WEST NOWRA LANDFILL EXTENSION

Environmental Impact Statement

31 MAY 2019

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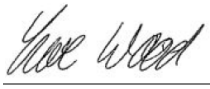
Checker	Zoe Wood	
Approver	Brad Searle	

Report No	AA008737-01
Date	31/05/2019
Revision Text	04

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
01	3/11/2017	Draft Chapters 1-5	Zoe Wood	Brad Searle
02	9/3/2019	Consolidated Final Draft EIS	Zoe Wood	Brad Searle
03	03/05/2019	Final EIS	Zoe Wood	Brad Searle
04	31/05/2019	Adequacy submission to DP&E	Zachary Quintal	Brad Searle

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GLOSSARY

Term	Definition
ABPP	Australian Bushfire Protection Planners Pty Ltd
ABS	Australia Bureau of Statistics
ADRs	Australian Design Rules
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
APZ	Asset Protection Zones
ASD	Approach Sight Distance
ASRF	Aboriginal Site Recording Form
ASS	Acid Sulfate Soils
AUD	Australian Dollars
AWT	alternative waste technologies
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016*
BGL	below ground level
BOM	Bureau of Meteorology
BTEX	Benzene Toluene, Ethyl Benzene
C&D	Construction and demolition
C&I	Commercial and industrial
CCL	Composite clay liner
CCTV	closed circuit television
CIV	Capital investment value
CLM Act	*Contaminated Land Management Act 1997*
CRC	Community Recycling Area
DA's	Development approvals
DCP	Development Control Plans
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries

Term	Definition
ENM	Excavated natural material
Environmental Guidelines	*Environmental Guidelines: Solid Waste Landfills* (NSW EPA, 2016)
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulations	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instruments
EPL	Environmental Protection License
ESD	Ecologically Sustainable Development
FBA	*Framework for Biodiversity Assessment*
GHG	Greenhouse Gas
ha	Hectares
Heritage Act	*Heritage Act 1977*
HV	Heavy vehicles
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
km	kilometres
Km/hr	Kilometres an hour
LCP	landfill closure plan
LCV	Light commercial vehicles
LCRP	Landfill Closure and Rehabilitation Plan
LDPE	low density polyethylene
LEMP	Landfill Environmental Management Plan
LEPs	Local Environmental Plans
LFG	Landfill gas
LoS	Level of Service
LV	Light vehicles
m	metres
M	Million

Term	Definition
MBT	mechanical biological treatment
MNES	Matters of National Environmental Significance
MSW	Municipal Solid Waste
NP&W Act	*National Parks and Wildlife Act 1974*
NPI	*NSW Noise Policy for Industry* (EPA, 2017)
OEH	Office of Environment and Heritage
OU	Odour unit
PAD	Potential archaeological deposit
PAH	Polycyclic Aromatic Hydrocarbons
PCT	Plant community type
PHA	Preliminary Hazard Analysis
PIRMP	Pollution Incident Response Management Plan
$PM_{2.5}$	Particulate matter less than 2.5 in diameter
PM_{10}	Particulate matter less than 10 in diameter
POEO (Waste) Regulation	*Protection of the Environment (Waste) Regulation 2014*
POEO Act	*Protection of the Environment Operations Act 1997*
Ppm	Parts per million
Proposal Site	The land which is subject to the Proposal as defined in Figure 1-2 (Landfill extension)
PSNL	Project-specific noise levels
RBLs	Rating Background Levels
RFS	NSW Rural Fire Service
RMS	Roads and maritime Services
RNP	*NSW EPA Road Noise Policy* (EPA, 2011)
RRF	Resource Recovery Facility
RRP	Resource Recovery Park which is proposed to be adjacent to the West Nowra Recycling and Waste Facility
SCC	Shoalhaven City Council
SCC DCP 2014	Shoalhaven City Council Development Control Plan 2014

Term	Definition
SCC LEP 2014	Shoalhaven City Council Local Environmental Plan 2014
SCC LGA	Shoalhaven City Council Local Government Area
SEPP	State Environmental Planning Policy
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*
SEPP 44	*State Environmental Planning Policy No. 44– Koala Habitat Protection*
SEPP 55	*State Environmental Planning Policy No. 55– Remediation of Land*
SEPP 64	*State Environmental Planning Policy No. 64 – Advertising and Signage*
Shoalhaven LEP	Shoalhaven Local Environmental Plan
SISD	Safe intersection sight distance
SSD	State Significant Development
SWL	Sound power levels
t	tonnes
TDS	Total dissolved solids
TIA	Traffic Impact Assessment
TOC	Total Organic Carbon
TRH	Total Recoverable Hydrocarbons
TSC Act	*Threatened Species Conservation Act 1995*
TSP	Total suspended particulate matter
VENM	Virgin Excavated Natural material
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
Waste classification guidelines	NSW EPA (2014) *Waste Classification Guidelines*
WCMR	Waste Contributions Monthly Report
WM Act	*Water Management Act 2000*
WNRWF	West Nowra Recycling and Waste Facility

EXECUTIVE SUMMARY

Introduction

This Environmental Impact Statement (EIS) has been prepared on behalf of Shoalhaven City Council (SCC) to support a State Significant Development (SSD) application (SSD 7187) under Part 4, Division 4.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act) to extend the current landfilling area at the West Nowra Recycling and Waste Facility (WNRWF) at 120 Flatrock Road, Mundamia (the Proposal). Division 4.1 of the EP&A Act identifies the Minister for Planning (the Minister) as the consent authority for development that is identified as SSD.

The Proposal is for the extension of the existing landfill at the WNRWF and would involve the progressive construction, operation and rehabilitation of the stage 4 landfill extension at the WNRWF. The Proposal would utilise existing approved infrastructure at the WNRWF including but not limited to the: staff amenity building, storage shed, plant and equipment shed, weighbridge, transfer station area, landfill gas generator, gas flare and wash down bay. The Proposal would provide landfill capacity to service the SCC LGA for up to 30 years and would commence operation from approximately 2026. While the Proposal seeks approval to operate for up to 30 years, landfill life expectancy modelling estimates that the landfill would provide capacity for a minimum of eight years (i.e. to end 2034 under a worst case scenario) and up to approximately 18 years (i.e. to end 2044) under a reduced waste disposal scenario (SCC, 2017a). A 30 year approval would provide ongoing security for use of the Proposal Site as a landfill as it would account for potential changes in waste diversion rates from the waste transfer station area and RRP, policy changes and operational / technology improvements.

Over the last 15 years, SCC have implemented a range of waste management initiatives to reduce waste diversion rates across the local government area (LGA). Despite recent and expected future increases in diversion of waste to landfill, the annual waste acceptance rate would progressively increase over the life of the Proposal due to predicted population and waste generation growth per capita.

This EIS has been prepared by Arcadis on behalf of SCC, the Proponent, to support an application for approval of the Proposal. It has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued in August 2015 and extended in September 2017 by the Department of Planning and Environment (DP&E), the EP&A Act and Schedule 2 of the *Environmental Planning and Assessment Regulations 2000*.

Proposal objectives

The objectives of the Proposal are to:

- Provide landfill capacity to service the SCC LGA for up to 30 years
- Implement the strategies outlined in the WNRWF Proposed Stage 4 Landfill Extension – Landfill Master Plan (Master Plan (SLR, 2019b) in particular, securing future capacity for waste disposal as an essential facility to complement current operational and future potential resource recovery options
- Receive, and dispose to landfill, general solid waste from within the SCC LGA
- Excavate and extract clay to provide landfill capacity and cover material requirements
- Operate the facility in accordance with the *Environmental Guidelines: Solid Waste Landfill, Second edition 2016* (New South Wales Environmental Protection Agency [NSW EPA], 2016) (the Environmental Guidelines).

Strategic need

The current approved area of the landfill at the WNRWF, operated by SCC, is nearing the end of its capacity and additional waste disposal capacity is required to service the needs of the LGA. The existing landfill is expected to reach capacity in approximately in 2026. Therefore, the Proposal is required to address the future waste disposal requirements of the SCC LGA.

The Proposal seeks approval for an extension to the existing landfill at the WNRWF on the basis that:

- There is sufficient information available and documented herein, to inform a full and thorough environmental assessment of the Proposal
- SCC has implemented numerous strategies that are contributing to achieving the NSW Waste Avoidance and Resource Recovery (WARR) targets for 2021 - 2022 (WARR targets)
- The landfill extension would be located adjacent to the existing landfill on appropriately zoned land.

Alternatives

Do-nothing option

The do-nothing option is not feasible for a number of reasons; in particular, as it would fail to provide a suitable waste disposal facility for the ongoing needs of the SCC LGA. The existing WNRWF landfill is nearing its capacity and is expected to reach full capacity in approximately 2026.

The do-nothing option is not considered appropriate given the need for ongoing waste disposal capacity in the SCC LGA.

Alternative sites

The location of the Proposal was selected based on investigations into potential waste disposal locations within the SCC LGA by Locale Consulting in 2014. A number of alternative sites to the Proposal Site were assessed, including a site located off Warra Warra Road at South Nowra, which was initially selected as the preferred site. At that time, the current Proposal Site was earmarked for use as a Resource Recovery Park (RRP). At a council meeting in April 2015, a decision was ratified to relocate the RRP to an alternative site and the Proposal Site was then identified as the preferred site for the landfill extension. A letter addressed to SCC by Locale Consulting in July 2015 supported the suitability of the Proposal Site for the Proposal, provided potential environmental impacts were adequately mitigated.

Consultation

As part of an ongoing commitment to stakeholder engagement, SCC has implemented a program of communication and consultation during the preparation of the EIS. SCC has consulted with statutory agencies and stakeholders throughout the preparation of the EIS including:

- Department of Planning and Environment (DP&E)
- Environmental Protection Authority (EPA)
- Office of Environment and Heritage (OEH)
- Department of Primary Industries (DPI)
- Roads and Maritime Services (RMS)

- Rural Fire Service (RFS)
- Mine Subsidence Board
- Nowra Local Aboriginal Land Council (Nowra LALC)
- AGL
- The local community and stakeholders.

Key issues raised by statutory agencies and stakeholders included the need to ensure:

- The existing leachate management system can achieve the performance required by the NSW Landfill Guidelines
- That regional Aboriginal heritage culture sites were considered.

These issues are further addressed in Section 4, Section 8.4, Appendix N, Section 8.8.1 and Appendix O.

Key environmental issues

Environmental investigations were undertaken during the preparation of the environmental assessment to identify the potential environmental impacts of the Proposal. Key environmental issues included biodiversity, soil, water and leachate, air quality, greenhouse gas and hazards and risks including bushfires. The findings presented below are based on the outcomes of specialist investigations/assessments for each of these issues.

Other potential environmental impacts assessed included strategic land use planning, noise and vibration, socio-economic, visual amenity, non-Aboriginal heritage and traffic. It was determined the Proposal would not significantly impact these environmental aspects.

Strategic land use planning

The Proposal is permissible under the Shoalhaven Local Environment Plan 2014 (Shoalhaven LEP) as the Proposal Site is zoned Special Purpose (SP2) Infrastructure (Waste and Resource Management Facility). The Proposal would establish the existing WNRWF as the central waste management facility in the Shoalhaven LGA as it would:

- Maximise the use of existing infrastructure and land already zoned for waste management activities
- Reduce possible environmental and social impacts from waste management activities by centralising all waste management activities into a single location
- Reduce SCC's environmental accountability on land with waste management activities occurring, by centralising all waste management operations into a single site.

Biodiversity

A *Biodiversity Assessment Report* (BAR) was prepared for the Proposal in accordance with the Office of Environment and Heritage (OEH) *Framework for Biodiversity Assessment* (FBA) under the *NSW Biodiversity Offsets Policy for Major Projects* (Appendix B). The BAR assessed the Proposal Site using the FBA

methodology based on a development footprint[1] area of 9.87 hectares (ha) being cleared and areas outside of the development footprint but within the Proposal Site being retained as a vegetated visual amenity buffer (shown as the Conservation Area on Figure 1-1) and potential Biobank site.

The BAR identified one Plant Community Type (PCT) on the Proposal Site, Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion (SR594, PCT 1082) that would be impacted by the Proposal. A total of 9.87 ha of this PCT would be cleared for the Proposal which would require offsetting with 719 ecosystem credits. This PCT is not associated with any threatened ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

One threatened flora species *Triplarina nowraensis* (Nowra Heath Myrtle), listed as Endangered under the TSC Act and EPBC Act, was recorded on the Proposal Site. A total of 83 plants were detected however, these plants were recorded outside the development footprint and buffered by a minimum distance of 50 metres (m). The Proposal Site also contains potential habitat for four additional flora species. These are *Cryptostylis hunteriana* (Leafless Tongue Orchid, listed as Vulnerable under the TSC Act and EPBC Act), *Genoplesium baueri* (Bauer's Midge Orchid, listed as Endangered under the TSC Act and EPBC Act), *Hibbertia puberula* (listed as Endangered under the TSC Act) and *Hibbertia stricta subsp. furcatula* (listed as Endangered under the TSC Act). The Proposal is unlikely to have any direct or indirect impacts to threatened flora species.

Eleven threatened fauna species were recorded or assumed present on the Proposal Site. These were the Powerful Owl (*Ninox strenua*, listed as Vulnerable under the TSC Act), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*, listed as Vulnerable under the TSC Act), Glossy Black-Cockatoo (*Calyptorhynchus lathami*, listed as Vulnerable under the TSC Act), Eastern Pygmy-possum (*Cercartetus nanus*, listed as Vulnerable under the TSC Act), Squirrel Glider (*Petaurus norfolcensis*, listed as Vulnerable under the TSC Act), Yellow-bellied Glider (*Petaurus australis*, listed as Vulnerable under the TSC Act) and Grey-headed Flying-fox (*Pteropus poliocephalus*, listed as Vulnerable under the TSC Act and EPBC Act). An additional four threatened fauna species were considered to have a "probable" likelihood of occurrence on the Proposal Site and were therefore assumed present. These were the Masked Owl (*Tyto novaehollandiae*, listed as Vulnerable under the TSC Act), Large-eared Pied Bat (*Chalinolobus dwyeri*, listed as Vulnerable under the TSC Act and EPBC Act), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*, listed as Vulnerable under the TSC Act) and Greater Broad-nosed Bat (*Scoteanax rueppellii*, listed as Vulnerable under the TSC Act).

Out of the eleven threatened fauna species recorded or assumed present on the Proposal Site, nine are considered ecosystem credit species. These are the Powerful Owl, Masked Owl, Yellow-bellied Glider, Glossy Black-Cockatoo, Eastern False Pipistrelle, Greater Broad-nosed Bat, Eastern Bentwing-bat, Grey-headed Flying-fox and Large-eared Pied Bat. The latter three species are considered dual-credit species under the FBA, where species credits are only required for impacts to breeding habitat. As the Proposal Site does not provide breeding habitat for any of these species, no species credits are required. The area of 9.87 ha being cleared is considered foraging habitat for these three species, and impacts will be offset as a component of ecosystem credits.

Two recorded threatened fauna species are considered species credit species. These are the Eastern Pygmy-possum and Squirrel Glider. A total of 9.87 ha of foraging

[1] The development footprint comprises a 9.87 hectare area of native vegetation that would be cleared within the Proposal Site.

habitat would be impacted by the Proposal and would require 197 species credits and 217 species credits to be offset respectively.

To offset the impacts of the Proposal, SCC is currently considering several offset options including investigating the potential to biobank a site approximately 22 km south east of the Proposal Site at Huskisson.

Air quality

SLR was engaged to undertake an air quality impact assessment for the Proposal. The assessment concluded that the following indicators are predicted to be below relevant criteria at all sensitive receivers:

- Annual average incremental and cumulative total suspended particles (TSP) concentrations
- Maximum monthly incremental dust deposition rates
- Annual average incremental and cumulative $PM_{2.5}$ and PM_{10} concentrations
- Maximum 24 hour average incremental and cumulative $PM_{2.5}$ concentrations
- Maximum 24 hour average incremental PM_{10} concentrations.

The maximum 24 hour average cumulative PM_{10} concentrations predicted at sensitive receivers exceeds relevant ambient air quality criteria at all sensitive receivers. This was expected due to background files (from the NSW EPA Bargo monitoring station in 2014) containing one exceedance. Residential receiver R1 was the only residential receiver where exceedances of the maximum 24 hour average cumulative PM_{10} concentrations were found to be contributed to by the Proposal.

The predicted 99th percentile odour concentrations would comply with the adopted criterion at all residential receivers except R1 which is slightly above the adopted criterion due to how close it is to the Proposal Site. Similarly, odour concentrations above adopted criterion would be expected at sensitive receivers C1 and C2. However, they were not considered to be particularly sensitive to odour impacts as they are located adjacent to the landfill when some periods of detectable odours would be expected and people will not be present at these locations on a continual basis, especially during the evening when the highest off-site odour concentrations are most likely to occur.

The assessment was based on a number of conservative, worst-case scenarios and it is unlikely that these worst case scenarios will actually eventuate. The predicted impacts to sensitive receivers are therefore anticipated to be overestimates of actual impacts. Nevertheless, mitigation measures would be implemented to adequately reduce the impact of dust and odour emissions to surrounding sensitive receivers. In particular to sensitive receiver R1, where regular consultation and communication would be undertaken to ensure that dust and odours are managed to acceptable levels.

Soil, water and leachate

SLR was engaged to undertake a soil, water and leachate assessment for the Proposal. The assessment considered relevant legislation, policies and guidelines and included: a review of the existing environment and surrounding land uses, analysis of site investigations, review of site history, development of a site water balance and modelling to estimate leachate production, identification of potential soil, water and leachate impacts and identification of mitigation measures to reduce potential soil, water and leachate impacts.

The Proposal Site is located within the Shoalhaven River Catchment and is approximately 1.5 kilometres (km) south of the Shoalhaven River. The Proposal Site flows towards Cabbage Tree Creek which is located 300 – 400 m east of the Proposal

Site and the existing landfill site flows towards Sandy Creek which flows along the western boundary of the existing WNRWF. The assessment concluded that it's unlikely that Acid Sulfate Soils (ASS) would be present on the Proposal Site due to the topography of the site.

The Proposal Site is not considered at a high risk of flooding and has a low salinity hazard ranking. A review of the Proposal Site history indicates no potential land contaminating activities have been undertaken on the Proposal Site and a search of government databases reveals no record of contamination on the Proposal Site. However, as the Proposal Site is located adjacent to an existing landfill there is the potential for groundwater and surface water contamination, but this is considered to be low.

An assessment of the Proposal Site indicated that there is the potential for impacts to soil and water from windblown debris, erosion and sedimentation of surrounding water courses and leachate impact on groundwater and surface water caused by potential overflow of the existing leachate dam, infiltration of leachate into groundwater and stormwater run-off being contaminated after coming into contact with the leachate irrigation area or landfill waste materials and flowing into surrounding waterways.

A number of mitigation measures would be implemented during further design, construction and operation of the Proposal to minimise any potential soil, water and leachate impacts. These include: a leachate management system, erosion and sediment control plans, groundwater monitoring, dust suppression and litter management procedures. With appropriate implementation of these mitigation measures, the likelihood of potential soil, water and leachate impacts to the Proposal Site and surrounding area is considered to be low.

Noise and vibration

SLR was engaged to undertake a noise and vibration assessment for the Proposal. Two operational worst-case scenarios were modelled and assessed. As construction and operational activities will occur concurrently (due to the progressive nature of cell excavation and filling) noise modelling incorporated both construction and operational impacts. The assessment concluded that predicted noise levels would comply with the *NSW Noise Policy for Industry* (NPI) (EPA, 2017) at all residential and commercial receivers during Scenario 2. However, during Scenario 1, the assessment concluded that the predicted noise levels comply with the NPI at all residential and commercial scenarios except the nearest receiver where a minor exceedance of 2 dB is expected. Mitigation measures would be implemented to reduce the impact of noise on surrounding sensitive receivers.

Road traffic noise is predicted to comply with the *NSW EPA Road Noise Policy* (RNP) (EPA, 2011) during the morning peak, however is expected to exceed the RNP by 0.3 dB during the afternoon peak. This exceedance is considered to be minor and traffic noise mitigation measures are considered unnecessary for the Proposal.

No vibration impacts to surrounding sensitive receivers are predicted as vibration levels will be below the threshold of perception and due to the distance between the Proposal Site and the nearest sensitive receivers.

Traffic

A traffic assessment was undertaken to assess the impacts of the Proposal on the surrounding road network. The assessment used modelling scenarios to predict potential traffic changes and determined that there would be minimal impacts on traffic flows, the road network and road safety as follows:

- The total traffic comprising light and heavy vehicles estimated to access the Proposal Site in the year of opening (2026) is 10 and 38 during morning and afternoon peak periods respectively. In the year of closing (2034) total traffic

estimated to access the Proposal Site would be 16 and 48 during the morning and afternoon peak periods respectively

- The Yalwal Road / Flatrock Road intersection would maintain a level of service (LoS) A during peak periods in the year of opening (2026) and year of closing (2034).
- The Proposal would increase demand at the Princes Highway / Kalandar Street intersection by approximately one percent during both opening and closing years at an intersection that already runs at a LoS F during both morning and peak periods.
- The sight distance for the eastbound Yalwal Road movement does not satisfy desirable safe intersection sight distance (SISD) requirements due to an existing geometrical alignment constraint. Despite this, the combination of the existing geometrical conditions and warning signs, low future traffic volumes and no recorded crashes at or near the intersection suggests that the intersection operates satisfactorily from a safety perspective and is not anticipated to be exacerbated by the Proposal.

The Proposal is expected to minimally increase traffic numbers to the surrounding road network however the transport network has been identified as having sufficient capacity to cater for additional traffic. Mitigation measures would be implemented during construction and operation of the Proposal to reduce the impact of the SISD requirements not being able to be satisfied when travelling eastbound at Yalwal Road.

Greenhouse gas

A greenhouse gas assessment was prepared to assess the predicted greenhouse gas impacts of the Proposal.

The Proposal would generate greenhouse gas (GHG) emissions from waste decomposition, transportation, machinery and vegetation clearing. The single largest contributor to GHG emissions would be methane gas generated from landfill waste decomposition. Overall GHG emissions from the Proposal are at their highest emitting point in 2035. At the highest emitting year, overall GHG emissions from the Proposal are estimated to be approximately 41,441 tonnes (t) of carbon dioxide equivalents per annum (tCO_2-e/pa). This represents approximately 0.01 percent of Australia's total annual GHG emissions (as at 2016) and 0.03 percent of NSW's total emissions.

A number of mitigation measures will be implemented to minimise the generation of GHGs. These include project planning to minimise vehicle movements, abiding with the Landfill Environmental Management Plan (LEMP) developed for the site and ensuring that the final capping layer meets the relevant requirements at the time of capping, and ongoing review of GHG emissions profile of the landfill based on recorded waste volumes after landfilling commences for the Proposal.

Aboriginal heritage

In 2014 and 2015 Artefact undertook Aboriginal archaeological surveys for the West Nowra Resource Recovery Park (RRP). An additional archaeological survey was undertaken by Artefact in 2017. The survey identified no Aboriginal objects or potential archaeological deposits (PADs) on the Proposal Site. The Proposal Site and surrounding area is considered to be of very low archaeological potential and low archaeological significance due to its distance from freshwater sources, the broad crest landform and prior ground disturbance.

The proposed mitigation measures focus on the procedure for the management of unexpected archaeological finds.

Non-Aboriginal heritage

No items of local, state or national heritage significance were identified near the Proposal Site. Similarly, no items of heritage or archaeological potential were identified within the Proposal Site. Due to the limited historical non-Aboriginal land uses and dense vegetation that covers the Proposal Site, it is unlikely that items of non-Aboriginal heritage significance would be found during construction and operation of the Proposal.

Visual amenity

Given the nature of the surrounding area that consists primarily of undeveloped bushland, rural and residential dwellings, public roads and industry, the visual impact of the Proposal would not be significant in the context of the area of the Proposal Site. Due to the distance of the Proposal to sensitive receivers and the vegetation that provides a visual barrier, it is considered unlikely that the Proposal is visible from the surrounding area. Hence it would have a negligible visual impact on the surrounding area.

Hazards and risk

The results of the preliminary risk screening indicated that a preliminary hazard analysis (PHA) is not required as the only hazardous material likely to be accepted and stored onsite is asbestos and it does not fall within the classification of the Dangerous Goods Code. All other hazardous materials will be stored in existing storage facilities at the WNRWF that would be managed in accordance with the WNRWF's 2008 Landfill Environmental Management Plan (2008 LEMP).

A bushfire assessment was conducted by Australian Bushfire Protection Planners (ABPP) who identified the Proposal Site as having a high bushfire risk due to the vegetation surrounding the Proposal Site and adjoining forest to the east of Flatrock Road. The Proposal includes a number of mitigation measures to ensure there is limited potential for increased occurrence or severity of bushfire on the Proposal Site or surrounds.

Other potential hazard and risks have been assessed, including:

- Fire and explosion caused by a number of factors including encroachment of bushfires, fires in waste, methane accumulation and ignition or fires reaching the landfill gas generator and gas flare infrastructure
- Liquid and solid spills may arise from situations such as potential loss of putrescible loads
- Health and respiratory impacts caused by vehicle exhaust, dust or microbial or gases/odours, and asbestos
- Safety of pedestrians and drivers at risk from vehicle movements on site.

The Proposal is considered to have minimal potential for impacts to human and environmental health with the application of the proposed mitigation measures.

Socio-economic

It is not expected that the construction and operation of the Proposal would lead to any long-term socio-economic impacts. Whilst construction and operation of the Proposal has the potential to impact on the surrounding area through minor increases in noise levels these impacts would be appropriately managed and are likely to be minimal and localised. Overall, the Proposal would provide a significant benefit to the LGA by securing future landfill capacity for the LGA, providing ongoing employment

opportunities and improving the environmental performance of SCC's waste management solutions.

Ecologically sustainable development

The Proposal has been developed in accordance with the four principles of ecologically sustainable development (ESD): the precautionary principle; inter-generational equity; conservation of biological diversity; and ecological integrity and improved valuation, pricing and incentive mechanisms.

The Proposal design and associated technical studies were undertaken using a conservative worst-case scenario analysis to avoid, minimise and mitigate potential environmental impacts. Subject to the implementation of mitigation measures outlined in this EIS, these specialist studies did not identify any issues that may cause serious or irreversible environmental damage as a result of the Proposal.

The Proposal has been designed to benefit both existing and future generation through the extension of the West Nowra Landfill, which combined with other SCC waste minimisation and resource recovery initiatives will be sufficient to service the Shoalhaven LGA for an additional eight to 18 years (i.e. to 2034 or 2044).

A biodiversity assessment was undertaken to identify any potential impacts of the Proposal on local biodiversity. A key element of the Proposal is the inclusion of a conservation area along the eastern side of the Proposal Site and installation of three fauna rope bridges to promote fauna connectivity east of the Proposal Site. In addition, SCC are undertaking further investigation into biodiversity offsets to further conserve the biological diversity and ecological integrity of the Proposal Site and surrounding area.

While it is often difficult to place a reliable monetary value on the residual, environmental and social effects of the Proposal. The value placed on environmental resources within and around the Proposal is evident in the extent of environmental investigations, planning and design of impact and mitigation measures undertaken to inform assessments and to minimise, if not prevent, adverse environmental impacts during construction and operation of the Proposal.

1 INTRODUCTION

Shoalhaven City Council (SCC), as part of waste management planning for the Shoalhaven region, is proposing to extend the current landfilling area at the West Nowra Recycling and Waste Facility (WNRWF) at 120 Flatrock Road, Mundamia (the Proposal).

1.1 Proposal overview

The Proposal would involve the progressive construction, operation and rehabilitation of the Stage 4 landfill extension at the WNRWF. The landfill extension and associated areas (including access roads, sediment dams, fire trails and a conservation area) would occur on Lot 1 DP 1104402, Lot 1 DP 870268 and Lot 1 DP 847203, with the leachate management system extending into Lot 1 DP 1018193. The location of the Proposal is shown in Figure 1-1 with the Proposal Site boundary and sub-cells layout shown in Figure 1-2. The Proposal Site is owned by SCC and it would utilise existing approved infrastructure at the WNRWF including but not limited to the: staff amenity building, storage shed, plant and equipment shed, weighbridges (entry and exit), transfer station area, landfill gas generator, gas flare and wash down bay. The interface between the existing infrastructure at the WNRWF and the Proposal is explained in further detail in Section 5.2.

The Proposal Site is predominantly set within undeveloped bushland. The Shoalhaven River is located approximately one kilometre north of the Proposal Site, with two tributary creeks, Sandy Creek and Cabbage Tree Creek, within 500 m to the west and east of the Proposal Site respectively. Semi-rural properties are located to the south and south-east of the WNRWF. The main township of Nowra is located approximately 4.5 kilometres to the east of the Proposal Site.

The Proposal Site is approximately 18.6 ha (including approximately 1.4 ha for the proposed new leachate irrigation area) and is on land appropriately zoned SP2 Infrastructure – Waste and Resource Management Facilities. The Proposal would be managed under SCC's existing and varied Environmental Protection Licence (EPL 5877) (Appendix A).

SCC considered a range of waste generation and disposal scenarios to develop estimates of future waste disposal rates and subsequent landfill life expectancy. Under the worst case scenario, the current operational landfill area (Stage 3) would reach capacity in approximately 2026[2].

The Proposal would provide landfill capacity to service the SCC LGA for up to 30 years and would commence operation from approximately 2026. While the Proposal seeks approval to operate for up to 30 years, landfill life expectancy modelling estimates that the landfill would provide capacity for a minimum of eight years (i.e. to end 2034 under a worst case scenario) and up to approximately 18 years (under a reduced waste disposal scenario) (SCC, 2017a). These scenarios are explained in further detail in Section 3.1.2.

The preparatory and completion works for the landfill extension (e.g. landfill cell construction, construction of leachate barrier systems, and final rehabilitation) may commence/conclude up to two years before/after the commencement and completion of landfilling. The filling rates and landfill capacity would be reviewed on an ongoing basis. The final landfill capacity would be approximately 1.38 Mm^3, with an approximate elevation of RL 59 m.

---

[2] Landfill life expectancy estimates were developed by SCC (2017a) and refined by Arcadis. The estimates are explained in further detail in Section 3.1.2 and provided in Appendix D (*Landfill Extension – Draft Landfill Life Expectancy Calculations – West Nowra – 20 January 2017)*.

Approval is sought for the Proposal in the form of a Development Application (DA) under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). SCC submitted a request for the Secretary's Environmental Assessment Requirements (SEARs) for the Proposal on 22 July 2015. SEARs were issued on 19 August 2015 (Reference SSD 15_7187) and were subsequently updated on 11 July 2017. An extension to the SEARs was granted on 22 September 2017 (Appendix C).

The Proposal would receive waste from all areas within the SCC local government area (LGA) including the major township of Nowra. Waste would include general solid waste (i.e. putrescible and non-putrescible materials), commercial and industrial (C&I) waste, and asbestos from domestic, construction and demolition (C&D) sources. Currently, the existing Stage 3 Landfill receives approximately 65,000 tonnes of waste per annum (p.a.). At the commencement of operation of the Proposal, the Stage 4 landfill is expected to receive approximately 65,000 tonnes of waste p.a. and this would progressively increase to approximately 160,000 tonnes p.a tonnes in the closing year (2044).

The key works for which approval is sought include:

- Progressive landfill cell construction, operation and rehabilitation of the Stage 4 landfill extension including:
  - Clearing of 9.87 ha of existing vegetation
  - Construction of access tracks and fire trails
  - Earthworks for cell formation including extraction and stockpiling of materials and the reapplication to form the leachate barrier (cell liner) as well as for daily, intermediate and final cover
  - Installation of leachate management structures including the leachate barrier, collection, storage and transfer system (including construction of a rising main to transfer leachate to the existing leachate collection dam established as part of earlier landfilling activities within the WNRWF and infrastructure to pump leachate from the dam to a proposed new leachate irrigation area on the existing Stage 2 landfill area).
  - Installation of a surface water management system, including sediment dams, sediment erosion control measures and surface diversion bunds/swale drains
  - Installation of additional groundwater bores for groundwater monitoring
  - Progressively increasing the annual waste acceptance rate at the landfill
  - Signage and other ancillary works
  - Rehabilitation of closed landfill sub-cells
- Delineation and ongoing management of a conservation area along the southern and eastern boundary of the Proposal Site
- Installation of three fauna rope bridges with monitoring cameras over Flatrock Road.

The Proposal is expected to provide approximately 1.38 Mm^3 of additional landfill capacity and would be developed in sub-cells as described in Section 5.

West Nowra Landfill Extension

LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- Watercourse

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Figure 1-1: Proposal Site location

West Nowra Landfill Extension

LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- WNRWF boundary
- Stage 4 landfill extension sub-cells
- Cadastre (LPI, 2017)
- Fire trail
- Internal road network
- Indicative wildlife rope bridge poles
- Existing leachate dam
- Existing sediment basin
- Proposed sediment basin
- Conservation area

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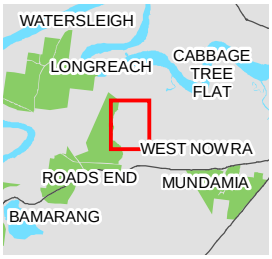


Figure 1-2: Proposal Site layout

The Proposal would be open to the public from 8:00 am to 5:00 pm, Monday to Sunday however would be closed on public holidays.

Site management activities, such as daily waste covering operations, may continue one hour after closure. The concept design for the Proposal has been developed by SLR Consulting (SLR) and is generally in accordance with the *Environmental Guidelines: Solid Waste Landfills*, Second Edition, 2016 (EPA, 2016) (Environmental Guidelines). The *Concept Design Report* (SLR, 2019a) is provided in Appendix E.

SCC is committed to the reduction of waste being directed to landfill. It should be noted that the proposed landfill extension is not being considered in isolation of other waste management efforts being considered by SCC, including development and operation of a Resource Recovery Park adjacent to the WNRWF which aims to further increase resource recovery rates and thus reduce waste to landfill volumes in the future.

Arcadis has been engaged by SCC to prepare this EIS for the Shoalhaven landfill extension.

1.2 Proposal objectives

The objectives of the Proposal are to:

- Provide landfill capacity to service the SCC LGA for up to 30 years
- Implement the strategies outlined in the *WNRWF Proposed Stage 4 Landfill Extension – Landfill Master Plan* (Master Plan) (SLR, 2019c) in particular, securing future capacity for waste disposal as an essential facility to complement current operational and future potential resource recovery options
- Receive, and dispose to landfill, general solid waste from within the SCC LGA
- Excavate and extract clay to provide landfill capacity and cover material requirements
- Operate the facility generally in accordance with the Environmental Guidelines.

The Proposal also aims to assist in meeting the NSW Waste Avoidance and Resource Recovery (WARR) targets for 2021–22 including:

- Increase recycling
- Divert more waste from landfill
- Manage problem wastes better
- Reduce litter
- Reduce illegal dumping.

1.3 Background to the Proposal

1.3.1 Existing approvals

The existing operational landfill within the WNRWF (the Stage 3 landfill) is the primary solid waste landfill for the SCC LGA. The landfill is operated by SCC and currently receives waste from nine waste transfer stations and a domestic waste collections service, as well as via public and commercial drop-off to the WNRWF transfer station. The landfill is the only one licensed to accept both general solid waste (putrescible and non-putrescible) in the SCC LGA.

The existing operational landfill at the WNRWF incorporating Stages 1, 2 and 3 was approved for operation by DA 90/3061 under Section 92 of the EP&A Act on 24 May 1991. DA 90/3061 included the construction of a range of supporting infrastructure

such as bunds and stormwater dams, leachate dam, internal access roads, car parking and leachate treatment and disposal areas.

Other DA approvals associated with the WNRWF (see Appendix AA) include:

- DA 90/3061 (amendment): amendment to the existing Conditions of Approval (CoA) to include conditions related to requirements of a rehabilitation plan, addition of a leachate collection system, retention of existing vegetation and alteration of the location of Stage 1 of Waste Depot (granted 14 December 1994)
- DA 90/3061 (amendment): amendment to the existing CoA to update condition 15 to indicate that no disturbance is to take place within 200 m of Sandy Creek from the Stage 2 landfill area and the inclusion of two new conditions related to the approval of a rehabilitation and revegetation plan to be prepared in consultation with Department of Land and Water Conservation (granted 17 September 1996)
- DA08/2388: approval for construction of a new Staff Amenities Building on Lot 1 DP 847203 within the WNRWF (granted 5 November 2008)
- DA16/1511: approval for construction of a cover over the existing Weighbridge Office on Lot 1 DP 1018193 within the WNRWF (granted 14 July 2016)
- DA16/1432: approval for a Waste Transfer Station on Lot 436 DP 808415 within the WNRWF (granted 16 September 2016)
- SSD 15_7015: As discussed in further detail in Section 2.5, Council has recently received approval for development of a Resource Recovery Park (RRP) adjacent to the WNRWF. The approval was granted under Part 4 of the EP&A Act and applies to the concept proposal for a resource recovery facility and Stage 1 works that include the demolition of existing structures, site clearing and site preparation works. This site is located directly north of the Proposal Site

Table 1-1 and Figure 1-3 provide details on the existing approved infrastructure at the WNRWF, including approval under relevant DAs. In addition to DA 90/3061 (see

Figure 1-3), the following DAs are also present within the WNRWF boundary:

- DA 08/2388: staff amenity building
- DA16/1511: cover over the existing weighbridge office
- DA16/1432: waste transfer station area.

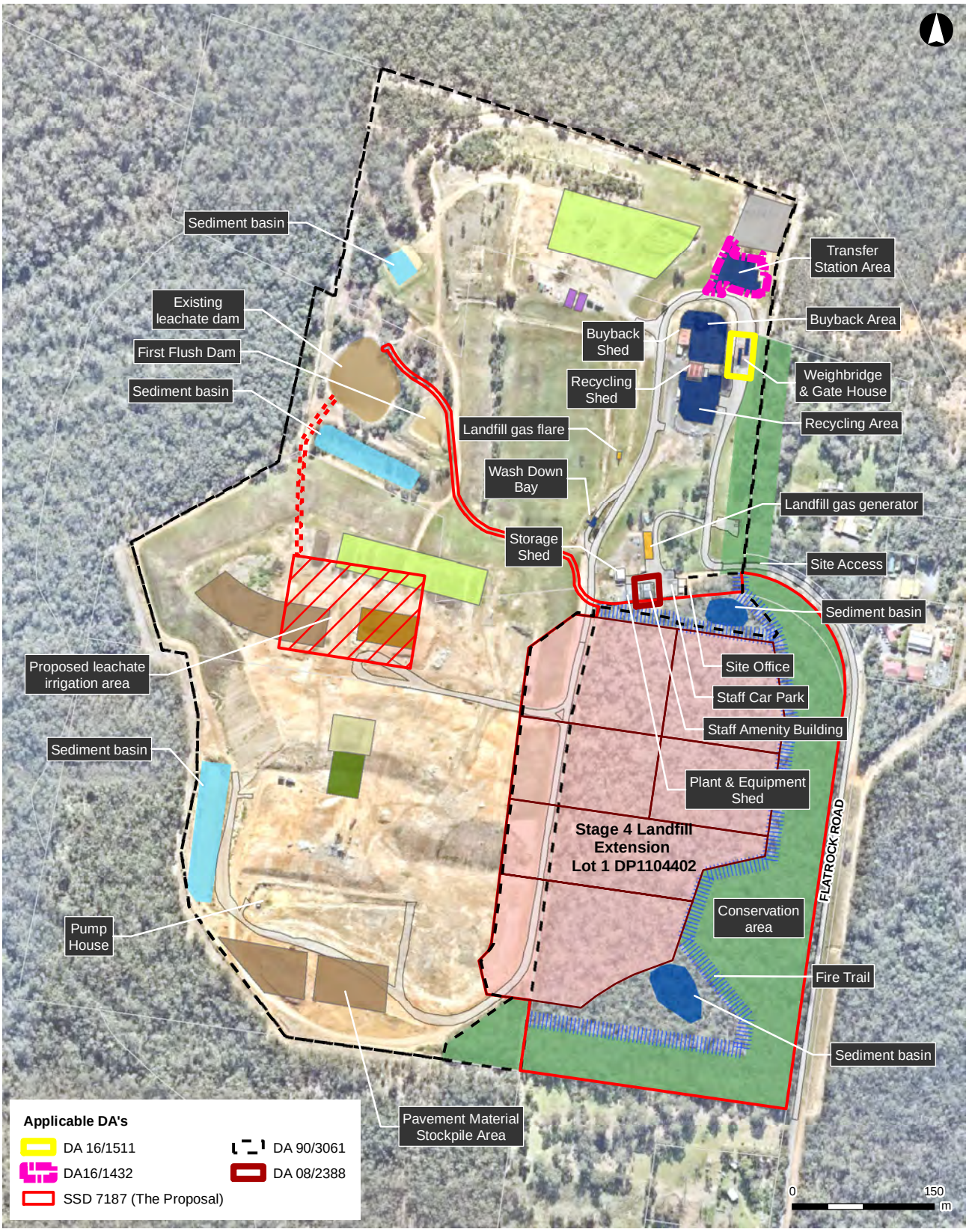
Whilst the above DAs are located within the WNRWF boundary, they are subject to different conditions of approval. However, they form part of the operation of the WNRWF. Section 5.2 provides details on how the Proposal utilises existing infrastructure at the WNRWF.

Table 1-1 Existing DA approvals at the WNRWF

Infrastructure item	DA Number
Site support facilities	
Entrance and exit	DA 90/3061 – 24 May 1991
Site office	DA 90/3061 – 24 May 1991
Car park	DA 90/3061 – 24 May 1991
Staff amenity building	DA 08/2388 – 5 November 2008
Plant and equipment shed	DA 90/3061 – 24 May 1991
Storage shed	DA 90/3061 – 24 May 1991

Infrastructure item	DA Number
Waste Processing Areas	
Weighbridges and gatehouse	DA 90/3061 24 May 1991 and DA 16/1511 – 14 July 2016 (Cover over weighbridge office)
Transfer station area	DA 16/1432 – 16 September 2016
Tyres collection area	DA 90/3061 – 24 May 1991
Non-ferrous collection area	DA 90/3061 – 24 May 1991
Green waste stockpile and processing area	DA 90/3061 – 24 May 1991
Steel waste stockpile and processing area	DA 90/3061 – 24 May 1991
Construction and demolition waste stockpile area	DA 90/3061 – 24 May 1991
VENM stockpile areas	DA 90/3061 – 24 May 1991
Pavement materials area	DA 90/3061 – 24 May 1991
Recycling sorting and collection area	DA 90/3061 – 24 May 1991
Buyback area	DA 90/3061 – 24 May 1991
Active landfill and wet weather disposal area	DA 90/3061 – 24 May 1991
Environmental Management Infrastructure	
Landfill gas generator	DA 90/3061 – 24 May 1991
Landfill gas flare	DA 90/3061 – 24 May 1991
Wash down bay	DA 90/3061 – 24 May 1991

West Nowra Landfill Extension



LEGEND

- WNRWF boundary
- Proposal site
- Leachate irrigation area
- Indicative leachate pipeline
- Internal access road
- Cadastre (LPI, 2017)
- Green waste processing and stockpile area
- Venm stockpile area
- Landfill gas flare
- Tyre & Non-Ferrous collection area
- CD waste stockpile area
- Active disposal area
- CRT cell
- Steel waste stockpile and accessing area
- Building

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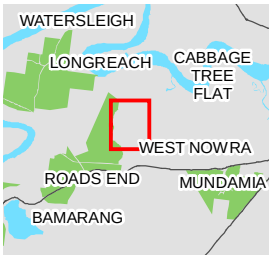


Figure 1-3: Applicability of Development Approvals at the WNRWF

1.3.2 Recent waste initiatives

As discussed further in Section 3.1, SCC has undertaken a range of waste initiatives over the last 15 years aimed at reducing waste to landfill and improving the waste management services within the region. These initiatives have included the closure of a number of small rural tip sites in order to concentrate resources and delivery of services at the West Nowra landfill. Other waste management initiatives either implemented or currently planned within the LGA include:

- Investigations in 2003 into alternative waste technologies (AWTs) that could form part of the solution for waste management and resource recovery
- Undertaking a number of trials in 2008 on the processing of domestic waste (including source separation of green waste)
- Preparation of a cost-benefit analysis in 2008 which considered the development of an RRP inclusive of an AWT. In 2013, SCC resolved to call for expressions of interests for the establishment of the RRP and AWT. The RRP received concept approval under Part 4 of the EP&A Act from the Department of Planning and Environment (DP&E) (SSD 15_7015) on 25 August 2016 and the construction contract for the RRP is currently out for tender
- Provision of:
  - Combined waste / recycling collection service for rural areas (851 additional services)
  - Collection facilities and equipment for the recycling of polystyrene (increased from 3.9 t in 2013 to 26.04 t in 2017)
  - Schools programs targeted to meet pre, primary and high school students
  - Increased waste and recycling collection services over the Christmas holiday period (increased recycling tonnages over this period by 12 %)
  - A popular program of home sustainability workshops, including home composting training with the provision of bins provides to approximately 8,000 households (16 % of the population) in the Shoalhaven over the last 10 years
  - A campaign run with real estate agencies to increase recycling from coastal holiday rentals.

These initiatives have improved waste reduction, reuse and recovery rates within the Shoalhaven LGA.

Despite the suite of beneficial waste management strategies implemented in recent years, there remains a need for additional landfill capacity to service the needs of the population into the future (see Section 3).

Given the existing landfill is nearing its capacity, SCC investigated the likely landfill life expectancy under a range of waste management scenarios. The investigation calculated the landfill life expectancy with the existing landfill only, and also with the addition of the RRP and the proposed landfill extension. The results show that the capacity of the existing landfill would be exhausted by approximately 2026 and an additional landfill stage is required to cater for SCCs waste disposal requirements.

1.4 Structure of this EIS

This document is structured as follows:

- **Executive Summary:** Provides a brief overview of the Proposal, key environmental assessment results and an outline of the proposed mitigation measures

- **Chapter 1 - Introduction:** Provides an introduction to the Proposal and the EIS, including the objectives and background to the Proposal
- **Chapter 2 - Site analysis:** Provides a summary description of the Proposal Site and surrounding land uses
- **Chapter 3 - Proposal need and alternatives:** Provides a discussion on the need for the Proposal including the strategic justification, relevant plans and policies and a description of alternatives to the Proposal
- **Chapter 4 - Consultation:** Provides a summary of the consultation (community, stakeholder and government agencies) which has been undertaken to date for the Proposal
- **Chapter 5 - Proposal description:** Includes a description of the Proposal including a description of proposed works, built form (such as landfill cells, leachate irrigation area, fauna poles etc), construction methodology and operational processes and procedures
- **Chapter 6 – Statutory planning and approvals:** Describes the statutory legislation and plans relevant to the Proposal at a Commonwealth, State and Local Government level
- **Chapter 7 - Environmental risk assessment:** Provides an analysis of the likely environmental risks and assigns a risk rating before and after the implementation of mitigation measures
- **Chapter 8 - Key environmental issues:** Provides a discussion on the existing environmental conditions and an assessment of the key environmental issues for the Proposal as identified in the SEARs as well as any issues not listed in the SEARs yet which are considered relevant to the Proposal
- **Section 9 - Compilation of mitigation measures:** Includes a summary of the mitigation measures provided in Section 8 to minimise any adverse impact of the Proposal on the surrounding environment
- **Section 10 - Summary and conclusion:** Provides a summary and conclusion of the Proposal
- **References:** Provides a list of the materials referenced throughout this EIS
- **Appendices:** Includes the SEARs and the specialist technical reports relied upon for the preparation of this EIS.

1.5 Secretary's environmental assessment requirements reference guide

The SEARs for the Proposal were issued on 19 August 2015 under Section 78A (8A) of the EP&A Act, Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulations) (SSD 7187) and were subsequently updated on 11 July 2017. An extension to the SEARs was granted on 22 September 2017 (Appendix C). Table 1-2 provides the full details of the SEARs and a reference to where they are addressed in this EIS.

Table 1-2 Secretary's environmental assessment requirements: reference guide

Sub-heading	Details	Reference
General requirements		
	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	All sections of this document

Sub-heading	Details	Reference
	Environmental Planning and Assessment Regulation 2000. In addition, the EIS must include a: • clear description of the existing operations carried out on the site and how the site operates lawfully under the *Environmental Planning and Assessment Act 1979*. • detailed description of the development including: – need for the proposed development having particular regard to the aims, objectives and guidance in the *NSW Waste Avoidance and Resource Recovery Strategy 2014-2021*. – justification for the proposed development – likely staging of the development – including construction and operational stage/s – likely interactions between the development and existing approved and proposed operations in the vicinity of the site; and – plans of any proposed building works. • consideration of all relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments • risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment • detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: – a description of the existing environment, using sufficient baseline data – an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes – a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment; and • a consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS The EIS must be accompanied by a report from qualified quantity surveyor providing: • a detailed calculation of the capital investment value as defined in clause 3 of the *Environmental Planning and Assessment Regulation 2000*) of the proposal, including details of all assumptions and components which the CIV calculation is derived	

Sub-heading	Details	Reference
	• a close estimate of the jobs that will be created by the development during the construction and operational phases of the development; and • certification that the information provided is accurate at the date of preparation	
Key issues		
Suitability of the Site	– details of all development consents and approved plans for the existing facility, including for all structures, plant and equipment – results of an independent audit of the operation of the existing facility against the conditions of all development consents and all Environmental Protection Licences in force in respect of the existing facility to ascertain the baseline for the proposed landfill extension – a detailed justification that the site can accommodate the proposed landfill extension, having regard to the scope of the operations of the existing facility and its environmental impacts and relevant mitigation measures	Section 1.3.1 Section 3.5 Appendix Y
Waste management	– identification, classification and quantification of the likely waste streams that would be handled/stored/disposed of at the facility; – a description of how this waste would be treated, stored, used, disposed and handled on site, and transported to the site, and the potential impacts associated with these issues; – an analysis of whether the development is consistent with Clause 123 of the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP); – a description of all reasonable and feasible measures that have been or would be implemented to maximise resource recovery from the waste stream and reduce the disposal of waste to landfill in line with the aims, objectives and guidance in the *NSW Waste Avoidance and Resource Recovery Strategy 2014-2021,* the EPA's *Guidelines for Composting and Related Organics Processing Facilities,* Council's adopted Waste Strategy, and other government policy; and – details of the landfill cell design and integrity in accordance with best practice industry standard guidelines such as the EPA's *Environmental Guidelines: Solid Waste Landfills.*	Section 5
Strategic land use planning	– demonstration that the proposal is generally consistent with the aims and objectives of all relevant environmental planning instruments and strategies including, but not limited to, the Infrastructure SEPP, the *NSW Waste Avoidance and Resource Recovery Strategy 2014-2021,*	Section 8.1

Sub-heading	Details	Reference
	NSW State Plan 2021 – Goal 23, the Waste Avoidance and Recovery Act 2001, the National Waste Policy, Shoalhaven Local Environmental Plan 2014, and relevant Development Control Plans; – justification for any inconsistency between the proposed development and these plans; – details on the suitability of the site for the proposed development.	
Flora and fauna	– an assessment of the proposal under the Framework for Biodiversity Assessment (Oct 2014) including an assessment of any potential impacts on riparian vegetation and groundwater dependant ecosystems	Section 8.2
Air quality and odour	– a quantitative assessment of the potential air quality and odour impacts of the development on surrounding receivers, including impacts from construction, operation and transport; and – details of the proposed mitigation, management and monitoring measures.	Section 8.3
Soil, water and leachate	– a detailed site water balance, including identification of water requirements for the life of the project, measures that would be implemented to ensure an adequate and secure water supply is available for the proposal and a detailed description of the measures to minimise the water use at the site; – consideration of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 and Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011;* – consideration of potential acid sulfate soils, salinity and soil contamination; – a detailed assessment of the potential impacts of the project on the quantity, quality and long-term integrity of the surface and groundwater resources in the area, including Cabbage Tree Creek and the Shoalhaven River, including baseline data of existing conditions, and potential flooding impacts; – the proposed stormwater management system, including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water; – the proposed leachate management system including the capacity of the system to treat and dispose of leachate; and – the proposed erosion and sediment controls during construction and operation.	Section 8.4

Sub-heading	Details	Reference
Noise and vibration	– quantitative assessment of potential construction, operational and transport noise and vibration impacts, including potential impacts on nearby sensitive receivers; and – details of the proposed noise management and monitoring measures.	Section 8.5
Traffic	– details of all traffic types and volumes likely to be generated; – plans demonstrating how all vehicles likely to be generated during construction and operation and awaiting loading, unloading or servicing can be accommodated on the site to avoid queuing in the street network – assessment of predicted impacts on road safety and the capacity of the road network to accommodate the project; – assessment of where off site infrastructure works are required as a result of traffic impacts.	Section 8.6
Greenhouse gas	– a quantitative assessment of the scope 1, 2 and 3 greenhouse gas emissions of the project; – a detailed description of the measures that would be implemented to minimise the methane emissions of the proposed landfill operations and ensure that the project is energy efficient.	Section 8.7
Heritage	– both Aboriginal and non-Aboriginal;	Section 8.8
Rehabilitation	– a detailed description of how the site would be progressively rehabilitated, revegetated, and integrated into the surrounding landscape, including measures to ensure that the final landform is free draining; – a justification for the proposed final landform and use, taking into consideration any relevant strategic land use planning or resource management plans or policies; and – a detailed description of the measures that would be put in place to ensure sufficient resources are available to implement the proposed rehabilitation measures, and the ongoing management of the site following the cessation of landfilling activities.	Section 5.9
Fire and incident management	– technical information on the environmental protection equipment to be installed on the premises such as air, water and noise controls, spill clean-up equipment and fire (including location of fire hydrants and water flow rates at the hydrant) management and containment measures	Section 8.10
Hazards and risks	– Hazards and risks – including bushfire;	Section 8.10

Sub-heading	Details	Reference
Biosecurity, pests and vermin	– Biosecurity, pests and vermin	Section 5.8.16
Visual impacts	– Visual impacts.	Section 8.9
Consultation	During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular, you must consult with: • Environment Protection Authority; • Office of Environment and Heritage; • Department of Primary Industries; • Roads and Maritime Services; • NSW Rural Fire Service • Mine Subsidence Board; • AGL; and • the local community and stakeholders. The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	Section 4

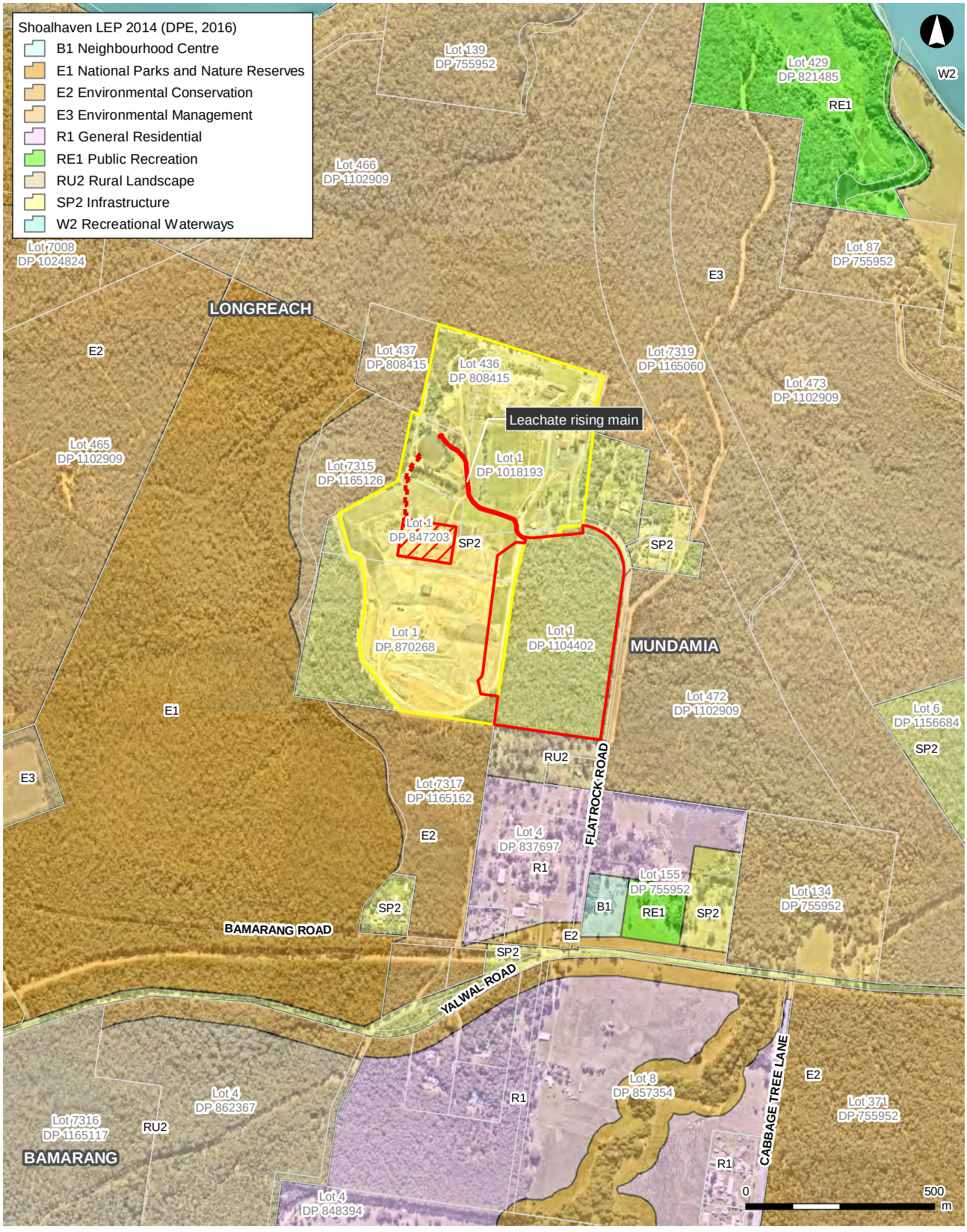
2 SITE DESCRIPTION

The Proposal Site is located approximately 4.5 kilometres west of Nowra and approximately 17 km south-west of Berry. The site is within the WNRWF and is approximately five kilometres west of the Princes Highway (see Figure 1-1).

The Proposal Site covers an area of approximately 18.6 ha (including approximately 1.4 ha for the proposed new leachate irrigation area) and is owned by SCC. The proposed site layout is shown in Figure 1-2. The Proposal Site is currently vegetated and includes the area proposed for the six landfill cells as well as an area designated as biodiversity corridor and conservation area. The Proposal Site is located along a ridge line that extends to Flatrock Road.

The site is managed by SCC and is classified as operational land. The site is within Lot 1 / DP 1104402, Lot 1 / DP 870268, Lot 1 / DP 847203, and Lot 1 / DP 1018193 at 114 Flatrock Road, Mundamia. The site is zoned SP2 Infrastructure – Waste and Resource Management Facilities under the Shoalhaven Local Environmental Plan 2014 (SCC LEP 2014) as shown on the land zoning map in Figure 2-1.

West Nowra Landfill Extension



LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- WNRWF boundary
- Cadastre (LPI, 2017)

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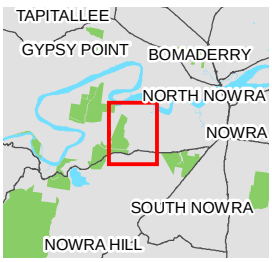


Figure 2-1: Land use zoning

The area for landfilling was chosen for the following reasons:

- The Proposal Site is appropriately zoned for waste management activities and would maximise the use of existing waste management infrastructure
- The landfill area is relatively flat and is located along a ridge line
- It is offset from the nearest residential property[3] by 250 m
- The landfill is appropriately buffered by vegetation to the north, south and east of the Proposal Site and by the WNRWF to the west of the Proposal Site
- The contours of the site and the extent of the area available to be retained as natural buffers ensure that there is minimal visibility of the site from any area outside the Proposal Site.

The WNRWF has been in operation since 1979 with current landfill operations approved in 1988. Since commencement of operations, the WNRWF has received very few complaints regarding management of the facility (approximately three complaints in the last 13 years). The few complaints received were related to odour and have been addressed through operational improvements and direct consultation with complainants and the regulator (EPA). The broader community's acceptance of the landfill (further detail in Section 4) and compliance with environmental performance requirements indicates that the siting of the landfill is suitable, providing an adequate buffer from sensitive environmental receivers.

2.1 Surrounding land uses

The land uses surrounding the Proposal Site can be ascertained through reference to the site layout shown on Figure 1-2 and the land zoning shown on Figure 2-1. The nearest residential property is located approximately 250 m to the south of the Proposal Site[3] on land zoned R1 General Residential.

Immediately to the west and north of the Proposal Site is the WNRWF which is zoned SP2 Infrastructure – Waste and Resource Management Facilities. To the west of the WNRWF is bushland zoned E3 Environmental Management and to the south is bushland zoned E2 Environmental Conservation. Further to the west and south-west of the WNRWF is the Bamarang Nature Reserve, however it is noted that this reserve does not abut the Proposal Site or the WNRWF.

SCC has recently received concept approval for construction of an RRP on a parcel of land north of the Proposal Site on land zoned SP2 Infrastructure – Waste and Resource Management Facilities. The proposed RRP is discussed in further detail in Section 2.5.

The southern boundary of the Proposal Site is bordered by land zoned RU2 Rural Landscape. Further south of the Proposal Site is land zoned R1 General Residential. This land contains several other residential receivers and is earmarked as a future Urban Release Area in the SCC Interactive SLEP 2014 Web Maps (SCC, 2017c).

[3] Note: there is one residential dwelling within 250 m of the proposed landfilling area, however SCC has advised this is an illegal dwelling and therefore the boundary of the landfilling area has been set to be 250 m from the nearest legal dwelling.

2.2 Site history

The WNRWF commenced operation in 1979 and to date has involved three landfill stages (Stages 1, 2 and 3). The current landfill operations (Stage 3) were approved in 1988 and are covered under EPL 5877.

The landfill originally received domestic, industrial and commercial liquid and solid wastes. Additionally, it has also received hazardous wastes such as asbestos and oil; however, with the exception of asbestos waste, the disposal of these wastes has been prohibited since 1996 (SLR, 2019a).

Early landfilling practices at the WNRWF consisted of excavating and filling a series of trenches however operations have evolved over time and now involve progressive excavation and filling of sub-cells.

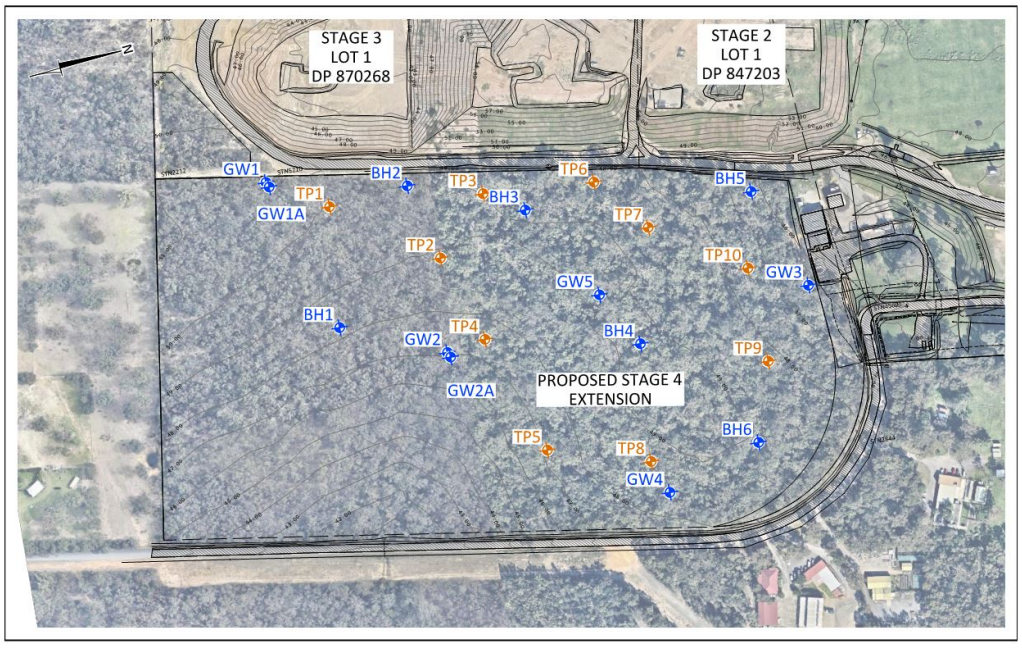
The use of the WNRWF in relation to the previous landfill stages is as follows:

- Stage 1: “old” landfill area, stockpile and irrigation areas, and landfill gas extraction
- Stage 2: recently completed landfill area, currently utilised for stockpiling and landfill gas extraction
- Stage 3: the active landfill disposal area(s) and wet weather tipping area.

The proposed Stage 4 landfill extension would be located to the east of the current Stage 3 landfilling area.

2.3 Site conditions

The concept design for the Proposal was informed by geotechnical and hydrogeological site investigations undertaken by Coffey between 23 May and 1 July 2016. The investigation included drilling of six boreholes, excavation of 10 test pits, drilling and installation of seven standpipe piezometers and laboratory testing of selected samples. The Coffey report (*Geotechnical and Hydrogeological Investigation: West Nowra Recycling and Waste Facility* (Coffey, 2016) (Geotechnical Report) is included as part of the Concept Design Report in Appendix E**.** The geotechnical and hydrogeological investigation plan is shown in Figure 2-2.



(Note: BH = borehole, TP = test pit, GW = standpipe piezometer)

Figure 2-2 Geotechnical and hydrogeological investigation plan

The information in this section is drawn from both the Geotechnical Report and the Concept Design Report.

2.3.1 Topography and hydrology

The Proposal Site is located approximately 1.5 km south and 2.5 km east of the Shoalhaven River. The site is situated on the eastern side of a ridge line and drains to Cabbage Tree Creek approximately 300 m to the east of the Proposal Site. Cabbage Tree Creek drains northward to join the Shoalhaven River.

The Proposal Site covers an area of approximately 18.6 ha and ranges in elevation from approximately RL 41 m to approximately RL 50 m.

The topography of the site is relatively flat with some undulations. There is an unnamed ephemeral drainage channel in the south east of the Proposal Site which has been excluded from the landfill footprint (to protect the threatened flora species, *Triplarina nowraensis* (Nowra Heath-Myrtle)) which is located in the vicinity of the drainage channel. The topography of the Proposal Site is shown in Figure 2-3.

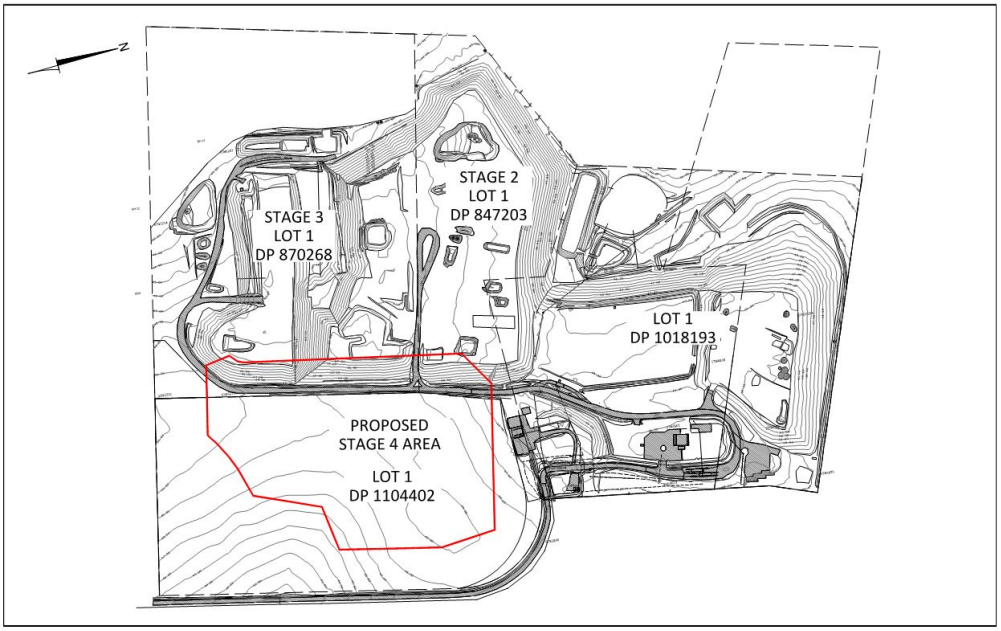


Figure 2-3 Topography of the Proposal Site (SLR, 2019a)

2.3.2 Geology

The Proposal Site is underlain by Nowra Sandstone and Wandrawandian Siltstone of the Permian age Shoalhaven Group. The Shoalhaven Group forms the base of the Sydney Basin succession in the southern onshore extremity. The Sydney Basin is part of the larger Sydney-Gunnedah-Bowen Basin (Tye, 1995)[4].

A study by Maunsell (1991) (cited in SLR, 2019a) states that the Proposal Site is typically underlain (from top to bottom) by:

- 50 mm to 100 mm of grey loam
- 200 mm layer of yellow/white silt clay
- 300 mm layer of yellow clay

[4] http://passthrough.fw-notify.net/download/239097/http://ro.uow.edu.au/cgi/viewcontent.cgi?article=2983&context=theses

- >1600 mm red/yellow/white clay.

A historical drilling report by Forbes Rigby (1996) (cited in SLR, 2019a) states that the depth to bedrock is highly variable and the condition of the bedrock ranges from moderately to heavily weathered.

The findings of the Geotechnical Investigation are consistent with the geological information documented above (SLR, 2019a). The Geotechnical Investigation and associated laboratory testing of selected materials found that:

- The top of bedrock was six to seven metres below ground surface and consisted of highly to moderately weathered sandstone
- The groundwater table ranged from 5.5 metres to 12 m below natural ground level
- The overburden material is usually sandy or silty clay of low to high plasticity (with the majority of medium plasticity with a liquid limit ranging from 35 to 50), overlying clayey sand, which is underlain by bedrock, comprising variably weathered sandstone
- Recovered materials had a high fines content
- Permeability results ranged from $5x10^{-9}$ m/s to $2x10^{-10}$ m/s
- Excavator refusal occurred on bedrock in six of the 10 test pits, ranging in depths from 2.5 metres to 4.5 metres.

2.3.3 Hydrogeology

A previous site investigation by Forbes Rigby (1996) (cited in SLR, 2019a) for the existing landfill area within the WNRWF found that there are two aquifers underlying the area: a semi-confined aquifer that follows the bedrock/overburden contact; and one within the sandstone unit. Depth to groundwater in both aquifers was generally two metres to three metres below the ground surface.

The Stage 1 landfill area was noted as having a deep weathered sandstone profile that provides a highly permeable aquifer that bears water (Forbes Rigby, 1996), (cited in SLR, 2019a). The groundwater at the WNRWF is believed to flow from northeast to southwest towards Sandy Creek.

2.3.4 Groundwater

The seven piezometers installed on the Proposal Site during the Geotechnical Investigation were consistently monitored from 7 June to 15 August 2016. The details of these piezometers, including the average water levels over this time period, are provided in Table 2-1.

Table 2-1 Piezometer and groundwater details

Piezometer ID	Total Depth (mbgs)	Screen Depth (mbgs)	Top of Casing (RL m)	Depth to Water 15/8/2016 (mbgs)	Average Water Table Elevation (RL m) (7 June 16 to 15 August 2016)
GW1A	9.95	5.95 – 8.95	51.26	Dry	Dry
GW1	18.96	14.95 – 17.95	51.09	9.263	41.5
GW2A	9.93	5.93 – 8.93	47.71	Dry	Dry

Piezometer ID	Total Depth (mbgs)	Screen Depth (mbgs)	Top of Casing (RL m)	Depth to Water 15/8/2016 (mbgs)	Average Water Table Elevation (RL m) (7 June 16 to 15 August 2016)
GW2	17.94	13.94 – 16.94	47.84	8.04	39.9
GW3	18.91	14.91 – 17.91	47.06	6.503	40.6
GW4	13.78	9.78 – 12.78	49.26	9.984	38.5
GW5	18.88	14.88 – 17.88	49.77	9.455	40.4

(Source: modified from SLR, 2019a).

The groundwater monitoring data has been plotted against the local rainfall data in Figure 2-4 to show any fluctuations due to surface water infiltration.

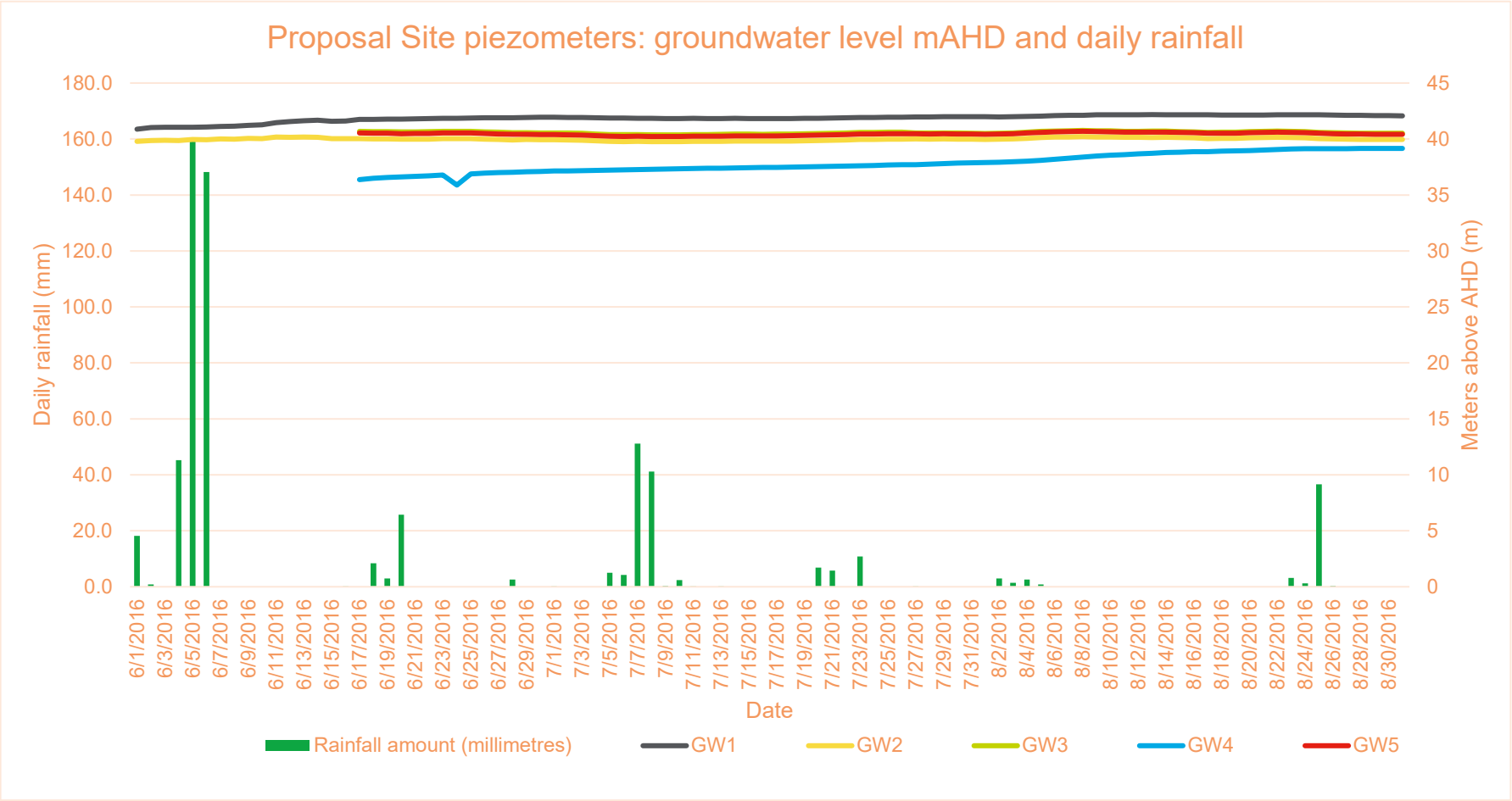


Figure 2-4 Groundwater monitoring results and daily rainfall (Source: SLR, 2019a)

The groundwater table varies across the site, with an apparent divide approximately one third of the way between the north and south of the available landfill extension footprint area (SLR, 2019a). SLR defined the average water table level based on the piezometer data available at time of writing as follows:

- Southern portion of the extension area: average of 41.5 m Australian height datum (AHD) (approximately 9.5 m below ground level (BGL))
- Northern portion of the extension area: average of 40.5 m AHD (approximately 6.5 to 10.5 m BGL).

Further information about groundwater at the Proposal Site and broader WNRWF is provided in Section 8.4.2.

2.4 WNRWF

2.4.1 Overview

Landfilling and waste management activities have been conducted at the WNRWF since 1979.

No significant changes to the existing site operations, uses and areas are considered likely as a result of the Proposal, which will provide additional landfill void space to the overall landfill footprint, and hence increase the life expectancy of the landfilling operations.

The existing landfill at the WNRWF currently operates in accordance with the Landfill Environmental Management Plan prepared by SCC in 2008 (2008 LEMP) and EPL 5877.

Details of the WNRWF operations, including the number of staff currently engaged at the WNRWF, are outlined below. Council employ a total of 20 staff at the facility although working seven days per week results in approximately eleven staff on site on any one day. This includes one supervisor, one administration officer, three weighbridge operators, nine plant operators, and six waste attendants. These staffing numbers are considered adequate to service the landfill extension.

Operating hours

- 8 am to 5 pm – Monday to Sunday, closed Public Holidays except Easter Monday.

Site support facilities

- Entry and exit
- Site office for administration
- Carpark
- Staff amenity building
- Plant and equipment shed – for equipment maintenance and storage
- Storage sheds for equipment.

Waste processing areas

- Weighbridges and gatehouse
- Transfer station
- Tyres collection area
- Mattresses collection area

- E-waste collection area
- Recyclables (cardboard, plastics and cans) collection area
- Shredded pasteurised green waste processing and distribution area
- Non-ferrous collection area
- Green waste stockpile and processing area
- Steel waste stockpiles and processing area
- Construction and demolition waste stockpile area
- Virgin Excavated Natural material (VENM) stockpile area
- Pavement materials stockpile area
- Recycling shed, and sorting and collection area
- Buyback shed
- CRC (community recycling area) for household problem waste such as paints, oils, smoke alarms, gas bottles, fluorescent globes and cell batteries
- Active landfill and wet weather disposal areas.

Environmental management infrastructure

- Landfill gas management infrastructure (generator and flare)
- Wash down bay
- Site water management infrastructure (sediment, leachate collection and first flush capture dams)
- Irrigation area
- Environmental buffer zones for biodiversity conservation
- Residential buffer zones to protect amenity for nearby residential land use
- Fire access trails/firebreaks, Asset Protection Zones (APZ's).

2.4.2 WNRWF operations: site support facilities

The site support facilities at the WNRWF are outlined below.

Entry/exit

- Entrance and exit to and from the WNRWF, Flatrock Road, Mundamia.

Site office

- Supervisor and administrative staff
- Lunch room facilities
- Number of staff: four.

Carpark

- Car parking spaces for site office and operational staff
- Number of car park spaces: 12.

Staff amenity building

- Operational staff
- Lunch room and sanitary facilities
- Number of staff: 14.

Plant and equipment shed

- Operational staff
- Storage of site equipment
- Provision of site plant maintenance.

Storage shed

- Operational staff
- Storage of site equipment.

2.4.3 Waste processing areas

Weighbridges and gatehouse

- In and out, two x 18 m long concrete structure weighbridges
- Gatehouse and weighbridge attendant
- All customers with waste materials must use the weighbridges
- Signboard advice to all customers of fees and charges for each waste material type
- All customers are asked of waste material type to be disposed and loads are inspected via the use of closed circuit television (CCTV)
- All customers are directed to the appropriate waste disposal areas (only heavy vehicles are directed to the active landfill disposal area) on the way in
- Outgoing recyclable materials (steel, processed green waste, etc.) are weighed on the way out
- Number of weighbridge attendants: one.

Transfer station area

- For use by small vehicle customers only, from municipal or small commercial sources, with mixed municipal and commercial waste, after they have been weighed in over the weighbridge and charged on the way out
- Mattresses and electronic wastes are collected in bins, for recycling off-site
- Waste deposited into a series of bays and bins
- Available transfer bins are for mixed municipal, commercial and builders waste
- Waste bins transferred, once full, to the appropriate disposal area, i.e. active landfill disposal area
- Number of transfer station attendants: two.

Tyre collection area

- For use by small vehicle customers only, from municipal and commercial sources, with clean separated vehicle waste tyres, after they have been weighed in over the weighbridge and charged on the way out
- Vehicle waste tyres deposited onto the ground and piled into manageable bundles
- Vehicle waste tyres collected, by appropriately licenced recycler, and transported off site for recycling
- Number of waste tyre attendants: 1/6 (or 0.167 full time equivalent (FTE)).

Non-ferrous collection area

- For use by small vehicle customers only, from municipal and commercial sources, only with clean separated non-ferrous materials, after they have been weighed in over the weighbridge and charged on the way out
- Non-ferrous materials deposited into aboveground bins
- Non-ferrous materials collected, by appropriately licenced recycler, and transported off site
- Number of non-ferrous attendants: 1/6 (or 0.167 FTE).

Green waste stockpile and processing area

- For use by small vehicle customers only. From municipal and commercial sources, with clean separated green wastes and untreated timbers, after they have been weighed in over the weighbridge and charged on the way out
- Green waste deposited onto the ground and pushed up into stockpiles
- Stockpiles maintained to manageable bundles and heights (maximum height of three metres)
- Green waste and untreated timbers shredded, by appropriately licenced contractor, into crude garden waste and woodchip materials
- Crude garden waste placed in -windrows and pasteurised (in accordance with AS4454) prior to making available to municipal customers and commercial operators
- Pasteurised garden waste and woodchip materials collected free of charge by municipal customers, and sold to commercial operators
- Pasteurised garden waste and woodchip materials also used on site for batter rehabilitation purposes
- Number of green waste attendants: 1/3 (or 0.33 FTE).

Steel waste stockpile and processing area

- For use by all vehicle customers, from municipal and commercial sources, with clean separated steel waste including whitegoods, after they have been weighed in over the weighbridge at no charge
- Steel waste deposited onto the ground and pushed up into stockpiles
- Stockpiles maintained to manageable bundles and heights (maximum height of three metres)
- Steel waste collected, by appropriately licenced recycler, and transported off site
- Number of steel waste attendants: 1/3 (or 0.33 FTE).

Construction and demolition waste stockpile area

- For use by heavy vehicle customers, from construction and demolition sources, with clean separated brick, concrete and tiles, after they have been weighed in over the weighbridge and charged on the way out
- Construction and demolition (C&D) waste deposited onto the ground, inspected by Operators to ensure no unacceptable contaminants are within the load, and piled into manageable stockpiles
- C&D waste used on site for the construction of hardstand areas
- Number of C&D waste attendants: 1/4 (or 0.25 FTE).

VENM stockpile areas

- For use by heavy vehicle customers, from construction and demolition sources, with clean fill, after they have been weighed in over the weighbridge and charged on the way out
- Also, VENM material excavated on site and used for operational purposes, such as; daily cover, landfill cell clay base liner, etc.
- VENM deposited onto the ground and piled into manageable stockpiles (maximum height of three metres)
- Number of VENM area attendants: 1/4 (or 0.25 FTE).

Pavement materials area

- For the stockpiling of recycled and virgin pavement materials, after they have been weighed in over the weighbridge at no charge
- Recycled and virgin pavement materials deposited onto the ground and piled into manageable stockpiles
- Pavement materials used in the construction and maintenance of internal roads and hardstand areas
- Number of pavement materials area attendants: 1/4 (or 0.25 FTE).

Recycling sorting and collection area

- For use by small vehicle customers to drop off household recyclables
- Number of staff at recycling area: ½ (or 0.50 FTE)
- Recycling shed for the drop-off and storage of recyclable materials i.e. polystyrene and any other recyclable materials
- Recyclables deposited in front lift bins and receptacles
- Area is before the weighbridge; hence customers do not need to pay to dispose of recyclables. Recycling of:
  - Paper/cardboard
  - Glass bottles
  - Aluminium/steel cans
  - Motor oil
  - Plastics and polystyrene and
  - Other recyclables.

Community Recycling Area (CRC)

- For use by small vehicle customers to drop off household problem wastes
- Number of staff at CRC area: ½ (or 0.50 FTE)
- Recycling shed for the drop-off and storage of CRC materials i.e. paints, gas bottles, fluorescent globes and smoke alarms
- Recyclables deposited in sealed stillages, buckets and cages
- Area is before the weighbridge; hence customers do not need to pay to dispose of CRC materials.

Buyback area

- For use by small vehicle customers to drop off and buy resalable goods and items
- Area is before the weighbridge hence customers do not need to pay to dispose of resalable goods and items
- Includes a buyback shed for goods and items that need to be stored away from inclement weather conditions
- Includes an outdoor area for goods and items that are not affected by weather conditions
- Number of staff at buyback area: one

Active landfill and wet weather disposal areas

- For the burial of mixed waste materials received from municipal, kerbside collection, commercial and construction and demolition sources (including waste materials deposited at the transfer station and internally transferred to this area)
- Only heavy vehicles permitted at the active landfill and wet weather disposal areas
- Limited waste disposal area, compacted and covered daily
- Number of active landfill disposal area attendants: 3/2 (or 1.50 FTE).

2.4.4 Environmental management infrastructure

Landfill gas generator

- Active landfill gas extraction of previously capped landfill cells
- Electricity generation (back to the electricity grid)
- Owned by Council
- Operated by Contractor
- Maintained by Contractor's sub-contractor.

Landfill gas flare

- Operated during maintenance of landfill gas generator
- Owned by Council
- Operated by Contractor
- Maintained by Contractor's sub-contractor.

Wash down bay

- Heavy vehicle wheel wash (for use by staff and customers to ensure no tracking of mud off site (EPL condition))
- Concrete slab on ground.

Hazardous materials storage

The CRC facility acts as a collection point for household quantities of paints, oils, household batteries, fluorescent tubes and globes. There is also a provision of hazardous waste storage cabinets (behind a locked wall) for by-catch hazardous materials. These materials are not permitted on site, but when they appear, are managed in a responsible manner. These are collected on a regular basis together with the CRC materials by the EPA collection contractor.

The landfill is also licensed to accept and dispose of asbestos containing materials. Transporters bring asbestos to the facility, are required to provide 24 hours' notice and to place the asbestos in certified asbestos bags. Asbestos is buried in accordance with the EPL conditions.

2.4.5 Site security

During operating hours, the Flatrock Road main entrance gate is left open to the public. All other access gates to the WNRWF are not for public access and are locked at all times unless used by SCC staff for operational purposes.

Outside operating hours, the main entrance and other access gates are locked to maintain the security of the WNRWF.

The boundary of the WNRWF is enclosed by a 2.1 metre high security fence. The gatehouse/weighbridge office is locked outside operating hours. Keys to gates and buildings are kept only by necessary SCC site staff members. The gates and surrounding fence areas are inspected daily. The boundary fence line is inspected weekly and on an as needs basis and maintained as required.

2.5 Resource Recovery Park

An RRP is proposed to be located adjacent to the Proposal Site. The RRP received concept approval under Part 4 of the EP&A Act from the DP&E (SSD 15_7015) on 25 August 2016. On 18 March 2019, SEARs were issued, to the preferred contractor, for Stage 2 of the RRP (SSD 9887) after the preferred contractor was selected by SCC for the construction and operation of the RRP. Contractual terms are yet to be agreed between Council and the preferred contractor. The RRP would form part of the broader WNRWF. Any residual waste emanating from this facility would be deposited within the Proposal.

The various waste technologies being considered for this site are discussed in Section 3.6.

3 PROPOSAL NEED AND ALTERNATIVES

This section describes the alternatives considered by SCC when investigating options for the ongoing management of waste in the SCC LGA. This section is structured under the following broad headings: the 'do-nothing' option, alternative sites for development of a landfill and consideration of on-site alternatives and/or technologies.

3.1 Need and strategic justification

SCC operates a licensed landfill site at the WNRWF. The current approved area of the landfill is expected to reach capacity in approximately 2026 and additional waste disposal capacity is required to service the needs of the LGA.

A modern, well-managed engineered landfill provides an important service to the community by handling its waste in a cost-effective, environmentally responsible way. SCC have made significant advances in diverting waste from landfill through a range of waste reduction and avoidance activities (see Section 3.1.1). Current waste diversion rates in the Shoalhaven are 41 % with plans to improve this figure in the future. Nevertheless, a need for landfill infrastructure will remain into the foreseeable future. For certain wastes, there is no current or foreseeable reuse, treatment or recycling option.

This Proposal seeks approval for an extension to the existing landfill at the WNRWF on the basis that:

- There is sufficient information available, and documented herein, to inform a full and thorough environmental assessment of the Proposal
- SCC has implemented numerous strategies that are contributing to achieving the WARR targets. Strategies either implemented or currently planned which have/will contribute to WARR targets include:
  - Reducing hours and days of operation at small rural tip sites in order to concentrate resources and delivery of services at the West Nowra landfill
  - Investigations in 2003 into alternative waste technologies (AWTs) that could form part of the solution for waste management and resource recovery
  - Undertaking a number of trials in 2008 on the processing of domestic waste (including source separation of green waste)
  - Preparation of a cost-benefit analysis in 2008 which considered the development of an RRP inclusive of an AWT. In 2013, Council resolved to call for expressions of interests for the establishment of the RRP and AWT
  - Concept approval for the RRP was granted on 25 August 2016 and SCC has recently let the tender documents for the design and construction of the RRP and AWT (see further information regarding the potential technologies to be adopted at the RRP in Section 3.6). The RRP is expected to be operational in 2021 and will play a significant role in diverting waste from landfill
  - Provision of:
    - Combined waste / recycling collection service for rural areas
    - Collection facilities and equipment for the recycling of polystyrene
    - Schools programs targeted to meet pre, primary and high school students
    - Increased waste and recycling collection services over the Christmas holiday period
    - A campaign run with real estate agencies to increase recycling from coastal holiday rentals

- The landfill extension would be located adjacent to the existing landfill on appropriately zoned land (zoned SP2 Infrastructure – Waste and Resource Management Facilities under the SCC LEP 2014).

SCC recognises the importance of improving environmental standards for landfill design and management. A review of waste management performance would be undertaken prior to construction of each new sub-cell within the landfill.

3.1.1 Meeting diversion targets

SCC's progress towards meeting waste diversion targets is evident, with the following material volumes being recovered at the recycling and waste facilities in the last financial year (2016/17):

- 11,102 t of garden organics waste received, with 7,707.5 t pasteurised garden organics (mulch) returned to the community
- 4,180.6 t of scrap metal including white goods
- 1,039.9 t concrete and brick
- 871.6 t cardboard
- 627.5 t of recyclable materials recovered through sorting bays from mixed household loads delivered to the transfer facilities
- 534.3 t electronic waste
- 519 t of reusable goods from the Buyback centres
- 361.3 t untreated timber
- 290.7 t or 11,600 mattresses
- 170 t glass
- 118 t of non-ferrous metals
- 45.9 t plastics
- 41.6 t of gas bottles
- 40.8 t of tyres, or the equivalent of 5,800 passenger tyres
- 30 t automotive batteries
- 28.4 t of polystyrene, equivalent to the volume of 12 Olympic size swimming pools.

3.1.2 Landfill life expectancy

In determining the need for the landfill extension, SCC considered the life expectancy of the existing landfill at the WNRWF, both with and without the development of the RRP at the adjacent site. The analysis took into account a population growth rate of two percent per annum[5] and a waste generation growth rate of three percent per annum[6]. This would result in approximately 65,000 tonnes p.a. being received at the Proposal in the opening year (2026) and progressively increasing to approximately 160,000 tonnes in the closing year (2044).

SCC undertook landfill life expectancy modelling based on the following scenarios:

[5] Adopted from the SCC Waste Strategy, 2014 / 2015.

[6] Assumed as per the annual waste generation medium-growth rate of 3% in the National Waste Report 2010.

- Scenario 1: Existing landfill at WNRWF only
- Scenario 2: The existing landfill at WNRWF with the addition of the RRP in 2021
- Scenario 3: The existing landfill at WNRWF with the addition of the RRP (in 2021) and the Stage 4 landfill extension
- Scenario 4: Existing landfill at WNRWF with the addition of the Stage 4 landfill extension (no RRP).

Under each of these scenarios, the following assumptions were adopted (where relevant):

- Existing landfill remaining capacity (at 2016) of approximately 1.3 Mm^3
- Proposed Stage 4 capacity of approximately 1.38 Mm^3
- Daily cover was assumed to utilise 10 % of the available landfill capacity
- Application of a compacted waste density of 800 kg/m^3
- For scenarios involving the RRP, it is assumed to commence operation in 2021 with a predicted waste diversion rate of 40 % in the first year, 50 % in the second year and 60 % for each consecutive year[7].

The results of the investigations into each of these scenarios are presented in Figure 3-1 to Figure 3-4.

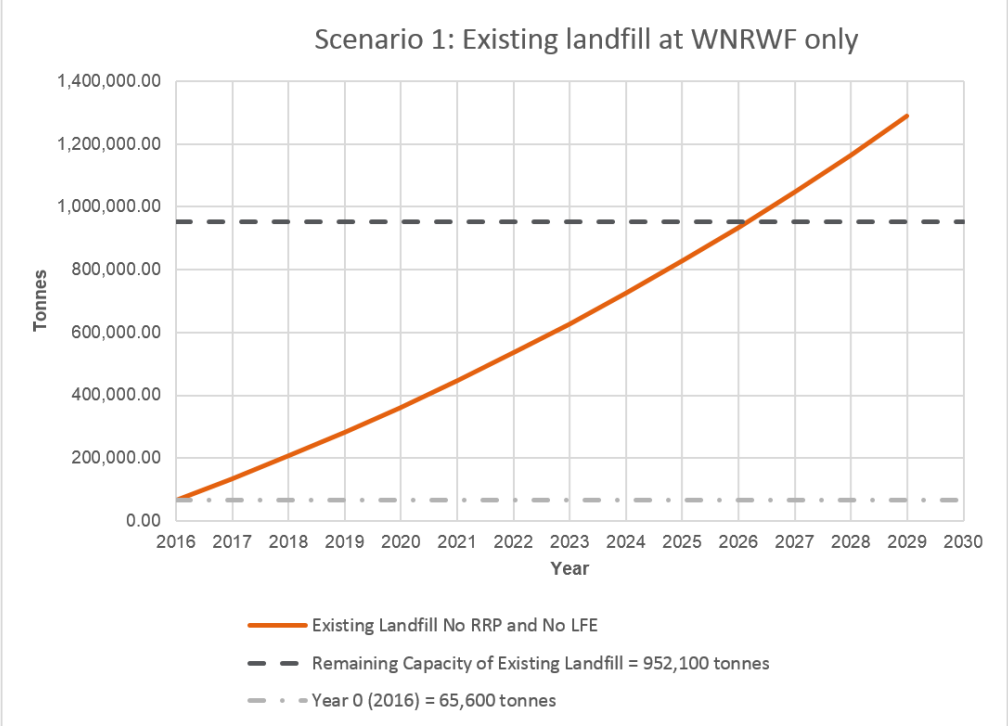


Figure 3-1 Scenario 1: Existing landfill at WNRWF only

[7] These diversion rates are broadly consistent with those cited in the *West Nowra Resource Recovery Park Environmental Impact Statement* (GHD, 2016) which recognised that overall diversion rates can vary from 40% to 80% depending on the waste treatment process adopted and the incoming waste stream.

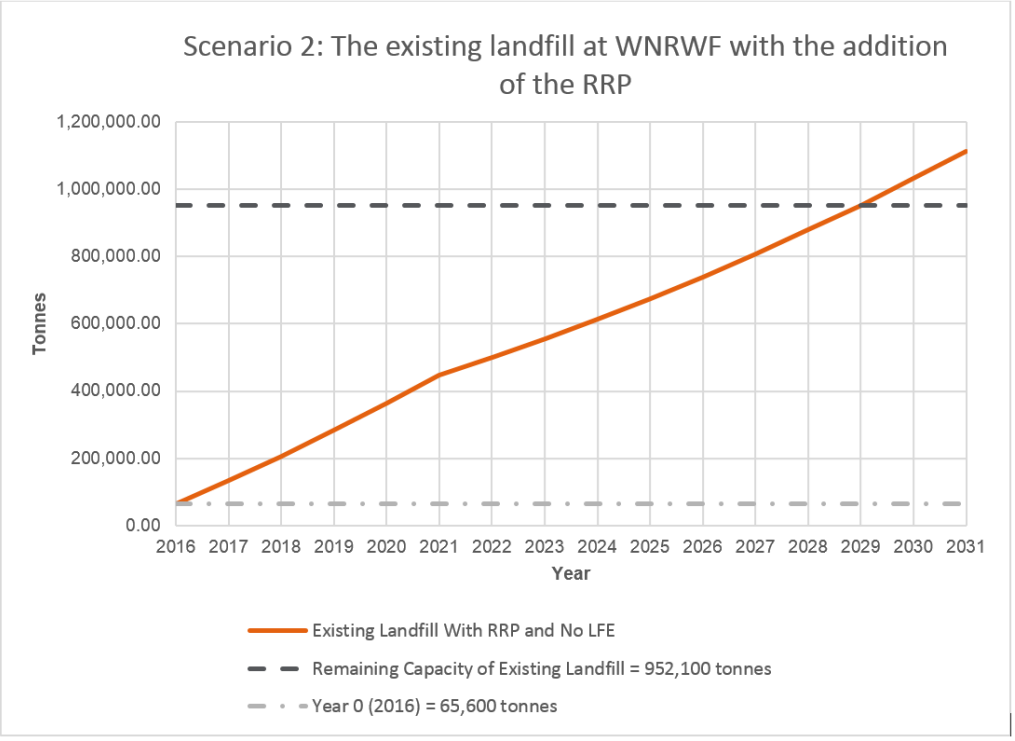


Figure 3-2 Scenario 2: The existing landfill at WNRWF with the addition of the RRP

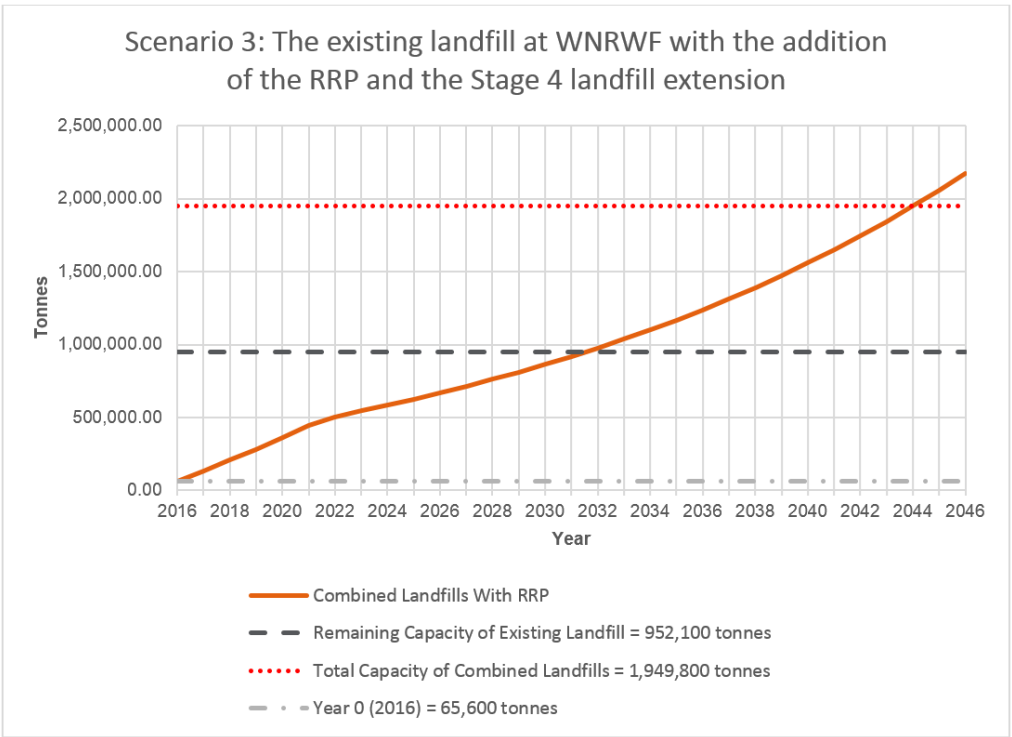


Figure 3-3 Scenario 3: The existing landfill at WNRWF with the addition of the RRP and the Stage 4 landfill extension

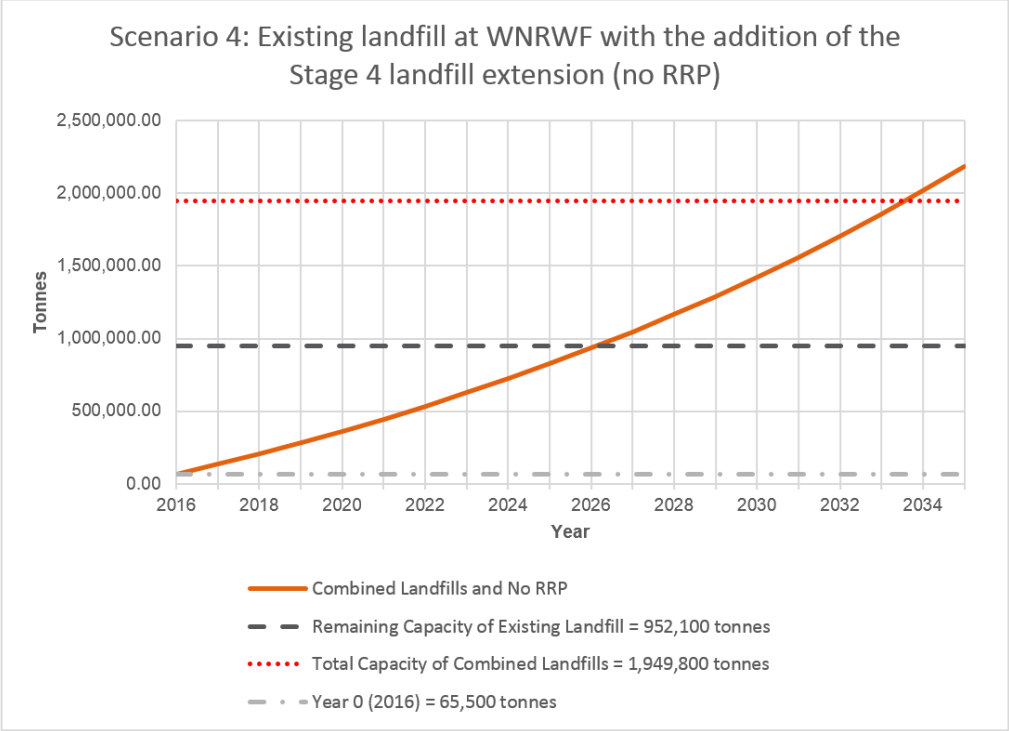


Figure 3-4 Scenario 4: Existing landfill at WNRWF with the addition of the Stage 4 landfill extension (no RRP)

Figure 3-1 (Scenario 1) shows that the current landfill will reach capacity in approximately 2026.

Figure 3-2 (Scenario 2) shows that with the addition of the RRP, the life expectancy of the current landfill would extend to approximately 2029.

Figure 3-3 (Scenario 3) shows that with the addition of both the RRP and a landfill extension, the landfill life expectancy would extend to approximately 2044.

Figure 3-4 (Scenario 4) shows that, without the addition of the RRP, the landfill extension would have capacity to approximately 2034.

Scenario 1 is not considered a realistic or suitable scenario as the Shoalhaven LGA would be without a waste disposal solution from approximately 2026 onwards. Scenario 2 shows that the RRP can extend the life expectancy of the existing landfill however an extension would still be required in approximately 2029. Scenario 3 represents a best-case scenario where both the landfill extension and the RRP are established. This would increase the life expectancy of the existing landfill through waste diversion, while also providing for the ongoing waste disposal needs of the LGA by extending the landfill. Scenario 4 represents a worst case scenario, whereby the RRP is assumed to not proceed, and the landfill extension is required to service the needs of LGA from 2026 onwards.

Council has adopted Scenario 4 as the basis of this EIS. This scenario assumes the existing landfill reaches capacity in 2026 and the RRP does not proceed - hence the landfill extension (the Proposal) is required to commence operations in 2026. This is considered to be a conservative, worst-case scenario that would provide an ongoing waste solution for the SCC LGA should the RRP not commence operation prior to the existing landfill reaching capacity. Adoption of this worst case scenario is considered a responsible approach to waste management planning, whereby Council can provide certainty in fulfilling their obligations under the *Local Government Act 1993* (LG Act 1993) to provide waste services to the Shoalhaven community. If the RRP does proceed as planned, the life expectancy of the Stage 4 landfill is expected to increase from approximately 2026 - 2034 to 2026 - 2044.

The adopted Scenario 4 would require that the Proposal receive consent to be in use for approximately 18 years from the commencement of operation in 2026. However, SCC is seeking consent for approximately 30 years from the commencement of operation in 2026. This would provide ongoing security for use of the Proposal Site as a landfill as it would account for potential changes in waste diversion rates from the waste transfer station area and RRP, policy changes and operational / technology improvements. For example, under a scenario where waste recovery improves landfill life expectancy would likely increase.

Table 3-1 summarises the approval timeframes required for the Proposal without the RRP, with the RRP and a possible best case scenario for the Proposal that would secure the long-term use of the Proposal Site for landfilling operations.

Table 3-1 Approval timeframes

Scenario	Approval timeframe	Approval year	Scenario summary
Scenario 4	8 years	2034	No RRP (worst case scenario for waste disposal / traffic / noise / air / quality)
Scenario 3	18 years	2044	With RRP (extends lifespan due to decreased waste to landfill)
Best case scenario	30 years	2056	This provides ongoing security to SCC regarding approval and accounts for potential changes in waste diversion rates, policy, operational / technology improvements

3.2 Strategic planning policies

As required by the SEARs, relevant aims, objectives and guidance from Council's adopted Waste Strategy and other relevant government policies are summarised in this section.

3.2.1 Draft SCC Waste Reduction Management Strategy 2015/16 – 2020/21

The *Draft SCC Waste Reduction Management Strategy: 2015/16 - 2020/2021* (Draft Strategy) (SCC, 2015b) outlines a strategic direction for all of SCC's waste and resource management activities. It includes a range of projects, initiatives and actions, and has been developed to align with the NSW WARR Strategy 2014-2021. It has also taken into consideration SCC's Community Strategic Plan 2020.

The vision of the Draft Strategy is "For the Shoalhaven City Council to become a leader in the recovery of recyclable materials from the waste stream, and minimise the quantities of waste disposed to landfill by re-using and processing waste types that would normally end up in landfill" (SCC, 2015b).

The Draft Strategy is underpinned by the following key drivers:

- The NSW WARR Strategy 2014-21 which aims to "enable the whole NSW community to improve environment and community well-being by reducing the environmental impact of waste, and using resources more efficiently"
- The requirement under the LG Act 1993 to have a long term focus and "address key issues relating to social, environmental, economic and civil leadership objectives"

- The goals within SCC's *Sustainability Action Plan 2011/12 – 2015/16*
- The limited lifespan of the west Nowra landfill
- Population growth dynamics forecasted for the Shoalhaven region.

The Draft Strategy aims to:

- Encourage the community to become involved in waste reduction programs
- Ensure the provision of best practice and cost effective waste management services and facilities
- Ensure consistency with relevant State and Federal Government policies, SCC policies and SCC's Community Strategic Plan.

The Draft Strategy acknowledges the success of the centralisation of all council's waste disposal to the WNRWF and recognises the need to secure access to a long-term landfill site.

3.2.2 SCG Regional Waste Avoidance and Resource Recovery Strategy 2022

The *Southern Councils Group* (SCG) *Regional Waste Avoidance and Resource Recovery Strategy 2022* (Wright Corporate Strategy, 2014) establishes a framework for collaboration amongst member councils (Wollongong, Shellharbour, Kiama, Shoalhaven and Wingecarribee) to address waste management and resource recovery issues and the possibility of co-funding grants through the *NSW Waste Less, Recycle More* program.

The *SCG Regional Waste Avoidance and Resource Recovery Strategy 2022* has developed principles to improve waste management and resource recovery activities by ensuring that member councils will:

- Implement best practice sustainable waste avoidance and resource recovery technologies and practices
- Encourage community-wide action to manage regional issues including litter, illegal dumping and safe management of problem wastes including, but not limited to, asbestos, paint, gas and household chemicals
- Use their shared buying power where feasible to obtain the most cost-effective waste management and resource recovery contracts
- Provide, where feasible, the creation and operation of waste infrastructure facilities that will deliver regional waste services.

The Proposal will contribute to these principles by ensuring best practice landfill design, construction, operation and management. The Proposal, in conjunction with the SCCs other waste avoidance initiatives, would increase resource recovery and reduce the amount of waste that goes to landfill.

3.2.3 National Waste Policy: less waste, more resources

The National Waste Policy: less waste, more resource was released in November 2009 and outlines the Federal government's direction for waste management in Australia through to 2020. The outcomes intended to be achieved under the Policy include the following:

- Australia manages waste, including hazardous waste, in an environmentally safe, scientific and sound manner, and has reduced the amount per capita of waste disposed
- Waste streams are routinely managed as a resource to achieve better environmental, social and economic outcomes

- Australia has increased the amount of products, goods and materials that can be readily and safely used for other purposes at end of life.

The Proposal will assist in achieving these outcomes by providing best practice landfill design, construction, operation and management. The Proposal will operate as one component of SCC's broader waste management services which include a number of waste avoidance and minimisation strategies. The extension of the landfill will complement the RRP and provide a safe and reliable location for disposal of waste. The Proposal is therefore consistent with the aims and objectives of the National Waste Policy.

3.2.4 NSW 2021: Goal 23

N*SW 2021: A Plan to Make NSW Number 1* (NSW 2021 State Plan) (NSW Government, 2013) is the NSW Government's 10 year plan to guide development and economic growth within NSW. NSW 2021 establishes 32 goals, of which Goal 23 is identified by the SEARs as being applicable to the Proposal:

- Goal 23 – Increase opportunities for people to look after their own neighbourhoods and environments

Specific targets within Goal 23 that are relevant to the Proposal include:

- NSW achieving the lowest litter count per capita in Australia
- Increase recycling to meet the 2014 WARR targets.

Overall, the Proposal has been designed to improve the efficiency, usability and environmental performance of waste management in the SCC LGA and this will result in benefits to the community, the commercial sector and the environment.

Operation of the Proposal will encourage and aim to prevent the escape of litter from vehicles transporting waste to the Proposal Site. Operational procedures for the site will incorporate litter reduction and collection procedures both within the site itself and on the local access road. Vehicles entering the site will continue to be inspected for potentially recoverable materials that can be diverted from landfill for reuse. The management of the landfill, in coordination with the RRP will support an increase in recycling that will contribute to meeting the *NSW Waste Avoidance and Resource Recovery Strategy 2014 – 2021* (WARR Strategy) (NSW EPA, 2014) targets.

3.2.5 NSW Waste Avoidance and Resource Recovery Strategy 2014 – 2021

The WARR Strategy (NSW EPA, 2014) is established under the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) and is the principal tool used to achieve the objectives of the WARR Act. The key result areas of the WARR Strategy are as follows:

1. Avoid and reduce waste generation
2. Increase recycling
3. Divert more waste from landfill
4. Manage problem wastes better
5. Reduce litter
6. Reduce illegal dumping

The WARR Strategy has named the following targets, to be achieved by 2021-22:

- Avoiding and reducing the amount of waste generated per person in NSW
- Increase recycling rates to:

  - 70 % for municipal solid waste
  - 70 % for commercial and industrial waste
  - 80 % for construction and demolition waste
- Increasing waste diverted from landfill to 75 %
- Managing problem wastes better, establishing 86 drop-off facilities and services across NSW
- Reducing litter, with 40 % fewer items (compared to 2012) by 2017
- Combatting illegal dumping, with 30 % fewer incidents (compared to 2011) by 2017.

The Proposal will contribute to the key result areas two to six through the provision of a best practice landfill through operational procedures that support the diversion of unacceptable or reusable materials from the landfill. This will support an increase in recycling and diversion of waste from landfill by providing a facility that allows for improved separation of waste streams and diversion of recoverable materials to the adjacent RRP.

Landfill diversion targets established in the WARR Strategy are financially incentivised through the waste levy, which is an instrument implemented through the *Protection of the Environment Operations Act 1997* (POEO Act). The waste levy requires certain licensed waste facilities in NSW to pay a contribution for each tonne of waste received at the facility. The waste levy applies in the regulated area of NSW which comprises the Sydney metropolitan area, the Illawarra and Hunter regions, the central and north coast local government areas to the Queensland border as well as the Blue Mountains, Wingecarribee and Wollondilly local government areas. As a result of this policy, waste avoidance, resource recovery and alternate waste treatment are financially incentivised through avoided levy.

3.2.6 Illawarra Shoalhaven Regional Plan

The *Illawarra Shoalhaven Regional Plan* (the Plan) (DP&E, 2015) provides a clear vision for the sustainable growth of the region over the next 20 years guided by a strategic policy, planning and decision-making framework.

Key goals of the Plan include ensuring the rehabilitation and preservation of environments that have significant environmental value. The design of the Proposal has considered a range of potential environmental impacts, including air, noise and visual impacts, and has avoided or mitigated these impacts as far as feasible and reasonable.

The Proposal aligns with the strategy in that it would provide waste disposal services to support the growing populations proposed in the Shoalhaven region.

3.3 Do-nothing option

The investigation of alternatives included consideration of a ‘do-nothing’ option. This option is not feasible for a number of reasons, in particular because it would fail to provide a suitable waste disposal facility for the ongoing needs of the SCC LGA. As discussed above (Section 3.1.2), the existing landfill is nearing its capacity, and based on current waste production and landfill volumes, will reach capacity in approximately 2026.

The do-nothing option is not considered appropriate given the need for ongoing waste disposal capacity in the SCC LGA.

3.4 Alternative sites

Acknowledging the approaching need for additional landfill space, SCC commissioned Locale Consulting to undertake a *Desktop Landfill Identification Study* in 2014 (Locale Consulting, 2014) (Appendix F). The intent of the study was to identify and assess a number of potential sites for a new landfill. The study investigated 11 potential sites. At the time of writing the *Desktop Landfill Identification Study*, the Proposal Site was earmarked for use as an RRP and the report concluded that a site located off Warra Warra Road at South Nowra was the preferred site for a new landfill.

However, the report (Section 3.4) noted that further investigation should be undertaken into the potential for the extension of the existing West Nowra Landfill on what is now the Proposal Site.

At a Council Meeting on 21 April 2015, SCC ratified the decision to relocate the RRP to an alternative site (i.e. to the location of an animal shelter site adjacent to the WNRWF) and identified the Proposal Site as the preferred site for the Proposal.

3.5 Suitability of the Proposal Site

To confirm the suitability of the Proposal Site, Locale Consulting, were consulted to undertake a further investigation to determine whether the Proposal Site would be suitable for use as a landfill. In a letter addressed to SCC on 5 July 2015 (Appendix G), Locale Consulting stated that the current Proposal Site would be suitable for a new landfill provided that SCC were able to adequately mitigate the potential environmental impacts that the Proposal may have on the surrounding area.

The WNRWF Annual Report 2017-2018 (Annual Report) (SCC, 2018) provides a summary of the WNRWF's landfill operations and rehabilitation works undertaken during the reporting period (30 October 2017 to 29 October 2018). The purpose of the Annual Report is to demonstrate how SCC has operated under EPL 5877 conditions for the WNRWF. The Annual Report includes results of an independent investigation undertaken by ENRS (Appendix Y) to assess and analyse the environmental monitoring data for the WNRWF against EPA endorsed criteria. The investigation found that 'based on the review of the 2017-2018 environmental monitoring results, for each surface water, leachate and groundwater monitoring point, ENRS conclude that there is unlikely to be any significant off-site impacts from site operations' (ENRS, 2018b).

The Annual Report also provides a record of complaints or accidents that occur at the WNRWF during the reporting period. No reportable complaints or accidents occurred at the WNRWF during the reporting period (SCC, 2018).

Based on the findings of the Annual Report (SCC, 2018), the ENRS investigation (ENRS, 2018b) and the Locale Consulting recommendations (Appendix G), it is considered that the Proposal Site can accommodate the Proposal. The potential environmental impacts of the Proposal are addressed throughout this EIS and with the implementation of appropriate mitigation measures discussed throughout this EIS and in Section 9, the Proposal Site is considered suitable for development as a landfill.

3.6 Consideration of on-site alternatives/technologies

In considering the need for ongoing waste management solutions for the SCC LGA, SCC has considered on-site alternatives to the landfill extension. As noted in Section 2.5 SCC has recently received concept approval for development of a RRP which would assist in minimising waste to landfill.

The RRP is expected to comprise a variety of waste processing activities including a composting facility, materials recovery facility and a sorting and recovery facility. The following alternative waste technologies (AWTs) have been shortlisted for construction and operation on the RRP site:

- Mixed waste mechanical biological treatment (MBT)
- Mixed waste tunnel composting
- Mixed waste in-vessel batch composting and energy recovery.

All three of the AWTs would be mechanically and manually pre-separated and sorted into ‘organic’ and ‘inorganic’ components. The organics component would be processed through the mixed waste MBT or mixed waste tunnel composting or mixed waste in-vessel batch composting and energy recovery waste technology (dependent on which is the selected process). The inorganics components would be either recovered or landfilled. Post AWT treatment would see the treated waste be mechanically and manually separated and sorted for beneficial re-use or landfill (pers. comms. Bianco 22/11/2016).

As discussed in Section 3.1.2 SCC has considered a range of waste diversion rates that could be achieved by the RRP (40 % in year of opening, 50 % in year two and 60 % in each subsequent year) and has determined that an extension to the existing landfill would still be required.

4 CONSULTATION

This section summarises the community and stakeholder engagement activities and feedback received during preparation of this EIS. This section also provides details on proposed stakeholder engagement activities which are to be undertaken during the public exhibition of this EIS.

4.1 Consultation requirements

The SEARs for the Proposal outline the requirements for consultation which should be undertaken during the preparation of the EIS. The SEARs require that consultation should be undertaken with the following parties:

- Environment Protection Authority (EPA)
- Office of Environment and Heritage (OEH)
- Department of Primary Industries (DPI)
- Roads and Maritime Services (RMS)
- NSW Rural Fire Service (RFS)
- Mine Subsidence Board
- AGL
- The local community and stakeholders.

A description of the consultation undertaken in accordance with the SEARs, including consultation undertaken with the community, stakeholders and government agencies is provided in further detail below.

4.2 Consultation objectives

The consultation objectives were to:

- Raise awareness of the Proposal in the local community, providing information about the project development and approval process
- Ensure a transparent and accountable community involvement process for the Proposal
- Document community input for consideration in the EIS and at the conclusion of the consultation process
- Manage community expectations by clearly outlining the decision making process and how their feedback would be used
- Engage with relevant government stakeholders to confirm issues relevant to the Proposal.

4.3 Government agency consultation

Consultation with government agencies was carried out to identify potential issues that should be addressed. A summary of responses raised in government agency consultation, and where each is addressed in the EIS, is provided in Table 4-1.

Table 4-1 Summary of key issues raised by government agencies

Agency/ stakeholder	Consultation details	Response/issue	EIS section where addressed
DPE	SCC wrote to DPE requesting SEARs for the Proposal on 22 July 2015	SEARs were issued to SCC on 19 August 2015. The SEARs were amended and reissued by DPE on 11 July 2017, and subsequently reissued on 22 September 2017 (see below).	All sections of this EIS. See SEARs reference guide in Section 1.5
	SCC wrote to DPE requesting an extension of time (EOT) on the SEARs on 31 July 2017	DPE requested SCC submit a revised preliminary environmental assessment on 13 September 2017. In a further phone conversation between SCC and DPE on 18 September 2017, DPE requested SCC re-submit a request for EOT with the PEA. SCC resubmitted the above documents on 18 September 2017. DPE approved the SEARs extension and issued amended SEARs on 22 September 2017	All sections of this EIS. See SEARs reference guide in Section 1.5
	Arcadis and SCC met with DPE on 21 May 2019 to discuss queries DPE had with the EIS prior to placing the EIS on public exhibition.	DPE requested clarity around how the Proposal would utilise existing infrastructure at the WNRWF and whether this existing infrastructure would form part of the Proposal. DPE also requested clarity around the suitability of the site, waste management processes at the WNRWF, noise and vibration modelling, heavy vehicle numbers accessing the Proposal Site, and how fire and hazards and risks would be managed at the Proposal Site.	Section 1.3.1 Section 5.2 Section 8.3 Section 8.6.3 Section 8.10.3
EPA	SLR contacted EPA on 15 December 2016 requesting clarification regarding the design of a sediment basin and fire break within the 250 m asset protection zone (APZ).	EPA responded to SLR via email on 21 December 2016 stating a sediment basin within the 250 m buffer was acceptable, but they were still awaiting confirmation from the Wollongong site office that there were no local considerations on the Proposal	Section 5 and the Concept Design (Appendix E).

Agency/ stakeholder	Consultation details	Response/issue	EIS section where addressed
		Site. EPA re-confirmed that a sediment basin was acceptable within the 250 m buffer on 7 February 2017.	
	SCC, SLR and Arcadis met with EPA on 15 September 2017 to discuss the Proposal including the use of the existing leachate management system.	EPA requested that SCC demonstrate the existing leachate management dam can achieve a similar level of performance to that required under the Environmental Guidelines.	Sections 5.6 and 8.4 and the Soil, Water and Leachate Assessment (Appendix N)
OEH	SCC submitted the draft Biodiversity Assessment Report (BAR) to OEH in late 2016 and engaged in teleconferences discussing the draft BAR on 17 and 23 January 2017 and 2 and 6 March 2017.	OEH provided feedback on the draft BAR on 17 July 2017.	Section 8.2
	SCC submitted the final BAR to OEH on 22 August 2017	SCC has not received any feedback from the OEH on the final BAR.	Section 8.2
	SCC provided OEH with the concept design report, Aboriginal archaeological survey report and non-Indigenous heritage assessment report on 17 November 2017.	OEH provided feedback on the Aboriginal archaeological survey report and requested early referral of draft biodiversity assessments (SCC TSO) on 11 December 2017. OEH requested further information be included in the Aboriginal heritage assessment regarding regional cultural sites. This information has been included in Section 8.8.1. As noted above the BAR was submitted to OEH on 22 August 2017.	Section 8.8.1 Section 8.8.2 Section 8.2

Agency/ stakeholder	Consultation details	Response/issue	EIS section where addressed
DPI	SCC provided DPI with the concept design report on 17 November 2017.	SCC has not received any feedback from DPI on the Concept Design Report.	N/A
RMS	DP&E consulted with RMS requesting input for SEARs in August 2015.	RMS responded to the request for SEARs indicating that it was unlikely that the Proposal would have a significant impact on the classified road network and that the environmental assessment should address any potential construction traffic impact on the safety and efficiency of the surrounding road network. Section 8.6 addresses the potential construction and operation impacts of the Proposal on the surrounding road network.	Section 8.6
RFS	SCC wrote to the RFS on 17 November 2017 regarding the Proposal and enclosing concept design drawings and the Bushfire Protection Assessment.	SCC received a response from RFS on 14 December 2017. The response recommended several conditions related to asset protection zones, water and utilities, access to the Proposal Site and emergency and evacuation planning. All of the conditions recommended by RFS have been incorporated into the Proposal (see Section 8.10).	Section 8.10
Mine Subsidence Board	SCC provided the Mine Subsidence Board with the concept design report on 17 November 2017.	SCC has not received any feedback from the Mine Subsidence Board .	N/A. No feedback received and the site is not within a mine subsidence district
AGL	SCC provided the AGL with the concept design report on 17 November 2017.	SCC has not received any feedback from AGL	N/A

4.4 Aboriginal heritage consultation

Artefact Heritage were engaged as part of development of this EIS to undertake an Aboriginal archaeological heritage assessment of the Proposal Site. The *Addendum Aboriginal Archaeological Survey Report* (ASR) (Artefact Heritage, 2017) is provided in Appendix H. The assessment built on earlier heritage assessments undertaken by Artefact Heritage in 2014 and 2015 and was undertaken in accordance with the following guidelines:

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010* (Department of Environment Climate Change & Water 2010)
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage [OEH] 2010).

A key objective of the assessment was to engage with the relevant Aboriginal stakeholders which, for the area, is the Nowra Local Aboriginal Land Council (LALC). Lee Ferguson represented the Nowra LALC and provided assistance and advice in the field. All survey methodology, results and any recommendations were discussed in the field by Michael Lever (Senior Heritage Consultant, Artefact Heritage) and Lee Ferguson. A copy of the draft ASR was sent to Nowra LALC for comment on 29 August 2017. No comments were received. A final copy of the ASR was also sent to the Nowra LALC.

4.5 Community consultation

The Waste Services Unit of SCC prepared the *Consultation Plan: Proposed Landfill Extension West Nowra Recycling and Waste Facility, Flatrock Road, West Nowra* (Consultation Plan) (SCC, 2015a) (Appendix I) to demonstrate how Council has consulted with the community regarding the Proposal.

As documented in the Consultation Plan, community consultation included the following:

- A letterbox drop undertaken in October 2015, delivered information to 813 properties within a four kilometre radius of the Proposal Site. The letterbox drop comprised a letter providing information about the Proposal and a form to make a submission to Council about the Proposal
- A letter was sent via mail to 525 account card customers of the WNRWF with information about the Proposal and a form to make a submission to Council
- A dedicated webpage on the SCC website was established offering detailed information about the Proposal (https://shoalhaven.nsw.gov.au/My-Council/Current-Projects/West-Nowra-Recycling-and-Waste-Facility)
- A post on the SCC Facebook page providing general information about the Proposal and a link to Council's dedicated Proposal webpage
- Flyers about the Proposal were placed at the weighbridge/gatehouse of the WNRWF for distribution to users of the WNRWF
- Advertisements were placed in the public notices section of the South Coast Register and Milton Ulladulla Times on 14 October 2015
- Public information sessions were held on Tuesday 13 October 2015 and Wednesday 14 October 2015
- A tour of the Proposal was conducted on 15 October 2015.

From this consultation process three submissions were received from the community, with two raising concerns/questions about particular elements of the Proposal and one submission supporting the Proposal. The concerns/questions raised related to:

- Traffic
- Litter
- Leachate
- Noise
- Air quality and odour
- Flora and fauna.

In reply to the issues raised, SCC responded directly to these stakeholders in writing, notifying each community member how their concerns would be addressed in the EIS process. These potential environmental impacts associated with these matters have been addressed in Section 8 of this EIS.

Ongoing consultation with the community will occur through public exhibition of the EIS, as required under clause 89F of the EP&A Act and Division 6 of the EP&A Regulations. This will include exhibition of the EIS for a period of not less than 30 days.

5 PROPOSAL DESCRIPTION

5.1 Proposal overview

SCC is seeking approval under Part 4, Division 4.1 of the EP&A Act to extend the existing landfill located at the WNRWF.

The Proposal would receive waste from all areas within the SCC LGA including the major township of Nowra.

The Proposal would provide landfill capacity to service the SCC LGA for up to 30 years and would commence operation from approximately 2026. While the Proposal seeks approval to operate for up to 30 years, landfill life expectancy modelling estimates that the landfill would provide capacity for a minimum of eight years (i.e. to end 2034 under a worst case scenario) and up to approximately 18 years (under a reduced waste disposal scenario) (SCC, 2017a). These scenarios are explained in further detail in Section 3.1.2.

Waste would include general solid waste (i.e. putrescible and non-putrescible materials) and asbestos from domestic and commercial and industrial (C&I) sources.

The key works for which approval is sought include:

- Progressive landfill cell construction, operation and rehabilitation of the Stage 4 landfill extension including:
  - Clearing of 9.87 ha of existing vegetation
  - Construction of access tracks and fire trails
  - Earthworks for cell formation including extraction and stockpiling of materials and the reapplication to form the leachate barrier (cell liner) as well as for daily, intermediate and final cover
  - Installation of leachate management structures including the leachate barrier, collection, storage and disposal system (including construction of a rising main to transfer leachate to the existing leachate collection dam established as part of earlier landfilling activities within the WNRWF and infrastructure to pump leachate from the dam to a proposed new leachate irrigation area on the Stage 2 landfill area)
  - Installation of a surface water management system, including sediment dams, sediment erosion control measures and surface diversion bunds/swale drains
  - Installation of additional groundwater bores for groundwater monitoring
  - Progressively increasing the annual waste acceptance rate at the landfill
  - Signage and other ancillary works
  - Rehabilitation of closed sub-cells
- Delineation and ongoing management of a conservation area along the southern and eastern boundary of the Proposal Site
- Installation of three fauna rope bridges with monitoring cameras over Flatrock Road.

The Proposal is expected to provide approximately 1.38 Mm^3 of additional landfill capacity and would be developed in sub-cells as described in Section 5.3.3.

5.2 Proposal utilisation of WNRWF infrastructure

The Proposal requires the use of existing approved infrastructure at the WNRWF to ensure its safe and efficient operation. Table 5-1 provides details on all the existing

approved infrastructure at the WNRWF that the Proposal would utilise and how it interfaces with it during operation.

Table 5-1 Interface of existing infrastructure at the WNRWF with the Proposal

Infrastructure item	Interface with the Proposal
Site Support Facilities	
Entrance and exit	Enables the movement of heavy and light vehicles into and out of the WNRWF, some of the heavy vehicles will proceed to the Stage 4 Landfill
Site office	For administrative staff associated with the WNRWF and the Stage 4 Landfill
Car park	Area where staff operating the WNRWF and Stage 4 Landfill park their vehicles
Staff Amenity building	WNRWF and Stage 4 Landfill staff lunch room and amenities facilities
Plant and equipment shed	Where equipment associated with the operation of the WNRWF and Stage 4 Landfill is located
Storage shed	Where equipment associated with the operation of the WNRWF and Stage 4 Landfill is located
Waste Processing Areas	
Weighbridges and gatehouse	All vehicles (light and heavy) will proceed through the two weighbridges (entry and exit) to enter and exit the WNRWF, some of which will proceed to the Stage 4 Landfill.
Transfer station area	All residual waste will be transferred to the Stage 3 and Stage 4 Landfill areas
VENM stockpile areas	VENM from the stockpile will be used for daily, intermediate and final cover as well as the landfill cell clay base liner at both the Stage 3 Landfill (until fully closed and capped) and the Stage 4 Landfill
Green waste stockpile and processing area	Any residual waste unable to be processed into mulch material and made available to the public would be transferred to the Stage 3 and Stage 4 Landfill areas.
Steel waste stockpile and	Any residual waste unable to be transferred and recycled off site would be transferred to the Stage 3 and Stage 4 Landfill areas.
Pavement materials area	Pavement materials will be used in construction and maintenance of internal road and hardstand areas across the WNRWF, including the road to the Stage 4 Landfill.
Active landfill and wet weather disposal area	• Stage 3 active landfill and wet weather disposal area would operate under this DA 90/3061 and EPL 50877 • Stage 4 active landfill would operate under the DA to be issued for this EIS, and varied EPL 5877 • The wet weather disposal area is a purpose-built hardstand area made from pavement materials taken from the WNRWF. This area would be moved progressively around the landfill cell

Infrastructure item	Interface with the Proposal
	and would be utilised when ground conditions become unsafe for heavy vehicles to utilise.
Environmental Management Infrastructure	
Landfill gas generator	Gas from the existing landfill cells at the WNRWF and the Stage 4 Landfill would go to the generator (16-cyclinder gas engine) which would generate electricity and send this back to the electricity grid
Landfill gas flare	Excess gas from the existing landfill cells at the WNRWF and the Stage 4 Landfill that would ordinarily go to the generator would be destroyed using the landfill gas flare
Wash down bay	All heavy vehicles accessing the WNRWF and Stage 4 Landfill would need to drive through this to ensure no tracking of mud off site

5.3 Concept design overview

The concept design for the Proposal was prepared by SLR Consulting (SLR) in 2017. The concept design is documented in the *West Nowra Recycling and Waste Facility: Proposed Stage 4 Landfill Extension - Concept Design Report* (Concept Design Report) (SLR, 2019a) and is included in Appendix E. The information contained in this Section of the EIS (Section 5) is drawn from the Concept Design Report.

This section of the EIS summarises the key components of the concept design. The Concept Design Report includes additional detail (including preliminary design drawings, volume and area estimates and technical specifications related to both earthworks and construction material specifications) and should be referred to for additional detail to that provided herein.

5.3.1 Design parameters and assumptions

The following design parameters and assumptions were adopted during the development of the concept design:

- The landfill cells are to be formed by excavating to approximately 43.5 m Australian Height Datum (AHD) at the Southern end and 42.5 m AHD at the Northern end and the basal lining system formed above this level. This will ensure that there is a two metre separation between the groundwater level and the top of the lining system / base of the waste. The cells will be filled to a final profile in line with the adjacent landfill stages 2 and 3.
- Excavation of batter side slopes is assumed to be as per current site conditions, i.e. one vertical to two horizontal (1V:2H)
- The maximum height of the final landform (at top of batter slope) is to be RL 59 m. As agreed with SCC, the maximum height has been established based on a slope of one percent falling from the highest point on Stages 2 and 3 (RL 61 m) to Stage 4
- The access road between Stages 2 and 3 and the Stage 4 extension is to remain in place until final filling and closure
- Leachate management is to be incorporated into existing site infrastructure and includes the development of a proposed new leachate irrigation disposal area located over the existing closed Stage 2 landfill area. There is no sewer connection

nearby therefore the leachate must be managed on site. It is understood this may change in the future with the introduction of a nearby sewer system connection

- Typical geology in the area comprises sandstone overlain by up to seven metres of sandy clay. The bedrock profile has been described as being variable, ranging from moderately to heavily weathered (SLR, 2019a).
- In accordance with the guidelines: *Siting, design, operation and rehabilitation of landfills* (Victorian Landfill Guidelines) (EPA Victoria, 2015), the base of the landfill must be more than two metres above the average groundwater level (i.e. two metres above 43.5 m AHD in the south and 42.5 m AHD in the north of the extension area).

5.3.2 Proposal landfill layout

The proposed landfill layout was developed to maximise the available space within the SCC owned land at the WNRWF, while also taking into account the relevant constraints within the area. The footprint of the Stage 4 landfill was developed acknowledging the following constraints:

- Western boundary: existing landfills (Stages 2 [closed] and 3 [currently operational]). An access road runs between these stages and Stage 4 and it is proposed to fill over this in the final stages of filling, hence it will form part of the Stage 4 landfill footprint.
- Northern boundary: the existing WNRWF waste transfer station and staff amenities building, including carpark.
- Eastern boundary: the proposed environmental conservation area set aside to protect *Triplarina Nowraensis* vegetation and to serve as a biodiversity corridor. Space has also been provided for a 10 m fire break/access road (as recommended in the *Bushfire Protection Assessment For The West Nowra Recycling And Waste Facility Proposed Stage 4 Landfill Extension* (ABPP, 2017) (Appendix J).
- Southern boundary: the nearest (legal) dwelling being located no closer than 250 m from the southernmost extent of the waste deposition area[8].

The proposed landfill layout is shown in Figure 5-1.

[8] The Environmental Guidelines require the edge of the waste deposition area to be a minimum of 250 m from the nearest environmentally sensitive location (including residences and dwellings). There is one dwelling approximately 185 m from the nearest waste deposition area, however SCC advised that this is an illegal/unapproved dwelling, and that the landfill should be designed to be 250 m from the nearest legal dwelling. SCCs advice has been incorporated into the design.

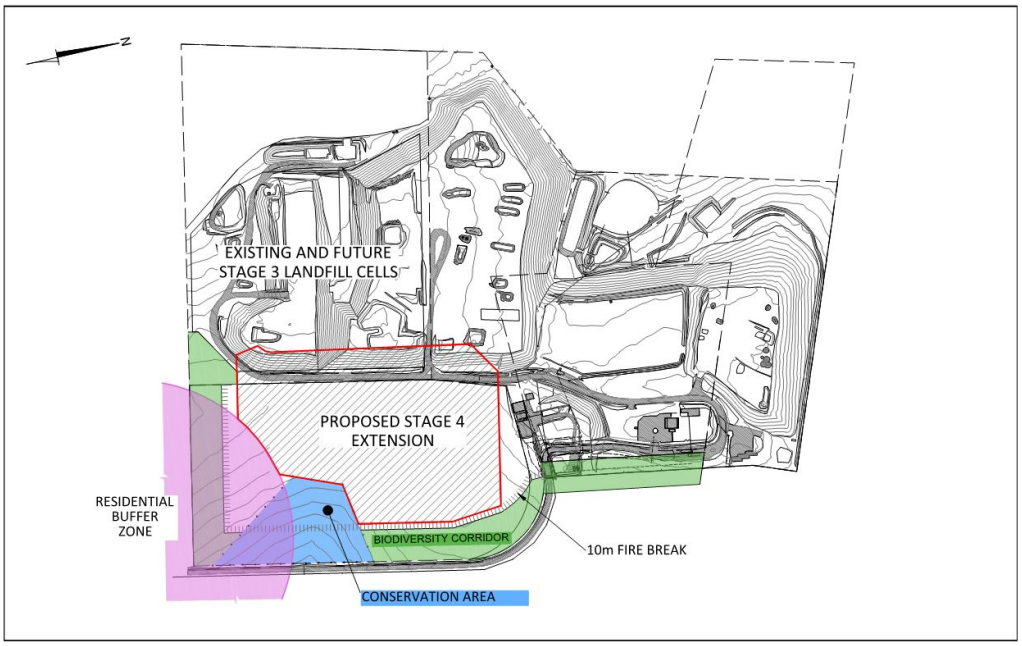


Figure 5-1 Proposed landfill layout (SLR, 2019a)

5.3.3 Development of sub-cells and landfilling sequence

It is proposed to develop the landfill in six sub-cells, sequentially filled and moving from the south (sub-cell one) to north (sub-cell six) with progressive side slope excavation and liner construction as required. Sub-cell one lies to the south of the groundwater divide and therefore will have a subgrade level of 43.2 m, while the remaining sub-cells lie to the north of the divide and will have a subgrade level of 42.5 m. The development will allow for a gradient drop between each cell to allow for leachate and surface water to be directed to (separate) low points progressively until sub-cell six. Longitudinal and transverse basal slopes of one to three percent will be incorporated as required by the Environmental Guidelines.

The layout of the landfill sub-cells is shown in Figure 5-2 and a 3D depiction is included in the Concept Design Report in Appendix E.

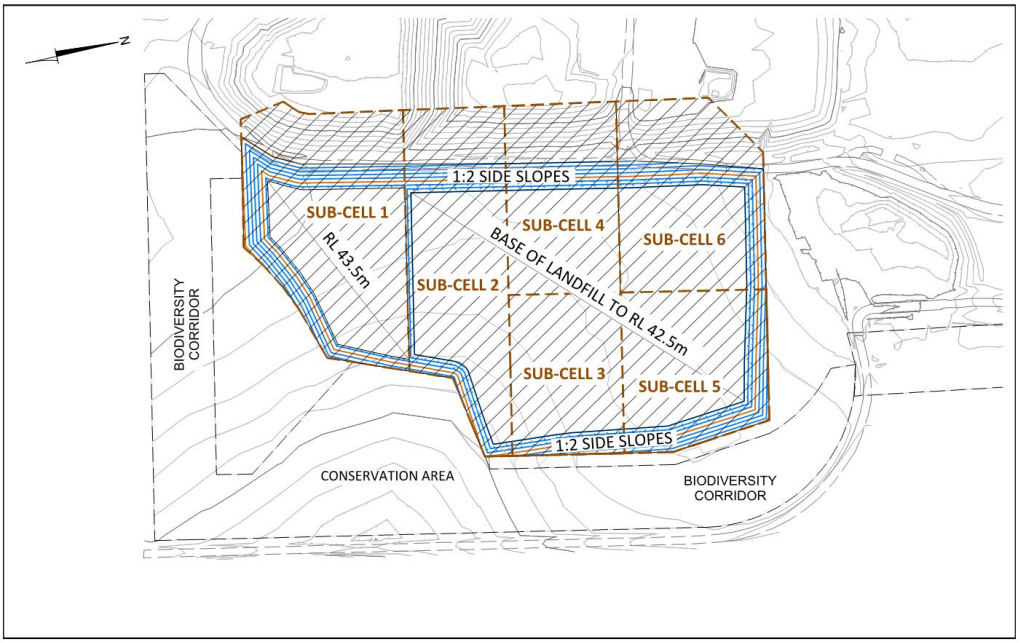


Figure 5-2 Proposed sub-cell layout

As each sub-cell is nearing capacity, construction of an adjacent sub-cell would begin. Access ramps to the landfill would be provided from the road between Stages 2 and 3, and Stage 4. The ramps would be maintained until construction and filling of each sub-cell is complete.

In order to provide stability and surface water management during construction, earthen bunds would be constructed between each landfill sub-cell. The bunds would incorporate a geomembrane liner overlap design with anchor trenches to ensure continuity in the geomembrane is present and that there is minimal slippage of the liner when loaded (SLR, 2019a).

The filling profile sections is shown in Figure 5-3 and the profile of the final landform is shown in Figure 5-4. Further detail on the landfilling process is included in the Concept Design Report (specifically, Figures 13 to 18 of Appendix E).

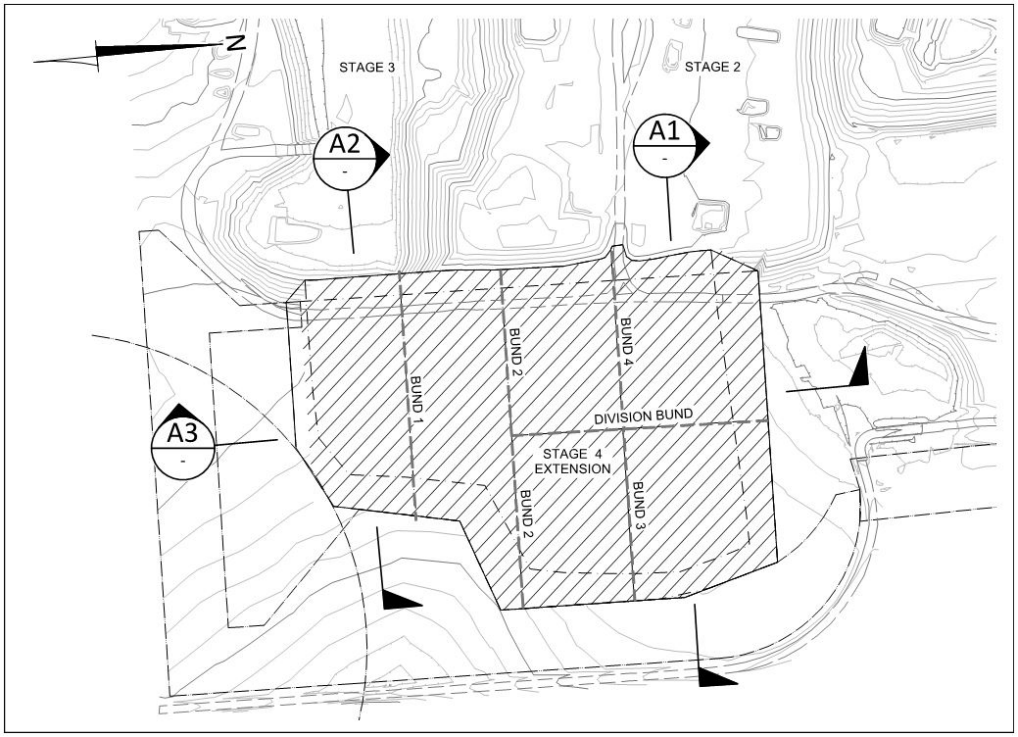


Figure 5-3 Section locations for filling profile

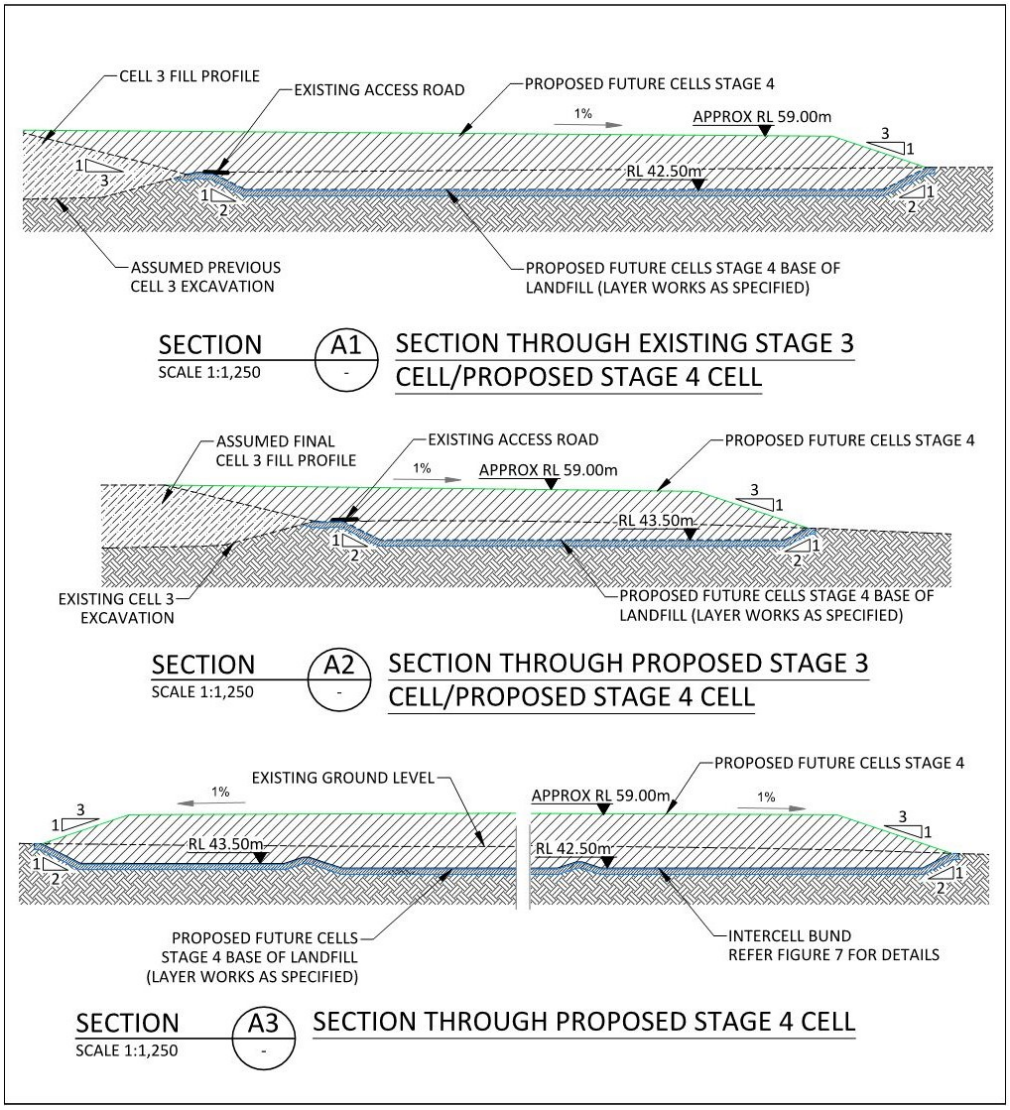


Figure 5-4 Final landform design development plan

5.3.4 Excavation stability

The base excavations will be performed in a staged manner with Cells 1 and 2 being excavated during the initial development phase, and cells 3 to 6 progressively excavated during the life of Stage 4. The side walls would have an angle of 1V:2H[9]. The open excavation areas will be covered with an engineering system comprising a 200 mm thick compacted subgrade, 1,000 mm of compacted clay liner (or an alternative geosynthetic liner), a two millimetre thick High density polyethylene (HDPE) flexible geomembrane and a minimum 300 mm of leachate drainage material (the proposed lining system is described in further detail in Section 5.5).

The maximum depth of excavation will be approximately 7.1 m for the southern landfill cell stages, and seven metres for the northern landfill cell stages. Groundwater infiltration is not anticipated, as all excavations will be a minimum of two metres above the average groundwater levels (as required by the Victorian Landfill Guidelines).

[9] SLR determined the side batter slope angle using the ground conditions provided in Geotechnical Report (Coffey, 2016). If ground conditions vary significantly from the conditions described in the Geotechnical Report, re-evaluation of side slope angle may be required (e.g. if a layer of loose sand is found upon excavation).

5.3.5 Landfill final landform and capacity

The completed side slopes of the Stage 4 landfill would have a gradient no greater than (1V:3H) and a height of approximately RL 59 m. The height of the landfill has been set to match with the equivalent maximum height on the Stage 3 development at the top of the batter slope. The Stage 4 landfill final landform is shown in Figure 5-5.

The final landfill capacity will be approximately 1.38 Mm^3.

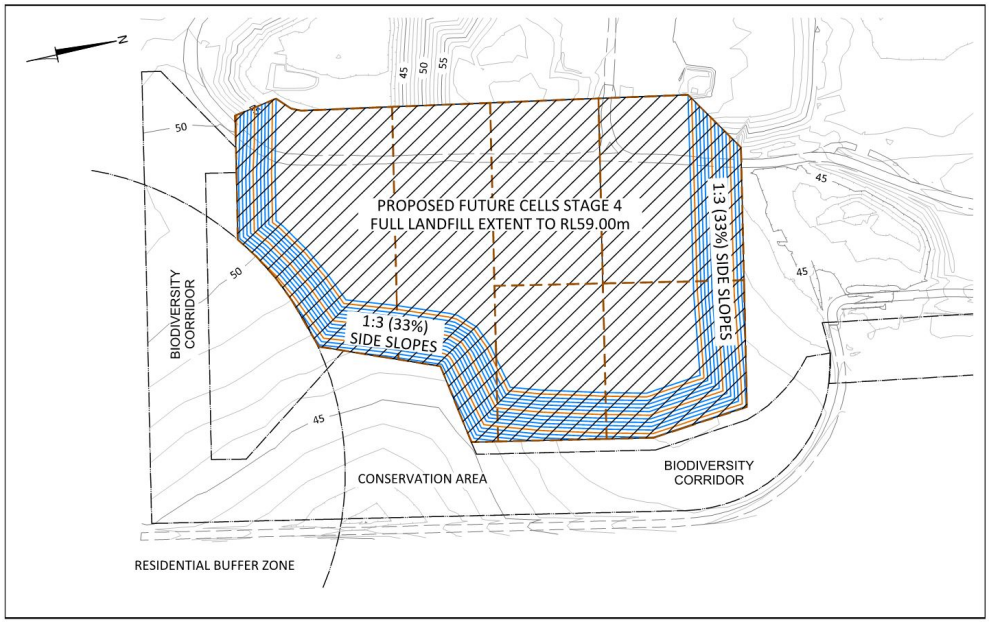


Figure 5-5 Final landform

5.3.6 Fauna rope bridge crossing

Three fauna rope bridges will traverse Flatrock Road as identified in Figure 1-1. Six poles are required to install the rope bridges and the exact locations of the three rope bridges and six poles will be determined during detailed design, in consultation with SCC Environmental Assessment Officers and road engineers and is subject to mitigation measures outlined herein. It is expected that footings for the rope bridges will be installed outside the road reserve on the eastern side of Flatrock Road and installed within the conservation area of the Proposal Site on the western side of Flatrock Road as identified in Figure 1-1.

The fauna rope bridges are required to enhance connectivity to the bushland east of the Proposal Site where Squirrel Gliders have been detected. Permanent monitoring cameras will be installed to monitor the use of fauna rope bridges by wildlife.

5.4 Groundwater management

The local groundwater has been considered when developing the proposed subgrade level of the landfill extension. The excavation will not come within 100 mm of the average depth to groundwater. The base of the landfill cell floor (i.e. top of leachate drainage layer) will be greater than two metres above the average groundwater table.

For the purposes of this concept design it has been assumed that the groundwater table in the area of sub-cell 1 is at an average of RL41.5 m, and an average of RL40.5 m in the area of sub-cells 2 to 6. These average groundwater elevations are based on the current piezometer readings[10].

5.5 Lining system requirements

Development of the lining system would be in accordance with NSW regulatory requirements and be supported by best practice considerations. Specifically, the lining system for the Proposal would comply with the Environmental Guidelines. A summary of the lining system requirements from the Environmental Guidelines is provided in Appendix E.

5.5.1 Recommended basal liner

The recommended base liner should include:

- Compacted subgrade formation level from RL 41.3 m to RL 39.30 m
- The average groundwater level would be greater than two metres below the base of the landfill (i.e. top of leachate drainage level), thus a groundwater extraction layer is not anticipated to be required
- Composite liner for the base and side batter slopes. The composite liner would comprise (from subgrade up):
  - A 1,000 mm thick composite clay liner (CCL) or alternatively an approved (geosynthetic clay liner) GCL of appropriate thickness. The excavated clay material from site has been found in the past to be generally suitable for use in the CCL, and this has been confirmed by the field investigation results, which indicates the in-situ clay to be of low to moderate plasticity with a permeability of less than $1x10^{-9}$ m/s for the majority of the samples
  - HDPE liner: A two millimetres thick double-rough HDPE overlain by a protection geotextile would be placed over the CCL or GCL, to provide a relatively impermeable barrier to leachate migration. At this concept design stage and based on information available, a double rough HDPE is recommended. Further investigation could be undertaken in the detailed design phase to establish if an alternative liner, such as smooth both sides, would be appropriate
  - Protection geotextile layer placed over the HDPE liner to protect it from the drainage aggregate.
- Leachate collection layer: a minimum 300 mm thick layer of drainage aggregate with HDPE leachate drainage pipes (drilled holes or slotted) would be placed over the protection geotextile layer, which would promote the flow of leachate under the landfill and into the leachate collection system. The central drain and spur drains pipes would have a minimum internal diameter of 200 mm and 150 mm respectively, and the spur drains placed at a maximum of 25 m intervals. The leachate collection system should be graded at a minimum of one percent longitudinally into the sump and three percent in the transverse direction. A separation geotextile layer would be placed over the leachate collection layer to minimise fines migration.

[10] See the mitigation measures in Section 8.4 regarding the need for confirmation of average groundwater depths as part of detailed design.

The leachate management system for the Proposal is discussed in detail in Section 5.6.

5.5.2 Overlapping liner between Stage 4 and Stages 2 and 3

The Stage 4 landfill will overlap the eastern flank of the existing Stage 2 and 3 landfills. The Stage 4 lining system would tie into the existing liner to ensure integrity of the system. The tie in detail is shown in Figure 5-6.

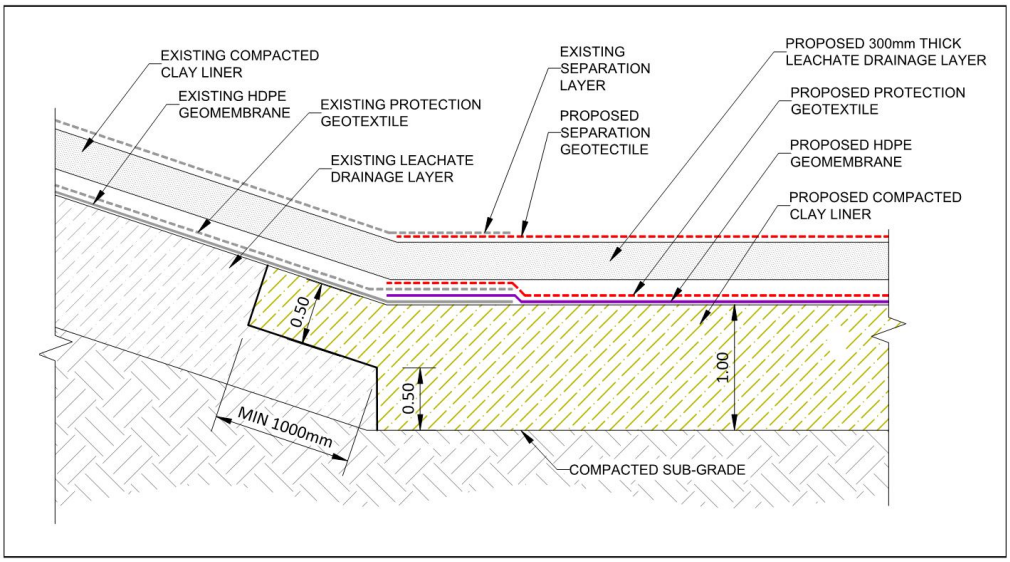


Figure 5-6 Overlapping liner tie-in detail between Stage 4 and Stages 2 and 3 for CCL

The CCL for Stage 4 may be replaced with a GCL if required.

There are leachate pipework inspection openings located between the access road and the south toe of Stages 2 and 3. These would be cut back to subgrade and capped off prior to construction of the liner in this location.

5.5.3 Stage 2 landfill liner

The Proposal includes irrigation of leachate over a new irrigation area (see Section 5.6.3) to be installed above the Stage 2 (lined, closed and capped) landfill. It is noted that the existing irrigation area at the WNRWF is situated above the unlined Stage 1 landfill cell whereas the proposed irrigation area will be situated above the lined Stage 2 landfill. This will mitigate leachate potentially migrating into the groundwater compared to the existing situation.

Liner design summary

The liner for the Stage 2 landfill was built over a number of years, in/around 1999. The guidelines for landfill liners in place at that time were the 1996 Environmental Guidelines: Solid Waste Landfills (EPA, 1996). Details of the Stage 2C/B landfill cell provided by SCC are included in Appendix W, including cross sections, long sections and liner details. It is unclear if these drawings are design drawings or as-built/works-as-executed drawings, and whether the HDPE liner was installed. The drawings show the liner to include (from bottom to top):

- 0.75 m compacted fill material excavated from site
- 0.3 m compacted clay

- 1.5 mm HDPE liner
- 0.3 m protective granular fill.

Based on the design drawings, there are differences between the Stage 2 liner design and the requirements under both the 1996 and 2016 Environmental Guidelines. An assessment of the existing groundwater quality downgradient of the Stage 2 landfill and performance of the liner based on water quality monitoring data from SCC is provided in Section 8.4.2. Mitigation measures related to the establishment and use of the Stage 2 irrigation area, including water quality monitoring prior to installation, are provided in Section 8.4.4.

5.5.4 Surface water management system

Appropriate surface water management controls would be applied to ensure clean surface water runoff is intercepted and diverted from the landfill footprint prior to entering the waste mass and thus becoming leachate. Stormwater (rain) that falls directly onto the landfill footprint is considered to be leachate.

Surface water management controls to be put in place would include:

- Sediment dams to manage potential sediment-laden runoff from the open and closed landfill cells
- Sediment erosion control measures (coir logs, sediment fences etc.); and
- Surface diversion bunds and swale drains around open excavations (unfilled) and active landfill cells.

A conceptual erosion and sediment control plan has been developed and is shown in Figure 5-7.

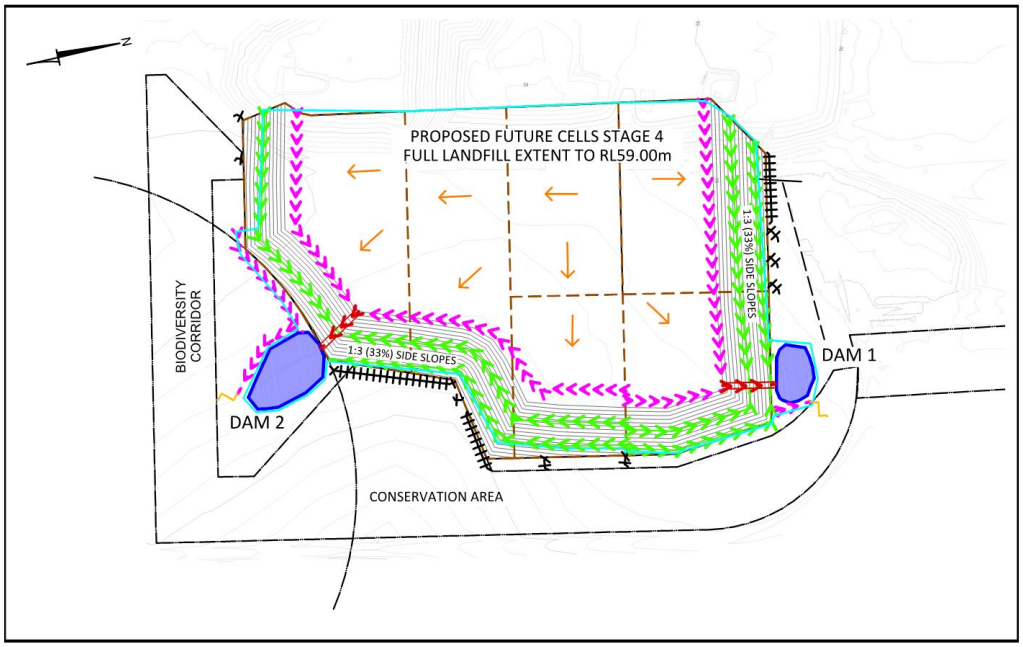


Figure 5-7 Conceptual erosion and sediment control plan

The required storage capacity of the dams has been determined in accordance with the requirements of the Blue Book (*Managing Urban Stormwater: Soils and Construction, Volume 1 and Volume 2B Waste Landfills* (Landcom, 2004 and DECC, 2008)) with the following design criteria and assumptions:

- Upslope catchment areas as shown in Figure 5-7 and Table 5-2

- Capacity calculations based on a five day, 90th percentile rainfall depth of 67 mm as listed in Table 6.3a of the Blue Book for Kangaroo Valley (closest listed location)
- The dams were designed as type F/D dams due to the nature of the soil in the area which contains some clay materials (in accordance with the Blue Book)
- Disturbed runoff coefficient of 0.79 in accordance with Table F2 of the Blue Book for a type D hydrological group with rainfall between 61 - 80 mm
- The sediment storage zone was based on a management period of 12 months (i.e. the sediment dam would be desilted once a year) and equates to 50 % of the settling zone storage capacity of the dams.

The dams would be regularly drawn down following rainfall (within five days). This is to ensure that the dams are operated in accordance with the requirements of the Blue Book to minimise the chances of an uncontrolled release. Suitably sized dam spillways would be designed in accordance with the Blue Book requirements prior to construction.

The results of the dam capacity calculations are provided in Table 5-2.

Table 5-2 Shoalhaven sediment dam capacity details

Dam	Catchment Area (ha)	Settling Zone Volume (ML)	Sediment storage zone (ML)	Total Dam Storage Volume (ML)
Dam 1	3.0	1.58	0.79	2.37
Dam 2	6.5	3.46	1.73	5.19

5.6 Leachate management system

Leachate is considered liquid that passes through the landfill waste mass as well as any stormwater runoff that may have come into contact with landfill footprint.

The primary sources of leachate generation are:

- Stormwater infiltration into the waste mass during periods of prolonged rainfall
- Surface water run-off from the landform that has come into contact with the landfill waste
- Leachate generated by the moisture content, and degradation of the received and emplaced waste.

The existing leachate collection system for Stages 2 and 3 involves diverting landfill generated leachate to a leachate collection dam. The stored leachate is then disposed on site via spray irrigation over the closed Stage 1 landfill area. SCC propose to divert Stage 4 leachate to the existing leachate dam and develop a new irrigation area over the Stage 2 (closed and lined) landfill. Further details on the proposed leachate management system are included below and are provided in full in the Concept Design Report (Appendix E).

5.6.1 Leachate collection and disposal

The proposed leachate collection system would allow leachate to be collected and temporarily stored within the basal granular leachate drainage blanket. The design components would include:

- The base of the leachate collection layer graded to direct leachate to specific leachate collection sumps

- Drilled holes or perforated leachate collection pipe network within the collection layer, to promote the flow of leachate to the sumps
- From the sumps, a series of inclined leachate extraction pipes would be designed to draw leachate from the base of the landfill cell to the surface by a series of submersible pumps
- The pumped leachate would be directed to the existing leachate dam for storage prior to being pumped to a newly established irrigation area over the Stage 2 landfill for controlled disposal via spray irrigation. The clay cap in Stage 2 where the irrigation system is proposed requires removal and is to be re-instated with 1400 mm depth of silty sand and 200 mm of topsoil to allow for infiltration.

5.6.2 Leachate collection pipework

The landfill generated leachate will be pumped from the sump of each landfill cell to the existing leachate dam. Leachate extraction pipework shall be progressively installed (in accordance with the Environmental Guidelines or approved alternative), on the eastern and western perimeters of the Stage 4 landfill cells upon a compacted fill apron placed above the engineered lining system. The fill apron will support the leachate extraction pipework over the series of rock benches. The leachate extraction risers per cell will be placed within a recessed trench within the crown of the compacted fill apron.

The Environmental Guidelines, Section 1.5, requires that leachate collector pipes should:

- Be flexible pipes (typically high density polyethylene) at least 150 mm in internal diameter (water balance and pipe flow calculations should confirm the pipe size needed to convey peak leachate flow rates)
- Be perforated such that the size, frequency and layout of the perforations are sufficient to facilitate leachate inflow and extraction without clogging, prevent entry of drainage gravel, and maintain adequate pipe strength
- Be strong enough to maintain performance under the maximum loads likely to be imposed in service, complying with the requirements of *Australian Standard AS 2566.11998 Buried Flexible Pipelines – Structural Design* (Standards Australia, various dates)
- Be joined by using techniques and materials recommended by the pipe manufacturer
- Loading calculations are required to determine the pipe strength to provide a pipe that is sufficient to resist buckling and deformation caused by the excessive loading from the anticipated depth of waste complying with the requirements of *Australian Standard AS 2566.11998 Buried Flexible Pipelines – Structural Design* (Standards Australia, various dates).

5.6.3 Leachate irrigation area

The proposed new leachate irrigation area would be constructed on Stage 2 of the existing landfill and be 14,000 m^2 in size. The proposed location for the new irrigation area is shown in green on Figure 5-8. The design of the irrigation area will be refined during detailed design and will consider compatibility with the gas capture system currently in place on the Stage 2 landfill.

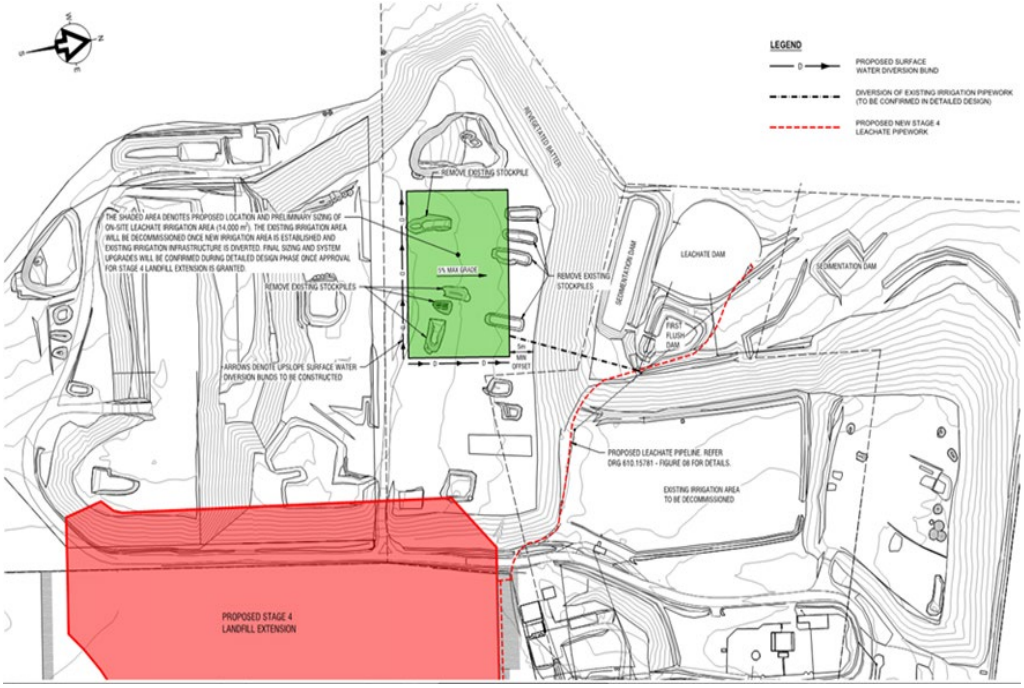


Figure 5-8 Proposed leachate irrigation area (shown in green)

5.7 Landfill gas

There is an existing landfill gas (LFG) extraction, cogeneration (generator) and treatment (flare) system operating at the WNRWF, which manages LFG generated from Stages 1 to 3. LFG generated from Stage 4 is expected to be managed by the existing system.

As part of the detailed design for Stage 4, the following would be addressed:

- Establish the likely LFG generation from Stage 4 and assess if the existing LFG extraction system has the ability and capacity to manage the additional LFG expected to be generated from Stage 4
- If an upgraded LFG management system is required, then:
  - Design the LFG management system to ensure compliance with LFG hierarchy
  - The LFG design would include allowance for progressive installation
  - Provide details of ongoing monitoring required.

A typical landfill gas management system suitable for the landfill extension is shown in Figure 5-9 and would include:

- Gas extraction wells laid out evenly across the extension area, at typical spacing's of between 50 m and 100 m. The spacing will vary depending on the morphology of the landfill and efficiency of the gas extraction, cogeneration and treatment systems
- Well head stations connected to the extraction wells to collect the gas
- A ring main system connecting the well heads back to the cogeneration and treatment systems.

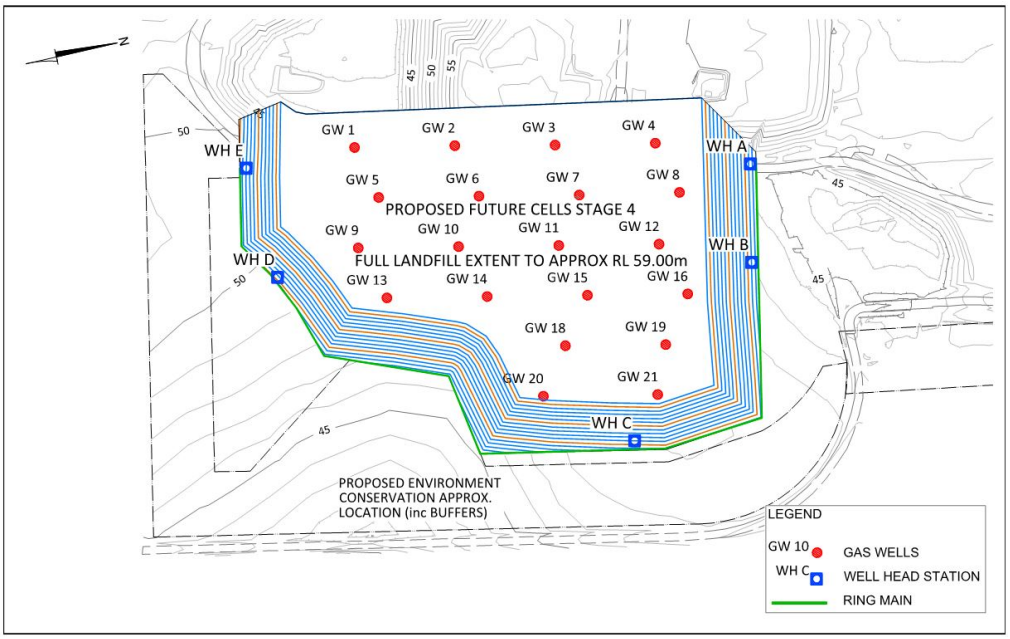


Figure 5-9 Typical landfill gas management system

It is essential to ensure that the extraction wells are fully sealed when installed to maintain the integrity of the capping system. A typical section through the sealing detail is shown in Figure 5-10.

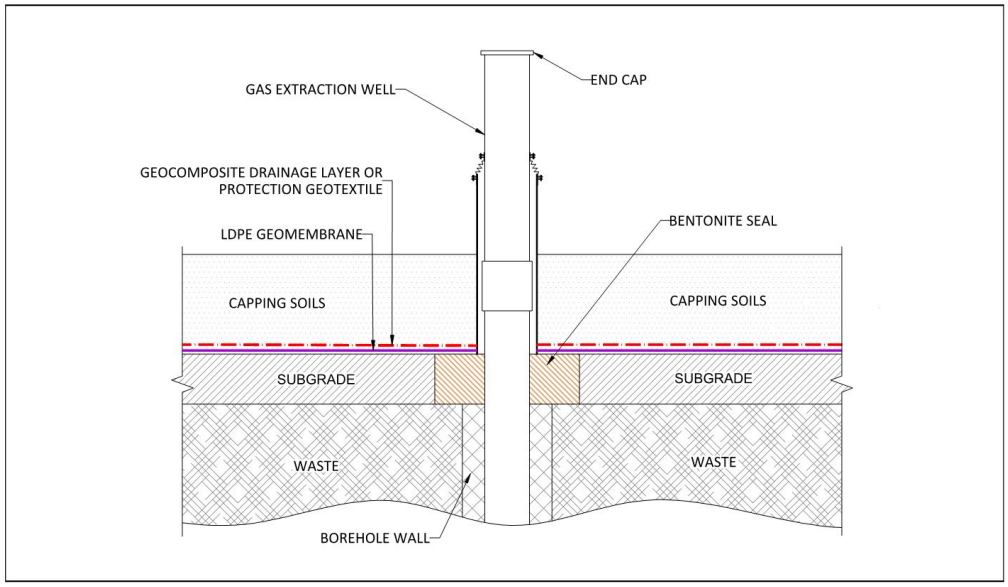


Figure 5-10 Typical section through extraction well sealing system

5.8 Landfill operations

As discussed in Section 2.4, the existing landfill at the WNRWF currently operates in accordance with the Landfill Environmental Management Plan prepared by SCC in 2008 (2008 LEMP) and EPL 5877, issued by the NSW EPA. SCC would apply for a variation to the conditions of EPL 5877 (should this Proposal be approved) to extend landfill operations to the Proposal Site.

SLR prepared a Landfill Environmental Management Plan (LEMP) for the Proposal in 2019 (SLR, 2019b) and this is included in Appendix L. The LEMP outlines site-specific instructions that ensure the operation of the Proposal would meet the necessary outcomes outlined in the Environmental Guidelines that relate to the siting, design and

construction, operation, monitoring and rehabilitation procedures of the landfill. The LEMP has been prepared by SLR to support the future application for an EPL variation to cover the Proposal, including the use of the existing leachate dam and the new proposed irrigation area over the Stage 2 landfill. The remainder of the WNRWF will continue to be managed in accordance with the 2008 LEMP.

The objectives of the LEMP relate to reducing the environmental impact of the landfill by controlling water discharge and emissions and ensuring compliance of the Proposal with the Environmental Guidelines.

The LEMP is a 'live' document and requires constant review and updating to ensure the effective environmental management of the Proposal.

5.8.1 Waste types and quantities

The Proposal would receive the same waste types as currently accepted at the WNRWF. In accordance with the requirements of EPL 5877, the *Waste Classification Guidelines* (NSW EPA, 2014) and SCC policies, the WNRWF is permitted to accept the waste types presented in Table 5-3.

Table 5-3 Permitted waste types for the WNRWF (from EPL 5877)

Waste	Description	Activity	Limits
General solid waste (putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land) Waste storage Composting Waste processing (non-thermal treatment)	No applicable limit
General solid waste (non-putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	No applicable limit
Asbestos waste	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	No applicable limit
Waste tyres	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	No applicable limit
Waste	Any waste received on site that is below licensing thresholds in Schedule 1 of the POEO Act, as in force from time to time	-	No applicable limit.

As outlined in the SEARs, the Proposal would involve progressively increasing the annual waste acceptance rate at the landfill from 65,000 t p.a in the year of opening (2026) to approximately 165,000 t p.a. by the year of closing (2044)if required.

Hazardous waste

The WNRWF is not licensed to accept hazardous waste[11].

Any hazardous waste substances produced by SCC operations are, and shall be managed according to the SCC Procedure for Hazardous Substances Control.

Asbestos waste

The WNRWF is licensed to accept asbestos waste. SCC has, however, opted to receive only household quantities of asbestos waste.

Liquid waste

The WNRWF is not licensed to accept any form of liquid waste.

Liquid Waste is defined in the Waste Classification Guidelines as waste that:

- Has an angle of response of less than five degrees above horizontal
- Becomes free-flowing at or below 60 °c or when it is transported
- Is generally not capable of being picked up by a spade or shovel
- Is classified as liquid waste under an EPA gazettal notice.

5.8.2 Waste control program

Waste delivered to the WNRWF will be inspected and screened at the entry weighbridge by SCC staff to prevent the disposal of unacceptable waste loads.

To facilitate the control of wastes accepted into the WNRWF, SCC has implemented the following management measures:

- Erection of signage at the WNRWF entrance that clearly indicates the types of wastes accepted, types of waste not accepted and fees
- Visual and CCTV inspection and screening of all incoming and outgoing waste at the entry weighbridge. All vehicles suspected of containing unacceptable waste would be refused entry until it is verified as being acceptable.
  - In the event that unacceptable waste is identified, the vehicle would be refused entry and redirected to an appropriate disposal facility.
- Inspection and screening of waste at active landfilling and stockpiling areas. All waste suspected of being unacceptable would be isolated and checked by SCC to its acceptability.

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[11] Hazardous waste is:

- Generally considered to be waste which, through toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, explosivity, chemical reactivity, corrosivity, infectiousness or other biologically damaging properties, may present danger to the life or health of living organisms when released into the environment (adapted from the definition of “Hazardous Waste” in Appendix B of the superseded EPA (1996) Landfill Guidelines); and/or
- Any waste that is classified as hazardous in accordance with the Waste Classification Guidelines

  - In the event unacceptable waste is identified in the landfilling / stockpiling area, SCC would immediately isolate and contain the waste away from the active tipping face / stockpile area. Details of the waste including type and source would be recorded by SCC staff. SCC would advise the driver that the waste is unacceptable and the waste would be loaded back onto the vehicle and escorted from the WNRWF.
- In the event unacceptable waste is identified during stockpiling or spreading and compaction of deposited waste, SCC would isolate and contain the waste away from the active disposal area. SCC would make all practical effort to identify the source of the waste.
- Incidents involving identification of unacceptable waste would be recorded in the daily operating log for the WNRWF and included in the Annual Returns for EPL 5877.

Refer to the LEMP (Appendix L) for further details of the management measures.

5.8.3 Waste recording and reporting

Waste recording

As with the current operation, all vehicles delivering waste to the WNRWF will have the time of entry and exit, vehicle registration, waste type and classification, vehicle type and a site destination recorded in the electronic waste tracking system. The gatehouse / weighbridge office will be manned at all times during operating hours to ensure that all vehicles entering and exiting the WNRWF are recorded.

Volumetric surveys

SCC will organise volumetric surveys of the WNRWF to be undertaken by a qualified surveyor at the periods/minimum frequencies specified by the EPA, currently:

- Landfilling areas: June and December every year
- Stockpile volumes: June and December, every year

The results of the volumetric survey will be used, in conjunction with the recorded tonnages of accepted waste, to calculate the compaction density that is being achieved and to allow SCC to keep track of the remaining landfill space available at the WNRWF.

The GPS based landfill grade system, currently mounted on the landfill compactor, provides a secondary volumetric survey, and ongoing measurement of landfill density and remaining capacity.

Annual return and waste reporting

The EPA waste contributions monthly report (WCMR) will be prepared using electronic waste tracking data recorded by the weighbridge attendant at the gatehouse.

SCC will prepare and submit an Annual Return in accordance with page four, page five and Condition R1 of EPL 5877.

5.8.4 Quality assurance

Design and construction

All design and construction work for the WNRWF will be completed by appropriately qualified and experienced staff and contractors in accordance with applicable Australian construction standards and industry best practice guidelines.

Operation

Operation of the WNRWF will be conducted in accordance with the WNRWF LEMP (Appendix L) and EPL 5877.

All environmental sampling and/or monitoring will be conducted by appropriately qualified SCC staff and/or environmental consultants.

Quality assurance auditing

Internal quality system audits will be conducted by SCC and external audits conducted as needed.

Any non-conformance in the quality system recognised by an internal or external audit will be addressed as soon as possible. Any non-conformances of the quality system in the construction or operation of the WNRWF will be amended by repairs to the construction and/or changes in operation.

5.8.5 Waste covering

Daily cover

At the end of each working day, all uncovered waste surfaces and the operational tipping face that have not reached the final landform levels will be covered with a minimum 150 mm thick layer of VENM or an alternative daily cover system including an automated tarp deployment system that was recently approved for use at the WNRWF by the EPA.

Implementation of the daily cover layer is not limited to the end of the working day. It can be placed over waste at any time, as needed for environmental management reasons (e.g. to reduce erosion, provide litter control, reduce the likelihood of vermin and minimise odours).

A two-week supply of VENM / excavated natural material (ENM) / inert solid waste / C&D materials are to be maintained and stockpiled next to uncovered waste.

Intermediate cover

Intermediate covering layers will be applied to any uncovered waste surface that hasn't reached final landform levels and will be unused for more than 90 days.

The intermediate covering layer will comprise VENM or an alternative material approved by the EPA, have a minimum thickness of 300 mm, a minimum slope of one percent to promote surface water runoff and inhibit rainfall infiltration rate into waste of no more than 20 % of total rainfall.

A two-week supply of VENM / excavated natural material (ENM) / inert solid waste / C&D materials are to be maintained and stockpiled next to uncovered waste.

The final capping arrangements are discussed in Section 5.9.2.

5.8.6 Customer service management and reporting

SCC will provide a customer service telephone contact number that will receive queries and feedback from customers and the general public. All correspondence received over the course of a reporting year will be reported to the EPA in the annual report to the EPA and when requested by the EPA. All correspondence records will be retained by SCC for at least four years from the date or receipt of feedback.

5.8.7 Environmental monitoring and environmental monitoring record keeping

In accordance with EPL 5877, environmental monitoring is to be conducted at the WNRWF for:

- Discharges to air
- Surface water quality
- Groundwater quality
- Leachate.

Environmental monitoring will be carried out by suitably qualified and experienced SCC personnel or environmental consultants. Monitoring records/reports will be kept by SCC for at least four years after the monitoring event and will be submitted to the EPA upon request and included in the annual return.

5.8.8 Reporting

Annual return

SCC would prepare an annual return for each required reporting period (that being the 12-month period ending 30 October each year), which would be submitted to the EPA no later than 60 days after the end of the reporting period.

A copy of the annual return would be retained by SCC for at least four years after the annual return us submitted to the EPA.

The annual return would include a certified “Statement of Compliance” and a signed Annual Report than contains a summary of environmental monitoring and incidences.

Annual report

The annual report would include the following information in relation to the reporting period:

- summary of total wastes received, composition and eventual fate (e.g. landfill, recycling market)
- qualified surveyors report of the volume of landfill space consumed, remaining landfill void space, and an estimate of the compaction density achieved over the period
- estimate of remaining landfill capacity
- assessment of any changes detected in the overflow drain water quality, surface water and groundwater monitoring results. Any notable changes in hydraulic gradient and/or variations in contaminant concentrations will be highlighted and potential models for the changes discussed
- report on landfill gas management to demonstrate achievement of the appropriate environmental objectives

- report on the performance of the leachate collection system
- details of any construction and/or rehabilitation works carried out
- recommendations on improving the environmental performance of the Proposal
- summary of environmental incidents that occurred at the Proposal
- record of correspondences received by SCC from the public, concerning the Proposal and their correlation with prevailing weather conditions and/or waste reception circumstances.

Incident reporting

Any incident on site that may lead to a breach of EPL conditions would be communicated to the EPA as soon as possible of SCC becoming aware of the incident.

Initial contact would be made via the EPA's environmental line service (telephone number: 131 555). Written notice is to be provided to the EPA within seven days of the incident.

Incidents would be recorded in the operator's daily log book, with sufficient detail to provide EPA with a written report of the incident, should such a report be requested. Incident reports typically would include (but may not necessarily be restricted to):

- The cause, time and duration of the incident
- The type, volume and concentration of every pollutant discharged as a result of the incident
- The name, address and business hours telephone number of employees of SCC or other witnesses
- Actions taken by the SCC in relation to the incident
- Details of any measure taken or proposed to be taken to prevent, or mitigate the likelihood for a recurrence of such an incident
- Any additional reporting obligations as required in the Pollution Incident Response Management Plan (PIRMP).

5.8.9 Water quality monitoring

Water quality monitoring for the Proposal will utilise, and build on, the existing monitoring program in place at the WNRWF. The water quality monitoring requirements for the Proposal are summarised below with full details provided in Section 8.4.4 and in the LEMP (Appendix L).

Groundwater and leachate monitoring

The purpose of undertaking groundwater and leachate monitoring is to:

- Chemically characterise the leachate in order to be able to identify potential leachate seepage/spillage
- Assess impacts (if any) of leachate from the WNRWF in local groundwater.

The existing landfill at WNRWF has a network of monitoring wells installed around the site to allow monitoring of groundwater quality and several leachate monitoring points.

Groundwater and leachate monitoring program

Groundwater and leachate monitoring at the Proposal would comprise:

- Quarterly and yearly field groundwater quality measurements, sampling and analysis of all groundwater monitoring wells for parameters and analytes
- Yearly field leachate quality measurements, sampling and analysis at LD1 (see Figure 8-15) and the leachate pump-house (see Figure 8-15) for parameters and analytes
- Monthly measurements of leachate volume at the pipeline and leachate pump-house using a flow meter and continuous logger results
- Groundwater quality measurements, sampling and analysis of all groundwater wells that will be established downgradient of the newly established irrigation area above/on the Stage 2 landfill area to monitor the effectiveness of the Stage 2 landfill liner.

SCC will be the responsible party for implementing the groundwater and leachate monitoring program.

Reporting

Groundwater parameters and analytical results shall be reviewed quarterly and compared yearly. The yearly comparisons would identify whether there has been any significant (or potentially significant) changes in parameters and analytes.

Additional reports may be required where contamination has been identified and corrective actions are taken.

All monitoring data, results and data evaluation results would be included in the annual report within the annual return.

Surface water monitoring and management

The primary purpose of undertaking surface water monitoring is to:

- Effectively monitor and report on surface water character
- Demonstrate that surface water has not been contaminated by the landfilling operations.

Surface water monitoring program

Surface water is to be monitored at six locations in and around the Proposal Site (EPL monitoring points three, five, six and seven and at SW1 and SW4 shown on Figure 8-15).

Surface water monitoring at the Proposal would comprise:

- Measuring pH and total suspended solids at EPA monitoring point three daily during any discharge
- Quarterly field water quality measurements, sampling and analysis for biochemical oxygen demand, conductivity, dissolved oxygen, nitrogen (ammonia), pH, potassium, total dissolved solids and total organic carbon at EPL monitoring points five, six and seven.
- Water quality measurements, sampling and analysis for biochemical oxygen demand, conductivity, dissolved oxygen, nitrogen (ammonia), pH, potassium, total dissolved solids and total organic carbon at monitoring points SW1 and SW4 after major rainfall events producing flows in the ephemeral drainage lines.

In addition, event-based monitoring is carried out by SCC at monitoring point two (First Flush Dam) although this is not currently a requirement of EPL number 5877. SCC would be the responsible party for implementing the surface water monitoring program.

Reporting

Surface water parameters and analytical results shall be reviewed quarterly and would identify whether there has been any significant (or potentially significant) changes in parameters and analytes.

Annual reports shall be submitted to EPA and additional reports may be required where contamination has been identified and corrective actions are taken.

Corrective actions

Should groundwater, surface water or leachate monitoring results indicate contamination of the groundwater and/or surface water may have occurred; the following steps are to be taken:

1. The affected monitoring wells/monitoring locations are to be sampled as soon as possible
2. If the contamination is confirmed from the sampling carried out, the EPA shall be notified in writing within 24 hours of the receipt of the laboratory results
3. SCC's Pollution Incident Response Management Plan (PIRMP) will be carried out.

5.8.10 Air quality monitoring

The primary purpose for undertaking air monitoring is to assess whether the following are occurring:

- If accumulation of landfill gas to dangerous levels is occurring within enclosed structures, within 250 m of landfilling and landfilled areas
- If any landfill gas emissions are detected above the landfill cover and capping layer areas
- If there are fugitive emissions from the landfill gas extraction/management system

Surface gas monitoring locations

Surface gas monitoring would occur every six months and is to be conducted:

- Inside all buildings within 250 m of deposited waste or leachate storage areas
- In a grid pattern at 25 m spacing across the surface of landfilled areas (areas to have cover and/or caps layers)
- Within depressions or surface fissures (where these are located away from grid sampling points)
- Of emissions from the landfill gas extraction system.

Performance indicators

Concentration of methane is the key indicator for potential hazards presented by landfill gas. SCC is the responsible party for implementing the air monitoring program.

Inside buildings the threshold for further investigation and corrective action is the detection of methane at concentrations above 1000 parts per million (ppm) or one percent volume/volume

The threshold for further investigations and corrective actions for surface gas emissions is the detection of methane at concentrations ≥ 500 ppm or ≥ 0.05 percent volume/volume

The gas flare shall satisfy the following operational requirements, based on the Environmental Guidelines:

- Gas residence time: >0.6 s
- Combustion temperature: > 760 ^{o}C
- Destruction efficiency: > 98 %

Emissions from the gas generator are not to exceed the following discharge limits (during dry weather and at standard atmospheric conditions):

- Hydrogen sulphide: five mg/m^3
- Nitrogen dioxide, nitric oxide, or both: 450 mg/m^3
- Sulfuric acid, sulphur trioxide, or both: 100 mg/m^3
- Volatile organic compounds (as n-propane): 40 mg/m^3

Reporting

Copies of air monitoring assessments, maintenance/performance logs for the landfill gas generator and gas flare and any landfill incidents are to be kept by SCC and included in the annual return.

Corrective actions

Where thresholds/discharge limits (Section 5.8.10 - performance indicators) are exceeded, SCC is to implement the following corrective actions:

Inside buildings:

1. Evacuate and isolate the affected locations and commence monitoring of affected locations
2. Notify the EPA within 24 hours
3. Implement the PIRMP

Surface gas emissions

1. Evacuate and isolate the immediate vicinity and conduct additional monitoring to locate the source of the surface gas emission
2. Set up an exclusion zone around the affected location
3. Commence monitoring of affected location, as required, and carry out the necessary corrective/remedial works
4. Continue monitoring of affected locations until methane gas surface levels are below the threshold concentrations

Landfill gas generator and gas flare emissions

Corrective actions involve identifying the issues with the landfill gas generator and/or gas, carrying out the required repairs/modifications and conducting additional air monitoring to ensure the repairs/modifications are adequate.

5.8.11 Fire prevention

With the exception of the gas flare, lighting of fire or incineration of waste is not permissible.

Performance indicators

Fire related incidences reported at the Proposal, or included in a written report, would serve as a performance indicator that site operations, with respect to fire prevention and fire control, are unsatisfactory and may require revision.

SCC would be the responsible party for implementing fire prevention management at the Proposal.

Reporting

All fire-related incidents would be recorded in detail including the date, time, location, inferred cause of the incident, time the incident was resolved, notification of authorities and whether any additional management measures are warranted to prevent and / or mitigate such incidents from occurring in future. This information would be recorded in the Operator's Daily Log Book.

Corrective actions

In the event of a fire occurring at the WNRWF, SCC would take prompt action to extinguish the fire if safe to do so as well as implementing the PIRMP.

5.8.12 Odour management

SCC must not cause or permit the emission of any offensive odour from the Proposal.

Measures to manage dust will include but not be limited to:

- Not disposing waste in standing water
- Covering all exposed waste at the end of each working day with daily cover material
- Minimising disturbance to previously landfilled areas

Performance indicators

Odour complaints received by SCC would act as performance indicators of odour control. These will be recorded in the customer relationship management system.

SCC would be the responsible party for the customer relationship management system.

Monitoring schedule

Site staff shall continuously monitor for odours on site and notify their supervisor or site manager when noticeably strong and persistent odours occur.

Reporting

A record of complaints regarding odours would be kept in SCC's customer relationship management system and reported to the EPA as required in the annual return and annual report.

Corrective actions

If odours detected and complaints received, the source of the odour would be identified and remediated until the odour nuisance is rectified.

5.8.13 Dust management

SCC shall ensure that operations and activities occurring at the Proposal are carried out in a manner that would minimise the emission of dust from the premises.

Measures to manage dust will include but not be limited to:

- Minimising dust-generating work during excessively windy periods
- Use of a site water cart, or dust suppressant chemicals or surfactant wetting agents as required
- Ensuring plant and equipment are fitted with appropriate pollution control devices

Performance indicators

Complaints from nearby residents, customers and visitors relating to dust would act as a performance indicator. SCC is the responsible party for minimising the impact of dust.

Monitoring schedule

Site staff shall continuously monitor for dust emissions from site and notify their supervisor or the site manager when noticeably large amounts of dust are being generated and/or are migrating off-site.

Reporting

A record of complaints relating to dust emissions will be kept in SCC's customer service management and reporting system and reported to the NSW EPA as required in the annual return and annual report.

Corrective actions

Should dust become a significant issue for the site, dust generating activities will be reviewed and, where possible, revised to alternative methods that generate less dust. The water cart is to be utilised more frequently for the wetting down of affected areas and to maintain vegetation cover over revegetated areas.

5.8.14 Noise management

SCC shall ensure that all operations and activities occurring at the Proposal are carried out in a manner that would minimise noise emissions.

Measures to manage noise would include but not be limited to:

- Avoiding use of plant, machinery and equipment with tonal movement alarms, where possible
- Ensuring noise reducing guards are installed and maintained on plant and machinery
- Carrying out of noisy/potentially noisy works away from nearby residential areas.

Performance indicators

Performance indicators for noise are the number of noise complaints received by SCC and the following:

- Noise emanating from the site shall not exceed the limits set out in the EPA (2000) *NSW Industrial Noise Policy* for daytime and night time noise, when measured at any point within one metre of any residential boundary

  - daytime is considered as from 7:00 am to 10:00 pm Monday to Saturday, and from 8:00 am to 10:00 pm Sunday and Public Holidays;
  - night time is considered as from 10:00 pm to 7:00 am Monday to Saturday, and from 10:00 pm to 8:00 am Sunday and Public Holidays
- Noise emanating from the site shall not exceed the limits set out in the EPA (2000) *NSW Industrial Noise Policy,* when measured at any point within one metre of any boundary of the WNRWF

SCC is the responsible party for noise management at the Proposal.

Monitoring schedule

Monitoring of maximum and background noise is as required by the operating conditions.

Reporting

A record of complaints relating to noise would be kept in SCC's customer service management and reporting system and report to EPA as required in the annual return and annual report.

Corrective actions

Should noise impacts be identified as a nuisance, a number of management strategies may be applied and these include but aren't limited to:

- noisy machinery be substituted with smaller or quieter alternative (if practicable) or operate shorter working hours
- noisy machinery be modified with noise-reducing parts (e.g. silencers)
- screening bunds be constructed between working areas and sensitive receptors.

5.8.15 Litter management

Litter would be managed by the following actions that include but aren't limited to:

- Establishing and maintaining vegetative litter screens around strategic locations within the Proposal
- Covering of loads entering the site and during transit within the Proposal
- Prompt, efficient placement, continuous compaction and covering of waste when unloading.

Performance indicators

The amount of litter retrieved by litter patrols and the number of litter complaints by SCC would act as a performance indicator.

SCC would be the responsible party for litter management at the WNRWF.

Monitoring schedule

Litter fencing, stormwater drains and nearby areas will be monitored regularly and on an as needs basis for the accumulation of litter. Litter would be removed regularly and damage to litter fencing will be repaired as soon as possible.

Reporting

Litter patrols, accumulations of litter and repair/maintenance needs would be included in the daily activities register on days that inspections are conducted.

A record of complaints regarding litter would be kept in SCC's customer relationship management system and reported to the EPA as required in the annual return and annual report.

Corrective actions

Litter control measures would be continually reviewed by SCC to provide maximum effort towards preventing degradation to the local area.

5.8.16 Pest, environmental weed and noxious weed management

Measures to manage pests and weeds include but are not limited to:

- Undertaking regular inspections for pests, vermin and noxious weeds and development of a control plan if required
- Regularly conducting weed-spraying around the site. Care must be taken to ensure that pesticides do not enter stormwater or leachate or pose an airborne pollution hazard or nuisance
- Use of traps and/or baits to deter and/or control vermin, as well as engaging professional pest and weed control subcontractors, if required.

Performance indicators

An observable increase or decrease in rodent, pest, noxious weed growth, usage of pesticides/herbicides or bird populations is an effective performance indicator.

SCC would be the responsible party for ensuring adequate pest control is maintained at the Proposal.

Monitoring schedule

Regular pest and weed observation checks and control programs will be noted in the site log.

Rodent traps could be set in areas where there is an increased likelihood of rodent activity. Traps would be checked regularly to determine the number of pests found at the Proposal.

Areas where weed spraying has been undertaken should be monitored for die back or re-growth.

Reporting

Records are required to detail the type of number of pests found. Any requirements for further pest control should also be recorded.

Corrective actions

The performance of pest and weed control measures, procedures and plans shall be continually reviewed by SCC and any deficiencies addressed and improvements implemented on an on-going basis.

Should pests and/or weeds become problematic at the Proposal, SCC would arrange for a pest and/or weed control plan to be developed.

5.8.17 Pollution incident response management plan

A PIRMP has been prepared by SCC[12] in accordance with the requirements of the Protection of the Environment Operations Act 1997 (POEO Act) for holders of an EPL.

It is understood that the LEMP and PIRMP are to be implemented in parallel by SCC at the Proposal.

5.9 Site closure and rehabilitation

The strategy for closure and rehabilitation of the Proposal comprise the following works:

- Final capping works
- Installation of infrastructure (e.g. landfill gas management systems) and subsequent post-closure management
- Monitoring.

The strategy is outlined in Table 5-4.

Table 5-4 Closure Rehabilitation Strategy

Closure and rehabilitation stage	Components
Stage 4 Closure and rehabilitation works	• Monitoring of surface water, groundwater and leachate • Operation and maintenance of surface water and erosion controls; • Monitoring of landfill gas, odour, dust, noise, litter and pests; • Incident recording and reporting procedures (including Customer Relationship Management System); • Waste emplacement including progressive installation of final capping over Stage 4 to the EPA-approved final landform; • Final stage of installation of landfill gas management system; and • Revegetation works.
Post-closure management and monitoring	• Monitoring of surface water, groundwater and leachate; • Operation and maintenance of surface water and erosion controls; • Incident recording and reporting procedures (including Customer Relationship Management System); and • Monitor integrity of final capping and implement any remediation measures as necessary. • Monitoring of landfill gas system.

5.9.1 Final landform

[12] SCC (2015c) *Pollution Incident Response Management Plan West Nowra Recycling and Waste Facility*, dated February 2015.

The Stage 4 landfill final landform concept has been designed to complement Stage 3 and facilitate draining of surface water in an easterly direction to discharge to the existing ephemeral watercourse.

The Stage 4 final landform will include:

- Side batter slopes with gradients no greater than 33.3 % (1V:3H)
- An easterly longitudinal fall of one percent
- A maximum height of RL 59 m at the western boundary (equivalent to the maximum height of the existing landfill).

5.9.2 Final capping

Landfill cells that have achieved the approved height are to be capped with a final capping layer within six months after the final delivery of waste to the cell.

As the Proposal is expected to receive waste up to approximately 2034-2044, a detailed design for the final capping layer based on current standards, methodologies and technologies may not represent an optimal final capping layer solution for the Proposal at the time of its final closure.

To allow SCC to take advantage of future innovations and technology in landfill capping designs and materials, it is recommended that the general capping design (described below) be reviewed and alternative designs (where appropriate) developed. Approval from the EPA would be obtained and the LEMP (Appendix L) and Landfill Rehabilitation and Closure Plan (Appendix P) revised to include the approved detailed design for the final capping layer, no later than six months prior to the expected completion date of each sub-cell stage of the Proposal.

Objectives

The design of the final cap would prevent groundwater pollution and degradation of air quality, and be capable of protecting the environment in the event of several components of the system failing.

The final capping layer shall achieve the following requirements and objectives:

- Isolate the deposited waste from the immediate environment
- Reduce rainwater/stormwater infiltration into the waste (total annual rainwater infiltration shall be less than five percent of the annual rainfall), thereby minimising the generation of leachate
- Stabilise the surface of the landfill cell
- Reduce sediment and contaminated water runoff (compared to pre-capping levels)
- Minimise the egress of untreated landfill gas, reduce surface emissions of landfill gas and assist in odour management
- Minimise odour emissions, dust, litter, presence of scavengers and vermin and risk of fire
- Prepare the site for its future use, including protecting people, fauna and flora on, or near, the site from exposure to pollutants still contained in, or escaping, the landfill.

Design

Development of the capping system is in accordance with the Environmental Guidelines and is supported by best practice considerations.

As Stage 4 is expected to receive waste at least up to 2034, it is acknowledged that a detailed design for the final capping layer based on standards, methodologies and technologies current at the time of writing may not represent an optimal final capping layer solution for Stage 4 at the time of its final closure.

Current capping requirements at the WNRWF under EPL Number 5877 comprise:

- 300 mm thick gas drainage layer
- 500 mm thick clay sealing layer
- 300 mm thick infiltration drainage layer
- 100 mm thick revegetation layer.

The recommended system for Stage 4 would comprise the following as a minimum (from bottom to top):

- A seal bearing surface 300 mm thick to provide a firm, stable, smooth surface of high bearing strength on which to install the cap. Engineered fill would be used.
- A sealing layer comprising:
  - a compacted clay layer at least 600 mm thick, with an in-situ saturated hydraulic conductivity of less than $1x10^{-9}$ m/s or as an alternative, a 2mm low density polyethylene flexible membrane (i.e. LDPE) or approved alternatives and
  - a geosynthetic clay liner (GCL);
- A 1,000 mm revegetation layer, the top 200 mm of which should be topsoil (and may include compost to support vegetation growth).

A typical section through the capping layer is shown in Figure 5-11.

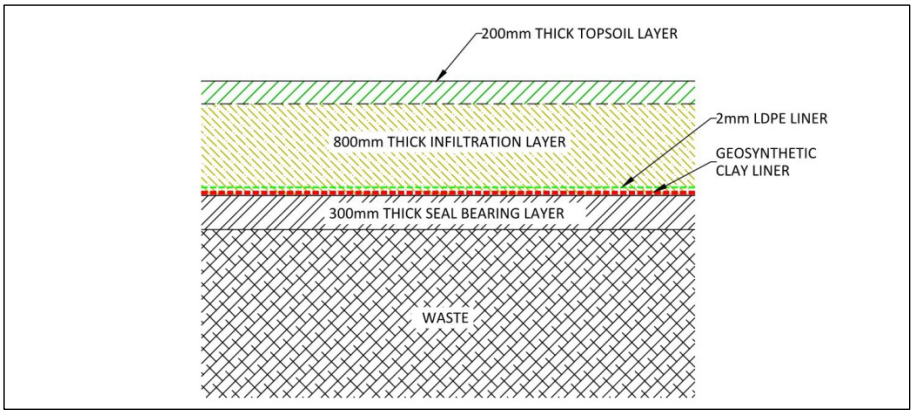

Figure 5-11 Typical capping and rehabilitation detail

In order to allow SCC to take advantage of future innovations and technology in landfill cap designs and materials, it is recommended that this general capping design be reviewed, alternative designs (where appropriate) developed, approval from the EPA obtained and this Landfill Closure and Rehabilitation Plan (LCRP) revised to include the updated and approved final capping designs. Final capping designs should be approved no later than six months prior to the scheduled date of cessation of waste deliveries to Stage 4.

Alternative landfill caps are also options that would be considered, such as evapotranspiration caps (also referred to as 'ET caps') or phytocaps would be assessed, as well as the conventional geomembrane capping system. The final design of the capping system would be based on the outcomes from the hydrogeological, stability and landfill gas risk assessments for the site, and addressed as part of the Landfill Closure and Rehabilitation Plan (discussed in Section 5.9.6).

Stabilisation

While the detailed design of the final capping is still to be prepared, it is nonetheless anticipated that the final capping for the Proposal would be stabilised with vegetation.

Vegetation on the Proposal Site shall achieve the following requirements:

- Provide effective protection against erosion for the final capping layer
- Allow effective monitoring and maintenance of the capping layer
- Comprise vegetation types that will not present a risk to the integrity of the capping layer.

Primary vegetation for the revegetation layer will comprise a combination of annual and perennial native grasses, planted within an erosion-resistant and moisture-retaining mulch matrix. It is recommended that the seed be dispersed by hand broadcasting (or alternatively, by hydro-seeding with a blend of seed, fertiliser and paper or wood pulp), with mulch laid on top of the seeded areas.

Secondary vegetation will comprise shrubs and potentially small trees. To avoid damage to, or interference with the integrity of the sealing layer, shrub and tree species selected for secondary vegetation are to have root systems which do not extend deeper than the revegetation layer.

5.9.3 Post-closure management

Post closure management of the Proposal would involve maintenance and repair of the final landform and final capping and environmental monitoring until such time that the landfilled waste in Stage 4 is demonstrated to be stable and non-polluting.

Maintenance and repair

SCC would take all required measures to maintain the integrity of the final landform and capping for the Proposal including:

- Monitoring the condition and efficacy of sediment erosion control measure and sediment dams, and undertaking repairs where necessary
- Replacement of vegetation, where necessary, to maintain the required vegetation cover density
- Filling any cracks that may occur in the final capping layer
- Filling of depressions created by settlement of the landfilled waste (to avoid ponding of surface water)
- Repairing erosion scours

Environmental monitoring and reporting

Environmental monitoring comprises individual monitoring programs for:

- Discharges to air
- Surface water quality
- Groundwater quality
- Leachate

These monitoring programs, have been developed to comply with the environmental monitoring requirements of EPL 5877, include programmed monitoring rounds and event-based sampling. Details of the environmental monitoring programs for the Proposal are provided in the LEMP (Appendix L).

These monitoring programs are to be continued during the closure and post-closure of the Proposal. Any variations to the monitoring programs are to be approved by the EPA.

Throughout the post-closure monitoring period, SCC is to continue reporting and managing environmental incidences as per the LEMP (Appendix L) and the Pollution Incident Response Management Plan (PIRMP) attached as Appendix B to the Landfill Closure and Rehabilitation Plan (Appendix P). SCC will continue to prepare and submit an Annual Return in accordance with EPL 5877 throughout the post-closure monitoring period.

Cessation of Post-closure management and monitoring

Environmental management and monitoring of the Proposal will continue to be undertaken by SCC until it has been demonstrated the waste is stable and non-polluting. Such an end-point shall be demonstrated by SCC submitting a certified statement of completion for approval by EPA, which shows the following criteria as having been met:

- Gas concentration levels in all perimeter gas wells have fallen to less than one percent methane (v/v) and less than 1.5 % carbon dioxide for a period of 24 months
- Analysis of the leachate composition indicates low levels of contamination posing no hazard to the environment and surface water and groundwater monitoring indicates no water pollution. These matters should be addressed in accordance with published water quality guidelines that are relevant at that time
- The landfill final capping has been assessed over some years and found to be in good condition and stable with acceptable stormwater drainage and with no evidence of erosion, cracking, dead vegetation, water ponding, and differential settlement of slope instability
- The level of sediments in stormwater run-off from the final capping shall be less than 50 mg/L
- The methane gas concentrations at the surface of the final capping shall not exceed 500 ppm at any point
- The closed landfill no longer poses an adverse amenity risk. It does not generate offensive or excessive odour, dust, noise, litter or debris, present a fire risk, or attract scavengers and vermin
- All other requirements of the Landfill Closure and Rehabilitation Plan (Appendix P) and Surrender Notice have been completed and/or satisfied.

5.9.4 Post-closure schedule

Detailed design of the Proposal are yet to be prepared, and as such, there is currently insufficient information to provide a detailed closure schedule. A broad closure plan based on current information is presented in Table 5-5. However, it is anticipated that the closure plan will be revised and refined over time and as additional information becomes available.

Table 5-5 Proposal Closure Plan

Item	Description	Estimated duration	Estimated completion timing*
1	Construct sediment dams	1 month	2026

Item	Description	Estimated duration	Estimated completion timing*
2	Landfilling of Proposal sub-cell stages. Apply intermediate cover over completed sub-cell stages	264 months	2034
3	Progressive installation of LFG extraction wells and associated LFG management infrastructure in completed Stage 4 sub-cell stages	264 months	2040
4	Progressive installation / construction of surface water and erosion controls	264 months	2040
5	Design and approve final capping	6 months	2039
6	Construction of final capping	6** months	2040
7	Environmental monitoring	On-going	Until no longer required
8	Maintenance of final cap, final landform and environmental management controls	On-going	Until no longer required

* Based on the worst case scenario adopted in the EIS which involves the landfill opening in 2026 and closing in 2034

** Construction of final capping may be carried out as a single phase of work, or carried out in a staged approach (e.g. final capping constructed over completed sub-cell stages while landfilling is still occurring in active sub-cell stages)

5.9.5 Post closure uses

Post closure uses for the Proposal currently being considered by SCC include, but are not limited to:

- Passive recreation
- Green waste processing facility
- Other approved activities

SCC will continue to review and assess a variety of post-closure uses for the Proposal.

5.9.6 Post closure management

Landfill closure plan

SCC will prepare and submit to the EPA a Landfill Closure Plan (LCP) no later than 12 months before the last load of waste is expected to be landfilled at the Proposal.

Post-closure management

After cessation of landfilling operations at the Proposal, SCC will conduct regular monitoring on the environmental performance of the Proposal as conditioned by the EPA and carry out maintenance actions are required.

SCC will continue maintenance and repairs of the final landforms until it has demonstrated to have been stabilised and non-polluting. This will be demonstrated by SCC submitting a certified statement of completion for approval by EPA showing established criteria has been met.

The LEMP provides detailed provisions relating to maintenance works that SCC will need to undertake and the criteria that SCC need to meet prior to submitting a certified statement of completion for approval by EPA.

5.10 Capital investment value

The capital investment value (CIV) for the Proposal, consistent with the definition provided in the EP&A Regulations is approximately $19 million (M) Australian Dollars (AUD) (refer to the Quantity Surveyor's Report prepared by Aquenta Consulting) (Appendix M).

6 STATUTORY PLANNING AND APPROVALS

This section provides an overview of the relevant legislation and planning instruments applicable to the Proposal and includes a description of the planning approval pathway for the Proposal.

6.1 Commonwealth legislation

6.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places and control certain actions as defined in the EPBC Act as Matters of National Environmental Significance (MNES). The MNES that are protected under the EPBC Act are:

- World heritage properties
- National heritage places
- Wetlands of international importance
- Listed threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef National Park
- Nuclear actions (including uranium mines)
- An action on Commonwealth land which is likely to have a significant impact on the environment
- Coal seam gas activities that pose risk to water resources.

In accordance with Section 67 and 67A of the EPBC Act, any works that have the potential to result in an impact on any MNES are considered ‘controlled actions’ and would require a referral to the Federal Minister for the Environment for approval.

A search of the EPBC Protected Matters Search tool was undertaken on 19 June 2017 for the site and a surrounding 10 km buffer. An overview of findings is presented in Table 6-1.

Table 6-1 EPBC Protected Matters Summary

Matters of National Environmental Significance	Assessment
Wetlands of International Importance (RAMSAR)	No wetlands of international importance are located within the Proposal Site.
World Heritage Properties	No World Heritage Properties are located within the vicinity of the Proposal Site.
National Heritage Places	No National Heritage Places are located within the vicinity of the Proposal Site.
Commonwealth Marine Areas	No Commonwealth Marine areas are located within the vicinity of the Proposal Site.

Matters of National Environmental Significance	Assessment
Listed Ecological Communities	Six listed threatened ecological communities are likely to occur within 10 km of the Proposal Site, however the Biodiversity Assessment undertaken confirmed that these communities are not present on the Proposal Site and would not be impacted by the Proposal. The Biodiversity assessment is summarised in Section 8.2.
Listed Threatened Species and Listed Migratory Species	109 threatened species and 85 migratory species were identified in the search as potentially occurring or with potential habitat within 10 km of the Proposal Site. The Biodiversity Assessment of the Proposal Site concluded that the Proposal would not result in a significant impact on EPBC listed threatened or migratory species. Further detail is provided in the Biodiversity assessment in Section 8.2.
Commonwealth Land	There is no Commonwealth land within the Proposal Site.

As the Proposal, would not have a significant impact on any MNES, referral to the Federal Minister for the Environment for approval under the EPBC Act is not required.

6.2 NSW legislation

6.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulations) provide the framework for the assessment of the environmental impact of proposed development in NSW.

The objectives of the EP&A Act include:

> *(a) the encouragement of:*
>
> *i) the proper management, development, and conservation of natural and artificial resources…*
>
> *ii) the promotion and coordination of the orderly and economic use and development of land…*
>
> *vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;*
>
> *vii) ecologically sustainable development…*
>
> *(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

Part 3 of the EP&A Act provides for the formation of Environmental Planning Instruments (EPIs), which can take the form of Local Environmental Plans (LEPs) or State Environmental Planning Policies (SEPPs). EPIs contain provisions that control the permissibility of development and identify when development approval is required. EPIs that are applicable to the Proposal are:

- *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP)

- *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP)
- *State Environmental Planning Policy No. 33 - Hazardous and Offensive Development* (SEPP 33)
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44)
- *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55)
- *State Environmental Planning Policy No.64 – Advertising and Signage* (SEPP 64)
- *Shoalhaven Local Environment Plan 2011* (Shoalhaven LEP).

Part 4 of the EP&A Act establishes the classification of development as permissible without consent, permissible with consent and prohibited, and the requirements for assessment of development that is permissible with consent. The permissibility and the planning assessment process for the Proposal are determined by the EPIs applicable to the Proposal Site. These are discussed in more detail in Section 6.3 and 6.4.

Within Part 4 of the EP&A Act there are a number of potential approval pathways for development that requires consent. These include:

- Development that requires development consent (and a DA) under an EPI; or
- Development that requires development consent (and a DA), however is of a nature that is considered 'designated development' under section 80 of the EP&A Act. Development that is 'designated development' is identified under Schedule 3 of the EP&A Regulations; or
- Development that requires development consent (and a DA) however is of a nature that is considered SSD under Part 4, Division 4.1 of the EP&A Act. Development that is SSD is identified under the *State Environmental Planning Policy (State and Regional Development) 2011.*

The Proposal is considered 'State Significant Development (SSD) under Clause 23 (Waste and Resource Management Facilities) of Schedule 1 of the State and Regional Development SEPP (refer to 6.3.1). In accordance with Section 89E of the EP&A Act, the Minister for Planning is the consent authority for SSD. As such the NSW Minister for Planning is the consent authority for the Proposal and a development application is required to be lodged with the DPE and, pursuant to Clause 8A of Section 78A of the EP&A Act, accompanied by an EIS.

6.2.2 Environmental Planning and Assessment Regulation 2000

Clauses 6 and 7 of Schedule 2 of the EP&A Regulations prescribe the form and content requirements for environmental impact statements. The SEARs specify that the EIS must meet these requirements. This EIS has been prepared pursuant to these requirements, as detailed in Section 1.5 and the Statement of Validity.

6.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (POEO Act) is the key piece of environmental protection legislation administered by the Environment Protection Authority (EPA). The principle objectives of the POEO Act are to:

- Protect, restore and enhance the quality of the environment, while having regard to the principles of ecologically sustainable development (ESD)
- Provide increased opportunities for public involvement and participation in environment protection

- Reduce risks to human health and prevent the degradation of the environment
- Assist in the achievement of the objectives of the WARR Act.

Environmental Protection Licences

Under the POEO Act, activities that will or are likely to cause pollution are identified as scheduled activities and require an EPL, which are issued and administered by the NSW EPA. These activities are set out in Schedule 1.

Scheduled activities which apply to the Proposal are outlined in Table 6-2 with the relevant EPL triggers for each activity. It is evident that the Proposal would trigger an EPL requirement waste processing (non-thermal treatment), waste processing (application to land) and waste storage. The current EPL for the WNRWF already includes these activities, however a variation would be sought to amend the existing EPL boundary to include the Proposal Site and associated landfilling activities.

Table 6-2 Applicable scheduled activities under the POEO Act

Clause	Activity type	Description	Relevant criteria
Clause 39	Waste disposal (application to land)	The application to land of waste received from off site.	The Proposal is located within a regulated area as defined in the POEO Act. The criteria triggered by the Proposal for waste disposal (application to land) is therefore the receiving of waste from offsite including but not limited to any of the following methods: • spraying, spreading or depositing on the land • ploughing, injecting or mixing into the land • filling, raising, reclaiming or contouring the land.
Clause 42	Waste storage	The receiving from off site and storing (including storage for transfer) of waste.	The Proposal Site is located within a regulated area as defined in the POEO Act. The criteria triggered by the Proposal for waste storage is therefore: • Has on site at any time more than 1,000 t or 1,000 m^3 of waste, or, receives more than 6,000 t of waste per year.

A search of the NSW EPA POEO Act public register for Mundamia, NSW was undertaken in March 2017 by SLR. This search returned 18 results of which, one of the results related to a (then pending, now issued) POEO EPL for SCC for 114 Flat Rock Road. The remaining 17 results referred to the issuing of the existing WNRWF Landfill POEO EPL and subsequent variations.

Environment protection offences

The POEO Act establishes a range of pollution offences and penalties that are applicable to all activities undertaken on a site. Specific pollution offences are created for actions associated with:

- Water pollution

- Air pollution
- Noise pollution
- Land pollution
- Littering and waste.

The POEO Act also establishes a number of regulations that provide further details on the management of pollution. Those that are applicable to the Proposal are discussed briefly below.

Construction and operation of the Proposal would be undertaken in a manner that achieves compliance with the requirements of the POEO Act and its regulations. Procedures to prevent pollution during construction and operation are detailed in the LEMP (SLR, 2019b) (Appendix L).

The existing Pollution Incident Response Management Plans (PIRMP) for the WNRWF would be extended to include the Proposal, and would be updated to include construction and operation of the Proposal in accordance with the requirements of Part 5.7A of the POEO Act and the *Protection of the Environment Operations (General) Regulation 2009*.

6.2.4 Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment (Waste) Regulation* 2014 (POEO (Waste) Regulation), came into effect on 1 November 2014. The POEO (Waste) Regulation introduced a number of changes to the regulatory environment for waste management in NSW.

The new regulations have reduced the volumes of waste that may be handled at resource recovery facilities and waste storage facilities without an EPL on a daily basis to 1,000 t per day and on an annual basis to 6,000 t per annum (within the regulated area), respectively. The volumes of waste handled on the Proposal Site would exceed these licensing thresholds and therefore operation of the site would need to be undertaken in accordance with an EPL issued by the EPA.

The WNRWF is currently subject to EPL 5877. SCC shall seek to vary the existing EPL to amend the boundary and to support the additional operations of the Proposal.

The POEO (Waste) Regulation also prescribes the requirements for recording information relating to:

- The delivery of waste or other material at scheduled waste facilities
- Loads of waste or other material transported from the WNRWF for use, recovery, recycling, processing or disposal at another appropriately licenced facility
- Other vehicles entering the WNRWF for a purpose related to the operation of the WNRWF.

The Proposal would meet the requirements of record-keeping and reporting under the POEO (Waste) Regulation.

6.2.5 Contaminated Land Management Act 1997

The general intention of the *Contaminated Land Management Act 1997* (CLM Act) is to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation.

Section 5 of the CLM Act defines ‘contamination’ of land as meaning:

the presence in, on or under the land of a substance at a concentration above the concentration at which the substance is normally present in, on or under (respectively)

land in the same locality, being a presence that presents a risk of harm to human health or any other aspect of the environment.

SLR prepared a soil, water and leachate impact assessment for the Proposal (Appendix N). An investigation into historical land titles and historical aerial photographs was undertaken by SLR and this indicated that no potential land contaminating activities have been undertaken on the Proposal Site. The WNRWF Annual Environmental Monitoring Report October 2014-15 (ENRS, 2015) concluded that there is unlikely to be any significant off-site impacts from existing operations of the WNRWF.

A search of the NSW EPA contaminated land public register of records of notices (under Section 58 of the CLM Act 1997) on 8 September 2016 by SLR found no records of notices within the SCC LGA,

A search of the NSW EPA public register of contaminated sites under section 60 of the CLM Act identified the closest contaminated site to be a service station that is four kilometres east of the Proposal Site. Refer to Appendix N for a copy of search records.

The potential for unexpected finds of contaminated materials, and related management processes, is discussed in Section 8.4.

6.2.6 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to identify and conserve items of local and state historical significance. This can be in relation to a building, work, relic, moveable object or precinct, and significant in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the place or item. The Heritage Act informs the State Heritage Register which lists places and items of particular importance to the state. Items are added to the State Heritage Register on the recommendation of the Heritage Council.

Under the Heritage Act and the EP&A Act it is illegal to cause harm to items identified on the State Heritage Register or to disturb or excavate land where the disturbance or excavation would or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed without the approval of the NSW Heritage Council.

An investigation of publicly available local, state and national heritage databases (including the Shoalhaven LEP, OEH State Heritage Register and EPBC Protected Matters Search Tool), revealed that no items of local, state, or national heritage significance are located on the Proposal Site.

Details of the potential heritage impacts and mitigation strategies are outlined in Section 8.8.

6.2.7 National Parks and Wildlife Act 1974

The objectives of the *National Parks and Wildlife Act 1974* (NP&W Act) are to conserve nature, objects, places or features of cultural value within the landscape including but not limited to:

- Places, objects and features of significance to Aboriginal people
- Places of social value to the people of NSW
- Places of historic, architectural or scientific significance.

The NP&W Act also aims to foster public appreciation of nature and cultural heritage and provide for management of land reserved under the NP&W Act. Areas protected by the NP&W Act are managed by the National Parks and Wildlife Service to conserve the area.

Under Section 85 of the NP&W Act, the Chief Executive of the OEH has the authority for the protection of Aboriginal objects and Aboriginal places in NSW. Under the NP&W Act it is illegal to impact or cause the destruction of Aboriginal objects, including for the purposes of investigations, without an Aboriginal Heritage Impact Permit (Section 90, NP&W Act and Section 89J EP&A Act).

An Aboriginal heritage impact assessment was undertaken by Artefact in 2014 (Appendix O) for the former RRP site, within the Proposal Site, and an Addendum Aboriginal Archaeological Survey Report was undertaken by Artefact in 2017 (Appendix H) for the additional areas within the Proposal Site not surveyed in the 2014 report. Both reports found no Aboriginal objects or areas of archaeological potential and concluded that the Proposal Site had very low archaeological potential and low archaeological significance. These findings are documented in Section 8.8.1.

6.2.8 Rural Fires Act 1997

The objectives of the *Rural Fires Act 1997* are to provide for:

- The prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fires districts
- Coordination of bush firefighting and bush fire prevention throughout the State
- Protection of persons from injury or death and property from damage arising from fires
- Protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires
- The protection of the environment by requiring the above-listed activities to be carried out having regard to the principles of ESD.

Section 63 of the Rural Fires Act places a ‘duty of care’ on all land owners to prevent a fire spreading on or from their land. This duty is applicable to the Proposal Site as it places an onus on SCC to provide and maintain appropriate setbacks and/or landscaping around the Proposal Site to minimise the potential bushfire risk. A 10 m fire trail will surround the southern and eastern boundary of the Proposal, a 20 m fire trail will extend to the northern boundary of the Proposal between the existing site office, staff amenity and plant and equipment buildings and a further six metre fire trail will extend east of the site office to Flatrock Road (refer to Figure 5-1) to surround the Proposal Site to minimise the potential bushfire risk to surrounding sensitive receivers.

A bushfire assessment has been undertaken to determine compliance of the Proposal with Planning for Bushfire Protection (NSW RFS, 2006). The assessment concluded that whilst the Proposal Site does have a high bushfire hazard rating, with the implementation of appropriate mitigation measures the Proposal would comply with the required legislative requirements. A summary of the assessment and the associated mitigation measures that would be adopted on the site is provided in Section 8.10 and Appendix J.

6.2.9 Threatened Species Conservation Act 1995 (repealed)

The TSC Act was repealed on the 25 August 2017 however the provisions of this Act would still apply to the Proposal (see Section 6.2.10).

The *Threatened Species Conservation Act 1995* (TSC Act) sets out provisions for planning and assessment of impacts on threatened species, populations and ecological communities listed under schedules 1, 1A and 2 of the TSC Act. The purpose of the TSC Act is to:

- Conserve biological diversity and promote ESD
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities
- Protect the critical habitat of those species, populations and ecological communities that are endangered
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities
- Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed
- Encourage the conservation of threatened species, populations and ecological communities through co-operative management.

The TSC Act lists a number of factors to be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. Schedules 1 and 2 of the TSC Act lists species, populations or ecological communities of native flora and fauna considered to be threatened in NSW. DAs and environmental assessments which need consent are required to be assessed with regard to the purpose of the TSC Act and consideration given to the significance of any impact on listed species.

A Biodiversity Assessment has been undertaken, and the results are summarised in Section 8.2.

6.2.10 Biodiversity Conservation Act 2016

On 25 August 2017, the *Biodiversity Conservation Act 2016* (BC Act) came into force, repealing the TSC Act and elements of the EP&A Act and NPWS Act. The transitional arrangements for the implementation of the BC Act are outlined in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* (BC S&T Reg). Under Item 28(1) of the BC S&T Reg, the former planning provisions (including the TSC Act) continue to apply to the determination of a 'pending or interim planning application'. Under Part 7 of these Regulations, a pending planning application is defined as:

> *(d) an application for planning approval (or for the modification of a planning approval) made after the commencement of the new Act if an environmental impact statement is to be submitted in connection with the application and the Secretary of the Department of Planning and Environment determines in writing that the proponent had undertaken substantial environmental assessment in connection with the statement before the commencement of the new Act (but only if the application is made within 18 months after that determination),*

On 12 April 2019, SCC sought a determination by the Secretary of DP&E under the BC S&T Reg, Item 28(1), that the project is a 'pending or interim planning application' and can therefore proceed under the former planning provisions including the *Threatened Species Conservation Act 1995* (TSC Act).

The BAR for the Proposal (Appendix B) was provided as evidence of substantial environmental assessment in support of the request for this determination. The BAR was finalised by SCC in 2017 and was submitted to the OEH on 22 August 2017 via the online Biobanking calculator portal. The BAR includes the results of the flora and fauna surveys and assessments undertaken prior to commencement of the BC Act on 25 August 2017.

On 1 May 2019 the Secretary of DPE determined that the Proposal is deemed to be a 'pending or interim planning application' and under Item 28(1) of the BC S&T Reg, the former planning provisions (including the TSC Act) apply to the Proposal.

6.2.11 Biosecurity Act 2015

The *Biosecurity Act 2015* provides a framework for the prevention, elimination and minimisation of biosecurity risks posed to the economy, the environment and the community. Relevant to this Proposal, weeds that present a social, environmental and economic risk are allocated mandatory measures or regionally relevant recommended measures. Weeds that present a particularly high threat are designated as prohibited matter, listed in Schedule 2 of the Act. Schedule 1 of the Act outlines special provisions relating to weeds.

The Biosecurity Act repealed the *Noxious Weed Act 1993*, however there is a strong correlation between weeds previously listed as noxious and those that have now been allocated mandatory measures. It is an offence to not implement the mandatory measures that have been allocated to species listed under the Biosecurity Act.

Further information about mitigation measures to reduce the impact of weeds on the Proposal Site and potential Biobanking sites is discussed in Section 8.2.

6.2.12 Waste Avoidance and Resource Recovery Act 2001

The WARR Act aims to encourage the most efficient use of resources to reduce environmental harm and ensure that resource management is undertaken in a logical, sustainable and organised manner. The WARR Act promotes the preparation of a waste strategy for the state and aims to improve the responsibility for waste reduction in the industry.

As discussed in Section 3.2 the Proposal is consistent with the waste management and recovery principles provided in state, regional and local waste strategies.

6.2.13 Water Management Act 2000

The object of the *Water Management Act 2000* (WM Act) is to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The WM Act provides for the preparation of water sharing plans that set extraction limits and rules for water access, available water determinations, account management and trading in order to protect surface water and groundwater sources and their dependent ecosystems, whilst recognising the social and economic benefits of the sustainable and efficient use of water.

The Proposal is located within the Shoalhaven Estuary Sub-Catchment under the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (Lower Shoalhaven River Management Zone) and the Water Sharing Plan for the Greater Metropolitan Region Unregulated Water Sources (Lower Shoalhaven River Management Zone).* Licences under the WM Act are required for interception of any aquifer underlying the landfill and for groundwater extraction. Extraction from waterways or groundwater is not proposed for the Proposal.

Under the WM Act, approval is required to undertake the following:

- Controlled activities, including dredging and reclamation works and any works that affect the quantity or flow of water in a water source; or
- Aquifer interference activities, including any activity involving the penetration of an aquifer, interference with water in an aquifer and obstruction of water within an aquifer.

Under section 91F of the WM Act, it is an offence to carry out an activity that would interfere with water within an aquifer, causing removal of water from the source or the movement of water from one part of an aquifer to another without an aquifer interference approval. The NSW Aquifer Interference Policy (NSW AIP) specifies the

requirements for assessing the impacts of aquifer interference activities on water resources. All construction works associated with the Proposal meet the requirements specified by the NSW AIP therefore an aquifer interference approval is not required.

Under section 60D of the WM Act, it is an offence to take water from a water source by means other than by a water supply work without a water licence. A water licence is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity.

Further information about potential surface and groundwater impacts is provided in Section 8.4 and Appendix N.

6.2.14 Roads Act 1993

The *Roads Act 1993* (Roads Act) governs activities in, on under or over a public road. This Act is governed by NSW Roads and Maritime Services (Roads and Maritime), the local council or the NSW Land and Property Management Authority depending on the road classification. Roads and Maritime has authority over major roads, and the local council over local roads. Under Section 138 of the Roads Act approval is required before any works can be undertaken within a public road reserve.

The Proposal requires three fauna rope bridges to cross Flatrock Road and as a result works would need to be undertaken within the road reserve to install and construct the fauna rope bridges. Approval is therefore required under the Roads Act from the Roads and Traffic Authority (now Roads and Maritime). Section 89K of the EP&A Act requires an authorisation granted under s138 of the Roads Act to be substantially consistent with the conditions of consent granted for State Significant Development.

As described in Section 5.3.6 the Proposal includes fauna rope bridges that will traverse Flatrock Road to enhance connectivity between the Proposal Site and bushland to the east. Section 139 approval will be required from SCC and Roads and Maritime for the works undertaken within the road reserve on Flatrock Road.

A discussion of the traffic impacts associated with the Proposal and mitigation measures proposed are presented in Section 8.6.

6.3 State environmental planning policies

6.3.1 State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP)

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) identifies classes of development and determines whether a development is classified as SSD under Section 4 of the EP&A Act. This SEPP identifies the thresholds for waste and resource management facilities, along with other development types, to be classified as SSD.

The aims of the SEPP (*State and Regional Development)* 2011 are to:

- Identify development that is SSD
- Identify development that is State Significant Infrastructure and critical State Significant Infrastructure.
- Confer functions on joint regional planning panels to determine development applications.

Under Clause 23, Schedule 1 of SEPP (*State and Regional Development)* the Proposal Site is considered to be:

development for the purpose of regional putrescible landfills that have capacity to receive over 650,000 tonnes of putrescible waste over the lifetime of the site.

The Proposal is expected to provide approximately 1.38 Mm^3 of additional landfill capacity and would receive over 650,000t of putrescible waste over the lifetime of the landfill. Development is therefore classified as SSD and is assessable under Part 4, Division 4.1 of the EP&A Act. Any activities that are related to the Proposal are also assessable as SSD.

Under Clause 11 of the SRD SEPP, development control plans (DCPs), developed under LEPs, are not applicable to SSD. As such, any DCPs established under the Shoalhaven LEP, are not applicable to the Proposal.

6.3.2 State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across NSW. The ISEPP specifies when development consent is, and is not, required for development to be carried out for certain types of development in certain zones.

Section 121 of the ISEPP makes provision for waste or resource management facilities to be undertaken, with development consent within a 'prescribed zone' (which includes SP2 Infrastructure). As discussed further below, the Proposal Site is zoned SP2 Infrastructure – Waste and Resource Management Facilities under the Shoalhaven LEP and therefore is considered to be a 'prescribed zone'. As such, the Proposal would be permissible with development consent.

Analysis against clause 123 of ISEPP

Clause 123 of ISEPP outlines the issues a consent authority must consider when determining developments for the purpose of construction, operation or maintenance of a landfill for the disposal of waste. Table 6-3 outlines the matters for consideration outlined in Clause 123 of ISEPP and the responses with respect to the Proposal.

Table 6-3 Clause 123 of ISEPP Matters of Consideration

Matters for consideration	Response
(a) whether there is a suitable level of recovery of waste, such as by using alternative waste treatment or the composting of food and garden waste, so that the amount of waste is minimised before it is placed in the landfill	The Proposal would contribute to the minimisation of waste to landfill through the provision of a best practice landfill with operational procedures that support the diversion of unacceptable or reusable materials from the landfill. This would support and increase in recycling and diversion of waste form landfill by providing a facility that allows for improved separation of waste streams and diversion of recoverable materials to the proposed RRP. Further details on SCC's performance against waste diversion targets is included in Section 3.2.
(b) whether the development: *(i) adopts best practice landfill design and operation*	The design and operation of the Proposal would adopt best practices and be consistent with the Environmental Guidelines. This is demonstrated though the Concept Design Report (SLR, 2019a). Key components of this are the proposed landfill cell liner and leachate management system. The Proposal would operate as one component of SCC's broader waste management services which include a number of waste avoidance and

Matters for consideration	Response
	minimisation strategies. The extension of the landfill would complement the proposed RRP located adjacent to the Proposal and provide a safe and reliable location for disposal of waste. The landfill would be operated in line with the LEMP prepared as part of this Proposal (SLR, 2019b) (Appendix L).
(ii) reduces the long-term impacts of the disposal of waste, such as greenhouse gas emissions or the offsite impact of odours, by maximising landfill gas capture and energy recovery	The Proposal would reduce long term impacts of the disposal of waste by project planning to minimise vehicle movements, reviewing GHG emissions profile of the WNRWF to identify opportunities to optimise existing landfill gas management strategies and ensuring the final capping layer meets the requirements of the LEMP and best practice standard and technologies at the time of capping.
(c) if the development relates to a new or expanded landfill: *(i) whether the land on which the development is located is degraded land such as a disused mine site*	The Proposal is an extension of the existing WNRWF. It is considered that the extension will provide less environmental impact than the creation of a new landfill at a greenfield site. While the Proposal is located outside the existing approved landfill footprint, it would be located on adjacent undeveloped land. The suitability of the Proposal Site for landfilling activities has been discussed throughout this EIS.
(ii) whether the development is located so as to avoid land use conflicts, including whether it is consistent with any regional planning strategies or locational principles included in the publication EIS Guideline: Landfilling (Department of Planning, 1996), as in force from time to time,	The Proposal Site is contained in an area zoned as SP2 – Waste or Resource Management Facility under the Shoalhaven LEP (2014). It is therefore consistent with regional planning strategies or locational principles included in the publication EIS Guideline. As described in Section 3.4 a detailed *Desktop Landfill Identification Study* was undertaken by Locale Consulting (2014) that considered a number of selection criteria including environmental constraints, topography and surrounding land uses. The Proposed land use is consistent with the land zoning and the Proposal Site is located a reasonable distance from sensitive receivers.
(d) whether transport links to the landfill are optimised to reduce the environmental and social impacts associated with transporting waste to the landfill.	As the Proposal Site is directly adjacent to the existing WNRWF, the Proposal will use the existing established road and access infrastructure to the WNRWF. As such, no new road infrastructure is required to provide access to the Proposal Site. The Proposal Site is located near Yalwal Road that provides an efficient transport link to the Proposal. The traffic assessment found that the Proposal is unlikely to impact the level of service on the existing site access routes thereby maintaining travel times in the vicinity of the Proposal Site.

6.3.3 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 - Hazardous and Offensive Development (SEPP 33) links the safety and environmental performance of an industrial development proposal to its permissibility. Certain activities may involve handling, storing or processing a range of materials, which, in the absence of controls, may create risk outside of operational borders to people, property or the environment. Such activities will be defined by SEPP 33 as a 'potentially hazardous industry' or 'potentially offensive industry'. SEPP 33 applies to any industrial development proposals which fall within these definitions.

Under Clause 3, a development is deemed part of a “potentially hazardous industry” if it satisfies the definition:

> *a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, will pose a significant risk in relation to the locality*:
>
> *a) to human health, life or property, or;*
> *b) to the biophysical environment;*
> *and includes a hazardous industry and a hazardous storage establishment.*

A development is deemed part of a potentially offensive industry if it satisfies the following definition:

> *a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

The DPE (2011) guideline *Applying SEPP 33* provides a risk screening procedure to facilitate determination of whether a proposed development is assessable under SEPP 33. If, under this screening test SEPP 33 is triggered, Clause 12 of SEPP 33 requires that any proposal to carry out a potentially hazardous development must be supported by a Preliminary Hazard Analysis (PHA).

Industries or proposed developments which require an EPL would suggest the proposed developments are potentially offensive and therefore require the limits prescribed by the aforementioned EPL. However, the issue of an EPL by the EPA to a proposed development would indicate the EPA does not consider it to be an ‘offensive industry’ while operating within the restrictions specified in the conditions of the EPL.

As discussed above, the WNRWF is currently subject to EPL 5877 and SCC would seek a variation to this EPL, where required, to incorporate the construction and operation of the Proposal. Notwithstanding this, the Proposal has the potential to pose environmental, human health, and amenity hazards (if it were to operate without any measures to reduce or minimise its impact in the locality) a screening assessment was undertaken, which is outlined in Section 8.10. The assessment found the Proposal would not trigger the need for a PHA as it would operate below the screening levels set out in the *Applying SEPP 33* guideline.

6.3.4 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage conservation of areas of natural vegetation that provide habitat for koalas. This is achieved by identifying and managing development within areas of core, or potential, koala habitat.

SEPP 44 applies to land in relation to which a DA has been made and which has an area of more than one hectare. The Proposal Site fulfils both of these criteria. If the land is identified as potential koala habitat under Part 2 of SEPP 44, further procedures must be carried out to determine whether the land constitutes 'potential' or 'core' koala habitat. Core koala habitat is defined as areas which contain a resident koala population and potential koala habitat is defined as 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. Should core habitat be identified, a plan of management must be prepared and any consent granted must be consistent with the plan of management.

Eucalyptus punctata (Grey Gum), which is listed as a feed tree species under Schedule 2 of SEPP 44, is scattered across the Proposal Site. However, no Koala scats were recorded during targeted surveys by GHD (2014), and no Koalas were observed/heard during numerous diurnal and nocturnal surveys of the Proposal Site. Koalas may occur on the Proposal Site on occasion when moving between areas of better quality foraging habitat. Koalas are unlikely to reside or breed on the Proposal Site due to the lack of primary and secondary feed trees.

Given these considerations, the Proposal Site does not represent core Koala habitat as defined under SEPP 44. No Koalas were detected on the Proposal Site and if the species does occur in the locality, it is unlikely to be impacted beyond the loss of 9.87 ha of non-core potential foraging habitat.

6.3.5 State Environmental Planning Policy No. 55 – Remediation of land

The objective of *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) is to provide for a coordinated state-wide planning approach for the remediation of contaminated land. SEPP 55 aims to promote the remediation of contaminated land with the objective of reducing the risk of harm to human health or other aspects of the environment.

Clause 7 of SEPP 55 requires the approval authority have regard to certain matters before granting approval. These matters include:

- Whether the land is contaminated
- Whether the land is, or will be, suitable for the purpose for which development is to be carried out
- If remediation is required for the land to be suitable for the proposed purpose, whether the land will be remediated before the land is used for that purpose.

SEPP 55 also imposes obligations to carry out any remediation work in accordance with relevant guidelines, developed under the *Contaminated Lands Management Act 1997* (CLM Act) (discussed further below) and to notify the relevant council of certain matters in relation to any remediation work.

A preliminary contamination assessment has been prepared for the Proposal and found that with the implementation of best practice procedures the potential for contamination is considered to be low.

A desktop contamination review found the following:

- A search of the *NSW Contaminated Land Public Record* found no records of contaminated sites within the SCC LGA (Appendix N)
- A search of the *List of NSW Contaminated Sites Notified to EPA (*Appendix N) identified one site in West Nowra however the property was not located adjacent to the Proposal Site
- A search of the NSW EPA POEO Act public register of licence, applications and notices was undertaken for Mundamia, NSW in March 2017 and it returned 18 results. One of the results was related to a (then pending, now issued) POEO licence for SCC for the RRP. The remaining 17 were related to the issuing of the existing landfilling operations POEO licence and subsequent variations.

6.3.6 State Environmental Planning Policy No. 64 – Advertising and Signage

State Environmental Planning Policy No. 64 – Advertising and Signage (SEPP 64) aims to regulate signage to ensure that it is compatible with the visual character of an area and provides effective communication in suitable locations. SEPP 64 is applicable to all signage, except for signage that is classified as 'exempt development' under an EPI.

While it is not envisaged that signage would be required for the Proposal (given it is an extension to the existing landfill which is already signposted), should signage be required, it would be developed in accordance with AS 1319-1994 and AS 4282-1997. The Proposal is considered consistent with the objectives of SEPP 64(clause 3) in that, signage would be compatible with the surrounding area, providing suitable communication for wayfinding and would be of high design quality.

An assessment of the Proposal having regard to the assessment criteria provided in SEPP 64 (Schedule 1) is provided in Table 6-4.

Table 6-4 SEPP 64 (Schedule 1) Assessment

Consideration	Compliance
Character of the area	The surrounding area is predominantly environmental conservation area. Signage would be designed in accordance with the relevant Australian Standards and to integrate into the surrounding area with the assistance of discrete selection of materials and vanishes and the appropriate placement of signage.
Special areas	The signage to be installed as part of the Proposal would be designed to ensure that it would not detract from the amenity or visual quality of any environmentally sensitive areas, heritage areas, natural or other conservation areas, open space areas, waterways, rural landscapes or residential areas near the Proposal Site.
Views and vistas	Any required signage would not impact on any existing views or dominate the skyline in the area. The signage would be designed to integrate into the surrounding area as a result of landscaping and suitable materials and finishes.
Streetscape, setting or landscape	The signage would be designed to create visual interest and be of appropriate scale and design for the surrounding industrial area.
Site and building	The signage would be designed to a scale that is reflective and consistent with the proposed buildings and structures to be

Consideration	Compliance
	located on the Proposal Site. The signage would not detract from these buildings and/or infrastructure.
Associated devices and logos with advertisements with advertising structures	Way finding signs to be incorporated into the Proposal would be designed to improve access to, from and within the site. This signage would be located in clearly visible areas to improve safety and maximise efficiency.
Illumination	No illumination is proposed for any signage associated with the Proposal.
Safety	Signage would be designed to improve access to, from and vehicle movements within the Proposal Site, thereby improving safety of vehicle and pedestrian movements.

6.4 Local environmental plans and development control plans

6.4.1 Shoalhaven Local Environment Plan 2014

The Shoalhaven Local Environmental Plan 2014 (Shoalhaven LEP) came into force on 22 April 2014. The Proposal Site is located within an area of the Shoalhaven City Council Local Government Area (SCC LGA) and the Shoalhaven LEP is therefore applicable to the Proposal Site. The aims of the Shoalhaven LEP are to:

a) *to encourage the proper management, development and conservation of natural and man-made resources,*
b) *to facilitate the social and economic wellbeing of the community,*
c) *to ensure that suitable land for beneficial and appropriate uses is made available as required,*
d) *to manage appropriate and essential public services, infrastructure and amenities for Shoalhaven,*
e) *to minimise the risk of harm to the community through the appropriate management of development and land use.*

This EIS discusses the potential impacts of the Proposal on the environment, including on biodiversity, waterways and water resources, community amenity and socio-economic factors. Through the implementation of mitigation identified throughout the EIS and compiled in Section 9, the Proposal will support the aims of the Shoalhaven LEP.

The Proposal Site is zoned SP2 – Waste or Resource Management Facility. The objects of the zoning are to provide for infrastructure and related uses, and to prevent development that is not compatible or may detract from the provision of infrastructure.

6.4.2 Shoalhaven Development Control Plan 2014

As noted in Section 6.3.12, Clause 11 of SEPP (S&RD) deems that Development Control Plans (DCPs) established under the Shoalhaven LEP, are not applicable to the Proposal. However, the SEARs request that an assessment of compliance against the DCP is undertaken. As such, consideration has been given to the objectives of the Shoalhaven DCP 2014 in order to demonstrate consistency of the Proposal with the overarching aims of the Shoalhaven LEP for the Proposal Site and surrounds.

The Shoalhaven DCP 2014 was prepared to support the provisions of the Shoalhaven LEP 2014 by providing guidance to persons carrying out development and to Council and landowners in preparation and assessment of development applications.

Relevant provisions of the Shoalhaven DCP 2014 and how they have been addressed in the Proposal have been considered in the Table 6-5.

Table 6-5 Proposal consideration of the general provisions of Shoalhaven DCP 2014

Shoalhaven DCP 2014 general provisions	Consideration for the Proposal	Section addressed in EIS
G2. Sustainable Stormwater Management and Erosion/Sediment Control	Sustainable stormwater management and erosion/sediment control has been addressed through the design of the Proposal and the incorporation of an Erosion and Sediment Control Plan.	Section 5
G3. Landscaping Design Guidelines	The Proposal Site is located within the WNRWF and is bordered by native vegetation on the south and eastern boundaries. No landscaping will be undertaken for the Proposal during construction and operation, however the native vegetation to the south and east will be established as a conservation area and maintained to provide visual screening to potential receivers outside of the WNRWF. The Rehabilitation and Closure Plan (Appendix P) includes the proposed rehabilitation and landscaping arrangements post closure of the landfill.	Appendix P
G5. Threatened Species Impact Assessment	A flora and fauna assessment has been undertaken by SCC and is documented in the Biodiversity Assessment Report in Appendix B and summarised in Section 8.2 of this EIS. The Biodiversity Assessment Report addresses the threatened species impact assessment requirements within the Shoalhaven DCP.	Section 8.2
G7. Waste Minimisation and Management Controls	SCC has considered a range of waste diversion rates that could be achieved by the RRP and has determined that an extension to the existing landfill would still be required.	Section 3.1, 3.2, 3.6
G21. Car Parking and Traffic	The Proposal would utilise the existing car park in the WNRWF which provides parking spaces for site office and operational staff and is designed in line with SCC requirements.	Section 2.4.2
G22. Advertising Signs and Structures	Any necessary signage would be compatible with the surrounding area, providing suitable communication for wayfinding and would be of high design quality.	Section 6.3.6

Shoalhaven DCP 2014 general provisions	Consideration for the Proposal	Section addressed in EIS
G.26 Acid Sulphate Soils and Geotechnical (Site Stability) Guidelines	Acid sulfate soils have not been identified on the Proposal Site and the Australian Soil Resource Information System (CSIRO, 2017) identifies an extremely low probability of acid sulphate soils on the site. A geotechnical and hydrogeological investigation was undertaken by Coffey (2016) and the findings have been taken into account in the design of the Proposal.	Section 5 and Section 8.4 Appendix E

7 ENVIRONMENTAL RISK ASSESSMENT

The SEARs (see Section 1.5) have identified the key environmental issues, or risks, which have been discussed in this EIS. These key issues were reviewed as part of an Environmental Risk Assessment (ERA). The purpose of the ERA was to identify the level of risk associated with the Proposal before and after the application of the safety measures inherent in the design as well mitigation measures outlined in Section 9 and to determine whether the residual risks are considered acceptable. Risks were therefore provided an 'initial' risk ranking and a 'residual' risk ranking, assuming effective implementation of the proposed design and mitigation measures.

The methodology used for the ERA, and the outcomes of this process, are outlined below.

Table 7-1 SEARs

Section	Requirement	Where addressed in EIS
General requirements	- Risk assessment of the potential environmental impacts of the development, identifying key issues for further assessment.	Section 7.2

7.1 ERA methodology

An assessment of environmental risk associated with the Proposal has been undertaken to identify the residual environmental risk, once the mitigation measures identified for each environmental aspect have been applied. The ERA aims to assign a qualitative environmental risk category to each issue.

Risk category is determined on the basis of consideration of the likelihood of an impact occurring and the consequences of the impact occurring. The criteria for evaluating likelihood and consequence are identified in Table 7-2 and Table 7-3, respectively.

Table 7-4 shows the determination of the risk rating through the combination of likelihood and consequence levels.

Table 7-2 Criteria for evaluating likelihood

Level	Descriptor	Description	Frequency of occurrence
A	Almost Certain	Is expected to occur in most circumstances	Once per month
B	Likely	Will probably occur in most circumstances	Between once a month and once a year
C	Possible	Might occur at some time	Between once a year and once in 5 years
D	Unlikely	Could occur at some time	Between once in 5 years and once in 20 years
E	Rare	May occur in exceptional circumstances	Once in more than 20 years

Table 7-3 Criteria for evaluating consequence

Level	Category	Safety	Financial	Operational	Environmental	Community
1	Not Significant	No medical control required	<$100,000	< 6 hours disruption to operations	Pollution release immediately contained on-site, no need for external assistance. No impact on native vegetation / fauna / fauna habitat.	No community or stakeholder complaints
2	Minor	Lost time injury occurs or medical control required	≥ $100,000 but less than $1M	≥ 6 hrs but < 24 hrs disruption to operations	Pollution release to environment contained on-site in < 24 hours, no need for external assistance. Minor impacts to native vegetation / fauna / fauna habitat on-site.	Several community or stakeholder complaints. Complaints rectified within adequate timeframes.
3	Moderate	Serious injury occurs	≥ $1M but less than $2M	≥ 24 hrs but < 48 hrs disruption to operations	Pollution release to off-site environment with short-term, localised, detrimental effect. Moderate, short-term impact to vegetation / fauna / fauna habitat requiring action to correct or minor impact on threatened species or communities.	Multiple and sustained community or stakeholder complaints. Complaints addressed after an interval. Limited media coverage of issues raised.
4	Major	Single fatality occurs	≥ $2M but less than $10M	≥ 2 days but < 5 days disruption to operations	Pollution release to off-site environment with medium-term, regional detrimental effect. Major, medium-term impact to vegetation / fauna / fauna habitat requiring action to correct or moderate impact on threatened species or communities.	Widespread community and stakeholder concern. Sustained failure to address complaints. Extensive media coverage.
5	Severe	Multiple but localised fatalities occur	≥ $10M	≥ 5 days disruption to operations	Pollution release to off-site environment with long-term, wide-spread detrimental effect. Severe, long-term impact to vegetation / fauna / fauna habitat or major impact on threatened species or communities.	Ongoing and widespread community and stakeholder concern, culminating in litigation. Inability to address complaints. Extensive and sustained negative media coverage.

Table 7-4 Risk analysis categories and criteria for risk rating

Likelihood	Consequence				
	1 – Not significant	2 – Minor	3 – Moderate	4 – Major	5 – Severe
A – Almost certain	Moderate	Moderate	High	Very High	Very High
B – Likely	Low	Moderate	High	Very High	Very High
C – Possible	Low	Low	Moderate	High	High
D – Unlikely	Low	Low	Low	Moderate	Moderate
E – Rare	Low	Low	Low	Low	Moderate

As shown in Table 7-4, each potential environmental impact was initially ranked between low and very high based on the environmental impacts that could potentially result if the risk was unmitigated. Subsequent to this initial risk categorisation, the environmental issues identified were assigned a residual risk rating to indicate the risk following implementation of the control measure/s that have been identified within this EIS.

7.2 ERA outcomes

A summary of the findings of the ERA, the suitability of the mitigation measures proposed throughout the EIS and the potential for appropriate environmental management during construction and operation of the Proposal will take into consideration the results of the environmental assessments, once complete.

A summary of the preliminary environmental risk assessment which has been undertaken for the Proposal is provided in Table 7-5.

Table 7-5 Summary of environmental risk assessment for the Proposal

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Waste Management	Generation of waste during construction. Poor waste management during operation resulting in impacts on the surrounding environment (e.g. escape of leachate, litter).	Moderate	Management of waste during construction and operation would be guided by the LEMP (SLR, 2019b) (Appendix L) which has been developed in consideration of the Environmental Guidelines. The LEMP incorporates mitigation measures outlined in this EIS which aim to ensure effective on-site waste management and minimise the potential for waste to leave the Proposal Site.	Low	Addressed throughout the EIS, including specifically Section 5.6 and 5.8.15
Flora and Fauna	Impacts on biodiversity during construction and operation of the Proposal	High	The Proposal will have impacts on native vegetation, including habitat for threatened fauna species due to the removal of 9.87 ha of vegetation. Measures to mitigate biodiversity impacts, include the establishment of a conservation area and fauna rope bridges to facilitate movement of fauna across Flatrock Road.	Low	Section 8.2
Soil, water and leachate	Erosion of soils from the Proposal Site during construction and operation resulting in sedimentation within stormwater and natural waterways	High	The Proposal has been designed in line with best practice procedures and in consideration of the Environmental Guidelines. An Erosion Sediment Control Plan (ESCP) will be developed in accordance with the 'Blue Book' to manage potential erosion of soils. An environmental monitoring pogrom will be developed to monitor any potential impacts to surface waterways.	Low	Section 8.4

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Soil, water and leachate	Potential to interact with contaminated soil and/or cause soil contamination during construction or operation, therefore causing environmental and/or community impacts	High	The design has been developed to comply with the Environmental Guidelines and a range of environmental management and monitoring measures have been developed to guide implementation of the Proposal. Provided the design and management measures are implemented appropriately, the potential for contamination during construction and operation is low. Measures to mitigate potential contamination impacts are outlined in Section 8.4, the Concept Design Report (Appendix E) and are incorporated into the LEMP (Appendix L).	Low	Section 8.4
Soil, water and leachate	Impacts from potential surface water pollution caused during construction or operation of the Proposal.	Very high	The landfill design incorporates appropriate surface water management controls to ensure clean surface water runoff is intercepted and diverted from the landfill footprint prior to entering the waste mass and thus becoming leachate, and to ensure that dirty water that has come into contact with the waste mass is collected and treated as leachate (Section 5.5.3). Mitigation measures to minimise the potential for surface water pollution have been outlined in Section 8.4	Low	Section 8.4

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Soil, water and leachate	Impacts related to contact with contaminated groundwater and/or pollution of groundwater from chemicals/leachate entering groundwater system during construction or operation of the Proposal.	High	As part of the Proposal the leachate irrigation area would be relocated, over Stage 2 of the existing landfill operation, to improve the existing leachate management process and minimise the risk of contamination to groundwater. Mitigation measures to further minimise the potential to cause groundwater contamination have been outlined in Section 8.4. Installation of additional groundwater wells and the implementation of an environmental monitoring program will be developed to monitor any potential impacts to groundwater.	Moderate	Section 8.4
Hazards and risk	Impacts from the release of hazardous materials and dangerous goods.	Moderate	The WNRWF is not licensed to accept hazardous waste (except small quantities of asbestos). Measures to ensure the safe handling and management of dangerous goods and hazardous materials which may make their way to the site are outlined in Section 8.10 and are incorporated in the LEMP.	Low	Section 8.10
Hazards and risk	Potential bushfire impacts (the site and surrounding area is considered medium risk for bushfire).	Moderate	The Proposal will include a number of mitigation measures including a fire break that surrounds the Proposal Site and on-site firefighting equipment and procedures to ensure there is limited potential for increased occurrence of severity of bushfire on the Proposal Site or surrounds. The mitigation measures outlined are in Section 8.10 and are incorporated in the LEMP.	Moderate	Section 8.10

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Air quality and odour	Dust generation during construction and operation of the Proposal.	High	The Proposal has the potential for air quality impacts. Implementation of mitigation measure such as minimising the area of the active tipping face, covering of loads and use water carts to suppress visible dust will aid in minimisation of these impacts. Mitigation measures to reduce dust generation are outlined in Section 8.3 and the LEMP (Appendix L).	Moderate	Section 8.3
Air quality and odour	Odour generation during construction and operation of the Proposal.	High	The Proposal has the potential for odour impacts. Implementation of mitigation measures including the daily covering and continual capping of waste will help minimise reduce odour impacts. Mitigation measures to reduce odour impacts are outlined Section 8.3 and the LEMP (Appendix L).	Moderate	Section 8.3
Noise and vibration	Impacts from noise and vibration generated during construction and operation of the Proposal.	Moderate	The Proposal has the potential for noise impacts . Mitigation measures include fitting of noise reducing guards on plant and machinery and minimising concurrent use of plant and equipment and will reduce noise impacts. Mitigation measures are outlined in Section 8.3 and the LEMP (Appendix L).	Moderate	Section 8.5
Traffic and transport	Impacts associated with traffic generated during construction and operation of the Proposal (e.g. traffic delays, reduced level of service (LoS), safety impacts).	Moderate	The traffic and transport impact assessment concluded that the Proposal would have a minimal impact on surrounding traffic levels. Traffic and transport mitigation measures are outlined in Section 8.6.	Low	Section 8.6

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Greenhouse gas	Release of greenhouse gas emissions.	High	Project planning to minimise vehicle movements and reviewing the Greenhouse Gas emissions profile of the WNRWF to identify opportunities to optimise existing landfill gas management strategies would reduce emissions of the Proposal. Further mitigation measures are outlined in Section 8.7.	Moderate	Section 8.7
Aboriginal heritage	Impacts to Aboriginal heritage during construction and operation of the Proposal.	Low	No Aboriginal heritage items were identified within the Proposal Site during the Aboriginal Heritage Assessment (Appendix O). Hence the initial risk rating is low. There is the potential for unexpected finds on the site. An unexpected finds procedure would be implemented should any unexpected finds be discovered. Mitigation measures addressing unexpected finds are included in Section 8.8.1.	Low	Section 8.8.1
Non-Aboriginal heritage	Impacts to non- Aboriginal heritage during construction and operation of the Proposal.	Low	No non-Aboriginal heritage items were identified within the Proposal Site during the non-Aboriginal Heritage Assessment (Appendix Q). Hence the initial risk rating is low. There is the potential for unexpected finds on the site. An unexpected finds procedure would be implemented should any unexpected finds be discovered. Mitigation measures addressing unexpected finds are included in Section 8.8.2.	Low	Section 8.8.2

Environmental aspect	Initial risk identified	Initial risk rating (pre-mitigation)	Design and mitigation measures	Residual risk (post-mitigation)	EIS reference
Visual impacts	Visual impacts of the Proposal during construction and operation.	Low	The Proposal Site is located adjacent to the WNRWF which has natural screening. Therefore negligible visual impacts are expected for sensitive receivers. Nevertheless, mitigation measures to address potential impacts are outlined in Section 8.9.	Low	Section 8.9

8 KEY ENVIRONMENTAL ISSUES

8.1 Strategic land use planning

Arcadis has undertaken an assessment of how the Proposal addresses relevant Federal and NSW Government strategies and strategic land use policies. A summary of the relevant SEARs, which relate to land use planning and where these have been addressed in this EIS, have been provided in Table 8-1.

Table 8-1 SEARs relevant to strategic land use planning

Section	Requirement	Where addressed in EIS
Strategic land use planning	– demonstration that the proposal is generally consistent with the aims and objectives of all relevant environmental planning instruments and strategies including, but not limited to, the Infrastructure SEPP, the *NSW Waste Avoidance and Resource Recovery Strategy 2014-2021, NSW State Plan 2021 – Goal 23, the Waste Avoidance and Recovery Act 2001, the National Waste Policy, Shoalhaven Environmental Plan 2014,* and relevant Development Control Plans;	Section 3.2 Section 6
	– justification for any inconsistency between the proposed development and these plans;	NA
	– details on the suitability of the site for the proposed development.	Section 1.1 Section 3

8.1.1 Existing environment

A study was commissioned in 2014 by SCC to identify a long-term waste management strategy to service the future needs of the Shoalhaven LGA (Locale Consulting and Environment and Natural Resource Solutions, 2014). The study identified two options for long-term waste management:

- Establishment of a new landfill at a new site.
- Identification of a strategy that would prolong the life of the existing landfill.

Establishment of a new landfill site was ruled out by SCC based on the lengthy lead times required for approval and construction and the comparative advantages gained by extending the existing landfill on the current WNRWF site.

SCC approved a strategy in 2015 that would establish the existing WNRWF as the central waste management facility for the Shoalhaven LGA. This strategy would extend the operational life of the landfill and involve the development of a RRP (Resource Recovery Park) that would reduce the volume of waste requiring disposal to the landfill and an extension to the existing landfill (known as the Stage 4 extension). The landfill extension on its own is expected to increase the operational life of the landfill by approximately eight years, assuming commencement of operations in 2026. In conjunction with the RRP, the operational life of the landfill is expected to increase by approximately 14 years.

The key objectives that the strategy adopted by SCC aims to achieve through the Proposal are:

- Reduce the possible environmental and social impacts that may occur from waste management activities in the Shoalhaven LGA by centralising all waste management activities into a single location
- Minimise transportation of waste and the corresponding heavy vehicle transport movements by centralising all waste management activities into a single location
- Maximise the use of existing infrastructure and land already zoned for waste management activities
- Reduce as much as possible, Council's environmental accountability on lands with waste management activities occurring, by centralising all waste management operations into a single site.

Having established the suitability of the Proposal in line with the Waste Management Strategy established by SCC in 2015, the remainder of this section focuses on the land use zoning at the site, existing land and surrounding land uses.

Land use zone

The Proposal Site lies within the WNRWF. Under the Shoalhaven LEP, the Proposal Site is zoned Special Purpose 2 (SP2) Infrastructure (Waste and Resource Management Facility). The objectives for this land use zone include:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

Development that is permitted with consent for areas zoned SP2 include:

- Roads; any development that is ordinarily incidental or ancillary to development for that purpose

Any development that is not "permitted with consent" or is inconsistent with the objectives for the zone are prohibited.

The proposed landfill extension is consistent with the objectives identified for this land use zone.

In addition, the three fauna rope bridge crossings would be located in land zoned Environmental Conservation (E2). The objectives for this land use zone include:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To protect water quality and the ecological integrity of water supply catchments and other catchments and natural waterways.
- To protect the scenic, ecological, educational and recreational values of wetlands, rainforests, escarpment areas and fauna habitat linkages.
- To conserve and, where appropriate, restore natural vegetation in order to protect the erosion and slippage of steep slopes.

Development that is permitted with consent for areas zoned E2 include:

- Environmental facilities and environmental protection works

Any development that is not "permitted with consent" is prohibited.

The proposed fauna crossings as part of the Proposal are consistent with the objectives identified for this land use zone.

Surrounding land use

The Proposal Site is surrounded immediately by the existing WNWRF and to the immediate north and north-east is land zoned SP2 (Infrastructure) that consists of the RSPCA Shoalhaven Shelter[13] and the OEH Nowra Area Office and Depot. The land surrounding the Proposal Site is zoned RU2 (Rural Landscape), E1 (National Parks and Nature Reserves), E2 (Environmental Conservation) and E3 (Environmental Management). Undeveloped bushland (E3) surrounds the WNRWF to the north, east and west, with a further portion of undeveloped bushland (E2) located to the immediate south. The Bamarang Nature Reserve (E1) is located further to the east and south-east of the Proposal Site. Figure 2-1 shows land use zoning on the Proposal Site.

The nearest sensitive receivers (shown in Figure 8-28) (RU2) are residential properties located approximately 185 m to 250 m from the southernmost extent of the waste deposition area[14].

8.1.2 Potential impacts

Land use zone

As identified above, the Proposal Site is zoned SP2 Infrastructure (Waste and Resource Management Facility) and the proposed landfill extension is permissible with consent under the Shoalhaven LEP (2014). No alterations to the current land zoning are proposed as part of the Proposal. The proposed landfill extension is consistent with the objectives identified for this land use zone.

Land use

The land use at the Proposal Site would change from undeveloped native bushland to an operational landfill. The Proposal requires 9.87 ha of native vegetation consisting of Red -Bloodwood – Hard-leaved Scribbly Gum to be cleared. Clearing would be undertaken progressively during the construction and operation of the Proposal. The clearing of the native vegetation is required to facilitate the extension of the landfill and impacts from clearing on the Proposal Site are discussed in Section 8.2.

Surrounding land use

The Proposal is unlikely to directly impact on the land use in the nearby Bamarang Nature Reserve, undeveloped vegetated land that surrounds the Proposal Site and existing WNRWF and residential receivers. Potential indirect impacts to users of the surrounding area include waste (litter), flora and fauna, noise, air quality and odour, soil and surface water, ground water and leachate impacts. These impacts are discussed in the relevant sections of this EIS.

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[13] As discussed earlier in this EIS, the current RSPCA Shoalhaven Shelter site is subject to redevelopment as a RRP. It is noted that should the RRP proceed, the Proposal and RRP are consistent and complimentary land uses.

[14] The Environmental Guidelines require the edge of the waste deposition area to be a minimum of 250 m from the nearest environmentally sensitive location (including residences and dwellings). There is one dwelling approximately 185 m from the nearest waste deposition area, however SCC advised that this is an illegal/unapproved dwelling, and that the landfill should be designed to be 250 m from the nearest legal dwelling. SCCs advice has been incorporated into the design.

8.1.3 Mitigation measures

As identified above, the Proposal is not expected to have any direct land use impacts (with the exception of clearing, as addressed in Section 8.2) and therefore no mitigation measures are required.

As mentioned above, potential indirect impacts to users of the surrounding area include waste (litter), noise, air quality and odour, soil and surface water, ground water and leachate impacts. These impacts are discussed in the relevant sections of this EIS.

8.2 Biodiversity

A Biodiversity Assessment Report (BAR) was prepared by SCC's Environmental Assessment Unit to assess the potential impacts of the Proposal on biodiversity values (Appendix B). Significant Impact Criteria (SIC) assessments are also included Appendix B.

The BAR was prepared to meet the requirements of the project SEARs and the Framework for Biodiversity Assessment (FBA) (OEH 2014), and was based on:

- A desktop assessment which included a review of landscape features using local and regional mapping datasets and online biodiversity database searches
- Detailed site surveys
- Assessment using the FBA calculator.

Table 8-2 provides a summary of the relevant SEARs, which relate to flora and fauna and where these have been addressed in this EIS.

Table 8-2 SEARs relating to flora and fauna

Section	Requirement	Where addressed in EIS
Flora and Fauna	– An assessment of the Proposal under the Framework for Biodiversity Assessment (Oct 2014) including an assessment of any potential impacts on aquatic and riparian vegetation and groundwater dependent ecosystems.	Section 8.2 and Appendix B

OEH provided additional requirements during consultation on the SEARs (Table 8-3).

Table 8-3 OEH additional assessment requirements for flora and fauna

Section	Requirement	Where addressed in EIS
A.	Impacts on the following species will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment: • *Acacia bynoeana* • *Galium australe* • *Melaleuca deanei* • *Triplarina nowraensis* • *Hibbertia stricta subsp. furcatula*	Section 8.2 and Appendix B

Section	Requirement	Where addressed in EIS
	• *Calochilus pulchellus* • *Pterostylis ventricosa* • *Pterostylis vernalis* • *Genoplesium baueri* • *Cryptostylis hunteriana*	
B.	Surveys for all species must include targeted searches in all habitat (including marginal habitat) on the subject site.	Section 8.2.3 and Appendix B
C.	Surveys for orchids must undertake consecutive/parallel 5m wide transects covering all potential habitat (including marginal habitat) on the subject site. Surveys must involve walking along each transect searching for the species, and must be undertaken during the species' flowering season. Flowering season must be confirmed by survey of flowering at known reference sites.	Section 8.2.3 and Appendix B

8.2.1 Methodology

The Proposal was assessed using the FBA methodology based on a site footprint area of 9.87 ha (the development footprint[15]) being cleared and utilised for the Stage 4 landfill, with areas outside of the development footprint retained as a vegetated visual amenity buffer (shown as the Conservation Area on Figure 1-1) and potential Biobank site.

Desktop Assessment

The landscape values of the Proposal Site (referred to within the BAR as the subject site) were determined using GIS mapping, with reference to local and regional datasets including OEH Bionet mapping and SCC GIS.

Threatened species requiring assessment were determined using the FBA calculator and the guidance in the SEARs. In addition, the NSW Bionet Atlas, administered by OEH, was searched in January 2016 to identify all threatened species with records within 10 km of the Proposal Site. The list of threatened species recorded within 10 km was reviewed against the habitat requirements for each species and those habitat requirements available on the Proposal Site.

Previous vegetation mapping in the region was reviewed, including:

- *Shoalhaven City Council Vegetation Mapping Project* by Mills (2000).
- *Compilation map: Biometric vegetation types and endangered ecological communities of the Shoalhaven, Euobodalla & Bega Valley local government areas. A living map Version 2.0* by OEH (2013).

Previous environmental studies of the Proposal Site were also reviewed, including:

- *Threatened Biodiversity Survey and Assessment – West Nowra* by Hyder Consulting (June 2007).

[15] The development footprint comprises a 9.87 hectare area of native vegetation that would be cleared within the Proposal Site.

- *West Nowra Resource Recovery Park EIS Flora and Fauna Impact Assessment* by GHD (February 2014).

Field assessment

Targeted threatened species surveys were undertaken by SCC Threatened Species Officers from December 2013 to November 2015 over the Proposal Site to provide data for the withdrawn development application (Council reference RA14/1003) as well as the current Proposal.

Additional field assessments were undertaken in 2015 and 2017 by SCC staff. Vegetation plots were sampled in accordance with the FBA and targeted threatened flora species surveys were conducted on the 15 September 2015 and 25 and 26 November 2015. The species targeted were *Hibbertia puberula,* (listed as endangered under the TSC Act)*, Hibbertia stricta subsp. furcatula* (listed as endangered under the TSC Act)*, Galium australe* (Tangled Bedstraw, listed as endangered under the TSC Act)*, Acacia bynoeana (*Bynoe's Wattle, listed as endangered under the TSC Act and vulnerable under the EBPC Act)*,* and *Melaleuca deanei* (Deane's Paperbark, listed as vulnerable under the TSC Act and EPBC Act).

Field assessments targeting threatened fauna species were also undertaken using a range of survey techniques, including habitat assessment, call playback surveys, Koala Spot Assessment Technique (Phillips & Callaghan, 2011), diurnal surveys, nocturnal spotlighting transects, pitfall surveys, remote camera sampling and Anabat surveys.

Plant Community Types (PCTs) were identified following a review of existing mapping and a rapid visual assessment of the site and surrounding areas as well as analysis of data from four vegetation plots.

A detailed description of survey effort, timing and methodology for targeted threatened species surveys is provided in the BAR (Appendix B).

8.2.2 Existing environment

Landscape features

The FBA requires the assessment of landscape features to describe the biodiversity values of the Proposal Site and assess the impacts of the Proposal. Landscape features relevant to the FBA calculations are shown on Figures 5 to 10 of the BAR (Appendix B) and are summarised in Table 8-4.

Table 8-4 Landscape features

Landscape feature	Proposal Site
IBRA (Interim Biogeographic Regionalisation for Australia) bioregions and subregions	The Proposal Site is located within the Sydney Basin bioregion and the Ettrema subregion classified under IBRA.
Major Catchment Area	The Proposal Site is located within the Southern Rivers Major Catchment Area (MCA).
Mitchell landscapes	The Proposal Site is located within the Nowra-Durras Coastal Slopes Mitchell landscape.

Landscape feature	Proposal Site
Rivers, streams and wetlands	There are no rivers or streams within or immediately adjoining the Proposal Site. The Proposal Site is within the catchment of, and within approximately 300 to 400 m from Cabbage Tree Creek which flows into the Shoalhaven River approximately 1.5 kilometres to the north. There are no SEPP14 Wetlands within 10 km of the Proposal Site, nor are there any other important wetlands or local wetlands adjacent to or downstream of the Proposal Site.
Native vegetation cover in landscape	The area of native vegetation within the 1,000 ha circle before development was calculated using ArcGIS software and totalled 804.80 ha (76-80% native vegetation cover class). After development, the area of native vegetation remains within the same native vegetation class despite being reduced by 9.8 7ha down to 794.93 ha. The area of native vegetation within the 100 ha circle before development is 52.71 ha (51-55 % native vegetation cover class). After development the area of native vegetation is reduced to 42.84 ha (41-45% native vegetation cover class). The Biobank Calculator generated a Percentage Native Cover Score of 1.00.
Connectivity value	The linkage width before development was determined to be in the >100 m – 500 m class; clearing of all vegetation on the Proposal Site will reduce the linkage width to >30m – 100m after development. The Biobank Calculator generated a Connectivity Score of 8.00.
Patch size	The patch size is greater than 200 ha, which a corresponding Patch Size Score of 12.
Strategic location	The Proposal Site is not within; a) An area of land identified as part of a state significant biodiversity link in a plan approved by the Chief Executive OEH, or b) The riparian buffer area of a third order stream or higher, an important wetland or an estuarine area. The Proposal Site is identified as being within a regional biodiversity habitat corridor (Shoalhaven Local Environment Plan 2014) on the SCC GIS and South Coast Regional Conservation Plan (DECCW, 2010). However for the purposes of the FBA, these are not identified as a regional biodiversity link and therefore a site based connectivity assessment is required.

Native vegetation

Plant community types

Two PCTs were identified within the Proposal Site.

- Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion (SR594, PCT 1082); and
- Grey Gum – Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion (SR549, PCT 858).

These PCTs were identified following a review of existing mapping and a rapid visual assessment of the Proposal Site and surrounding areas as well as analysis of data from three vegetation plots within PCT 1082 and one from within the PCT 858 (Figure 8-1). As PCT 858 is outside of the development footprint and will not be impacted, the data from the plot sampling this PCT was only used to verify the identity of the PCT. The assessment and calculation of biodiversity credits is based on the impact of the development on PCT 1082 only.

PCT 1082 is in the South East Dry Sclerophyll Forests Vegetation Class and its percent cleared estimate is 20 %.

Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion is not associated with any Threatened Ecological Communities (TECs) listed under the TSC Act or EPBC Act.

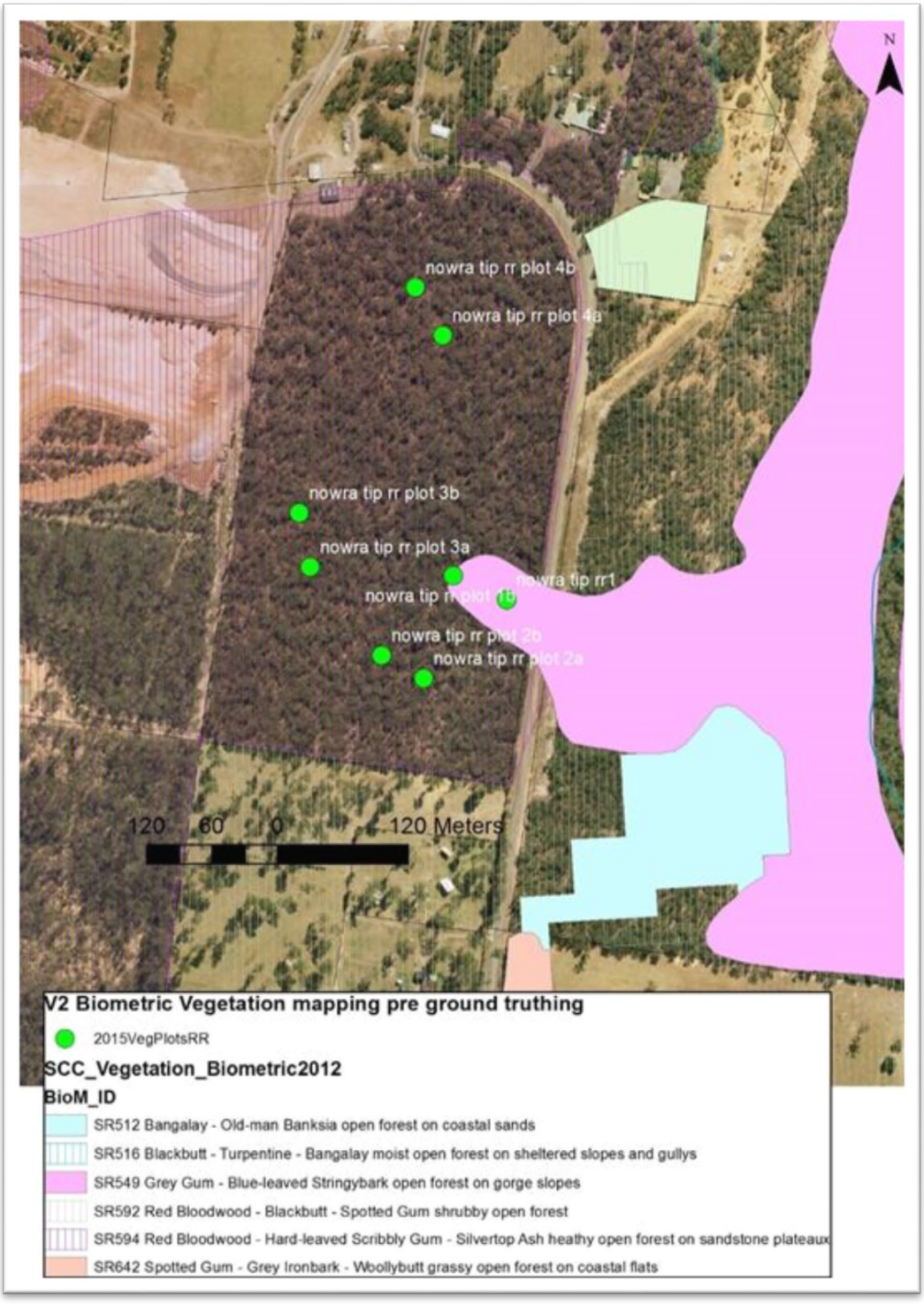

Figure 8-1 Biometric vegetation mapping and vegetation plot locations

Vegetation condition

Only one vegetation zone occurs on the Proposal Site within the development footprint, in PCT 1082. The vegetation zone covers 9.87 ha. The vegetation condition before development was assessed as being within Benchmark.

Vegetation on the Proposal Site, outside the development footprint, has been subjected to a small amount of historic disturbance but remains within Benchmark condition values. A small number of trees have been cleared with old weathered stumps observed

in a number of locations and vegetation in the south-east corner of the Proposal Site appears to have been cleared in the distant past during some minor quarrying activity.

The site value score for the vegetation zone identified on the development footprint was determined through assessment of site attribute data collected in three vegetation plots. The site attribute data was entered into the Biobanking credit calculator to generate site value scores.

Threatened species

Threatened species for assessment

Threatened species requiring survey and / or assessment were identified through:

- Project specific species identified in the SEARs as requiring survey or / and assessment
- The Biobank Calculator
- Previous recent biodiversity surveys on the Proposal Site and existing BioNet threatened species records.

The threatened species identified as requiring survey and assessment are listed in Table 8-5 and Table 8-6 below.

Table 8-5 Flora species requiring survey or/and assessment

Species Name	EPBC Act status	TSC Act status	Assessment method used
Acacia bynoeana Bynoe's Wattle	Vulnerable	Endangered	Survey
Calochilus pulchellus	Not listed	Endangered	Expert report
Cryptostylis hunteriana Leafless Tongue Orchid	Vulnerable	Vulnerable	Survey
Eucalyptus langleyi Albatross Mallee	Vulnerable	Vulnerable	Survey
Eucalyptus sturgissiana Ettrema Mallee	Not listed	Vulnerable	Survey
Galium australe Tangled Bedstraw	Not listed	Endangered	Survey
Genoplesium baueri Bauer's Midge Orchid	Endangered	Endangered	Survey
Hibbertia puberula	Not listed	Endangered	Survey
Hibbertia stricta subsp. furcatula	Not listed	Endangered	Survey
Melaleuca deanei Deane's Paperbark	Vulnerable	Vulnerable	Survey

Species Name	EPBC Act status	TSC Act status	Assessment method used
Pterostylis ventricosa	Not listed	Critically Endangered	Expert report
Pterostylis vernalis	Critically Endangered	Critically Endangered	Expert report
Triplarina nowraensis Nowra Heath Myrtle	Endangered	Endangered	Survey

Table 8-6 Fauna species requiring survey or / and assessment

Species Name	EPBC Act status	TSC Act status	Species/ Ecosystem credit species (FBA)	Suitable habitat present?
Broad-headed Snake *Hoplocephalus bungaroides*	Vulnerable	Endangered	Species	Marginal habitat only
Giant Burrowing Frog *Heleioporus australiacus*	Vulnerable	Vulnerable	Species	No (only marginal foraging habitat at best)
Masked Owl *Tyto novaehollandiae*	Not listed	Vulnerable	Ecosystem	Yes (large hollows on site)
Powerful Owl *Ninox strenua*	Not listed	Vulnerable	Ecosystem	Yes (large hollows on site)
Regent Honeyeater *Anthochaera phrygia*	Critically Endangered	Critically Endangered	Species	Habitat not optimal, only potentially provides occasional woodland foraging habitat when *C.gummifera* is in flower).
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	Not listed	Vulnerable	Ecosystem	Yes (foraging habitat only)
Eastern Pygmy-possum *Cercartetus nanus*	Not listed	Vulnerable	Species	Yes
Koala	Vulnerable	Vulnerable	Species	No (no core habitat due to

Species Name	EPBC Act status	TSC Act status	Species/ Ecosystem credit species (FBA)	Suitable habitat present?
Phascolarctos cinereus				lack of primary and secondary feed trees)
Large-eared Pied Bat *Chalinolobus dwyeri*	Vulnerable	Vulnerable	Species	Yes (foraging habitat)
Squirrel Glider *Petaurus norfolcensis*	Not listed	Vulnerable	Species	Yes
Yellow-bellied Glider *Petaurus australis*	Not listed	Vulnerable	Ecosystem	Yes

The presence of threatened species was assessed using habitat assessment, targeted surveys and expert reports. Details of survey methodology and timing are provided in Appendix B.

The results of the assessment for each species is detailed below in Table 8-7 and Table 8-8.

Table 8-7 Flora species assessment results

Species Name	Assessment outcomes
Acacia bynoeana Bynoe's Wattle	Potential habitat for the species was not found on the Proposal Site, but it was not detected during surveys.
Calochilus pulchellus Pretty Beard Orchid	An expert report found there is no suitable habitat for the species on the Proposal Site.
Cryptostylis hunteriana Leafless Tongue Orchid	While the Proposal Site contains what appears to be suitable habitat, the species was not detected during targeted seasonal surveys.
Eucalyptus langleyi Albatross Mallee	Potential habitat for the species was not found on the Proposal Site and it was not detected during surveys.
Eucalyptus sturgissiana Ettrema Mallee	Potential habitat for the species was not found on the Proposal Site and it was not detected during surveys.
Galium australe Tangled Bedstraw	Potential habitat for the species was not found on the Proposal Site and it was not detected during surveys.
Genoplesium baueri Bauer's Midge Orchid	A small area of potential habitat for the species occurs on the Proposal Site. The species was not detected during targeted seasonal surveys.
Hibbertia puberula	While the site contains what appears to be suitable habitat, the species was not detected during targeted seasonal surveys

Species Name	Assessment outcomes
Hibbertia stricta subsp. furcatula	While the site contains what appears to be suitable habitat, the species was not detected during targeted seasonal surveys
Melaleuca deanei Deane's Paperbark	Potential habitat for the species was not found on the Proposal Site and it was not detected during surveys.
Pterostylis ventricosa	An expert report found there is no suitable habitat for the species on the Proposal Site.
Pterostylis vernalis	An expert report found there is no suitable habitat for the species on the Proposal Site.
Triplarina nowraensis Nowra Heath Myrtle	This species is known to occur on the Proposal Site, with 83 plants detected. The plants occur at the start of a shallow drainage line that flows to the east and into Cabbage Tree Creek and away from the Proposal Site. The area where the specimens are found is outside the development footprint and buffered from the development by a minimum distance of 50m with a naturally vegetated area to be retained to screen the landfill from Flatrock Road.

Table 8-8 Fauna species assessment results

Species Name	Assessment outcomes
Broad-headed Snake *Hoplocephalus bungaroides*	Given the distance from escarpments and the lack of rock habitat on the Proposal Site, it is unlikely the species occurs there. Species not detected during six nights of spotlight surveys.
Giant Burrowing Frog *Heleioporus australiacus*	It is likely the Proposal Site only represents marginal foraging habitat at best for the species, and it is considered unlikely to occur on the site.
Masked Owl *Tyto novaehollandiae*	There is suitable breeding and roosting habitat for this species on the Proposal Site. Tentatively identified on the edge of Flatrock Road on the Proposal Site previously by GHD (2013). Species not detected utilising hollows during targeted surveys on the Proposal Site.
Powerful Owl *Ninox strenua*	The species was detected on site by Hyder (2007) and SCC (2015). A Powerful Owl was heard calling at dusk and into the early evening in June 2017. It is considered likely that the Proposal Site is part of the home range for a resident pair of this species. No nest sites were detected on the Proposal Site during targeted surveys.
Regent Honeyeater *Anthochaera phrygia*	Proposal Site contains sub-optimal seasonal foraging habitat only. Species not detected on site during surveys in accordance with guidelines.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	The species was detected with an Anabat along Flatrock Road by GHD (2014). The Proposal Site provides foraging habitat only for the species, with no breeding habitat (caves) available.

Species Name	Assessment outcomes
Eastern Pygmy-possum *Cercartetus nanus*	This species was detected in December 2013 and January 2014 on the Proposal Site in targeted pitfall trap surveys and once during a nocturnal spotlight survey in January 2014. It is likely the entire Proposal Site is utilised by the species.
Koala *Phascolarctos cinereus*	No primary or secondary feed trees for the Koala are present at the Proposal Site. No Koala scats were recorded during the GHD surveys, and no Koalas observed/heard during numerous diurnal and nocturnal surveys. Koalas may occur on the Proposal Site on occasion when moving between areas of better quality foraging habitat. They are unlikely to reside or breed in the Proposal Site due to the lack of primary and secondary feed trees. Given these considerations, the Proposal Site does not represent core Koala habitat as defined under SEPP 44.
Large-eared Pied Bat *Chalinolobus dwyeri*	The Proposal Site provides potential foraging habitat for Large-eared Pied Bats with potential roosting and breeding available along the escarpment cliffs along the Shoalhaven River and the lower reaches of Flatrock Creek to the north and east, respectively approximately one to 1.5 kilometres away. Large-eared Pied Bat was detected as “probable” to the north of the Proposal Site with an Anabat by GHD (2013).
Squirrel Glider *Petaurus norfolcensis*	This species was observed on the Proposal Site during spotlight surveys in January 2014. A Squirrel Glider was also observed approximately 200m away on land immediately to the southeast in mid 2013. The species was targeted with arboreal trapping but no animals were captured. Suitable habitat with numerous hollow-bearing trees and foraging signs is found across the Proposal Site.
Yellow-bellied Glider *Petaurus australis*	Hyder (2007) detected the species on the Proposal Site. The species was targeted with arboreal trapping but no animals were captured. Numerous hollows suitable for Yellow-bellied Glider are found across the site.

8.2.3 Avoidance and minimisation of impacts

Extension of the existing landfill site has been identified as a viable option by Council with the number of potential new sites within the LGA being limited.

Locale Consulting (2014) reviewed the suitability of 11 potential landfill sites within the Shoalhaven LGA, including the Proposal Site. The potential new sites would require a larger area of land clearing and therefore have greater direct impacts with a new site requiring a total minimum land area of 40 ha to accommodate stockpiling areas, infrastructure such as roads and buildings, and buffers.

The Proposal would make use of the existing infrastructure and therefore have a direct impact footprint at least a quarter of the size when compared to the area required to establish a new landfill elsewhere in the Shoalhaven.

8.2.4 Potential impacts

The Proposal Site contains 14.52 ha of native vegetation in moderate to good condition. Of this, 9.87 ha of the PCT Red Bloodwood – Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion will be directly impacted (cleared) for the Proposal. The remaining 4.65 ha will be maintained as part of a conservation area as shown on Figure 8-2.

West Nowra Landfill Extension

LEGEND

- Proposal site
- Propoed leachate irrigation area
- Indicative leachate pipeline
- WNRWF boundary
- Native vegetation to be cleared
- Conservation area
- Cadastre (LPI, 2017)

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Coordinate System: GDA 1994 MGA Zone 56
Date issued: April 30, 2019
Aerial imagery supplied by nearmap (Dec, 2018)

1:6,000 at A4

ARCADIS

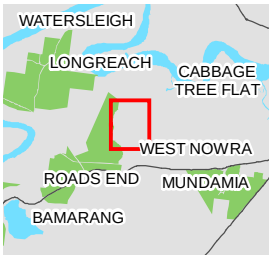


Figure 8-2: Native vegetation to be cleared

The 9.87 ha of native vegetation to be cleared for the Proposal contains terrestrial fauna habitat including habitat for a number of threatened species. The estimated hollow-bearing tree density across the Proposal Site is 27 trees per ha.

One threatened flora species *Triplarina nowraensis* was recorded on the Proposal Site. A total of 83 plants were detected however, these plants were recorded outside the development footprint and buffered by a minimum distance of 50 m. The Proposal Site also contains potential habitat for four additional flora species. These are *Cryptostylis hunteriana*, *Genoplesium baueri, Hibbertia puberula* and *Hibbertia stricta subsp. furcatula*. The Proposal is unlikely to have any direct or indirect impacts to threatened flora species.

Eleven threatened fauna species were recorded or assumed present on the Proposal Site. These were the Powerful Owl, Eastern Bentwing-bat, Glossy Black-Cockatoo, Eastern Pygmy-possum, Squirrel Glider, Yellow-bellied Glider and Grey-headed Flying-fox (*Pteropus poliocephalus*, listed as vulnerable under the TSC Act and EPBC Act). An additional four threatened fauna species were considered to have a "probable" likelihood of occurrence on the Proposal Site and were therefore assumed present. These were the Masked Owl, Large-eared Pied Bat, Eastern False Pipistrelle (*Falsistrellus tasmaniensis*, listed as vulnerable under the TSC Act) and Greater Broad-nosed Bat (*Scoteanax rueppellii*, listed as vulnerable under the TSC Act).

Out of the eleven threatened fauna species recorded or assumed present on the Proposal Site, nine are considered ecosystem credit species. These are the Powerful Owl, Masked Owl, Yellow-bellied Glider, Glossy Black-Cockatoo, Eastern False Pipistrelle and Greater Broad-nosed Bat. Three recorded threatened fauna species, the Grey-headed Flying-fox, Eastern Bentwing-bat and Large-eared Pied Bat, are considered dual-credit species under the FBA, where species credits are only required for impacts to breeding habitat. As the Proposal Site does not provide breeding habitat for any of these species, no species credits are required. Therefore, the Grey-headed Flying-fox, Eastern Bentwing-bat and Large-eared Pied Bat are also considered ecosystem credit species.

Two species credit species, the Squirrel Glider and the Eastern Pygmy-possum, are also known to inhabit the Proposal Site. Squirrel Glider are not common in the SCC Local Government area based on the number of BioNet Atlas records, and Eastern Pygmy-possum is thought to be more common but not regularly detected due to a lack of targeted survey effort.

The habitat in the Proposal Site contains elements critical to the life cycle of viable local populations, including potential breeding sites such as hollow-bearing trees. The FBA methodology accepts these ecosystem species as being able to withstand the loss of this habitat. In the likely event threatened fauna are utilising tree hollows on the Proposal Site, mitigation measures are proposed in relation to how and when hollow-bearing trees are to be removed.

The Proposal requires installation of six poles for the three fauna rope bridge crossings. It is unlikely that vegetation would be required to be removed, however, if clearing is required the area would need to be assessed by an ecologist as outlined in Section 8.2.5.

The Proposal has been designed to maintain connectivity through the rest of the Proposal Site to areas of known threatened species habitat to the south west, north and east. Nevertheless, the width of the existing connectivity corridor will be reduced.

Impacts requiring offset determination

Under the NSW Biodiversity Offsets Policy for Major Projects, a biobanking agreement is required to be used to secure an offset site. The ecosystem and species

credit offset requirements for the biodiversity impacts of the Proposal are detailed below.

Impacts on native vegetation

Loss of landscape and site value for the PCT and its associated ecosystem species, as determined using the credit calculator, is presented in Table 8-9.

Table 8-9 Impact summary for PCTs and associated ecosystem credit species requiring offsets and their required credits

Vegetation zone	Associated EECs and/or threatened species	Loss in landscape value	Loss in site value score	Number of ecosystem credits required
Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Masked Owl	21.00	90.10	719

Impacts on threatened species

Impacts to threatened species credit species and their associated species are summarised in Table 8-10.

Table 8-10 Impact summary for threatened species credit species requiring offsets and their required credits

Common name	Scientific name	Status	Impacts	Number of species credits required
Eastern Pygmy-possum	*Cercartetus nanus*	Vulnerable (TSC Act)	9.87 ha	197
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable (TSC Act)	9.87 ha	217

8.2.5 Mitigation measures

The mitigation measures outlined in Table 8-11 were recommended by SCC (2017b) to mitigate the direct loss of habitat and associated fauna, including threatened species, during construction and operation of the Proposal.

Table 8-11 Summary of flora and fauna mitigation measures

ID	Environmental safeguards	Timing
B*-01	Three rope bridges with monitoring cameras will be installed over Flatrock Road a minimum of one month before clearing of the development footprint commences to allow arboreal fauna to be accustomed to the rope bridges and be used once clearing works commence. The exact locations for the rope bridges are to be determined by SCC Environmental Assessment Officers in consultation with the relevant road engineers but approximate locations are found in Figure 29 in Appendix B.	Pre-construction
B-02	Prior to the commencement of any clearing works the extent of clearing must be accurately marked on the ground.	Pre-construction / construction
B-03	Clearing is only to be carried out during autumn and early winter following a trapping program to capture and relocate resident fauna. The trapping program is to involve terrestrial and arboreal trapping methods over a minimum of 2 separate occasions of 4 nights at an intensity to cover the clearing area under the supervision of a qualified and experienced ecologist. All methods and captures must be documented and recorded in a report to SCC and fauna records submitted to the NSW Wildlife Atlas. All fauna captured are to be relocated to areas of suitable habitat at the direction of the supervising ecologist or retained and kept in the care of a licenced wildlife handler until such time they can be safely released.	Pre-construction / construction
B-04	All clearing works are to be planned in consultation with a supervising ecologist with experience in land clearing and animal capture and handling.	Pre-construction
B-05	An experienced and qualified ecologist must supervise all clearing works on site. The ecologist may utilise the help of a NPWS licenced Wildlife Handler but be supervised on site by the ecologist.	Construction
B-06	To ensure any animals injured during the clearing are dealt with in a humane manner the supervising ecologist must have pre-organised a local vet to deal with injured native animals. Any animals injured during clearing works must be transported to the vet ASAP.	Pre-construction / construction
B-07	The clearing of the development extent must be completed in the following stages under the supervision and direction of the supervising ecologist. • Prior to clearing all hollow-bearing trees are to be clearly identified on site with a 5 m buffer around the trunk using barrier fencing or marking tape. • Stage one of clearing will be the under-scrubbing of the shrub layer and small trees less the 15 cm in diameter at “breast height” under the supervision of the commissioned ecologist. The ecologist is to check logs on the ground for fauna and rescue / relocate fauna as far as practicable. • Stage two of the clearing will be the felling of trees including hollow-bearing trees (HBT). Felling of HBTs is to be under the supervision of the ecologist and wildlife handler with hollow-bearing sections to be lowered to the ground using a “cherry	Construction

ID	Environmental safeguards	Timing
	picker" if it is known to contain fauna or potentially contains a fauna occupied hollow ("potentially" means the hollow can't be inspected by the ecologist or wildlife handler). Hollow sections may be dropped if known to be clear of fauna. Any trees with bird nests containing eggs must not be disturbed and can only be felled once the birds have fledged. • Hollow-bearing sections must be placed, under the supervision of the ecologist in consultation with SCC's Waste Services section, along disturbed areas on the Proposal Site outside the development footprint.	
B-08	Any disturbed bushland areas along Flatrock Road outside the development footprint (except for access to the monitoring wells) must be rehabilitated and returned to a weed free natural state using the services of a restoration ecologist or bush regenerator.	Construction/ operation
B-09	To improve fauna movements through the bushland remnant of the Proposal Site, fencing in the south-west corner of the subject lot where it adjoins the neighbouring existing landfill site, and along that portion of the southern boundary of the landfill site outside the "landfill cells", will be removed to allow for the clear passage of native fauna. The fencing must be removed prior to the landfill extension area becoming operational.	Construction/ operation
B-10	SCC will establish a formal Biobank Site (and/or purchase and retire the required biobanking credits) to offset the impacts of the vegetation clearing required as part of the Proposal.	Pre-clearing
B-11	Should any clearing for the installation of fauna poles be required, the area would need to be assessed by an ecologist and advice sought regarding the need for additional approvals for any required clearing.	Pre-clearing

* The 'B' predecessor indicates 'biodiversity' and this nomenclature has been used throughout the EIS.

8.2.6 Biodiversity offsets

Council is currently proposing several offset options for consideration. One option is to Biobank the portion of the Proposal Site being retained as a Conservation Area (shown on Figure 8-1) to provide for some of the credits needed in addition to the purchase and retirement of the required credits. The Conservation Area (4.65 ha) would generate 33 species credits each for the Eastern Pygmy-possum and Squirrel Glider (to be verified by OEH).

An Expression of Interest for the required ecosystem credits failed to attract the required credits.

Council is also investigating the potential to biobank a site at Huskisson approximately 22 km south east of the Proposal Site (Potential Huskisson Biobank Site). It is currently the site for the Huskisson Recycling and Waste Facility, with 55.28 ha of the 72.36 ha site available for biobanking. The 55.28 ha has a credit value of 699 ecosystem credits (to be verified by OEH). The Potential Huskisson Biobank Site is shown on Figure 8-3 (in relation to the Proposal Site) and Figure 8-4.

The native vegetation on the Huskisson site is not like-for-like with that to be impacted by the Proposal, but is more valuable (in terms of percent cleared and strategic location) than the vegetation to be cleared (SCC, 2017b). The site also contains a confirmed Eastern Pygmy-possum population worth 333 credits, Eastern Bristlebird (*Dasyornis brachypterus*, listed as Endangered under the TSC Act and EPBC Act)

habitat worth 100 credits (species credits to be verified by OEH) and habitat for Green and Golden Bell Frog (*Litoria aurea*, listed as Endangered under the TSC Act and Vulnerable under the EPBC Act) (subject of ongoing assessment).

Management actions proposed to improve the proposed Huskisson Biobank site include:

- Fox baiting (the species has been detected on the offset site during fauna surveys)
- Weed control (weed species are growing around the perimeter of the existing landfill site)
- Close and rehabilitate unauthorised tracks and install vehicle exclusion fencing.

Figure 8-3 Proposal Site relative to Biobank site

Biobank Site - 235 Huskisson Road, Huskisson (Lot 17, DP 857006)

Figure 8-4 Biobank site

8.3 Air quality and odour

An air quality impact assessment was undertaken by SLR (Appendix U) to investigate potential air quality and odour impacts on nearby sensitive receivers from the Proposal. This section provides a summary of the findings of this assessment and proposed mitigation measures in relation to potential impacts associated with the Proposal on air quality and odour.

Table 8-12 provides a summary of the relevant SEARs, which relate to air quality and where these have been addressed in this EIS.

Table 8-12 SEARs relevant to air quality and odour

Section	Requirement	Where addressed
Air quality and odour	– A quantitative assessment of the potential air quality and odour impacts of the development on surrounding receivers, including impact from construction, operation and transport; and	Section 8.3.3 Appendix U
	– Details of the proposed mitigation, management and monitoring measures	Section 8.3.4 Appendix U

8.3.1 Methodology

The Air Quality Impact Assessment (SLR, 2019d) was prepared based on a number of worst case scenarios to determine the odour and dust impacts on surrounding sensitive receivers.

Meteorological modelling

Odour and particulate emissions from the WNRWF have been modelled using the US EPA's CALPUFF modelling system as recommended by the NSW EPA. To determine a representative meteorological year for use in dispersion modelling, meteorological data from 2012 – 2016 were analysed at the Nowra Airport location, analysing:

- Percentage of calm wind speed events
- Wind speeds
- Wind direction
- Temperature.

Odour

Odour emissions from the WNRWF have been compiled using data sourced from a detailed emissions monitoring survey completed at the Eastern Creek Landfill in 2009 (SLR, 2019d). The monitoring survey consisted of measurements of odour emission rates from the following sources that are comparable to the existing WNRWF:

- The active waste disposal area
- Daily cover
- Intermediate capped areas
- Final capped areas
- Leachate dam
- Green waste / compost stockpiles.

Dust

To assess potential cumulative $PM_{2.5}$ and PM_{10} concentrations, the incremental 24-hour average PM_{10} concentrations predicted by the modelling for the Proposal were added to the daily varying PM_{10} concentrations measured at Bargo air quality monitoring station over the same period (2014 calendar year).

Scenarios assessed

Construction and operational activities associated with the Proposal have been assessed on worst case scenarios discussed in the following sections. These worst-case scenarios include a high growth in waste volumes and assume no resource recovery operations have been implemented. It is unlikely that these worst-case scenarios will actually eventuate and the predicted off-site impacts are anticipated to be conservative estimates of actual impacts. The locations of the key activities giving rise to odour and dust emissions assumed in the assessment are shown in Figure 8-5 to Figure 8-7.

Odour

The following construction and operational activities associated with the Proposal have been assessed using the following worst case odour scenarios:

- Stages 2 and 3 areas have reached waste capacity and are final capped
- The active landfill disposal face, where disposal of waste is occurring, is located at the southern end of landfill sub-cell 1 of Stage 4, which is located closest to the nearest sensitive receptors

- Recently disposed waste in landfill sub-cell 1 of Stage 4 adjacent to the active landfill disposal face covered daily, with the area assumed to be equivalent to twice the active landfill disposal face area
- Remainder of landfill sub-cell 1 of Stage 4 assumed to be filled and capped with an appropriate final capping material
- Existing leachate dam to remain at the current size
- Landfill sub-cells 2 - 6 of Stage 4 assumed to be filled and final capped – *Note this has been assumed to provide a worst-case emissions scenario for use in the modelling and will not happen in reality as filling of Stages 2 – 6 will not occur until after Stage 1 is completed. This assumption has been included as a conservative approach to cover the end of life scenario where sub-cells 1 – 5 have been filled and sub-cell 6 is being filled, while keeping the most odorous source, the active landfill disposal face, closest to the nearest sensitive receptor*
- Fresh green waste stockpile, composting windrows, mature compost stockpile and associated materials handling activities remain located in the Stage 1 area at the current sizes/activity rates.

Dust

The following construction and operational activities associated with the Proposal have been assessed using the following two dust emissions worst case scenarios:

Dust Emissions – Scenario 1 (concurrent operation of existing landfill and construction of landfill sub-cell 1 in the Proposal landfill extension area):

- Construction of landfill sub-cell 1 of Stage 4 and the drainage system completed over a 1 month period
- Excavated soils from landfill sub-cell 1 of Stage 4 loaded onto a truck
- Transport of excavated soils along internal unpaved road to landfill sub-cell 2 area
- Unloading of waste at the southern end of Stage 3
- Landfill articulated compactor operating at active landfill disposal face in Stage 3 and
- Wind erosion from all unvegetated areas of Stages 2 and 3, and from composting area.

Dust Emissions – Scenario 2 (concurrent operation of landfilling in sub-cell 1 and construction of landfill sub-cell 2 in the Proposal area):

- Construction of landfill sub-cell 2 of Stage 4 completed over a 1 month period
- Excavated soils from landfill sub-cell 2 of Stage 4 loaded onto a truck
- Transported of excavated soils along internal unpaved road to landfill sub-cell 1
- Unloading of excavated soils in landfill sub-cell 1
- Bulldozer or other appropriate machinery spreading / placing unloaded soil in landfill sub-cell 1
- Transport of waste on internal paved and unpaved roads to landfill sub-cell 2
- Disposing of waste at the southern end of landfill sub-cell 2
- Articulated landfill compactor operating at active waste disposal area in landfill sub-cell 2
- Wind erosion from landfill sub-cell 1, Stages 2 and 3, and the composting area.

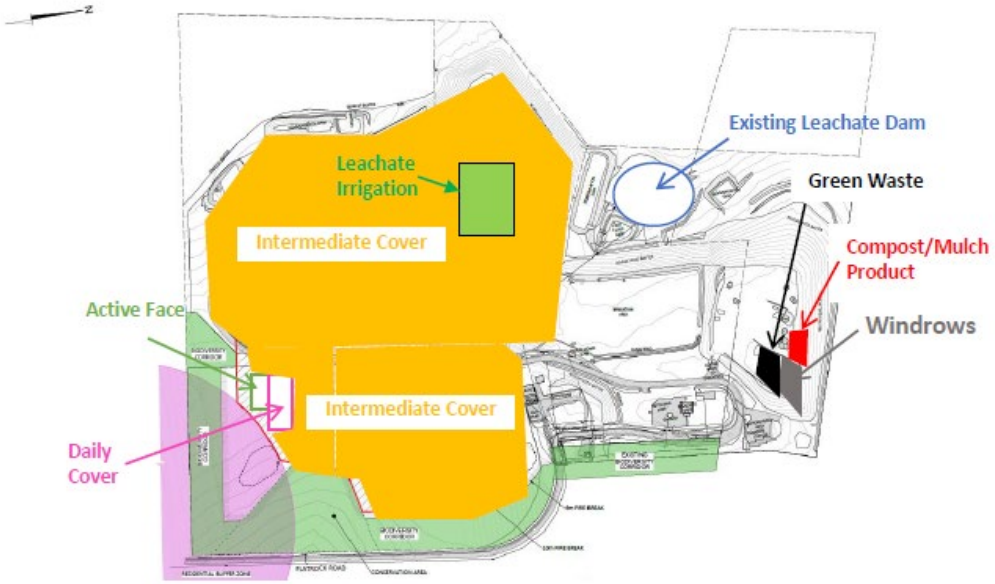


Figure 8-5 Source locations for assessing potential worst case odour impacts

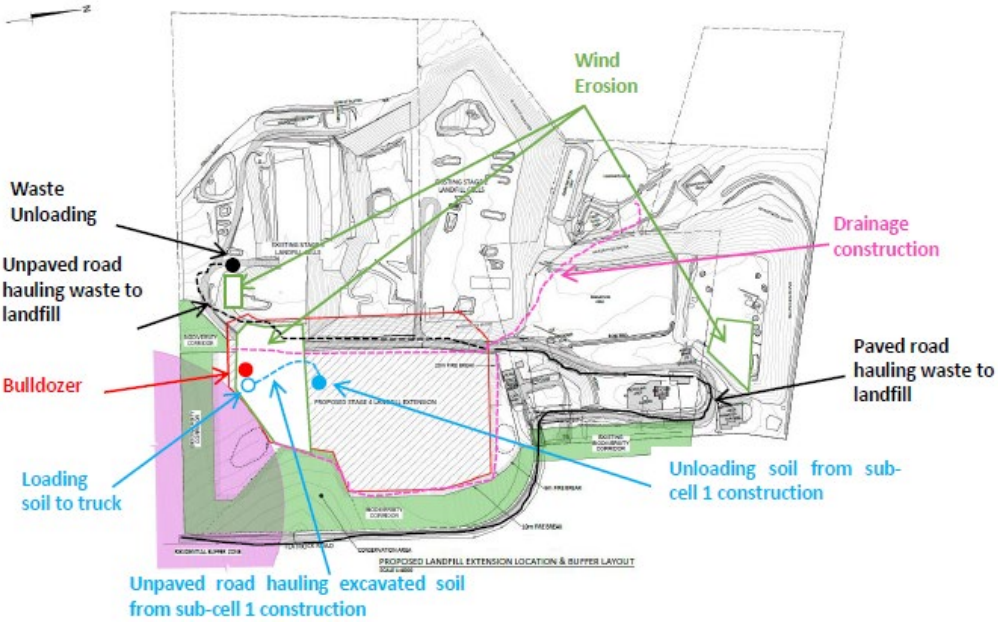


Figure 8-6 Source locations for assessing potential worst case dust impacts – Scenario 1

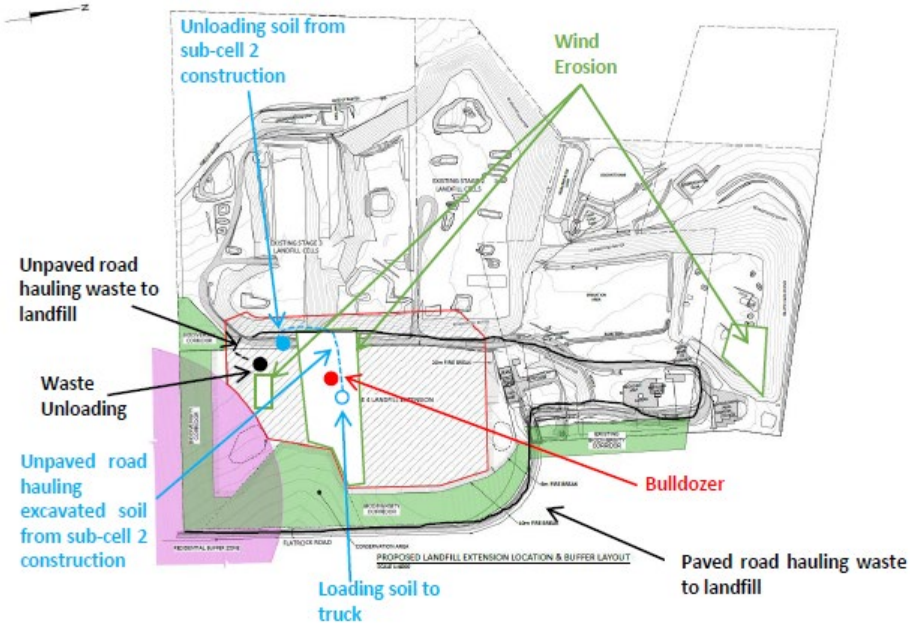


Figure 8-7 Source locations for assessing potential worst case dust impacts - Scenario 2

8.3.2 Existing environment

Sensitive receivers

The land use surrounding the Proposal Site is predominantly vegetated bushland. The nearest sensitive receivers to the Proposal Site, and potentially most affected are identified in Table 8-13 and Figure 8-8, including their approximate distance from the Proposal Site.

Table 8-13 Sensitive receivers closest to the Proposal Site

Receptor	Address	Distance to site boundary (m)
Residential		
R1	Residential dwelling, 43 Flatrock Road	90 m south
R2	Residential dwelling, 41 Flatrock Road	190 m south
R3	Residential dwelling/shed, 3 Flatrock Road	375 m south
R4	Residential dwelling, 3 Flatrock Road	420 m south
R5	Residential dwelling, 3 Flatrock Road	515 m south
R6	Residential dwelling, 3 Flatrock Road	460 m south
R7	Residential dwelling, 18 Bamarang Road	510 m south
R8	Jim Da Silva Farm, 38A Old Bamarang Drive	550 m southwest
R9	56 Stonegarth Road	1000 m northeast
Commercial		

Receptor	Address	Distance to site boundary (m)
C1	RSPCA Shoalhaven Animal Shelter	85 m northeast
C2	OEH buildings	55 m northeast
C3	University of Wollongong – Shoalhaven Campus	1300 m east

Figure 8-8 Air quality sensitive receivers

Long-term meteorological data

Long-term meteorological data from the Bureau of Meteorology (BOM) weather station at Nowra Airport, located approximately seven kilometres south-west of the Proposal Site, were analysed to characterise the local climate in the proximity of the Proposal Site including wind speed, wind direction, temperature, relative humidity and rainfall.

Figure 8-9 presents wind rose plots at 9 am and 3 pm for Nowra Airport for the period 2000 – 2017. The data shows varying patterns of wind speed and consistent patterns of wind direction during the morning, with north westerly winds being prevalent in the morning. Whilst, during the afternoon, the data shows consistent patterns of wind speed and varying patterns of wind direction.

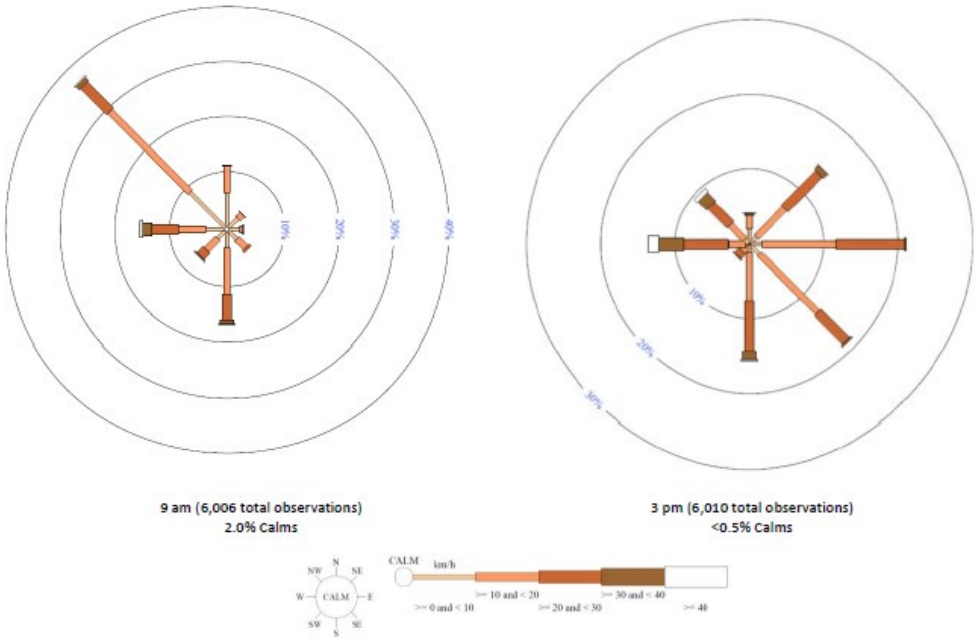


Figure 8-9 9am and 3pm Wind Roses – Nowra Airport AWS Wind Data (2000 – 2017)

Figure 8-10 presents long term temperature data at Nowra Airport for the period 2000 to 2017. Temperature data indicates that the mean maximum temperatures range from 16.0°C in winter to 27°C in summer, while mean minimum temperatures range from 6°C in winter to 17°C in summer.

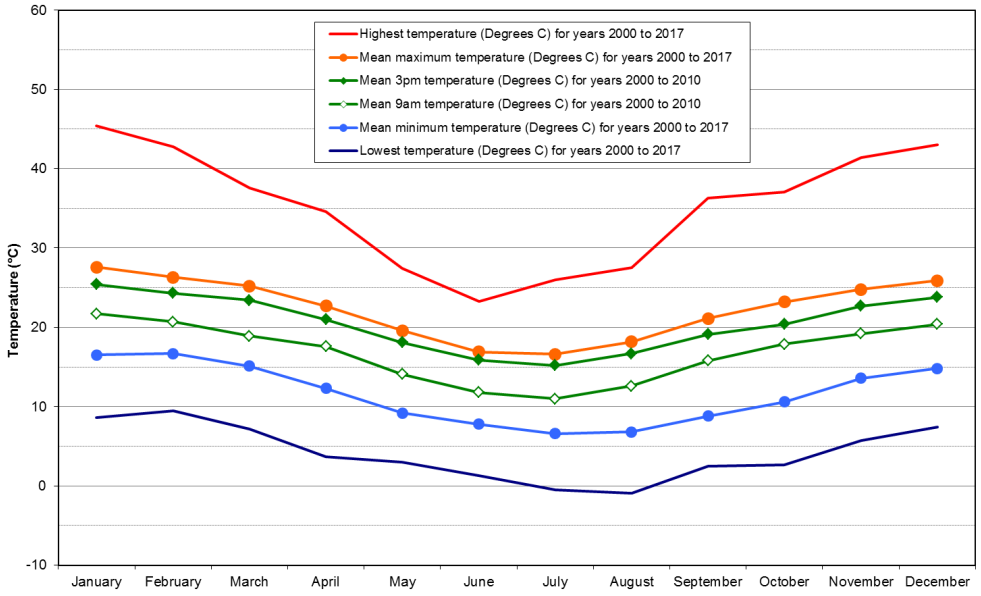


Figure 8-10 Long-term temperature data for Nowra (2000 – 2017)

Figure 8-11 presents the long-term monthly rainfall data at Nowra Airport for the period 2000 to 2017. Rainfall data indicates that the average annual rainfall in the region is 901.5 mm, with the average monthly rainfall ranging from 51 mm to 133 mm. The driest months are in late winter and spring, with higher rainfalls experienced in the summer months.

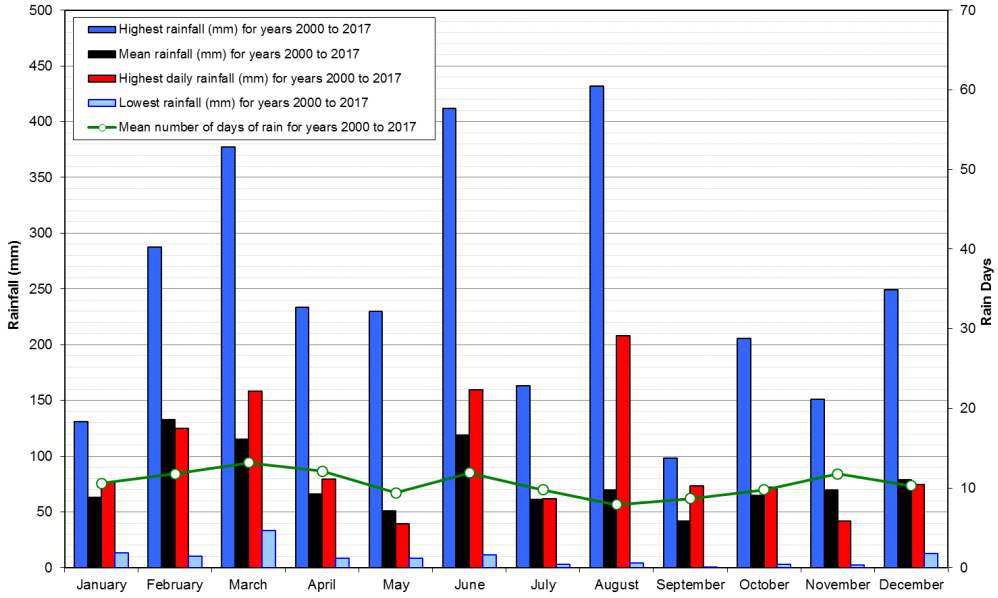


Figure 8-11 Long-term monthly rainfall data for Nowra (2000 - 2017)

Figure 8-12 presents humidity data for Nowra Airport for the period 2000 to 2010. Relative humidity data indicates that morning humidity levels range from an average of approximately 75 % in late summer to around 55 % in spring. Afternoon humidity levels are slightly lower at approximately 63 % in late summer and dropping to 46% in late winter.

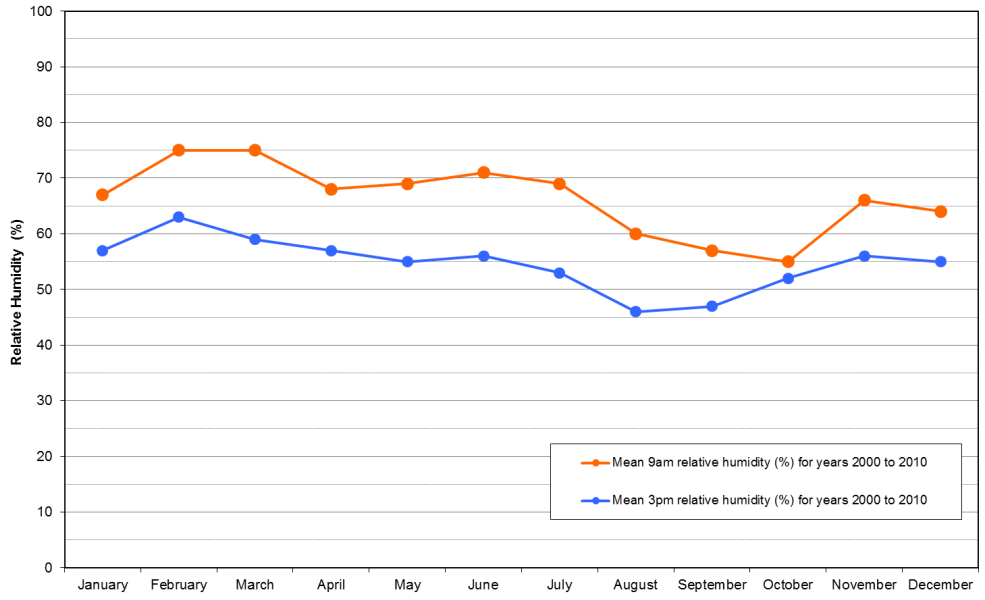


Figure 8-12 Long-term humidity data for Nowra (2000 - 2010)

Local ambient air quality

Odour

The most significant potential odour sources in the vicinity of the sensitive receivers are the existing activities at the WNRWF and the natural odours generated by surrounding vegetation and potentially manure from grazing activities. Existing odour levels at sensitive receivers are understood to be negligible, however the WNRWF has received three odour related complaints between 2006 and 2018. These

complaints have been addressed through consultation with complainants and operational improvements.

Dust and particulate matter

No ambient air quality monitoring stations are in the area surrounding the Proposal Site, with the closest EPA air quality monitoring station located approximately 40 km north of the Proposal Site in Albion Park. However, this monitoring site is located in a built up residential area that would be heavily impacted by vehicle emissions. As a result, Bargo air quality monitoring station located approximately 62 km north of the Proposal Site was chosen as it is located in a much similar setting to the Proposal Site. It is surrounded by rural residential properties, agricultural operations and national parks.

A summary of the background total suspended particulate (TSP), PM_{10} and $PM_{2.5}$ used in this assessment is provided in Table 8-14.

Table 8-14 Background concentrations assumed for this assessment

Pollutant	Averaging Period	Adopted Background Concentration/Level
TSP	Annual	29 µg/m^3
PM_{10}	24 hour	14.5 µg/m^3
	Annual	Daily varying
$PM_{2.5}$	24 hour	6.6 µg/m^3
	Annual	Daily varying

8.3.3 Potential impacts

Assessment criteria

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the applicable air quality criteria for the potential air emissions that would be generated by the Proposal.

Odour

The NSW EPA criteria for acceptable levels of odour range from 2 to 7 odour units (OU), with a more stringent criterion applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas. Considering the low population density and rural nature of the area, a criterion of 5 OU is therefore considered to be appropriate for the Proposal.

Dust

Table 8-15 summarises the air quality criteria for dust and particulate matter that are relevant to the Proposal. The air quality criteria relate to the total concentrations of dust and particulate matter in the air and not just pollutants from the Proposal. As such background levels require consideration when using this criterion to assess impacts.

Table 8-15 NSW EPA air quality assessment criteria

Pollutant	Averaging period	Impact	Criteria
Total suspended particulates (TSP)	Annual	Total	90 µg/m^3
Particulate matter PM_{10}	Annual	Total	25 µg/m^3
	24 hours	Total	50 µg/m^3
Particulate matter $PM_{2.5}$	Annual	Total	8 µg/m^3
	24 hours	Total	25 µg/m^3
Deposited dust	Annual	Total	4 g/m^2/month
	Annual	Incremental	2 g/m^2/month

Air quality impacts

Odour

The predicted operational odour impacts are presented in Table 8-16. These results indicate that at the predicted 99th percentile, odour concentrations associated with the Proposal comply with the adopted criteria at all identified residential receivers except R1 which is located approximately 90 m south of the Proposal Site. The exceedance is only slightly above adopted criteria and a review of predicted odour concentrations at R1 indicated that concentrations above 5 OU are predicted to occur from 5:00 pm to 5:00 am. This exceedance is considered to be negligible as odour concentrations are based on a number of conservative assumptions and the results presented in Table 8-16 are conservative worst-case impacts and the actual odour concentrations at R1 and all other sensitive receivers should be lower than predicted odour concentrations presented in Table 8-16.

At commercial receivers' odour concentrations are predicted to exceed adopted criteria at C1 and C2. However, these receptors would not be considered to be particularly sensitive to odour as they are located adjacent to the existing landfill where periods of detectable odour are expected. A review of odour concentrations found that concentrations above 5 OU are predicted to occur from 4:00 pm to 7:00 am where people will not be present during these hours.

The results presented in Table 8-16 also show that odour emissions from the proposed irrigation of leachate on the surface of the existing stage 2 (closed) landfill area are predicted to have a very minimal impact on the predicted cumulative off-site odour concentrations.

To ensure odour concentrations are controlled and the potential for impacts to sensitive receivers are reduced, appropriate mitigation measures described in Section 8.3.4 will be implemented.

Table 8-16 Predicted 99th percentile odour concentrations

ID	Name	Odour concentration (OU)	
		Without leachate irrigation	With leachate irrigation
Residential			
R1	Residential dwelling, 43 Flatrock Road	**6.3**	**6.3**
R2	Residential dwelling, 41 Flatrock Road	4.1	4.2
R3	Residential dwelling/shed, 3 Flatrock Road	3.6	3.7
R4	Residential dwelling, 3 Flatrock Road	2.7	2.8
R5	Residential dwelling, 3 Flatrock Road	2.0	2.0
R6	Residential dwelling, 3 Flatrock Road	2.6	2.6
R7	Residential dwelling, 18 Bamarang Road	2.6	2.6
R8	Jim Da Silva Farm, 38A Old Bamarang Drive	3.3	3.3
R9	56 Stonegarth Road	1.8	1.9
Commercial			
C1	RSPCA Shoalhaven Animal Shelter	**12.6**	**12.7**
C2	OEH buildings	**12.6**	**12.7**
C3	University of Wollongong – Shoalhaven Campus	1.0	1.1
Criterion		**5.0**	

Dust

The incremental and cumulative annual average TSP concentrations and maximum monthly incremental dust deposition rates predicted at surrounding sensitive receivers for Scenario 1 and 2 are presented in Table 8-17. Modelling results presented in Table 8-17 indicate that the cumulative TSP concentrations and incremental dust deposition rates predicted at each sensitive receiver complies with relevant ambient air quality criteria.

Table 8-17 Predicted TSP concentrations and dust deposition rates - Scenarios 1 and 2

Receptor ID	Annual average incremental TSP concentrations (µg/m³)		Annual average cumulative TSP concentrations* (µg/m³)		Maximum monthly incremental dust deposition rates (g/m²/month)	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Residential						
R1	4.6	3.0	34	32	0.5	0.3
R2	1.8	1.4	31	30	0.2	0.1
R3	0.9	0.8	30	30	0.1	0.1
R4	0.7	0.6	30	30	0.1	0.1
R5	0.5	0.5	30	29	<0.1	<0.1
R6	0.6	0.6	30	30	0.1	<0.1
R7	0.6	0.6	30	30	0.1	0.1
R8	1.1	1.0	30	30	0.1	0.1
R9	0.4	0.5	29	29	<0.1	<0.1
Commercial						
C1	5.6	6.6	35	36	0.5	0.6
C2	7.2	9.3	36	38	0.8	1.0
C3	0.7	0.7	30	30	0.1	0.1
Criteria	-	-	**90**	**90**	**2.0**	**2.0**

The cumulative annual average and 24-hour average PM_{10} concentrations predicted at surrounding sensitive receivers for Scenario 1 and 2 are presented in Table 8-18. Daily varying background PM_{10} data recorded at Bargo in 2014 (concurrent with meteorological data) have been used to calculate the incremental and cumulative impacts. The number in brackets in the cumulative 24-hour column indicates the number of days per annum predicted to exceed the NSW EPA criteria of 50 µg/m³. Modelling results presented in Table 8-18 demonstrates that the predicted annual average PM_{10} concentrations are below the NSW EPA criteria at all sensitive receivers. The maximum 24 hour average cumulative PM_{10} concentrations predicted at the nearest sensitive receivers exceed all relevant NSW EPA criteria at all receivers for both scenarios. This is due to background data files containing one marginal exceedance of 50.8 µg/m³ (recorded on 29 September 2015) caused by elevated background PM_{10} concentration emissions. None of the sensitive receivers are predicted to experience any additional exceedance due to emissions from the Proposal.

Table 8-18 Predicted PM_{10} concentrations – scenarios 1 and 2

Receptor ID	24-hour average PM_{10} Concentrations ($\mu g/m^3$)[16]				Annual average PM_{10} Concentrations ($\mu g/m^3$)[17]			
	Incremental		Cumulative[18]		Incremental		Cumulative	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Residential								
R1	26.7	21.3	54.5 (1)	52.7 (1)	1.7	1.1	16.1	15.6
R2	16.4	11.5	52.0 (1)	51.6 (1)	0.7	0.5	15.2	15.0
R3	5.0	4.7	51.2 (1)	51.2 (1)	0.4	0.3	14.8	14.8
R4	4.3	3.8	51.2 (1)	51.2 (1)	0.3	0.3	14.7	14.7
R5	4.2	3.2	51.2 (1)	51.1 (1)	0.2	0.2	14.7	14.6
R6	4.0	3.6	51.2 (1)	51.1 (1)	0.3	0.2	14.7	14.7
R7	4.0	3.8	51.1 (1)	51.1 (1)	0.3	0.2	14.7	14.7
R8	8.4	7.5	51.1 (1)	51.0 (1)	0.5	0.4	14.9	14.9
R9	3.1	3.5	50.9 (1)	50.9 (1)	0.2	0.2	14.6	14.7

[16] Includes daily varying background PM_{10} concentrations based on data from Bargo

[17] Includes an assumed annual average PM_{10} background value of 14.5 $\mu g/m^3$

[18] There is already one day in the background data file with a 24-hour average concentration above 50 $\mu g/m^3$, hence only *additional* exceedances are considered to represent non-compliances.

Receptor ID	24-hour average PM_{10} Concentrations (µg/m³)[16]				Annual average PM_{10} Concentrations (µg/m³)[17]			
	Incremental		Cumulative[18]		Incremental		Cumulative	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Commercial								
C1	21.4	26.1	51.8 (1)	51.8 (1)	1.9	2.3	16.3	16.7
C2	24.1	31.0	53.3 (1)	54.1 (1)	2.3	3.0	16.7	17.5
C3	3.7	3.6	51.7 (1)	51.8 (1)	0.3	0.3	14.8	14.8
Criteria	**-**		**50.0**		**-**		**25.0**	

The cumulative annual average and 24-hour average $PM_{2.5}$ concentrations predicted at surrounding sensitive receivers for Scenario 1 and 2 are presented in Table 8-19. Daily varying background PM_{10} data recorded at Bargo in 2014 (concurrent with meteorological data) have been scaled by a ratio of 0.46 to provide estimates of background $PM_{2.5}$ concentrations to enable an assessment of potential cumulative impacts. Modelling results presented in Table 8-19 show that the maximum 24-hour average incremental and cumulative $PM_{2.5}$ concentrations and annual average incremental and cumulative $PM_{2.5}$ concentrations predicted at all sensitive receivers are below established criteria.

Table 8-19 Predicted $PM_{2.5}$ concentrations – Scenarios 1 and 2

Receptor ID	24-hour average $PM_{2.5}$ Concentrations (µg/m³)[1]				Annual average $PM_{2.5}$ Concentrations (µg/m³)			
	Incremental		Cumulative		Incremental		Cumulative	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Residential								
R1	2.8	2.3	23.8	23.6	0.2	0.1	6.8	6.8
R2	1.8	1.2	23.5	23.5	0.1	0.1	6.7	6.7
R3	0.6	0.5	23.4	23.4	<0.1	<0.1	6.7	6.7
R4	0.5	0.4	23.4	23.4	<0.1	<0.1	6.7	6.7
R5	0.5	0.4	23.4	23.4	<0.1	<0.1	6.7	6.7
R6	0.4	0.4	23.4	23.4	<0.1	<0.1	6.7	6.7
R7	0.5	0.4	23.4	23.4	<0.1	<0.1	6.7	6.7
R8	0.9	0.8	23.4	23.4	0.1	<0.1	6.7	6.7
R9	0.4	0.4	23.4	23.4	<0.1	<0.1	6.7	6.7
Commercial								
C1	9.8	12.5	23.7	23.6	0.7	0.9	7.4	7.6
C2	10.7	14.4	24.2	24.3	0.9	1.2	7.5	7.8
C3	1.9	2.0	23.8	23.8	0.1	0.1	6.8	6.8
Criteria	**-**		**25.0**		**-**		**8.0**	

8.3.4 Mitigation measures

The air quality impact assessment has demonstrated that the Proposal is expected to comply with all relevant air quality at surrounding sensitive receivers except R1 which is located 90 m to the south of the Proposal Site. Regular consultation and communication with this sensitive receiver is recommended to ensure that odours from the Proposal and WNRWF are managed to acceptable levels. Table 8-20 identifies additional mitigation measures that would be implemented during construction and operation of the Proposal to reduce dust and odour impacts to sensitive receivers.

Table 8-20 Air quality and odour mitigation measures

ID	Mitigation measures	Timing
AQ-1	The LEMP would be updated to include the following dust and odour mitigation measures: • methods for management of odour and dust emissions into site inductions, training and daily toolbox meetings. • Ensure all trucks entering and leaving the premises carrying loads are to be covered at all times • Train staff to ensure that any particularly odorous loads are quickly covered to prevent significant odour emissions • The active tipping face would be kept as small as practicable	Construction / operation
AQ-2	Implement and regularly review traffic management procedures to co-ordinate delivery schedules and avoid queueing of incoming or outgoing trucks at the Facility for extended periods of time.	Construction / operation
AQ-3	Plant and machinery will be regularly checked and maintained in accordance with manufacturer's specifications, engines switched off when not in use and fitted with emission control devices complying with Australian Design Standards	Construction / operation
AQ-4	Record any dust and/or odour complaints in the Customer Relationship Management System and include the following information: • The time and date the complaint was received • The location where dust and/or odours were observed; • A description of the nature of the dust and/or odour • Any information the complainant can provide on the meteorological conditions at the time of the complaint; • Contact details for the complainant; and • The feedback provided to the complainant once the event has been investigated. Records of complaints will be provided to the EPA.	Construction / operation

8.4 Soil, water and leachate

A soil, water and leachate assessment was undertaken by SLR (Appendix N) to investigate potential soil, water and leachate impacts of the Proposal. This section provides a summary of the findings of the assessment and proposed mitigation measures.

Table 8-21 provides a summary of the relevant SEARs, which relate to soil, water and leachate and where these have been addressed in this EIS.

Table 8-21 SEARs relevant to soil, water and leachate

Section	Requirement	Where addressed
Soil, water and leachate	– A detailed site water balance including identification of water requirements for the life of the project, measures that would be implemented to ensure an adequate and secure water supply is available for the proposal and a detailed description of the measures to minimise the water use at the site	Section 8.4.3 Appendix N
	– Consideration of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* and *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*;	Section 6.2.13
	– Consideration of potential acid sulfate soils, salinity and soil contamination	Section 8.4.2 Section 8.4.3
	– A detailed assessment of the potential impacts of the project on the quantity, quality and long-term integrity of the surface and groundwater resources in the area, including Cabbage Tree Creek and the Shoalhaven River, including baseline data of existing conditions and potential flooding impacts	Section 8.4.3
	– Characterisation of water quality at the point of discharge to surface and/or groundwater against the relevant water quality criteria (including details of the contaminants of concern that may leach form waste into the wastewater and proposed mitigation measures to manage any impacts to receiving waters);	Section 8.4.2 Section 8.4.3 Section 8.4.4
	– The proposed stormwater management systems, including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water	Section 5.5.3 Section 8.4.4
	– The proposed leachate management system including the capacity of the system to treat and dispose of leachate; and	Section 5.5 Section 5.6 Section 8.4.4

Section	Requirement	Where addressed
		Appendix N Appendix L
	– The proposed erosion and sediment controls during construction and operation	Section 8.4.4 Appendix N Appendix L

8.4.1 Methodology

The soil, water and leachate assessment undertaken by SLR (Appendix N) considered the following legislation, policies and guidelines:

- *Water Management Act 2000*
- *Water Act 1912*
- *Protection of the Environment Operations Act 1997*
- State Environmental Planning Policy No. 55 – Remediation of Land
- Greater Metropolitan Region Unregulated River Water Sources (2011)
- Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2018)
- Managing Urban Stormwater: Soils & Construction (NSW Government, 2004)
- National Environmental Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) April 2011, Schedule B2, Guideline on Site Characterisation (hereafter referred to as the Amendment 1 NEPM 2013);
- National Water Quality Management Strategy, Department of Environment, Australian Government, 1992;
- NSW State Rivers and Estuaries Policy, NSW Government 1993; and
- State Water Management Outcomes Plan (WM Act, 2000).

The assessment included:

- Review of the existing environment and surrounding land uses including topography, hydrology, hydrogeology, soils and flooding.
- Analysis of relevant site investigations including contamination assessments and geotechnical studies
- Review of site history using aerial imagery and search of publicly available government databases and title searches
- Development of a site water balance
- HELP-modelling to estimate leachate production
- Identification of potential soil, water and leachate impacts of the Proposal on the Proposal Site and surrounding area
- Analysis of proposed mitigation measures to reduce potential soil, water and leachate impacts of the Proposal.

8.4.2 Existing environment

Soil

Geology and soils

A review of the 1:250,000 Wollongong Geological Map (1966) indicated that the Proposal Site is underlain by Nowra Sandstone and Wandrawandian Siltstone of the Permian age Shoalhaven Group. The Shoalhaven Group predominantly comprises marine shelf to coastal plain sediments and the Nowra Sandstone consists typically of quartz sandstone (see Section 2.3.2 for further details).

An investigation conducted by Coffey (2016) indicated that the top of bedrock was found to be between six and seven metres below ground surface and this was found to be highly to moderately weathered sandstone. The overburden material was typically found to be sandy or silty clay of low to high plasticity, overlaying clayey sand.

Acid sulfate soils

A search of the Australian Soil Resource Information System (CSIRO, 2017) indicated that the Proposal Site has no known occurrence of Acid Sulfate Soils (ASS). The topography of the Proposal Site is 40 – 50 m Australian Height Datum (AHD), and ASS are predominantly encountered at < 20 m AHD, therefore it's unlikely that ASS would be present on the Proposal Site (Figure 8-13).

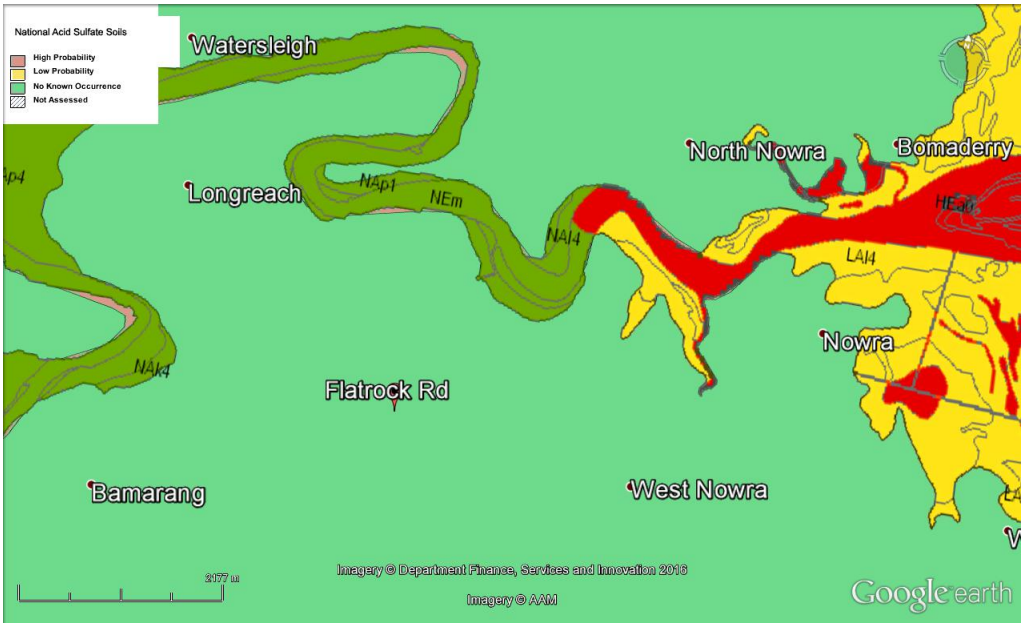


Figure 8-13 Acid sulfate soil mapping (CSIRO, 2017)

Salinity

According to salinity mapping provided by DPI, the Proposal Site is zoned as having a salinity hazard ranking of low. In this area, salt stores are considered low and salinity outbreaks are uncommon. Resilience refers to the ability of a soil to resist change or restore itself back to its healthy state in response to change. In this area, resilience is considered moderate as the soils are shallow and infertile but this is counterbalanced by relatively high rainfall.

Water

Surface water

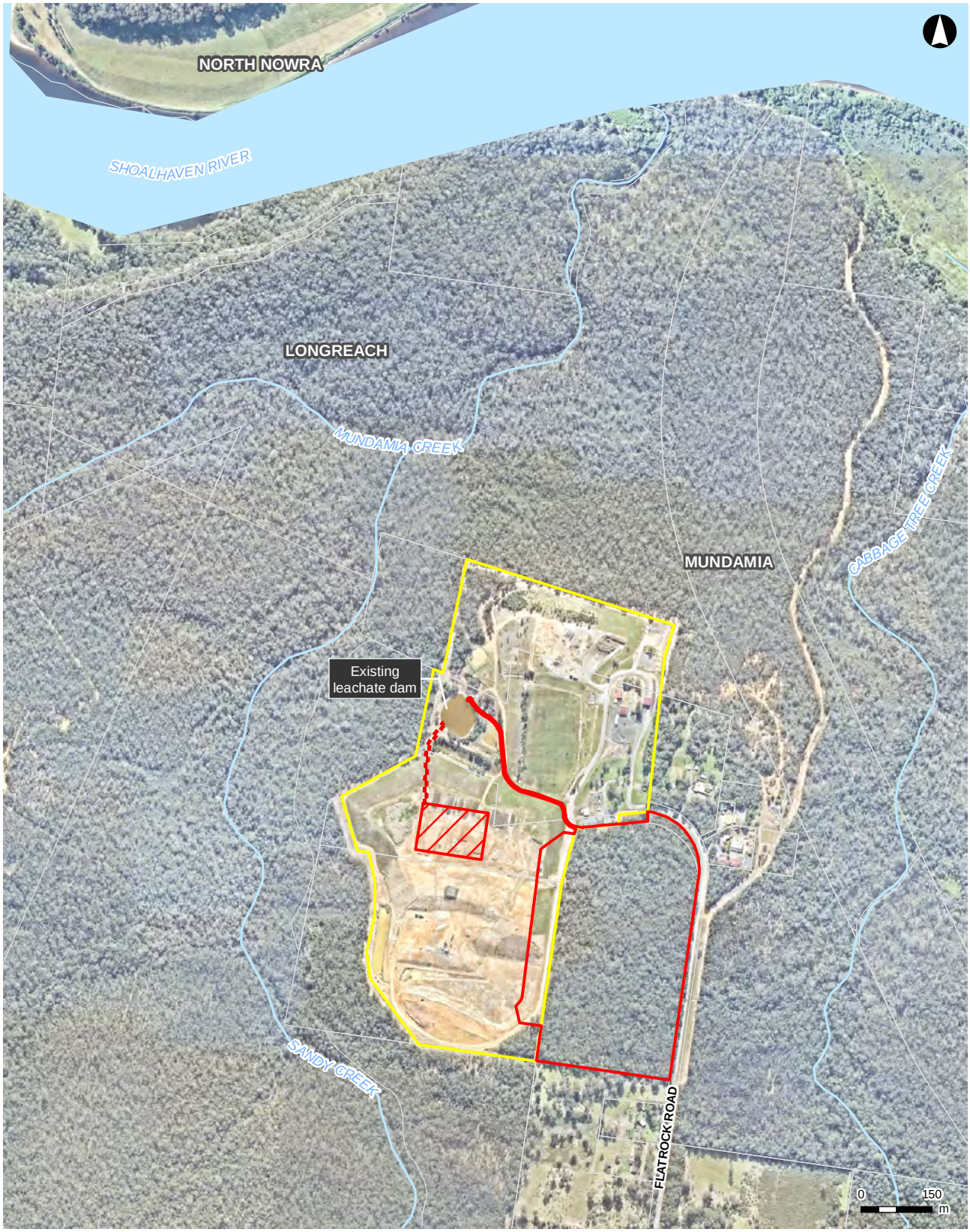
The Proposal is located within the Shoalhaven Catchment and is approximately 1.5 km south and 2.5 km east of the Shoalhaven River (Figure 8-14).

The Proposal Site generally slopes from a north-south ridgeline (approximately 50 m AHD) towards Cabbage Tree Creek to the east (approximately 30 m AHD). Cabbage Tree Creek is located approximately 300 – 400 m to the east of the Proposal Site and flows northward to the Shoalhaven River. There are no permanent surface water bodies / courses within the WNRWF (Figure 8-14).

Sandy Creek flows along the western boundary of the existing landfill and drains into the Shoalhaven River up gradient of the Cabbage Tree Creek outlet. The existing leachate storage dam is located on the northern side of the existing landfill area (and on the western side of former landfilling areas), approximately 225 m from Sandy Creek (Figure 8-14).

There is no available baseline water quality data for Cabbage Tree Creek. The limited monitoring data collected from Sandy Creek, indicates water in Sandy Creek has low dissolved oxygen, is acidic (pH < 6.5) and the conductivity ranges from 460 – 1850 uS/cm (ENRS, 2015).

The monitoring data collected from the Shoalhaven River provides some long term background data for the river. Baseline data appears to be on a quarterly basis between 1992 and 2013 for temperature, dissolved oxygen, faecal coliform, salinity, pH and turbidity and results appear to be relatively stable and representative of an estuarine river. Additional fragmented datasets are available for inorganics e.g. phosphorous, nitrogen and ammonia (Shoalhaven City Council, 2019).



LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- WNRWF boundary
- Existing leachate dam
- Cadastre (LPI, 2017)
- Watercourse

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1:12,000 at A4

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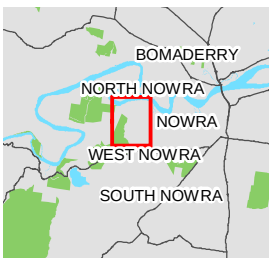

Figure 8-14: Watercourses

Groundwater

Groundwater monitoring undertaken by Environmental and Natural Resource Solutions (ENRS) in 2015 at the WNRWF indicated that groundwater resources of the Proposal are associated with two primary aquifer systems:

- A shallow unconfined alluvial aquifer generally less than 20 m in depth with moderate yields, variable water quality and strongly controlled by rainfall recharge; and
- A deep fractured rock aquifer, typically deeper than 20 m with low yields, high iron and variable salinity

The Geotechnical Report prepared by Coffey, 2016 and included as part of the Concept Design Report (Appendix E) found:

- The groundwater table ranged from five metres to 12 m below natural ground level (37 - 42 m AHD). This level may rise after Stage 3 is completed and capped
- Groundwater table levels have the potential to fluctuate up to five metres due to rainfall and seasonal variations
- Groundwater from the Proposal Site flows predominantly east, discharging into Cabbage Tree Creek as the Proposal Site lies to the east of the ridgeline. Groundwater from areas of the WNRWF that lie west of the ridgeline flow predominantly to the west, discharging into Sandy Creek
- Recharge to the groundwater system is reliant on rainfall and at lower elevations groundwater occurs within the alluvial sediments of Cabbage Tree and Sandy Tree Creeks.

In addition, first round baseline monitoring of groundwater wells located in the Proposal Site was undertaken by ENRS in June 2017 (Appendix X). Locations of the groundwater monitoring points are shown in Figure 8-15. The results of baseline monitoring found the following about groundwater on the Proposal Site:

- Salinity levels are elevated across the Proposal Site with total dissolved solids (TDS) levels ranging from 1870 – 7830 mg/L
- Neutral pH levels
- Only one heavy metal exceedance, that being zinc
- No elevated levels of Total Organic Carbon (TOC), Phenols, Organochloride / Organophosphorus (OC/Ops), Total Recoverable Hydrocarbons (TRH), Benzene Toluene Ethyl Benzene (BTEX) or Polycyclic Aromatic Hydrocarbons (PAHs)
- Nutrient levels are below adopted trigger levels.

LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- West Nowra RWF
- Stage 4 landfill extension sub-cells
- Cadastre (LPI, 2017)
- Watercourse

Water monitoring locations

- Groundwater
- Surface water
- Leachate

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Figure 8-15: Groundwater and surface water monitoring locations

Groundwater quality surrounding the existing leachate dam

ENRS undertook a hydrogeological assessment of the existing leachate dam at the WNRWF in 2018 (Appendix V) (ENRS, 2018a). The assessment found that groundwater downstream from the existing leachate dam (GW7, BH6, BH7 and BH4) appears to be marginally impacted by leachate. TOC levels in groundwater have varied overtime however, average groundwater TOCs are a factor of five lower compared to TOC levels measured within the leachate dam itself (described below). ENRS (2018) concluded that groundwater quality downstream of the leachate dam reported concentrations of potential key landfill indicators and contaminants of potential concern (CoPC) either below the adopted trigger values or within the range of historical levels for downgradient bores at the Site. Hence, the groundwater conditions downgradient of the existing leachate dam, "do not present any indicators of impacts from landfill operations or potential leaks from the existing leachate dam" (ENRS, 2018a). Furthermore, ENRS concluded "there is unlikely to be any direct hydraulic connection between the existing leachate dam and the surrounding soil and groundwater, or any associated risks posed by the ongoing operation of the leachate dam to water bodies and other sensitive receptors in the locality" (ENRS, 2018a).

Groundwater downstream from the existing irrigation area (unlined Stage 1 landfill cell area, BH13, GW6, GW6D and GW6S) but upstream from the existing leachate dam appears to be marginally impacted by leachate with average TOC levels a factor two lower compared to TOC concentrations measured inside the leachate dam. Review of available Council records indicates that GW6, GW6D and GW6S are located up gradient of the Leachate Dam in an area which has been disturbed by the former Stage 1 landfilling activities, including unlined excavations and trenches. Hence, the elevated ammonia in GW6 and GW6D is assessed to be unrelated to the Leachate Dam.

Groundwater quality downgradient of the Stage 2 landfill area/proposed leachate irrigation area and liner performance summary

Based on the design drawings, there are differences between the Stage 2 liner design and the requirements under both the 1996 and 2016 Environmental Guidelines. An assessment of the existing groundwater quality downgradient of the Stage 2 landfill and performance of the liner based on water quality monitoring data from SCC is provided below.

The groundwater quality downgradient of Stage 2 has been monitored as part of the ongoing operation of the WNRWF and as required by EPL 5877. Arcadis have reviewed the following information to assess the performance of the Stage 2 liner and the suitability of using the Stage 2 landfill area for leachate irrigation:

- 2017-2018 Annual Environmental Monitoring Report for the WNRWF (ENRS, 2018b) (Appendix Y);
- Report on Groundwater Hydrology and Water Quality West Nowra Waste Disposal Depot (Forbes Rigby, August 1996); and
- Hydrogeological Assessment (HA – Leachate Dam (ENRS, 2018a) Appendix V.

The review focussed on monitoring data collected at BH10 and BH18 (downgradient of the Stage 2 landfill area) and comparison of this data to: the 1996 water quality data (Forbes Rigby) at monitoring wells BH8, BH9 and BH10; the ANZECC 2000 water quality guidelines[19]; and groundwater quality data downgradient of the Stage 1 irrigation area (monitoring wells BH13, GW6, GW6D and GW6S) and downgradient of the leachate dam (monitoring wells GW7, BH4, BH6 and BH7). The findings of the

[19] For protection of ammonia-N the 95% freshwater guideline of 0.9 mg/L at pH of 8.0 was adopted. Or a detailed summary of the ANZECC guidelines refer to ENRS, 2018b

review in relation to pH, ammonia and heavy metals (key leachate indicators) is summarised below:

- pH:
  - pH in monitoring wells downgradient from Stage 1 and 2 is generally more acidic (between ~4 - ~6) compared to the pH in the leachate dam which is between 7.9-8.8[20] (ENRS, 2018b)
  - ANZECC recommended range of pH is 6.5-8.0. ENRS notes "*Whilst the readings are generally below the ANZECC recommended range of pH 6.5-8.0 the results are within the range of historical values for the Site and may be considered satisfactory supported by ongoing monitoring and review of downgradient conditions*"
  - ENRS (2018b) concludes that "*the pH in raw leachate is recorded between 4.3-8.3[21] which indicates low pH in groundwater is likely the result of in-ground process and not direct connection with leachate"*
  - A similar conclusion was derived by Forbes Rigby in August 1996 who collected background groundwater data downgradient from Stage 2 (BH8, BH9 and BH10) before Stage 2 landfilling operations commenced.
  - Arcadis has reviewed the data and can confirm that the low pH in the downgradient monitoring wells at these locations is likely due to in-ground processes rather than impacted by leachate.
- Ammonia-N:
  - Average ammonia-N levels in BH10 and BH18 were 0.68 mg/L and 0.38 mg/L respectively[22] (based on monitoring data collected between November 2014 and August 2018, ENRS, 2018b). These average concentrations were below the ANZECC 2000 criteria (0.9 mg/L at pH of 8.0 and 2.57 mg/L at pH of 6.0[23]).
  - The average baseline concentration (in BH8, BH9 and BH10) for ammonia-N[24] downgradient of the proposed Stage 2 irrigation area is 0.27mg/L (Forbes Rigby, 1996).
  - Arcadis concludes that the downgradient ammonia-N levels are slightly elevated compared to background levels, however are below appropriate ANZECC criteria.
- Heavy metals.

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[20] Based on a total of four pH measurements collected from the leachate dam LD1 (pH of 7.9, 8.5, 8.8 and 8.3),

[21] Based on data collected from the leachate dam (LD1) and the Leachate Pump House (Leach pH)

[22] Note that one outlier [7.01 mg/L] was excluded from the calculation of these averages.

[23] It is noted that the ANZECC criteria for total ammonia-N include adjusted values based on the pH of the waters. The lowest pH considered in the ANZECC guidelines is a pH of 6. In the absence of total ammonia-N criteria for waters with a pH of less than 6, these criteria have been used as the relevant criteria which is considered suitable as lower pH (as present on site) is typically related to lower percentage of un-ionised ammonia (NH_3) which is recognised as being the more toxic compared to ionised ammonium (NH_4^+)

[24] Arcadis has assumed that the NH3-N concentration as presented in Forbes Rigby, August 1996 should be interpreted as total Ammonia-N as otherwise background levels for total Ammonia-N would be in the order of 178 mg/L (refer to Table 8.3.6 in ANZECC2000)

- Various heavy metals such as Aluminium, Lead, Zinc and Copper were elevated above the ANZECC criteria in monitoring wells (BH10 and BH18) downgradient from the proposed Stage 2 irrigation area as well as downgradient from the leachate dam (BH6 and BH7) and the existing Stage 1 irrigation area (BH13).
- ENRS (2018b) noted that samples were analysed for Totals (as opposed to filtered values) and were not filtered in the field. In addition to this the acidic nature of the groundwater liberates heavy metals.
- Arcadis calculated average background levels for (filtered) heavy metals using data from Forbes Rigby (1996) for downgradient boreholes BH8, BH9 and BH10. Background levels for filtered heavy metals (assuming totals) were also above ANZECC criteria.
- Based on the data above and the collection measures being used, it is not possible to definitively determine whether the elevated heavy metals recorded are related to leachate migration out of the Stage 2 landfill.
- As recommended by ENRS (2018b), Arcadis also recommends that future monitoring should collect filtered groundwater samples for both dissolved and total heavy metal analysis. This is to compile a suitable dataset before the proposed Stage 2 irrigation area will be commissioned.

In summary, while there are slightly elevated levels of ammonia-N, heavy metals and some other components, as well as low pH's, at the bores downgradient of the Stage 2 landfill area, the levels are mostly below ANZECC Guidelines and do not indicate a significant impact on the environment. While the monitoring indicates a potential leachate influence from the Stage 2 landfill area, the leachate indicators recorded in this location are significantly lower than those recorded downgradient of the existing leachate irrigation area located on the unlined Stage 1 landfill area. Based on the review of groundwater quality data noted above, the liner in Stage 2 is performing adequately and relocation of the irrigation area from the Stage 1 area to the Stage 2 landfill area is appropriate and will present an overall improvement in leachate management at the WNRWF.

Mitigation measures related to the establishment and use of the Stage 2 irrigation area, including water quality monitoring prior to installation, are provided in Section 8.4.4.

Flooding

Detailed flood studies do not currently exist for the Upper Shoalhaven River. The available information provided on the SCC website indicates that flooding in the Upper Shoalhaven River is not considered a high risk, however, SCC recommends that any development provide a buffer of 40 m to a creek and 10 m to a drainage system, overland flow path or drainage easement as these areas may be subject to flooding.

Leachate

Contamination

A desktop assessment of the site history was undertaken to determine the likelihood of contamination on the Proposal Site. The Proposal Site currently consists of undeveloped bushland. A review of aerial photography from 1961, 1974, 1997, 2004 and 2015 indicates that no potential land contaminating activities have been undertaken on the Proposal Site (excluding in the location of the new leachate irrigation area being installed over the Stage 2 (closed) landfill area). However, as the Proposal Site is immediately adjacent to the existing WNRWF and downgradient of existing landfilling operations, there is the potential for soils, surface water and groundwater to be contaminated from windblown debris, stormwater runoff or

groundwater contamination migration. Notwithstanding this, due to the topography of the area, and stormwater and groundwater runoff directed east, rather than west, the potential of groundwater and surface water contamination from the existing WNRWF landfilling operations is considered to be low.

A search of historical land title ownership records was undertaken in February 2016. The records indicate the potential for land contaminating activities (landfilling) to have occurred on the Proposal Site, however, based on review of aerial photography landfilling activities have not yet occurred on the Proposal Site.

A search of the *NSW EPA Contamination Land Public Record* (maintained by the NSW EPA under section 58 of the CLM Act) found no records of contaminated sites on the Proposal Site (see Appendix N). A search of the *NSW EPA Public Register of Contaminated site* (maintained by NSW EPA under Section 60 of the CLM Act) did not identify any records on the Proposal Site. One site was listed in West Nowra; however, this site is not adjacent to the Proposal Site.

A search of the NSW EPA POEO Act public register of licence, applications and notices was undertaken in March 2017 for Mundamia, NSW. The search returned 18 results, one related to a (then pending, now issued) POEO licence for SCC for 114 Flatrock Road. The remaining 17 results related to the issuing of POEO licence and subsequent variations of the existing WNRWF.

Leachate production

As discussed in Section 5.6, the existing WNRWF landfill includes a leachate collection system that directs leachate to a leachate collection dam. Monitoring of leachate is undertaken by SCC and a summary of the current leachate quality based on monitoring data collected from the existing leachate storage dam and pump station is provided in Table 8-22.

Table 8-22 Estimate leachate quality

Analyte	Range Encountered	Trigger Value
Salinity	1740-1840mg/L	1500mg/L
pH	7.2-8.0	6.5-8.0
TSS	<LOR – 5mg/L	50mg/L
Phosphorus	0.4-0.42mg/L	0.05mg/L
Phosphate	0.15-0.16mg/L	0.02mg/L
Ammonia	42.1-43.1mg/L	2.57mg/L
Nitrate	0.04-0.05mg/L	0.7mg/L
TOC	43-43.7mg/L	-
TPH C10-C36	0.24-0.27mg/L	0.6mg/L
Aluminium	0.21mg/L	0.055mg/L

Source: Annual Environmental Monitoring Results October 2014 – October 2015, West Nowra Recycling and Waste Facility (ENRS, 2015) (referenced in SLR, 2018a).

Bold indicates range encountered is greater than the Trigger Value

Trigger Values – Australian and New Zealand Guidelines for Fresh and Marine Water, 95% Level of Species Protection in Fresh Waters (ANZECC, 2014)

HELP-modelling was conducted by SLR during concept design of the Proposal (Appendix E) and it estimated leachate production of the existing landfill (Table 8-23). Based on an assessment undertaken by the Assets & Works Group, SCC (11 September 2017) the existing leachate dam has a working capacity of approximately 8.9 ML.

Table 8-23 Leachate production volumes - Stage 1 - 3

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (m^3)
	Precipitation (mm)	**63.5**	**81.5**	**93.4**	**96.0**	**87.3**	**70.5**	**98.5**	**121.5**	**138.3**	**108.0**	**106.8**	**115.6**	**1170.9**
Stage 1 Closure Area	Leakage (mm)	3.24	3.20	3.1	3.24	3.12	3.19	3.21	2.9	3.26	3.15	3.28	3.19	
	Monthly infiltration percentage (%)	4.8	3.0	3.2	2.8	2.6	3.6	2.3	1.6	1.7	2.0	2.4	1.8	
	Leachate production (m^3)	92.34	91.20	88.35	92.34	88.92	90.915	91.485	82.65	92.91	89.775	93.48	90.915	1,085.28
Stage 2 Closure Area	Leakage (mm)	1.3	0.93	1.66	1.36	0.9	0.46	0.73	0.73	1.08	1.17	1.78	1.36	
	Monthly infiltration percentage (%)	2.0	1.1	2.0	1.4	1.0	0.7	0.7	0.6	0.8	1.1	1.7	1.2	
	Leachate production (m^3)	115.7	82.77	147.74	121.04	80.1	40.94	64.97	64.97	96.12	104.13	158.42	121.04	1,197.9
Stage 3 Closure Area	Leakage (mm)	1.03	1.04	1.52	1.43	1.02	0.66	0.8	0.69	0.86	1.01	1.37	1.23	
	Monthly infiltration percentage (%)	1.6	1.3	1.8	1.5	1.2	0.9	0.8	0.6	0.6	0.9	1.3	1.1	
	Leachate production (m^3)	91.67	92.56	135.28	127.27	90.78	58.74	71.2	61.41	76.54	89.89	121.93	109.47	1,126.7
Stage 3 Operational Area	Leakage (mm)	26.5	23.1	20.2	23.1	25.7	27.9	27.2	25.6	28.5	26	26.6	27.1	
	Monthly infiltration percentage (%)	41.73	28.34	24.22	24.06	29.44	39.57	27.61	21.07	20.61	24.07	24.91	23.44	
	Leachate production (m^3)	212	184.8	161.6	184.8	205.6	223.2	217.6	204.8	228	208	212.8	216.8	2460
Estimated Monthly Stage 1 – 3 leachate production (m^3)		511.7	451.3	533	525.5	465.4	413.8	445.3	413.8	493.6	491.8	586.6	538.2	**5869.96**

8.4.3 Potential impacts

Construction and operation of the Proposal has the potential to result in soil, water and leachate impacts to surrounding sensitive receivers. These impacts include:

- Erosion and sedimentation on surrounding water courses
- Leachate impacts on surrounding groundwater, surface water, vegetation and residential receivers
- Contamination of soil and water courses from wind blown debris

Mitigation measures to reduce these impacts prior to and during construction and during operation are discussed in Section 8.4.4.

Soil

Erosion and sediment

Construction and operation of the Proposal would involve clearing of vegetation and earthworks activities which will expose the soil and increase the risk of erosion and sedimentation. If this is inappropriately managed, eroded sediments can be transported downstream and could result in damage to Cabbage Tree Creek which lies 300 – 400 m to the east of the Proposal Site and Sandy Creek which lies 225 m to the west of the existing WNRWF by the scouring of beds and banks of watercourse and altering water quality.

The Proposal will receive general solid waste (i.e. putrescible and non-putrescible materials), small quantities of asbestos and C&D wastes. The potential soil impacts associated with these activities include erosion and sedimentation (via wind and water) and generation of leachate which, if inappropriately managed, can result in soil / groundwater contamination. These impacts have the potential to affect Cabbage Tree Creek, Sandy Creek and other surrounding sensitive receivers.

Due to the large area of disturbance required at the site, there is the potential for erosion from the Proposal Site if not properly managed.

Acknowledging the risk of potential soil erosion, the Proposal has been designed in line with best practice procedures and in consideration of the 2016 Environmental Guidelines. Provided the Proposal is constructed and operated in accordance with the Proposal Description and leachate management system (Section 5.6) the potential for soil erosion and contamination impacts are considered to be low.

Mitigation measures to reduce the impact of soil erosion and sedimentation from the Proposal during construction and operation are discussed in Section 8.4.4.

Water

Surface water

As discussed above, the Proposal has the potential to result in surface water quality impacts from erosion and sedimentation prior to and during construction, and during operation. This could result in impacts to downstream environments including vegetation, creeks, rivers and other aquatic habitats. In particular, this could impact on Cabbage Tree Creek and Sandy Creek.

To minimise erosion and sedimentation impacts to downstream waterways during operation of the Proposal, two sedimentation dams, one to the south and one to the north of the Proposal Site will collect and manage disturbed surface water runoff. The sedimentation dams have been designed to adequately capture and retain sediment laden runoff allowing for the settlement of suspended sediment from stormwater prior

to release. In addition, erosion and sediment control structures including swale drains and surface diversion bunds would be installed to divert clean runoff around disturbed areas of the Proposal.

Surface water could also be impacted during construction and operation of the Proposal due to the spillage of hazardous materials and substances (e.g. oil and petrol) in the waste vehicles accessing the Proposal. However, the potential for such an impact is considered low.

Wind-blown debris from operation of the Proposal and stormwater runoff from the existing WNRWF has the potential to contaminate surface water with gross pollutants and asbestos fibres. However, the risk of this occurring is considered to be low.

Mitigation measures to reduce the impact of erosion, sedimentation, debris and hazardous materials on surface water during construction and operation are discussed in Section 8.4.4.

Groundwater

The Proposal has the potential to impact groundwater quality should landfill generated leachate not be managed appropriately.

As noted in Section 8.4.2, there is evidence of elevated contaminants within groundwater downgradient from the existing leachate irrigation area (over the Stage 1 unlined landfill area). As part of the Proposal, the leachate irrigation area would be relocated to the Stage 2 landfill area.

Based on the review of groundwater quality data provided above (Section 8.4.2), the liner in Stage 2 is performing adequately and relocation of the irrigation area from the Stage 1 area to the Stage 2 landfill is appropriate and will present an overall improvement in leachate management at the WNRWF. The design for the Stage 4 landfill area has been developed in accordance with the 2016 Environmental Guidelines.

The Proposal is therefore anticipated to result in an improvement in environmental outcomes as a result of the relocation of the irrigation area from an unlined landfill area to a lined landfill area. Monitoring of downgradient groundwater quality from the proposed irrigation area will be undertaken to observe any changes in groundwater quality and provide ongoing feedback on the performance of the Stage 2 liner prior to the relocation of the irrigation area.

Mitigation measures to reduce groundwater impacts during construction and operation are discussed in Section 8.4.4.

Water balance

SLR completed a water balance for the Proposal (Appendix N) to determine whether the proposed water harvesting from sediment basins would provide adequate water for re-use for on-site dust suppression so that potable water would not be required.

The water balance considered annual rainfall, runoff volumes, evaporation rates and estimated re-use quantities for dust suppression. Run off storage volumes were calculated using HELP modelling. Results of the modelling relating to runoff storage are shown in Table 8-24.

Table 8-24 Sediment dam capacity details

Dam	Catchment Area (ha)	Settling zone volume (ML)	Sediment storage zone (ML)	Total dam storage volume (ML)
Dam 1	3.0	1.58	0.79	2.37

Dam	Catchment Area (ha)	Settling zone volume (ML)	Sediment storage zone (ML)	Total dam storage volume (ML)
Dam 2	6.5	3.46	1.73	5.19
Total Dam Storage Volume				7.56

The results of the water balance shows the annual predicted flow volumes and predicts there will be excess on-site water for dust suppression uses. The catchment is large and the estimated re-use is low which results in an overflow that greatly exceeds the onsite re-use demands as is represented in Figure 8-16.

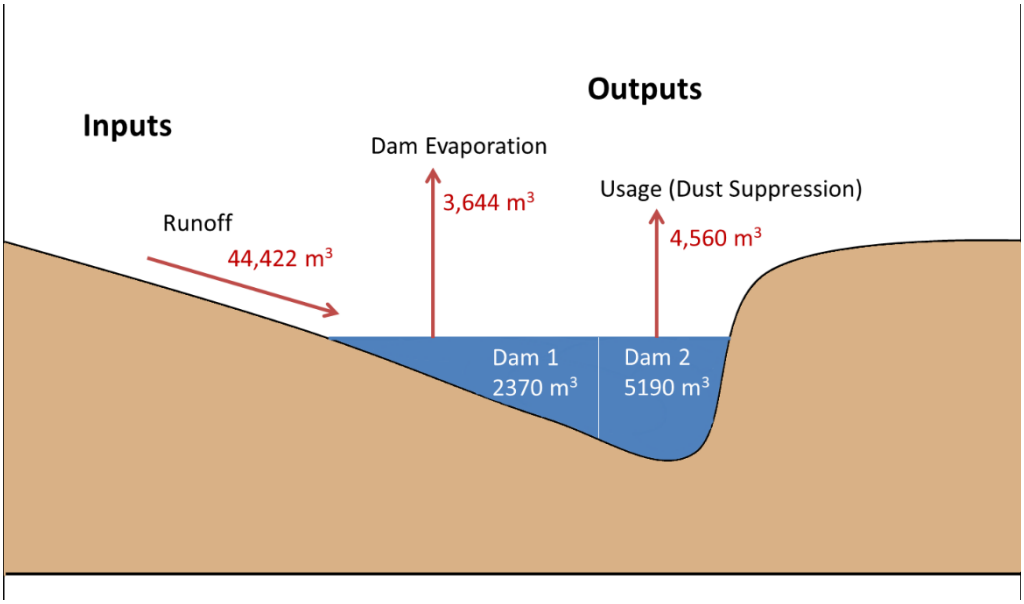


Figure 8-16 Water balance for on-site water demand

Leachate

Contamination

As discussed in Section 8.4.2, the Proposal Site does not have a site history of contamination, but as the Proposal Site is located adjacent to the existing WNRWF and downgradient of landfilling activities there is the potential for soils, surface water and groundwater to be contaminated from wind-blown debris, stormwater run-off and groundwater migration caused by existing landfilling activities. As discussed in Section 8.4.2 the likelihood of contamination from existing landfilling activities on the Proposal Site is considered to be low. However, as the Proposal Site is located immediately adjacent to the existing WNRWF and downgradient of existing landfilling operations, there is the potential for soils and groundwater to be contaminated from windblown debris, stormwater runoff or groundwater contamination migration. Due to the topography of the area, and stormwater and groundwater runoff directed east, rather than west, the potential of groundwater and surface water contamination from the existing WNRWF landfilling operations is considered to be low.

Mitigation measures to reduce the potential impact of contamination from landfilling operations on the Proposal Site during construction and operation are discussed in Section 8.4.4.

Leachate production

Leachate is liquid waste generated through decomposition of waste within a landfill as well as any surface water run-off that has come into contact with the landfill waste.

HELP-modelling was conducted by SLR to estimate leachate production from the Proposal (see Table 8-25).

Table 8-25 Proposal (Stage 4) Leachate production values

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (m^3)
	Precipitation (mm)	**63.5**	**81.5**	**83.4**	**96**	**87.3**	**70.5**	**98.5**	**121.5**	**138.3**	**108**	**106.8**	**115.6**	
Closure 8.9 Ha	Leakage (mm)	4.75	4.73	4.57	4.72	4.54	4.65	4.63	4.23	4.68	4.55	4.75		
	Monthly infiltration percentage (%)	7.5	5.8	5.5	4.9	5.2	6.6	4.7	3.5	3.4	4.2	4.4	4	
	Leachate production (m^3)	422.75	420.97	406.73	420.08	404.06	413.85	412.07	376.47	416.52	404.95	422.75	409.4	4930.6
Operational 0.8 Ha	Leakage (mm)	26.5	23.1	20.2	23.1	25.7	27.9	27.2	25.6	28.5	26	26.6	27.1	
	Monthly infiltration percentage (%)	41.73	28.34	24.22	24.06	29.44	39.57	27.61	21.07	20.61	24.07	24.91	23.44	
	Leachate production (m^3)	212	184.8	161.6	184.8	205.6	223.2	217.6	204.8	228	208	212.8	216.8	2460
Stage 4 monthly leachate production (m^3)		634.75	605.77	568.33	604.88	609.66	637.05	629.67	581.27	644.52	612.95	635.55	626.2	**7390.6**

A water balance of the existing leachate dam's capability to store the additional leachate generated from Stage 4 was completed (SLR, 2018c). The results indicated the existing leachate dam has sufficient storage capacity to accommodate two consecutive 90th Percentile rainfall years together with the leachate that would be generated from Stages 1 to 4 if a new leachate irrigation area of 14,000m^2 is established.

In addition:

- *"*Independent assessment of the existing Leachate Dam base clay liner (GHD 2018) reports the coefficient of permeability for the Clay is compliant with the NSW EPA (2016) Solid Waste Landfill guidelines" ENRS (2018a) and
- "*the permeability of the clay liner and GCL provides a barrier at least equivalent to a 1,000 mm thick compacted clay liner with k of less than 1x10^{-9} m/sec*" (GHD, 2018, provided in Appendix N).

As the Proposal will be similar to the current landfill operations particularly in relation to the types of waste received, the quality of the leachate generated from the Proposal is expected to be of the same quality as the leachate that is currently generated from the existing landfilling operation. The raw leachate quality has the potential to be a source of contamination to the surrounding environment if leachate collection, storage and treatment / disposal are not adequately implemented and maintained. Potential impacts resulting from inadequate collection, storage and treatment / disposal of leachate that would be generated by the Proposal include:

- Infiltration of contaminated leachate into the groundwater underlying the landfill or the leachate storage dam. Groundwater at times can discharge into the surrounding creek systems potentially impacting upon the waterways ecosystem, riparian zones and downstream users
- Overflow of contaminated leachate from the leachate dam into Sandy Creek
- Stormwater runoff coming into contact with landfill waste materials resulting in contaminated runoff potentially impacting upon the waterways ecosystem, riparian zones, protected vegetation and downstream users.

Potential leachate related impacts from the Proposal are predicted to be low provided the design (outlined in Section 5) and the mitigation measures outlined in Section 8.4.4 are appropriately implemented.

8.4.4 Mitigation measures

Several soil water and leachate mitigation measures have been incorporated into the design to ensure the Proposal meets the requirements of the Environmental Guidelines and reduces potential soil, water and leachate impacts at the Proposal Site. Table 8-26 identifies additional mitigation measures that would be implemented during pre-construction, construction and operation to further reduce potential soil, water and leachate impacts.

Table 8-26 Soil, water and leachate mitigation measures

ID	Mitigation measures	Timing
SWL-01	Undertake ongoing monitoring of the wells downgradient of the Stage 2 landfill prior to construction of the irrigation area in this location to observe any changes in groundwater quality and provide ongoing feedback on the performance of the liner. Should the monitoring data indicate a decline in water quality downgradient of the Stage 2 landfill, SCC will review the proposed location of the irrigation area and consider reasonable and feasible alternative leachate disposal/treatment solutions.	Pre-construction

ID	Mitigation measures	Timing
SWL-02	Surface water management infrastructure (including clean water diversion infrastructure, first flush dams, sedimentation dams) will be maintained to ensure clean surface water runoff is intercepted and diverted from the landfill footprint prior to entering the waste mass and thus becoming leachate. Surface water infrastructure will be regularly cleared of litter.	Pre-construction / construction / operation
SWL-03	An environmental monitoring program will be developed and implemented that includes groundwater, surface water and leachate. The program will incorporate the existing EPL requirements as well as the monitoring requirements outlined in the LEMP at Appendix L.	Pre-construction / construction / operation
SWL-04	A Landfill Closure Plan (LCP) will be prepared and submitted to the EPA for approval no later than 12 months before the last load of waste is due to be landfilled at the Facility. This LCP will include measures to reduce any impacts to soil and water during and after closure of the Landfill along with on-going post closure monitoring requirements.	Operation
SWL-05	An Erosion Sediment Control Plan (ESCP) will be developed in accordance with the 'Blue Book' for the construction and operational phase of the Proposal and will include the following measures to minimise discharge of sediment laden water downstream: • Collection and management of disturbed runoff into two sedimentation dams, one to the north and one to the south of the Stage 4 landfill extension area. Sediment ponds have been designed to adequately capture and retain sediment laden runoff allowing for the settlement of suspended sediment from the stormwater prior to release. • Monitoring and management of the sedimentation dams and surface waters to ensure minimal discharge of sediment laden waters as per the Landfill Environmental Management Plan (LEMP) and the ESCPs. • Diversion of clean runoff around the disturbed areas. This will include the installation and management of erosion and sediment control structures such as surface diversion bunds and swale drains around open excavations (unfilled) and active landfill cells. • Minimisation of disturbed areas and minimising the disturbance period. The Stage 4 landfill extension will take place as 6 landfill cell sub-stages, minimising exposed soils and the potential for erosive effects. • Stockpiles will be placed at a minimum of 5m from concentrated flow paths and any soils stockpiled for further use will be vegetated to stabilise the surface and reduce erosion risks.	Operation
SWL-06	As a minimum, at the end of each working day, all exposed waste surfaces at the active tipping face that have not achieved final landform levels will be covered	Pre-construction / construction / operation

ID	Mitigation measures	Timing
	with a minimum 150 mm thick layer of VENM or an alternative material(s) approved by the EPA.	
SWL-07	Avoiding, if practicable, tipping and/or waste handling during windy conditions and keeping the active waste tipping face area as small as possible.	Pre-construction / construction / operation
SWL-08	Detailed design will consider the compatibility of the irrigation area over the Stage 2 landfill with the gas collection system operating at this location.	Pre-construction

8.5 Noise and vibration

A noise and vibration assessment was undertaken by SLR (Appendix R) to determine noise and vibration impacts of the Proposal on surrounding sensitive receivers. Table 8-27 provides a summary of the relevant SEARs, which relate to noise and vibration and where these have been addressed in this EIS.

Table 8-27 SEARs relevant to noise and vibration

Section	Requirement	Where addressed in EIS
Noise and vibration	- Quantitative assessment of potential construction, operational and transport noise and vibration impacts, including potential impacts on nearby sensitive receivers; and	Section 8.5.3 Appendix R
	- Details of the proposed noise management and monitoring measures	Section 8.5.4

8.5.1 Methodology

Noise assessment

Noise monitoring

Noise monitoring was conducted by SLR in 2016 in order to determine the rating background levels (RBLs) applicable to the Proposal Site surrounding area. The RBLs are used to determine the existing environment for the Proposal Site to enable the assessment of impacts associated with the Proposal in accordance with the relevant noise impact assessment criteria. The measured RBLs are discussed in Section 8.5.2 and project specific noise criteria are presented in Table 8-30.

Operational noise assessment criteria

Operational noise criteria were established with consideration of the NSW *Noise Policy for Industry* (NPI) (EPA, 2017), which provides the framework and process for deriving noise limit conditions for consents and licences issued by the EPA. The NPI sets project trigger noise levels to provide assessment benchmarks for noise emitted by commercial or industrial activities into the community. The NPI is based upon extensive research into community reactions to noise and presents two criteria for protecting the community against noise. These are the intrusiveness' and project 'amenity' criteria.

Noise criteria generally apply to both day time and night time periods. However, as the Proposal will only operate during the day time (8:00am to 5:00pm), night time criteria are not relevant and are not discussed.

Operational noise criteria - intrusiveness

The NPI intrusiveness assessment is based on the existing background noise levels and requires that the equivalent continuous noise level (L_{Aeq}) from the source should not be more than five dBA above the measured (or default) rating background level (RBL).

Operational noise criteria - amenity

The NPI amenity assessment is based on amenity noise level specific to the land use and associated activities and relate only to industrial-type noise and do not include road, rail or community noise. The amenity criterion aims to protect amenity noise levels by setting targets that ensure the industrial noise contribution within an area does not exceed the amenity noise levels specified in the NPI.

Different amenity criteria apply for different types of receivers (e.g. residential, commercial, industrial) and different areas (e.g. urban, suburban, rural). All residential receivers identified in this assessment are classified as rural residential receivers. The non-residential receivers are classified as either commercial or educational receivers.

Road traffic noise criteria

Road traffic noise criteria were established with consideration of the *NSW EPA Road Noise Policy* (RNP) (DECCW, 2011), which defines criteria to be used in assessing the impact of road traffic noise from new developments. The RNP assessment criteria for residential land use is presented in Table 8-28.

The timeframe adopted for analysis in this assessment is the year 2034 (worst case scenario). The 2034 assessment represents the final year of operation of the landfill. This assessment is focused on noise impacts from traffic generated by the Proposal along Flatrock Road. According to the RNP, Flatrock Road is a local road.

Table 8-28 RNP criteria for road traffic noise at residences

Road	Type of project/land use	Assessment criteria – dBA
		Day (7:00am – 10:00pm)
Local road	Existing residences affected by **additional traffic** on existing local roads generated by land use developments	LAeq(1hour) 55 dBA (external)

Furthermore, in applying the assessment criteria the RNP recommends *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'* (DECCW, 2011).

Therefore the baseline criteria is 55 dBA, and if existing traffic noise (no build) exceeds 55 dBA, then the total increase should be limited to two dB above the no build noise level (SLR, 2019d).

Vibration assessment

Vibration is not considered a key issue for the project given the activities involved and distance to receivers, and has been assessed qualitatively below.

8.5.2 Existing environment

Sensitive receivers

The land use surrounding the Proposal is predominantly undeveloped bushland. The nearest sensitive receivers to the Proposal are identified in Figure 8-17 and Table 8-29, including their approximate distance direction from the Proposal Site.

Table 8-29 Sensitive receivers

ID	Address	Distance/direction to site boundary (m)[25]
Residential		
R1	43 Flatrock Road	90 m south
R2	41 Flatrock Road	190 m south
R3	3 Flatrock Road	475 m south
R4	3 Flatrock Road	420 m south
R5	3 Flatrock Road	513 m south
R6	3 Flatrock Road	466 m south
R7	18 Bamarang Road	511 m south
R8	38A Old Bamarang Drive	550 m south-west
R9	56 Stonegarth Road	1000 m north-east
Commercial/Educational		
C1	RSPCA Shoalhaven Animal Shelter	85 m north-east
C2	OEH Buildings	55 m north-east
C3	University of Wollongong – Shoalhaven Campus	1300 m east

[25] Distance is from the receiver location to the Proposal Site boundary, not the distance to the edge of the active landfill, which is a minimum of 250m as required by the Environmental Guidelines. Note that R1 is the nearest legal dwelling (an unapproved residence, and that there is one closer residence)

Figure 8-17 Noise sensitive receptor locations (Source: SLR, 2018b)

Existing ambient noise levels

Noise monitoring identified the following daytime noise levels at the two locations monitored:

- R4 - 3 Flatrock Road: 37 dBA RBL($L_{A90(15minute)}$) and 53 dBA Ambient ($L_{Aeq(period)}$)
- R9 - 56 Stonegarth Road: 30 dBA RBL ($L_{A90(15minute)}$) and 46 Ambient ($L_{Aeq(period)}$).

The attended monitoring confirmed that measured ambient noise levels are dominated by rural noise, traffic noise and existing operations at the WNRWF.

8.5.3 Potential impacts

Project specific noise levels

The project-specific noise levels (PSNL) reflect the most stringent noise level requirement from the criteria, derived from both the intrusiveness and amenity criteria, to ensure that intrusive noise is limited and amenity is protected. The PSNLs applicable to the Proposal are shown in Table 8-30.

Table 8-30 Project specific noise levels

Location	Time period	Project specific assessment trigger levels	
		Intrusive ($L_{Aeq\ (15\ minutes)}$)	**Amenity $L_{Aeq\ (Period)}$**[26]
Nearby (R1 to R8)	Daytime	42	50
Distant (R9)		40[27]	50
Nearby (C1 to C2)		65	65
Distant (C3)		45[28]	45

Modelling scenarios assessed

Due to the progressive nature of landfill cell excavation and filling, construction and operational activities will occur concurrently. As such, the noise impacts have been modelled and assessed using two conservative (i.e. worst-case) scenarios that assume construction and operation activities are occurring concurrently. The scenarios and noise impacts are described below.

Scenario 1 – Operation of Stage 3 and clearing of landfill sub-cell 1 of Stage 4

Stage 3 of the existing landfill is approaching completion, and landfill sub-cell 1 of Stage 4 is being cleared. This scenario (depicted in Figure 8-18) is assumed to occur in the opening year, with the corresponding traffic volumes used for that assessment year. The following activities are included in scenario 1:

- Truck transport of waste on internal unpaved roads to Stage 3
- Unloading of waste at the southern end of Stage 3
- Watercart used on the haul road
- Compaction equipment operating on active landfill face in Stage 3
- Front end loader (FEL) operating in the green waste processing, C&D waste and VENM stockpile areas in the WNRWF
- Vegetation being stripped in landfill sub-cell 1 of Stage 4 with a bulldozer
- Excavator loading landfill sub-cell 1 excavated material on to truck.

[26] According to the NPI, as the RBLs are below 40 dBA in a rural landscape; the rural residential category has been applied to the area and the associated recommended amenity noise level is 50 dBA.

[27] The NPI recommends that where RBLs are below 35dBA, a 40 dBA intrusiveness noise level be applied. As the RBL was 30 dBA at R9, which is below the NPI specified minimum, the adopted project intrusiveness noise level of 40 dBA applies to this receptor. According to the NPI, as the RBL at R9 was 30 dBA

[28] External intrusive trigger levels, based on an internal trigger level of 35 dBA, and 10 dB external to internal noise reduction with openable windows.

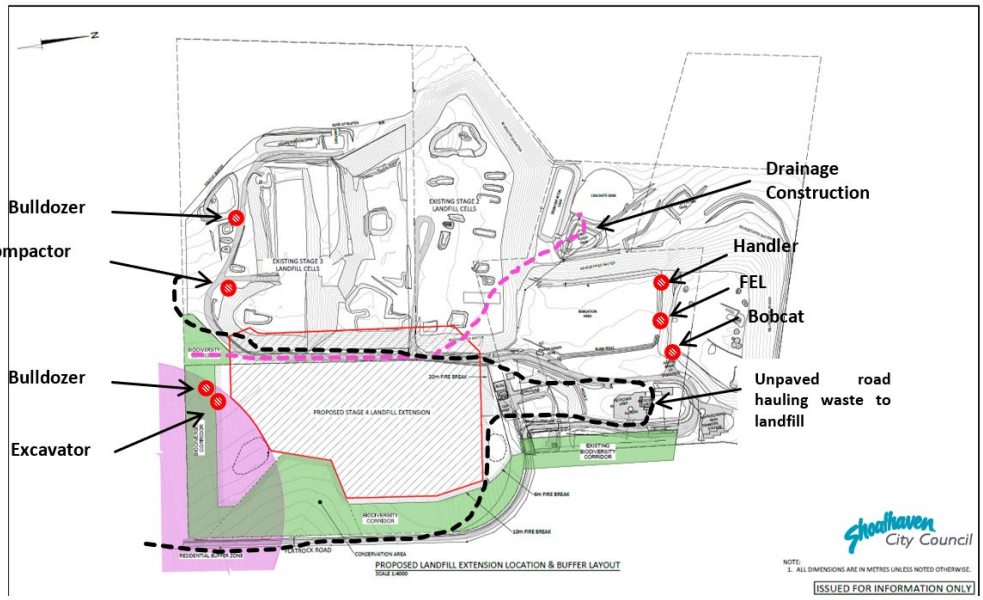


Figure 8-18 Scenario 1 (Operation of Stage 3 and clearing of landfill sub-cell 1 Stage 4) (Source: SLR, 2018b)

Scenario 2 – Stage 4 operation

Stage 3 of the existing landfill is completed with final cover (i.e. no noise generating activities on Stage 3 area). Landfill sub-cell 1 of Stage 4 is used for the disposal of waste materials and landfill sub-cell 2 of Stage 4 is being cleared. This scenario (depicted in Figure 8-19) is predicted to occur in year 2026, however in order to assess the potential worst-case scenario, the final year (2034) truck delivery movements are applied to this scenario. The use of 2034 truck movements represents a worst case noise scenario. The following operations are included:

- Truck transport of waste on internal unpaved roads to landfill sub-cell 1
- Unloading of waste at southern end of landfill sub-cell 1
- Watercart on the haul road
- Compaction equipment operating on active landfill face in Stage 4 (sub-cell 1)
- FEL operating in the green waste processing, C&D waste and VENM stockpile areas
- Landfill sub-cell 1 of Stage 4 vegetation being stripped with a bulldozer
- Excavator loading landfill sub-cell 2 excavated material on to truck.

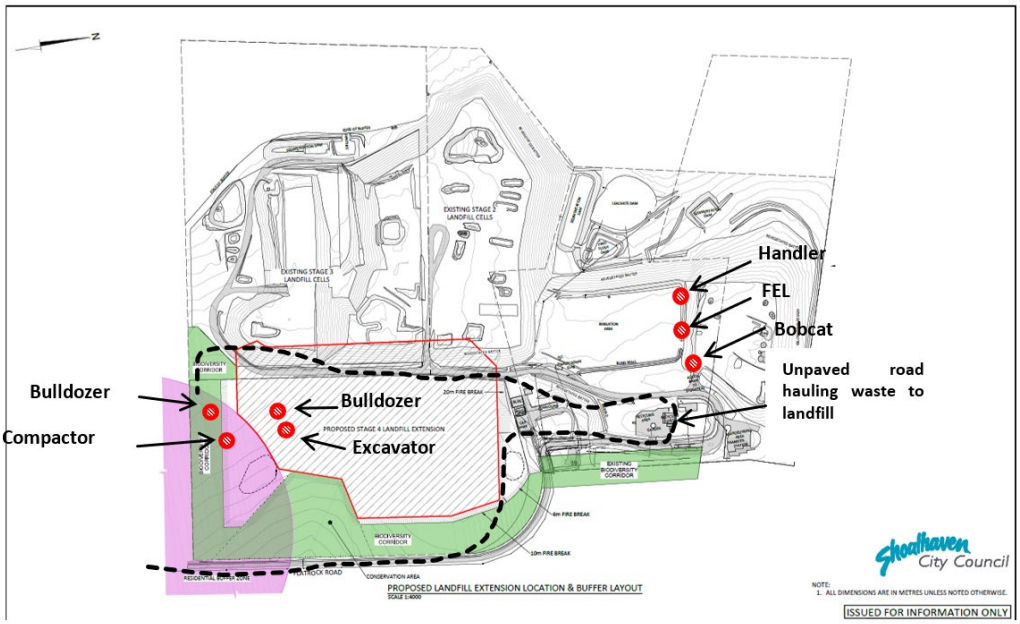


Figure 8-19 Scenario 2 (Operation of landfill sub-cell 1 and clearing of landfill sub-cell 2 of Stage 4) (Source: SLR, 2018b)

The most significant sources of operational noise associated with the Proposal are the various items of mobile plant used in the day to day operation of the landfill and the incoming waste trucks. The mobile plant items associated with the daily operation of the landfill and their respective sound power levels are provided in the noise assessment at Appendix R. Equipment typically includes: bulldozers, compactor/bulldozer, handlers, excavators, haul trucks, water carts, generators, bobcats, diesel delivery trucks, mowing carts and garbage trucks. This equipment has been taken into account in the scenarios discussed above.

Noise impacts

The noise modelling results for Scenarios 1 and 2 are presented in Table 8-31 and Table 8-32. Table 8-31 presents the results in relation to the intrusiveness criteria and Table 8-32 presents the results in relation to the amenity criteria.

The results indicate that predicted noise levels comply with established criteria at all the nearest residential and commercial receivers during Scenario 1, with the exception of the nearest residence (R1) where a minor exceedance of two dB is predicted. A review of source contributors at sensitive receiver R1 indicated that the operation of a compactor in landfill Stage 3 and dozer stripping in landfill sub-cell 1 of Stage 4 were the primary noise sources that caused the minor exceedance of established criteria at R1. Mitigation measures are proposed to address this exceedance.

The results indicate the predicted noise levels comply with established criteria at all residential and commercial receivers during Scenario 2.

Table 8-31 Predicted intrusive $L_{Aeq(15\ minute)}$ noise levels - dBA re 20 µPa

ID	Receiver	Project intrusive noise trigger level	Predicted $L_{Aeq\ (15\ minute)}$ noise level – Scenario 1	Predicted $L_{Aeq\ (15\ minute)}$ noise level – Scenario 2
	Residential			
R1	Residential dwelling, 43 Flatrock Road	42	**44**[29]	42
R2	Residential dwelling, 41 Flatrock Road	42	42	39
R3	Residential dwelling/shed, 3 Flatrock Road	42	39	35
R4	Residential dwelling, 3 Flatrock Road	42	38	33
R5	Residential dwelling, 3 Flatrock Road	42	35	31
R6	Residential dwelling, 3 Flatrock Road	42	37	36
R7	Residential dwelling, 18 Bamarang Road	42	37	32
R8	Jim Da Silva Farm, 38A Old Bamarang Drive	42	38	33
R9	56 Stonegarth Road	40	29	28
	Commercial / Educational			
C1	RSPCA Shoalhaven Animal Shelter	65	43	46
C2	OEH buildings	65	46	49
C3	University of Wollongong – Shoalhaven Campus	45[30]	26	27

[29] Exceedances are shown in bold.

[30] External intrusive trigger levels are based on an internal trigger level of 35 dBA, and 10 dB external to internal noise reduction with openable windows.

Table 8-32 Predicted amenity $L_{Aeq(15\ hour)}$ noise levels - dBA re 20 µPa

ID	Receiver	Project amenity noise trigger level	Predicted $L_{Aeq\ (15\ minute)}$ noise level – Scenario 1[31]	Predicted $L_{Aeq\ (15\ minute)}$ noise level – Scenario 2
	Residential			
R1	Residential dwelling, 43 Flatrock Road	50	41	39
R2	Residential dwelling, 41 Flatrock Road	50	39	36
R3	Residential dwelling/shed, 3 Flatrock Road	50	36	32
R4	Residential dwelling, 3 Flatrock Road	50	35	30
R5	Residential dwelling, 3 Flatrock Road	50	32	28
R6	Residential dwelling, 3 Flatrock Road	50	34	33
R7	Residential dwelling, 18 Bamarang Road	50	34	32
R8	Jim Da Silva Farm, 38A Old Bamarang Drive	50	35	30
R9	56 Stonegarth Road	50	26	25
	Commercial / Educational			
C1	RSPCA Shoalhaven Animal Shelter	65	40	43
C2	OEH buildings	65	43	46
C3	University of Wollongong – Shoalhaven Campus	45[32]	23	24

Road traffic noise assessment

Road noise levels have been calculated at the most affected receivers using the traffic volumes sourced from the traffic impact assessment (Appendix S) along Flatrock Road in 2034 under the “No-Build” and “Build” scenarios. The predicted road noise levels are summarised in Table 8-33.

[31] Amenity noise trigger levels were established using a conservative approach whereby a 3 dBA reduction was applied to the predicted intrusive noise level at each receiver.

[32] External intrusive trigger levels are based on an internal trigger level of 35 dBA, and 10 dB external to internal noise reduction with openable windows.

The traffic noise prediction indicates that the 55 dBA baseline criteria would be exceeded by 1.3 dB in 2034 and the two dB allowance criteria exceeded by 0.3 dB These are minor exceedances and confirm that there will be no significant change in traffic noise levels experienced by residences along Flatrock Road. Furthermore, the major contributor to the predicted noise levels is from heavy vehicles, and improvements in the noise performance is expected in the future, noting Australian Design Rules (ADRs) apply to heavy vehicles which result in the ongoing improvements in the design of heavy vehicles, and future fleet replacements will benefit from these changes.

As only minor exceedances are expected, traffic noise mitigation is considered unnecessary for the Proposal.

Table 8-33 Predicted noad noise levels (2034)

Access road	Base criteria day ($L_{Aeq(1hr)}$)	Predicted road traffic noise (No-Build)	Predicted road traffic noise (Build)	Predicted Road Traffic Noise Increase (dB) above the No-Build Noise level
Flatrock Road – morning peak	55	53	54.9	1.9
Flatrock Road – afternoon peak	55	54	**56.3**	**2.3**

Vibration impact assessment

Vibration will be produced from the operation of compactors and bulldozers at the Proposal Site, with the highest vibration levels occurring from the operation of compactors with vibration levels of approximately two millimetres/second at distances of 15 m and the vibration levels from bulldozers being lower. Due to the distance between the Proposal Site and the nearest sensitive receivers, vibration levels will be below the threshold of perception. As a result, no mitigation of vibration is required for the Proposal.

8.5.4 Mitigation measures

The noise and vibration impact assessment has demonstrated that noise levels from day-to-day operational activities within the Proposal are predicted to comply with established criterion at all receivers except R1, where minor exceedances are predicted due to the use of certain plant and equipment and road traffic.

Notwithstanding this, mitigation measures are identified in Table 8-34 to further reduce noise emissions associated with the Proposal Site.

Table 8-34 Noise mitigation measures

ID	Mitigation measures	Timing
NV-01	Activities involving the use of a compactor in Landfill Stage 3 and bulldozer stripping in Landfill Sub-cell 1 of Stage 4 would be scheduled so works aren't occurring concurrently.	Construction / operation
NV-02	SCC would maintain an ongoing complaint register at the site to ensure any noise concerns raised by the public are promptly and effectively addressed.	Pre-construction /

ID	Mitigation measures	Timing
		construction / operation

8.6 Traffic

Arcadis has undertaken a traffic assessment to address the SEARS relating to traffic. The complete Traffic Impact Assessment (TIA) is included as Appendix S to the EIS. This section summarises the assessment and identifies the key risks relating to traffic and transport, as well as management strategies to mitigate them.

A summary of the relevant SEARs, which relate to traffic, and where these have been addressed in this EIS is provided in Table 8-35.

Table 8-35 SEARs relevant to traffic and transport

Section	Requirement	Where addressed in EIS
Traffic	- Details of all traffic types and volumes likely to be generated;	Section 8.6.2 Section 8.6.3
	- Plans demonstrating how all vehicles likely to be generated during construction and operation and awaiting loading, unloading or servicing can be accommodated on the site to avoid queuing in the street network	Section 8.6.3
	- Assessment of predicted impacts on road safety and the capacity of the road network to accommodate the project; and	Section 8.6.3
	- Assessment of where off site infrastructure works are required as a result of traffic impacts	Section 8.6.3

8.6.1 Methodology

Traffic counts were undertaken by SCC on 9 November 2016 at the Yalwal Road / Flatrock Road intersection and by SkyHigh (on behalf of SCC) on 14 March 2014 and the Princes Highway / Kalandar Street intersection to determine the AM and PM weekday peak periods for each intersection. Traffic generation estimates for the Proposal were determined by separating traffic identified as accessing the landfill from all data recorded at the weighbridge and applying a five percent per annum linear growth rate to existing landfill traffic volumes to predict future traffic volumes in 2026 and 2034[33].

Traffic generation estimates for the surrounding area were determined by identifying the remaining traffic that accessed other properties on Flatrock Road from the Yalwal Road / Flatrock Road intersection, and a two percent per annum linear growth rate

[33] The 5 % p.a. linear growth rate is based on the 2 % growth rate adopted for background traffic and a 3 % waste generation medium-growth rate as advised by Shoalhaven City Council (SCC) based on estimates in the *National Waste Report 2010* (Australian Government, 2010)

was applied to all vehicles not accessing the WNRWF in the existing year (2017) and assessment years 2026 and 2034.

8.6.2 Existing environment

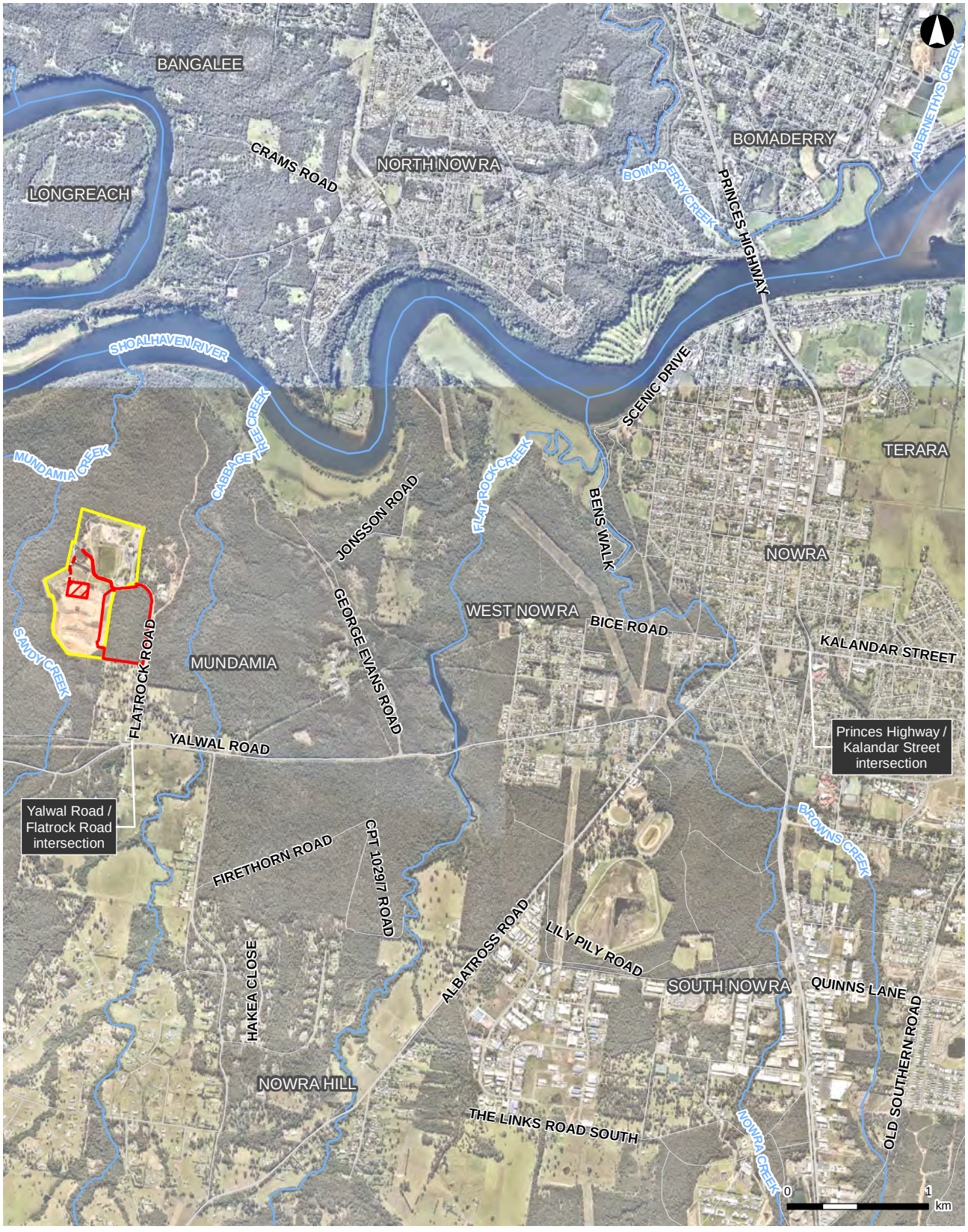
The Shoalhaven LGA, including the major townships of Nowra, Vincentia, Ulladulla and Huskisson, currently have access to the WNRWF as their primary waste disposal facility. Customer and waste disposal vehicles currently access the WNRWF via Flatrock Road.

This section describes the existing road network surrounding the site, existing traffic volume on the network, and predicted traffic volumes and road network performance, without the Proposal. Section 8.6.3 outlines the predicted traffic volumes, with the Proposal.

Surrounding road network

Access to the Proposal Site is shown on Figure 8-20 and includes:

- Flatrock Road
- Yalwal Road
- Albatross Road
- Kalandar Street
- Princes Highway.



LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- WNRWF boundary
- Road
- Watercourse

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Coordinate System: GDA 1994 MGA Zone 56
Date issued: May 2, 2019
Aerial imagery supplied by nearmap (May, 2017)

1:40,000 at A4

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Figure 8-20: Surrounding road network

Flatrock Road

Flatrock Road is a SCC controlled road and is considered a local road providing access primarily to the WNRWF and a small number of residential and commercial properties. It is a two-way sealed carriageway road that contains no line markings or sealed shoulders. No posted speed limits exist on this however, based on Table 2.1 of the NSW *speed zoning guidelines* (Roads and Maritime Services, 2009) the default rural speed limit for an undivided rural road with seal pavement greater than 5.6 m is 100 km/h.

Yalwal Road

Yalwal Road is a SCC controlled road and is classified as a collector road that connects West Nowra to Danjera Dam. It is a two-way sealed road with one lane in each direction, contains centreline road markings with no sealed shoulders within the vicinity of the Yalwal Road / Flatrock Road intersection, and has a posted speed limit of 100 km/h.

Albatross Road

Albatross Road is a SCC controlled road and is classified as a collector road that connects Nowra (from Kalandar Street) to the Nowra Airport. It is a two-way sealed road with one lane in each direction and has a posted speed limit of 60 km/h.

Kalandar Street

Kalandar Street is classified as a collector road that connects the Princes Highway and Albatross Road. It is a two-way sealed road with one lane in each direction and a posted speed limit of 60 km/h.

Princes Highway

Princes Highway is a State Controlled Road and is classified as a major arterial road with regional significance. The Princes Highway extends from Sydney to Port Augusta in South Australia generally following the coastline through the states of New South Wales, Victoria and South Australia. It has four lanes, with two lanes in each direction, and a posted speed limit in the vicinity of the Princes Highway / Kalandar Street intersection of 70 km/h.

Existing traffic conditions

Yalwal Road / Flatrock Road intersection

Traffic counts for the Yalwal Road / Flatrock Road intersection were undertaken by SCC on 9 November 2016 in 15-minute increments for both Light Vehicles (LV) and Heavy Vehicles (HV) between the hours of 7:00am – 10:00am and 2:00pm – 5:00pm.

Based on the observed traffic volumes at the intersection, it was determined that the AM peak hour occurs between 7:45am and 8:45am with a total of 141 vehicles, of which 25 % were heavy vehicles. The PM peak hour was determined to occur between 2:45pm and 3:45pm with a total of 150 vehicles, of which 28 % were heavy vehicles. A breakdown of the hourly vehicle volumes is presented in Figure 8-21.

Princes Highway / Kalandar Street intersection

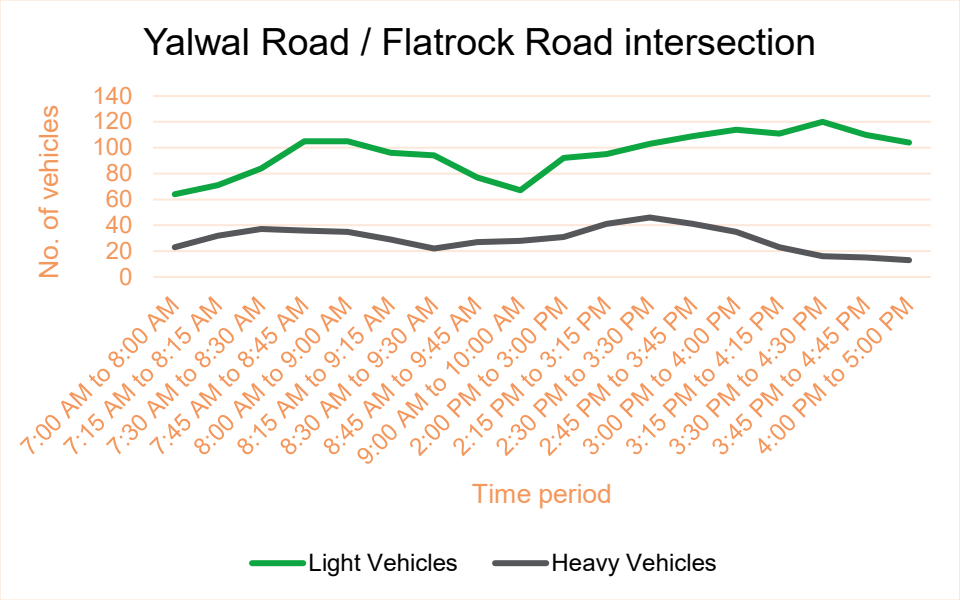


Figure 8-21 Yalwal Road / Flatrock Road intersection traffic count

Traffic counts for the Princes Highway / Kalandar Street intersection were provided by SCC and undertaken by SkyHigh on 14th March 2014 in 15-minute increments for LV, Light Commercial Vehicle (LCV), rigid trucks, articulated trucks and buses between the hours of 8:00am – 9:00am and 3:00pm – 6:00pm.

The provided intersection count data was limited to AM traffic volumes between the hours of 8:00am and 9:00am and as such the AM peak hour adopted for this impact assessment occurs between 8:00am and 9:00am with a total of 3,203 vehicles of which 19 % are heavy vehicles. Based on the observed traffic volumes at the intersection, it was determined that the PM peak hour occurs between 4:00pm and 5:00pm with a total of 4,007 vehicles, of which 17 % are heavy vehicles. A breakdown of the hourly vehicle volumes is presented in Figure 8-22.

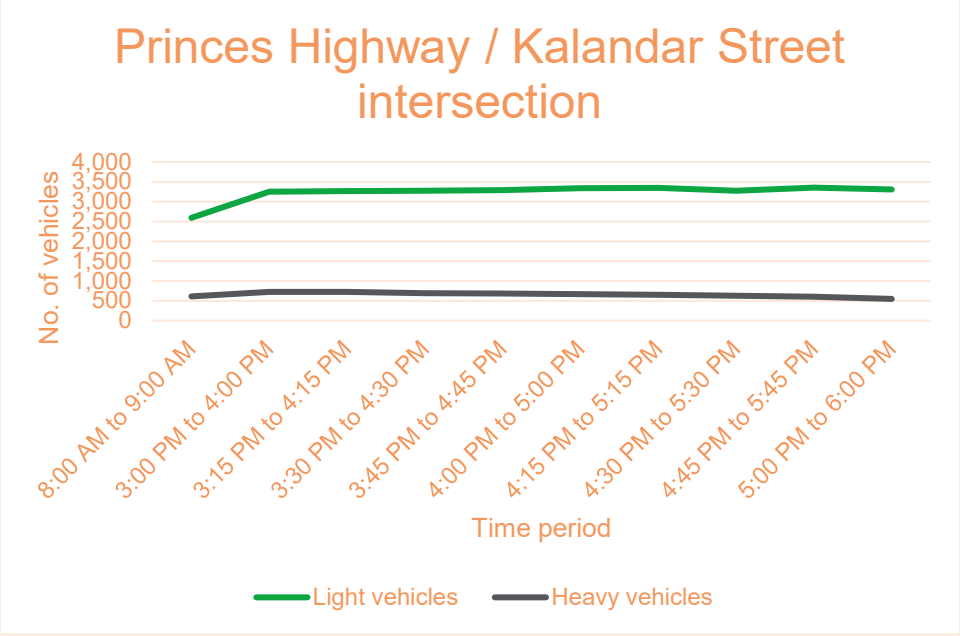


Figure 8-22 Princes Highway / Kalandar Street intersection traffic count

8.6.3 Potential impacts

Construction of the Proposal will be undertaken using the same equipment which is used for operation of the landfill (e.g. excavators and compactors). This equipment is permanently located on-site and therefore no construction related traffic will be generated on the external road network and no construction traffic impact assessment was warranted.

However, construction and installation of three fauna rope bridges that traverse Flatrock Road may require issue of a road occupancy licence as works would need to be undertaken in the road corridor. Mitigation measures outlined in Section 8.6.4 would be implemented during these works.

The following operational impacts have been assessed using modelling scenarios to predict potential traffic changes:

- Traffic generation
- Impacts to the road network
- Road safety.

Operational traffic generated by the Proposal has been assessed using the following two scenarios:

- Opening year – 2026: Weekday AM Peak and PM Peak
- Closing year – 2034: Weekday AM Peak and PM Peak.

Traffic generation

Traffic related to the Proposal would primarily comprise heavy vehicles (typically Austroads Class 5 – Four Axle trucks) with a smaller percentage of light vehicles accessing the site. Peak volumes have been determined based on Yalwal Road / Flatrock Road intersection counts and correlated with weighbridge data provided by SCC.

Table 8-36 shows the estimated average weekday vehicle trips associated with the Proposal for the year 2026 and 2034. As previously mentioned, the existing (2016) landfill traffic volumes were grown by five percent p.a. to generate opening and closing year traffic volumes. The total traffic volume, comprising light and heavy vehicles estimated to access the Proposal Site in the year of opening (2026) on a weekday is estimated to be 10 and 38 during the morning and afternoon periods, respectively. This would result in approximately 48 vehicles accessing the Proposal Site in the year of opening (2026). In the year of closing (2034) on a weekday is estimated to be a total of 16 and 48 vehicles during the morning and afternoon periods, respectively. This would result in approximately 64 vehicles accessing the Proposal Site in the year of closing (2034).

Table 8-36 Weekday morning and afternoon Proposal traffic generation (two-way trips / period)

Vehicle type	Opening year (2026)			Closing year (2034)		
	Morning	Afternoon	Daily	Morning	Afternoon	Daily
LV	2	6	8	4	8	12
HV	8	32	48	12	40	52
Total	10	38	48	16	48	64

Note: Morning (7:00am to 10:00am) / Afternoon (2:00pm to 5:00pm)

Peak volumes

Table 8-37 includes the breakdown of traffic generated by the Proposal for the weekday AM and PM peak.

Table 8-37 Proposal traffic generation (two-way trips / peak period)

Peak Period	Opening Year (2026)			Closing Year (2034)		
	LV	HV	Total	LV	HV	Total
Weekday AM peak (7:45am-8:45am)	20*	20*	40	20*	20*	40
Weekday PM peak (2:45pm-3:45pm)	20*	30	50	20*	38	58

* Note: Due to peak hour volumes being considered low, more conservative volumes were used. If the calculated trips were less than five trips they were rounded up to five and any trips greater than five and less than ten were rounded up to ten.

Impacts to the road network

The overall Proposal impact on the road network has taken into consideration the impact on the key intersections facilitating operation of the Proposal (Study Intersections). An analysis of the likely impact the Proposal would have on the study intersection has been undertaken using traffic analysis software (SIDRA versions 6.1). The results of these assessments are discussed below.

Yalwal Road / Flatrock Road intersection

The SIDRA assessment was undertaken for two peak periods: weekday AM 7:45am – 8:45am and weekday PM 2:45pm – 3:45pm. Table 8-38 shows the delay and level of service (LoS) results from SIDRA modelling at the Yalwal Road / Flatrock Road intersection for the opening and closing years without the Proposal while Table 8-39 shows the delay and LoS for the opening and closing years with the Proposal.

Table 8-38 SIDRA summary results for the Yalwal Road / Flatrock Road intersection - without Proposal

Year	Weekday AM (7:45am-8:45am)			Weekday PM (2:45pm-3:45pm)		
	Volume*	Delay (s)	LoS	Volume*	Delay (s)	LoS
Opening year (2026)	183	3	A	182	4	A
Closing year (2034)	213	3	A	215	4	A

Note: *An uplift of 5 % has been applied to the volumes within SIDRA as a result of the Peak Flow Factor being applied.

Table 8-39 SIDRA summary results for the Yalwal Road / Flatrock Road intersection - with Proposal

Year	Weekday AM (7:45am-8:45am)			Weekday PM (2:45pm-3:45pm)		
	Volume*	Delay (s)	LoS	Volume*	Delay (s)	LoS
Opening year (2026)	225	4	A	235	4	A
Closing year (2034)	255	4	A	276	5	A

Note: *An uplift of 5 % has been applied to the volumes within SIDRA as a result of the Peak Flow Factor being applied

The results of this assessment show that the SIDRA model predicts an LoS A (good operation) at the Yalwal Road / Flatrock Road intersection for both peak periods in both assessment years. As the Proposal is predicted to meet or exceed the adopted assessment criterion of LoS D, no upgrades to this intersection are required.

Princes Highway / Kalandar Street intersection

The SIDRA assessment was undertaken for two peak periods weekday AM 8:00am – 9:00am and weekday PM 4:00pm – 5:00pm. Table 8-40 shows the delay and LoS from SIDRA modelling at the Princes Highway / Kalandar Street intersection for the opening and closing years without the Proposal while Table 8-41 shows the delay and LoS for the opening and closing years with the Proposal.

Table 8-40 SIDRA summary results for the Princes Highway / Kalandar Street intersection - without Proposal

Year	Weekday AM (8:00am-9:00am)			Weekday PM (4:00pm-5:00pm)		
	Volume*	Delay (s)	LoS	Volume*	Delay (s)	LoS
Opening year (2026)	3,941	>200	F	4,934	>200	F
Closing year (2034)	4,453	>200	F	5,571	>200	F

Note: *An uplift of 5 % has been applied to the volumes within SIDRA as a result of the Peak Flow Factor being applied

Table 8-41 SIDRA summary results for the Princes Highway / Kalandar Street intersection - with Proposal

Year	Weekday AM (8:00am-9:00am)			Weekday PM (4:00pm-5:00pm)		
	Volume*	Delay (s)	LoS	Volume*	Delay (s)	LoS
Opening year (2026)	3,983	>200	F	4,986	>200	F
Closing year (2034)	4,494	>200	F	5,632	>200	F

Note: *An uplift of 5 % has been applied to the volumes within SIDRA as a result of the Peak Flow Factor being applied

The SIDRA model predicts a LoS F (defined as over capacity, unstable operation) at the Princes Highway / Kalandar Street intersection, *with Proposal Traffic,* on the weekday AM and PM peaks for both assessment years, which is similar to the without proposal scenario. Therefore, the intersection is unlikely to perform at an acceptable LoS with or without the Proposal.

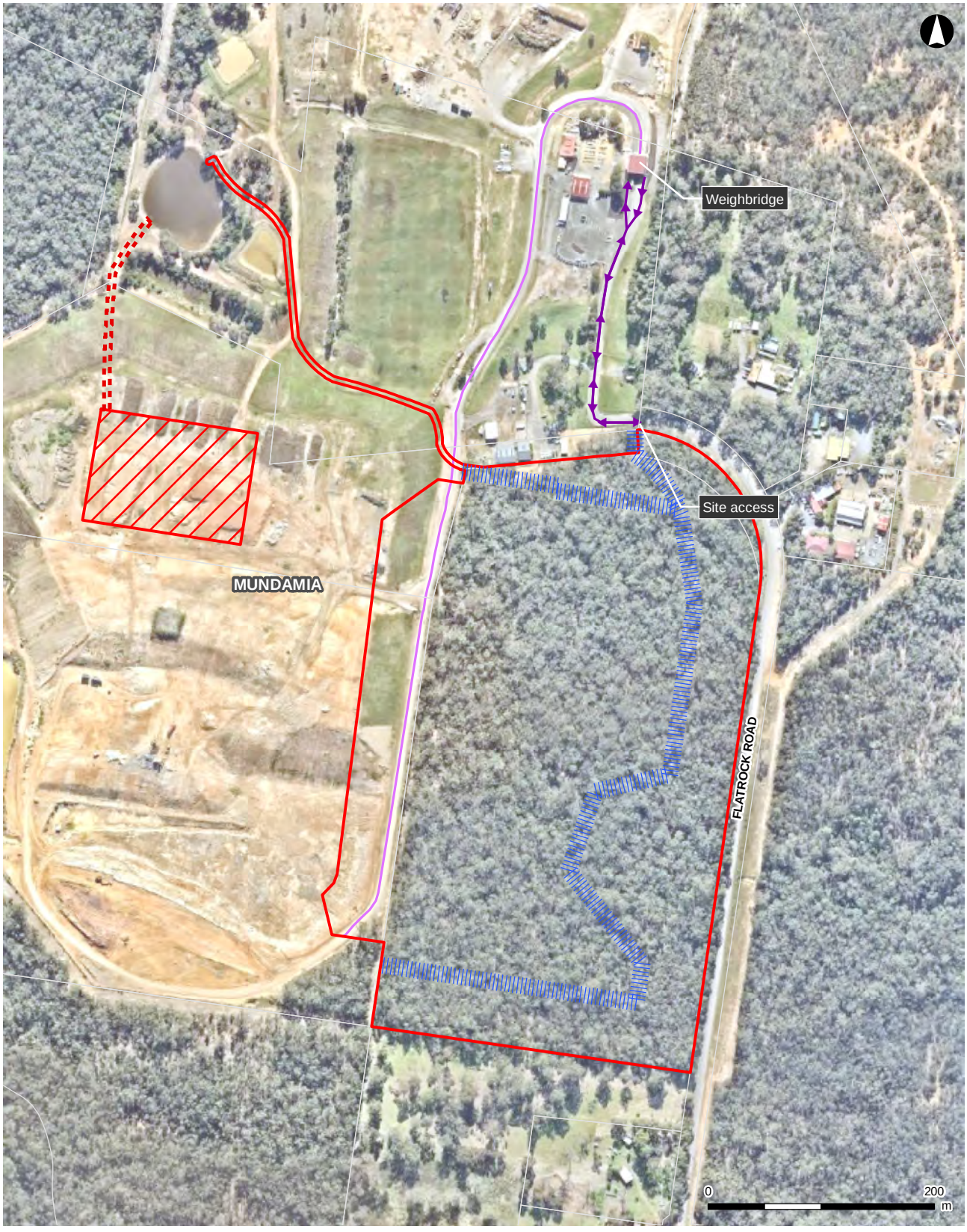
The Proposal is expected to add 42 vehicles in the AM peak and 41 vehicles in the PM peak for the opening year, and 52 vehicles in the AM peak and 61 in the PM peak in the year of closing. This represents an approximate one percent increase in the total intersection demand, which is deemed minimal in comparison to the total demand at the intersection.

The analysis shows that the impact of Proposal traffic is insignificant and no upgrades are needed to the Princes Highway / Kalandar Street because of the additional traffic generated as a result of the Proposal.

On site traffic flows

All vehicles will enter the Proposal Site from Flatrock Road via a two-way access point, which will be the only point of access / egress to the site. Waste disposal vehicles would enter the site, travel approximately 240 m on the internal road network and pass through a weighbridge prior to circulating to the designated waste disposal area. The waste disposal vehicle would then exit the site via the same point of entry via the weighbridge. Figure 8-23 illustrates the onsite circulation of Proposal traffic and the 240 m (approx.) of onsite queue space which is considered to be ample to accommodate all vehicles accessing the Proposal Site.

West Nowra Landfill Extension



LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- Onsite queue space (240m)
- Internal road network
- Fire trail
- Cadastre (LPI, 2017)

ARCADIS AUSTRALIA PACIFIC PTY LTD
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Coordinate System: GDA 1994 MGA Zone 56
Date issued: May 2, 2019
Aerial imagery supplied by nearmap (May, 2017)

1:5,000 at A4

ARCADIS

Figure 8-23: Onsite circulation of proposal traffic

Road safety

The existing posted speed limit along Yalwal Road is currently 100 km/h. The site distance assessment was based on required site distances outlined in the *Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2010), which specifies the following:

Approach Sight Distance (ASD)

This is the minimum requirement to provide the driver of a vehicle adequate distance to observe the road layout, including pavement markings, kerbs, islands, etc. in sufficient time to react and stop if necessary before entering the conflict area. Approach Sight Distance is measured from driver eye height (1.05 m) to 0.0 m (i.e. the road surface).

Safe Intersection Sight Distance (SISD)

It provides sufficient sight distance for a driver of a vehicle on the major road to observe a vehicle from the minor road approach moving into a collision situation (e.g. in the worst case stalling across traffic lanes), and to decelerate to stop before reaching to collision point. Safe Intersection Sight Distance is measured from the driver eye height (1.05 m) on the approach with priority to eye height of a driver in the side street (1.05 m).

The ASD and SISD requirements for vehicles approaching and departing the Yalwal Road / Flatrock Road intersection were determined based on a vehicle speed of 100 km/h. The required sight distances for both northbound and southbound movements are 165 m (ASD) and 248 m (SISD). The available sight distances range between 170 and 810 m. However, the sight distance for the eastbound (Yalwal Road) movement does not satisfy the desirable sight distance (SISD) requirements.

It should be noted that there is an existing geometrical alignment constraint in the eastbound direction of Yalwal Road approaching the intersection with Flatrock Road. There is a horizontal curve and hill (uphill) on the approach to the intersection. Signage warning vehicles of the Yalwal Road / Flatrock Road intersection on approach from the west currently exists.

Although the desirable SISD requirement was not satisfied, the combination of the existing geometrical conditions and warning signs, low future traffic volumes and no recorded crashes at or near the intersection suggests that, although the existing SISD is approximately 78 m shorter than desired, the intersection operates satisfactorily from a safety perspective and is not anticipated to be exacerbated by the Proposal. Mitigation measures have been developed to address this issue and are included in Section 8.6.4.

8.6.4 Mitigation measures

Table 8-42 identifies safeguards and management measures that will be implemented to address potential traffic impacts associated with the Proposal.

Table 8-42 Traffic mitigation measures

ID	Mitigation measures	Timing
TA-01	Driver training (i.e. such as a driver code of conduct, safety toolbox, or similar) would need to be implemented to ensure staff and contractors are aware of the existing sight distance issue at the Yalwal Road / Flatrock Road intersection. This mitigation measure has been identified as a precaution against any road safety and intersection capacity impacts associated with the operation of the Proposal.	Construction / Operation

ID	Mitigation measures	Timing
TA-02	A road occupancy licence would be secured prior to construction and installation of the fauna rope bridges	Pre-construction
TA-03	Appropriate traffic control measures would be implemented to manage traffic during construction and installation of the fauna rope bridges	Construction

8.7 Greenhouse gas

A Greenhouse Gas (GHG) assessment was undertaken by Arcadis to quantify the likely GHG emissions that may be produced by the Proposal. The detailed assessment report is provided in Appendix T. This section provides a summary of the findings of the assessment in relation to the potential for GHG production associated with the Proposal and related mitigation measures.

Table 8-43 provides a summary of the relevant SEARs, which relate to GHG emissions and where these have been addressed in this EIS.

Table 8-43 SEARs relevant to greenhouse gas

Section	Requirement	Where addressed in EIS?
Greenhouse Gas	– A quantitative assessment of the scope 1, 2 and 3 greenhouse gas emissions of the project;	Section 8.7.3 Appendix T
	– A detailed description of the measures that would be implemented to minimise the methane emissions of the proposed landfill operations and ensure that the project is energy efficient.	Section 8.7.4 Appendix T

8.7.1 Methodology

The scoping processes used for the assessment of GHG emissions for the Proposal has been based on the following guidelines and regulations:

- The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard Revised Edition (The World Resources Institute/World Business Council for Sustainable Development [WRI/WBCSD]) (WRI/WBCSD, 2004)
- National Greenhouse and Energy Reporting System Measurement: Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia, Department of Energy and Environment (DoEE, 2017a)
- National Greenhouse Accounts (NGA) Factors, Department of Energy and Environment (DoEE, 2017b).

Under 'The Greenhouse Gas Protocol' (WRI/WBCSD, 2004), a Proposal's direct and indirect emissions sources can be delineated into three 'scopes' (Scope 1 (direct GHG emissions), Scope 2 (typically electricity indirect GHG emissions) and Scope 3 (other indirect GHG emissions)) for GHG accounting and reporting purposes.

Quantification of potential emissions from the Proposal has been undertaken in relation to carbon dioxide (CO_2) and other non-CO_2 GHG emissions, including methane (CH_4), and nitrous oxide (N_2O). All emissions are reported as carbon dioxide equivalents (CO_2-e).

The existing landfill (Stages 1 to 3) at the WNRWF are not part the Proposal. Stages 1 and 2 are complete, with those area closed and capped, while Stage 3 is currently operational and will reach capacity in 2026. To ensure a complete picture of methane generation is represented, emissions produced from the decomposition of putrescible waste deposited within these stages prior to the expected commencement of the Proposal have been considered as part of the GHG assessment and are referred to herein as 'legacy emissions'.

8.7.2 Existing environment

Existing accounts of greenhouse gases provided by the Commonwealth Department of the Environment and Energy (DoEE) estimate that approximately 537.9 Mega tonnes (Mt) CO_2-e were emitted in Australia during the 2015-16 financial year (DoEE, 2016).

As reported within Australia's Greenhouse Gas Inventory (Ageis.climatechange.gov.au, 2014), solid waste disposal forms a sub-sector of the waste disposal sector. The combined waste disposal subsectors (including solid waste disposal) were the second smallest generators of GHG sector emissions in Australia in 2015, comprising just 2.1 percent of Australia's total emissions (537.9 $MtCO_2$-e) (DoEE, 2016).

The solid waste disposal sector accounted for 1.6 % (8.4 $MtCO_2$-e) of Australia's GHG emissions in 2015 and 1.5 % of total GHG emissions in NSW (DoEE, 2016). Approximately 74.1 % of emissions produced by the waste sector are attributable to the solid waste disposal subsector. Further trend analysis of the sector shows that since 1990 net GHG emissions from the NSW waste sector have declined by 56 % while nationally emissions have dropped by 42 % .

8.7.3 Potential impacts

The Proposal (Stage 4) will commence operation in 2026 and accept waste up to the year 2034. Construction of the landfill sub-cells, landfilling and capping are expected to occur concurrently within the Stage 4 area (i.e. one sub-cell will be constructed while another is filled, and another is capped). These activities require the use of fuels, vegetation clearing, transportation and waste storage which would result in associated GHG emissions.

The Proposal would generate emissions from:

- Waste decomposition (including consideration of legacy emissions)
- Transportation
- Machinery used during construction and operation
- Vegetation clearing.

Waste decomposition

Decomposition of putrescible waste on-site would be the most substantial emissions source over the life of the Proposal. The estimated emission generation from decomposition, incorporates the reduction in emission from the landfill gas generator and flare system installed on site as well as from natural oxidisation that is expected to occur through the final capping layer. All waste decomposition would occur on-site and is therefore regarded as a source of Scope 1 emissions.

As noted, legacy emissions have been included in the calculations to ensure a complete picture of methane generation is presented, even though waste generated during Stages 1 to 3 has already been approved and therefore does not form part of this Proposal.

The assumptions adopted to predict tonnes of waste that would be placed in the Stage 4 landfill are the same as those adopted for the landfill life expectancy modelling undertaken for the Proposal and used throughout the EIS (i.e. a population growth rate of two percent per annum[34] and a waste generation growth rate of three percent per annum[35]). This is considered to be a conservative estimate of waste generation as both population and waste growth may be slower.

Municipal Solid Waste (MSW) is expected to be the largest source of methane emissions within the Proposal. Annual waste emissions are predicted to increase substantially as the Proposal progresses in its lifecycle. Table 8-44 shows that total waste emissions would be expected to peak at 35,115 tCO_2-e in 2035 (from legacy and Proposal emissions), the year after the landfill has closed.

Table 8-44 GHG emissions from waste decomposition

Emitting year	Waste decomposition emissions (tCO_2-e)			
	Scope 1	Scope 2	Scope 3	Percent of emissions from legacy waste (%)
Lowest - 2026	22,154	-	-	83%
Highest - 2035	35,115	-	-	23%

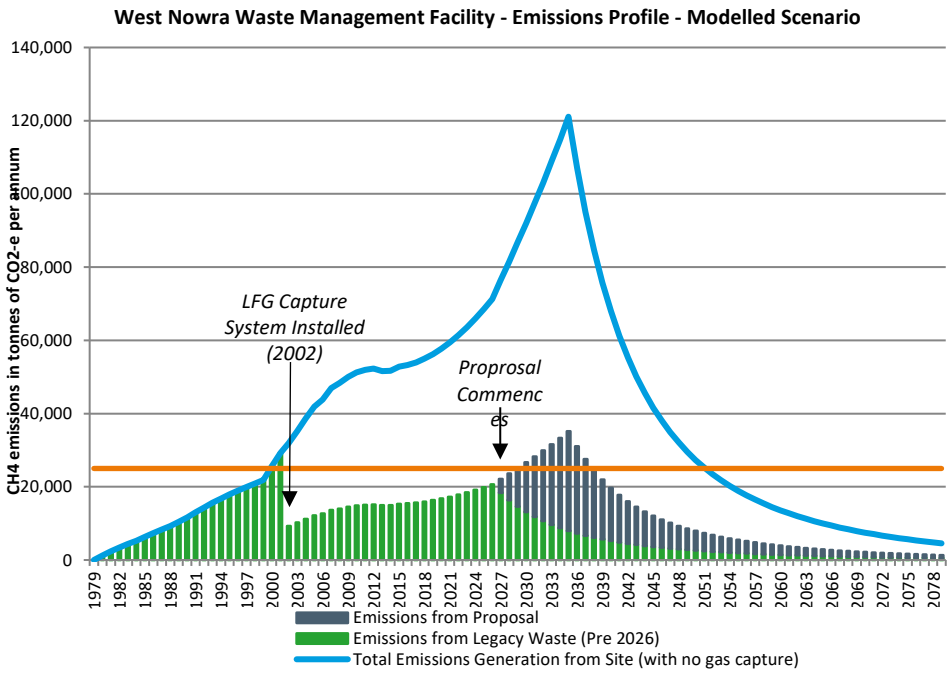


Figure 8-24 Landfill emissions profile for the Proposal, including legacy waste

Figure 8-24 shows the historical and expected emissions profile for the site. The following are noted in relation to the profile:

[34] Adopted from the SCC Waste Strategy, 2014 / 2015 (SCC, 2015a).

[35] Assumed as per the annual waste generation medium-growth rate of 3% in the National Waste Report 2010.

- The orange line represents the facility threshold *(*25kt or more of greenhouse gases CO_2-e per annum (Scope 1 and Scope 2 emissions)), which determines whether an entity has an obligation to report emissions under the *National Greenhouse and Energy Reporting (NGER) Act 2007*
- The blue line represents the total net emissions generation from the site, with no gas capture
- The green columns represent the net emissions originating from legacy waste disposal (Stage 1, 2 and 3)
- The grey columns represent the net emissions originating from waste disposed under the Proposal (Stage 4).

The total emissions generation from the site (blue line) and emissions from legacy waste (green columns) are equal until 2002, where a significant drop is observed. This is due to the landfill gas generator and flare system and highlights the importance it plays in reducing overall landfill gas emissions from this site.

From its implementation in 2002 to the current year of 2018, the emissions from the site were modelled to amount to 810,581 t of CO_2-e (excluding natural emissions reduction from oxidation through cap). Based on the reported capture rate of the gas generator and flare system of 71 % , the emission are estimated to have reduced to 235,068 t of CO_2-e.

Despite the high performance of the landfill gas generator and flare system, the Proposal is expected to breach the NGER reporting threshold in the year 2029.

Transportation

Movement of waste between the originating location and the Proposal Site would generate GHG emissions from fuel combustion within transportation vehicles, as well as upstream and downstream emissions associated with the production of fuel. Waste collection would predominantly be undertaken by third party contractors, and therefore represents a Scope 3 emissions source.

Historical data on the number of vehicles depositing waste at the WNRWF were provided by Council for the year 2012-13. The data provides information on light vehicles (cars, trailers) and heavy vehicles (trucks). However, the light vehicles accessing the WNRWF site would not access the tip-face and therefore have been excluded from consideration of transportation emission associated with the Proposal. Only heavy vehicles have been considered. The provided data was extrapolated to estimate vehicle movements across the duration of the Proposal.

The Proposal would generate on average approximately 555 tCO_2-e of Scope 3 emissions across the eight years, which includes emissions from both fuel combustion and upstream emissions generated from fuel production. In the lowest emitting year for Stage 4 (2026), the Proposal would generate approximately 307 tCO_2-e of Scope 3 emissions and in the highest year (2034), the Proposal would generate approximately 802 tCO_2-e of Scope 3 emissions. This is summarised below in Table 8-45.

Table 8-45 Summary of waste collection vehicles emissions (tCO2-e)

Emitting year	Waste collection vehicle emissions (tCO_2-e)		
	Scope 1	Scope 2	Scope 3
Lowest - 2026	-	-	307
Highest - 2034	-	-	802

Machinery

The use of machinery on-site would generate Scope 1 GHG emissions from fuel combustion (diesel). Additionally, the upstream and downstream emissions associated with the production of fuel would be incurred as a result of onsite machinery use. This would represent a Scope 3 GHG emission for the Proposal. As shown in Table 8-46, Scope 1 emissions generated from machinery would be approximately 312 tCO_2-e per annum over the eight-year landfill life cycle for Stage 4, while an additional 16 tCO_2-e per annum of Scope 3 emissions would be produced as a result of the up and downstream production of the fuel required for operational machinery.

Table 8-46 Summary of GHG emissions generated from the operation of on-site machinery

Emissions source	Stage 4 emissions from on-site machinery (tCO2-e/yr)		
	Scope 1	Scope 2	Scope 3
Excavators	169	-	9
Diesel compactor	100	-	6
Bogie Tipper	4	-	0
Diesel pumps	7	-	0
Generator	2	-	0
Material Handler	7	-	0
Mulcher	23	-	1
TOTAL	**312**	**-**	**16**

Vegetation clearing

Vegetation clearing would generate emissions from a number of potential sources; including the loss of carbon sequestration, diesel consumption in machinery used for clearing and mulching (assessed above), and vegetation decomposition.

A total of 9.87 ha of vegetation would need to be cleared for the Proposal. Clearing would commence in approximately 2025 to enable commencement of landfilling in Stage 4 in 2026.

Total emissions from vegetation clearing throughout the life of the Proposal (8-year period) are estimated to be 5,196 tCO_2-e as shown Table 8-47.

Table 8-47 Summary of GHG emissions (tCO2-e) arising from cleared vegetation

Emissions source	Total emissions due to vegetation clearing (tCO2-e)		
	Scope 1	Scope 2	Scope 3
Loss of carbon sequestration	5,144	-	-
Emissions from vegetation decomposition	52	-	-
TOTAL	**5,196**	**-**	**-**

8.7.4 Mitigation measures

The GHG assessment has identified the projected GHG emission that would be produced as a result of the Proposal. Table 8-48 identifies mitigation measures to reduce these emissions.

Table 8-48 GHG mitigation measures

ID	Mitigation measures	Timing
GHG-01	Ensure that the final capping layer meets the requirements outlined in the Landfill Environmental Management Plan (LEMP) prepared by SLR for the site. A review of best practice standards, methodologies and technologies at the time of capping, should be undertaken to ensure that an optimal solution is achieved. To maximise natural oxidisation through the final capping layer and reduce emissions, the capping layer should be maintained in good condition (i.e. thick layer of topsoil with healthy vegetation). The design and implementation should be reviewed at the time of capping.	Post-operation / closure
GHG-02	Undertake project planning to ensure that on-site vehicle movements and construction activities are efficient, avoid double handling of materials and avoid unnecessary fuel use.	Pre-construction / construction / operation
GHG-03	Consider use of alternative fuels which are less carbon intensive, such as operating machinery and construction activity vehicles which use bio-diesel fuels.	Pre-construction / construction / operation
GHG-04	Review the GHG emissions profile of the landfill based on recorded waste volumes four years[36] after landfilling commences in Stage 4 to: • Confirm the emissions projections reported herein and the need for reporting under the NGER scheme, and • Identify opportunities to optimise existing landfill gas management strategies, including existing landfill gas infrastructure.	Operation
GHG-05	Provide a separate report to DPE summarising the findings of the GHG emissions review and outlining any additional reduction and/or management strategies to be implemented.	Operation

8.8 Heritage

8.8.1 Aboriginal heritage

An Aboriginal heritage assessment was undertaken by Artefact to determine the Aboriginal heritage significance of the Proposal Site as well as the likely opportunities and constraints in respect of the Proposal. The assessment was undertaken in

[36] The selection of the date of four years post opening is because the landfill is predicted to open in 2026 and the NGER reporting threshold is predicted to be breached in 2031 (5 years later). Hence the timing would inform a decision on whether SCC is required to report under the NGER scheme.

accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*.

In 2014 and 2015 GHD engaged Artefact to undertake Aboriginal archaeological surveys for the West Nowra RRP. However, since that time further extensions have been proposed and Arcadis has engaged Artefact to undertake a further archaeological survey and prepare an addendum archaeological survey report for the Proposal.

The detailed assessment report is provided in Appendix T. This section provides a summary of the findings of the assessment in relation to potential impacts associated with the Proposal on Aboriginal heritage and related mitigation measures.

Table 8-49 provides a summary of the relevant SEARs, which relate to Aboriginal heritage and where these have been addressed in this EIS.

Table 8-49 SEARs relevant to Aboriginal heritage

Section	Requirement	Where addressed in EIS
Heritage	Both Aboriginal and non-Aboriginal	Section 8.8

Existing environment

The previous and current study area for the Aboriginal heritage assessment is shown in Figure 8-25. The assessment included background research, targeted visual surveys and observations.

In addition to the most recent study undertaken by Artefact in 2017, Artefact has previously undertaken heritage surveys and assessments in and around the Proposal Site in 2014 and 2015, from Artefact (2014) and Artefact (2015). These assessments were relied upon as part of the most recent assessment. The findings of the 2014 assessment concluded that there is a very low potential for Aboriginal relics or artefacts to be present on the 2014 study area that is adjacent to the current Proposal Site.

The most recent field surveys of the Proposal Site were conducted on 17 August 2017 with a representative of the Nowra LALC. No Aboriginal objects or potential archaeological deposits (PADs) were identified during the survey.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) site register was requested on 24 August 2017 and revealed 103 registered sites within a 10 km radius of the Proposal Site. The predominant site types identified were open camp sites comprising artefact scatters and combined rock shelter sites.

There are no registered sites within the Proposal Site with the closest registered site to the Proposal Site being a stone arrangement (AHIMS ID 52-5-19) located on the northwest corner of the existing WNRRP. The stone arrangement was registered in 1963 however no verification of the site location appears to have occurred since it was registered. The Aboriginal Site Recording Form (ASRF) mentions the rapid destruction of this stone arrangement therefore it is difficult to determine the exact location of the aforementioned stone arrangement and whether it is still extant.

A large number of various rockshelters comprising of art, deposit and grinding grooves are distributed to the north of the Proposal Site. These are related to the abundance of suitable sandstone outcrops for shelters, art and grinding grooves in the Nowra area. There are no such suitable outcrops in the Proposal Site. Nevertheless, the occurrence of these types of rockshelters would suggest that landscape to the north of the Proposal Site is of high cultural significance as well as high

archaeological significance. These sites appear to be clustered along the creeks and river wherever there are suitable sandstone outcrops.

Based on a summary of previous archaeological surveys, the Proposal Site and surrounding area are predicted to be of low archaeological potential due to its distance from freshwater sources, the broad crest landform, prior ground disturbance and its location outside the Primary and Secondary resources zones as identified by Clarke and Kuskie (2006). Furthermore, sandstone outcropping suitable for art, shelters and grinding grooves does not appear to be present in the Proposal Site.

Figure 8-25 Aboriginal heritage study area

Potential impacts

The additional surveys undertaken in 2017 by Artefact confirmed that no previously recorded Aboriginal sites and/or places, and no areas of archaeological potential are located within the boundaries of the Proposal Site. As a result, the Proposal Site is considered to be of very low archaeological potential and low archaeological significance.

Neither construction or operation of the Proposal is likely to have any impact on existing Aboriginal heritage items. As the Proposal Site has low archaeological potential, it is unlikely that any Aboriginal heritage significance would be uncovered as a result of either construction or operation.

The locations for the installation of the six poles for the three fauna rope bridge crossings have not been inspected as part of the EIS. While there are no known Aboriginal heritage objects in the vicinity of the Proposal Site based on the AHIMS search undertaken on 24 August 2017, an Aboriginal heritage specialist would need to inspect the area to ensure there are no Aboriginal archaeological heritage items prior to installation of the fauna poles (see mitigation measure H-04).

If any items of Aboriginal significance are uncovered, mitigation measures would be implemented as per Table 8-50.

Mitigation measures

While no direct or in-direct impacts are expected to occur to Aboriginal items due to the low archaeological potential and significance of the Proposal Site, the mitigation measures outlined in Table 8-50 will be employed to ensure protection of any unexpected finds during construction and operation works of the Proposal.

Table 8-50 Summary of Aboriginal heritage mitigation measures

ID	Environmental safeguards	Timing
H-01	Prior to their on-site involvement, all personnel engaged for tree clearing and topsoil stripping would undergo a general site induction prior to their on-site involvement that provides information on legal obligations with respect to archaeological relics, including 'stop work' conditions applicable in the event that any identified or suspected heritage relics are discovered at any time	Pre-construction
H-02	In the event that any previously identified / suspected Aboriginal historical relics are detected at any time, all disturbance work should immediately cease within 20 m of the find and temporary protective fencing erected around this 'no-go zone' pending further management advice from the OEH (Planning and Aboriginal Heritage Section, South Coast Region). If the find consists of or includes human remains, the NSW Police Department and NSW Coroner's office would be contacted.	Pre-construction / construction / operation
H-03	An LEMP will be updated for the Proposal. This would include a procedure for unexpected finds and protocols for communication with the Aboriginal community during the construction and operational phases of the Proposal.	Pre-construction
H-04	Prior to installation of fauna poles for the fauna rope bridge crossing an Aboriginal heritage specialist would need to inspect the area to ensure there are no Aboriginal archaeological heritage items.	Pre-construction

8.8.2 Non-Aboriginal heritage

An assessment of potential impacts of the Proposal on non-Aboriginal heritage was undertaken by Artefact, *West Nowra Recycling and Waste Facility Non-Indigenous Heritage Assessment* (Artefact, 2017b) (Appendix Q). A summary of the findings is provided below. This assessment was prepared based on:

- A desktop assessment which included a review of key legislation and online heritage database searches
- Previous non-Aboriginal heritage assessments of part of the Proposal Site including assessments undertaken in 2014 and 2015.

A site survey was conducted on 17 August 2017 to inspect the Proposal Site. The following publicly available local, state, national and world heritage databases were searched on 27 September 2017 as part of this assessment:

- Register of the National Estate (non-statutory)
- National Heritage Register List
- Commonwealth Heritage List
- Section 170 Register
- State Heritage Register and Inventory Tool (NSW Heritage Office)
- Shoalhaven Council LEP 2014

Table 8-51 provides a summary of the relevant SEARs, which relate to non-Aboriginal heritage and where these have been addressed in this EIS.

Table 8-51 SEARs relating to non-Aboriginal heritage

Section	Requirement	Where addressed in EIS
Heritage	- both Aboriginal and non-Aboriginal	Section 8.8

Existing environment

The Proposal Site remained vacant bushland during the early years of settlement. A parish map from 1900 shows that some subdivision had commenced in the region; however, the Proposal Site was located in an unsurveyed area (Figure 8-26). The earliest identifiable subdivision of the Proposal Site is to a size similar to its current extent, as shown in the 1963 parish map (Figure 8-27). An annotation on the parish map indicates that the site was vested in the Shoalhaven City Council on 20 April 1979.

The investigations by Artefact revealed that no items of local, state or national heritage significance are located near the Proposal Site. This is likely due to the limited historical non-Aboriginal land uses and the dense vegetation that covers the Proposal Site. A site inspection of the Proposal Site revealed that no items of heritage or archaeological potential were identified within the Proposal Site.

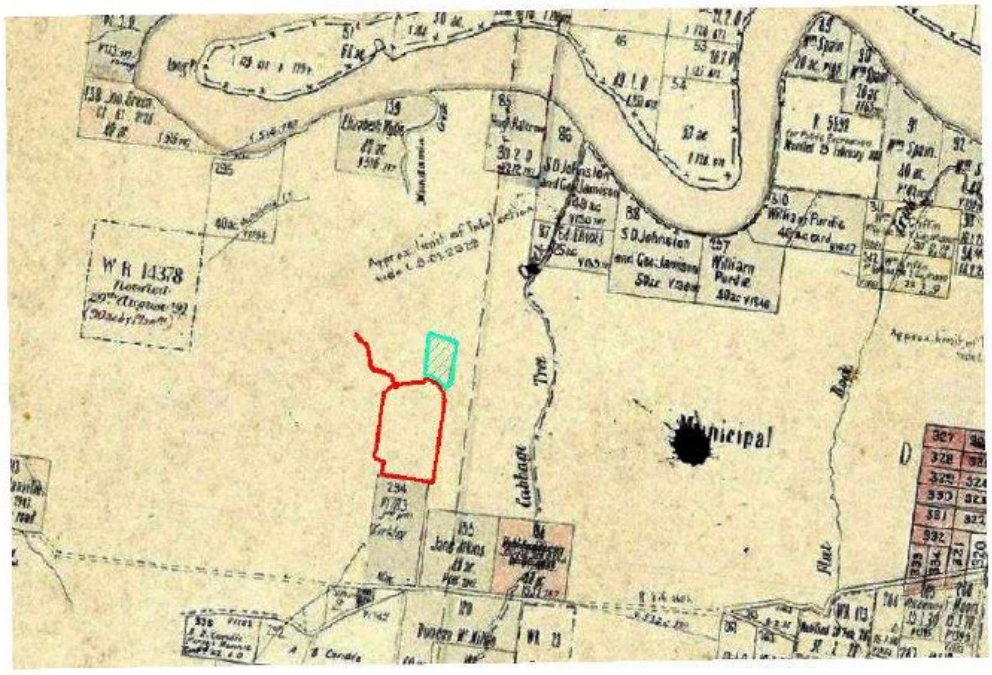


Figure 8-26 Parish of Nowra, County of St. Vincent (Source: HLRV:1900 cited in Artefact, 2017b)[37]

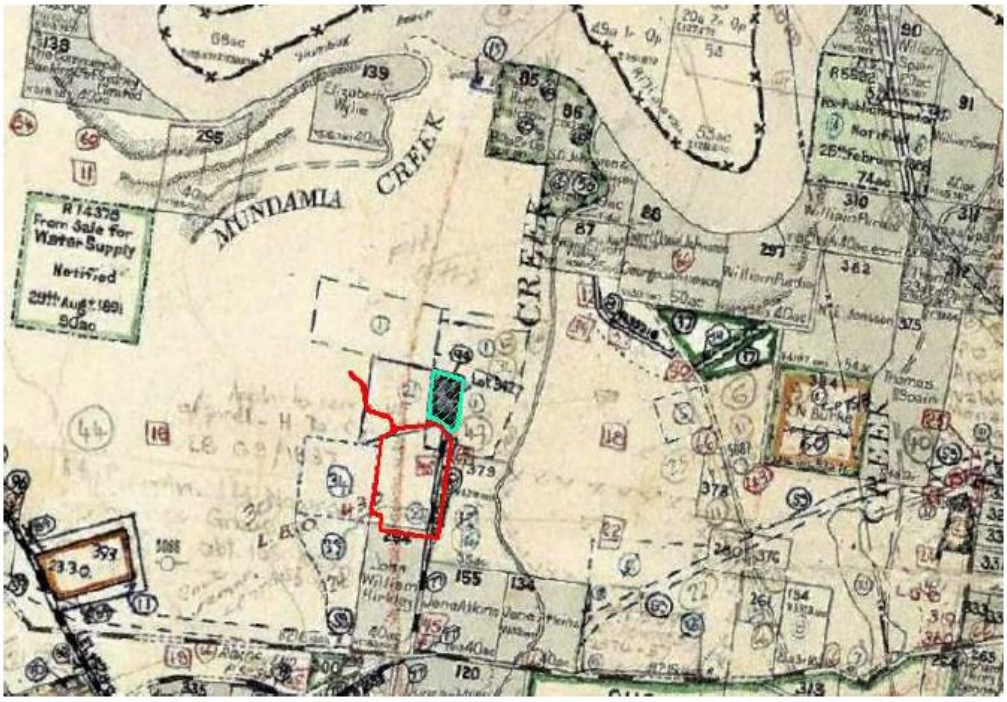


Figure 8-27 Parish of Nowra, County of St. Vincent (Source: HLRV: 1963 cited in Artefact, 2017b)[38]

[37] The red area on this map represents the Proposal Site. The blue polygon is an adjacent land parcel, not related to this Proposal.

[38] The red area on this map represents the Proposal Site. The blue polygon is an adjacent land parcel, not related to this Proposal.

Potential impacts

Due to there being no non-Aboriginal items identified on or near the Proposal Site, no direct physical impacts on any items of non-Aboriginal heritage are anticipated.

Mitigation measures

While no direct or in-direct impacts are expected to occur to non-Aboriginal heritage items, the mitigation measures outlined in Table 8-52 will be employed to ensure protection of any unexpected finds during construction and operation of the Proposal.

Table 8-52 Summary of non-Aboriginal heritage mitigation measures

ID	Mitigation measures	Timing
H-05	Prior to their on-site involvement, all personnel engaged for tree clearing and topsoil stripping would undergo a general site induction prior to their on-site involvement that provides information on legal obligations with respect to archaeological relics, including 'stop work' conditions applicable in the event that any identified or suspected heritage relics are discovered at any time	Pre-construction
H-06	In the event that any previously identified / suspected non-Aboriginal historical relics are detected at any time, all disturbance work should immediately cease within 20m of the find and temporary protective fencing erected around this 'no-go zone' pending further management advice from the OEH (Planning and Aboriginal Heritage Section, South Coast Region). If the find consists of or includes human remains, the NSW Police Department and NSW Coroner's office would be contacted.	Pre-construction / construction / operation

8.9 Visual impacts

Arcadis has undertaken a desktop study to address the SEARs relating to visual impacts. A summary of the relevant SEARs and where these have been addressed in this EIS is provided in Table 8-53.

Table 8-53 SEARs relevant to visual impacts

Section	Requirement	Where addressed in EIS
Visual impacts	- Visual impacts	Section 8.9

8.9.1 Methodology

An initial desk-top analysis of topographic and cadastre maps, and a review of the Proposal description, was undertaken to determine key receivers and potential view corridors. Baseline visual data on the Proposal Site was gathered during a visual site inspection undertaken on 12 February 2016 to determine key viewpoints which may experience a visual change as a result of the Proposal.

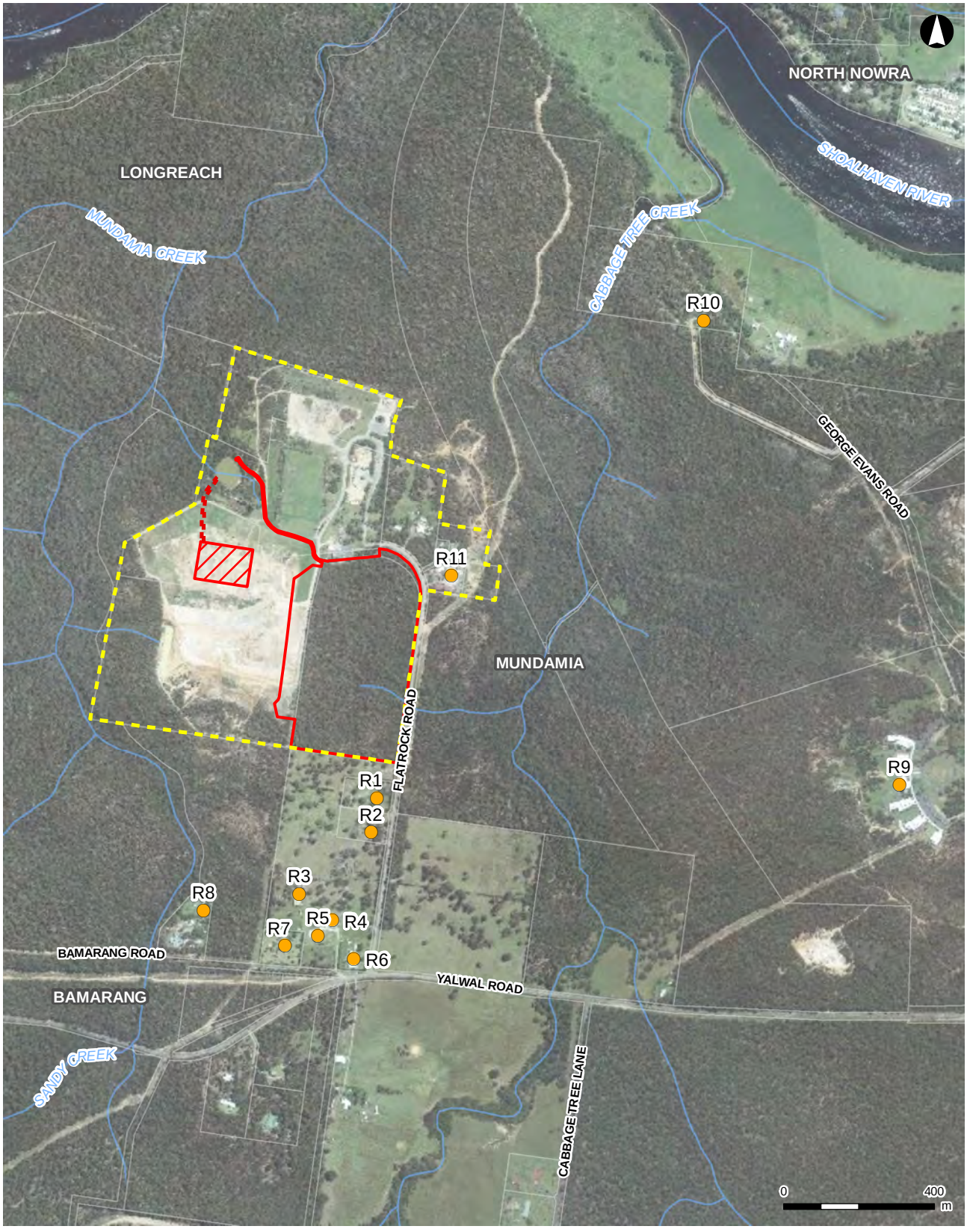
8.9.2 Existing environment

The Proposal Site is located within the WNRWF, approximately 4.5 km to the west of the main township of Nowra and 2.7 km to the west of the township of West Nowra.

Surrounding receivers

The area surrounding the Proposal Site includes a combination of residential and rural dwellings, public roads and industry. A summary of potential view receivers is shown in Figure 8-28 and described in Table 8-54.

West Nowra Landfill Extension



LEGEND

- Proposal site
- Proposed leachate irrigation area
- Indicative leachate pipeline
- West Nowra RWF
- Sensitive reciever
- Cadastre (LPI, 2017)
- Watercourse

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Coordinate System: GDA 1994 MGA Zone 56
Date issued: April 30, 2019

Imagery supplied by NSW LPI

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Figure 8-28: Potential visual receivers

Table 8-54 Potential visual receivers

Receiver No.	Name/Distance
NA	Travellers along Flatrock Road Immediately east of the Proposal Site
1-2	Residential dwellings located at 41 and 43 Flatrock Road, Mundamia Approximately 100 m – 200m directly south of the Proposal Site
3-7	Residential dwellings located at Bamarang Road, Mundamia 500 m directly south of the Proposal Site
8	Jim Da Silva Farm, 18 Bamarang Road, Mundamia 550 m south west of the Proposal Site
9	University of Wollongong – Shoalhaven Campus Approximately 1.3 km directly east of the Proposal Site
10	Residential dwelling at 56 Stonegarth Road, Mundamia Approximately 1.3 km north-east of the Proposal Site
11	Industrial site / offices at 104-108 Flatrock Road Mundamia Approximately 70 m north-east of the Proposal Site respectively

Visual landscape

The Proposal Site is located in an area predominantly covered in undeveloped bushland. Immediately to the west of the Proposal Site is the existing landfill currently operating at the WNRWF. Immediately to the north are offices associated with the WNRWF. Immediately to the east is Flatrock Road and then undeveloped bushland. Immediately to the south is a partly forested rural property. The vegetation along the eastern and southern border of the Proposal Site will be retained as a conservation area as part of the Proposal and will provide visual screening.

The undeveloped bushland to the south west of the Proposal Site is zoned for environmental conservation and undeveloped bushland to the east is zoned for environmental management. Further from the Proposal Site there is a combination of rural and residential properties, bushland, agricultural open space and industry. Flatrock Road is tree lined along the majority of its length and therefore there is a limited view of the WNRWF from Flatrock Road.

Overall the Proposal Site has very limited visibility in the surrounding landscape context.

8.9.3 Potential impacts

Sensitive receivers are located to the south, north-east and east of the Proposal Site. All sensitive receivers will be visually screened from the Proposal Site by the existing vegetation along the southern and eastern boundaries of the Proposal Site which is being incorporated into a conservation area as part of the Proposal (the conservation area is shown on Figure 1-2).

The maximum height of the final cap of the Proposal (RL. 59 m) would be less than the existing landfill (max. RL. 61 m). Therefore, the Proposal would not increase the height of the landfill or its visibility to surrounding sensitive receivers.

Additionally, views of the Proposal Site and WNRWF from locations in the broader landscape are screened by the extensive surrounding native bushland.

Table 8-55 Potential visual impacts

Receiver No.	Name/Distance	Visual impact summary
NA	Travellers along Flatrock Road Immediately east of the Proposal Site	Existing dense vegetation runs along the eastern and southern boundary of the Proposal Site. This is proposed to become the conservation area to be maintained as part of the Proposal and would adequately screen views of the Proposal resulting in a negligible impact to road users.
1-2	41 and 43 Flatrock Road, Mundamia Approximately 100 m – 200m directly south of the Proposal Site	Existing dense vegetation runs along the southern boundary of the Proposal Site. This is proposed to become the conservation area to be maintained as part of the Proposal and would adequately screen views of the Proposal resulting in a negligible impact to the sensitive receiver.
3-7	Residential dwellings located at Bamarang Road, Mundamia 500 m directly south of the Proposal Site	Existing vegetation located on these properties would block the view of the Proposal Site. Additionally, conservation area along the southern boundary of the Proposal Site and distance to the Proposal Site would ensure that the Proposal would have a negligible impact on these sensitive receivers.
8	Jim Da Silva Farm, 18 Bamarang Road, Mundamia 550 m south west of the Proposal Site	Existing dense vegetation runs along the southern boundary of the Proposal Site. This is proposed to become the conservation area to be maintained as part of the Proposal and would adequately screen views of the Proposal Site resulting in a negligible impact to the sensitive receiver. There is also a significant stretch of forested bushland between the receiver and the Proposal Site which would provide additional screening.
9	University of Wollongong – Shoalhaven Campus Approximately 1.3 km directly east of the Proposal Site	The University Campus sits at an elevated level in the landscape (approximately 67m AHD) compared to the proposed final landfill level (approximately 59m AHD). Therefore, there is the potential for limited views of the Proposal Site from within the university campus. Notwithstanding this, due to the distance from the Proposal Site, and the existing dense vegetation that surrounds both the sensitive receiver and the Proposal Site, it is expected that the Proposal would have a negligible visual impact on this sensitive receiver.
10	Residential dwelling at 56 Stonegarth Road, Mundamia Approximately 1.3 km north-east of the Proposal Site	The proposed conservation area would adequately screen views of the Proposal Site resulting in a negligible impact to the sensitive receivers. There is also a significant stretch of forested bushland between the receiver and the Proposal Site which would provide additional screening.

Receiver No.	Name/Distance	Visual impact summary
11	Industrial site / offices at 104-108 Flatrock Road Mundamia Approximately 70 m north-east of the Proposal Site respectively	The proposed conservation area would adequately screen views of the Proposal Site resulting in a negligible impact to the sensitive receivers.

Overall, it is considered unlikely that the Proposal is visible from the surrounding area. Even if it were visible, due to the distances to sensitive receivers and the vegetation which provides a visual barrier, any impact would be negligible.

Visual landscape

As discussed above, the landfill would be located behind existing dense vegetation that surrounds the eastern and southern boundary of the Proposal Site which would be maintained as a conservation area as part of the Proposal. The proposed Stage 4 landfill height (RL 59 m) for this Proposal would also be lower than the existing Stage 3 landfill height (max RL 61 m). As a result, the Proposal would not create any significant additional visual impacts.

8.9.4 Mitigation measures

As negligible visual impacts have been identified, and a proposed conservation area has already been included to provide visual screening, no additional visual impact mitigation measures are required.

8.10 Hazard and risks

Arcadis has undertaken a hazard and risk assessment to address the SEARS relating to hazards and risk. A summary of the relevant SEARs, which relate to hazards and risk, and where these have been addressed in this EIS is provided in Table 8-56.

Table 8-56 SEARs relevant to hazards and risk

Section	Requirement	Where addressed in EIS
Hazards and risk	- Including bushfire	Section 8.10

8.10.1 Methodology

The Proposal has the potential to pose environmental, human health, and amenity hazards if it were to operate without any measures to reduce or minimise its impact in the locality. As such, the Proposal falls within the definition of a “potentially hazardous industry” or “potentially offensive industry” under *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33).

A hazard is anything or situation with a potential for causing damage to people, property or the biophysical environment. Hazard identification was undertaken based on a review of the Proposal in the context of the Proposal Site and surrounding area.

In identifying hazards, operational and organisational safeguards designed to prevent or mitigate the effects of hazardous incidents have also been taken into consideration.

In addition to addressing the SEARs, this section has been prepared to address SEPP 33 which requires an assessment of hazards and risks. The hazard and risk assessment included completion of a screening test in accordance with *Applying SEPP 33* (DPI, 2011) to determine whether a preliminary hazard analysis (PHA) is required. This involved:

- Identification of dangerous goods involved in the Proposal, the quantities of these goods and the distance of the storage location relative to the Proposal Site boundary
- Determination of whether the Proposal would emit a polluting discharge which would cause a significant level of offense, and hence require a licence.

8.10.2 Existing environment

The Proposal Site includes the extension of the Stage 4 landfill, located within the existing WNRWF.

Bushfire-prone land has been mapped by Council, pursuant to provisions of section 146 of the EP&A Act. ABPP conducted a bushfire assessment to ascertain the bushfire risk to the Proposal. The Proposal Site has been assessed as containing and being adjacent to Category 1 Bushfire Prone Vegetation. An extract of the SCC Bushfire Prone Land Map is provided in Figure 8-29. A *Bushfire Risk Management Plan* has been prepared by SCC pursuant to section 52 of the *Rural Fires Act 1997*, wherein the Proposal Site has been assessed as having a high-risk level as there is potential for harm to humans and infrastructure from bushfires.

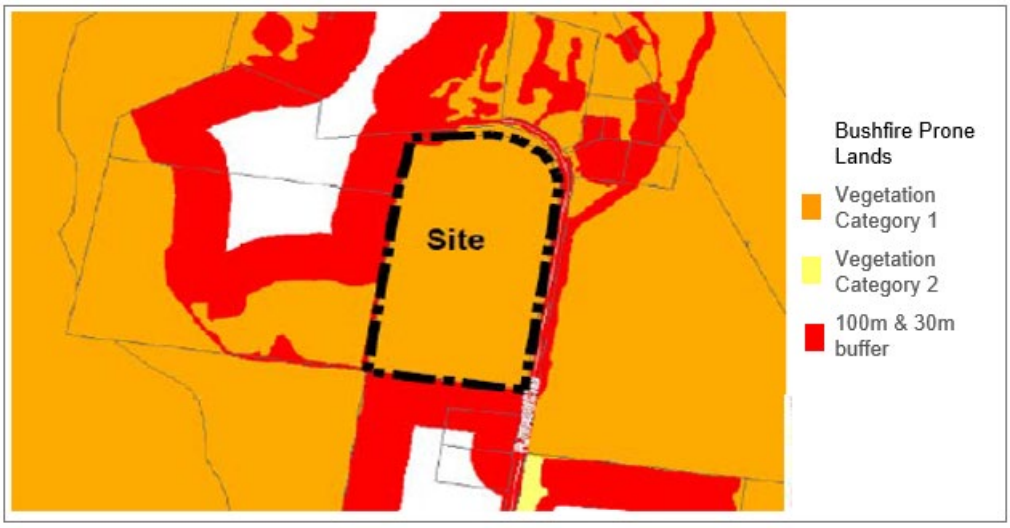

Figure 8-29 Extract of the SCC Bushfire Prone Land Map

8.10.3 Potential impacts

Risk screening

As described in *Applying SEPP 33* (DoP, 2011) the first stage of determining the SEPP 33 procedural requirements, and in particular to determine if a PHA is required, is to undertake screening tests, such as dangerous goods quantity / distance thresholds.

Hazardous materials are substances falling within the classification of the Australian Code for Transportation of Dangerous Goods by Road and Rail Edition 7.5

(Dangerous Goods Code) (NTC Australia, 2017). The only hazardous material likely to be accepted and stored onsite is asbestos, which does not fall within the classification of the Dangerous Goods Code.

All other hazardous materials, including fuel for site vehicles, will be stored in the existing storage facilities in the WNRWF and would be managed in accordance with the 2008 Landfill Environmental Management Plan (2008 LEMP). As such, a PHA would not be required for the Proposal.

All asbestos waste on the existing WNRWF is regulated under EPL 5877 from the EPA. The EPL does not prescribe an applicable limit of asbestos allowed to be received onsite however the existing WNRWF only accepts small quantities of asbestos waste.

Other potential hazards and risks are discussed below, however with the application of the mitigation measures outlined in Section 8.10.4. The Proposal is considered to have minimal potential for impacts to human and environmental health. The risk screening therefore concludes that a PHA is not required.

Bushfire

A bushfire assessment (Appendix J) was conducted by ABPP who classified the Proposal Site as having a high bushfire hazard rating and a high bushfire threat rating. The vegetation comprising the forest in the Biodiversity Corridor retained on the Proposal Site and the adjoining forest to the east of Flatrock Road presents a potential bushfire risk.

The risk to the Proposal Site includes the ignition of exposed combustible materials, gas emissions and the vegetation in the Biodiversity Corridor from burning embers. Staff and equipment may be exposed to high levels of radiant heat and smoke. Table 8-58 provides residual risk levels, which are the risk levels after the implementation of mitigation measures. Mitigation measures to reduce the risk and impact of bushfire are addressed in Table 8-60.

Table 8-57 Risk analysis matrix

		Consequence				
		Minimal	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood	**Remote**	Negligible	Negligible	Very Low	Low	Medium
	Unlikely	Negligible	Very Low	Low	Medium	High
	Possible	Very Low	Low	Medium	High	Very High
	Likely	Low	Medium	High	Very High	Significant
	Almost Certain	Medium	High	Very High	Significant	Significant

Table 8-58 Bushfire risk register

Scenario	Consequence	Likelihood	Consequence rating	Likelihood rating	Level of risk	Residual risk level
1: A bushfire burning in unmanaged forest vegetation in the biodiversity corridor/land to the east of Flatrock Road, spreading across the landscape under north-easterly winds	Ignition of unmanaged vegetation	Likely to occur during severe/ catastrophic fire danger periods	Moderate	Likely	High	Medium
2: A bushfire burning in unmanaged forest vegetation in the biodiversity corridor/land to the east of Flatrock Road, spreading across the landscape under south-easterly winds	Ignition of unmanaged vegetation	Likely to occur during severe/ catastrophic fire danger periods	Moderate	Likely	High	Medium
3: A bushfire burning in landfill waste spreading into the adjoining forest vegetation within the Proposal Site or on adjoining lands	Ignition of unmanaged vegetation	May occur if fire within landfill material is not immediately extinguished during severe/ catastrophic fire danger periods	Moderate	Possible	Medium	Low
4: Ignition of the landfill waste/gas emissions and vegetation in the biodiversity corridor by embers from fires burning to the north-west, west and south-west of the Proposal Site.	Ignition of waste/gas/ vegetation	May occur during severe/ catastrophic fire danger periods	Moderate	Possible	Medium	Low

Fire and explosion

Fire and explosion have the potential to cause human injury and damage to property and equipment. Fire may be caused by a number of factors including: bushfires encroaching onto the site (discussed above), fires in waste entering the Proposal Site caused by burning material brought in with waste, or fire initiated onsite (e.g. from a vehicle accident, inappropriate management of hot works, equipment or vandalism). Explosion may result from methane accumulation and ignition, or fires reaching the gas generator and gas flare infrastructure.

SCC operates a landfill gas generator and gas flare system on site to extract landfill generated gas and produce electricity. The landfill gas generated at the Facility is used to power a 16-cylinder gas engine, with any excess gas destroyed using the gas flare. Between August 2013 and 2014, the gas flare system destroyed an amount of methane gas equivalent to 26,739 t of carbon dioxide (AGL, 2014). By reducing the volume of the ignitable gas within the landfill cell, the extraction system reduces the potential severity for ignition and/or explosion at the Proposal Site.

Other hazards and risks

Spills

Liquid and solid spills may arise from situations such as potential loss of putrescible waste loads. Depending on the material and circumstances, spills mays result in damage to skin and airways, as well as physical impact and injury. Spills also have potential to cause harm to the environment, particularly if liquid spills of toxic and hazardous substances enter waterways or groundwater and / or contaminate soil.

Health and respiratory impacts

Potential emissions from the Proposal Site include vehicle exhaust, dust, microbial or gases / odours. These airborne emissions have the potential to cause health impacts, such as asthma and allergies, in the local community. Mitigation measures relating to health and respiratory impacts are addressed in Section 8.10.4.

Vehicle movements

Heavy vehicles, private vehicles and pedestrian (staff and public) movements on the Proposal Site present potential hazards in terms of incidents between vehicles, between vehicles and pedestrians and vehicles and property. Mitigation measures relating to traffic and vehicle movements are addressed in Section 8.6.

Hazardous material

Asbestos would continue to be received at the Proposal Site as allowed under the current EPL. Private vehicles disposing of asbestos containing material will be directed to the designated asbestos area. Risks associated with the disposal of asbestos include human health (respiratory) risks and vehicle safety when accessing the landfill site. Mitigation measures relating to asbestos are included in Table 8-60.

Other than small household quantities of asbestos, hazardous materials would be identified by the weighbridge operators and would be refused entry to the Proposal Site. The person delivering the material would be required to dispose of the waste elsewhere at an appropriately licensed facility at their own cost. Any hazardous material that is unintentionally accepted/identified within the Proposal Site has the potential to cause harm to the environment and/or result in human health impacts.

Other hazardous material including fuel for on site vehicles would be stored in existing storage facilities located in the plant and equipment shed and storage shed (see Figure 1-3). In accordance with the approved 2008 LEMP, all fuels and flammable solvents would be stored in suitably ventilated and secured stores and waste oil would be stored within a bund of 110 % capacity of the volume of flammable liquids.

Mitigation measures have been identified for key hazards and risks and are included in Table 8-60.

Operational risk assessment

Based on a review of the key hazards, described above Table 8-59 outlines the potential hazards identified as part of the operational risk assessment, the risk associated with the hazard and the proposed mitigation strategy that would be adopted to address the hazard, along with the relevant standard or guidance document that would be used in the development of the procedure or engineered control.

Hierarchy of controls

In identifying hazard mitigation and management measures the following hierarchy of controls (which range from most effective to least effective) were considered:

1. **Eliminate** the hazard altogether.
2. **Substitute** the hazard with a safer alternative.
3. **Isolate** the hazard from anyone who could be harmed.
4. Use **engineering** controls to reduce the risk.
5. Use **administrative** controls to reduce the risk.
6. Use **personal protective equipment** (PPE).

This hierarchy starts with the most preferable approach to managing hazards.

The hazard scenarios and the mitigation measures and guidelines that would be implemented to minimise risks, along with the type of control that each mitigation measure or guideline represents, is presented in Table 8-59.

Table 8-59 Hazard scenarios and consequences associated with the activities and facilities

Potential Hazard	Risk	Potential Impact	Management Standards and Guidelines	Hierarchy of Control
Light and heavy vehicle, and equipment movements surrounding the Proposal Site	Vehicle accidents, including: • With private vehicles • With Proposal-related light and heavy vehicles • With pedestrians • With structures	Physical harm and property damage	Clear signage and road markings (speed limits, directions, restricted access areas, marked parking bays)	Administrative
			Separation, where practicable, of light and heavy vehicles and equipment, heavy vehicles only at the landfill tipping face, all other vehicles are directed to the transfer station tipping floor.	Engineer
			Heavy vehicle drivers and equipment operators trained, licenced and competent	Administrative
			Operational procedures	Administrative
			Pollution Incident Response Management Plan (PIRMP) prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
Trucks unloading unsecure or unstable loads	Falling objects, loss of control, vehicle accident, impacts on other vehicles, plant or staff	Physical harm and property damage	Operational procedures	Administrative
			Drivers and operators licenced and competent	Administrative
			PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
Use of plant and equipment to move and sort waste	Falling objects, loss of control, equipment or vehicle accident, impacts on vehicles, plant or staff	Physical harm and property damage	Operational procedure	Administrative
			Drivers and operators licenced and competent	Administrative
			PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
Fires or explosion	Bushfire, fire initiated on-site or at adjacent sites, fire initiated from spontaneous combustion of waste stockpiles on-site, fire from waste trucks entering the Proposal Site	Physical harm and property damage	Operational procedure	Administrative
			AS 1815: Maintenance of Fire Suppression System and Equipment	Engineering
			AS 1851-2012 *Routine service of fire protection systems and equipment*	Engineering

Potential Hazard	Risk	Potential Impact	Management Standards and Guidelines	Hierarchy of Control
			PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
Diesel fuel leak or fire due to vehicle collision or faulty storage	Fire or skin contact/inhalation	Physical harm and property damage	PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
			Currently no diesel fuel is stored on site, with all plant being refuelled by a mobile tanker that parks at an alternative location. If necessary, storage will be in a separate bund or within a storage area where no other flammable materials stored.	Engineering
			Operational procedure	Administrative
			PPE supplied and worn	PPE
	Release of dangerous goods	Environmental harm	Surface and groundwater contingency plans (in the event of contamination)	Administrative
Non-conforming waste (e.g. paints and chemicals)	Spills, exposure to hazardous substances	Physical harm	PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
			Operational procedure	Administrative
			Visual inspection of waste at the weighbridge by staff	Administrative
		Environmental harm	Surface and groundwater contingency plans (in the event of contamination)	Administrative
Dust generated from operating equipment, vehicle movements and bulk material handling	Respiratory health impacts, eye and skin irritation	Physical harm	PIRMP prepared in accordance with AS 3745 - 2010 *Planning for emergencies in facilities*	Administrative
			Enclosed areas where practicable, including enclosed working cabins Sealed roads Dust suppression systems	Engineering
			Covered loads	Administrative
			Eye protection and dust masks where required	PPE

Potential Hazard	Risk	Potential Impact	Management Standards and Guidelines	Hierarchy of Control
Vehicle exhaust generated from movement of trucks and equipment	Respiratory health impacts, eye and skin irritation	Physical harm	Vehicle and equipment maintenance to reduce particulate discharge	Administrative
			Where practicable, limit vehicle movements within enclosed areas	Administrative
			PPE (masks, air con within cabins, isolation, etc)	Administrative
Natural hazards (e.g. flooding and lightning)	Personal injury or potential fire	Physical harm and property damage	Buildings designed to appropriate standards Site drainage	Engineering
			Operational procedure	Administrative

8.10.4 Mitigation measures

Table 8-60 identifies safeguards and management measures that will be implemented to address potential hazards and risks associated with the Proposal. Safeguards and management measures are recommended in line with the relevant objectives and principles set out in the LEMP (SLR, 2019b). All safeguards relating to air quality and traffic are discussed in Sections 8.3 and 8.6 respectively.

Table 8-60 Hazard and risk mitigation measures

ID	Mitigation measures	Timing
HR-01	Procedures for responses to fire to be included in LEMP/PIRMP in accordance with: • *AS 3745 - 2010 Planning for emergencies in facilities* • *AS 1815: Maintenance of Fire Suppression System and Equipment* • *AS 2419.1-2005 Fire hydrant installations - System design, installation and commissioning.*	Construction/ Operation
HR-02	The PIRMP for the WNRWF will be updated to be applicable to the Proposal Site	Construction/ Operation
HR-03	The LEMP would be updated to include the following hazard and risk mitigation measures: • Control of vehicle movements in the facility to be overseen by attendants • Clear signage and road markings (speed limits, give way signs, directions, no access areas and disposal areas) • Limited number of heavy vehicles to be onsite at any one time • Ensure all personnel operating vehicles on site are licenced and competent • Operational procedures for plant and equipment to be outlined in the LEMP • Requirements for asbestos removal and disposal	Construction/ Operation
HR-04	The LEMP would be updated to include the bushfire mitigation measures outlined in Appendix J including: • Water tankers and heavy earth moving plant on stand-by during days of Total Fire Ban • Provision of portable fire extinguishers during maintenance activities involving cutting, grinding, welding and slashing • Hazard reduction burning of vegetation within the biodiversity corridor, operating cell, fire trails and fire breaks in accordance with the NSW Rural Fire Services Environmental Assessment Code 2006 • Provision and maintenance of a 10 m wide temporary slashed fire break to the outer edge of incremental landfill cells	Construction/ Operation

ID	Mitigation measures	Timing
	• Provision and maintenance of a 20 m wide fire break to the south of the existing site office, staff amenity and plant and equipment buildings • Provision and maintenance of a 10 m wide fire break to the south and east outer edges of the Stage 4 extension • Provision of on-site fire-fighting water tanks, portable first-aid firefighting equipment (fire hose reels/fire extinguishers), heavy equipment including bulk water trucks and water supplies and equipment for firefighting. • At the perimeter of each incremental landfill cell a temporary fire trail that connects to the existing/proposed perimeter/internal road/fire trail network should be provided that is capable of carrying a NSW RFS tanker • A locked gate would be provided at the junction of the Main Entry Road and fire trail • Drilling, cutting, grinding, welding and slashing works would not be undertaken on total fire ban days unless during an emergency, in which case firefighting equipment should be on stand-by • For the purpose of fuel reduction using hazard reduction burning: – All perimeter fire trails clear and maintained – Maintain a 20 m wide defendable space (fire break) to the existing office complex – Provide and maintain temporary fire trails and defendable spaces adjacent to each stage.	

8.11 Other environmental issues

8.11.1 Socio-economic

While not listed as a key issue in the SEARs, socio-economic considerations are a key component of an environmental assessment, as required under the EP&A Act and EP&A Regulation and therefore have been addressed below. This section presents an assessment of the Proposal in relation to socio-economic impacts

Existing environment

The demographic profile provided in this chapter was prepared based on the 2011 Australian Bureau of Statistics (ABS) census data. A subsequent census has taken place in 2016; however, the complete data has not been released by ABS and as such, the 2011 census is considered to provide the most recent information regarding the demographic profile of the Shoalhaven LGA.

Surrounding land uses

The Proposal is located within the suburb of Mundamia and the main township of Nowra is located approximately 4.5 km to the east of the Proposal Site. The nearest residential properties to the Proposal Site are located 65 m to the south of the Proposal Site boundary. Immediately to the west and north of the Proposal Site is the

WNRWF which is zoned SP2 Infrastructure – Waste and Resource Management Facilities. To the west of the WNRWF is bushland zoned E3 Environmental Management and to the south is bushland zoned E2 Environmental Conservation. Further to the west and south-west of the WNRWF is the Bamarang Nature Reserve, however it is noted that this reserve does not abut the Proposal Site or the WNRWF.

Population and growth

The population in the Shoalhaven LGA has been derived from the latest census data available (ABS, 2011) and is shown in Table 8-61.

Shoalhaven LGA has experienced moderate growth between 2006 and 2011, with an increase of 4.99 %. The resident population from the 2011 census was 92,811 for the LGA compared to the resident population from the 2006 census which was 88,405.

Analysis of the age structure of the Shoalhaven LGA in 2011, compared to NSW, shows the Shoalhaven LGA has a relatively older population than the NSW average, with a higher percentage of the population aged 55 to 64 years, and a significantly higher percentage over 65 years. The median age is significantly higher than NSW, at 46 years of age, compared to the NSW average of 38 years.

Table 8-61 Age summary of Shoalhaven LGA (ABS, 2011)

Characteristic	Shoalhaven LGA		NSW average	
	No. of persons	% of persons	No. of persons	% of persons
Infants (0-4)	5,185	5.6	458,736	6.6
Children (5-14)	11,221	12.1	873,776	12.6
Young adults (15-24)	10,023	10.8	893,101	12.9
Adults (25-54)	31,074	33.4	2,863,574	41.5
Mature adults (55-64)	13,701	14.8	810,290	11.7
Aged (65+)	21,607	23.3	1,018,180	14.7
Total	92,812	100	6,917,657	100

Characteristic	Shoalhaven LGA	NSW
Median age of persons	46	38

Employment

Employment data from the ABS 2011 census is provided in Table 8-62. Data shows that employment rates vary for the majority of the Shoalhaven LGA compared to the NSW average, with full time employment being lower than the NSW average and part time employment being higher than the NSW average. Unemployment levels in the Shoalhaven LGA are slightly higher than the NSW average.

Table 8-62 Employment summary for Shoalhaven LGA (ABS 2011 census)

Employment status	Shoalhaven LGA		NSW average	
	No. of persons	% of persons	No. of persons	% of persons
Full time	18,829	51.4	2,007,924	60.2
Part time	12,640	34.5	939,465	28.2
Away from work[39]	2,380	6.5	190,944	5.7
Unemployed total	2,798	7.6	196,525	5.9
Total in labour force	36,647	100	3,334,858	100

Income

Personal income data for the Shoalhaven LGA provided in Table 8-63 and Table 8-64 demonstrate that approximately 59 % of the population earn less than $600 per week. Weekly income data is slightly negatively skewed with few people earning greater than $1,250 per week. Table 8-64 demonstrates that income in the area is generally lower than that of the NSW average. Median family and median household income in the Shoalhaven LGA is significantly lower than the NSW average, and median individual income is only slightly lower than the NSW average.

Table 8-63 Weekly personal income for Shoalhaven LGA

Weekly income	Number of persons	Percentage
Negative/nil income	4,440	5.8
$1-$199	5,943	7.8
$200-$299	11,917	15.6
$300-$399	11,113	14.5
$400-$599	11,382	14.9
$600-$799	8,074	10.6
$800-$999	5,108	6.7
$1,000-$1,249	4,223	5.5
$1,250-$1,499	2,681	3.5
$1,500-$1,999	3,163	4.1
$2,000 or more	1,759	2.3
Individual income not stated	6,607	8.7
Total	76,410	100

[39] 'Away from work' includes parents/partners who either did not state the number of hours worked or did not work any hours in the week prior to Census night.

Table 8-64 Weekly income data for Shoalhaven LGA

Income	Shoalhaven LGA	NSW
Median weekly individual income	$426	$561
Median weekly family income	$984	$1,477
Median weekly household income	$822	$1,237

Impacts

An assessment of the impacts of the Proposal are provided in Table 8-65. Overall, the Proposal will result in a number of positive impacts on the social and economic fabric of the immediate surrounds of the Shoalhaven LGA. The Proposal will provide the local community with ongoing access to a landfill that has proven usability, efficiency, safety and environmental performance.

Table 8-65 Socio-economic impacts

Impact	Comment	Stage	Type/timeframe
Economic			
Employment	The Proposal will result in the generation of four to eight temporary jobs during construction in addition to the existing 20 permanent staff that would continue to be required on-site to manage the landfill operations including: • Weighbridge operation • Transfer station operation • Waste tyre operation • Non-ferrous operation • Green waste operation • Steel waste operation • C&D waste operation • VENM area operation • Pavement materials area operation • Active landfill disposal area operation	Construction and operation	Direct, positive, short and long term impact
Future economic implications	The Proposal would increase the landfill capacity by up to 30 years to cater for the predicted increase in population and waste generation. Without the Proposal, an alternative waste disposal solution would be required. For items where there are currently no reuse or recycling options available, alternatives such as transporting waste to facilities outside of the Shoalhaven LGA would likely have	Operation	Direct, positive, long term impact

Impact	Comment	Stage	Type/timeframe
	to be explored. Such an option would involve associated increases in economic, environmental and social costs.		
Cost-effective waste service	The Proposal will extend the capacity of the WNRWF thus prolonging the cost-effective waste service it provides to the community.	Operation	Direct, positive, long term impact
Social			
Environmental performance	SCC will continue to operate in line with the current EPL for the WNRWF with ongoing continued attention to the landfills environmental performance.	Construction and operation	Direct, positive, short and long term impact
Compliance with social and economic policies	As discussed in Section 3 the Proposal is consistent with, and supports state, regional and local planning (social and economic) policies. The Proposal has given considerable attention to ensuring that it achieves the goals of these strategies and in particular supports the anticipated population growth within the Shoalhaven LGA.	Operation	Direct, positive, short and long term impact
Traffic management and generation	As discussed in Section 8.6 the traffic generated from the Proposal would increase traffic numbers on the surrounding road network. However, a traffic impact assessment indicated the Proposal would have a negligible impact on the LoS of the surrounding road network.	Construction/ operation	Neutral impact

Overall, the Proposal would have a positive impact on the socio-economic environment within the Shoalhaven LGA by securing future landfill capacity to service the Shoalhaven LGA, providing ongoing employment opportunities and improving the environmental performance of the Shoalhaven's waste management solutions.

Mitigation measures

Section 9 includes a range of mitigation measures which would ensure that the Proposal does not adversely impact on the surrounding social and economic context. Any future complaints or feedback received from the public would be managed by SCC using the Customer Relationship Management System. The LEMP (SLR, 2019b) details the Customer Relationship Management System in place for the WNRWF which would be used to demonstrate that any concerns raised by the public are promptly and effectively addressed.

8.11.2 Ecologically sustainable development

As required under the EP&A Regulation (Schedule 2, Clause 7), the following section outlines how the Proposal is consistent with the principles of Ecologically Sustainable Development (ESD).

The Proposal has been assessed against the principles of ESD, as described in Schedule 2 of the EP&A Regulations:

- **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
  - (ii) An assessment of the risk-weighted consequences of various options
- **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
- **Conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration
- I**mproved 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 life cycle of 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, which enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Precautionary principle

The precautionary principle requires evaluation of the risks of serious or irreversible environmental damage associated with a proposed development. The Proposal has been assessed with the purpose of reducing the risk of serious and permanent impacts on the environment, including an evaluation of the consequences of alternatives and options to implementing the Proposal.

Specialist studies were undertaken to provide accurate information to assist with the evaluation and development of the Proposal, including: flora and fauna, air quality and odour, soil, water and leachate, noise, traffic and transport and indigenous and non-indigenous heritage. Where a level of uncertainty was identified in the data used for the assessment, a conservative worst-case scenario analysis was undertaken. These specialist studies did not identify any issues that may cause serious and irreversible environmental damage as a result of the Proposal, assuming the Proposal is implemented as described herein and the mitigation measures are appropriately implemented. The detailed assessment of each of these potential impacts is provided throughout this EIS (refer to Section 8 of this EIS) and the mitigation measures that are provided in a consolidated format in Section 9.

A precautionary approach has been applied throughout the development of the concept design, and minimising environmental impacts has been a key consideration when selecting design solutions as part of the Proposal.

Inter-generational equity

The principle of inter-generational equity is concerned with ensuring the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The Proposal has been designed to benefit both existing and future generations through the provision of the extension of the existing West Nowra Landfill which, combined with the other SCC waste minimisation and resource recovery initiatives, will be sufficient to service the Shoalhaven LGA for an additional eight to 18 years (i.e. to 2034 or 2044). In the absence of providing a well-cited, constructed and operated extension to the landfill, the cumulative effects of waste accumulation would significantly reduce local environmental values and amenity which would in turn affect future generations.

The Proposal would be constructed and operated according to high environmental standards, outlined in the LEMP, to avoid and minimise any adverse environmental impacts. Continuous improvements in the LEMP would occur to ensure that best practice methods are being employed wherever reasonable and feasible.

Overall, the design of the Proposal has incorporated the ESD principle of intergenerational equity through ensuring the Proposal can be constructed and operated sustainably to ensure that there is no significant on-going impacts on the surrounding community and future generations. The mitigation measures provided in Section 9 of this EIS, in particular those for Soil, Water and Leachate, identify the Proposal's commitment to minimising impacts on the surrounding area.

Conservation of biological diversity and ecological integrity

This principle stipulates that biological diversity and ecological integrity should be fundamentally considered when assessing the impacts of a proposed development. A comprehensive assessment of the existing local environment at the Proposal Site has been undertaken to develop a sound understanding of the site context and inform the identification and assessment of any potential biodiversity impacts.

The assessment found that 9.87 ha of native vegetation mapped as PCT Red Bloodwood – Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion would be cleared as part of the Proposal. This vegetation forms habitat for a number of threatened fauna species including Powerful Owl, Yellow-bellied Glider, Grey-headed Flying Fox, Eastern Bentwing Bat and Glossy Black-cockatoo, all of which were recorded on the Proposal Site. As such, it is likely that the Proposal would result in impacts to threatened fauna species and habitat listed under the TSC Act and/or EPBC Act.

The Proposal includes establishment of a 4.65 ha conservation area that surrounds the eastern and southern sides of the Proposal Site and installation of three fauna rope bridges to promote connectivity to the east of the Proposal Site. In addition, SCC is investigating potential Biodiversity offset sites in accordance with the requirements of the NSW Biodiversity Offsets Policy for Major Projects.

The biodiversity assessment and proposed mitigation measures have been outlined in Section 8.2.

Improved valuation, pricing and incentive mechanisms

This principle requires that costs to the environment are incorporated or internalised in terms of the overall project costs, ensuring that decision making takes into account the environmental impacts.

While it is often difficult to place a reliable monetary value on the residual, environmental and social effects of the Proposal. The value placed on environmental resources within and around the Proposal is evident in the extent of environmental investigations, planning and design of impact and mitigation measures undertaken to inform assessments and to minimise, if not prevent, adverse environmental impacts during construction and operation of the Proposal.

This EIS has examined the environmental consequences of the Proposal and identifies mitigation measures for areas where adverse environmental impacts may occur. The implementation of mitigation measures represents a capital and/or operational cost for the Proposal, acting as a valuation in economic terms of environmental resources.

Summary of impacts

Potential impacts to ecologically sustainable development is outlined in Table 8-66.

Table 8-66 Potential impacts to ESD

Aspects	Impacts
Biodiversity	• Loss of 9.87 ha of native vegetation of the Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion which provides terrestrial fauna habitat • Habitat fragmentation / loss of fauna habitat
Air quality and odour	• The air quality assessment concluded that all indicators are predicted to be below relevant criteria at all sensitive receivers except for at residential receiver R1 where exceedances of the maximum 24 hour average cumulative PM_{10} concentrations were found to be contributed to by the Proposal. • Similarly, the predicted 99th percentile odour concentrations would comply with the adopted criterion at all residential receivers except R1 which is slightly above the adopted criterion. • The assessment was based on a number of conservative, worst-case scenarios and it is unlikely that these worst case scenarios will actually eventuate.
Soil water and leachate	Soil: • Earthmoving activities exposing soil and increasing risk of erosion and sedimentation • Potential erosion and sedimentation impacts are considered low provided relevant mitigation measures are implemented effectively Water: • Changes to local hydrology during construction and operation have been minimised through the placement of two

Aspects	Impacts
	sedimentation basins, one to the south and one to the north of the Proposal Site. • Site water balance found that a water deficit is highly unlikely as there will be an excess of on-site water for on-site demands • Potential water quality impacts are considered unlikely provided relevant mitigation measures are implemented effectively. Leachate: • Potential leachate impacts to soil and water are considered unlikely provided the Proposal is implemented in accordance with the design and mitigation measures outlined herein.
Noise and vibration	• Noise levels associated with the Proposal are predicted to comply with established criteria during operation hours at all sensitive receivers except R1 where a minor exceedance of 2dB is expected. Appropriate mitigation measures will be implemented to reduce the impact of the exceedance • Road noise levels are predicted to exceed the RNP assessment criteria. However, the increase in road noise levels due to the Proposal is less than 2dB and therefore no mitigation of traffic noise levels is warranted.
Traffic	The total number of two-way trips is predicted to increase by 1% in the closing year compared to the opening year of the Proposal
Greenhouse gas	GHG emissions from the Proposal would be approximately 41,000 t in the closing year
Heritage	• There are no registered Aboriginal heritage sites within the Proposal Site. • There are no items of non-Aboriginal heritage (local, state or national heritage significance) within the Proposal Site.
Visual	The Proposal is unlikely to be visible from surrounding sensitive receivers.
Hazard and risks	Potential impacts including the following can be minimised appropriately provided the Proposal is implemented in accordance with the design and mitigation measures outlined herein • Fire and explosion caused by a number of factors including encroachment of bushfire, fires in waste, methane accumulation and ignition or fires reaching the gas generator or gas flare infrastructure • The Proposal Site has been assessed as having a high bushfire risk • Liquid and solid spills may arise from situations such as potential loss of putrescible loads • Health and respiratory impacts from vehicle exhaust, dust, microbial or gases/odours and asbestos • Safety of pedestrians and drivers at risk from vehicle movements on site.

Mitigation measures

As identified above, the ESD related impacts are associated with the environmental aspects discussed in earlier chapters of this EIS (see Section 8). The relevant mitigation measures are summarised in Section 9.

8.11.3 Cumulative impacts

The Proposal has been assessed in the context of the proposed and future developments in the surrounding area that may result in cumulative environmental impacts.

The future and proposed developments in the area surrounding the Proposal include:

- Cabbage Tree Urban Release Area
- RRP.

The cumulative impacts of the Proposal have been considered in relation to each of the issues identified in Section 8. Cumulative impacts of the Proposal, particularly in relation to traffic, noise and air quality have been considered in technical studies undertaken as part of this EIS.

Potential cumulative impacts of the Proposal and the above-mentioned future developments have been considered as part of development of this EIS and are documented in Table 8-67.

Cabbage Tree Urban Release Area

The Cabbage Tree Urban Release Area is a future urban release area located approximately 450 m south of the Proposal Site (SCC, 2014). The Proposal Site and the urban release area will share the intersection of Yalwal and Flatrock Road. SCC (2017a) advised the current estimated construction commencement date, for stage 1 development, of the Cabbage Tree Urban Release Area is the year 2026. This includes a total of 1,650 lots to be released progressively between 2026 and 2041. No population forecasts have been made available for the urban release area. The details of the urban release are subject to change, depending on other land releases, the economy, etc and a project approval would be required for the development.

RRP

As discussed in Section 1.3, a RRP is proposed adjacent to (northeast of) the Proposal Site. The RRP would effectively divert some of the waste streams currently received at the WNRWF to the RRP site for processing (i.e. would recover and process waste streams at the RRP and divert residual wastes to the WNRWF). This EIS adopts a worst case scenario whereby the RRP is not developed and impact assessments (such as traffic, odour and dust) have assumed ongoing operation of the WNRWF as described in Section 5.8.

The RRP has a Master Plan and Stage 1 Development (i.e. clearing of the site) approval and requires a separate major project approval prior to further development. The project approval would need to consider the specific impacts of the particular technology proposed, and the associated potential cumulative impacts.

Consideration of cumulative impacts

Table 8-67 outlines how potential cumulative impacts of the Proposal and the above-mentioned projects have been considered as part of development of this EIS.

Table 8-67 Summary of potential cumulative impacts and how they are considered in the EIS

Issue	Assessment of potential cumulative impacts
Biodiversity	The Proposal will have a direct impact on vegetation with the clearing of 9.87 ha of native vegetation used for terrestrial fauna habitat for a number of threatened species. To reduce the cumulative impact of the Proposal several mitigation measures would be implemented including: installation of three fauna rope bridges to enhance connectivity to the east of the Proposal Site, retaining of a conservation area within the Proposal Site and a clearing procedure to reduce the impact of clearing on threatened fauna species. Biodiversity offsets will be secured in accordance with the requirements of the NSW Biodiversity Offsets Policy for Major Projects
Air quality and odour	The air quality assessment concluded that all indicators are predicted to be below relevant criteria at all sensitive receivers except for at residential receiver R1 where exceedances of the maximum 24 hour average cumulative PM_{10} concentrations were found to be contributed to by the Proposal. Similarly, the predicted 99th percentile odour concentrations would comply with the adopted criterion at all residential receivers except R1 which is slightly above the adopted criterion. The assessment was based on a number of conservative, worst-case scenarios and it is unlikely that these worst case scenarios will actually eventuate. As such, through the implementation of mitigation measures identified in Section 8.3.4, the Proposal is unlikely to have a cumulative impact on air quality.
Soil, water and leachate	The soil, water and leachate assessment undertaken by SLR (Appendix N) concluded that with the implementation of appropriate mitigation measures identified in Section 8.4.4, the Proposal would not result in additional erosion, contamination or water and hydrology impacts. As a result, through the implementation of these mitigation measures, cumulative soil, water and contamination impacts are not predicted.
Noise and vibration	The noise impact assessment undertaken by SLR (Appendix R) assessed the noise impact of the Proposal using two scenarios. The assessment concluded that the Proposal would comply with relevant noise criteria at all sensitive receivers during Scenario 2 and would comply with all sensitive receivers except the nearest sensitive receiver located approximately 90 m from the Proposal Site during Scenario 1. However, this exceedance is only 2 dB and considered to be minor. Therefore, the Proposal would not be expected to result in any increase cumulative noise levels experienced by surrounding sensitive receivers.
Traffic	The traffic assessment for the Proposal assumes a worst case scenario, where the RRP does not proceed and all of the traffic that could be going to the RRP is going to the Proposal Site. Should the RRP proceed, the traffic would effectively transfer from one site to another. As the sites are adjacent and use the same access road, no cumulative impacts are expected. Note: the RRP currently has Master Plan and Stage 1 Development approval only and assessment of cumulative traffic impacts will require further attention, by the successful contractor, as part of the project approval once the particular waste treatment technology has been identified. Cumulative traffic impacts from development of the Cabbage Tree Urban Release Area are possible as the Proposal Site and the urban release area will share the intersection of Yalwal and Flatrock Road. The environmental assessment for the urban release area would need to consider the potential cumulative traffic impacts in further detail.

Issue	Assessment of potential cumulative impacts
Greenhouse gas	There is potential for cumulative GHG impacts from the Proposal and the abovementioned projects however, should the RRP proceed, waste would be diverted from the landfill and GHGs from the Proposal would be reduced. .
Aboriginal heritage	No impacts to Aboriginal heritage are expected as a result of the Proposal and therefore no cumulative impacts are anticipated. Aboriginal heritage is considered in Section 8.8.1 of this EIS.
Non-Aboriginal heritage	No impacts to non-Aboriginal heritage are expected as a result of the Proposal and therefore no cumulative impacts are anticipated. Non-Aboriginal heritage is considered in Section 8.8.2 of this EIS.
Visual impacts	The Proposal is considered to have a negligible visual impact on the surrounding area due to its distance from sensitive receivers and vegetation surrounding the Proposal Site that acts as a visual barrier. Nevertheless, the Proposal will result in a change in the landscape due to clearing of a currently vegetated parcel of land. This change, combined with the development of the RRP and urban release area in the vicinity of the WNRWF, will result in a change from the current agricultural/bushland setting to a more urbanised environment. The visual impact of the Proposal alone is considered negligible however, considered cumulatively, the visual impact is considered to be minor-moderate. Visual impacts are considered in Section 8.9 of this EIS.
Socio-economic	The construction of the Proposal will generate four to eight temporary jobs. The Proposal would be operated in a similar manner to the current operation of the WNRWF and would result in socio-economic benefits to the local economy by employing local labour and to the wider region by supporting the disposal of household and commercial waste. Should construction of other projects occur at the same time as the Proposal such as the proposed RRP located adjacent to the Proposal; increased levels of traffic, noise and air pollution may be experienced by sensitive receivers. However, considering the location of the Proposal Site, the impact is likely to be minimal and localised to the Proposal Site and surrounding sensitive receivers.

9 COMPILATION OF MITIGATION MEASURES

The EIS for the Proposal has identified a range of environmental impacts and recommended management and mitigation measures to avoid, remedy or mitigate these impacts (see Section 8). Table 9-1 provides a compilation of the mitigation measures.

This section presents a summary of the measures that SCC is committed to implementing either prior to construction, during construction, during operation and post operation. These draft mitigation measures may be revised in response to public submissions to the EIS and/or design changes. The final Compilation of Mitigation Measures will form part of a post submissions response to SCC. It is envisaged that these mitigation measures will form the basis of the Conditions of Consent which would be provided for the Proposal, subject to successful approval.

The draft Compilation of Mitigation Measures for the Proposal is provided in Table 9-1. In some instances, greater detail as how these measures would be implemented is provided in Section 8.

Table 9-1 Draft compilation of mitigation measures

ID #	Mitigation Measure	Timing
Biodiversity		
B-01	Three rope bridges with monitoring cameras will be installed over Flatrock Road a minimum of one month before clearing of the development footprint commences to allow arboreal fauna to be accustomed to the rope bridges and be used once clearing works commence. The exact locations for the rope bridges are to be determined by SCC Environmental Assessment Officers in consultation with the relevant road engineers but approximate locations are found in Figure 29 in Appendix B.	Pre-construction
B-02	Prior to the commencement of any clearing works the extent of clearing must be accurately marked on the ground.	Pre-construction / construction
B-03	Clearing is only to be carried out during autumn and early winter following a trapping program to capture and relocate resident fauna. The trapping program is to involve terrestrial and arboreal trapping methods over a minimum of 2 separate occasions of 4 nights at an intensity to cover the clearing area under the supervision of a qualified and experienced ecologist. All methods and captures must be documented and recorded in a report to SCC and fauna records submitted to the NSW Wildlife Atlas. All fauna captured are to be relocated to areas of suitable habitat at the direction of the supervising ecologist or retained and kept in the care of a licenced wildlife handler until such time they can be safely released.	Pre-construction / construction
B-04	All clearing works are to be planned in consultation with a supervising ecologist with experience in land clearing and animal capture and handling.	Pre-construction
B-05	An experienced and qualified ecologist must supervise all clearing works on site. The ecologist may utilise the help of a NPWS licenced Wildlife Handler but be supervised on site by the ecologist.	Construction

ID #	Mitigation Measure	Timing
B-06	To ensure any animals injured during the clearing are dealt with in a humane manner the supervising ecologist must have pre-organised a local vet to deal with injured native animals. Any animals injured during clearing works must be transported to the vet ASAP.	Pre-construction / construction
B-07	The clearing of the development extent must be completed in the following stages under the supervision and direction of the supervising ecologist. • Prior to clearing all hollow-bearing trees are to be clearly identified on site with a 5 m buffer around the trunk using barrier fencing or marking tape. • Stage one of clearing will be the under-scrubbing of the shrub layer and small trees less the 15 cm in diameter at "breast height" under the supervision of the commissioned ecologist. The ecologist is to check logs on the ground for fauna and rescue / relocate fauna as far as practicable. • Stage two of the clearing will be the felling of trees including hollow-bearing trees (HBT). Felling of HBTs is to be under the supervision of the ecologist and wildlife handler with hollow-bearing sections to be lowered to the ground using a "cherry picker" if it is known to contain fauna or potentially contains a fauna occupied hollow ("potentially" means the hollow can't be inspected by the ecologist or wildlife handler). Hollow sections may be dropped if known to be clear of fauna. Any trees with bird nests containing eggs must not be disturbed and can only be felled once the birds have fledged. • Hollow-bearing sections must be placed, under the supervision of the ecologist in consultation with SCC's Waste Services section, along disturbed areas on the Proposal Site outside the development footprint.	Construction
B-08	Any disturbed bushland areas along Flatrock Road outside the development footprint (except for access to the monitoring wells) must be rehabilitated and returned to a weed free natural state using the services of a restoration ecologist or bush regenerator.	Construction/ operation
B-09	To improve fauna movements through the bushland remnant of the Proposal Site, fencing in the south-west corner of the subject lot where it adjoins the neighbouring existing landfill site, and along that portion of the southern boundary of the landfill site outside the "landfill cells", will be removed to allow for the clear passage of native fauna. The fencing must be removed prior to the landfill extension area becoming operational.	Construction/ operation
B-10	SCC will establish a formal Biobank Site (and/or purchase and retire the required biobanking credits) to offset the impacts of the vegetation clearing required as part of the Proposal.	Pre-clearing
B-11	Should any clearing for the installation of fauna poles be required, the area would need to be assessed by an ecologist and advice sought regarding the need for additional approvals for any required clearing.	Pre-clearing

ID #	Mitigation Measure	Timing
Air Quality and odour		
AQ-1	The LEMP would be updated to include the following dust and odour mitigation measures: • methods for management of odour and dust emissions into site inductions, training and daily toolbox meetings. • Ensure all trucks entering and leaving the premises carrying loads are to be covered at all times • Train staff to ensure that any particularly odorous loads are quickly covered to prevent significant odour emissions • The active tipping face would be kept as small as practicable	Construction / operation
AQ-2	Implement and regularly review traffic management procedures to co-ordinate delivery schedules and avoid queueing of incoming or outgoing trucks at the Facility for extended periods of time.	Construction / operation
AQ-3	Plant and machinery will be regularly checked and maintained in accordance with manufacturer's specifications, engines switched off when not in use and fitted with emission control devices complying with Australian Design Standards	Construction / operation
AQ-4	Record any dust and/or odour complaints in the Customer Relationship Management System and include the following information: • The time and date the complaint was received • The location where dust and/or odours were observed; • A description of the nature of the dust and/or odour • Any information the complainant can provide on the meteorological conditions at the time of the complaint; • Contact details for the complainant; and • The feedback provided to the complainant once the event has been investigated. • Records of complaints will be provided to the EPA.	Construction / operation
Soil, water and leachate		
SWL-01	Undertake ongoing monitoring of the wells downgradient of the Stage 2 landfill prior to construction of the irrigation area in this location to observe any changes in groundwater quality and provide ongoing feedback on the performance of the liner. Should the monitoring data indicate a decline in water quality downgradient of the Stage 2 landfill, SCC will review the proposed location of the irrigation area and consider reasonable and feasible alternative leachate disposal/treatment solutions.	Pre-construction
SWL-02	Surface water management infrastructure (including clean water diversion infrastructure, first flush dams, sedimentation dams) will be maintained to ensure clean surface water runoff is intercepted and diverted from the landfill footprint	Pre-construction / construction / operation / post operation

ID #	Mitigation Measure	Timing
	prior to entering the waste mass and thus becoming leachate. Surface water infrastructure will be regularly cleared of litter.	
SWL-03	An environmental monitoring program will be developed and implemented that includes groundwater, surface water and leachate. The program will incorporate the existing EPL requirements as well as the monitoring requirements outlined in the LEMP at Appendix L.	Pre-construction / construction / operation /post operation
SWL-04	A Landfill Closure Plan (LCP) will be prepared and submitted to the EPA for approval no later than 12 months before the last load of waste is due to be landfilled at the Facility. This LCP will include measures to reduce any impacts to soil and water during and after closure of the Landfill along with on-going post closure monitoring requirements.	Operation / post operation
SWL-05	An Erosion Sediment Control Plan (ESCP) will be developed in accordance with the 'Blue Book' for the construction and operational phase of the Proposal and will include the following measures to minimise discharge of sediment laden water downstream: • Collection and management of disturbed runoff into two sedimentation dams, one to the north and one to the south of the Stage 4 landfill extension area. Sediment ponds have been designed to adequately capture and retain sediment laden runoff allowing for the settlement of suspended sediment from the stormwater prior to release. • Monitoring and management of the sedimentation dams and surface waters to ensure minimal discharge of sediment laden waters as per the Landfill Environmental Management Plan (LEMP) and the ESCPs. • Diversion of clean runoff around the disturbed areas. This will include the installation and management of erosion and sediment control structures such as surface diversion bunds and swale drains around open excavations (unfilled) and active landfill cells. • Minimisation of disturbed areas and minimising the disturbance period. The Stage 4 landfill extension will take place as 6 landfill cell sub-stages, minimising exposed soils and the potential for erosive effects. • Stockpiles will be placed at a minimum of 5m from concentrated flow paths and any soils stockpiled for further use will be vegetated to stabilise the surface and reduce erosion risks.	Operation
SWL-06	As a minimum, at the end of each working day, all exposed waste surfaces at the active tipping face that have not achieved final landform levels will be covered with a minimum 150 mm thick layer of VENM or an alternative material(s) approved by the EPA.	Pre-construction / construction / operation
SWL-07	Avoiding, if practicable, tipping and/or waste handling during windy conditions and keeping the active waste tipping face area as small as possible.	Pre-construction / construction / operation

ID #	Mitigation Measure	Timing
SWL-08	Detailed design will consider the compatibility of the irrigation area over the Stage 2 landfill with the gas collection system operating at this location.	Pre-construction
Noise and vibration		
NV-01	Activities involving the use of a compactor in Landfill Stage 3 and dozer stripping in Landfill Sub-cell 1 of Stage 4 would be scheduled so works aren't occurring concurrently.	Construction / operation
NV-02	SCC would maintain an ongoing complaint register at the site to ensure any noise concerns raised by the public are promptly and effectively addressed.	Pre-construction / construction / operation
Traffic		
TA-01	Driver training (i.e. such as a driver code of conduct, safety toolbox, or similar) would need to be implemented to ensure staff and contractors are aware of the existing sight distance issue at the Yalwal Road / Flatrock Road intersection. This mitigation measure has been identified as a precaution against any road safety and intersection capacity impacts associated with the operation of the Proposal.	Construction / Operation
TA-02	A road occupancy licence would be secured prior to construction and installation of the fauna rope bridges	Pre-construction
TA-03	Appropriate traffic control measures would be implemented to manage traffic during construction and installation of the fauna rope bridges	Construction
Greenhouse Gas		
GHG-01	Ensure that the final capping layer meets the requirements outlined in the Landfill Environmental Management Plan (LEMP) prepared by SLR for the site. A review of best practice standards, methodologies and technologies at the time of capping, should be undertaken to ensure that an optimal solution is achieved. To maximise natural oxidisation through the final capping layer and reduce emissions, the capping layer should be maintained in good condition (i.e. thick layer of topsoil with healthy vegetation). The design and implementation should be reviewed at the time of capping.	Post-operation / closure
GHG-02	Undertake project planning to ensure that on-site vehicle movements and construction activities are efficient, avoid double handling of materials and avoid unnecessary fuel use.	Pre-construction / construction / operation
GHG-03	Consider use of alternative fuels which are less carbon intensive, such as operating machinery and construction activity vehicles which use bio-diesel fuels.	Pre-construction / construction / operation

ID #	Mitigation Measure	Timing
GHG-04	Review the GHG emissions profile of the landfill based on recorded waste volumes four years[40] after landfilling commences in Stage 4 to: • Confirm the emissions projections reported herein and the need for reporting under the NGER scheme, and • Identify opportunities to optimise existing landfill gas management strategies, including existing landfill gas infrastructure.	Operation
GHG-05	Provide a separate report to DPE summarising the findings of the GHG emissions review and outlining any additional reduction and/or management strategies to be implemented.	Operation
Heritage		
H-01	Prior to their on-site involvement, all personnel engaged for tree clearing and topsoil stripping would undergo a general site induction prior to their on-site involvement that provides information on legal obligations with respect to archaeological relics, including 'stop work' conditions applicable in the event that any identified or suspected heritage relics are discovered at any time	Pre-construction
H-02	In the event that any previously identified / suspected Aboriginal historical relics are detected at any time, all disturbance work should immediately cease within 20 m of the find and temporary protective fencing erected around this 'no-go zone' pending further management advice from the OEH (Planning and Aboriginal Heritage Section, South Coast Region). If the find consists of or includes human remains, the NSW Police Department and NSW Coroner's office would be contacted.	Pre-construction / construction / operation
H-03	A LEMP will be updated for the Proposal. This would include a procedure for unexpected finds and protocols for communication with the Aboriginal community during the construction and operational phases of the Proposal.	Pre-construction
H-04	Prior to installation of fauna poles for the fauna rope bridge crossing an Aboriginal heritage specialist would need to inspect the area to ensure there are no Aboriginal archaeological heritage items.	Pre-construction
H-05	Prior to their on-site involvement, all personnel engaged for tree clearing and topsoil stripping would undergo a general site induction prior to their on-site involvement that provides information on legal obligations with respect to archaeological relics, including 'stop work' conditions applicable in the event that any identified or suspected heritage relics are discovered at any time	Pre-construction

[40] The selection of the date of four years post opening is because the landfill is predicted to open in 2026 and the NGER reporting threshold is predicted to be breached in 2031 (5 years later). Hence the timing would inform a decision on whether SCC is required to report under the NGER scheme.

ID #	Mitigation Measure	Timing
H-06	In the event that any previously identified / suspected non-Aboriginal historical relics are detected at any time, all disturbance work should immediately cease within 20m of the find and temporary protective fencing erected around this 'no-go zone' pending further management advice from the OEH (Planning and Aboriginal Heritage Section, South Coast Region). If the find consists of or includes human remains, the NSW Police Department and NSW Coroner's office would be contacted.	Pre-construction / construction / operation
Hazard and risks		
HR-01	Procedures for responses to fire to be included in LEMP/PIRMP in accordance with: • *AS 3745 - 2010 Planning for emergencies in facilities* • *AS 1815: Maintenance of Fire Suppression System and Equipment* • *AS 2419.1-2005 Fire hydrant installations - System design, installation and commissioning.*	Construction/ Operation
HR-02	The PIRMP for the WNRWF will be updated to be applicable to the Proposal Site	Construction/ Operation
HR-03	The LEMP would be updated to include the following hazard and risk mitigation measures: • Control of vehicle movements in the facility to be overseen by attendants • Clear signage and road markings (speed limits, give way signs, directions, no access areas and disposal areas) • Limited number of heavy vehicles to be onsite at any one time • Ensure all personnel operating vehicles on site are licenced and competent • Operational procedures for plant and equipment to be outlined in the LEMP • Requirements for asbestos removal and disposal	Construction/ Operation
HR-04	The LEMP would be updated to include the bushfire mitigation measures outlined in Appendix J including: • Water tankers and heavy earth moving plant on stand-by during days of Total Fire Ban • Provision of portable fire extinguishers during maintenance activities involving cutting, grinding, welding and slashing • Hazard reduction burning of vegetation within the biodiversity corridor, operating landfill cell, fire trails and fire breaks in accordance with the NSW Rural Fire Services Environmental Assessment Code 2006 • Provision and maintenance of a 10 m wide temporary slashed fire break to the outer edge of incremental landfill cells	Construction/ Operation

ID #	Mitigation Measure	Timing
	• Provision and maintenance of a 20 m wide fire break to the south of the existing site office, staff amenity and plant and equipment buildings • Provision and maintenance of a 10 m wide fire break to the south and east outer edges of the Stage 4 extension • Provision of on-site fire-fighting water tanks, portable first-aid firefighting equipment (fire hose reels/fire extinguishers), heavy equipment including bulk water tucks and water supplies and equipment for firefighting. • At the perimeter of each incremental landfill cell a temporary fire trail that connects to the existing/proposed perimeter/internal road/fire trail network should be provided that is capable of carrying a NSW RFS tanker • A locked gate would be provided at the junction of the Main Entry Road and fire trail • Drilling, cutting, grinding, welding and slashing works would not be undertaken on total fire ban days unless during an emergency, in which case firefighting equipment should be on stand-by • For the purpose of fuel reduction using hazard reduction burning: – All perimeter fire trails clear and maintained – Maintain a 20 m wide defendable space (fire break) to the existing office complex – Provide and maintain temporary fire trails and defendable spaces adjacent to each stage.	

10 SUMMARY AND CONCLUSION

SCC (the Proponent) proposes to extend the West Nowra Landfill at the WNRWF. SCC is seeking development approval to extend the West Nowra Landfill to occur on undeveloped bushland directly adjacent to the current West Nowra Landfill.

The Proposal is for the extension of the existing landfill at the West Nowra Recycling and Waste Facility, and would involve the progressive construction, operation and rehabilitation of the Stage 4 landfill extension. The Proposal would provide landfill capacity to service the SCC LGA for up to 30 years and the landfill extension would commence operation from approximately 2026 and would provide capacity for a minimum of eight years (i.e. to end 2034 under a worst case scenario) and up to approximately 18 years (under a reduced waste disposal scenario). Despite recent and expected future increases in diversion of waste to landfill, the annual waste acceptance rate would progressively increase over the life of the Proposal due to predicted population and waste generation growth per capita.

The Proposal will receive waste from all areas within the SCC LGA including the major township of Nowra. Waste will include general solid waste, C&I and asbestos from domestic and C&D sources.

The key works for which approval is sought include:

- Progressive landfill cell construction, operation and rehabilitation of the Stage 4 landfill extension including:
  - Clearing of 9.87 ha of existing vegetation
  - Construction of access tracks and fire trails
  - Earthworks for cell formation including extraction and stockpiling of materials and the reapplication to form the leachate barrier (cell liner) as well as for daily, intermediate and final cover
  - Installation of leachate management structures including the leachate barrier, collection, storage and disposal system (including construction of a rising main to transfer leachate to the existing leachate collection dam within the WNRWF and infrastructure to pump leachate from the dam to a proposed new leachate irrigation area on the Stage 2 landfill area)
  - Installation of a surface water management system, including sediment dams, sediment erosion control measures and surface diversion bunds/swale drains
  - Installation of additional groundwater bores for groundwater monitoring
  - Progressively increasing the annual waste acceptance rate at the landfill
  - Signage and other ancillary works
  - Rehabilitation of closed sub-cells
- Delineation and ongoing management of a conservation area along the southern and eastern boundary of the Proposal Site.
- Installation of three fauna rope bridges with monitoring cameras over Flatrock Road.

Environmental investigations were undertaken during the preparation of the EIS to assess the potential environmental impacts of the Proposal. these included specialist assessment and assessment for key environmental issues involving biodiversity, soil, water, leachate, air quality and odour, noise and vibration, traffic, greenhouse gas, aboriginal and non-aboriginal heritage and hazards and risks.

The EIS concludes that many of the potential impacts identified would be effectively managed though Proposal design features. To manage other impacts a number of mitigation and management measures would be implemented as outlined in Section 9.

The EIS includes an assessment of the permissibility of the Proposal under relevant EPIs and legislation. The Proposal is permissible with consent and is ‘state significant development’ (SSD) under Part 4, Division 4.1 of the EP&A Act.

In conclusion the Proposal has been subject to an EIS in accordance with the EP&A Act and the SEARs. The Proposal satisfies the requirements of the SEARs and is consistent with the principles of ecologically sustainable development. The potential environmental, social and economic impacts, both direct and cumulative, have been identified and thoroughly assessed as part of this EIS. The assessment concluded that no significant environmental impacts have been identified as a result of the Proposal. It is considered that any potential impacts can be satisfactorily mitigated through a range of measures that have been identified within the EIS. In addition, the Proposal has been assessed against, and has been found to be consistent with, the priorities and targets adopted in relevant published and draft State plans, as well as Government policies and strategies.

The Proposal will provide significant benefit by providing additional landfill capacity required to meet the projected SCC population and waste generation rates in an environmentally responsible way. Overall, the EIS concludes that the Proposal is in the public interest and approval is recommended.

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APPENDIX A ENVIRONMENTAL PROTECTION LICENCE

APPENDIX B BIODIVERSITY ASSESSMENT REPORT

APPENDIX C SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

APPENDIX D LANDFILL EXTENSION – DRAFT LANDFILL LIFE EXPECTANCY CALCULATIONS

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APPENDIX G LOCALE CONSULTING LETTER TO SCC

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APPENDIX M QUANTITY SURVEYOR'S REPORT

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APPENDIX W STAGE 2C/B LANDFILL LINER DETAILS

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ARCADIS Design & Consultancy for natural and built assets

APPENDIX AA EXISTING INFRASTRUCTURE DEVELOPMENT APPLICATION