline silica and thus applied to the project.

Table 10.5: Air quality impact assessment criteria – respirable silica

Pollutant	Averaging period	Criterion
Respirable crystalline silica (as $PM_{2.5}$)	Annual	3 µg/m³

10.1.4 Summary of background dust levels

Annual average PM_{10} and $PM_{2.5}$ values from the Stockton monitoring station for 2015 were used to represent the background levels for the project as they were the highest recorded at the three monitoring locations.

As noted, the $PM_{2.5}$ and PM_{10} concentrations at the Stockton monitor were elevated due to heavily salt laden air or particulates blowing from the east along the surf break of Stockton Bight. Fresh sea salt aerosol arises from the wave breaking in the ocean and is a natural source of particulate matter. To account for this, background $PM_{2.5}$ and PM_{10} concentrations were adjusted to discount the contribution from salt laden air and annual average $PM_{2.5}$ and PM_{10} concentration were estimated to be 7.3 µg/m³ and 17.0 µg/m³ respectively. These adjusted estimates are comparable with measurements at the Beresfield and Wallsend monitors.

In the absence of available data, estimates of the annual average background TSP and deposited dust concentrations can be determined from a relationship between PM_{10}, TSP and deposited dust concentrations and the measured PM_{10} levels. The annual average TSP concentration and dust deposition levels at the site were conservatively estimated using the relationship and assumed that a PM_{10} concentration of 30 µg/m³ will have an equivalent TSP concentration of 90 µg/m³ and dust deposition level of 4 g/m²/month.

The estimated background air quality levels used in the modelling were:

- annual average TSP concentrations – 61.2 µg/m^3;
- annual average deposited dust levels – 2.7 g/m^2/month;
- 24-hour average $PM_{2.5}$ and PM_{10} concentrations – variable;
- annual average $PM_{2.5}$ concentrations – 7.3 µg/m^3;
- annual average PM_{10} concentrations – 17.0 µg/m^3;
- 1-hour average NO_2 concentrations – 80 µg/m^3; and,
- annual average NO_2 concentrations – 15.0 µg/m^3.

10.1.5 Sensitive receivers

As described in **Section 2.8**, land use surrounding the quarry is a mix of extractive industry, rural, residential, public recreation and environmental conservation areas.

Sensitive receivers considered in the AQIA modelling are identified in **Table 10.6**.

Table 10.6: Sensitive receiver locations

Receiver	Property address	Proximity to the project
R1	101 Norfolk Street, Fern Bay	1,475 m south-west
R2	14 Tuckeroo Circuit, Fern Bay	1,015 m west-south-west
R3	260 Fullerton Cove Road, Fullerton Cove	775 m north-west
R4	12 Coxs Lane, Fullerton Cove	540 m north-west
R5	17A Coxs Lane, Fullerton Cove	520 m north
R6	21 Coxs Lane, Fullerton Cove	490 m north

10.2 Impact assessment

Wind blowing across exposed surfaces and project activities such as loading/unloading of sand and vehicle movements could generate dust emissions.

Project related vehicle movements could generate air emissions from the exhaust and wheel generated dust when travelling on roads.

10.2.1 Particulate matter concentrations

Results from the incremental assessment are in **Table 10.7** and results from the cumulative assessment are in **Table 10.8**.

Dust emissions from the project are predicted to be below criteria.

Table 10.7: 24-hour and annual average particulate dispersion modelling results for sensitive receivers – incremental impact

Receiver ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m³/mth)
	24hr average	Annual average	24hr average	Annual average	Annual average	Annual average
	Criteria					
	-	-	-	-	-	2
R1	0.1	<0.1	0.5	<0.1	0.1	<0.1
R2	<0.1	<0.1	0.5	<0.1	0.1	<0.1
R3	0.1	<0.1	0.5	<0.1	0.1	<0.1
R4	0.2	<0.1	1.1	<0.1	0.2	<0.1
R5	0.3	<0.1	1.8	0.2	0.4	<0.1
R6	0.4	<0.1	2.1	0.2	0.5	<0.1

Table 10.8: Annual average particulate dispersion modelling results for sensitive receivers – cumulative impact

Receiver ID	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m³/mth)
	Annual average criteria			
	8	25	90	4
R1	7.3	17.1	61.4	2.7
R2	7.3	17.1	61.4	2.7
R3	7.3	17.1	61.4	2.7
R4	7.3	17.3	62.1	2.8
R5	7.4	18.2	65.2	2.9
R6	7.6	19.9	71.5	3.3

The cumulative annual average PM_{10} concentrations generated by the project are illustrated in **Figure 10.1**, and shows that PM_{10} concentrations would be highest within Stage 1 of the project site, before quickly dispersing and resulting in concentrations well below the criterion at the nearest sensitive receivers.

Assessment of cumulative $PM_{2.5}$ and PM_{10} impacts

As indicated in **Section 2.5.2**, maximum 24-hour concentrations of $PM_{2.5}$ and PM_{10} have exceeded or come close to the criteria on occasion at the Stockton monitoring station.

The EPA requires a more thorough assessment when the criteria is likely to be exceeded due to background levels, where the measured background level on a given day is added contemporaneously to the predicted incremental level using the same day's weather. This method has limits in predicting short term impacts, so impacts are described as 'systemic', or over five or more days.

The Level 1 contemporaneous assessment approach of *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2017), which involves adding the maximum background levels to the maximum predicted levels from the project, would show levels above the criterion whether or not the project was operating.

In such situations, a Level 2 contemporaneous assessment approach is applied, where the measured background levels are added to the daily corresponding predicted dust level from the project. The ambient $PM_{2.5}$ and PM_{10} concentrations corresponding with the daily concentrations from the year of modelling (2015) from the Stockton monitoring site were applied to represent the prevailing background levels at receivers around the project.

The results showed that the project will not increase the number of days above the 24-hour average criteria for $PM_{2.5}$ and PM_{10} at any sensitive receiver.

Figure 10.1
Predicted cumulative annual average PM_{10} concentrations (µg/m³) concentrations

STOCKTON SAND QUARRY DREDGING
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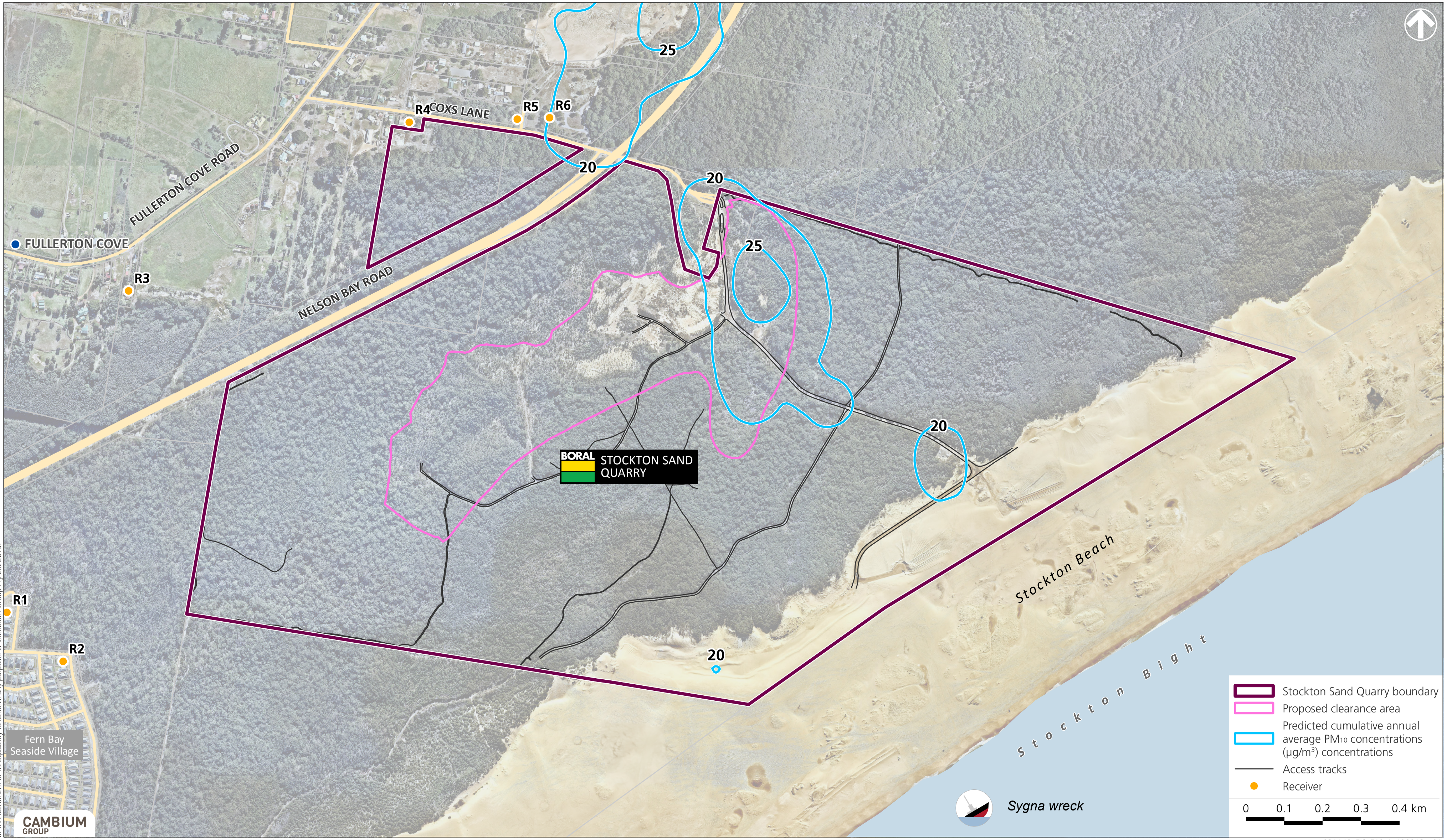

Source: LPI (2017), Photomapping Services (2018), Todoroski Air Sciences (2019), Boral (2019), Cambium Group (2019).

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10.2.3 Nitrogen dioxide concentrations

Table 10.9 presents the predicted incremental and cumulative NO_2 dispersion modelling results at each the receivers. NO_2 emissions from the project are predicted to be below criteria.

Table 10.9: NO_2 dispersion modelling results for residential receivers

Receptor ID	Incremental		Cumulative	
	1-hour average	Annual average	1-hour average	Annual average
	Air quality impact criteria			
	-	-	246	62
R1	22.5	<0.1	102.5	15.1
R2	19.5	<0.1	99.5	15.1
R3	26.4	<0.1	106.4	15.1
R4	32.2	0.2	112.2	15.2
R5	49.1	0.3	129.1	15.3
R6	52.1	0.3	132.1	15.3

10.2.4 Respirable crystalline silica

The predicted maximum incremental annual average $PM_{2.5}$ concentration at the nearest receiver will be less than 0.1 µg/m^3. Only a small portion of this dust would contain silica.

As the total level is over thirty times below the adopted criteria of 3 µg/m^3 for respirable crystalline silica, the actual level from the project will be significantly below the criteria and as such the project will not result in an unacceptable level of respirable crystalline silica at receivers.

10.3 Mitigation and management measures

An air quality management plan will be prepared prior to the commencement of operations. The plan will outline the measures to manage dust emissions at the site and include key performance indicators, response mechanisms, compliance reporting and complaints management.

The air quality management measures in **Table 10.10** will be implemented during operation of the project.

Table 10.10: Summary of operational phase air quality management measures

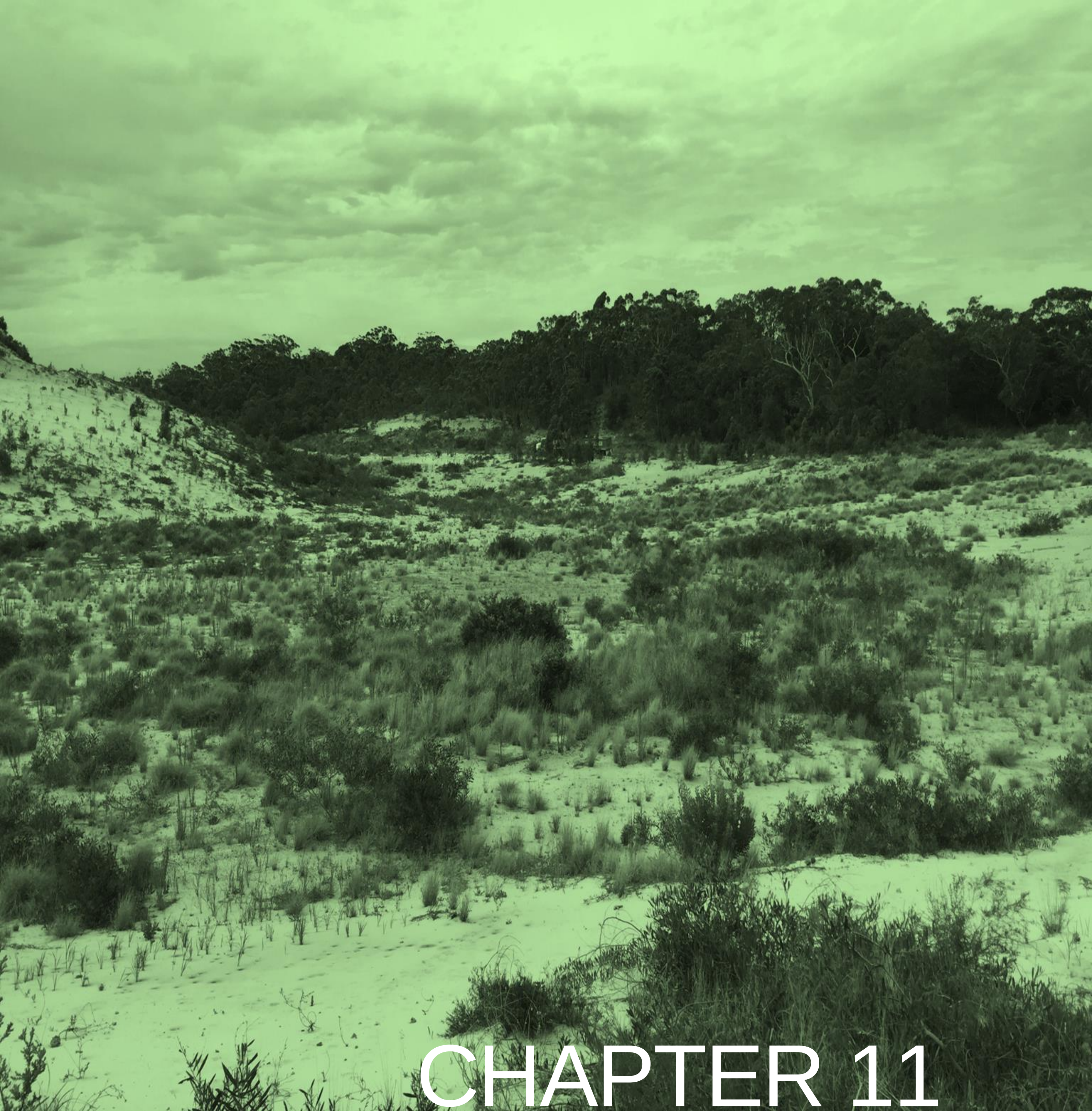
Activity	Control measure
General	▪ Dust generation will be monitored during adverse weather and activities modified as required (e.g. activity will be curtailed or ceased where reasonable levels of visible dust cannot be maintained using the available means). ▪ On-site vehicles and plant will be switched off when not in use. ▪ Vehicles will be maintained and serviced according to manufacturer's specifications.
Exposed areas / stockpiling	▪ The extent of exposed surfaces and stockpiles will be kept to a minimum. ▪ Exposed areas and stockpiles will be covered or dampened with water if dust emissions are visible, or there is potential for dust emissions outside operating hours.

Activity	Control measure
	▪ Dust generation will be minimised by rehabilitating exposed areas when topsoil and subsoil stockpiles are moist and/or wind speed is below 10 m/s.
Material handling	▪ Drop heights from loading and handling equipment will be reduced where practical. ▪ Dampen material when excessively dusty during handling.
Hauling activities	▪ Haul roads will be watered using water cart so the road surface has sufficient moisture to minimise on-road dust generation but not so much as to cause mud/dirt track out. ▪ Regularly inspect haul roads and maintain surfaces to remove potholes or depressions. ▪ Driveways and hardstand areas will be swept/cleaned regularly as required. ▪ Site speed limits will be enforced. ▪ Vehicle loads will be covered when transporting material off-site.
Incidents and complaint management	▪ Complaints and incidents will be logged and investigated via Boral's site incident management system. ▪ Any controls required to manage, mitigate or rectify a complaint or incident will be implemented as soon as practical. Following a complaint or incident, Boral will review all air quality controls and investigate implementation of additional controls if required.

10.4 Residual impacts

The dispersion modelling predictions show the project, with the application of suitable dust mitigation and management measures, will not result in air pollutant levels above criteria at any receiver.

The assessment of cumulative 24-hour average PM_{10} concentrations found that the project, in conjunction with surrounding third party extractive operations, will not result in any additional days above the 24 hour average PM_{10} criterion at receivers.



CHAPTER 11

NOISE

11 NOISE

11.1 Introduction

This section summarises the noise impact assessment (NIA) report, which is in **Appendix G**. It describes the noise assessment criteria which apply to the project, potential noise emission sources, modelling method and results, potential impacts and mitigation measures where impacts are unavoidable.

11.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely operational and transportation noise impacts of the project on nearby sensitive receivers (**Table 11.1**).

Table 11.1: Noise related SEARs

Requirement	Section and appendix where addressed
A detailed assessment of the likely construction, operational and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy;	11.3, Appendix G

11.1.2 Overview of assessment methods

Operational noise emissions from the project were predicted at sensitive receivers using the 'CadnaA' noise prediction software (refer to Section 4.1 of **Appendix G** for detailed operational noise modelling methods). The predictions were compared to the noise criteria in the EPA's (2017) *Noise Policy for Industry* (NPI), DECCW's (2011) *Road Noise Policy* (RNP) and the existing EPL for the quarry. Impacts will occur if the predicted noise levels exceed relevant criteria at any sensitive receivers.

Vibration impacts were not assessed given the separation distance between proposed activities and sensitive receivers.

Meteorology

Certain meteorological conditions may increase noise levels by focusing soundwave propagation paths at a single point. The refraction of sound waves occurs during temperature inversions (where temperature increases with height above ground level) and can vary from hour to hour during the night period. Other adverse meteorological conditions, such as prevailing winds are also required to be considered where relevant for an industrial activity.

The NPI stipulates default parameters to account for noise enhancing weather conditions and these parameters were considered in the NIA. It has been determined that given the project will involve commencement of operations at prior to 7 am (which is the morning shoulder of the night period), the project may be subject to temperature inversions, which occur during the night. Prevailing winds also occur and have been incorporated into noise modelling.

11.1.3 Assessment criteria

The noise modelling results were compared to the project specific noise criteria, which were established using the NPI. The NPI stipulates that intrusiveness and amenity criteria must be determined for daytime (7 am – 6 pm), evening (6 pm – 10 pm) and night time (10 pm – 7 am), as relevant, and apply at the most affected point on or in the receiver property boundary.

The project noise trigger level is the lowest value of the project intrusiveness noise level and project amenity noise level.

Table 11.2 summarises the intrusiveness and amenity criteria for the project, and the project noise trigger levels.

Table 11.2: Project noise trigger levels

Receiver	Time of day[1]	Criteria (dBA)		
		Intrusiveness ($L_{Aeq,\ 15min}$)	Amenity ($L_{Aeq,\ period}$)	Project Noise Trigger Level ($L_{Aeq,\ 15min}$)
All	Morning shoulder (5am-7am)	43	N/A[2]	43
	Day	46	53	46
	Evening	41	43	41
	Night	38	38	38

Sleep disturbance screening levels

Short duration but high intensity activities could cause sleep disturbance at night, without significantly affecting $L_{Aeq,\ 15min}$ noise levels. The dredge will operate from 6 am and maximum noise level events need to be considered for potential sleep disturbance.

The NPI recommends that, where the night time noise levels at residential receivers exceeds 52 dBA or the RBL plus 15 dBA, whichever is the greater, then a more detailed assessment of potential sleep disturbance impacts is warranted.

As the RBL value plus 15 dBA will be less than 52 dBA for all sensitive receivers, the maximum noise trigger level (sleep disturbance screening level) established by the NIA is set at 52 dBA.

Road traffic noise criteria

The impact assessment criteria for off-site road traffic are specified in the RNP and presented in **Table 11.3**.

Table 11.3: Road traffic noise criteria

Road category	Type of project/land use	Assessment criteria - dBA	
		Day (7am-10pm)	Night (10pm-7am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ 15\text{-}hour}$ 55 (external)	$L_{Aeq,\ 9\text{-}hour}$ 50 (external)

Road category	Type of project/land use	Assessment criteria - dBA	
		Day (7am-10pm)	Night (10pm-7am)
	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments	$L_{Aeq, 15\text{-hour}}$ 60 (external)	$L_{Aeq, 9\text{-hour}}$ 55 (external)
Local roads	Existing residences affected by noise from new local road corridors Existing residences affected by noise from redevelopment of existing local roads Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, 1\text{-hour}}$ 55 (external)	$L_{Aeq, 1\text{-hour}}$ 50 (external)

The RNP states the relative increase criteria to manage the permissible increase in road traffic noise from a land use development as follows:

'For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

As measured noise levels are above the RNP assessment criteria at the respective monitoring locations, the relative increase criteria was adopted.

Environment protection licence

Section L3 of the EPL stipulates noise limit conditions as described in **Table 11.4**.

Table 11.4: EPL noise criteria

Condition	Description
L3.1	Noise emissions from the premises must not exceed an Leq(15 minute) noise emission criterion of 35 dB(A) at the nearest residential receiver.
L3.2	Noise from the premises is to be measured at the worst affected point or within the residential boundary, or the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise limit in this licence.
L3.3	The noise emission limit identified in this licence applies in the following weather conditions: ▪ wind speed up to 3m/s at 10m above ground level; or

Condition	Description
	▪ temperature inversion conditions of up to 30C/100m and wind speed up to 2m/s at 10m above ground level.

11.2 Potential impacts

11.2.1 Operational noise sources

The most significant operation noise sources from the project will be:

- operation of mobile plant and equipment such as excavator, front-end loader, dozer and heavy vehicles during site establishment and sand extraction operations;
- operation of mobile screen equipment;
- operation of the dredge;
- operation of the wash plant and associated pumps and diesel generators;
- heavy vehicles importing fill material during stabilisation works; and
- heavy vehicles transporting sand in the quarry and onto the public road network.

Noise impacts from the project will vary as the nature and location of the works change over the life of the project. The following operational scenarios have been modelled to assess the potential worst-case noise impacts over the life of the project:

- Scenario 1 – where receivers to the north-west of the project in Fullerton Cove will be worst impacted during Stage 1 when a significant portion of plant and work activity is at the northern most area of the project site near the quarry entrance.

  During Stage 1, extraction will still be taking place in Pit 7 (windblown sand extraction area) and, therefore, plant was modelled in this area.

  Heavy vehicles and a water cart moving between pit 7 and the northern end of the project site were included in this scenario.

- Scenario 2 – where plant and extraction operations in Stage 5 will be closest to the Fern Bay receivers to the south-west of the project. A water cart was included moving between the Stage 5 extraction area and the entrance to the quarry in Stage 1.

11.2.2 Assessment of operational noise impacts

The modelled day time operational noise levels at the identified sensitive receivers are presented in **Table 11.5**.

Table 11.5: Predicted day time operational noise impacts

Receiver	Project noise trigger level ($L_{Aeq,15min}$ dBA)	Predicted noise levels – Scenario 1 (dBA)	Predicted noise levels – Scenario 2 (dBA)	Compliance
R1	46	28	28	Yes
R2	46	29	28	Yes
R3	46	29	29	Yes
R4	46	30	29	Yes
R5	46	27	31	Yes

Receiver	Project noise trigger level ($L_{Aeq,15min}$ dBA)	Predicted noise levels – Scenario 1 (dBA)	Predicted noise levels – Scenario 2 (dBA)	Compliance
R6	46	26	30	Yes
R7	46	27	33	Yes
R8	46	26	31	Yes
R9	46	27	31	Yes
R10	46	26	30	Yes
R11	46	24	29	Yes
R12	46	24	30	Yes
R13	46	24	30	Yes
R14	46	15	23	Yes
R15	46	14	23	Yes
R16	46	13	23	Yes
R17	46	12	23	Yes
R18	46	13	22	Yes
R19	46	16	25	Yes
R20	46	15	24	Yes
R21	46	16	24	Yes
R22	46	18	24	Yes
R23	46	18	24	Yes
R24	46	17	24	Yes
R25	46	16	23	Yes
R26	46	17	23	Yes
R27	46	17	22	Yes
R28	46	17	22	Yes
R29	46	17	21	Yes
R30	46	15	21	Yes
R31	46	14	21	Yes
R32	46	13	21	Yes
R33	46	14	21	Yes
R34	46	23	28	Yes
R35	46	23	29	Yes

The predicted operational noise levels will comply with the project noise trigger levels at all sensitive receivers.

The morning shoulder operational noise levels are presented in **Table 11.6**.

Table 11.6: Predicted operational noise levels during the morning shoulder

Receiver	Project noise trigger level ($L_{Aeq,15min}$ dBA)	Predicted noise levels – Scenario 1 (dBA)	Predicted noise levels – Scenario 2 (dBA)	Compliance
R1	43	29	29	Yes
R2	43	30	29	Yes
R3	43	30	29	Yes
R4	43	31	30	Yes
R5	43	28	32	Yes
R6	43	27	31	Yes
R7	43	28	33	Yes
R8	43	27	32	Yes
R9	43	27	32	Yes
R10	43	27	31	Yes
R11	43	25	30	Yes
R12	43	24	31	Yes
R13	43	24	31	Yes
R14	43	15	24	Yes
R15	43	14	24	Yes
R16	43	14	24	Yes
R17	43	12	23	Yes
R18	43	13	22	Yes
R19	43	16	26	Yes
R20	43	15	25	Yes
R21	43	16	25	Yes
R22	43	18	25	Yes
R23	43	19	25	Yes
R24	43	18	24	Yes
R25	43	17	24	Yes
R26	43	17	24	Yes
R27	43	17	23	Yes
R28	43	17	22	Yes
R29	43	17	22	Yes
R30	43	16	22	Yes
R31	43	15	22	Yes
R32	43	14	21	Yes
R33	43	14	21	Yes

Receiver	Project noise trigger level ($L_{Aeq,15min}$ dBA)	Predicted noise levels – Scenario 1 (dBA)	Predicted noise levels – Scenario 2 (dBA)	Compliance
R34	43	23	29	Yes
R35	43	23	30	Yes

The predicted morning shoulder operational noise levels will comply with the project noise trigger levels at all receivers during noise enhancing meteorological conditions.

Sleep disturbance

As detailed in **Table 11.6** the predicted noise levels during the morning shoulder period will be well below the maximum noise trigger level of 52 dBA. Given this, it is considered unlikely that the operations would cause sleep disturbance and no further assessment of maximum noise levels is required.

Road traffic noise

Compliance is predicted on a busy day at all assessment locations, with predicted relative increases of less than 0.2 dB along all routes. Based on compliance during the busy weekday, it is expected that compliance will be comfortably achieved during an average weekday.

Environment protection licence

EPL condition L3.1 states that noise emissions from the premises must not exceed an $L_{eq(15\ minute)}$ noise emission criterion of 35 dB(A) at the nearest residential receiver.

The project will result in a maximum $L_{Aeq,15min}$ noise level at any sensitive receiver of 33 dB(A). and compliance with the EPL conditions would be achieved.

11.2.3 Cumulative noise impacts

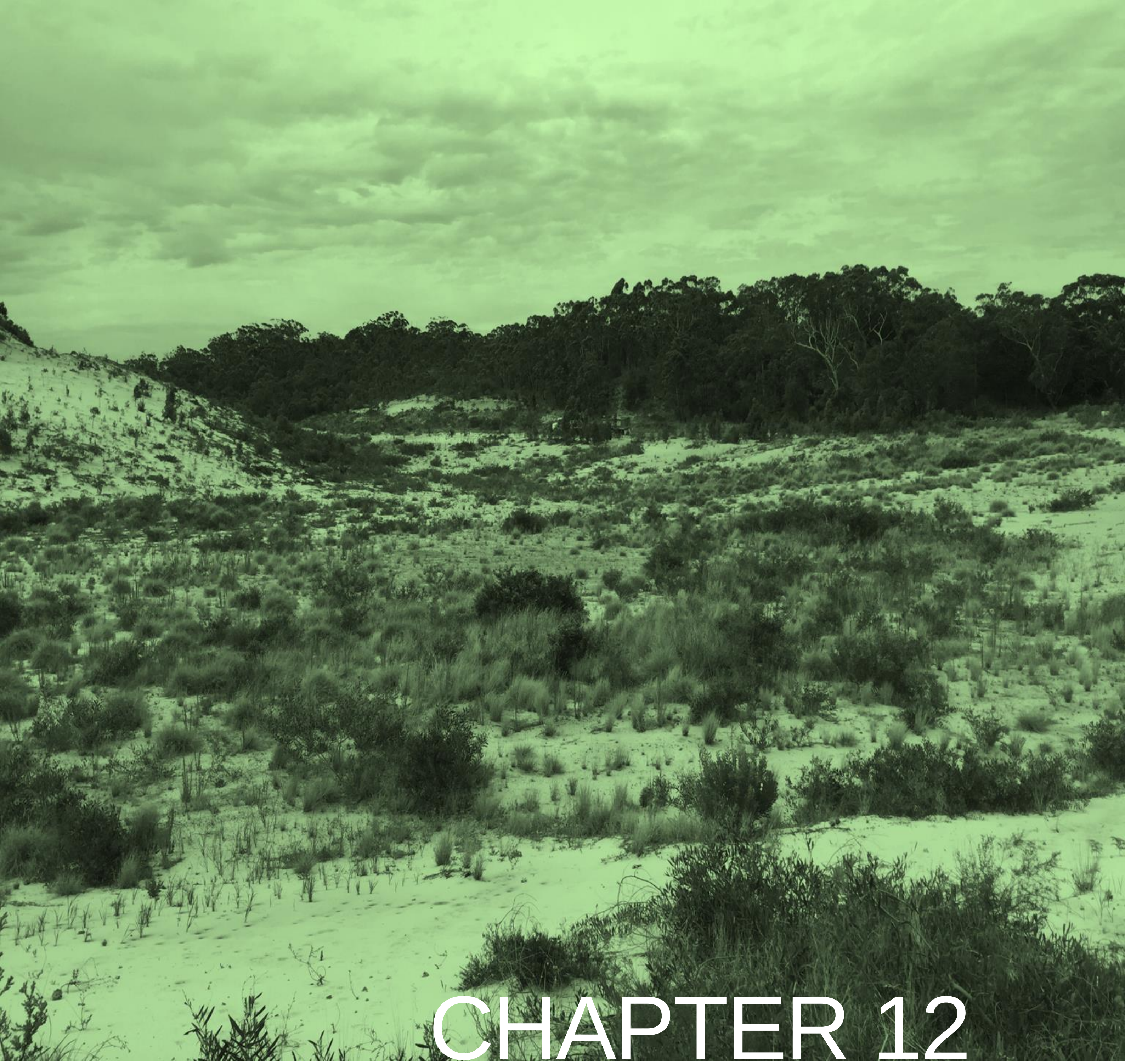
Cumulative noise levels from multiple industrial noise sources are implicit in the amenity criteria.

All predicted $L_{Aeq,15min}$ noise levels are 10 dB or more below the project noise trigger level and it is therefore expected that the project will have a negligible contribution to cumulative noise levels at the receivers.

11.3 Mitigation and management measures

The residual noise impact is the exceedance of the project noise trigger level after all feasible and reasonable mitigation measures have been considered. No residual impacts are predicted at any privately-owned receivers and, therefore, receiver-based treatments or controls are not required.

Notwithstanding, Boral will continue routine operational noise monitoring and community consultation, and will implement measures if an exceedance is detected or a verified/substantiated complaint is received from a member of the community.



CHAPTER 12

TRAFFIC AND TRANSPORT

12 TRAFFIC AND TRANSPORT

12.1 Introduction

This chapter summarises the traffic impact assessment (TIA) report, which is in **Appendix H**. It describes the existing traffic conditions on the nearby road network, describes potential impacts of the project on this network and provides measures to minimise and manage these impacts.

12.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on the road network (**Table 12.1**).

Table 12.1: Traffic related SEARs

Requirement	Section and appendix where addressed
Accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products.	12.4, Appendix H
A detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road network, paying particular attention to the intersections of Nelson Bay Road (MR108) / Coxs Lane (local road) and Nelson Bay Road / Seaside Boulevard (local road) (using SIDRA or a similar traffic model) including a road safety audit.	12.4, Appendix H
A description of the measures that would be implemented to mitigate any impacts.	12.5, Appendix H

12.2 Overview of assessment methods

The objective of the TIA was to examine the impact of additional traffic generated by the project. The Signalised and Unsignalised Intersection Design and Research Aid (SIDRA) traffic modelling program was used to predict impacts on key intersections for the morning (AM) and afternoon (PM) peak hour periods using the existing traffic volumes together with the maximum additional vehicles generated by the project (worst case scenario).

The best criteria for assessing intersection performance is level of service (LoS), degree of saturation (DS), highest movement delay in seconds (HMD) and average vehicle delay (AVD). **Table 12.2** shows the LoS criteria for intersections in the *Guide to Traffic Generating Developments* (RMS, 2002).

The RMS design criteria for intersections is LoS D or better.

Relevant standards/guidelines adopted and used during the TIA were:

- Austroads Guide to Traffic Management;
- Austroads Guide Supplements – Austroads Guide to Traffic Management;
- AS2890.1 (2004) – Parking Facilities. Part 1 Off street car parking; and
- AS2890.2 (2002) – Parking Facilities. Part 2 Off Street Commercial Vehicle facilities.

Table 12.2: LoS criteria for intersections

Level of service	Average delay (seconds per vehicle)	Traffic signals roundabout	Give way & stop signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Intersection is oversaturated	Oversaturated, requires other control mode

Source: RMS Guide to Traffic Generating Developments, October 2002

12.3 Existing traffic conditions on road network

The major transportation routes that the Boral fleet use to transport sand product is outlined in **Section 2.4.3**.

Traffic was counted (inclusive of volume and vehicle classification counts) on the road network adjacent to the quarry in December 2018 to examine the traffic conditions on the road network for the peak hours of operation of the quarry. Traffic was counted at several locations on Nelson Bay Road, Coxs Lane (including the on and off ramps to and from Nelson Bay Road) and Cabbage Tree Road.

Vehicles entering and departing the quarry were also counted.

12.3.1 Daily traffic volumes

The daily volumes of traffic on the surrounding road network are outlined in Table 4.1 of **Appendix H**, and **Table 12.3** provides a summary of the average two-way traffic volumes and percentage of heavy vehicles using the road network.

Table 12.3: Daily traffic volumes

Location	Average vehicles per day	Percentage of heavy vehicles (%)
Nelson Bay Road – north of Coxs Lane	22,654	5.2
Nelson Bay Road – south of Seaside Boulevard	26,246	6.7
Coxs Lane – east of Nelson Bay Road	140	82.9
Northbound off ramp from Nelson Bay Road to Coxs Lane	116	57.8

Location	Average vehicles per day	Percentage of heavy vehicles (%)
Southbound on ramp from Coxs Lane to Nelson Bay Road	131	51.9
Cabbage Tree Road – west of Nelson Bay Road	10,857	10.5
Medowie Road – north of Ferodale Road	7,206	6.1

12.3.2 Peak hour traffic volumes

The morning peak hour generally occurs between 7:15 am to 8:15 am, although slightly higher volumes occurred at the Coxs Lane on/off ramp intersections between 6.45 am to 7.45 am.

The principal intersections of Nelson Bay Road, Cabbage Tree Road and Lavis Lane, and Nelson Bay Road, Seaside Boulevard and Fullerton Cove Road had the highest intersection volumes. These are two lane roundabouts.

The afternoon peak hour occurred between 4 and 5 pm at the Nelson Bay Road with Cabbage Tree Road and Lavis Lane, and with Seaside Boulevard and Fullerton Cove Road roundabouts. The afternoon peak occurred between 3 and4 pm at the Coxs Lane intersections with the on and off ramps to and from Nelson Bay Road.

Peak hour traffic volumes recorded at principal intersections are summarised in **Table 12.4**.

Table 12.4: Peak hour traffic volumes

Intersection	Contributing roadway	Morning peak hour traffic volumes (vph)	Afternoon peak hour traffic volumes (vph)
Nelson Bay Road, Cabbage Tree Road and Lavis Lane	Cabbage Tree Road	198	145
	Lavis Lane	279	230
	Nelson Bay Road - northbound	1161	1366
	Nelson Bay Road - southbound	1021	1116
Nelson Bay Road, Seaside Boulevard and Fullerton Cove Road	Seaside Boulevard	330	102
	Fullerton Cove Road	43	37
	Nelson Bay Road – northbound	1205	1293
	Nelson Bay Road - southbound	1032	1254

Traffic volumes on the Coxs Lane off ramp and on ramp intersections, which provide vehicle access to the quarry are very low and number less than 20 vehicles per hour (vph) in the morning and afternoon peak hours.

12.3.3 Assessment of existing traffic conditions

SIDRA modelling of the intersections identified in **Table 12.4** without proposed truck increases during the morning and afternoon peak hours demonstrated they were performing at LoS A, with minimal delays and spare capacity.

12.3.4 Road safety

According to three years of RMS road accident data, there were 21 accidents on Nelson Bay Road between Cabbage Tree Road at Williamtown and Fullerton Street at Fern Bay, comprising:

- 12 of the accidents were casualty crashes, with nine non-casualty crashes;
- 7 of the accidents occurred at or near the Nelson Bay Road, Cabbage Tree Road and Lavis Lane roundabout, three of which were casualty crashes;
- 5 accidents occurred at or near the Nelson Bay Road, Seaside Boulevard and Fullerton Cove Road roundabout, three of which were casualty crashes;
- the remainder were spread along the length of Nelson Bay Road comprising two pedestrian accidents at different locations, rear end and run off road accidents; and
- one of the pedestrian accidents was fatal and involved an elderly pedestrian walking along Nelson Bay Road at night facing traffic, approximately 1.6 km north of Seaside Boulevard. The other pedestrian accident involved a pedestrian crossing Nelson Bay Road approximately 600 m north of Vardon Road (adjacent a bus stop), at night.

This accident history shows no pattern which could be addressed by specific remedial measures.

A safety audit of Nelson Bay Road between Cabbage Tree Road and Fullerton Street identified several minor maintenance issues, which are the responsibility of RMS.

12.3.5 Public transport

Public transport options in the area include local bus routes connecting Port Stephens to Newcastle, and Raymond Terrace to Stockton. Bus routes with services stopping within proximity to the site include 131, 132, 136 and 138 that use Nelson Bay Road.

Routes 136 and 138 are along the section south of Seaside Boulevard and at the section north of Fullerton Cove Road (north intersection) and have a number of bus stops south of Seaside Boulevard.

Routes 130 and 131 have one stop at Bayway Village on Nelson Bay Road, south of Seaside Boulevard.

Traffic flow is not disrupted by buses as there are pull off areas and bus bays on Nelson Bay Road between Fullerton Street and Seaside Boulevard.

12.3.6 Pedestrian and cyclist traffic

There is minimal pedestrian traffic on Nelson Bay Road between Cabbage Tree Road and Seaside Boulevard. To the south of Seaside Boulevard, there is minor residential pedestrian traffic to and from bus stops.

There are no formal pedestrian crossings along Nelson Bay Road between Cabbage Tree Road and Fullerton Street at Fern Bay.

There was minimal pedestrian traffic across Nelson Bay Road at or near the key intersections during the peak hour traffic counts.

There is sufficient room for cyclists on the sealed road shoulders of Nelson Bay Road, however, the bridge over Coxs Lane on Nelson Bay Road is a pinch point for cyclists.

Port Stephens Council is proposing a shared path along Fullerton Cove Road from Seaside Boulevard and joining Nelson Bay Road south of Cabbage Tree Road, which will be an alternative route to the section of Nelson Bay Road adjacent to Coxs Lane.

The weekday peak hour traffic counts indicate that small numbers of cyclists use this section of Nelson Bay Road.

12.4 Potential impacts

12.4.1 Traffic generation

The project will generate additional traffic on the public road network.

There will be a small increase in light, delivery and maintenance vehicles. The largest increase will be in product transport vehicles (heavy vehicles) associated with the additional site wide 250,000 t of sand production to 2028.

The importation of up to 70,000 tpa of VENM will also increase heavy vehicle movements entering and exiting the quarry.

Existing operations

The existing windblown extraction area for the quarry generates:

- 58 one-way heavy vehicle trips on an average weekday; and
- up to 76 one-way heavy vehicle trips on a peak day.

Total two-way heavy vehicle trips (i.e. heavy vehicle movements in and out of the quarry) are 116 on an average weekday, and up to 152 heavy vehicle trips on a peak day.

Currently the highest traffic generation of the quarry occurs on weekdays and this is expected to continue with the project, given that on Saturdays the quarry normally operates for half a day and there is no sand product transportation on some Saturdays.

Project operations

The maximum traffic generation associated with the project will run until 2028, where the existing windblown sand extraction area will run in tandem with the project to reach a site wide maximum output of 750,000 tpa. Following completion of the windblown sand extraction area, the traffic generation of the project will decrease and will comprise vehicles transporting sand and importing VENM.

The project will generate approximately 100 one-way heavy vehicle trips (i.e. 200 two-way heavy vehicle movements) on an average weekday, and up to 142 one-way heavy vehicle trips (i.e. 284 two-way heavy vehicle movements) on a peak day.

Table 12.5 shows the daily two-way traffic volumes generated by the existing quarry operations and those for the project during the peak day to 2028.

Table 12.5: Maximum daily traffic generation for existing and proposed operations until 2028

Activity	Peak day of existing operation	Peak day of project	Additional heavy vehicle movements
Sand product transportation	152	228	76 trucks
VENM importation	-	56	56 trucks
Total	152	284	132 trucks

Up to 284 two-way heavy vehicle trips could occur in the maximum or peak day to 2028. This will be an increase of 132 two-way heavy vehicle trips per day compared to the existing operation.

Table 12.6 shows the daily two-way traffic volumes generated by the existing quarry operations, as well as those for the project during the peak day after 2028.

Table 12.6: Maximum daily traffic generation for existing and proposed operations after 2028

Activity	Peak day of existing operation	Peak day of project	Additional heavy vehicle movements
Sand product transportation	152	152	Nil
VENM importation	-	56	56 trucks
Total	152	208	56 trucks

Up to 56 additional two-way heavy vehicle trips could occur from in the maximum or peak day after 2028 when the windblown sand extraction project ceases operation.

The resulting average weekday heavy vehicle movements on the road network are summarised in **Table 12.7**.

Table 12.7: Additional average weekday vehicle movements on the road network

Location	Additional two-way heavy vehicle movements on average weekday (vpd)	Increase in traffic volumes on road network (%)	Increase in heavy vehicles on road network (%)
Nelson Bay Road – north of Coxs Lane	46	0.47	6.8
Nelson Bay Road – south of Coxs Lane	130	1.35	17.1
Nelson Bay Road – south of Seaside Boulevard	38	0.34	6.2
Cabbage Tree Road – west of Nelson Bay Road	42	0.91	8.1

The additional heavy vehicle traffic will represent a small proportion of total heavy vehicles using the road network on an average weekday.

Heavy vehicle volumes on a maximum day of operation will be higher, with a total of 284 two-way movements. However, maximum days will only occur on approximately 5% of operational days when Boral is supplying major contracts.

12.4.2 Traffic impacts on the road network

During the maximum hour, the project will result in 30 inbound and 30 outbound heavy vehicle trips for product transport and VENM importation (60 two way heavy vehicle trips).

As previously noted in **Section 12.4.1**, the maximum increase associated with the project is an additional 284 two-way heavy vehicles per day.

To assess the impacts of additional traffic associated with the project at the key intersections in the surrounding road network, traffic modelling using the software package SIDRA has been undertaken, as detailed in **Section 12.2**.

SIDRA was used to model the morning peak hour and afternoon peak hours using the maximum proposed hourly traffic volumes (the worst-case scenario).

The results indicate that all intersections identified in **Table 12.4** will continue to operate at LoS A. Therefore, the additional traffic will have satisfactory impacts on these intersections.

12.4.3 Cumulative impacts

Future traffic volumes on Nelson Bay Road and the wider road network will increase due to approved land use changes and developments in the area.

A background traffic growth of 2.4% per year on the intersections was modelled to assess cumulative impacts and demonstrated:

- The Coxs Lane on and off ramps will continue to operate at LoS A, with very low vehicle delays.
- The roundabout intersection of Nelson Bay Road, Cabbage Tree Road and Lavis Lane will retain a good operation with LoS A. The increase in the total average vehicle delay will be 0.2 seconds in the morning peak hour and one second in the afternoon peak hour, which is a very small increase.
- The roundabout intersection of Nelson Bay Road, Seaside Boulevard and Fullerton Cove Road will retain LoS A operation with relatively low total average vehicle delays. The increase in the total average vehicle delay will be 0.3 seconds per vehicle in the morning peak hour and 0.8 seconds per vehicle in the afternoon peak hour.

The intersections to be used by heavy vehicles associated with the project will have sufficient capacity for background traffic growth as well as project related traffic for the next 10 years.

12.4.4 Public transport, pedestrians and cyclists

Given the minimal pedestrian and cyclist use of Nelson Bay Road and other roads to be utilised by the project, the additional heavy vehicles movements will not significantly impact pedestrians, cyclists and buses routes.

12.4.5 Road safety

A safety audit of Nelson Bay Road between Cabbage Tree Road and Fullerton Street identified several minor maintenance issues, which are the responsibility of RMS. The safety audit did not identify any project aspects which would compromise the safety of the road network.

The section of Nelson Bay Road adjacent to the quarry and the other roads to be used by project related vehicles are approved B-double routes.

12.4.6 Parking and internal access

Boral will change the internal operation of the quarry and upgrade the existing infrastructure as described in **Chapter 4**.

New internal roads will be designed and constructed to AS2890.2 requirements for one-way or two-way flow as appropriate to cater for the quarry’s heavy vehicles.

The new parking area for the light vehicles will be designed to AS2890.1 requirements. Sufficient parking will be provided for employees and visitors.

12.4.7 Construction traffic

The proposed site infrastructure will be constructed in Stage 1.

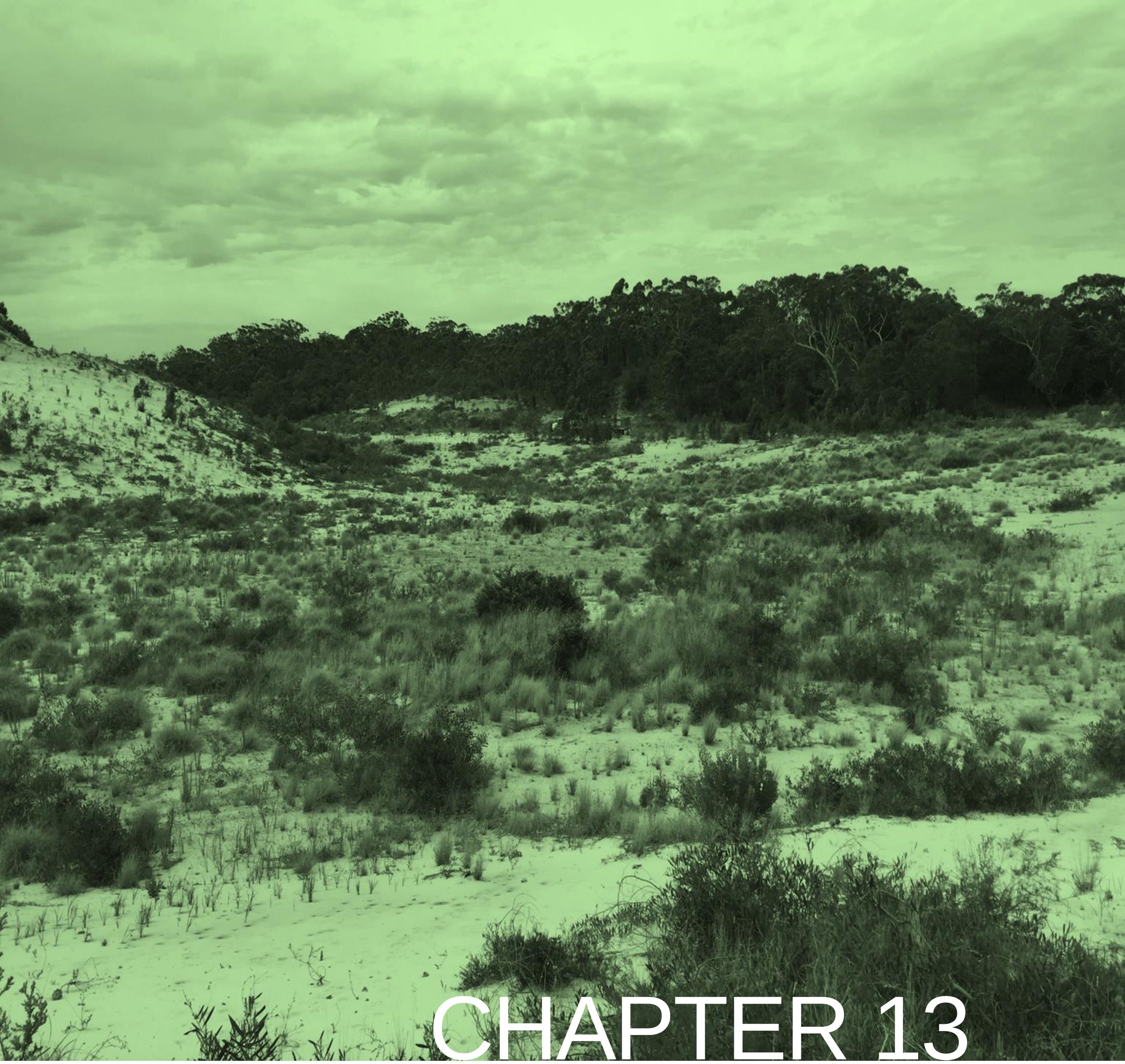
Construction vehicles will comprise low loaders delivering earthwork plant and equipment, semi-trailers, truck and dog trailers delivering road pavement and hardstand materials, concrete agitator trucks and light vehicles associated with the workforce.

There will be up to six light vehicles and between 5 to15 heavy vehicles per day. All construction vehicles will access the site via Coxs Lane and Nelson Bay Road.

The number of construction vehicles accessing the quarry per hour and on a daily basis will be less than the assessed operational vehicle numbers and therefore not anticipated to have significant impact on existing network capacity.

12.5 Mitigation and management measures

Boral will continue to implement the driver awareness training for all truck drivers, with a focus on the correct protocols when entering and exiting the site.



CHAPTER 13

SOCIAL

13 SOCIAL

13.1 Introduction

This chapter summarises the social impact assessment report (SIA), which is in **Appendix I**. It describes the best practice techniques for engaging with the community, and provides a process for assessing, determining and responding to social impacts associated with the project.

13.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely social impacts of the project (**Table 13.1**).

Table 13.1: Social impact related SEARs

Requirement	Section and appendix where addressed
A detailed assessment of the potential social impacts of the development that builds on the findings of the Social Impact Assessment Scoping Report, in accordance with the Social impact assessment guideline for State significant mining, petroleum production and extractive industry development, paying particular consideration to:	Appendix I
▪ the full range of categories of potential social impacts identified in Section 1.1 of the SIA guideline;	
▪ how impacts (positive and negative) may be distributed among different groups in the affected communities;	
▪ the principles in Section 1.3 of the SIA guideline;	
▪ ensuring that the person preparing the SIA has appropriate qualification and experience as outlined in the Box 4 of the SIA guideline; and	
▪ the review questions in Appendix D of the SIA guideline.	

The SEARs recommended the use of the *Social impact assessment guideline – For State significant mining, petroleum production and extractive industry development* (NSW Department of Planning and Environment, 2017), which formed the basis of the SIA for the project.

13.1.2 Overview of assessment methods

The SIA involved the following steps:

- scoping the SIA – including consultation to understand issues potentially affecting stakeholders and determining the project's area of social influence;
- establishing the social baseline – which is described in **Section 2.7** of this EIS;
- predicting and analysing social impacts;
- evaluating social impacts;
- developing responses to social impacts; and
- developing a monitoring and management framework.

Scoping

The ‘scoping tool’ defined in (NSW Department of Planning and Environment, 2017) was used for the SIA scoping exercise. The tool is designed to ensure a consistent approach to identifying which of the social impacts associated with a project need to be investigated in the SIA and provides a methodological guide and ready-made SIA template.

The process of applying the scoping tool involved:

1. Using early engagement result as inputs to the scoping tool and considering each ‘matter’ (i.e. amenity, access, built environment, heritage, community and economic) and its subcategories, before determining how likely it is that project activities will cause an impact to it;
2. Considering each ‘matter’ (i.e. amenity, access, built environment, heritage, community and economic) and its subcategories, and determining how likely it is that project activities will impact the matter.
3. For each matter, considering and assessing the material characteristics of any likely impact.
4. For each matter, considering stakeholder/community opinions and sentiment towards the project activities.
5. For each matter, determining whether a social impact will arise from the project activities, and then developing a rationale for the decision.
6. For each matter, determining the level of assessment (and engagement) which is required in the EIS preparation phase, and selecting from the following list the most appropriate SIA type:

    i. desktop;
    ii. standard; or
    iii. comprehensive.

7. Each matter and its associated level of assessment (determined by the scoping tool) was considered in the context of the social impact categories specified in Section 1.1 of the Guideline.

Stakeholders

A stakeholder is a group, individual or organisation that is interested in, affected by, or has the capacity to influence a project. The locally-specific stakeholders are known to Boral courtesy of their long-term presence in the Fullerton Cove area. The stakeholders are generally:

- residents – neighbours and in the community;
- people in host communities – people in communities where construction workers and other people may in-migrate;
- other communities – more distant communities that may be affected;
- project employees;
- Indigenous people – including non-residents who may have connections to the land;
- non-government organisations – local, national or international groups who may have an interest in environmental values of a site; and
- other stakeholders – such as governments, developers, agencies, funding agencies.

Engagement methods

The community was comprehensively engaged during 2018 (scoping engagement) and 2019 (further engagement) for the project. A range of methods were used to engage stakeholders and provide an opportunity to interface with Boral about its operations at the quarry. Engagement methods used and when they were deployed are described in detail in Table 2 and Table 4 of **Appendix I**.

The key stakeholders identified for the project are summarised in **Table 13.2** including the engagement techniques applied to establish and foster a dialogue about the project.

Table 13.2: Stakeholders and engagement methods

Project stakeholder	Letter	Phone call	Email	Interview / Informal briefing / 'door knock'	Site visit / tour	Formal presentation	Community drop-in sessions notification	Community drop-in sessions	Newsletter	Meetings	Social media / online
Host communities and fenceline neighbours											
Coxs Lane neighbours	X			X			X	X	X		X
Fern Bay residential area	X			X			X	X	X		X
Fullerton Cove residential area	X			X			X	X	X		X
Residents in wider region – Stockton/Williamtown							X	X	X		X
Indigenous groups											
Worimi LALC	X	X	X				X	X	X	X	X
Local government (Port Stephens Council)											
Mayor	X		X			X	X	X	X	X	X
General Manager	X		X			X	X	X	X	X	X
Elected councillors	X		X			X	X	X	X	X	X
Planning representatives	X	X	X			X	X	X	X	X	X
State and Federal government											
NSW Member for Port Stephens	X	X	X				X	X	X	X	X

Project stakeholder	Letter	Phone call	Email	Interview / Informal briefing / 'door knock'	Site visit / tour	Formal presentation	Community drop-in sessions notification	Community drop-in sessions	Newsletter	Meetings	Social media / online
NSW Member for Newcastle	X	X	X		X		X	X	X		X
DPIE	X	X	X								X
EPA	X		X								X
RMS	X		X								X
OEH	X		X								X
Worimi Conservation Lands	X		X								X
Media											
Boral corporate media (i.e. Facebook and website)		X	X				X	X	X		X
Interest / activist Groups											
Nil											
Business groups											
Quad bike king	X	X	X	X			X	X			X
Sand dune adventures		X	X				X	X		X	X
Sid Foggs Coaches			X	X					X		

Area of social influence

The term 'locality', or area of social influence (ASI), does not have a prescribed meaning or refer to a fixed, pre-defined geographic boundary. People may not perceive social impacts created by a project to be those felt exclusively in or immediately adjacent to the project boundary, or at a time when operations are conducted on site.

These time and space relationships between the project site and communities, economies, infrastructure, and resources (both human and natural), were explored using a mixed-methods approach. The methods were:

- semi-structured interviews with key Boral project personnel familiar with the existing operations on site and the local communities near the project;
- feedback from residents obtained during the early community engagement methods, in particular the in-person interactive methods; and
- analysis of historical correspondence records.

The development of the ASI considered factors including but not limited to:

- supply chains;
- haulage of sand products;
- transport of goods;
- materials and equipment;
- movement of workers (drive-in-drive-out/fly-in-fly-out working arrangements);
- natural features and recreational values (e.g. coastal sand dunes of Stockton Bight);
- ancillary infrastructure; and
- reputation of other extractive industries in the area.

Social impact assessment

At the completion of the scoping engagement activities, the project team possessed a thorough collection of feedback and questions raised by stakeholders. This collection was obtained from both the scoping engagement and further engagement activities. At this point in time the full collection of results was considered, and a decision was made about the SIA methods. It was evident that the feedback and questions raised during the scoping engagement activities, closely aligned with those raised in the 2019 further engagement.

Table 13.3 summarises the collection of stakeholder feedback and reflects the SIA method decisions.

Table 13.3: The collection of stakeholder feedback and the SIA method selected for the study

Engagement topic and stakeholder feedback	Social impact category (Guideline section 1.1)	Will a specialist study be conducted for the EIS?	Level of assessment for the social impact (scoping tool output)	SIA method(s) to be implemented for the assessment
Amenity (acoustic) Stakeholders did not raise any concerns about acoustic impacts from sources on site or from vehicles utilising the public road network	Health and wellbeing	Yes	No SIA required	Nil
Amenity (visual)	Surroundings	No	Standard SIA	Visual impact assessment

Engagement topic and stakeholder feedback	Social impact category (Guideline section 1.1)	Will a specialist study be conducted for the EIS?	Level of assessment for the social impact (scoping tool output)	SIA method(s) to be implemented for the assessment
Stakeholders did not raise any concerns about visual impacts associated with the project				Semi-structured interview
Access (road and rail network) Residents had minimal concerns with quarry related traffic or the network capacity	Access to and use of infrastructure, services and facilities	Yes	No SIA required	Further engagement and adaptive research approach in relation to the results of the traffic impact assessment
Built environment (public infrastructure) No stakeholder feedback was obtained in relation to the effect of the project on the quality of public infrastructure (i.e. road surfaces)	Access to and use of infrastructure, services and facilities	Yes	Standard SIA	Ethnographic content analysis
Heritage (natural features) There was no evidence to suggest that the sites current operations impact the Stockton Bight dune system or its recreational values	Surroundings	Yes	Standard SIA	Further engagement (consultation with Worimi LALC)
Community (safety) Site records confirm unauthorised site access (attempted and actual)	Health and wellbeing	No	Standard SIA	Participant observation
Economic (natural resource use and livelihood) The PEA established that natural fine sand derived from the quarry will influence supplies for local and regional development projects	Personal and property rights	Yes	Desktop SIA	Desktop research
Economic (livelihood) Boral staff stated that the project will extend the employment of locally-based quarry employees	Personal and property rights	Yes	Desktop SIA	Desktop research

Engagement topic and stakeholder feedback	Social impact category (Guideline section 1.1)	Will a specialist study be conducted for the EIS?	Level of assessment for the social impact (scoping tool output)	SIA method(s) to be implemented for the assessment
and provide additional employment.				

Ethnographic content analysis

Ethnographic content analysis (ECA) is a qualitative media analysis method used to obtain, categorise and analyse different media documents (such as newspapers and magazines) in addition to other forms of media delivered online and via television. It blends the traditional notion of objective content analysis with participant observation to form ethnographic content analysis.

ECA encourages the investigator to be reflexive and interactive, and it enables an element of ongoing discovery as progress is made towards the SIA research goal. It is in this vein that ECA enables documents to be studied to understand culture – or the process and the array of objects, symbols, and meanings that make up social reality shared by members of a society.

The most important element of ECA is the protocol, or a data collection sheet. It is a way to ask questions of a document; a protocol is a list of questions, items, categories or variables that guide data collection from documents.

The following ten steps were applied to articles from the *Port Stephens Examiner*:

1. Pursue a specific problem to be investigated – the scoping tool provided the social matters to be investigated.
2. Become familiar with the process and context of the information source. Explore possible sources of information – the *Port Stephens Examiner* was used as it is the most dominant and popular text media publication.
3. Become familiar with several examples of relevant documents and select a unit of analysis – the string 'Sand trucks + Stockton' was searched online and the five highest ranked articles ('unit of analysis') were read to recognise article layouts and other sections of the page.
4. List several categories (variables) to guide data collection and draft a protocol (data collection sheet) – categories that emerged from the articles discovered in Step 3 were entered into the protocol. The articles contained the following discourses:

    - excessive quarry trucks using public infrastructure.
    - negative impacts on families and schools.
    - additional truck movements (negative sentiment regarding road quality).
    - quarry operators should share road maintenance burden.

5. Test the protocol by collecting data from several documents – additional articles were collected using the string 'Sand trucks + Nelson Bay Road', which provided new discourses and the protocol was expanded accordingly.
6. Revise the protocol and select several additional cases to refine the protocol – the protocol was revised when all articles had been analysed by renaming, splitting, re-defining and merging categories as appropriate.
7. Arrive at a sampling rationale and strategy (e.g. theoretical, purposive, opportunistic, cluster or stratified) – theoretical sampling was used, which involves the selection of material based on emerging understanding of the topic under investigation and was used to identify and refine knowledge of narratives about the quarry over time. An eight-year range of articles was selected to capture cumulative social impacts emerging in the media narratives.
8. Complete data collection for the target social matters – the relevant search strings were applied and the collection of relevant *Port Stephens Examiner* articles continued in a sustained

and rigorous fashion until all articles returned via the online searches had been covered. At the completion of Step 8 the sample had been obtained, each article in the sample had been subject to a manifest content analysis, and the results from these analyses had been recorded in the protocol. The results provided a means to understand the implications of the project for the target social impact matters, via the discourses being circulated amongst the population.

9. Consider the content analysis results shown in the 'discourse' section of the protocol. Write summaries or overviews of the key findings – the individual results were considered, each discourse was summarised, and they were the key findings of the ECA.
10. Integrate the findings including the discourse interpretations and key concepts into the SIA report – refer to impact section.

Participant observation

Participant observation (PO) is a conventional method used in social sciences and provides a researcher with a means to collect data about cultural phenomena and the social settings in which they arise. In practice, this involves the researcher either openly or covertly examining the daily life of people under study.

The PEA identified unauthorised access to the quarry as a potential community safety risk. Despite mitigation measures (e.g. security fencing, high visibility line and signage, closed circuit television (CCTV), equipment and safe batter requirements, trespass procedures, and operating hours) being implemented by Boral, there have been safety incidents associated with members of the public accessing the quarry haul road to gain access to and from the beach. The SIA scoping phase concluded the prominent recreational dune user groups should be further engaged to assess this community safety matter.

It was determined that further engagement with the user groups was not feasible. On the advice of quarry staff, this is due to the fact that members of the public that travel on the public road towards the site and the few that attempt to seek to enter site without authority, are generally unidentified. The few that arrive to the quarry either recognise they are trespassing and leave quickly, or choose an access route that avoids contact with Boral staff. Their visit is fleeting in nature, and establishing a dialogue with them is rarely possible. As such, there is little prospect of engaging them further.

Due to this scenario, PO was selected for the SIA as an alternate method used to explore instances of potential or actual unauthorised access to the existing quarry. As an alternative to direct engagement with the public, it enabled the project team to collect and record data about the behaviour of the members of the public (i.e. the participants) travelling on the public road towards the quarry, including those who actually intended to enter the quarry.

Boral weighbridge staff volunteered their time to make observations about the participants. The weighbridge staff are permanently present at the entry to the quarry during operating hours, and have visibility of the entry either by direct sight or CCTV footage. Accordingly, they were positioned perfectly to make and record observations. The staff were provided with an overview of the method, advice about what observations were required for the SIA, recording instructions, and a template to collect the necessary data.

Visual impact assessment

Visual impacts are relevant to the 'surroundings' social impact category. Visual impacts were assessed (considered during the scoping phase) as Stockton Beach dune users could see the project site.

Observations (including photographs) were made of the dunes from a point higher than surrounding publicly accessible areas.

The significance of visual impacts was assessed by considering:

- Magnitude – the magnitude of visual change in the landscape and its proximity to the viewer. This is influenced by the visibility of the project/components and comprises the combination of scale, extent, distance and duration of views.
- Sensitivity – depends on the nature of the existing environment and on the likely response from people viewing the scene. Someone who is enjoying a recreational experience or someone who is viewing the scene from their living room is more sensitive to a view than someone passing by in a car.

Magnitude and sensitivity are ranked as:

- negligible – very minor loss or alteration to one or more key elements of the baseline visual character and/or introduction of elements that are consistent with the existing visual character;
- low – minor loss/alteration of one or more key elements of the baseline visual character and/or introduction of elements that are consistent with the existing landscape character;
- moderate – partial loss or alteration of one or more key elements of the baseline visual character and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic of the existing landscape character; or
- high – substantial to total loss of key elements of the baseline visual character and/or introduction of elements considered to be totally uncharacteristic of the existing landscape character.

The rankings can be determined by a combination of the factors in **Table 13.4**.

Table 13.4: Visual impact criteria

Criteria	Definition	Rating
Duration of view		
Long term	>1 hour	High
Moderate term	30 minute to 1 hour	Moderate
Short term	<30 minute	Low
Number of viewers		
High	>1,000	High
Moderate	100-999	Moderate
Low	<100	Low
Viewer sensitivity (type)		
Resident	N/A	High
Pedestrian/cyclist		Moderate
Motorist		Low
View sensitivity		
Pristine landscape	N/A	High
Moderately modified landscape		Moderate
Significantly modified landscape		Low
View distance/proximity		
Short	< 100m	High
Medium	100m-500m	Moderate
Long	>500m	Low

Semi-structured interview

Interviewing was used to explore and assess a number of matters identified in the scoping tool. An interview was conducted under a semi-structured format using a list of predetermined questions. The process involved:

- developing the pre-determined interview questions, designed to explore the social matters identified in the scoping tool;
- sending an interview invitation letter to the participant. The letter explained the purpose of the interview, the intention to record it, and provided some frequently asked questions. It explained that consent was required, and sought to obtain it in a 'free, prior and informed' fashion;
- obtaining participant consent;
- arranging a date and forwarding the participant an advanced copy of the predetermined questions;
- conducting and recording the interview;
- drafting and conducting a qualitative analysis of the interview transcript; and
- extracting transcript content for use in the SIA assessment.

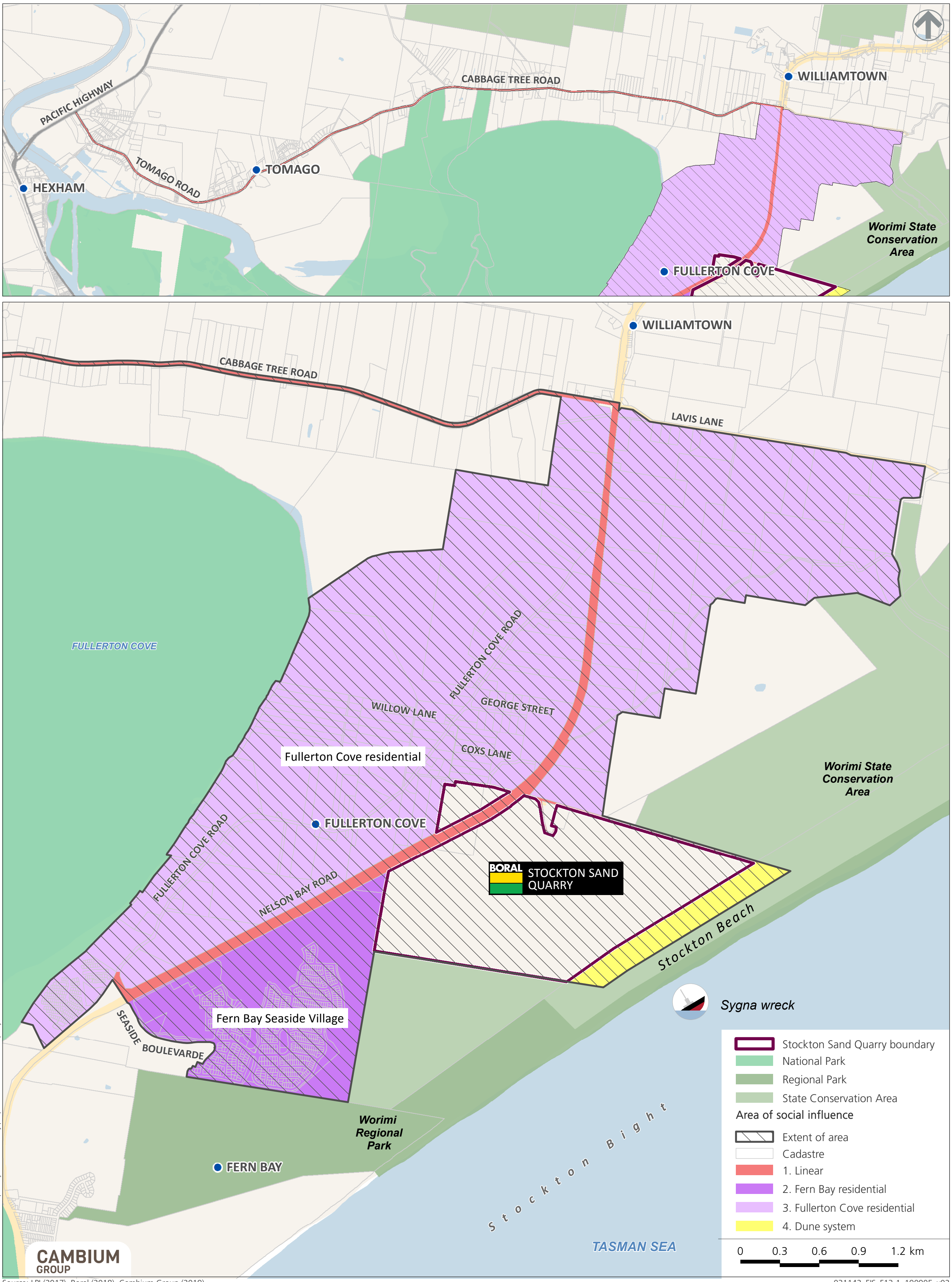
13.2 Results

13.2.1 Area of social influence

The ASI is illustrated in **Figure 13.1** and comprises a polygon containing the project site, the nearest communities including properties in Fern Bay and Fullerton Cove, and a small portion of the sand dune system adjacent to the project site. The polygon is also comprised of linear areas associated with the main transport routes proposed to be used by the project. These linear areas include Coxs Lane, and Nelson Bay Road from its intersection with Seaside Boulevard to its intersection with Cabbage Tree Road. There are no remote locations considered to be indirectly impacted.

Figure 13.1
Area of social influence

STOCKTON SAND QUARRY DREDGING
ENVIRONMENTAL IMPACT STATEMENT



Source: LPI (2017), Boral (2018), Cambium Group (2019).

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13.2.2 Early engagement

Engagement feedback was relevant to the SIA scoping phase and was used to consider what social impacts might warrant investigation.

Letter inviting feedback on Boral's operations

No response was received following the distribution of the letter to households near the project site. The survey contained a link to an online survey which invited all recipients to submit their opinions. No residents completed the survey.

Emails

Email correspondence was sent to councillors from Port Stephens Council to inform them about the consultation program for the project. One reply was received. The reply from a Councillor acknowledged the project and expressed gratitude for the update. It contained no specific feedback.

Interviews

Interviews with 31 residents (via random sample doorknock) living in Fern Bay and Fullerton Cove in March 2018 generated feedback about traffic and road infrastructure, noise, and access to Stockton Beach, as shown in Table 8 of **Appendix I**.

Newsletter

No response or feedback was received from recipients of a newsletter distributed to stakeholders in May 2018. The newsletter was distributed to Fullerton Cove and Fern Bay residents in hard copy, to members of Parliament (MP) offices via email, and online via the project website.

Meeting invitations

Members of the project team met with Kate Washington MP's staffers and briefed them about the project. The discussion was positive and the staffers were familiar with the issues relating to sand quarrying. The staffers raised one question about the project's implications for the water table. The project team responded that groundwater studies to date had not shown the project having a hydrogeological impact.

Council meeting

Members of the project team presented a briefing to Council officers in May 2018 and Councillors in July 2018. The material provided by the project team was welcomed by Council and no specific feedback was received.

Meeting invitations to Worimi LALC

Boral's National Indigenous Affairs Manager received no specific project feedback from Worimi LALC at their meeting in January 2018.

13.2.3 Further engagement

Stakeholders were further engaged during 2019 via the methods summarised in Table 8 of **Appendix I**. The full results of consultation were considered, which resulted in the selected SIA methods summarised in **Table 13.5**.

Table 13.5: Results of further engagement

Engagement activity	Feedback/question received by Project team
Written methods	
Project newsletter and community drop-in sessions notification	No specific feedback from stakeholders was received. It was concluded that it did not prompt a specific interest in the project. However, one community member who received the newsletter did attend the community drop-in session.
Community drop-in sessions notification	70 notifications were distributed via letter-box drop in Fern Bay, and 60 were distributed in Fullerton Cove on 7 February 2019. The residential block nearest to the project site was included in the distribution area. Following its distribution, no specific feedback from stakeholders was received.
Emails	Emails were sent to project stakeholders including the Port Stephens Mayor and councillors regarding the progress of the project. One Councillor replied via email to acknowledge receipt of the project team email. No specific feedback about the project was receive
Phone briefing (informal)	A member of the project team briefed the Port Stephens MP via telephone about the project during early February 2019. The Port Stephens MP confirmed she would like to meet the project team later in the year. The Port Stephens MP did not raise specific concerns about the project.
In person interactive methods	
Meeting – Chief Executive Officer (CEO) Worimi LALC	At the meeting between Boral's Indigenous Affairs Manager and the CEO of Worimi LALC, no concerns about the project were raised by the CEO. The CEO made a request for consultation to occur with five stakeholders whom are either neighbours of the project, part of the Indigenous community, representatives of NSW Government agencies, or a combination of these. The CEO also requested ongoing meetings as a means to receive project updates. Boral's Indigenous Affairs Manager agreed to the requests.
Site tour (Newcastle MP)	Members of the project team escorted the Newcastle MP during the visit. Boral staff provided details about the project and addressed questions raised by the Newcastle MP. No concerns were formally raised with the project team during or following the site tour.
Community drop-in sessions	The community drop-in sessions advertised locally and held on 14 February 2019 attracted only two community members (a husband and wife couple) from Fullerton Cove, who received the project newsletter and community drop-in sessions notification. Consequently, little data was collected from the sessions.
Consultation with resident	A member of the project team had a conversation with Fern Bay resident, following the traffic query he raised with a project consultant conducting field work adjacent to the project site. The project team member explained the proposal for project related traffic, and confirmed the quantity of proposed traffic movements. The resident was satisfied with the responses. Subsequent to the conversation, the project newsletter and community drop-in sessions notification, and the community drop-in sessions notification was provided to the resident via letter-box drop.

Engagement activity	Feedback/question received by Project team
Consultation with neighbours via doorknock	Refer to Appendix D of **Appendix I** for a summary of the consultations.
Media methods	
Website	No project related feedback was received via the website feedback form or via the contact phone number listed on the webpage.
Facebook campaign	The project Facebook post received some reply comments. Within three hours of being uploaded, the post attracted 10 'likes', one 'love', one 'share' and one positive comment from a quarry customer who was satisfied with the service he received from quarry staff. Later, it attracted one ‘angry’ emoji and two comments criticising sand extraction generally.

13.3 Impact assessment

The potential negative social impacts of the project are summarised in this section and are identified on the assumption there is no mitigation. Predicted positive impacts are also assessed.

13.3.1 Access to and use of infrastructure, services and facilities

This social impact category was identified as being relevant to the project and comprises the road and rail network, and public infrastructure. These were assessed in the traffic impact assessment (**Appendix H**), which was supplemented by the ECA methodology for the purpose of the SIA.

Road and rail network

As described in **Chapter 12**, the TIA found that:

- traffic impacts from the additional heavy vehicles associated with the project will not be significant on the adjacent road network;
- future cumulative traffic impacts associated with the project will not be significant;
- construction traffic impacts will not be significant; and
- the project will not negatively impact other road users including pedestrians, cyclists and public transport vehicles (buses), or road safety.

With the above considered, this social impact was assessed to have a low social risk rating during all stages of the project.

Public infrastructure

Public infrastructure (or the condition of local roads) was not identified during the scoping phase as a social matter relevant to the SIA. The condition of local roads was not raised by residents during the early or further engagement activities. However, acknowledging the increased volume of heavy vehicles proposed for the project and the absence of a traffic impact assessment during the scoping phase, a precautionary approach was adopted. This approach involved the implementation of a standard SIA, via the ECA method. The ECA results supplement the traffic impact assessment which has since been completed.

The following discourses emerged from the ECA, each conveying some negative sentiment (excluding item five) towards the social impacts of heavy vehicles using public infrastructure:

1. excessive number of quarry trucks using public infrastructure;
2. trucks have negative impacts on families and schools;

3. the introduction of additional truck movements (negative sentiment regarding road quality);
4. quarry operators should share road maintenance burden;
5. the introduction of additional truck movements (neutral sentiment regarding road quality);
6. negative impacts for community safety; and
7. sand haulage route debate.

Whilst heavy vehicles were a feature of each discourse, neither the project, the project location, or the ASI were their exclusive focus, and the discourses related to truck movements across the Port Stephens LGA, not specifically to heavy vehicles associated with the project. These observations have implications for the assessment of social impacts under the ‘access to and use of infrastructure’ social impact category. They suggest that the social impacts in question are cumulative, and are a result of the volume of heavy vehicles from across the region, using public infrastructure. That is, the collection of heavy vehicles sourced from multiple projects both in the ASI and beyond, are producing a negative social impact in relation to public infrastructure. Overall, the results of the ECA illustrate a social unease in relation to the collective volume of heavy vehicles, the introduction of additional truck movements, and the road maintenance burden created by heavy vehicles for public infrastructure across an area much broader than the ASI.

This social impact was assessed to have a moderate social risk rating during the operation of the project. This rating was applied on the prediction that the additional heavy vehicle traffic will likely contribute to the cumulative social impact evident in media articles and the ECA results, even if that impact was one perceived by the community.

13.3.2 Culture

Culture, comprising shared beliefs, customs, values and stories, and connections to land, places, and buildings (including Aboriginal culture and connection to country), was considered during the scoping phase and determined to be a social matter not impacted by the project.

13.3.3 Health and wellbeing

The ‘health and wellbeing’ social impact category is relevant to the SIA in relation to ‘acoustic’ amenity and ‘community safety’.

Acoustic amenity

The scoping exercise determined that no SIA will be required to assess the acoustic amenity impacts of the project in addition to the noise impact assessment conducted for the EIS (refer to **Chapter 11**).

As described in **Chapter 11**, noise generated by the project and project related trucks on public roads will be below relevant noise criteria.

From a social impact perspective, the project is predicted to have a low social risk rating in all stages of the project. The risk is considered to immaterial and not requiring the implementation of a mitigation measure.

Community safety

The scoping exercise determined that a standard SIA will be required in the absence of any specialist study designed to investigate potential implications to public safety. The PO method was applied for this purpose.

During the PO exercise, quarry staff explained that Google maps currently provides directions to Stockton Bight and the Sygna wreck via Cox's Lane. This is likely to draw members of the public to the quarry entrance. Boral have requested that Google correct this and remove the directions from their mapping software. The request was accepted, yet at the time of writing this EIS there is no change to this situation.

Results of the PO exercise show that 17 participant events were observed by the quarry staff. Of these, two events involved actual instances of unauthorised access to the quarry during the observation period, from early January to late March 2019. For all other instances, members of the public did not enter the quarry and there is every possibility that the participants involved were merely using the public road with no intention of accessing the quarry. They either turned away voluntarily at the quarry entry, some having read the signage on display, or were prompted by quarry staff to turn away.

The data were viewed in the context of the following research questions:

1. *Do the participants seem to be intentionally or unintentionally accessing site?*

PO results indicate that intentional or unintentional site access did occur albeit for a small percentage (12%) of the recorded instances.

2. *What was the known or predicted purpose of those people attempting to access the project site?*

The purpose of the persons who accessed the site without authority is known for only one of the two recorded instances, who was intending to access the beach. The purpose of the second person who accessed site is not known, as quarry staff were not able to have a conversation or determine with certainty what intention that person held.

The travel mode of persons who were potentially interested in site access on five occasions was travel by foot, horse and bicycle. The implied purpose in each case was recreation, however there is no evidence to verify this.

3. *Was the safety of those attempting to access the Project site put at risk?*

In the two instances of unauthorised site access, there was no immediate safety risk to the members of the public. The weighbridge staff were able to alert the members of the public to quarry operations, either by gesture or conversation, and advised them to leave the quarry in a safe manner. Members of the public then departed voluntarily. The cause of risk in these events rests entirely with members of the pubic who choose to undertake their recreational pursuits, whilst ignoring the prominent warning signage and/or communications of quarry staff.

After considering and assessing the PO results, a moderate social risk rating is considered to be adequate for the project.

13.3.4 Surroundings

Visual impacts and heritage (natural features) are relevant to this social impact category.

Impacts of the project on visual amenity were not assessed by a specialist. The scoping exercise determined a standard SIA was required comprising a semi-structured interview and the VIA method were applied

In relation to heritage (natural features), the interface between the Indigenous community and the dune areas adjacent the project formed a focal point of the scoping exercise. It was determined that further engagement with the Worimi LALC was required in relation to the heritage matter. This engagement was required in addition to the Aboriginal cultural heritage assessment (ACHA) process for the project (refer to **Chapter 5** and **15**).

Visual amenity

It was concluded during the VIA that given that recreational dune users are not authorised to breach the boundary rope and access the vantage point assessed, there is no option for them to gain a better vantage point of the quarry and project site, unless they access the site without authorisation. Therefore, the project will have negligible visual impacts.

The owner of a quad bike adventure company stated during the semi-structured interview that there will be negligible visual impacts from the project.

Based on the VIA, semi-structured interview, and engagement results, potential visual impacts will represent a low social risk rating and mitigation measures will not be required.

Heritage (natural features)

No feedback on social impacts from the project was received during further engagement with Worimi LALC. Boral's Indigenous Affairs Manager agreed to the CEO of Worimi LALC's request to include stakeholders in future communication campaigns.

Heritage impacts from the project represent a low social risk rating as the Worimi LALC and other Aboriginal persons were not concerned by the project and management measures will not be required.

13.3.5 Personal and property rights

Economic impacts (use of natural resources and livelihood) were identified under this social impact category.

Economic (natural resource use)

There is a shortage of natural fine sand supply in the local and regional economy, and it is relevant to the SIA that the project will provide a partial remedy to this situation. Natural fine sand is an essential component to construction materials and consequently, to local and regional development projects. The project presents an opportunity to maintain supply at a cost-effective price.

As highlighted by the economics assessment summarised in **Chapter 21**, it is predicted that the project will yield a positive impact from an economic (natural resource use) perspective. This prediction is made on the basis that the level of interest, scale of benefit, equity in the distribution of the benefit, and likelihood of the benefit is forecast to be high.

Economic (livelihood)

An obvious positive impact of the project will be the extension of local employment for the current quarry employees, and the employment of additional staff and subsequent flow on effects.

Interviews with Boral management confirmed the current quarry employees are locally based.

Although the current workforce is not large, it must be recognised that the maintenance of employment for a single staff member will enable an income for the household unit of that employee. In this scenario, the number of people benefitting from the project will be larger than the individuals employed by the project. Employment for the project workforce will ensure income for the associated families (or housemates as the case may be).

Considering the information obtained from the economics assessment for this aspect of the SIA, a positive 'economic (livelihood)' social impact for the local population is predicted. The level of interest, scale of benefit, equity in the distribution of the benefit, and likelihood of the benefit is forecast to be moderate.

13.3.6 Decision making systems

Decision-making systems is the social impact category that relates to the influence that individuals have on decisions that affect their lives, and access to complaint, remedy and grievance mechanisms. Decision making systems were considered during the scoping phase and determined not to be a social impact affected by the project.

13.3.7 Fears and aspirations

Fears and aspirations, comprising fears about the future of the communities surrounding the project, was considered during the scoping phase and determined to be a social impact not affected by the project.

13.3.8 Summary

Positive and negative social impacts are summarised in **Table 13.6**.

Table 13.6: Predicted positive and negative social impacts

Social impact type	Social impact category	Predicted social impact
Positive	Personal and property rights.	Mitigation of a potential shortage of natural fine sand supply in the local and regional economy.
		Employment benefits in the form of income for quarry employees and their households.
Negative	Access to and use of infrastructure, services and facilities.	Community perception of cumulative impacts to road quality caused by heavy vehicles, per the ECA results.
	Health and wellbeing.	Personal safety impact to members of the public that access site without authority.

13.4 Management measures and residual impacts

The below measures and those summarised in **Table 13.7** will be implemented to minimise the predicted negative social impacts of the project.

13.4.1 Access to and use of infrastructure, services and facilities

When the EIS is placed on public exhibition it is recommended that:

- Fullerton Cove residents will be notified in writing about exhibition of the EIS, the increased heavy vehicle volumes derived from the project, where these matters are addressed in the EIS, SIA and technical studies, how/where they can easily view the documentation, and an invitation to contact Boral to discuss any residual or additional concerns they may have; and
- Boral will place a notice on the project webpage (and send the web link to the notice via other media channels typically used throughout the SSD stakeholder engagement process) to notify of the EIS exhibition process as outlined above.

During the above, Boral will outline the:

- increase in heavy vehicle numbers proposed for the road network; and

- high-level results of the road safety audit.

13.4.2 Health and wellbeing

The SIA concluded that potential personal safety risks remain in relation to unauthorised site access. Boral has taken all reasonable and necessary steps to ensure the security of the site and the safety of the public. Staff efforts and quarry features include security fencing and lockable gates, high visibility line and signage, CCTV, equipment and safe batter requirements, trespass procedures, and operating hours, yet a small number of people continue to access site without authority

With other options exhausted, the initial request made to Google will be repeated with the objective of removing the Stockton Bight route (via the quarry) from Google maps. Achieving that objective will potentially dissuade members of the public from attempting to access the quarry without authority.

Table 13.7: Summary of negative impacts and management measures

Social impact category	Impact description			Impact without mitigation		Impact with mitigation		
	Impact	Timing	Affected parties	Impact characteristic	Social risk rating	Mitigation	Social risk rating	Residual risk description
Access to and use of infrastructure, services and facilities	Impact to condition of public road network	Operational	Road users (road network utilised by the project)	Cumulative (perceived or actual) risk of additional heavy vehicle traffic affecting road quality	Moderate	Written notification about the availability of the EIS on exhibition, including the dissemination of EIS information about project heavy vehicles	Low	Low
Health and wellbeing	Impact to personal safety	Operational	Unauthorised community members	Personal safety risk from unauthorised site access	Moderate	The initial request made to Google is repeated with the objective of removing the Stockton Bight route (via the quarry) from Google maps	Low (if Google maps is corrected)	Low and immaterial (if Google maps is corrected)

13.4.3 Management framework

The mitigation measures summarised in **Table 13.7** will be implemented as part of a broader management and monitoring framework for the quarry. A range of management plans will be developed as part of the quarry operations, and those addressing safety issues will assist with the management of the negative project impacts identified in **Table 13.6**. The management plans include the:

- environmental management strategy.
- air quality management plan.
- safety management plan.

Aside from the various management plans, performance measures applicable to the management framework are listed in **Table 13.8**, along with the measure type defined in the DPIE assessment and mitigation framework (NSW Department of Planning and Environment, 2017). Community sentiment derived from stakeholder feedback exists as a performance measure and is additional to those listed in **Table 13.8**.

Table 13.8: Management framework for social impacts

Social impact category	Objectives	Affected parties	Actions	Performance measures	Measure type
Access to and use of infrastructure, services and facilities	Counter cumulative and perceptual risk of increased heavy vehicle volumes	Road users (roads surrounding the project)	Written EIS exhibition notification to Fullerton Cove residents	Distribution of notifications to neighbours during EIS exhibition	Performance-based2F
			Provision of a notification via web link, to disseminate EIS information about Project heavy vehicles	Distribution of social media post and print media	Prescriptive3F
Health and wellbeing	Mitigate personal safety risks for people attempting to access the quarry without authority	Unauthorised community members	Repeat the initial request to Google with the objective of removing the Stockton Bight beach route (via the quarry) from Google maps	Google maps is accurate	Prescriptive

13.4.4 Monitoring

A social impact monitoring framework will apply to the project. Monitoring results will be disclosed via the submission of an AEMR prepared and submitted to DPIE in accordance with conditions of the new SSD approval and will include reporting on all key matters assessed in the EIS.

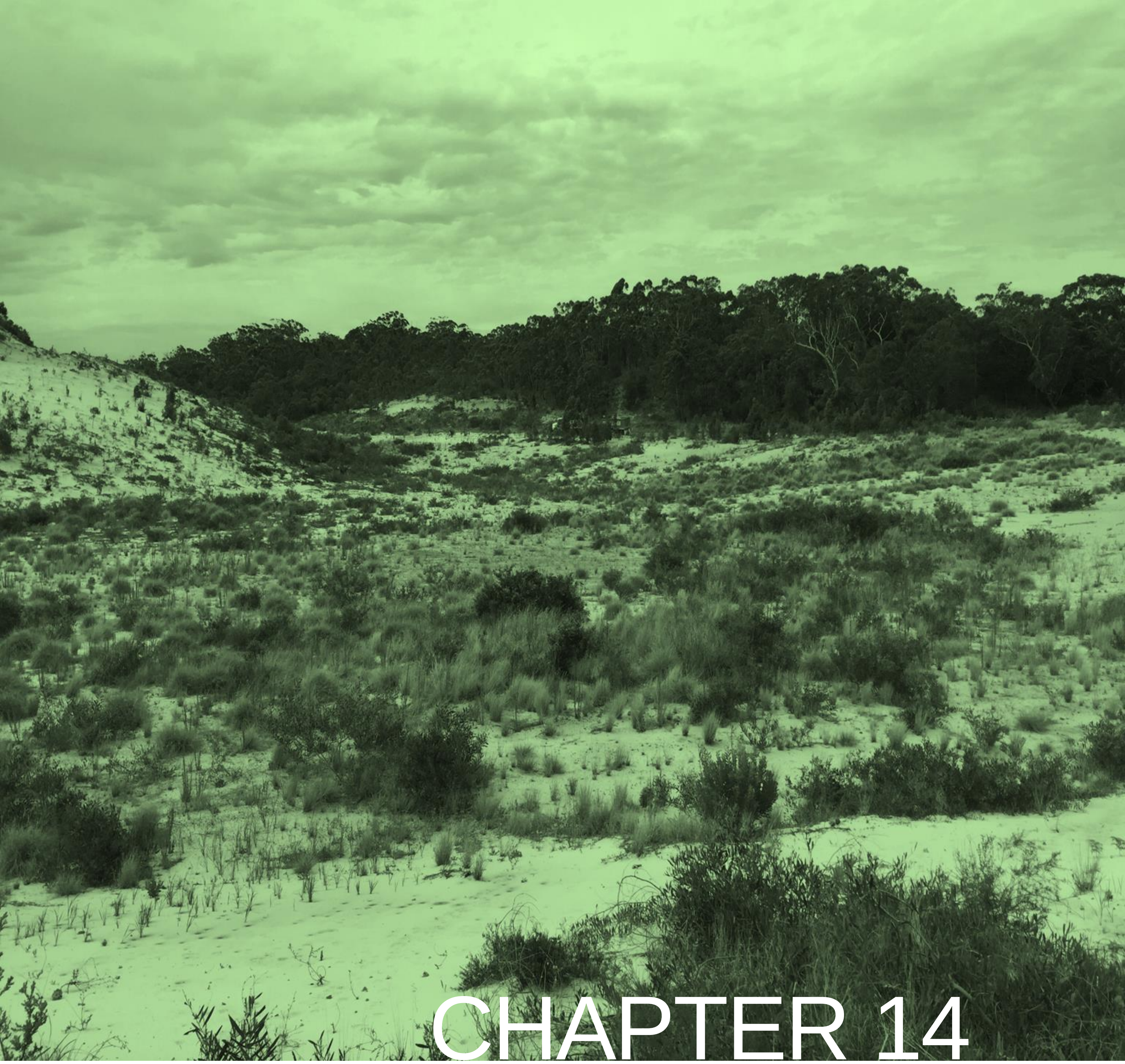
Table 13.9 outlines the social issues which will be monitored to ensure compliance and meet the social objectives. In accordance with the Guideline, the table outlines the:

- key social issues to be monitored;
- how and when monitoring data will be collected; and
- community participation.

Although not included in **Table 13.9**, the project complaints register is an additional data source that applies to each social issue and provides value to the monitoring framework. The register will continue to operate and provide data in relation to each social issue should a complaint be submitted.

Table 13.9: Monitoring framework for social impacts

Social impact category	Social issue	Data source	Data availability / frequency
Access to and use of infrastructure, services and facilities	Road user satisfaction	Council feedback	As available
		Feedback received via Boral corporate communications channels or quarry staff	
Health and wellbeing	Community safety	Quarry staff and CCTV	Constantly during business hours (weighbridge staff) and after hours (CCTV)



CHAPTER 14

SOILS AND LAND RESOURCES

14 SOILS AND LAND RESOURCES

This chapter summarises the potential impacts to soils and land resources at the site and surrounding locality.

14.1 Assessment guidelines and requirements

The SEARs require a consideration of the project to impact soils, landforms and the coastal environment (**Table 14.1**).

Table 14.1: Soils and land resources SEARs

Requirement	Section and appendix where addressed
potential impacts on the broader coastal environment and dune system;	Section 14.2.1, Section 14.3.2
potential impacts on soils and land capability (including potential erosion and land contamination);	Section 14.3.1, Section 14.3.3, Section 14.3.4
potential impacts on landforms (topography), paying particular attention to the long term geotechnical stability of any new landforms;	Section 4.2.5 and Section 14.3.1

14.2 Soil resources

14.2.1 Soil landscape

As outlined in **Section 2.5.5**, most of the project is confined to the Boyces Track soil landscape unit, with the central southern portion of the project site encompassing the Hawks Nest soil landscape unit.

14.2.2 Acid sulfate soils

The ASS maps in the Port Stephens LEP 2013 categorise most of the project site as risk Class 4 (in which ASS is likely to be found beyond two metres depth), while pockets of the southern extent of the proposed extraction area are mapped within risk Class 3 (in which ASS is likely to be found beyond one metre depth).

The project site was also reviewed in the Port Stephens 1:50 000 Acid Sulfate Soils Map (1996) produced by NSW Department of Land and Water Conservation. The project site is in an area of low probability of ASS occurring. The southern boundary of the project site has low probability of ASS between 1-3 m Below Ground Level (BGL) whilst the remainder and majority of the project site has low probability that ASS occurs >3 m BGL.

There is potential for exposed sediments generated by potential lowering of the water table or via bulk sand extraction to form acid upon oxidation. Therefore, the potential for ASS to occur was assessed (**Appendix J**).

Four boreholes were drilled in the project site to depths between 18-24 m BGL. One soil sample was obtained, and field pH and peroxide were tested every change in lithology in the borehole profile.

Of the 44 soil samples collected and analysed from within the project area only one returned a moderate risk of ASS. The risk for ASS was identified in BH2 at a depth between 2.0 m to 2.5 m

BGL. The borehole is located within the northern portion of the project site in a low-lying swale with organics noted in the lithology at the same depth. Soil samples obtained above and below this depth in the borehole did not indicate ASS potential, and as such it was concluded the potential for ASS at the identified depth was a localised occurrence. Other than the one moderate risk of ASS identified, the remainder of the project site is not identified at risk of ASS.

There is low risk of oxidation of possibly localised of potential ASS as most of the water will be returned to the pond during dredging. Returning the water to the dredge pond will prevent lowering of the water table and exposure of potential ASS to air. Furthermore, recharge is rapid in the dune lithology, further preventing impacts to groundwater in and across the project site and beyond.

No fine sediments such as clays, silts, or estuarine muds were observed in the soil profiles. This occurrence further reduces the risk for PASS being oxidised as sulphides typically reside in the finer grained sediments.

The extracted sands will pass through a sluicing device where finer grained materials, if present, will drain back into the dredge pond. This will reduce the risk of any localised finer grained sediments oxidising into potential ASS.

An ASS management plan will be prepared and implemented for the project in accordance with ASSMAC's (1998) *Acid Sulfate Soils Assessment Guidelines*.

14.3 Land resources

14.3.1 Landform and topography

The extraction of sand associated with the project would alter existing landform and topography in the project site. As it would not be possible to reinstate the pre-existing landform and topography of the project site following completion of the project, the final land use of the project site would aim to ensure that all landforms are adequately stabilised. As highlighted in **Section 4.2.5**, geotechnical advice has been obtained pertaining to design of the dredge pond to ensure that landforms are stabilised both above and below the water surface. This coupled with an adequate rehabilitation program (as described in **Chapter 22**) would ensure that the final landform remains stable and is less susceptible to erosion via wind and rainfall into the future.

14.3.2 Coastal dune environment

The project will not impact the beach, foredune, deflation basin and mobile transverse dunes of Stockton Bight as the project site is physically removed from, and downwind of these environments (Coastal Studies, 2019). There is a buffer of at least 300 m of vegetated dunes between the southern boundary of the project site and the mobile (Phase II) dunes, and this is more than sufficient to physically isolate the project from these environments.

Likewise, the project will not impact the existing sand transported along the beach and in the active mobile (Phase II) dunes as the project site is isolated from these environments. The vegetated Phase I and II dunes that surround the project site will be graded, battered and vegetated to ensure their stability as part of the rehabilitation of the project site. Once the vegetation is established, the dunes will remain stable and well vegetated (Coastal Studies, 2019).

In regards to dune morphology, the project site will be surround by 5-20 m high sand dunes covered in remnant native vegetation, with at least a 300 m wide vegetated zone between the project site's southern boundary and the bare mobile (Phase II) dunes, and at least a 1.3 km wide buffer from the Stockton Bight shoreline. These buffers are more than adequate to protect the project site from windblown sand and shoreline erosion and/or marine inundation (Coastal Studies, 2019).

14.3.3 Land capability

Land capability is the inherent physical capability of land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources.

Land in the project site was previously assessed and mapped for land and soil capability according to *The Land and Soil Capability Assessment Scheme: Second approximation. A general rural land evaluation system for New South Wales* (OEH, October 2012) (the scheme).

This scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to class land into one of eight classes (Class 1 to Class 8). Land capability class indicates the level of land management required to sustain a potential land use, without causing degradation to the land and soil. General definition of the eight land capability classes is presented in **Table 14.2**.

Table 14.2: General definitions of land capability classes

Class	General definition
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	High capability land: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	Moderate capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	Moderate–low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	

Class	General definition
7	Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	Extremely low capability land: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

Broadscale regional land and soil capability mapping by the scheme identified the majority of the project will be in Class 8, meaning that the land has extremely low capability and is incapable of agricultural land use.

The central southern portion of the project is mapped as Class 5, resulting in moderate to low capability and potential for limited agricultural land use such as grazing land.

Given the project will be in a previously disturbed quarry pit, coupled with low land capability classes (5 and 8), the project will have minimal negative impact on the overall land capability, and use of the site for extractive industry will not detract from other agricultural land use.

14.3.4 Land contamination

Historic excavation in the project site associated with the inland extraction area did not involve contaminating activities or incidents, and the secure nature of the site has ensured that there has been no dumping of illegal waste or disposal of hazardous materials in the project site.

There will be low potential to disturb contaminated land given historical land use at the project site, which comprised vegetation clearing and sand extraction at the inland extraction area. Disturbed areas were rehabilitated when sand extraction ceased in 2008. Notwithstanding, there could have been localised spills and leaks from equipment. However, given the project site has replenished with windblown sand, the potential for remnant contaminated material will be low.

The project could contaminate soils by hydraulic oil leaks from equipment. Mobile machinery will be parked overnight at the depot. The concrete floor will ensure no soil or groundwater contamination from oil leaks.

All vehicles will be refuelled off-site or within the bunded fuel storage and distribution facility in depot.

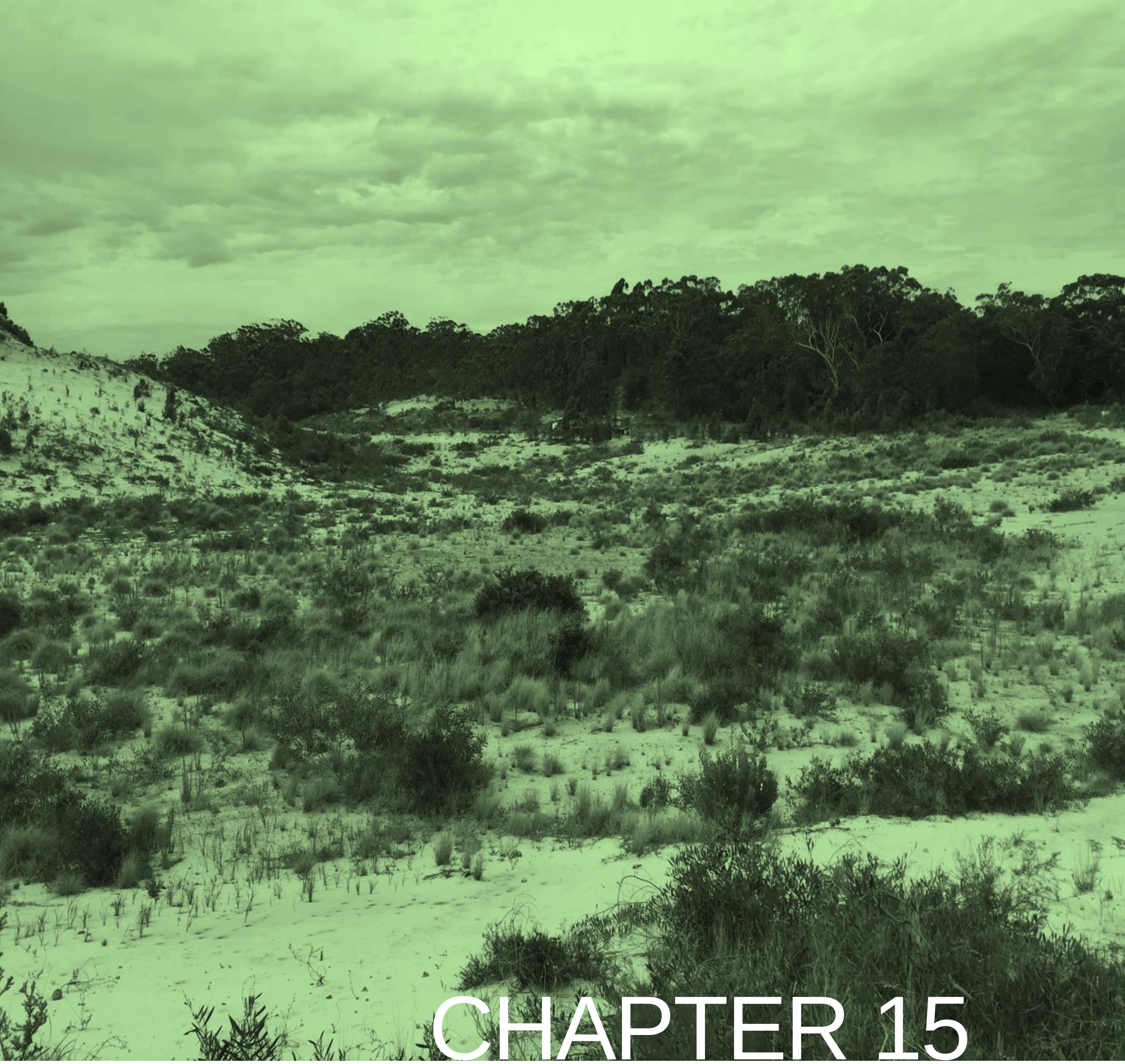
Personnel will regularly check and maintain machinery to minimise the risk of oil leaks.

Given the low risk of contamination, no further assessment of contaminated land or land remediation is required.

Exposure to unexpected contaminated soil and/or materials could pose a health risk to site personnel and impact the wider area if the contaminant migrates. Contamination entering waterways can pose a threat to aquatic ecology, water quality and the wider community. It is an offence under the POEO Act to cause contamination or spread contaminated material.

If previously unidentified contaminated materials are encountered during construction and operation of the project, relevant statutory requirements, including potential soil testing and waste classification, will be complied with, and the material managed and disposed of appropriately.

The mitigation measures in **Section 20.3** will be implemented to contain, remove and remediate contaminated material if there is a leak or spill.



CHAPTER 15

ABORIGINAL HERITAGE

15 ABORIGINAL HERITAGE

15.1 Introduction

This chapter summarises the ACHA report, which is in **Appendix K**. It describes the cultural context of the project site, consultation with the Aboriginal community, study methods, findings of field surveys, potential impacts and mitigation measures to minimise the potential for harm to unidentified Aboriginal objects.

15.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on Aboriginal cultural heritage (**Table 15.1**).

Table 15.1: Aboriginal heritage SEARs

Requirement	Section and appendix where addressed
an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage	5.4, Appendix K

15.1.2 Overview of assessment methods

The following assessment methods were used during the ACHA.

Desktop study

The AHIMS database was searched (July 2019) to identify any registered Aboriginal sites or places in the project site or surrounds.

Environmental features which could influence historic Aboriginal occupation of the locality were characterised, for example landscape, drainage, geology, soils, vegetation, fauna and climate.

Literature such as previous heritage assessments of the quarry and local area were reviewed to understand historical Aboriginal use of the area and customs.

Information gathered from the desktop study was used to develop a predictive model of what types of Aboriginal sites are likely to occur in the project site and the landforms they may be associated with.

Aboriginal consultation

Aboriginal parties were consulted in accordance with OEH's (2010) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. Sixteen Aboriginal groups or individuals registered their interest (RAPs) in the project and contributed cultural knowledge and archaeological expertise to the Aboriginal heritage assessment process.

Archaeological survey

The project site was surveyed by an archaeologist and the RAPs, which targeted ground exposures. The site inspection aimed to identify Aboriginal objects or sites (if present), assess the archaeological potential and sensitivity of the Project site, and confirm the nature and extent of previous disturbance associated with the former inland extraction area.

Any potential Aboriginal sites were to be photographed, and their locations recorded using global positioning system units.

15.1.3 Results

Desktop study

The search of AHIMS and review of background information revealed there were no known Aboriginal archaeological sites in the project site. The potential for subsurface Aboriginal archaeological material in the project site is considered low and potential has not been indicated by previous archaeological investigations. The project site is generally highly disturbed due to previous disturbance associated with sand extraction.

Archaeological survey

Visual inspection of the project site confirmed the extent and nature of previous disturbance. Previously disturbed areas had little to no archaeological potential given the previous removal of the dune mass to 5 m AHD. Ground surface exposure varied from high to low, with archaeological visibility obscured by vegetation and disturbed sands.

Large sections of the former dunes are absent, with the expansion of the central low-lying basin landform following extraction. The adjoining slopes to the west have also been modified as part of rehabilitation. The reinstated higher elevation slopes and crests to the south and west are heavily vegetated with native regrowth. Aerial imagery from 2004 shows the widespread disturbance prior to the rehabilitated landform.

Topsoil has been reintroduced to a number of areas and surface exposures were infrequent, and where present the visibility was generally low. No shell midden material or Aboriginal objects were observed in these areas. Scattered introduced fill and other rubble was also present on the surface in some of the larger exposures.

Ground disturbance from tracks and the former haul roads was evident in the central basin formed by the previous inland extraction area. Areas of lower disturbance along the southern margin of the project site (where a haul road is proposed) were closely inspected but no archaeological sites or areas of potential were identified.

Other areas of lower disturbance associated with the remnant slope/crest landforms on the edges of the former inland extraction area were closely inspected, but no archaeological material was identified despite frequent exposure and localised disturbance of the ground surface.

In summary, no archaeological sites, Aboriginal objects or areas of Aboriginal archaeological potential (such as shell material) were identified within the project site. The archaeological potential for subsurface archaeological deposits was assessed as very low to nil given the extent of previous disturbance and the findings of previous archaeological assessments.

Therefore, further detailed investigation (test excavation) was not warranted to determine the nature, extent and significance of any archaeological sites and potential archaeological deposits in the project site.

15.2 Significance assessment

15.2.1 Overview

The heritage values held by communities are an important management consideration, with the values collectively called 'cultural significance'. The ACHA assessed potential impacts of the project as outlined in Section 7.1 of the ACHA.

15.2.2 Statement of significance

The wider area has cultural value for the local Aboriginal community. The identified cultural value is a feeling of attachment and responsibility for the land. RAPs have expressed that traditional knowledge indicates significant areas in the surrounding dune field (outside of the Boral landholding and project site).

To date, no areas of Aboriginal cultural significance have been identified in the project site. Stakeholders concurred with the assessment of severe levels of disturbance in the project site. The project site does not display any identified archaeological, historic or aesthetic significance in relation to Aboriginal heritage values.

15.3 Impact assessment

A review of background information revealed there were no known Aboriginal archaeological sites in the project site. The potential for Aboriginal archaeological material in the project site is low and has not been indicated by previous archaeological investigations.

The potential for subsurface midden sites has consistently been assessed as low and extensive previous investigations across the quarry have not detect any subsurface shell deposits or archaeological material.

Previous extraction for the inland extraction area is likely to have removed any once present archaeological material associated with the earlier Holocene foredune ridge plain at 5-10 m AHD. Given the indications from previous studies that midden material within the Phase I and II dune field occurs within the top 50 cm of the soil profile, the potential for deposit associated with these geomorphological elements has also been removed. The project site is therefore unlikely to contain any buried deposits associated with Aboriginal occupation.

The archaeological survey confirmed the extent and nature of previous disturbance, and no Aboriginal objects, archaeological sites or areas of archaeological potential were identified. Areas of lower apparent disturbance (remnant slope/crest landforms on the edges of the former inland extraction area) were closely inspected but no archaeological material was identified despite frequent exposure and localised disturbance of the ground surface.

The project site does not display any scientific / archaeological significance as does not contain any identified Aboriginal archaeological sites or areas of potential. The wider landscape encompassing the quarry retains Aboriginal cultural value and significance, including nearby traditional areas, movement routes, flora and fauna communities, natural landscape values and the linkages the landscape provides to ancestors and storylines.

The configuration of the project has been developed having regard to the constraints of the land, the desire to mitigate and avoid impacts where possible, whilst balancing the commercial viability of the project and the extent of the known resource. The project seeks to capitalise on sand availability within the area of existing and previous operations, maximising output from existing production facilities. This results in a smaller disturbance footprint and minimises environmental impacts compared to expansion into un-quarried adjacent areas within the wider quarry.

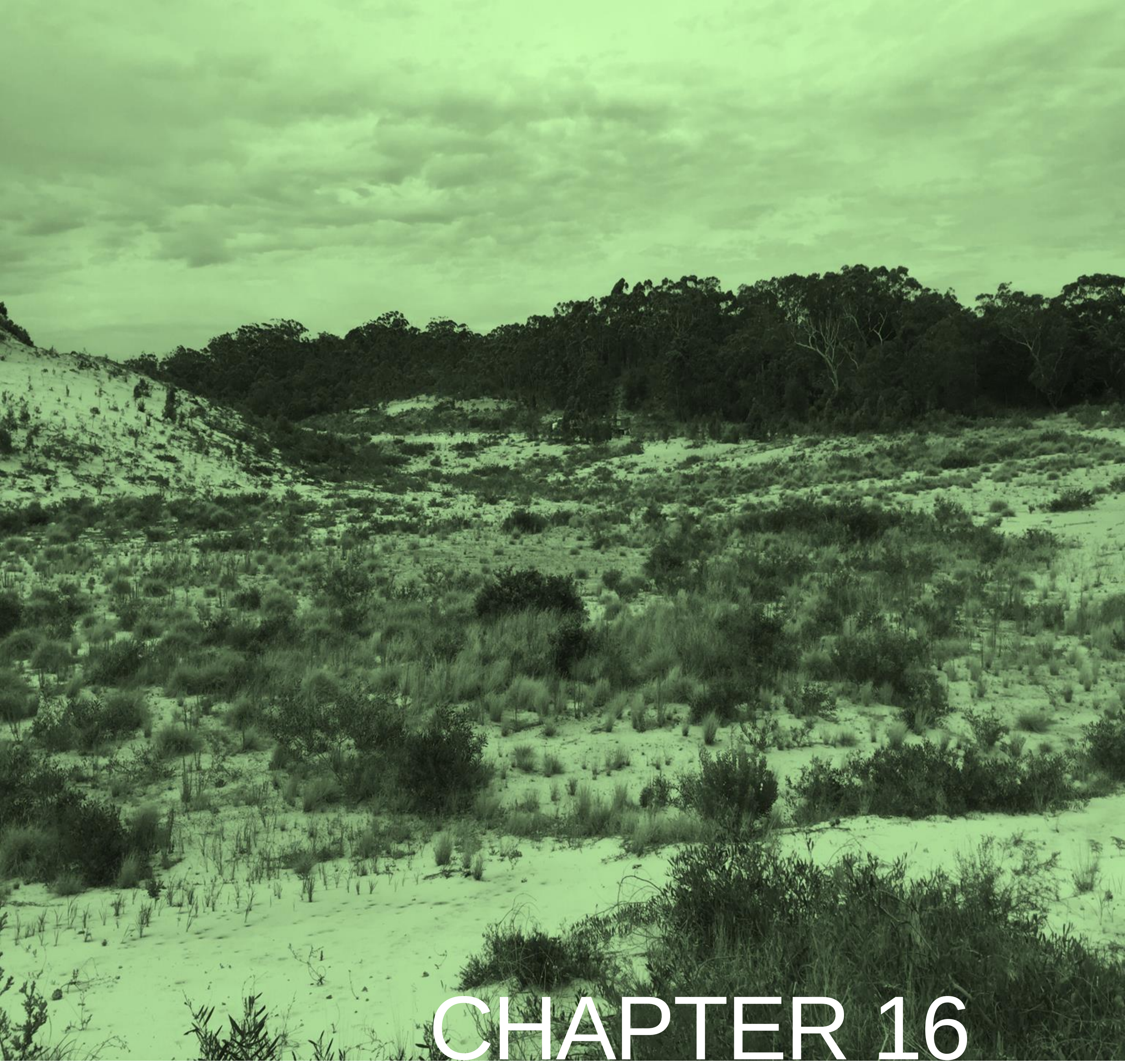
Impact to intrinsic Aboriginal cultural values of the surrounding landscape will also be minimal.

15.4 Management and mitigation measures

Despite no impacts to Aboriginal heritage values resulting from the project, Aboriginal objects are known to occur in adjacent landforms and these must be avoided by all project operations. The boundary of the approved project site will be clearly delineated and Aboriginal heritage considerations will be included in the environmental management strategy.

Documented toolbox talks will also be held to ensure all on-site staff and contractors are aware of obligations and requirements regarding the protection of Aboriginal heritage.

An unexpected finds and human remains procedure will be implemented during the project as summarised in Section 9.3 and 9.4 of the ACHA.



CHAPTER 16
VISUAL

16 VISUAL

16.1 Introduction

This chapter considers the nature, extent and significance of the potential visual impacts of the project with reference to the range of public and private places that could be affected.

16.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely risks of the project to the visual amenity of the surrounding locality (**Table 16.1**).

Table 16.1: Visual related SEARs

Requirement	Section and appendix where addressed
an assessment of the potential visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to any new landforms.	16.3

16.2 Existing environment

The project site is situated at approximately 5 m AHD which is below the level of the surrounding dune system. The dunes, combined with the established vegetation, work together to prevent a direct line of sight between adjoining private and public land to the project site.

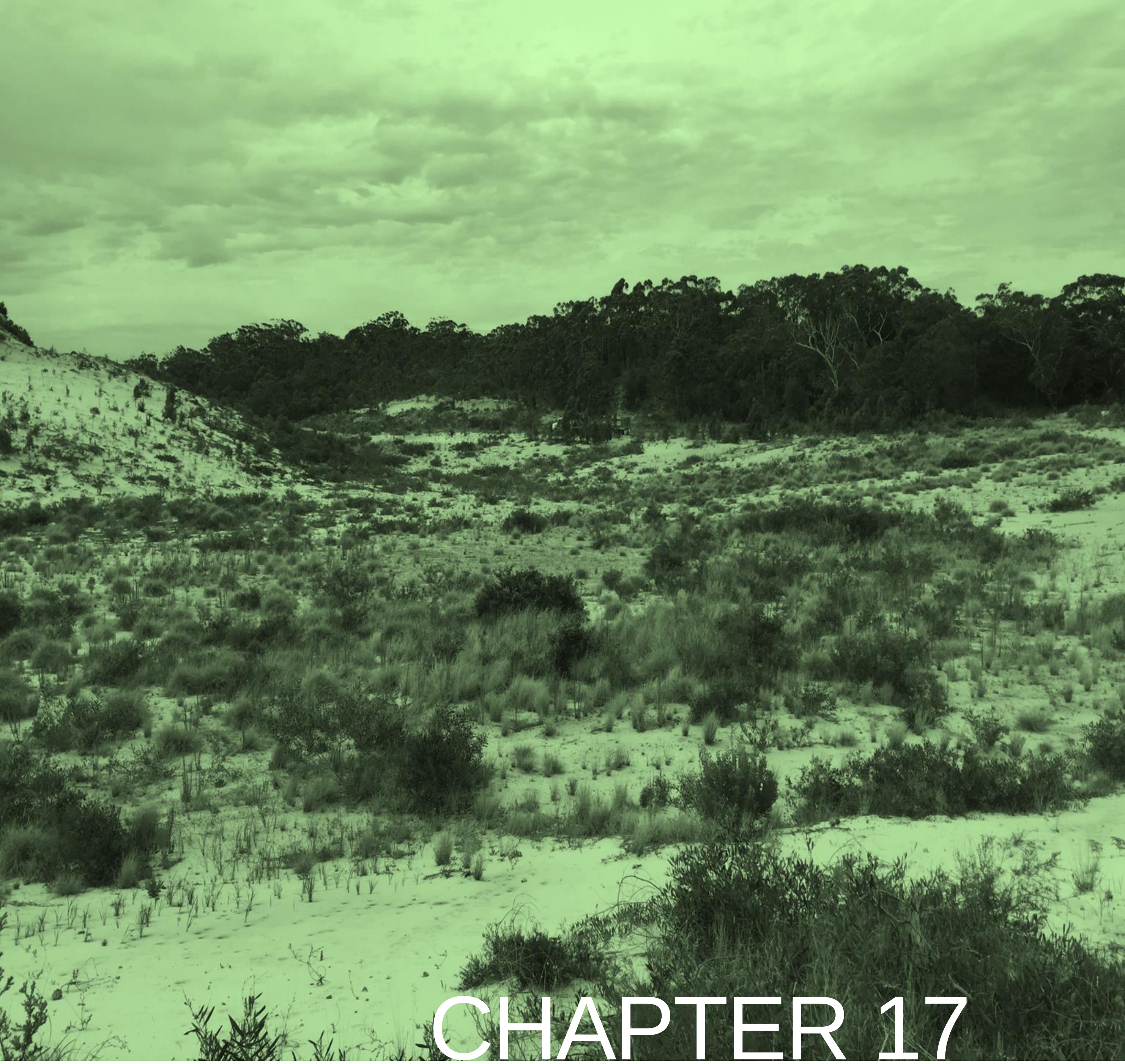
16.3 Potential impacts

The project site will not be visible from Nelson Bay Road or surrounding residential areas.

The project may be partially visible to recreational users accessing the top of the remnant hind dune directly adjacent to Boral's consent boundary. However, the project will only be partially visible from this viewpoint during the initial stages of sand extraction, and following extraction of the existing dune profile, the proposed dredge pond will be formed in a low point shielded by vegetation between the project and hind dunes. As a result, dredging operations will be shielded from potential viewpoints of recreational users of Stockton Bight.

With the above considered, the only likely viewpoint of the project for the public will be along a discrete section of Stockton Bight beach immediately adjacent to the quarry boundary, with temporary views confined to the highest elevation of the project site. As this area is quarried, the remainder of the project will be entirely concealed from public view.

Business operators who utilise this section of Stockton Bight for recreational ventures were consulted during the SIA process and provided feedback that they had grown accustomed to Boral operations associated with the windblown sand extraction area and did not envisage that the project will have any negative implications for their business.



CHAPTER 17

SURFACE WATER

17 SURFACE WATER

17.1 Introduction

This section summarises the surface water assessment report, which is in **Appendix L**. It summarises the potential impacts from the project on surface waters in and near the project site.

The hydrology of the project site and surrounds is summarised in **Section 2.5.8**.

17.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely impacts of the project on surface water (**Table 17.1**).

Table 17.1: Surface water related SEARs

Requirement	Section and appendix where addressed
a detailed site water balance, including a description of site water demands and intakes, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and, water storage structures	Section 17.4, Appendix L
identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*	Section 17.5.3, Appendix L
demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)	Section 17.5.3, Appendix L
a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo	Section 17.6, Appendix L
an assessment of any likely flooding impacts of the development, having regard to the relevant requirements provided by OEH in Attachment 2.	Section 17.2.2, Appendix L
an assessment of the likely impacts on the quality and quantity of existing surface and ground water resources (having regard to the Williamtown RAAF Base Contamination Broader Management Zone), including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives	Section 17.3, 17.4 and 17.5, Appendix L
a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts	Section 17.3 and 17.5, Appendix L

The following guidelines were used during the assessment:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council, 2000); and
- Managing Stormwater: Soils and Construction, Volume 2E – Mines and Quarries (Department of Environment and Climate Change, 2008a); and

The objectives of the surface water assessment were to address the SEARs by:

- describing the existing catchment conditions and flow regime and water quality of water resources in and adjacent to the project site;

- describing the proposed water management system including water supply and demand requirements;
- assessing the potential impacts of changes to potential surface water flow and water quality from the project and identifying measures to prevent or manage these impacts;
- identifying a system to monitor project impacts on surface water and initiate additional management measures if required; and
- identify water licensing and approval requirements for the project.

17.2 Surface water environment

17.2.1 Drainage and interaction with groundwater

The existing project site is a formed basin and has no surface flow connection to adjacent areas. There are no springs or permanent streams within the project site. The lowest existing surface level of the project site is around the south-eastern edge of the project site with an approximate height of 6 m AHD. Local hydrology is characterised by high infiltration rates associated with the porous sands over the quarry and the subsequent interaction with the unconfined aquifer below.

Surface runoff is limited to periods where the aquifer reaches surface levels. This predominantly occurs when rainfall intensity exceeds infiltration rates, resulting in complete saturation of the soil. Ocean conditions, including storm surge, large tides and the wave action also influence groundwater levels. This was highlighted during what is known as the ‘Pasha Bulker storm’ of June 2007, where the associated storm surge and rainfall resulted in partial inundation of the project site up to approximately 3.5 m AHD.

As summarised in **Section 2.5.7**, a range of previous investigations have been carried out to establish groundwater depths and flow regimes in response to rainfall infiltration.

17.2.2 Flooding

Flooding in the vicinity of the project site is influenced by floodwaters from the Hunter River that overtop the Fullerton Cove levee, and the severity is a function of the magnitude of flooding in the Hunter River, which in turn is influenced by a combination of sea level impacts and catchment runoff.

The project site is beyond Port Stephens Council’s mapped flood hazard extents, which also include allowance for climate change impacts. Estimates of the 1% annual exceedance probability (AEP) flood level and probably maximum flood (PMF) level in the vicinity of the quarry are 1.5 m and 5.2 m AHD respectively. Direct surface flood impacts from the Hunter River on the project site for the PMF or more frequent events are not expected, however, floodwaters for the PMF will impact on access to and from the quarry.

As outlined in **Section 17.2.1**, potential ponding of surface water in project site is associated with raised groundwater levels which can be exacerbated by ocean inundation and localised heavy rainfall events. Historically, groundwater levels up to 3.5 m to 4.0 m AHD are experienced at the quarry during wet periods.

17.2.3 Water quality of receiving environment

Rainfall which falls over the project site ultimately infiltrates to the Stockton Groundwater Source, which therefore acts as the receiving environment for the project.

Section 2.5.7 summarises the water quality of the Stockton Groundwater Source beneath the quarry, which has been informed by historical groundwater monitoring at the quarry.

17.2.4 Coastal hazards

Coastal hazards to the project consist of erosion and wave inundation along Stockton Bight. Estimates have been quantified by City of Newcastle Council for coastal erosion and recession to the year 2100. These estimates extend up to the LGA boundary at Fern Bay, approximately 3 km to the south-west of the project site and represent a similar aspect and coastal exposure to that of the quarry.

The likely beach erosion and recession in a large ocean inundation event by 2100 is estimated at 250 m. The project site is well beyond the projected coastal erosion extents and will be completed within 25 years. As such, coastal hazards are not deemed to present a risk for the project.

17.2.5 Existing water demands

The current water demands of the quarry must be understood as these demands will continue once the project is operational.

Dust suppression

Dust is suppressed on the existing unsealed haul roads from the site depot to the active windblown extraction area using a water cart. Water is purchased directly from a water cart contractor, drawing water from the potable water network.

The quantity of water used for dust suppression water use during 2018 was 15.2 ML over an area of approximately 1.82 ha, equating to 8.3 megalitres per hectare (ML/ha) over the year.

Water used in site depot

Apart from potable water, which is supplied in 20 L containers from a contractor, the remainder of water used for the office building and amenities is supplied via a 10,000 L rainwater tank, which collects rainwater from the roof of the office and maintenance shed. Since installation in 2017, the tank has not required supplementary filling from a water contractor, suggesting that captured rainwater is sufficient to service the water consumption of the site depot. The tank may be filled by a water contractor if required.

Wastewater is treated via a septic system and collected in pump out tanks which are regularly emptied by a contractor and disposed off-site. Approximately 5,000 L are collected every seven weeks on average.

17.3 Water management system

17.3.1 Stormwater

Stormwater runoff will generally be confined to roof areas, hardstand areas, and constructed unsealed haul roads. The sandy soils over the remainder of the project site will generate little surface runoff. Exposed slopes within the project site that generate runoff may cause localised sand movement and possible slumping, however these areas will be stabilised to minimise the potential for sediment runoff and possible slumping.

The existing office will continue to drain to the existing rainwater tank. Where possible, any new roofed areas will be plumbed to the tank.

Haul roads will be constructed from imported material to support the necessary traffic loads. Road design, including longitudinal and crossfall grading will divert stormwater runoff from the road surface to the adjoining landscape via sheet runoff or into shallow table drains. Runoff from haul roads will infiltrate to adjacent areas, or flow to low points in the landscape where it will subsequently infiltrate.

17.3.2 Extraction area

Extracting the sand resource in stages of disturbance will reduce water losses by maintaining surface cover and shading as long as possible and limit sand product losses though wind erosion.

As groundwater is intercepted and the dredge pond is formed, areas previously losing water to the atmosphere via evapotranspiration associated with vegetation over this area will transition to direct evaporation and direct recharge from rainfall. The dredge pond will progressively increase in size up to the completion of Stage 6, after which the pond will be retained as a feature of the rehabilitated site.

17.3.3 Processing

Dry extracted sand will leave the site with a moisture content of approximately 3% based on the results of laboratory testing of extracted material previously undertaken by Boral.

The sand/water pumped from the dredge will pass through a screen and floatation tank for fines removal, prior to being pumped through a cyclone for dewatering and then stockpiled. Dewatered sand leaving the quarry will be estimated to have a moisture content of approximately 5%.

Water and removed fines will be recycled back to the dredge pond away from dredging operations and isolated via a silt boom.

17.3.4 Dust suppression

As highlighted in **Section 4.2.2**, the existing haul road accessing the windblown extraction area will be adjusted to allow for extraction within the Stage 1 area. Alterations will also be made to internal haul roads and a designated exit via the weighbridge. The haul roads will continue to require intermittent dust suppression via a water cart contractor and the frequency will be dependent on climatic conditions and vehicle movements. The haul roads will be progressively constructed to avoid soil/vegetation disturbance and loss of sand to wind erosion.

17.3.5 Wastewater

Wastewater from the site depot will continue to be collected and disposed by a licenced waste management contractor as required during the project. No alterations to the existing septic system are required.

17.4 Water balance

The water balance for the project comprises three components:

- direct water consumption and wastewater generation associated with the site depot;
- water consumption associated with dust suppression as required over the project site; and
- alterations to landscape conditions, primarily comprising removal of vegetation and transformation of dune areas to a dredge pond, as well as losses associated with the moisture content of extracted material leaving the quarry.

17.4.1 Direct demand

Site depot

Water demand at the site depot will not change significantly over the life of the project. Additional potable water will be purchased if required. Currently, rainfall is sufficient for water demands of the site depot.

The project will increase staff numbers to six full time staff and three casual staff. The existing wastewater system can accommodate this additional load and any increase in the generation of wastewater will be managed via an increase in the frequency of servicing of the septic system by a waste management contractor.

Firefighting

A 30,000 L rainwater tank will be installed adjacent to the existing maintenance shed to provide water for firefighting. The tank will be filled with rainwater from the shed roof. The water supply contractor will fill the tank if required.

Dust suppression

The quarry used approximately 15.2 ML in 2018 to suppress dust on approximately 3 ha of unsealed haul roads. This quantity was used to estimate dust suppression water requirements for the life of the project. Dust suppression will peak when the dredge pond is at its full extent, then reduce as the pond area is rehabilitated. Water for dust suppression will continue to be supplied form the contractor.

17.4.2 Landscape changes and sand extraction

The project will interact with the Stockton Groundwater Source.

The site water balance comprises inflow from rainfall and groundwater movement through the extraction area, and outflows in the form of evapotranspiration. The quantity of recharge to groundwater is a function of rainfall depth, evapotranspiration and the condition of the soil moisture store. This system will continue under the project.

Stage 1 of the project will have no interaction with the aquifer, and water extracted during dry extraction activities will be limited to the moisture content of the sand and topsoil.

A ‘window’ to the aquifer will be created when each subsequent stage reaches the aquifer and dredging will generate loss of the groundwater resource associated with the moisture content of the material leaving the site, in addition to losses associated with direct evaporation to the atmosphere via the window to the aquifer. Conversely, the dredge pond will create a direct recharge connection between the aquifer and rainfall over the project site.

A conceptual model of both the existing condition and future condition over the footprint of the project site was conducted to establish how the water balance will change from existing conditions, and then forward over time as the sand extraction process associated with the project expands. The model was used to estimate the likely quantity of water extraction from the Stockton Groundwater Source over the life of the project.

Refer to Section 5.3.2 of **Appendix L** for model assumptions and parameters.

17.4.3 Results

The quantity of water extracted will generally increase over time as the dredge pond surface area expands, peaking at an average close to 100 ML/y in the final years of the project. Monitoring will be required during the project to verify estimated extraction rates and compare with water allocations whilst the aquifer is exposed.

As the dredge pond is created, direct rainfall to the aquifer will increase, as will evaporation and moisture losses associated with the exported sand material.

The model concluded that the net extraction of water is more likely than net import to the aquifer from above average rainfall. Generally, the project will only contribute a net import of water to the Stockton Groundwater Source in years when rainfall is at or above the 90^{th} percentile.

The water balance model of the project shows that there will be significant variability in the quantity of extraction from the Stockton Groundwater Source due to variability in rainfall and the associated changes that direct rainfall will recharge to the aquifer.

17.5 Potential impacts

17.5.1 Water management – site establishment

Given that rainfall infiltrates into the sandy soils quickly, the potential for erosion is negligible. However, access roads and the embankments of the proposed dredge pond will require VENM or other engineering fill that contain clays and other soil types of smaller particle sizes that are more erodible than existing sand material at the project site. Erosion and sediment controls will be required for areas where VENM or other erodible material are imported, in order to limit sediment movement into the established dredge pond (resulting in turbidity and deterioration in water quality in the Stockton Groundwater Source) or into adjoining native vegetation communities at the quarry.

The construction of haul roads and embankment stabilisation will be managed in accordance with an erosion and sediment control plan, which will be prepared in accordance with DECC's (2008) *Managing Urban Stormwater: soils and construction, Volume 1 and Volume 2C: Unsealed roads*, and *Managing Stormwater: Soils and Construction, Volume 2E – Mines and Quarries*.

17.5.2 Water management – operational phase

The haul roads will present a continued source of sediment in periods of high rainfall. The nature of the soil landscape at the quarry means that any eroded material from the haul road surface will be contained within close proximity to the road.

Refueling and storage of hazardous materials will be required and will present a potential for adverse impacts associated with spills, which have the potential to reach surface or groundwater resources, particularly during heavy rainfall events.

Dredge extraction involves a caged impeller which disturbs the sand profile creating a sand/water mix for extraction. Minimal sediment will be suspended during dredging operations as fines are extracted within the mix before being transferred to the wash plant via pipeline. The mix will then pass through a wash plant to remove any fines or other unwanted materials. Given the nature of the sand resource, fines content is expected to be low.

Materials filtered out in the wash plant (predominantly fines) will be pumped back to the dredge pond, away from the dredge operation to encourage settlement, and limit fines movement back though the dredge.

There is no direct connection from the project site to surface floodwaters. However, localised inundation of the project site to 3.5 m to 4.0 m AHD have been experienced at the project site. Despite the potential for occasional localised ponding in the project site, all permanent infrastructure for the quarry (existing and proposed) is located at 4 m AHD and above, and procedures will be implemented to monitor forecast heavy weather events and implement mitigative measures in response.

17.5.3 Water extraction and licensing

Water leaving the project site will include water lost to the atmosphere via evaporation of the dredge pond as well as water exported from the site as moisture content in the outgoing sand product.

Towards the end of the project, when the dredge pond is at its largest extent, total water extraction is estimated at up to 100 ML/y, assuming median rainfall within the catchment.

The project will comprise a minimal impact on the quantity of the Stockton Groundwater Source. The available water within the Stockton Groundwater Source is 14,000 ML/y and after existing landholder rights and allocations are accounted for approximately 12,000 ML/y remains. The estimated annual extraction associated with the project is approximately 1% of the available allocations from the Stockton Groundwater Source.

Boral has previously been issued a WAL for the quarry, however has a zero share allocation for the Stockton Groundwater Source. Boral will therefore be required to obtain sufficient water share allocations from DPIE prior to the commencement of the project to account for the projected quantity of water extraction. These allocations can be obtained either through the trading of existing allocations, or through application for new allocations under Section 65 of the WM Act. Such allocations have been identified as available in the WSP.

17.5.4 Drinking water resources

The Stockton Sandbeds Catchment Area is approximately 150 m to the north-east of the project site at its closest point. Historical groundwater monitoring at the quarry demonstrates that the direction of groundwater flow is away from the catchment area, flowing from the catchment area towards the quarry, and subsequently north-west towards Fullerton Cove or south-east towards the ocean.

As discussed in **Chapter 8**, the potential for adverse impacts on flow regimes and standing levels of the aquifer will be minimal, and the project is unlikely to alter the water quality of the aquifer, thereby maintaining the integrity of available water supply for Hunter Water in the Stockton Sandbeds Catchment Area and Stockton Groundwater Source.

17.6 Mitigation and management measures

The following mitigation and management measures are recommended to ensure surface water is appropriately managed at the project site.

17.6.1 Refuelling and spill management

The mitigation and management measures for hydrocarbon and chemical storage, handling and management as outlined in **Section 20.3** will be implemented.

The existing Environmental Management Strategy for the quarry will be updated to accommodate these changes to operations at the site.

17.6.2 Erosion and sediment control plans

Exposed soils generated through the construction of the haul roads and stabilised dredge pond embankments will be managed through standard erosion and sediment controls implemented in accordance with DECC's (2008) *Managing Urban Stormwater: soils and construction, Volume 1 and Volume 2C: Unsealed roads and 2D: main road construction*, and will be outlined within an erosion and sediment control plan prepared for the establishment of the project.

17.6.3 Flooding and inundation

To predict possible periods of localised inundation, rainfall and ocean level conditions will be monitored through the BoM, including storm warnings for heavy rain and high seas. In conjunction, groundwater levels will continue to be monitored in accordance with the existing groundwater monitoring program, and movement in standing water levels noted. The Quarry Manager will decide on precautionary measures to remove machinery from areas where groundwater levels may increase, and localised ponding may occur.

For the dredge pond, allowances will be made for the dredge to move to a higher level through adjustments in mooring lines and transfer pipes. Management of this risk will include a groundwater inundation management plan that includes monitoring of existing bores, flood and storm warnings as well as specific triggers for the movement of machinery and equipment and temporary storage locations.

17.6.4 Reduction of evaporation

Boral will consider implementing measures to reduce the quantity of water extraction from the Stockton Groundwater Source, particularly via evaporation from the dredge pond surface.

There are a range of technologies available to reduce evaporation through techniques which limit exposure of surface water to atmosphere by providing shade and reducing air flow (wind), and direct barriers.

17.6.5 Fines management

Any fines collected within the wash plant will be returned to the dredge pond. The water and fines return point will be located as far as possible from the dredging operation to limit reprocessing. Should fines settlement become an issue, a silt curtain will be installed to restrict fines movement between the dredge and fines return point. Dredging operations will be monitored to determine whether installation of a silt curtain is required.

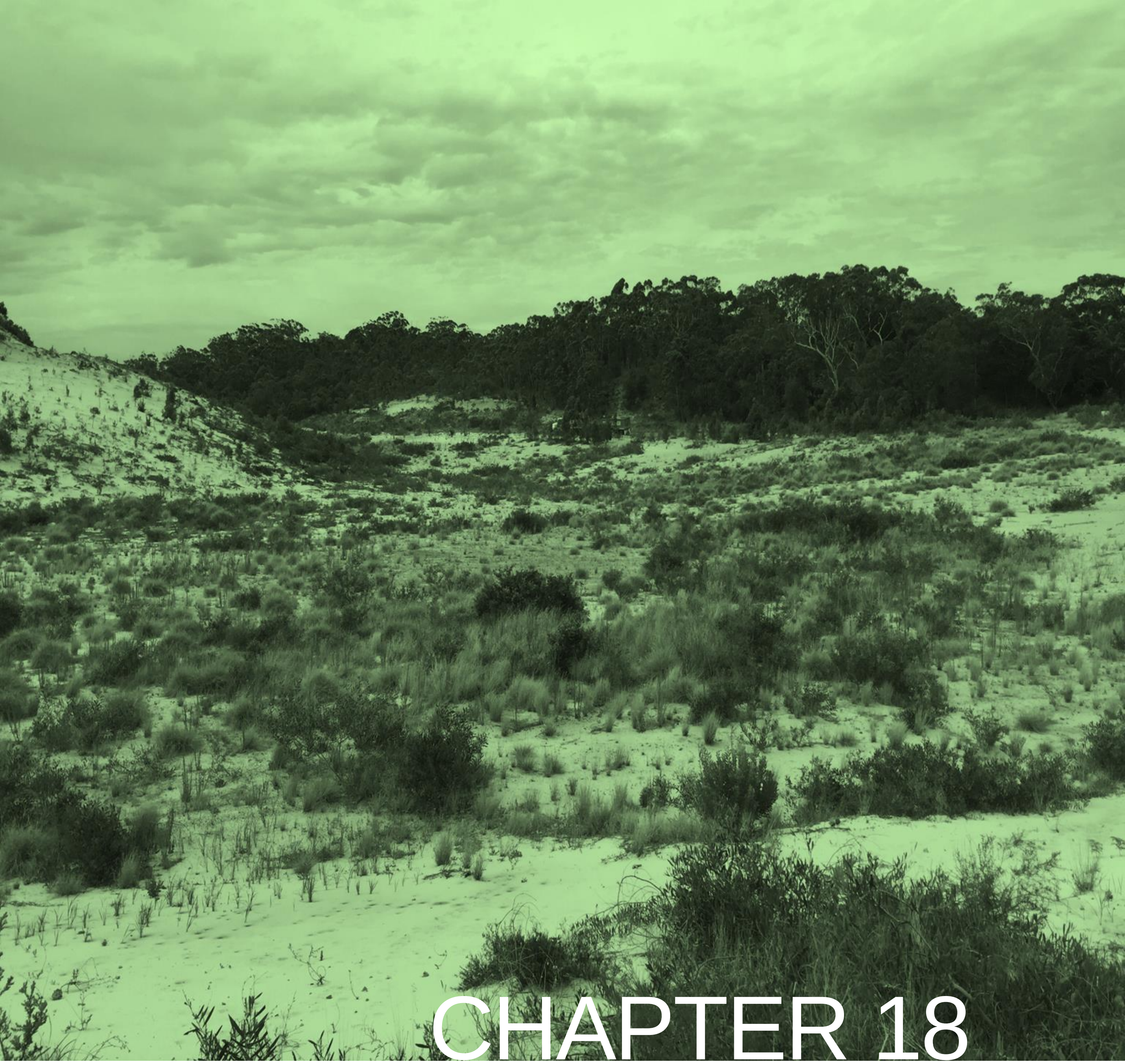
17.6.6 Water quality monitoring

Surface water monitoring within the dredge pond will follow the recommendations outlined in **Section 8.5.1**. After 12 months of regular testing, monthly sampling may be extended to bi-monthly should no exceedances or significant variations occur over time.

17.6.7 Water quantity monitoring

To gather an accurate understanding of extractions from the groundwater source and accurately estimate evaporation losses detailed measurements of the pond area, moisture content of sand material, and sand material export are required. The following monitoring is recommended:

- six monthly measurements of the dredge pond surface area, either through site survey or aerial survey;
- fortnightly measurements of the moisture content of exported sand material through stockpile measurements; and
- records of sand material leaving the project site, including the source of sand material from excavations above the aquifer or from the dredge pond.



CHAPTER 18

HISTORIC HERITAGE

18 HISTORIC HERITAGE

18.1 Introduction

Historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the NSW *Heritage Act 1977*.

This chapter describes the non-Aboriginal cultural context of the project site, significance of identified heritage items and the potential historic heritage impacts.

18.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely risks to historic heritage from the project (**Table 18.1**).

Table 18.1: Historic heritage related SEARs

Requirement	Section and appendix where addressed
identification of historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items.	18.2, 18.3

18.2 Potential impacts

As highlighted in **Section 2.6.2**, the project will not impact a registered heritage item/place protected under the NSW *Heritage Act 1977* or Port Stephens LEP.

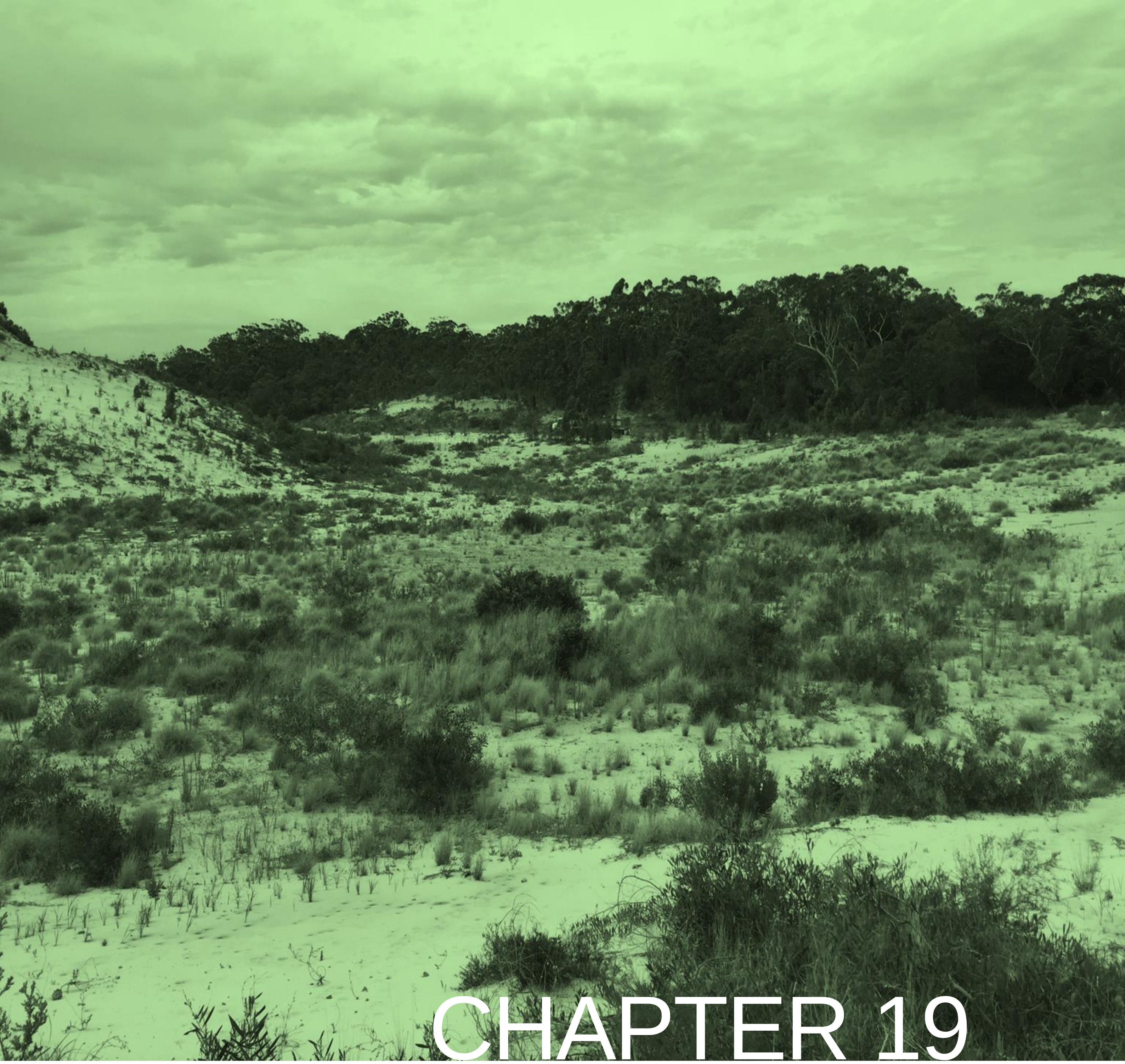
Despite proximity to the Stockton beach dune system, as highlighted in **Section 14.3.2**, the project will not impact the beach, foredune, deflation basin and mobile transverse dunes of Stockton Bight as the project site is physically removed from, and downwind of these environments. As such, the project will not impact upon the natural landscape features comprising the listing.

The project site has been subject to previous surface disturbance and is unlikely to contain any unknown historic heritage items.

18.3 Management and mitigation measures

The following mitigation measure will be implemented:

- should an item of potential Non-Aboriginal heritage be identified during project operations, works will cease, and the Quarry Manager will be contacted immediately. Appropriate measures will be taken to minimise the potential for harm to the object. Further advice will be sought from a qualified archaeologist, and subsequently DPIE Biodiversity and Conservation Division will be notified of the proposed course of action, if required.



CHAPTER 19

WASTE MANAGEMENT

19 WASTE MANAGEMENT

19.1 Introduction

Waste streams will be generated by the project and will require responsible management in accordance with the objectives of the WARR Act, POEO Act and other relevant legislative requirements.

Failure to collect, separate and store waste, or transport and dispose of waste appropriately can result in adverse impacts on the receiving environment.

19.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely risks of the project regarding waste management (**Table 19.1**).

Table 19.1: Waste related SEARs

Requirement	Section and appendix where addressed
a waste (overburden, rejects, tailings etc) management strategy;	19.2, 19.3
estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams;	19.3

19.2 Existing operations

The main waste streams generated by the quarry comprise general solid wastes and hazardous and liquid wastes from operations and servicing of equipment.

All waste generated at the quarry is separated, collected in designated waste disposal bins, reused where possible, or disposed of at an appropriately licenced waste facility.

19.2.1 Existing waste management practices

Boral has developed a waste management system for the quarry that ensures all waste generated on site is classified and managed in accordance with EPA's (2014) *Waste Classification Guidelines* and relevant regulatory requirements of the WARR Act and the POEO Act.

In accordance with the WARR Act, Boral adopts the principles of the waste management hierarchy.

These principles will continue to be upheld during the project, and be achieved by:

- purchasing recycled products where appropriate;
- developing and implementing waste management procedures to minimise the generation of waste and where unavoidable, re-use waste on-site;
- recycling as many wastes as practically possible through appropriate handling, separation, storage, and collection; and
- where waste cannot be re-used or recycled, transportation and disposal of waste off-site at an appropriately licenced facility.

19.2.2 General solid waste

The quarry generates building and demolition waste, glass, plastic, rubber, garden waste, wood, paper and cardboard. Additionally, general solid waste (putrescible), such as food waste, is generated by site personnel.

General solid waste streams are segregated where possible, and deposited in large bins, which are covered and collected fortnightly by a licensed waste removal contractor.

19.2.3 Hazardous waste

Contaminated materials generated at the maintenance shed, such as recovered oil and grease, is collected and stored in a 400 L tank for removal by a licensed recycling contractor. Approximately 800 L of oil and grease waste is generated per year.

Used hazardous substance and chemical containers, grease drums, and oil filters, are stored in accordance with standards and regulations, until collected for recycling or disposal by a licensed contractor.

Any spills in the collection areas are contained in bunds and managed in accordance with emergency response procedures.

19.2.4 Liquid waste

The septic system is inspected and pumped out regularly by a licenced disposal contractor.

19.2.5 On-site resource recovery

Cleared vegetation is mulched or stockpiled on-site for later use in rehabilitation. Following clearing of vegetation, topsoil is stripped using a dozer and stored in stockpiles.

When an extraction area is exhausted, topsoil and previously felled vegetation or mulch is re-spread over finished areas and the area is actively rehabilitated and managed. Felled timber is evenly distributed to act as a wind break for emerging seedlings and provide habitat opportunities for small fauna.

19.3 Assessment of impacts

The primary waste streams likely generated by the project will be limited volumes of general solid wastes and hazardous and liquid wastes from operation and servicing of equipment.

All waste will be managed in accordance with the existing quarry waste management system. Waste streams will be classified according to the Waste Classification Guidelines (NSW Environment Protection Authority, 2014) and disposed of accordingly.

19.3.1 Establishment phase impacts

The following waste sources are likely to be generated during establishment of the project:

- removed native and exotic vegetation;
- general solid wastes (non-putrescible), including building and demolition waste;
- excavated material (e.g. spoil) unsuitable and/or not required for backfilling and restoration;
- maintenance waste – waste generated from construction plant and machinery maintenance, such as oil and fuel; and

- general solid wastes (putrescible) and liquid waste from construction personnel.

The nature and volume of waste generated during construction will predominantly be non-hazardous and relatively minor. However, there is potential for adverse impacts on the local environment if waste is not managed appropriately.

Inappropriately managed waste will have potential adverse impacts upon:

- visual amenity and aesthetic quality of the surrounding area;
- health and safety of residents, workers and visitors;
- landfill space, through potentially reusable and/or recyclable materials contributing to landfill waste;
- native fauna through ingestion of fugitive waste materials e.g. plastic bags; and
- hazardous waste, particularly fuels or oils, leaching into local drainage lines and watercourses, leading to subsequent water quality degradation.

Construction wastes will be classified and disposed of in accordance with (NSW Environment Protection Authority, 2014), and in accordance with the resource management hierarchy principles and associated requirements of the WARR Act and NSW Protection of the Environment Operations (Waste) Regulation 2014.

19.3.2 Operational phase impacts

Waste generated during operation of the project will be the same as those currently generated by existing quarry operations **Table 19.2**.

Table 19.2: Operational waste inventory

Waste description	Waste classification	Source	Approximate quantity	Re-used on-site?	Recycled?	Disposed of on-site / off-site
Sewerage	Liquid	Main Office Facilities	5,500 L every 7 weeks	No	Yes	Off-site
Oil and grease	Liquid	Maintenance of mobile equipment	800 L / year	No	No	Off-site
Maintenance / Production waste	Solid	Workshop waste, packaging, waste from quarry processes	6 m^3 / month	No	No	Off-site
Office	Solid	General office waste	5 m^3 / month	No	No	Off-site
Paper	Solid	Office	540 kg / year	No	Yes	Off-site
Scrap steel	Solid		5 t per year	No	Yes	Off-site
Timber	Solid	Felled vegetation	20 t per year	No	Yes	On-site

These wastes will continue to be managed in accordance with waste management systems and practices, including for topsoils and felled native vegetation.

All wastes generated by operations will be classified and disposed of in accordance with (NSW Environment Protection Authority, 2014), and in accordance with the resource management hierarchy principles and associated requirements of the WARR Act and NSW Protection of the Environment Operations (Waste) Regulation 2014.

19.3.3 Cumulative impacts

General solid wastes, liquid and hazardous wastes will continue to be generated by quarry operations. However, waste quantities will be minimal, and licenced waste contractors will collect and dispose of these wastes to ensure recycling or disposal in a legislatively compliant manner.

Other land uses near the quarry, including other extractive industries, will be subject to waste related consent and EPL conditions. As such, waste at these facilities are likely to be managed in an environmentally responsible manner and in accordance with legislation, thereby minimising the potential for cumulative impacts from the project combined with nearby facilities.

19.4 Management and mitigation measures

Waste will be managed in accordance with the WARR Act by adopting the resource management hierarchy (in order of priority) of avoidance, re-use, recycling / re-processing / treatment and disposal.

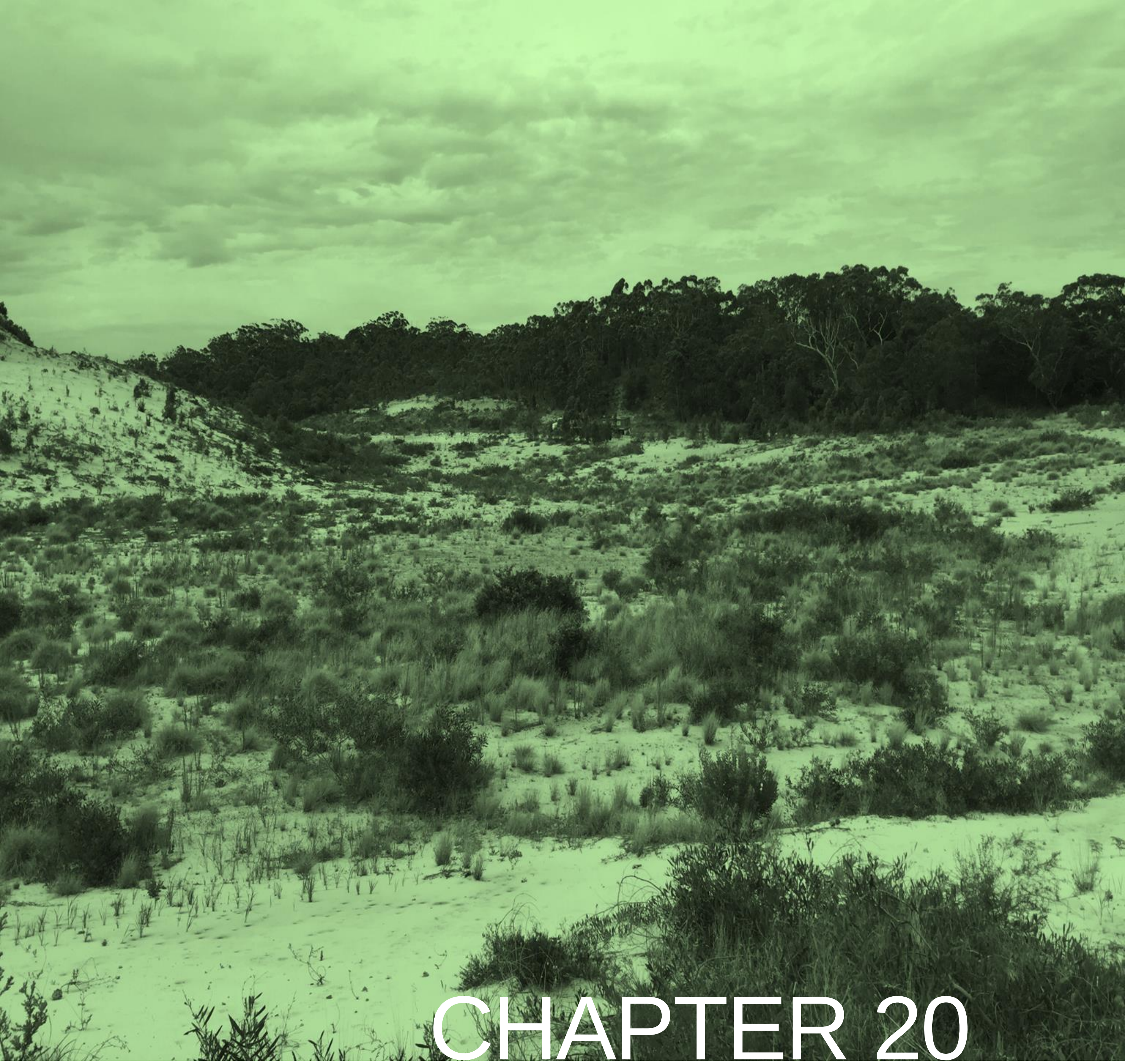
The existing environmental management strategy for the quarry will be updated as follows:

- Wastes will be quantified and classified;
- disposal/reuse strategies for each type of material;
- details of how waste will be stored and treated on site;
- identification of non-recyclable waste;
- identification of measures and initiatives to reduce, reuse and recycle; and
- procedures and disposal arrangements for potentially hazardous material.

The environmental management strategy will include the following:

- Waste will be managed in accordance with (NSW Environment Protection Authority, 2014) and relevant regulatory requirements. This will include (i) its classification prior to leaving the site and (ii) recording (via an appropriate waste tracking system) its legal off site transportation for re-use, recycling or disposal.
- Waste (excluding toilet waste) will be stored in a suitable container with a lid, and transported to an appropriate facility. Enough receptacles for general waste, hazardous waste and recyclable materials will be provided, including sufficient bins to allow separation of wastes for recycling.
- Wastes will only be disposed at a licenced waste disposal depot.
- Wastes will be securely stored so that pollutants are prevented from escaping.
- Fuel, lubricant or hydraulic fluid spillages will be collected using absorbent material and the contaminated material disposed of at a licensed waste facility.
- Hazardous or contaminated wastes (if identified) will be removed and disposed in accordance with the State and national regulations and guidelines and best practice for the removal of these materials. Hazardous materials will only be removed by suitably qualified, licensed and experienced contractors.
- Personnel will be required to notify the Quarry Manager, and follow approved SafeWork NSW procedures for the handling and transport of any asbestos containing material wastes to an EPA approved facility.
- Documents and records of the transport and fates of all materials removed from the project site will be kept as proof of correct disposal and for environmental auditing purposes.

- Waste streams will be sorted to maximise the reuse/recycling potential and minimise disposal costs.
- Waste will be covered, stored and removed in a timely manner so as not to attract native animals or vermin.



CHAPTER 20

HAZARDS AND RISK

20 HAZARDS AND RISK

20.1 Introduction

This chapter provides details on the potential hazards and risks associated with the project, including public safety and bushfire risks, and, where required, management measures to reduce these to acceptable levels.

Additionally, this chapter describes the handling, transport, storage and use of dangerous goods in the project site, and the implications of these dangerous goods with respect to SEPP 33.

20.1.1 Assessment guidelines and requirements

The SEARs require an assessment of the likely risks of the project to public safety (**Table 20.1**).

Table 20.1: Hazards related SEARs

Requirement	Section and appendix where addressed
an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks (including the identification of potential ignition sources during construction and operation) and the transport, handling, storage and use of any chemicals, fuels and, hazardous or dangerous goods; and	20.2
proposed bushfire protection measures including vegetation management, fire suppression capabilities and operational access for firefighting appliances to the site;	20.3

20.2 Potential impacts

20.2.1 Hazardous substance and dangerous goods management

The hazardous substances and dangerous goods required for the project include hydrocarbons, such as fuels (diesel), oils and greases.

Diesel

Diesel is classified as a combustible liquid by Australian Standard (AS) 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids* (AS 1940:2004) (Class C1) for the purpose of storage and handling, but is not classified as a dangerous good by the Australian Dangerous Goods (ADG) Code (National Transport Commission, 2007).

Approximately 105,160 L of diesel was used by the existing operations in 2018, a decrease of approximately 11,840 L from 2017 due to reduced production levels in 2018.

The project will require the continued use of diesel. The quarry has an above ground 4,200 L diesel storage tank in a bunded area of the maintenance shed. Heavy vehicles will be fuelled off-site, with the dredge, front-end loader, generators and excavators to be re-fuelled on-site with a mobile fuel tanker. Diesel will be transported, stored, handled and managed in accordance with regulations and industry standards. The tanker will be parked in a temporary bunded area on an impermeable surface while re-fuelling, and spills in the collection area will be contained and managed in accordance with emergency response procedures. Any incidental contamination will be classified and disposed of in accordance with waste legislation. A sealed system will transfer fuel from the mobile tanker to the dredge.

The storage and use of diesel is not potentially hazardous under SEPP 33 as the tank will be bunded and stored away from other flammable materials.

Oils and greases

Oil is classified as a combustible liquid (Class C2) by AS 1940:2004.

Boral will need to store small quantities of hydrocarbons, typically oils and greases for maintaining plant and equipment. These will be stored in an existing 400 L bunded tank, installed in accordance with relevant Australian Standards. Recovered oil and grease material is then collected for removal by a licensed recycling contractor.

Oils and greases will not be stored within the same bund as other flammable liquids, and as such would not be subject to the Applying SEPP 33 screening thresholds. As a result, the storage of these materials is not considered potentially hazardous in terms of SEPP 33.

20.2.2 Bushfire management

The site is identified on bushfire planning maps as ‘Vegetation Category 1’ requiring the preparation of a bushfire management plan.

The existing internal haul roads and site depot were previously assessed for bushfire hazard (Boral Country, 1997), which concluded:

- The sand extraction operations provide no detrimental impact on the ignition or progression of bushfires. The availability of earthmoving equipment and a water cart on- site has a significant positive impact on the firefighting capacity of the area.
- The maintenance of the haul road also contributes to easy access to the area by firefighting crews. The local bushfire brigade has 24-hour access to the site.
- The development of the Boral site has improved overall access to any fires progressing through the vegetated dunes as the haul road provides both a firebreak and access road for firefighting equipment.
- Adequate fire access is provided for the Seaside Village Estate residential development at Fern Bay to the south-west of the quarry, minimising the likelihood of fires encroaching on the site from the south. Fires from the north and east are less common, and existing access in these directions provide for firefighting.
- The water cart will be available at all times for firefighting and employees are trained to be diligent with regard to fire risk and necessary emergency procedures.
- Adequate cleared land occurs around fuel tanks to minimise fire danger.

The bushfire season in the Lower Hunter region predominantly occurs during the hotter months of the year, between October and March. The prevailing weather conditions associated with the bushfire season are north-westerly winds accompanied by high day time temperatures and relative low humidity.

The main sources of bushfire ignition in the region are:

- arson;
- car dumping;
- fugitive embers from legal burn off events;
- fugitive embers from illegal burning; and
- arcs from power lines in high winds.

Most vegetation in the project site consists of stands of replanted woodland, interspersed with grassland and exposed sand.

The land in the project site has a low to moderate risk of bushfire due to limited available fuel source, existing vegetation composition interspersed with disturbed areas, a large former open quarry pit and site infrastructure. Undisturbed vegetated surrounding the project site, including environmental conservation areas to the north-east and south-west represent a high risk of bushfire. These adjoining environmental conservation reserves will experience build-up of high fire fuel sources over time, associated with dense vegetation canopy contributing to leaf litter and tinder on the ground surface.

A combination of relatively low rainfall, dry nature of the landscape, topography, and dense vegetation and high fuel source in the adjacent environmental conservation areas could pose a bushfire risk to the quarry. Bushfires in the reserves will be managed by NSW Rural Fire Service (RFS) and the National Parks & Wildlife Service. Boral will continue to work with the RFS and land authorities to co-ordinate any scheduled burn off events, and monitor and report any fires, suspicious behaviour or hazardous fuel loads within proximity to the quarry boundary.

New development in NSW is assessed for bushfire risks in accordance with RFS (2006) *Planning for Bushfire Protection* (PBP). Extractive development is regarded as ‘other’ development in PBP and must satisfy the aim and objectives of PBP.

Project infrastructure such as the wash plant, site office and car park are adjacent to Category 1 bushfire prone vegetation and in the surrounding 100 m buffer. The wash plant will be valuable site infrastructure, and the site office will contain personnel during work hours. These assets could be vulnerable to property destruction, and personnel vulnerable to injury or fatality from a fire. The wash plant and car park will be outside the vegetation buffer, however the site office will be inside the buffer.

Bushfire hazards were assessed (**Appendix M**) in relation to the aim and objectives of PBP and is summarised below.

The aim of PBP is:

To use the NSW development assessment system to provide for the protection of human life (including fire fighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, on-site amenity and protection of the environment.

As demonstrated in the consideration of the PBP objectives below, the project will present low bushfire risk and the implementation of bushfire protection measures will not impact the environment.

The objectives of PBP are to:

- *afford occupants of any building adequate protection from exposure to bushfire:*

Occupants of the site depot will have a reduced exposure to bushfire following the establishment of an asset protection zone (APZ). Evacuation planning for the quarry in the event of bushfire will clearly indicate to workers to evacuate early and in a direction away from the fire.

- *provide for a defendable space to be located around buildings:*

A 25 m APZ will be implemented around the buildings in the site depot, and as such defendable space will be available surrounding the buildings from where the fire will be fought. If there is a bushfire, fire fighters and emergency response personnel will have direct access to the surrounding bushland via the internal road network of the quarry.

- *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition:*

PBP provides for APZs, which are a buffer area between the bushfire hazard and buildings. The 25 m APZ for the site depot was determined in accordance with Appendix 2 of PBP.

- *ensure that safe operational access and egress for emergency service personnel and residents is available:*

The existing access to the quarry along Coxs Lane will be an adequate emergency evacuation route in the event of a fire. Similarly, the existing and proposed access roads will provide suitable access for emergency service personnel and the RFS during a fire.

- *provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ):*

The APZ will be maintained in accordance with Appendix 5 of PBP and the RFS Standards for Asset Protection Zones.

- *ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush firefighting):*

As the quarry is not connected to the potable water network and relies on external water supply, a minimum 20,000 L static water supply will be required for the project and will be equipped with firefighting fittings. There will be a plentiful supply of water in the dredge pond once it is established, which will be available to emergency services for use at the quarry and region.

The assessment of the project against the aim and objectives of PBP concludes that with the implementation of APZs, the site depot and other infrastructure will be sufficiently separated from bushfire hazard vegetation and the risk of bushfire attack will be low.

Notwithstanding the above, activities associated with the project may result in inadvertent bushfire ignition. Such activities may include grass fires sparked by the hot exhaust of vehicles driving or parking in long, dry grassland; fires sparked during hot work activities such as welding; clearing of vegetation; or stockpiling of removed vegetation and timber (prior to reuse in revegetation or rehabilitation) contributing to a fuel source for ignition. This risk can be suitability be managed by continued implementation of the site's emergency management plans and hot works protocols.

Boral will continue to work with the RFS and respective land authorities to co-ordinate any scheduled burn off events, and monitor and report any fires, suspicious behaviour or hazardous fuel loads within proximity to the quarry boundary.

20.2.3 Unexploded explosive ordinance

The project site was historically part of the Stockton Beach Artillery Proof Range from 1942 to 1944 (ERM, 2005). The Artillery Proof Range extended from just south of Boral's property to Lavis Lane. Most of the firing was from Snake Battery Gun Position (to the south of Boral's land holding), with the projectiles impacting on the beach and adjoining sand dunes. Artillery (18 pounder) was also fired from the Ypres observation post (near the depot) towards the beach with the main impact area expected to be at the northern end of Boral's property.

ERM (2005) mapped the project site as having no risk for unexploded explosive ordinance, as it has been previously disturbed by quarrying activities from 1996 to 2008.

20.2.4 Soil and water contamination

Hydrocarbon spills could cause localised contamination of soil and water and impact health and safety.

Uncontrolled releases of hydrocarbons to the environment may damage soils and aquatic ecosystems, and fires can occur if these materials are ignited.

Potentially hazardous materials such as hydrocarbons will be contained in bunded areas in accordance with relevant Australian Standards, codes and regulations.

Refuelling and maintenance activities will be restricted to bunded hardstand areas within the site depot. Therefore, the risk of soil, surface water and groundwater contamination from spills will be low.

20.2.5 Risk to workers

As with any extractive industry operations, daily operations have inherent risk to workers and contractors and have the potential to result in injury or fatality if workers are ill informed of the hazards involved, or risks associated with plant and machinery are not managed. Examples of activities which could result in injury or fatality include crush injuries by moving plant and equipment, motor accidents or crush by heavy vehicles, exposure to hazardous materials, heat exhaustion, working from heights or confined spaces, and exposure to airborne dust and industrial noise.

Boral has a rigorous workplace health and safety regime, as required by the NSW *Work Health and Safety Act 2011* (WHS Act). All workers, contractors and visitors will be inducted on safety protocols and procedures before entering active parts of the site. All personnel working on the site will be required to wear personal protective equipment such as hard hats, high visibility clothing and enclosed footwear. Regular communication of safety requirements and initiatives will also be undertaken on a regular basis.

Provided the implementation of workplace health and safety protocols during construction and operation of the project, as required by the WHS Act and other relevant regulations or standards, the potential for injuries or fatalities to workers, contractors or visitors to the site will be minimised.

20.2.6 Public safety

Risks to public safety may arise where members of the public gain unauthorised access to the site. This is particularly hazardous as it could result in potential fatality for members of the public associated with movement of heavy vehicles and moving plant.

There were nine incidents during 2018, predominantly associated with recreational vehicles and pedestrians entering the quarry either unintentionally or deliberately to access the beachfront.

There is a security gate at the quarry entrance on Coxs Lane. This gate is closed and locked overnight when the site is unoccupied but left open during operation hours to permit the entry and exit of heavy and light vehicles from the site office and weighbridge.

There is a high visibility line and bunting on the fencing along the Stockton Bight windblown extraction area, which demarcates the Boral property boundary, and includes warning signage.

Security fencing and high visibility line and signage are inspected regularly by quarry personnel, with posts for signage and high visibility line made of flexible shatterproof plastic to prevent possible injury during possible collision.

The following management measures are implemented:

- **Operation and maintenance of safe batters –**a working extraction face that does not produce a grade of greater than 1:3 (V:H) is maintained to blend the extraction area with the surrounding dune system to limit risks to recreational vehicles.
- **Equipment requirements –** heavy earthmoving equipment operates with safety equipment including flashing beacons for visibility in all weather conditions, radio communication and rear cameras for reversing movements.

- **Operating hours –** operations are limited on Saturdays, unless there is increased supply demand. Although operations are approved on Saturdays between the hours of 6:15 am and 12 pm (extended to 3 pm during major supply contracts), Boral reduces these hours of operation wherever possible to minimise the potential for contact with recreational users of the beach.
- **Trespassing or emergency assistance procedures –** personnel are trained to inform site management if members of the public are observed on the site in either a trespassing capacity or seeking emergency assistance. In response, the operation of all heavy machinery is ceased until the party is removed from site and it is safe to resume operations.

To address the risks to public safety, Boral will continuously review and improve security at the site, including new fencing, security cameras, gates and signage.

All visitors to the site will be required to report to the site administration office and register prior to gaining entry to the active areas of the site.

With these security initiatives in place, coupled with a regular review and inspection of the integrity and effectiveness of these measures, the potential for members of the public to gain unauthorised access to the quarry will be minimised.

20.2.7 Road safety

Heavy vehicles associated with dispatch of sand product, importation of VENM to the site and deliveries of consumables will frequently travel along Nelson Bay Road and the wider road network. Potential hazards associated with product transportation may occur in the event of a motor vehicle accident, or tip over resulting in the spill of materials across the roadway. Such events could result in injury, fatality, or general inconvenience (e.g. road closures) to the general public who utilise these roadways.

As outlined in **Chapter 12**, the project will not result in negative impacts to other road users and the safety of the public road network and Boral will implement driver awareness training for all staff at the site, with a focus on the correct protocols when entering and exiting the site and driving on public roads.

20.2.8 Cumulative impacts

Despite the project being in proximity to other extractive land uses (including the windblown sand extraction area), there will be no significant cumulative risks as a result of the proximity of the project to these operations. All technical assessments of the potential impacts of the project, have where relevant, considered the cumulative impacts of the development combined with existing activities in the area thereby assessing the cumulative impacts of the project.

Other land uses near the quarry, including other extractive industries, will be subject to hazard related consent and EPL conditions. As such, hazards and risks associated with these facilities are likely to be managed in an environmentally responsible manner and in accordance with legislation, thereby minimising the potential for cumulative impacts from the project combined with nearby facilities.

20.3 Mitigation and management measures

20.3.1 Hazardous substances

The objectives of hazardous substance storage and handling are to avoid contamination of soil and water and to minimize risks to health and safety.

A pollution and incident response management plan (PIRMP) has been prepared to manage potential chemical or hydrocarbon spills. The PIRMP will be updated as follows to incorporate the project:

- All personnel will be trained in hazardous substance management, emergency response and the use of spill kits.
- Appropriately sized and stocked spill response kits will be provided in strategic areas of the quarry and in vehicles used to transport hazardous materials to and from the site.
- Spill response kits will be maintained, clearly identified and readily accessible for use in case of accidental spillages. Key staff will be trained in their use, application and disposal of contaminated material.
- Potential chemical pollutants (e.g. fuels, oils, lubricants, paints, etc.) will be stored in appropriate containers in bunded areas in vehicles or designated storage areas to minimise the risk of spillages and mobilisation of pollutants into the soil or stormwater drains.
- Equipment will not be used if there are signs of fuel, oil or hydraulic leaks. Leaks will be repaired immediately, or the equipment will be removed from site and replaced with a leak-free item.
- Soil contaminated by spills will be excavated, classified in accordance with Waste Classification Guidelines, and disposed of at a licensed waste management facility, or remediated on site in accordance with a contaminated land management action plan to be prepared by a contaminated land specialist.

20.3.2 Bushfire management

The following management measures will continue to be implemented:

- Fire extinguishers will continue to be provided in the depot. The water cart and front-end loader will continue to be available for firefighting.
- The existing haul road to the windblown sand extraction area has been constructed and will continue to be maintained to enable ready access for fire fighting vehicles.
- Internal roads at the quarry will continue to be maintained for operational and firefighting purposes.
- All employees will continue to be trained through the induction process to be vigilant with regard to fire prevention, emergency procedures and reporting of fires to the RFS.

The following additional management measures will be implemented:

- following the approval of the project and for the life of the quarry, the APZ around the depot buildings will be maintained to a distance of 25 m as an inner protection area, as outlined in Appendix 5 of PBP and the NSW Rural Fire Service's document Standards for APZs;
- the existing workshop will have the polycarbonate roofing replaced with metal roof sheeting;
- the new haul roads will comply with Appendix 5 of PBP comprising a minimum 6.5 m in width, with a turning bay with minimum 12 m outer radius at the termination of the road;
- water, electricity and gas utilities will comply with Section 4.1.3 of PBP;
- a 30,000 L static water supply with firefighting fittings will be installed;
- the depot will be landscaped in accordance with Appendix 5 of PBP and managed and maintained; and
- the Quarry Manager will incorporate the new demountable building into the existing emergency evacuation plans, with specific consideration of bushfire evacuation planning.

20.3.3 Soil and water contamination

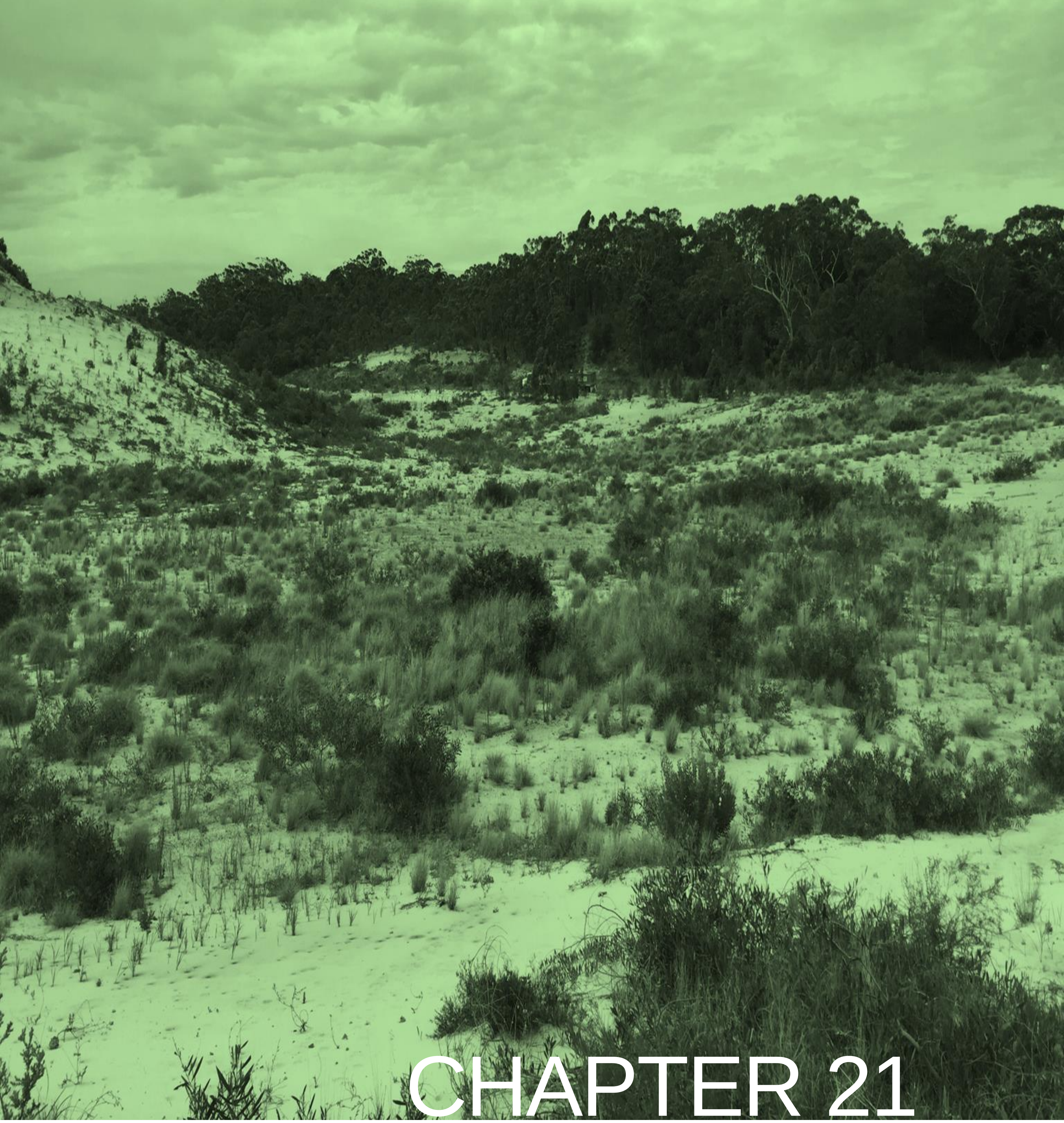
Plant and equipment will be maintained to minimise the potential for leakages, while appropriately sized and stocked spill response kits will be provided in strategic areas of the site, and in vehicles.

A PIRMP has been developed by Boral as part of the approved windblown sand extraction project to manage any potential chemical or hydrocarbon spills. The PIRMP will be updated to incorporate the project.

20.3.4 Risk to workers

Designated first aid and emergency response equipment will be available during construction and operation phases of the project. Appropriately trained personnel will be on site throughout the life of the operations to provide first aid and respond to site emergencies.

Any injuries incurred at the quarry will be reported and investigated in consultation with NSW Resource Regulator and other relevant authorities. Any recommendations or findings of investigation reports will be implemented by Boral where feasible and practical.



CHAPTER 21

ECONOMICS

21 ECONOMICS

21.1 Introduction

This chapter summarises the economic assessment report, which is in **Appendix N**. It describes the Cost Benefit Analysis (CBA), local effects analysis (LEA) and supplementary local effects analysis of the project.

21.1.1 Assessment requirements

The SEARs require an assessment of the likely economic impacts of the project (**Table 21.1**).

Table 21.1: Economics related SEARs

Requirement	Section and appendix where addressed
An assessment of the likely economic impacts of the development, paying particular attention to:	Chapter 21, Appendix N
▪ the significance of the resource;	Section 1.2, Appendix N
▪ the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates;	Section 21.2, Section 21.3, Appendix N
▪ the demand for the provision of local infrastructure and services.	Section 21.2.1, Appendix N
The reasons why the development should be approved having regard to physical, economic and social considerations, including the principles of ecologically sustainable development.	Section 6.3.2

The following guidelines were used for the assessment:

- Guidelines for the economic assessment of mining and coal seam gas proposals (NSW Department of Planning and Environment, 2015); and
- Draft guideline for economic effects and evaluation in environmental impact assessment (Planning NSW, 2002).

21.1.2 Overview of assessment methods

Cost benefit analysis

CBA is the standard technique applied to identify changes in aggregate wealth, from a national perspective, associated with alternative resource use patterns.

CBA compares the present value of aggregate benefits to society as a result of a project with the present value of the aggregate costs. It is the financial and non-financial values held by individuals in society that are relevant. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

The key steps in CBA are:

1. **Establish the base case** against which to assess the potential economic, social and environmental impacts of changes due to the project.
2. **Define the project** including all significant inputs required to achieve the project's objectives.
3. **Quantify the changes** from the base case resulting from the project. This will focus on the incremental changes to a range of factors (for example, environmental, economic, social) resulting from the project.
4. **Estimate the monetary value of these changes** and aggregate these values in a consistent manner to assess the outcomes. Where market prices exist, they are a starting point for valuations of both outputs and of inputs used for production. For non-market goods, as for many environmental impacts and some social impacts, the aim is to value them as they will be valued in money terms by the individuals who experience them.
5. **Estimate the net present value (NPV)** of the project's future net benefits, using an appropriate discount rate.
6. **Undertake sensitivity analysis** on the key range of variables, particularly given the uncertainties related to specific benefits and costs.
7. **Assess the distribution of costs and benefits** across different groups.
8. **Report CBA results, including all major unquantified impacts** so the appraisal addresses and incorporates all material relevant to the decision maker.

Local effects analysis

The LEA complements CBA by translating effects at the NSW level to impacts on the communities near the project site (using Statistical Area Level 3 – the LGA). It also provides additional information to describe changes that are anticipated in a locality, such as employment changes. LEA informs the scale of change rather than being representative of costs and benefits to the local community.

The local effects analysed in a LEA are:

- local employment and income effects;
- other local industry effects, for example on suppliers; and
- environmental and social change in the local community.

21.2 Cost benefit analysis

21.2.1 Cost and benefit estimates

CBA is concerned with whether the incremental benefits of the project exceed the incremental costs and, therefore, whether the community will, in aggregate, be better off 'with' the project compared to 'without' it.

The base case (without the project proceeding) for the CBA was continued operation of the windblown sand extraction area with extraction of a remaining sand resource of 1.45 Mt until 2028. On completion of the operation, final rehabilitation of disturbed areas would occur.

In contrast, the project will extract at a rate of up to 0.5 million tonnes per annum (Mtpa). Until such time as the current windblown sand extraction area development consent ceases, the windblown sand extraction area and the project will run in parallel to reach a maximum extraction and processing quantity from the site of up to 0.75 Mtpa.

Relative to the base case, the project may have incremental economic benefits and costs as described in **Table 21.2**.

The main potential economic benefit is the producer surplus (net production benefits) generated from sand extraction, producer surplus generated from ex-quarry transportation to customers, and any wage benefits to employment. The main potential economic costs relate to any environmental, social and cultural costs of quarrying and product transportation.

The environmental, social and cultural costs are only economic costs to the extent that they affect individual and community well-being through direct use or non-use of the environmental factors. Unless community wellbeing is significantly affected by these, only mitigation, compensation or offsetting costs are included in the CBA.

The analysis period was 25 years and was in real values with 7% discounting. Where available, competitive market prices were used as indicators of economic values.

Production costs

Production costs were applied as follows:

- opportunity cost of land – the land is owned by Boral, with a leased Crown land title. This land could be used for rural production rather than extractive industry and has an estimated value of $2.5 million (M) in 2028.
- capital equipment and infrastructure – there is an opportunity cost of using this equipment for the project that holds some residual market value. For the purposes of the CBA, it was assumed that there is no residual value of capital equipment and infrastructure.
- development cost – capital costs for replacement and upgrades of site infrastructure and purchase of mobile plant and equipment, estimated at $6 M.
- additional one-off costs – $2.5 M was attributed to acquisition of biodiversity offsets and WAL and installation of a water storage tank for firefighting purposes.
- annual operating costs – operating costs of $3 M per year include those associated with project operations progressive rehabilitation and administration (including labour). Operating costs do not include royalties or depreciation.
- rehabilitation and decommissioning costs – the cost to decommission and rehabilitate the project site will be approximately $100,000.

Production benefits

Production benefits were applied as follows:

- avoided rehabilitation and decommissioning costs – by undertaking the project there are no avoided or delayed rehabilitation costs associated with the existing windblown sand development consent. This is because the existing development consent relates to sand extraction in a different location to that proposed for the project. Final rehabilitation under the existing development consent will occur at the end of that consent (i.e. 2028), regardless of the project. The site has minimal infrastructure, comprising a site office with amenities, workshop and weighbridge. Minimal decommissioning costs are assumed.
- value of sand – the main economic benefit of the project will be the market value of the annual sand extracted for external and internal sale.
- residual value at end of evaluation period – it is assumed that rehabilitated land (not including the biodiversity offsets) has a residual value of $2.5 M in accordance with its current land value, and that capital equipment has no residual value.

As product transport externalities are a consideration of the EIS, economic benefits associated with transportation of sand product to customers were considered.

Environmental, social and cultural impacts

Costs or benefits were not attributed to environmental, social or cultural impacts as:

- the opportunity costs of any foregone rural production were incorporated in the CBA by inclusion of the full value of land required for the project (including land already owned by Boral).
- there will be no material noise, air quality, historic heritage or visual impacts.
- the opportunity cost of extracting up to 100 ML/year from the Stockton Groundwater Source was included in the operating costs by applying an assumed market value of water of $5,000/ML.
- no private registered bores will be impacted by the project and hence no material impacts from an aggregate economic efficiency perspective were identified for inclusion in the CBA.
- the capital and operating costs of providing biodiversity offsets and installation of a water storage tank for firefighting purposes were included in the capital and operating costs of the project.

Employment

The project will result in all five existing jobs at the quarry being retained together with an additional two new full-time jobs and two casual jobs at the quarry. In addition, jobs associated with the transportation of quarry material will also be retained and additional transport jobs generated.

The wages associated with employment are considered in the CBA as an economic cost of production, with this cost included in the calculation of net production benefits (producer surplus).

Adjoining land values

All land required for the project is owned by Boral. No benefits to other landholders via land prices in excess of the opportunity cost of the land will occur.

Public infrastructure

No net infrastructure costs to the NSW Government are envisaged as a result of the project. Given that additional employment will likely be sourced from existing residents of NSW, no additional demand for community infrastructure is envisaged.

21.2.2 Consolidated value estimate

The present value of costs and benefits, using a 7% discount rate, are summarised in **Table 21.2**. The project is estimated to have total net production benefits (quarrying and product transportation) of $48 M. Assuming 25% foreign ownership of Boral, $41 M of these net production benefits will accrue to Australia.

For the project to be questionable from an economic efficiency perspective, all incremental residual environmental impacts from the project will need to be valued by the community at greater than $41 M.

However, most of the potential impacts are internalised into the capital and operating costs of Boral via mitigation, offset or compensation, and hence are incorporated into the estimate of net production benefits. Consequently, the project is estimated to have net social benefits to Australia of $41 M and hence is desirable and justified from an economic efficiency perspective.

Table 21.2: Global and national cost benefit analysis results

	Costs		Benefits	
	Description	**Value ($M)**	**Description**	**Value ($M) (present values at 7% discount rate)**
Net production benefits from quarrying	Opportunity cost of land	1	Avoided decommissioning and rehabilitation costs	0
	Opportunity cost of capital	0	Financial sand – internal and external sales	72
	Development costs	7	Residual value of capital	1
	Operating costs	27	Residual value of land	0
	Decommissioning and rehabilitation costs	0		
	Sub-total	***34***	***Sub-total***	***73***
	Net production benefits			**39 (32)**
Net production benefits from ex quarry transport	Transport costs.	72	Transport revenue	81
	Net production benefits			**9 (9)**
	Total net production benefits			**48 (41)**
Environmental, social and cultural impacts	Noise	No property impacted by exceedances	Market values of employment	N/A
	Air quality	No property impacted by exceedances	Economic benefits to existing landholders	N/A
	Surface water and groundwater	Cost of WAL included in capital costs	Economic benefits to suppliers	N/A
	Ecology	Some loss of values but offset. Cost of offset included in capital and operating costs		
	Road transport impacts	No material network, level of service or safety impacts		
	Aboriginal heritage	No material impacts		
	Bushfire hazard	Additional cost of water storage tank and firefighting equipment included in capital costs		
	Historic heritage	No material impacts		

	Costs		Benefits	
	Description	Value ($M)	Description	Value ($M) (present values at 7% discount rate)
	Visual	No material impacts		
	Greenhouse gas	No material impacts		
	Net public infrastructure costs	No material impacts		
	Loss of surplus to other industries	No material impacts		
	Non-market impacts sub-total	**0**		**0**
Net social benefits				**48 (41)**

21.2.3 NSW costs and benefits

The costs and benefits of the project to NSW are summarised in **Table 21.3**. The potential impacts were apportioned to NSW as follows:

- 32% of the company tax (sand extraction and product transport) goes to NSW;
- 32% of the residual net producer surplus (sand extraction and product transport) goes to NSW; and
- 100% of residual net producer surplus of transport provision is apportioned to NSW.

All other potential environmental, social and cultural impacts accrue to NSW households. However, these impacts are largely mitigated, compensated or offset by Boral.

The estimated net social benefits of the project to NSW are estimated at $17 M, present value at 7% discount rate (the latter including employment benefits). Consequently, as well as resulting in net benefits to Australia, the project will also result in net benefits to NSW.

Any unquantified residual impacts of the project after mitigation, offset and compensation will need to be valued at greater than $17 M, present value for the project to be questionable from an NSW economic efficiency perspective.

Table 21.3: NSW cost benefit analysis results

Costs		Benefits	
Description	**Value ($M)**	**Description**	**Value ($M) (present values at 7% discount rate)**
Environmental, social and cultural impacts		**Net production benefits of quarrying**	
Noise	No properties impacted by exceedances	Direct company taxes	4
Air quality	No properties impacted by exceedances	Residual net production benefits	7
Surface water and groundwater	Cost of WAL included in capital costs	***Sub-total***	***11***
Ecology	Some loss of values but offset. Cost of offset included in capital and operating costs	**Net production benefits of product transport**	
Road transport	No capacity or safety issues.	Boral company tax	1
Bushfire hazard	Additional cost of water storage tank and firefighting equipment included in capital costs	Boral residual net production benefits	6
Aboriginal heritage	No material impacts	***Sub-total***	***7***
Historic heritage	No material impacts	**Additional benefits**	
Visual	No material impacts	Market values of employment	N/A
Net public infrastructure costs	No material impacts	Economic benefits to existing landholders	N/A
Loss of surplus to other industries	No material impacts	Economic benefits to existing suppliers	N/A
Total	**0**	***Sub-total***	***0***
Net social benefits to NSW			**17**

Incidence of NSW costs and benefits

The costs and benefits of the project to NSW will potentially be distributed among the stakeholders summarised in **Table 21.4**.

Table 21.4: Incidence of NSW costs and benefits

Benefits and costs	Incidence of costs and benefits	Magnitude of impact ($M)
Net production benefits of quarrying		
Direct company tax	NSW Government and households	4
Residual net production benefits	Boral and its NSW shareholders	7
Net production benefits of product transport		
Boral company tax	NSW Government and households	1
Other transport providers residual net production benefits	Other transport providers and their owners/shareholders	6
Additional benefits		
Wage benefits to employment	Employees of the project who reside in NSW	N/A
Economic benefits to existing land holders	Local landholders who sell land required for project including buffer land	N/A
Economic benefits to suppliers	Regional and State suppliers of inputs to production	N/A
Environmental, social and cultural costs		
Noise	Adjoining landholders.	No properties impacted by exceedances
Air quality	Adjoining landholders	No properties impacted by exceedances
Surface water and groundwater	Local surface water users	0.5 - cost of WAL included in capital costs
Ecology	Local and NSW households	2 - some loss of values but offset. Cost of offsets included in capital and operating costs
Road transport	Local residents	No material network, level of service or safety impacts
Aboriginal heritage	Aboriginal people and other local and NSW households who value Aboriginal heritage	No material impacts
Historic heritage	Local and NSW households who value heritage	No material impacts
Visual	Adjoining landholders and those travelling past the quarry	No material impacts
Greenhouse gas	Local and NSW households	No material impacts
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the project	No material impacts

21.3 Local effects analysis

Two different methods were used to assess local effects, with the local effects analysis summarised in this section. The Port Stephens, Newcastle and Maitland LGAs were used as the local area.

The project will have a direct effect by continuing to employ a minimum of five people on-site. Assuming the project did not proceed, these employment opportunities will gradually reduce in line with reduced production and cease following 2028.

The project is estimated to provide continued transport employment for 17 people from the local area, plus employment for an additional nine people from the local area. Based on estimated wages for quarry workers and average wage from the input-output table for the road transport sector, the project is estimated to provide initial incremental net income to the local area of $0.6 M increasing to around $1 M when production levels reduce to 500,000 tpa following 2028. The increased disposable net income in the region may be as high as $1.6 M if current production levels could not be maintained under the base case due to shortages of sand.

The level of benefit to the local area economy, may be reduced if people employed by the project will otherwise have been employed elsewhere in the local area, and the increased demand for labour as a result of the project has no job chain effects (i.e. it is assumed that employment for the quarry and transport will simply substitute for other jobs in the region).

Non-labour expenditure to the local area will be $2.4 M per year, when production associated with the project is at its peak of 750,000 tpa.

The incremental expenditure by employees and non-labour expenditure that is captured by the local area provides flow-on economic activity to the local economy, which can be estimated in terms of economic activity indicators of output, value-added, income and employment.

21.4 Supplementary local effects analysis

The supplementary LEA uses input-output (IO) analysis to identify the gross economic activity associated with the project on the local economy. It involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.

The IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of indicators of economic activity – output, income, value-added and employment. Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

The project is estimated to make up to the following incremental contribution to the regional economy for 25 years:

- $5 M in annual direct and indirect regional output or business turnover;
- $3 M in annual direct and indirect regional value added;
- $1 M in annual direct and indirect household income; and
- Nine direct and indirect jobs.

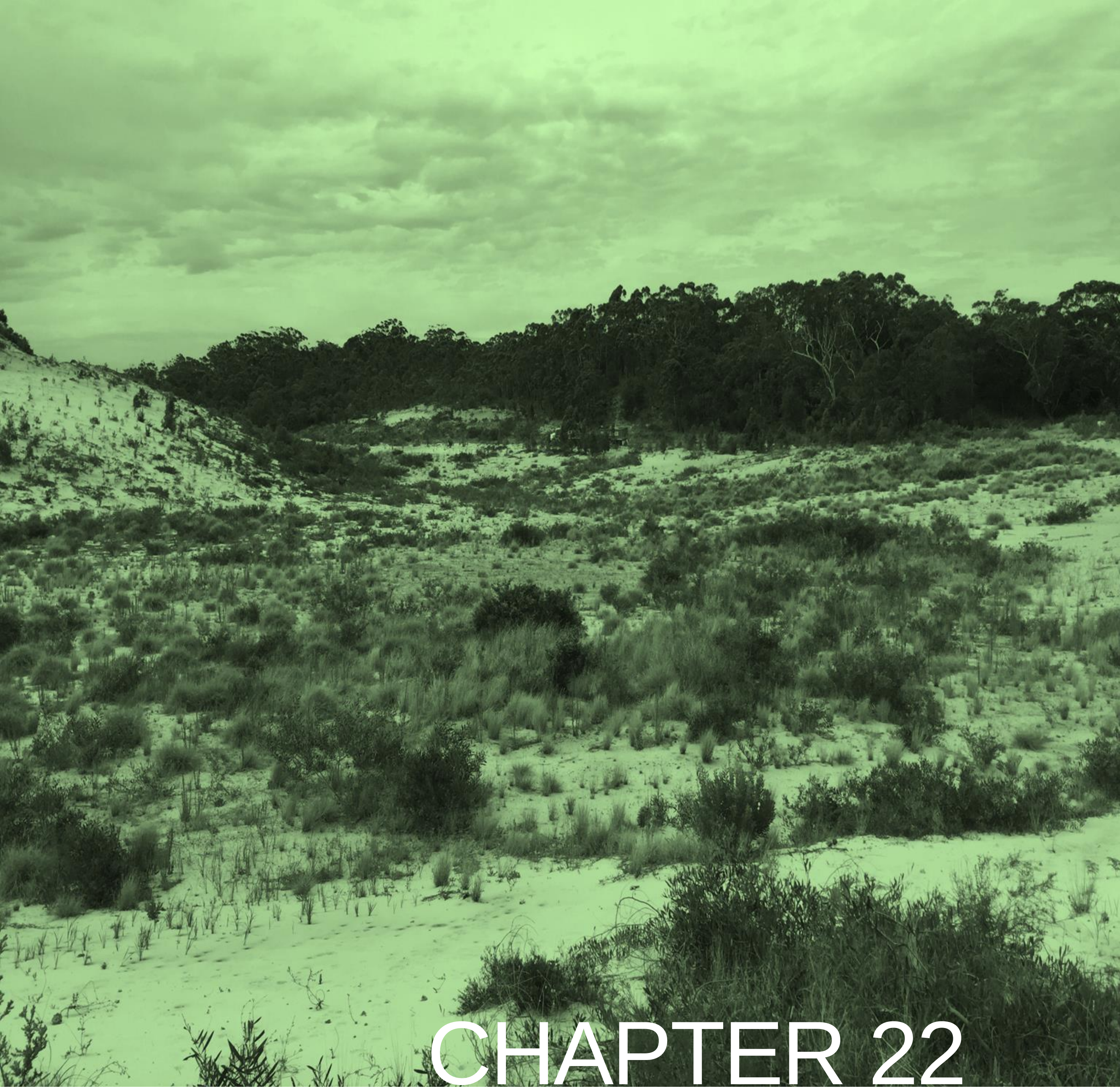
The transportation of sand products generated by the project is estimated to make up to the following incremental contribution to the regional economy for 25 years:

- $4 M in annual direct and indirect regional output or business turnover;
- $2 M in annual direct and indirect regional value added;
- $1 M in annual direct and indirect household income; and

- 16 direct and indirect jobs.

21.5 Residual impacts

A CBA of the project indicated that it will have net social benefits to Australia of $41 M, and net social benefits to NSW of $17 M. Hence the project is desirable and justified from an economic efficiency perspective. Environmental, social and cultural impacts of the project have been minimised through project design and mitigation, offset and compensation measures. The economic value of residual impacts are considered to be immaterial from an aggregated economic efficiency perspective.



CHAPTER 22

REHABILITATION

22 REHABILITATION

This chapter summarises the rehabilitation strategy in **Appendix O**. It describes the rehabilitation objectives, method and management measures.

22.1 Assessment guidelines and requirements

The SEARs require a rehabilitation strategy for the project (**Table 22.1**).

Table 22.1: Rehabilitation strategy SEARs

Requirement	Section and appendix where addressed
the proposed rehabilitation strategy for the site having regard to the key principles in the Strategic Framework for Mine Closure, including:	Appendix O
rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;	Section 22.2, 22.3 and 22.5
nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and	Section 22.2
the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.	Section 22.4

The SEARs recommend use of the following guidelines, which were used during the assessment:

- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Industry, Tourism and Resources, 2006);
- *Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Industry, Tourism and Resources, 2006); and
- *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000).

22.1.1 Overview of existing rehabilitation methods

As set out in **Section 4.1**, the project site is generally consistent with the footprint of the previous inland extraction area. This area of historical extraction has and continues to be subject to rehabilitation in accordance with the *Rehabilitation and Landscape Management Plan* (ERM, 2010), that has been updated to include rehabilitation measures for the windblown sand project area.

The rehabilitation and landscape management plan outlines rehabilitation methods comprising species selection, weed and pest management measures, and monitoring and reporting requirements for rehabilitated areas.

The rehabilitation method, where relevant to the inland dunes, is summarised below.

Landscape reshaping

The finished batters along the perimeter of the active extraction area were shaped to merge with the contours of the adjoining land to form a continuous landform free of depressions and steep slopes.

Topsoil replacement

Topsoil stripped ahead of the active working face for immediate placement on reshaped areas or from stockpiles is re-spread over finished areas to a minimum depth of 200 mm. Once placed, the topsoil layer was protected from disruption or compaction by excluding vehicle traffic from the area.

Revegetation procedures

The primary objective is to provide sufficient ground cover to minimise the potential for wind erosion. Initially, a cereal cover crop was sown, which was fertilized to ensure successful establishment. The purpose of the cover crop was to stabilise the soil surface and provide protection for emerging native seedlings from the sun and wind.

Timber felled from disturbance areas is often evenly distributed over the revegetation area to act as brush matting and assist as a wind break for emerging native seedlings.

On steeper slopes, temporary fences, such as woven synthetic cloth, were erected perpendicular to the prevailing wind conditions to protect juvenile plantings from wind damage.

Spinifex (*Spinifex hirsutus*) is often planted to ensure that a stable vegetated surface is maintained in areas subject to severe wind erosion. Generally, the replacement of organic topsoil will ensure the successful re-establishment of native shrubs, trees and ground cover species.

The area was the re-planted with tubestock of indigenous native species to supplement natural regeneration from seed stock.

Revegetation areas are frequently watered after planting.

Weed control

Weed growth is monitored and managed by physical, chemical or biological controls depending on the nature of weed infestation.

The principal weed management strategy is to reduce or eliminate physical disturbance to existing and regenerating vegetation and to closely monitor equipment and vehicles for the spread of weed propagules. Any weeds that establish on revegetated areas are controlled as soon as practicable.

22.1.2 Inspection of rehabilitated areas

The efficiency of rehabilitation to date was assessed, with consideration of time since rehabilitation and any localised site impacts which may have impacted vegetation establishment. The findings of the assessment were used to inform recommendations for rehabilitation of the project site.

Rehabilitation activities have generally been successful at the quarry to date. The degree of vegetation establishment largely depends on the duration since sand extraction activities ceased, with the older rehabilitated areas of the former inland extraction area having well established tree cover, while more recent rehabilitated areas of the inland extraction area have smaller trees and shrubs.

The successful species in rehabilitated areas predominantly comprised:

- Swamp Mahogany (*Eucalyptus robusta*);
- Coastal Wattle (*Acacia sophorae*);
- Beach Fescue (*Austrofestuca littoralis*); and

- Pig Face (*Carpobrotus glaucescens*).

Poor vegetation establishment has occurred in some areas due to:

- exposure to high winds which disturb surface soil, particularly on elevated slopes;
- areas where nutrient deficiency limits plant growth; and
- limited water availability observed on high exposed dunes, and
- soil compaction over former haul roads.

22.1.3 Key rehabilitation learnings

The following successful rehabilitation techniques will continue for the project:

- species selection which has facilitated establishment of a diverse and robust ecological environment which is representative of local native vegetation; and
- weed management which has been successful in removing targeted species and preventing infestation.

The existing rehabilitation process will be improved as follows:

- Areas subject to high winds, such as elevated dunes, require additional stabilisation to allow vegetation establishment. These areas may also require use of more robust species, such as Spinifex to stabilise soil.
- Areas subject to compaction and heavy impact, such as haul roads, may require deep ripping prior to rehabilitation to improve soil water availability and allow root penetration of soil.
- Targeted application of suitable fertilizer, and/or use of nitrogen fixing plant species may improve plant establishment in some areas.

22.2 Rehabilitation objectives

Upon completion, the project site will be left as a freshwater pond and rehabilitation efforts will generally include:

- rehabilitating the pond edge, to provide additional habitat for native fauna;
- plant species planted along the edges of the pond will be selected to maximise the bank stability; and
- stabilising re-profiled areas as soon as possible, minimise potential erosion and degradation of areas of exposed topsoil.

In the initial phases of work, rehabilitation will primarily aim to stabilise the edge of the pond and where necessary continued use of a poly pipe to form a floating boom system at the exposed pond edge to minimise erosion.

Disturbed areas will be progressively rehabilitated to achieve the final landform. The general rehabilitation objectives are:

- rehabilitated land will be geotechnically stable and will not present a greater safety hazard than surrounding land to land-users, the public and native fauna accessing or transiting the post-quarried area;
- land capability will, as far as possible, be returned to a class similar to that existing prior to project commencement (class 5 or 8).
- rehabilitated landforms will be visually compatible with the surrounding natural landscape;
- rehabilitated landforms will be designed to drain surface runoff without causing excessive erosion or increasing downstream sedimentation;

- re-establishment of vegetation community which reflects the endemic ecology of the region and minimises the potential for weed invasion or vegetation community collapse; and
- rehabilitated landforms will not negatively impact visual amenity for nearby residents, thoroughfare motorists of Nelson Bay Road, or recreational users of Stockton Bight.

22.3 Rehabilitation performance criteria

The performance criteria for the rehabilitation of the final post sand extraction landform of the project site are:

- stabilisation of disturbed areas with re-established coverage of endemic species of vegetation; and
- a landscape function analysis (LFA) level of natural regeneration greater than 50% of the previously assessed natural bushland control site in the quarry property.

22.4 Integration of rehabilitation with previous efforts

The post-quarrying landscapes from previous quarry stages have been rehabilitated according to their respective rehabilitation plan (ERM, 2010). While the rehabilitation of these areas has been largely successful, some aspects of the rehabilitation indicate areas where improvements and efficiencies could be made. Where practical, these findings have been incorporated into the development of the rehabilitation strategy for the project. There are no other rehabilitation strategies in the region identified with commonality to the setting of the project site.

The rehabilitation strategy for the project therefore aims to integrate the successful aspects of the rehabilitation efforts at the quarry. This will also provide the benefit of consistency in approach for Boral, consistent use of rehabilitation species and continuity for landscape suppliers.

22.5 Mitigation, monitoring and management measures

Table 22.2 summarises mitigation, rehabilitation, monitoring and maintenance works for rehabilitation of the project site.

Table 22.2: Proposed rehabilitation and management timeline

Site area	Mitigation / rehabilitation measure	Timeframe
Entire project site	Fly over survey of current landform levels to inform rehabilitation, vegetation and monitoring.	Prior to site establishment
Project site periphery	Maintain buffer zone of trees to provide a screen between Project activities and the quarry boundaries	Ongoing
	Monitor buffer zone to ensure the screen remains intact and sufficient for operations.	During sand extraction and ongoing
	Removal of undesirable weed species and vegetation not consistent with the local vegetative succession.	Ongoing maintenance
	Revegetation by way of selective planting with species native to the locality	Ongoing
	Encouragement of natural reafforestation through weed control and reduction.	Ongoing maintenance

Site area	Mitigation / rehabilitation measure	Timeframe
Extraction area / dredge pond	Vegetate dredge pond / excavation area embankments with native low growing shrubs and grasses to provide bank stability and reduce erosion (including water tolerant and salt tolerant species).	During sand extraction and at conclusion of operations in each stage
	Monitor dredge pond / excavation pit embankments to ensure the area remains intact and sufficient for operations.	During sand extraction
	Encouragement of natural reafforestation through weed control and reduction.	Ongoing maintenance
Final landform	Conversion of the dredge pond to a wetland (open pit) / freshwater pond.	At conclusion of Stage 6
	Revegetate dredge pond embankment and other disturbed areas with native water plant species (including water tolerant and salt tolerant species).	At conclusion of site operations in each stage
	Encouragement of natural reafforestation through weed control and reduction.	At conclusion of site operations in each stage

22.5.1 Rehabilitation process

The following steps will be implemented for progressive rehabilitation of the project site.

Development of final landform following completion of dredge activities

Design of the final landform will consider:

- the proposed post quarry land use;
- slope steepness and slope length to facilitate erosion control and establishment of slope stability;
- site drainage;
- requirement for soil preparation (i.e. deep ripping haul road corridors); and
- development to of a ‘natural’ contour profile.

Species selection for landscape position

Species selection will consider landscape position in relation to the dredge pond wetland or beach dune vegetation zones. The beach dune vegetation zones are specifically relevant to high exposed dunes, where wind impacts soil stabilisation.

Suitable revegetation species which may be used in rehabilitation is summarised in **Table 22.3**.

Table 22.3: Revegetation species

Species	Vegetation class	Vegetation zone	Suitability notes
Broad Leaved Paperbark (*Melaleuca quinquenervia*)	Tree	Riparian Zone Emergent Zone Hind Dune	Grows in swampy conditions and can regenerate within weeks of a bushfire. Successful previous use on site.

Species	Vegetation class	Vegetation zone	Suitability notes
Swamp Mahogany (*Eucalyptus robusta*)	Tree	Riparian Zone Hind Dune	Grows in swampy sandy conditions and is tolerant of waterlogging. Successful previous use on site.
Smooth-barked Apple (*Angophora costata*)	Tree	Hind Dune	Large tree, suitable for elevated, but not exposed locations.
Blackbutt (*Eucalyptus pilularis*)	Tree	Riparian Zone Hind Dune	Large tree common in grassy coastal forests.
Red Bloodwood (*Corymbia gummifera*)	Tree	Riparian Zone Hind Dune	Common to coastal flats and low hills. Tolerant of poorer, sandy soils.
Coastal Wattle (*Acacia sophorae*)	Shrub	Riparian Zone Hind Dune Foredune	Has the capacity to capture windblown sands resulting in the formation of hummocks. Beneficial for windblown and exposed areas. Nitrogen fixing species. Successful previous use on site. Wattles may have relatively short lifespan.
Sydney Golden Wattle (*Acacia longifolia*)	Shrub	Riparian Zone Hind Dune Foredune	Has the capacity to capture windblown sands resulting in the formation of hummocks. Beneficial for windblown and exposed areas. Nitrogen fixing species. Subspecies of Coastal wattle. Wattles may have relatively short lifespan.
Sweet Wattle (*Acacia suaveolens*)	Shrub	Riparian Zone Hind Dune Foredune	Has the capacity to capture windblown sands resulting in the formation of hummocks. Beneficial for windblown and exposed areas. Nitrogen fixing species. Wattles may have relatively short lifespan.
Coastal Teatree (*Leptospermum laevigatum*)	Shrub	Hind Dune Foredune	Salt and drought tolerant. Successful previous use on site.
Coastal Banksia (*Banksia integrifolia*)	Shrub	Hind Dune Foredune	Thrives in sandy conditions and suitable for the stabilisation of sand and enables the solubilisation of nutrients. Successful previous use on site.

Species	Vegetation class	Vegetation zone	Suitability notes
Old Man Banksia (*Banksia serrata*)	Shrub	Hind Dune Foredune	Thrives in sandy conditions and suitable for the stabilisation of sand and enables the solubilisation of nutrients.
Tree Broom Heath (*Monotoca elliptica*)	Shrub	Hind Dune Foredune	Long lived and hardy dune species. May be difficult to propagate from seeds – cuttings may perform better.
Common Bush Hop (*Dodonaea triquetra*)	Shrub	Riparian Zone Hind Dune	Forest understory.
Pig Face (*Carpobrotus glaucescens*)	Ground cover	Hind Dune Foredune Exposed dune	Has the capacity to capture windblown sands resulting in the formation of hummocks. Beneficial for windblown and exposed areas. Successful previous use on site.
Beach Fescue (*Austrofestuca littoralis*)	Grass	Hind Dune Foredune Exposed dune	Endemic beach grass species. Successful previous use on site.
Blue Flax Lily (*Dianella caerulea*)	Understory	Riparian Zone Hind Dune Foredune	Hardy and long-lived. Tolerant of a range of moisture conditions.
Kangaroo Grass (*Themeda australis*)	Grass	Foredune, Exposed dune	Widespread native grass, tolerant of a range of conditions.
Bracken Fern (*Pteridium esculentum*)	Understory	Hind Dune Foredune Exposed dune	Quick to colonise disturbed areas. Common in coastal woodlands. May be invasive.
Spiny Headed Mat-Rush (*Lomandra longifolia*)	Rush	Emergent Zone Riparian Zone	Tolerant of wet and drought conditions.
Cogon Grass (*Imperata cylindrica*)	Grass	Foredune Exposed dune	Tolerant grass used for ground cover and erosion control. May be invasive and difficult to control. Highly flammable.
Beach Spinifex (*Spinifex sericeus*)	Grass	Exposed dune	Deep roots to stabilise sand and prevent moisture loss. Recommended for locations where establishment of other vegetation has proven unsuccessful. Successful previous use on site.

Species	Vegetation class	Vegetation zone	Suitability notes
Common Spike Rush (*Eleocharis acuta*)	Rush	Aquatic/emergent zone	Shallow water freshwater wetland rush.

Note:
Information regarding collection of seed and runners, germination and planting, fertilisation and watering are provided in the Stockton Transgressive Dune Quarry Rehabilitation and Landscape Management Plan (ERM, 2010).

Stabilisation and revegetation of disturbed areas

The existing *Rehabilitation and Landscape Management Plan* (ERM, 2010) will be updated to incorporate the project. The updated management plan will address:

- the landscape units within each rehabilitation area;
- species and numbers of plants required for each rehabilitation area;
- site preparation requirements – including earthworks and deep ripping;
- soil stabilisation, erosion control and plant protection requirements for each stabilisation area;
- fertilizer requirements; and
- watering and maintenance requirements until plants are established.

Species selection for each rehabilitation area will also address species diversity and succession over time. While some species, such as wattles, may perform well in the short term, they may result in a monoculture which inhibits establishment of other species.

Pest and weed management

Rehabilitation will be regularly inspected for pests and weeds. Bitou Bush has been a problem at the quarry, however, manual removal has been successful in controlling this species. Targeted spraying or removal may be required during the project.

Animal or insect infestations will be monitored and managed as required.

22.5.2 Rehabilitation inspection schedule

The rehabilitation process will be inspected monthly and annually for progress and problems will be proactively identified.

Monthly monitoring will focus on identification of plant health or establishment issues.

Compliance with the performance criteria, particularly the 50% LFA target, will be inspected annually by a suitably experienced ecologist or environmental restoration consultant.

Long term monitoring

Management and monitoring of rehabilitation may occur for 10 years from the commencement of operations. The success of initial site preparation and vegetation establishment will significantly reduce the management requirements for each area over time.

Short to medium term management and monitoring will occur from 1-5 years where landscape stabilisation, vegetation establishment, erosion control and weed management will be monitored.

Monitoring may be substantially reduced over the long term if the short to medium term rehabilitation is successful. Monitoring over 5-10 years will focus on weed management, and species diversity and succession.

Rehabilitation will be inspected for 10 years post rehabilitation, or until the ecologist or restoration consultant advises inspections are no longer required.

22.5.3 Proposed rehabilitation completion criteria

The completion of the rehabilitation process will be assessed against the performance criteria for the rehabilitation of the final landform.

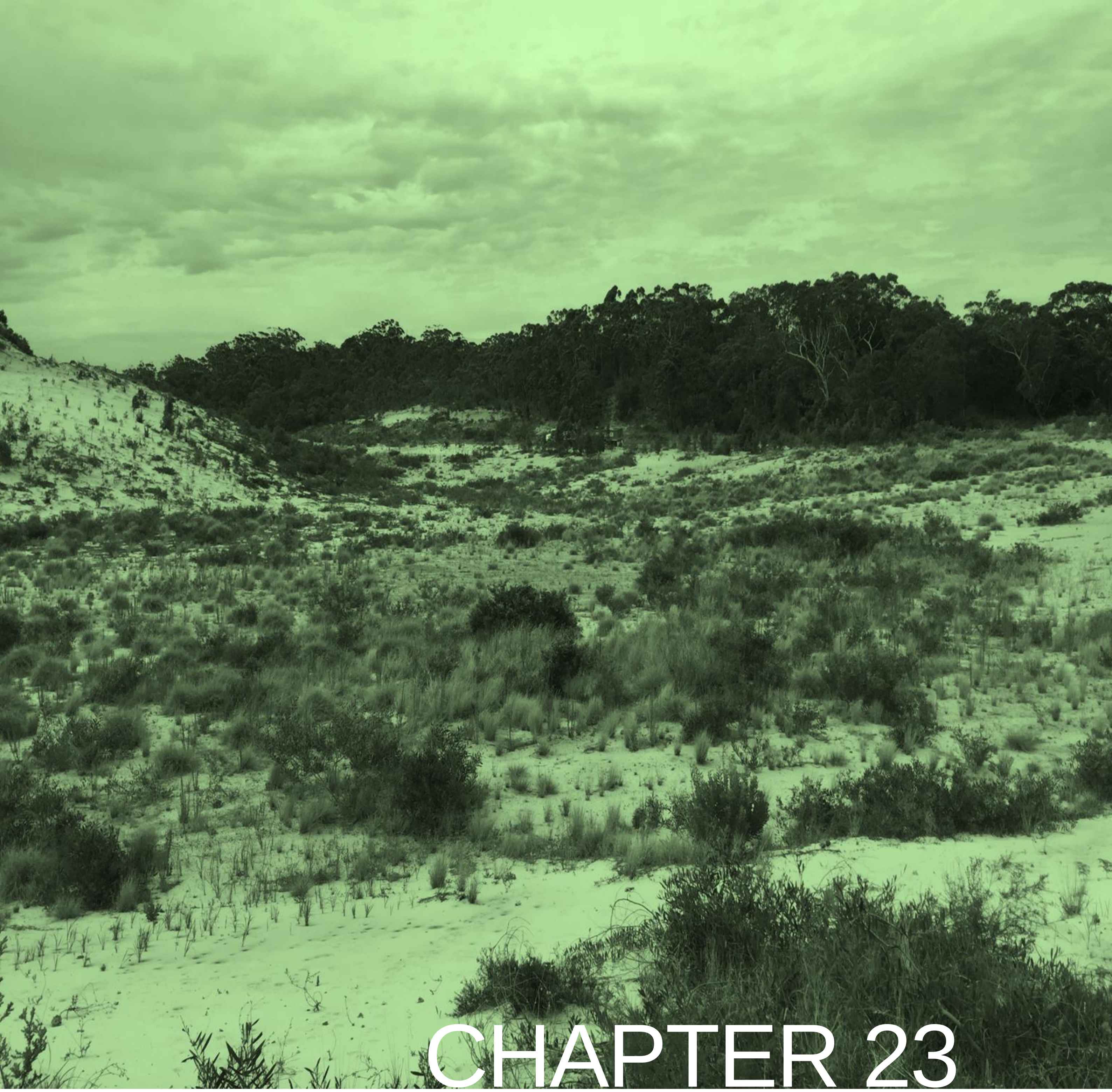
The rehabilitation criteria will be deemed to be complete when the criteria have been met, and vegetation communities are mature and stable. This may occur between 5-10 years post rehabilitation for each rehabilitation area. This will be assessed by the ecologist or environmental restoration consultant who may recommend that ongoing inspections are no longer required.

22.6 Residual impacts

The following risks may be present after implementation of the rehabilitation strategy:

- soils, geology and erosion – poor quality and/or insufficient topsoil; erosion; geotechnical failure such as slumping or subsidence; rehabilitation not meeting targeted land capability classes; and
- biological and environmental – poor vegetation establishment; inadequate weed control; animal predation of juvenile vegetation; disease infestation; poor vegetation development; severe or prolonged drought; bushfire; and major storm damaging vegetation and resulting in erosion.

A trigger action response plan will be prepared to identify trigger events or indicators related to the above threats, and provide appropriate response strategies.



CHAPTER 23

ENVIRONMENTAL MANAGEMENT, MONITORING AND REPORTING

23 ENVIRONMENTAL MANAGEMENT, MONITORING AND REPORTING

23.1 Introduction

This chapter summarises the key mitigation and management measures for addressing the potential environmental impacts of the project as required by the SEARs (**Table 23.1**).

Table 23.1: Environmental management and mitigation SEARs

Requirement	Section and appendix where addressed
Consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.	Chapter 23

As outlined in **Chapter 2** and **3**, the quarry is managed in accordance with the conditions of consents, leases and licences, as well as various site environmental management plans.

Boral also maintains a comprehensive groundwater monitoring network at and surrounding the quarry. Data captured from this monitoring is used by quarry management to monitor compliance with their conditions of consent, EPL and other regulatory requirements.

23.2 Environmental management measures

The environmental management measures summarised in **Table 23.2** will be implemented during construction and operation of the project.

Table 23.2: Summary of environmental mitigation and management measures

Mitigation and management measures
Groundwater
The existing *Stockton Sand Quarry Groundwater Management Plan* (GWMP) (Jacobs, 2017) will be updated to encompass the project site.
Biodiversity
Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the project site. Conservation areas will be signposted to restrict entry and reduce incidental interactions with threatened species (e.g. speed limit signage along access roads to reduce potential for fauna vehicle strikes).
Employees and contractors will be educated and required to implement the following controls to avoid or minimise potential indirect biodiversity impacts: ▪ minimise the extent and time that bare sand is exposed and by implementing appropriate dust suppression ▪ implement procedures for the management of hydrocarbon and/or chemical spills throughout the project site, including the requirements for vehicles to carry spill kits; ▪ ensure vehicles remain on designated roads and tracks and abide by site speed limits, through use of signposting and driver education during the induction process, and in ongoing project discussions; and ▪ management and removal of all waste material from the project site.
The vegetation clearing protocol in the *Stockton Transgressive Dune Quarry Rehabilitation and Landscape Management Plan* (ERM, 2010) will continue to be implemented for the project. The following will be implemented: ▪ Ecologists will survey for ground dwelling fauna prior to clearing of native vegetation and remove any fauna/fauna habitats to adjacent areas not proposed to be disturbed. ▪ Ecologists will supervise felling of remnant hollow-bearing trees or habitat trees located within Stage 1 of the project area. All hollow-bearing trees that are accessible safely from the ground will be checked and fauna relocated. Hollows higher up and not accessible from the ground will be

Mitigation and management measures
identified and trees felled gently by an excavator or dozer and left overnight to allow fauna to relocate. ▪ Fauna displaced during clearing will be captured where possible and relocated to designated areas by trained personnel. ▪ NSW Wildlife Information, Rescue and Education Service will be contacted to collect injured fauna.
Disturbed areas will be progressively rehabilitated in accordance with a rehabilitation management strategy to create a stable landform that does not result in sediment laden runoff or fugitive dust emissions, blends well with the adjacent natural landscapes and re-establishes native bushland. The *Stockton Transgressive Dune Quarry Rehabilitation and Landscape Management Plan* will be updated to reflect biodiversity management measures to protect and manage biodiversity values. The existing plan contains commitments to threatened species management, pest and weed management, fire management and site hygiene practices, which are to continue for the project.
The existing rehabilitation and landscape management plan will be updated to include a section on pest and weed management, including management protocols for the identification of noxious or environmental weeds within areas to be cleared (in order to avoid transporting the weeds to rehabilitation areas or other parts of the quarry).
Boral's (2010) *Stockton Transgressive Dune Quarry Environmental Management Strategy* includes a bushfire management plan, which contains fire prevention and suppression measures including maintenance of access roads to prevent potential ignition of grassland by vehicle exhaust. This plan will be updated to reflect the findings of the Bushfire Hazard Assessment for the project.
Air quality
Dust generation will be monitored during adverse weather and activities modified as required (e.g. activity will be curtailed or ceased where reasonable levels of visible dust cannot be maintained using the available means).
On-site vehicles and plant will be switched off when not in use.
Vehicles will be maintained and serviced according to manufacturer's specifications.
The extent of exposed surfaces and stockpiles will be kept to a minimum.
Exposed areas and stockpiles will be covered or dampened with water if dust emissions are visible, or there is potential for dust emissions outside operating hours.
Dust generation will be minimised by rehabilitating exposed areas when topsoil and subsoil stockpiles are moist and/or wind speed is below 10 m/s.
Drop heights from loading and handling equipment will be reduced where practical.
Dampen material when excessively dusty during handling.
Haul roads will be watered using water cart so the road surface has sufficient moisture to minimise on-road dust generation but not so much as to cause mud/dirt track out.
Regularly inspect haul roads and maintain surfaces to remove potholes or depressions.
Driveways and hardstand areas will be swept/cleaned regularly as required.
Site speed limits will be enforced.
Vehicle loads will be covered when transporting material off-site.
Complaints and incidents will be logged and investigated via Boral's site incident management system.
Any controls required to manage, mitigate or rectify a complaint or incident will be implemented as soon as practical. Following a complaint or incident, Boral will review all air quality controls and investigate implementation of additional controls if required.
Traffic
Boral will continue to implement the driver awareness training for all truck drivers, with a focus on the correct protocols when entering and exiting the site.
Social
When the EIS is placed on public exhibition it is recommended that: ▪ Fern Bay and Fullerton Cove residents will be notified in writing about exhibition of the EIS, the increased heavy vehicle volumes derived from the project, where these matters are addressed in the EIS, SIA and technical studies, how/where they can easily view the documentation, and an invitation to contact Boral to discuss any residual or additional concerns they may have; and ▪ Boral will place an article in the *Port Stephens Examiner* as well as on their website (and other media channels typically used throughout the SSD stakeholder engagement process) to notify of the EIS exhibition process as outlined above. During the above, Boral will outline the: ▪ increase in heavy vehicle numbers proposed for the road network; and

Mitigation and management measures
▪ high-level results of the road safety audit.
The initial request made to Google will be repeated with the objective of removing the Stockton Bight route (via the quarry) from Google maps. Achieving that objective will potentially dissuade members of the public from attempting to access the quarry without authority.
Written notification about the availability of the EIS on exhibition, and social media and local print media campaign to disseminate EIS information about project heavy vehicles
Soils and land resources
An ASS management plan will be prepared and implemented for the project in accordance with ASSMAC's (1998) Acid Sulfate Soils Assessment Guidelines.
Rehabilitation
Conduct a fly over survey of current landform levels to inform rehabilitation, vegetation and monitoring.
Maintain buffer zone of trees to provide a screen between project activities and the quarry boundaries.
Monitor buffer zone to ensure the screen remains intact and sufficient for operations.
Remove undesirable weed species and vegetation not consistent with the local vegetative succession.
Promote revegetation by way of selective planting with species native to the locality.
Encourage natural reafforestation through weed control and reduction.
Vegetate dredge pond / excavation area embankments with native low growing shrubs and grasses to provide bank stability and reduce erosion (including water tolerant and salt tolerant species).
Monitor dredge pond / excavation pit embankments to ensure the area remains intact and sufficient for operations.
Revegetate dredge pond embankment and other disturbed areas with native water plant species (including water tolerant and salt tolerant species).
Design of the final landform will consider: ▪ the proposed post quarry land use; ▪ slope steepness and slope length to facilitate erosion control and establishment of slope stability; ▪ site drainage; ▪ requirement for soil preparation (i.e. deep ripping haul road corridors); and ▪ development to of a 'natural' contour profile.
Species selection will consider landscape position in relation to the dredge pond wetland or beach dune vegetation zones. The beach dune vegetation zones are specifically relevant to high exposed dunes, where wind impacts soil stabilisation.
The existing *Rehabilitation and Landscape Management Plan* (ERM, 2010) will be updated to incorporate the project. The updated management plan will address: ▪ the landscape units within each rehabilitation area; ▪ species and numbers of plants required for each rehabilitation area; ▪ site preparation requirements – including earthworks and deep ripping; ▪ soil stabilisation, erosion control and plant protection requirements for each stabilisation area; ▪ fertilizer requirements; and ▪ watering and maintenance requirements until plants are established. Species selection for each rehabilitation area will also address species diversity and succession over time. While some species, such as wattles, may perform well in the short term, they may result in a monoculture which inhibits establishment of other species.
Rehabilitation will be regularly inspected for pests and weeds. Bitou Bush has been a problem at the quarry, however, manual removal has been successful in controlling this species. Targeted spraying or removal may be required during the project. Animal or insect infestations will be monitored and managed as required.
Aboriginal heritage
The boundary of the approved project site will be clearly delineated and Aboriginal heritage considerations will be included in the environmental management strategy.
Documented toolbox talks will be held to ensure all on-site staff and contractors are aware of obligations and requirements regarding the protection of Aboriginal heritage.
An unexpected finds and human remains procedure will be implemented during the project.
Surface water
Exposed soils generated through the construction of the haul roads and stabilised dredge pond embankments will be managed through standard erosion and sediment controls implemented in accordance with DECC's (2008) Managing Urban Stormwater: soils and construction, Volume 1 and

Mitigation and management measures
Volume 2C: Unsealed roads and 2D: main road construction, and will be outlined within an erosion and sediment control plan prepared for the establishment of the project.
Boral will consider implementing measures to reduce the quantity of water extraction from the Stockton Groundwater Source, particularly via evaporation from the dredge pond surface. There are a range of technologies available to reduce evaporation through techniques which limit exposure of surface water to atmosphere by providing shade and reducing air flow (wind), and direct barriers.
Any fines collected within the wash plant will be returned to the dredge pond. The water and fines return point will be located as far as possible from the dredging operation to limit reprocessing. Should fines settlement become an issue, a silt curtain will be installed to restrict fines movement between the dredge and fines return point. Dredging operations will be monitored to determine whether installation of a silt curtain is required.
Historic heritage
Should an item of potential Non-Aboriginal heritage be identified during project operations, works will cease, and the Quarry Manager will be contacted immediately. Appropriate measures will be taken to minimise the potential for harm to the object. Further advice will be sought from a qualified archaeologist, and subsequently DPIE Biodiversity and Conservation Division will be notified of the proposed course of action, if required.
Waste management
Waste will be managed in accordance with the WARR Act by adopting the resource management hierarchy (in order of priority) of avoidance, re-use, recycling / re-processing / treatment and disposal.
The existing environmental management strategy for the quarry will be updated as follows: ▪ wastes will be quantified and classified; ▪ disposal/reuse strategies for each type of material; ▪ details of how waste will be stored and treated on site; ▪ identification of non-recyclable waste; ▪ identification of measures and initiatives to reduce, reuse and recycle; and ▪ procedures and disposal arrangements for potentially hazardous material.
Waste will be managed in accordance with (NSW Environment Protection Authority, 2014) and relevant regulatory requirements. This will include (i) its classification prior to leaving the site and (ii) recording (via an appropriate waste tracking system) its legal off site transportation for re-use, recycling or disposal.
Waste (excluding toilet waste) will be stored in a suitable container with a lid, and transported to an appropriate facility. Enough receptacles for general waste, hazardous waste and recyclable materials will be provided, including sufficient bins to allow separation of wastes for recycling.
Wastes will only be disposed at a licenced waste disposal depot.
Wastes will be securely stored so that pollutants are prevented from escaping.
Fuel, lubricant or hydraulic fluid spillages will be collected using absorbent material and the contaminated material disposed of at a licensed waste facility.
Hazardous or contaminated wastes (if identified) will be removed and disposed in accordance with the State and national regulations and guidelines and best practice for the removal of these materials. Hazardous materials will only be removed by suitably qualified, licensed and experienced contractors.
Personnel will be required to notify the Quarry Manager, and follow approved SafeWork NSW procedures for the handling and transport of any asbestos containing material wastes to an EPA approved facility.
Documents and records of the transport and fates of all materials removed from the project site will be kept as proof of correct disposal and for environmental auditing purposes.
Waste streams will be sorted to maximise the reuse/recycling potential and minimise disposal costs.
Waste will be covered, stored and removed in a timely manner so as not to attract native animals or vermin.
Hazardous substances
A pollution and incident response management plan (PIRMP) has been prepared to manage potential chemical or hydrocarbon spills. The PIRMP will be updated to incorporate the project.
All personnel will be trained in hazardous substance management, emergency response and the use of spill kits.
Appropriately sized and stocked spill response kits will be provided in strategic areas of the quarry and in vehicles used to transport hazardous materials to and from the site.

Mitigation and management measures
Spill response kits will be maintained, clearly identified and readily accessible for use in case of accidental spillages. Key staff will be trained in their use, application and disposal of contaminated material.
Potential chemical pollutants (e.g. fuels, oils, lubricants, paints, etc.) will be stored in appropriate containers in bunded areas in vehicles or designated storage areas to minimise the risk of spillages and mobilisation of pollutants into the soil or stormwater drains.
Equipment will not be used if there are signs of fuel, oil or hydraulic leaks. Leaks will be repaired immediately, or the equipment will be removed from site and replaced with a leak-free item.
Soil contaminated by spills will be excavated, classified in accordance with Waste Classification Guidelines, and disposed of at a licensed waste management facility, or remediated on site in accordance with a contaminated land management action plan to be prepared by a contaminated land specialist.
Bushfire management
The following management measures will continue to be implemented: ▪ Fire extinguishers will continue to be provided in the depot. The water cart and front-end loader will continue to be available for firefighting. ▪ The existing haul road to the windblown sand extraction area has been constructed and will continue to be maintained to enable ready access for fire fighting vehicles. ▪ Internal roads at the quarry will continue to be maintained for operational and firefighting purposes. ▪ All employees will continue to be trained through the induction process to be vigilant with regard to fire prevention, emergency procedures and reporting of fires to the RFS.
Following the approval of the project and for the life of the quarry, the APZ around the depot buildings will be maintained to a distance of 25 m as an inner protection area, as outlined in Appendix 5 of PBP and the NSW Rural Fire Service's document Standards for APZs.
The existing workshop will have the polycarbonate roofing replaced with metal roof sheeting.
The new haul roads will comply with Appendix 5 of PBP comprising a minimum 6.5 m in width, with a turning bay with minimum 12 m outer radius at the termination of the road.
Water, electricity and gas utilities will comply with Section 4.1.3 of PBP.
A minimum 20,000 L static water supply with firefighting fittings will be installed.
The depot will be landscaped in accordance with Appendix 5 of PBP and managed and maintained.
The Quarry Manager will incorporate the new demountable building into the existing emergency evacuation plans, with specific consideration of bushfire evacuation planning.

23.3 Environmental monitoring

Environmental monitoring summarised in **Table 23.3** will be implemented during operation of the project.

Table 23.3 Summary of environmental monitoring

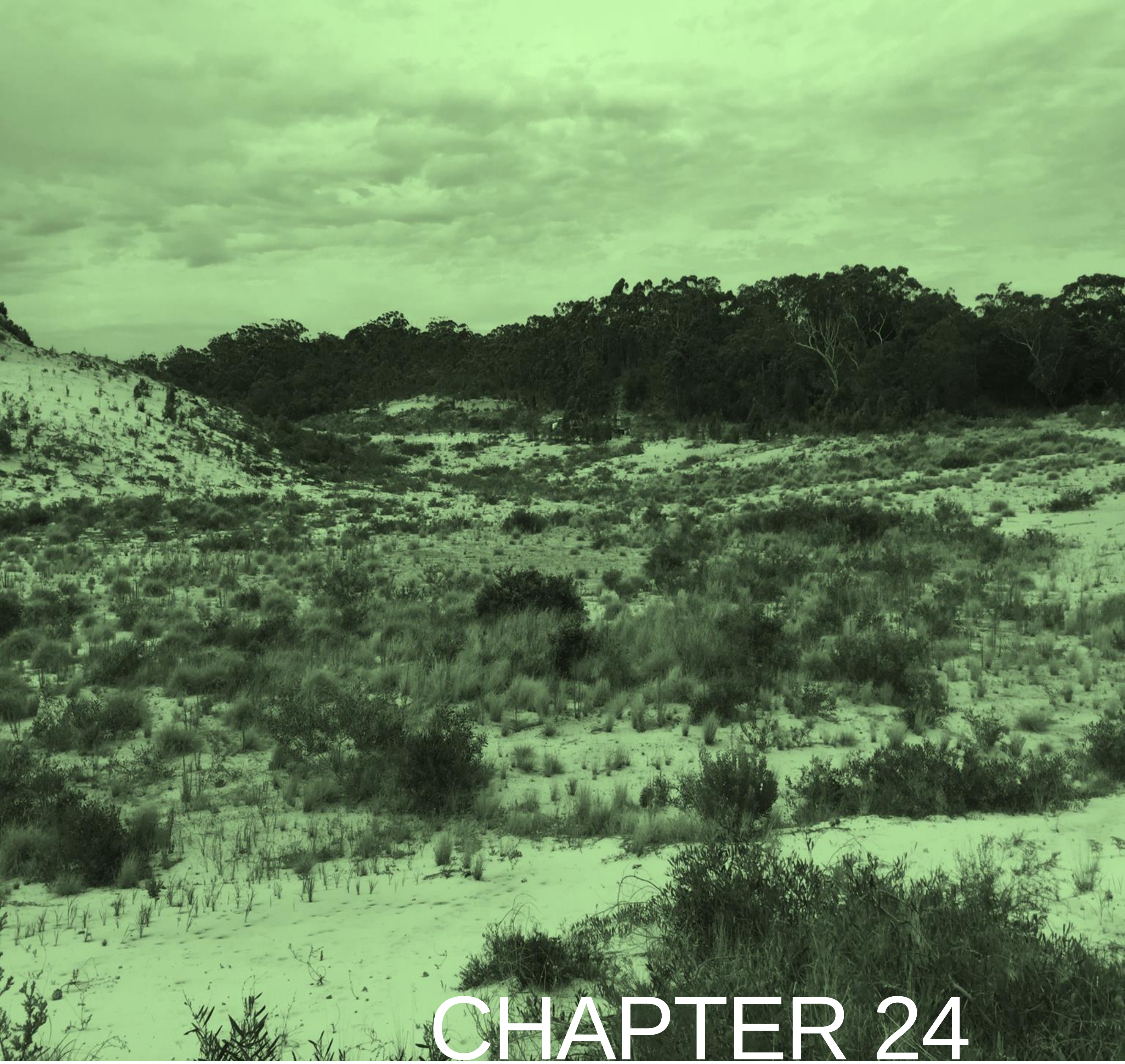
Environmental monitoring
Groundwater
The boreholes located outside the project site will form a monitoring network to be periodically sampled. The bores to be included are MW_X1, MW_X2, MW_X5, MW_X6, MW_X7, GW2, GW4 and MW2. Once extraction progresses below the water table, the dredge pond surface will be surveyed so that the relative height of water in the pond over time can be accurately measured.
Standing groundwater levels (SWL) from all eight bores, and the water level (m AHD) of the dredge pond will be measured monthly during dredging operations. The measurement of SWL from bores will continue during rehabilitation works. Following rehabilitation, all bores will be incorporated into the existing quarterly groundwater monitoring program for the quarry.
All eight bores and the dredge pond will be tested for pH on a monthly basis during dredging operations. The measurement of pH will be performed in the field with a hand-held electronic meter that is 2-point calibrated. In addition to the above recommended measurement for pH, all bores will be incorporated into the GWMP, which will be updated following approval of the project.

Environmental monitoring
Groundwater bores will be sampled on a monthly basis for SWL and pH, and tested quarterly for the following analytical suite: Field measurement of: ▪ pH, EC, ORP, SWL, DO and temperature. Laboratory analysis for: ▪ full ionic balance suite pH, TDS, cations (Na, Ca, Mg, K), anions (Cl, SO_4, HCO_3, PO_4, F) and nutrients (NH_4, NO_3, NO_2, Total N); and ▪ dissolved metals / metalloids including aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni) and zinc (Zn).
Noise
Boral will continue routine operational noise monitoring and community consultation, and will implement measures if an exceedance is detected or a verified/substantiated complaint is received from a member of the community.
Rehabilitation
The rehabilitation process will be inspected monthly and annually for progress and problems will be proactively identified.
Monthly monitoring will focus on identification of plant health or establishment issues.
Compliance with the performance criteria, particularly the 50% LFA target, will be inspected annually by a suitably experienced ecologist or environmental restoration consultant.
Short to medium term management and monitoring will occur from 1-5 years where landscape stabilisation, vegetation establishment, erosion control and weed management will be monitored.
Monitoring may be substantially reduced over the long term if the short to medium term rehabilitation is successful. Monitoring over 5-10 years will focus on weed management, and species diversity and succession.
Rehabilitation will be inspected for 10 years post rehabilitation, or until the ecologist or restoration consultant advises inspections are no longer required.
The completion of the rehabilitation process will be assessed against the performance criteria for the rehabilitation of the final landform. The rehabilitation criteria will be deemed to be complete when the criteria have been met, and vegetation communities are mature and stable. This may occur between 5-10 years post rehabilitation for each rehabilitation area. This will be assessed by the ecologist or environmental restoration consultant who may recommend that ongoing inspections are no longer required.
Surface water
To predict possible periods of localised inundation, rainfall and ocean level conditions will be monitored through the BoM, including storm warnings for heavy rain and high seas. In conjunction, groundwater levels will continue to be monitored in accordance with the existing groundwater monitoring program, and movement in standing water levels noted. The Quarry Manager will decide on precautionary measures to remove machinery from areas where groundwater levels may increase, and localised ponding may occur. For the dredge pond, allowances will be made for the dredge to move to a higher level through adjustments in mooring lines and transfer pipes. Management of this risk will include a groundwater inundation management plan that includes monitoring of existing bores, flood and storm warnings as well as specific triggers for the movement of machinery and equipment and temporary storage locations.
After 12 months of regular dredge pond monitoring, monthly sampling may be extended to bi-monthly should no exceedances or significant variations occur over time.
To gather an accurate understanding of extractions from the groundwater source and accurately estimate evaporation losses detailed measurements of the pond area, moisture content of sand material, and sand material export are required. The following monitoring is recommended: ▪ six monthly measurements of the dredge pond surface area, either through site survey or aerial survey; ▪ fortnightly measurements of the moisture content of exported sand material through stockpile measurements; and ▪ records of sand material leaving the project site, including the source of sand material from excavations above the aquifer or from the dredge pond.

23.4 Environmental reporting

The principal reporting mechanism for the project with be the submission of an Annual Environmental Management Report, which will be prepared and submitted to DPIE in accordance with conditions of the development consent and will include reporting on all key environmental matters assessed in the EIS.

Other environmental reporting may be required in accordance with the varied/new EPL and/or conditions of approval of the SSD application.



CHAPTER 24

CONCLUSION

24 CONCLUSION

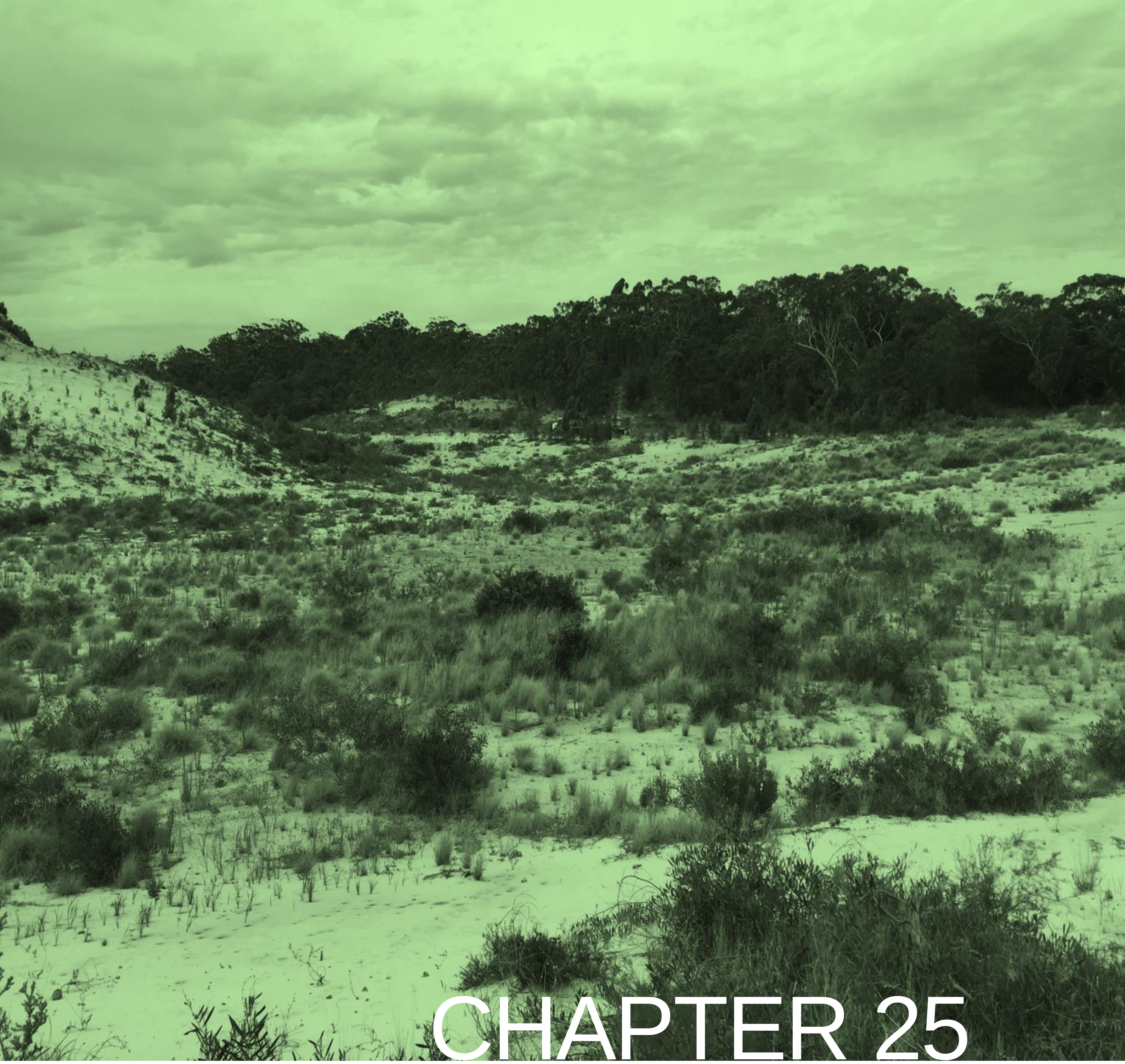
The project is justified on economic, social and environmental grounds, as demonstrated with its consistency with the objects of the EP&A Act and ecologically sustainable development.

The project will enable continued extraction of a resource that is of vital importance to the development of NSW and the associated continued employment of the quarry workforce. It is economically viable and technically feasible to extract a portion of the remaining sand resource for another 25 years.

The project will not result in significant residual impacts on most environmental aspects, including amenity impacts associated with noise, air quality and visual exposure.

The project will have residual impacts on terrestrial biodiversity, which will be offset in accordance with NSW policy. This offsetting will have the benefit of protecting areas of similar native vegetation communities into perpetuity.

The economic analysis of the project demonstrated that it will be socio-economically beneficial to the nation, State and local community. The project will have net social benefits to Australia of $41 M and to NSW of $17 M including employment benefits.



CHAPTER 25

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25 REFERENCES

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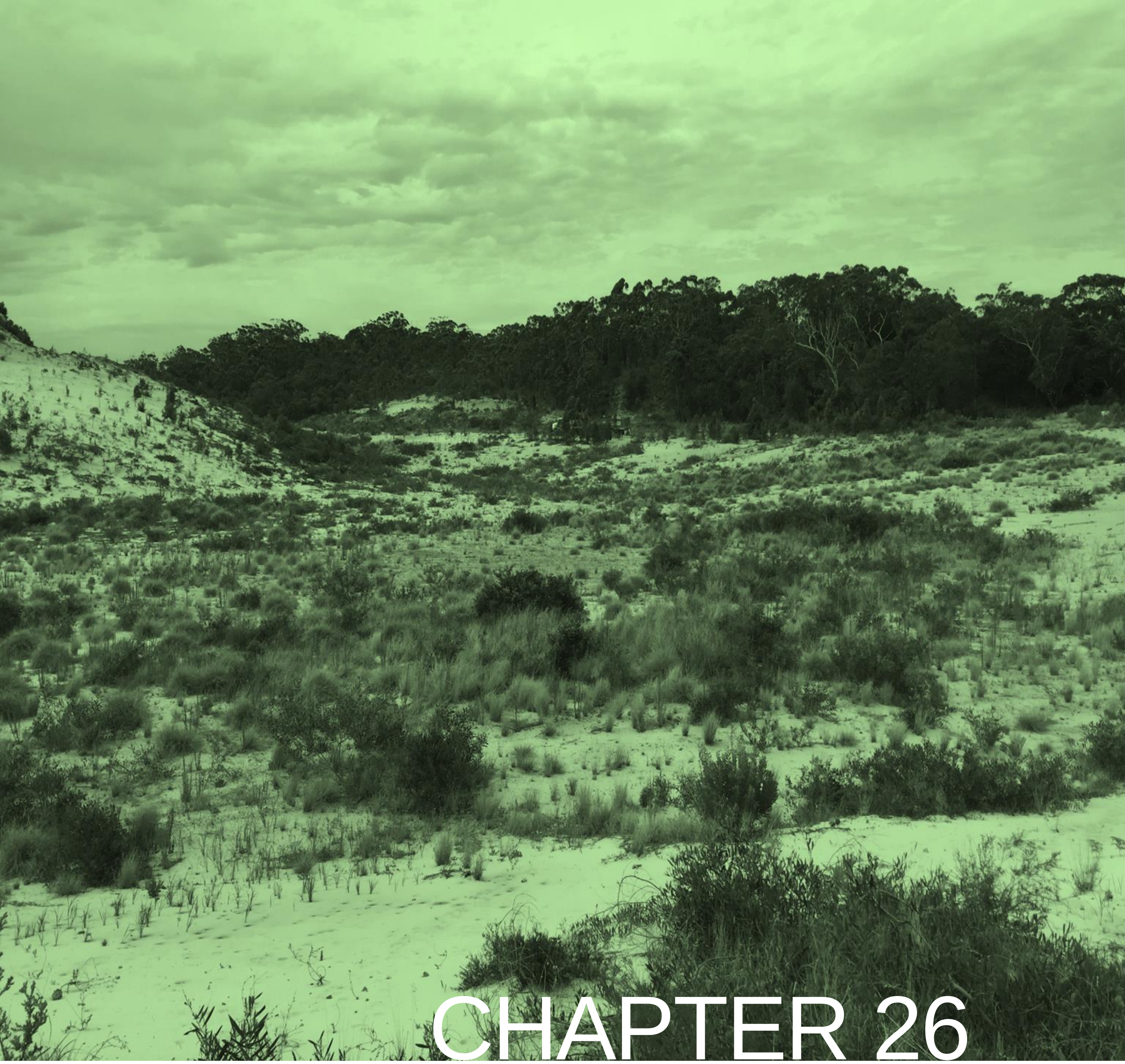

CHAPTER 26
ABBREVIATIONS

26 ABBREVIATIONS

Abbreviation	Definition
ACHA	Aboriginal Cultural Heritage Assessment
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AIP	NSW Aquifer Interference Policy
ANZECC	Australian and New Zealand Environment and Conservation Council
BC Act	NSW *Biodiversity Conservation Act 2016*
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BGL	Below ground level
Boral	Boral Resources (NSW) Pty Ltd
BoM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CBA	Cost Benefits Analysis
CLM Act	NSW *Contaminated Land Management Act 1997*
cm	Centimetre
DA	Development Application
DECCW	Department of Environment Climate Change and Water (now DPIE)
DP	Deposited Plan
DoEE	Commonwealth Department of Environment and Energy
DPIE	Department of Planning, Industry and Environment
DRE	Department of Resources and Energy
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
Element	Element Environment Pty Ltd
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	The *NSW Environmental Planning and Assessment Act 1979*
EP&A Regulation	The NSW Environmental Planning and Assessment Regulation 2000
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument

Abbreviation	Definition
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystems
ha	Hectare
HRP	Hunter Regional Plan 2036
HW Act	NSW *Hunter Water Act 1991*
ICNG	Interim Construction Noise Guideline (DECC 2009)
IPC	Independent Planning Commission
kL	Kilolitre
km	Kilometre
L	Litre
LALC	Local Aboriginal Land Council
LEA	Local Effects Analysis
LFA	Landscape Function Analysis
LEP	Local Environmental Plan
LGA	Local Government Area
m	Metre
mm	Millimetre
ML	Megalitre
MNES	Matters of National Environmental Significance
M	Million
Mt	Million tonnes
NPI	Noise Policy for Industry
NPW Act	NSW *National Parks & Wildlife Act 1974*
NSW	New South Wales
OA	Output Analysis
OEH	Office of Environment and Heritage (now DPIE)
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
PFAS	Per- and poly-fluoroalkyl substances
PFOA	Perfluorooctanoic acid
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometres in aerodynamic diameter
PM_{10}	Particulate matter less than or equal to 10 micrometres in aerodynamic diameter
PMST	Protected Matters Search Tool
POEO Act	*NSW Protection of Environment Operations Act 1997*

Abbreviation	Definition
Quarry	Stockton Sand Quarry
RAAF	Royal Australian Air Force
RAP	Remediation Action Plan
RFS	NSW Rural Fire Service
RMS	NSW Roads and Maritime Services
RNP	NSW Road Noise Policy (EPA 2011)
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SIA	Social Impact Assessment
SRLUP	NSW Strategic Regional Land Use Policy
SSD	State Significant Development
SWL	Sound Power Level
t	Tonne
TEC	Threatened Ecological Community
tpa	Tonnes Per Annum
TSP	Total Suspended Particulate
VLAMP	NSW Voluntary Land Acquisition and Mitigation Policy
WAL	Water Access Licence
WARR Act	NSW *Waste Avoidance and Resource Recovery Act 2001*
Water Act	NSW *Water Act 1912*
WM Act	NSW *Water Management Act 2000*
WSP	Water Sharing Plan