

Review of Environmental Factors Addendum

Refresh Vacluse Diamond Bay – Diamond Bay

Determination

This Review of Environmental Factors Addendum (REFA) assesses potential environmental impacts of Refresh Vacluse Diamond Bay – Diamond Bay. The REFA was prepared under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority.

The Sydney Water Project Manager is accountable for ensuring the proposal is carried out as described in this REFA and the *Refresh Vacluse Diamond Bay Review of Environmental Factors* (approved REF). Additional environmental impact assessment may be required if the scope of work or work methods described in this REFA change significantly following determination.

Certification

I certify that I have reviewed and endorsed this REFA and, to the best of my knowledge, it is in accordance with the EP&A Act and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation). The proposal has been considered against matters listed in section 171 (Appendix A) and the guidelines approved under section 170 of the EP&A Regulation. The information it contains is neither false nor misleading.

Prepared by:	Reviewed and endorsed by:	Endorsed by:
 Senior Environmental Scientist Date: 13/05/2026	 Environment Representative Sydney Water Date: 13/05/2026	 Project Manager Sydney Water Date: 14/05/2026




Decision Statement

The main potential additional construction environmental impacts of the proposal change include impacts associated with biodiversity, noise, vibration and traffic. Potential operational impacts generally remain consistent with the approved REF. The proposal will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats. Therefore, a Species Impact Statement (SIS) and/or Biodiversity Development Assessment Report (BDAR) is not required.

Given the nature, scale and extent of impacts, and implementation of the mitigation measures outlined in this REF, the proposal is unlikely to significantly affect the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.

Determined by:



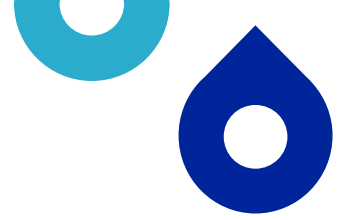
 A/Senior Manager, Environment & Heritage Services, Sydney Water

Date: 29 May 2026

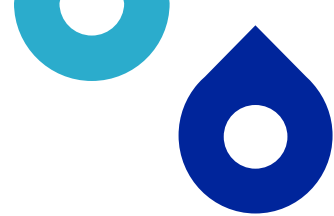
1. Proposal description

Table 1-1 Proposal need, objectives and consideration of alternatives

Aspect	Relevance to proposal
Approved REF	<i>Review of Environmental Factors Refresh Vaucluse Diamond Bay (June 2020)</i>
Proposal need and objectives	<p>In November 2018, the NSW Government announced its commitment to address the flow of untreated wastewater from three ocean outfalls at Vaucluse and Diamond Bay. This wastewater program is required to service growth and improve environmental outcomes in the area. Sydney Water proposed building two new wastewater pumping stations to redirect flows from the existing ocean outfalls to the Bondi Water Resource Recovery Facility (WRRF); one at Parsley Bay and another at Eastern Reserve, Dover Heights.</p> <p>The proposal will connect to Bondi WRRF under Environment Protection Licence (EPL) No 1688, as assessed in the approved REF.</p>
Justification for proposal change	<p>Hydraulic modelling found a section of the existing gravity wastewater main on Old South Head Road was insufficiently sized to accommodate the increase in flow created by the new pumping station SP1217 (Eastern Reserve). The project scope now includes wastewater main amplification on Old South Head Road from Northcote Street to Hamilton Street. The scope assessed in the approved REF included a drilling entry/exit pit and trenching for wastewater reticulation on Carlisle Street, Rose Bay. The proposed wastewater main amplification at Old South Head assessed in this REFA removes the need for the Carlisle Street works and therefore no construction on Carlisle Street is required.</p> <p>The proposal assessed in the approved REF also involved intercepting wastewater flows to the north of ■ Kimberley Street, Vaucluse. Following geotechnical investigations it was found the condition of the rock in the area is poor, requiring redesign to intercept flows beneath ■ Kimberley Street.</p>
Proposal change description and methodology	<p>The proposal is part of the Refresh Vaucluse Diamond Bay program.</p> <p>The proposed changes assessed in this REFA relate to two main site areas: Old South Head Road and the Diamond Bay/Eastern Reserve. The proposed changes include:</p> <ul style="list-style-type: none"> • Old South Head Road: <ul style="list-style-type: none"> - a new wastewater main amplification of about 550 m on Old South Head Road • Diamond Bay and Eastern Reserve: <ul style="list-style-type: none"> - changes to the construction area at Diamond Bay Outfall 1 and 2 - changes to the location of an entry/exit pit for micro-tunnelling from Diamond Bay Reserve to Eastern Reserve. <p>The proposed wastewater main amplification at Old South Head Road will occur from Northcote Street to Hamilton Street. Open trenching will be the</p>



Aspect	Relevance to proposal
	<p>main methodology with micro-tunnelling used for road crossings if required by road occupancy approvals.</p> <p>The proposal at Diamond Bay involves installing gravity and pressure wastewater mains to divert wastewater from Diamond Bay Outfall 1 and 2 and will require additional excavation and a larger construction area from what was assessed in the approved REF. This includes excavation north of Kimberley Street. This work facilitates diversion of wastewater from the Diamond Bay Outfall 1 and 2 catchments towards the proposed wastewater pumpstation SP1217 in Eastern Reserve.</p> <p>The proposed pumping station (SP1217) was assessed in the approved REF and is located at the end of Eastern Avenue. The construction area associated with the Eastern Avenue works remains unchanged, however the location of an entry/exit pit has been relocated. In the approved REF, the entry/exit pit was proposed at SP1217. The proposal change would move this about 60 m north, in an area already approved for open trenching works under the approved REF.</p> <p>The proposed construction area changes are shown in Figure 1-1, Figure 1-2 and Figure 1-3.</p>
Location and land ownership	<p>The Refresh Vacluse Diamond Bay project is located in the Woollahra Municipal Council and Waverley Council local government areas (LGAs), within the suburbs of Parsley Bay, Dover Heights, Vacluse, and Rose Bay.</p> <p>This REFA relates to the works located in the Waverley Council LGA at various locations, including:</p> <ul style="list-style-type: none">• Old South Head Road from Lot A, DP320051 to Lot 17, DP168020• Eastern Reserve, Lot 7030, DP1023184• Kimberley Street, Diamond Bay SP464. <p>The proposed works at Eastern Reserve and Kimberley Street require minor deviations from the work area assessed in the approved REF while the proposal at Old South Head Road is located completely outside the approved REF construction footprint.</p> <p>The proposal at Old South Head Road will occur within the road reserve managed by Woollahra Municipal Council and Waverley Council. The proposal change at Eastern Reserve is located on Crown land. Sydney Water is currently securing an easement along the wastewater main at Eastern Reserve which includes the entry/exit pit area. The proposal change area at Diamond Bay is mostly within Waverley Council land with some work on private property required. Sydney Water is in the process of acquiring a portion of the land and securing an easement for the incoming power supply.</p>
Site establishment and access tracks	<p>The proposal at Old South Head Road will be accessed via existing public roads. Access for other areas of the proposal remain unchanged to those assessed in the approved REF.</p>
Ancillary facilities (compounds)	<p>The location of compounds and access tracks will be within the construction area of the approved REF or approved REF. If additional access tracks or compounds outside these areas are required, these will be chosen by the</p>



Aspect	Relevance to proposal
Work hours	<p>contractor in consultation with the landowner(s) and approved by Sydney Water's Project Manager as described in the mitigation measures in Table 4-5.</p> <p>Work and deliveries will be scheduled during standard daytime hours where possible:</p> <ul style="list-style-type: none">• 7 am to 6 pm, Monday to Friday• 8 am to 1 pm, Saturdays. <p>The proposed work at Old South Head Road is expected to require work outside these hours for 5 days per week for 6 months. Out of hours works are likely to be required by Council and Transport for New South Wales (TfNSW) due to the requirement to work within the road reserve of the State and Regionally classified Old South Head Road. Mitigation measures related to out of hours works are included in the approved REF. Additional measures are provided in Table 4-5 of this REFA.</p>
Proposal timing	<p>Construction of the proposal changes assessed in this REFA is expected to start in mid-2026 and take about 18 months, or 78 weeks. Some activities will occur simultaneously across the three sites over the 78 weeks. Construction assessed in this REFA will have a duration of about:</p> <ul style="list-style-type: none">• 26 weeks at Old South Head Road• 20 weeks at Eastern Reserve• 78 weeks at Diamond Bay

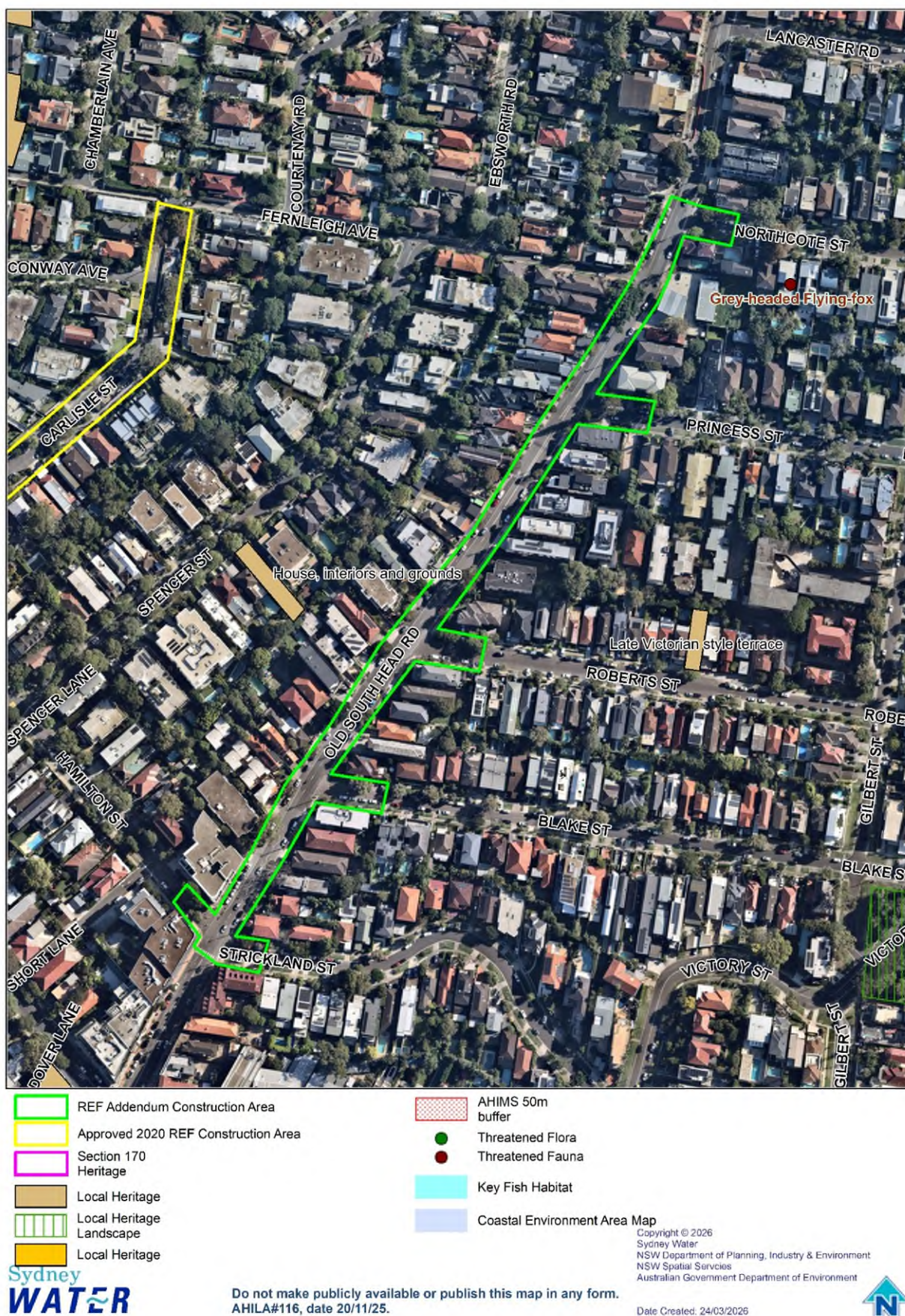


Figure 1-1 Location of proposal change at Old South Head Road and key environmental constraints



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|--|-------------------------------------|--|------------------------------|
| | REF Addendum Construction Area | | AHIMS 50m buffer |
| | Approved 2020 REF Construction Area | | Threatened Flora |
| | Section 170 Heritage | | Threatened Fauna |
| | Local Heritage | | Key Fish Habitat |
| | Local Heritage Landscape | | Coastal Environment Area Map |
| | Local Heritage | | |

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Figure 1-2 Location of proposal change at Eastern Reserve and key environmental constraints



- | | | | |
|--|-------------------------------------|--|------------------------------|
| | REF Addendum Construction Area | | AHIMS 50m buffer |
| | Approved 2020 REF Construction Area | | Threatened Flora |
| | Section 170 Heritage | | Threatened Fauna |
| | Local Heritage | | Key Fish Habitat |
| | Local Heritage Landscape | | Coastal Environment Area Map |
| | Local Heritage | | |



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Figure 1-3 Location of proposal at Diamond Bay and key environmental constraints

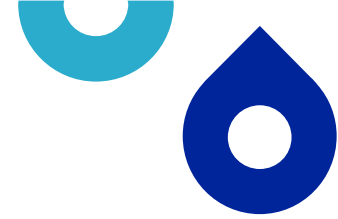


Figure 1-4 Validated biodiversity features and values at Diamond Bay

Legend

- Study Area
- Impact Area
- Exotic vegetation
- Planted native and exotic vegetation
- PCT 3811
- PCT 3920



Validated biodiversity features and values





2. Consultation

Additional consultation matters above those already assessed in the approved REF are detailed below.

2.1 Community and stakeholder consultation – general

Our approach to community and stakeholder consultation is guided by Sydney Water’s community and stakeholder engagement guidelines.

Stakeholder and community engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in our activities. Community and stakeholder engagement:

- enables us to explain strategy, policy, proposals, proposal or programs
- gives the community and stakeholders the opportunity to share their knowledge, issues and concerns
- enables us to understand community and stakeholder views in our decision-making processes alongside safety, environment, economic, technical and operational factors.

The nature, scale and extent of the proposal’s potential impact has been evaluated in this REFA. If our work impacts the community in some way, we will consult with affected groups throughout the proposal. This includes engaging the broader community and stakeholders during plan or strategy development or before making key decisions.

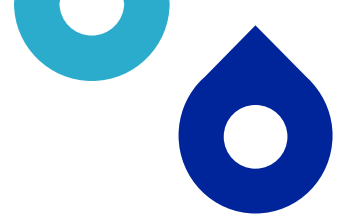
We will also provide local councils with reasonable notice when we would like to commence works. Local council(s) will be consulted about matters identified in environmental planning instruments such as public safety issues, temporary works on council land, and full or partial road closures of council managed roads (refer below).

2.2 Community and stakeholder consultation – proposal

The Refresh Vaucluse Diamond Bay project commenced consultation in 2018 with the establishment of a community reference group (CRG) to help inform the options for the project. In June 2020, the REF for the project was placed on public exhibition on Sydney Water Talk and comment was invited. Thirty-three submissions were received, mostly focused on works at Parsley Bay and impacts on vegetation. Sydney Water addressed the feedback by redesigning part of the pumping station to reduce vegetation impacts. A Decision Report responding to the public submissions was prepared in December 2020. A REFA was also prepared in May 2024 to assess potential additional ecological impacts at Parsley Bay.

Sydney Water has commenced engagement with relevant stakeholders, including Waverley Council, in relation to land access, acquisition and use of Crown land required for the proposal.

Consultation with affected property owners will be undertaken following construction contract award and the community will be provided with appropriate notification prior to the commencement of construction works.



2.3 Consultation required under State Environmental Planning Policies and other legislation

Sydney Water consulted with both Woollahra and Waverley Councils, and other authorities, during preparation of the approved REF and Decision Report to meet State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) requirements, including for works on Council roads. The former ISEPP has since been repealed and replaced by the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP). Sydney Water consulted with Councils and other authorities during preparation of the May 2024 REFA to meet the TISEPP.

The proposal requires works within the road reserve of Old South Head Road, a Regionally Classified Road managed by both Transport for NSW (TfNSW) and Woollahra Municipal Council. The proposed works also require works within road reserves managed by Waverley Council. Construction activities for the proposal within and adjacent to the Old South Head Road reserve trigger consultation requirements under Section 2.10(1)(e) and Section 2.10(1)(f) of the TISEPP.

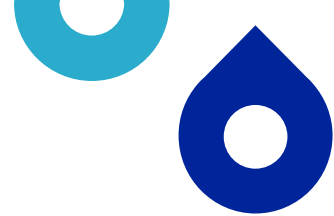
Notification of the proposed works within Council managed road reserves within and adjacent to Old South Head Road was provided to Waverley Council and Woollahra Municipal Council on 13 February and 3 March 2026 respectively. Woollahra Municipal Council responded on 23 March 2026 in relation to the protection of public street trees, the implementation of sediment and erosion controls, and requirements for road openings and traffic management within Old South Head Road. These matters are assessed within this REFA and relevant mitigation measures are included in Table 4-5. Waverley Council acknowledged receipt of the notification however no further response was received. Consultation with both councils will continue during the delivery phase of the proposal. Further detail is provided in Appendix D.

Consultation with TfNSW would also be required as Old South Head Road is a Regionally Classified Road. Sydney Water is preparing to notify and consult with Transport for NSW (TfNSW) regarding the proposed works on Old South Head Road. A Traffic Management Plan will be developed during detailed design and construction planning to support a Road Occupancy Licence application and inform ongoing consultation with TfNSW.

3. Legislative requirements

Table 3-1 Additional or updated environmental planning instruments relevant to the proposal change

Environmental Planning Instrument	Relevance to proposal
<p>State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)</p>	<p>The approved REF was prepared in 2020 under the provisions of the former <i>State Environmental Planning Policy (Infrastructure) 2007</i> (ISEPP). Under Clause 106 of the ISEPP the proposed development for the purpose of sewage reticulation systems was permissible without consent on any land. In 2021 the ISEPP was repealed with its provisions substantially carried forward into the TISEPP. Accordingly, this REFA has been prepared under the statutory framework of the TISEPP.</p> <p>Clause 2.126 of the TISEPP permits development by or on behalf of a public authority for sewerage reticulation systems without consent on any land in the prescribed circumstances.</p> <p>As Sydney Water is a public authority, the proposal will be carried out in the prescribed circumstances and is permissible without consent.</p>
<p>State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BCSEPP)</p>	<p>Vegetation in non-rural areas (Chapter 2)</p> <p>The proposal is located within an area to which Chapter 2 of the BCSEPP applies. At the time the approved REF was prepared in 2020, vegetation clearing in non-rural areas was regulated under the former State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017, which has since been repealed and consolidated into Chapter 2 of the BCSEPP.</p> <p>The proposal is in an area or zone listed in subsection 2.3(1). However, subsection 2.4(1) states: <i>'This Policy does not affect the provisions of any other SEPP....'</i>, and as the works are permissible under the TISEPP, a council permit to clear vegetation under this SEPP is not required.</p> <p>Water catchments (Chapter 6)</p> <p>In 2020, water catchment impacts were assessed under the Sydney Harbour Catchment Regional Environmental Plan 2005 (REP) and the Coastal Management SEPP 2018, both of which have since been consolidated into the BCSEPP and Resilience and Hazards State Environmental Planning Policy 2021 (RHSEPP).</p> <p>Chapter 6 of the BCSEPP applies as the proposal is partially within the Sydney Harbour Catchment, a regulated catchment. Section 4 of this REF assessed potential environmental impacts on water quality and quantity, aquatic ecology, flooding, access, cultural heritage, flora and fauna, and scenic quality. The assessment confirmed that potential impacts are minor and meet the requirements of Part 6.2 of the BCSEPP.</p>



Environmental Planning Instrument	Relevance to proposal
State Environmental Planning Policy (Resilience and Hazards) 2021 (RHSEPP)	<p>Coastal Management (Chapter 2)</p> <p>The proposal is located within land identified as part of the Coastal Environment Area.</p> <p>At the time the approved REF was prepared, coastal matters were assessed under the former <i>State Environmental Planning Policy (Coastal Management) 2018</i>, which has since been repealed and consolidated into Chapter 2 of the RHSEPP.</p> <p>The proposal has been assessed against the relevant provisions for development within the Coastal Environment Area, including the need to protect coastal environmental processes, avoid increasing exposure to coastal hazards, and ensure appropriate land-use outcomes. Based on this assessment, the proposal is not expected to adversely affect the management objectives for these coastal management areas.</p>

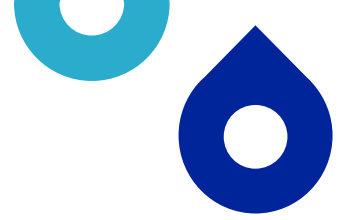


Table 3-2 Consideration of key environmental legislation

Key environmental legislation was considered in the approved REF. Legislation is only listed in Table 3-2 where additional considerations are required compared to the approved REF or where the legislation has been updated since the approved REF.

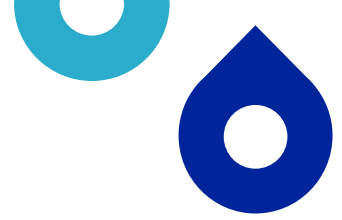
Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
<i>Biodiversity Conservation Act 2016 (BC Act)</i>	Schedules 1 and 2 of the BC Act list terrestrial species, populations, and ecological communities threatened in NSW. We are required to assess impacts to listed items according to section 73 of the Act. An assessment has been completed as part of this REFA, which considered the impact of the proposal changes on threatened species, communities and their habitats (see Section 4 of this REFA). The assessment found that the proposal changes are unlikely to affect any threatened species. As such, we will not require a Species Impact Statement (SIS) or additional approvals under this Act.	REF	Pre-construction, Sydney Water
<i>Heritage Act 1977</i>	The proposal change may cause a minor additional impact to the heritage significance of the Sandstone Escarpment Conservation Area at Eastern Reserve. Vegetation offsetting and replanting will be completed in consultation with Council to minimise longer term impacts to the heritage significance of the conservation area. Impact to the heritage significance of Sandstone Escarpment Conservation Area is anticipated to be minor.	REF	Pre-construction, Sydney Water
<i>Roads Act 1993</i>	The contractor is required to consult with TfNSW and obtain a road occupancy licence (ROL). This is required in accordance with Section 138 of the <i>Roads Act 1993</i> for works within the road reserve of Old South Head Road, which is a Regional Classified Road.	Road Occupancy Licence	Pre-construction, contractor

4. Environmental assessment

The environmental impacts checklist (SWEMS0019.01) was considered for the proposal change. Table 4-1 includes only the potentially changed aspects and Table 4-5 lists additional mitigation measures. All other environmental impacts in the approved REF remain the same and will be incorporated into the contractor's CEMP.

Table 4-1 Review of environmental aspects

Aspect	Potential additional impacts
Topography, geology and soils	<p>The proposal at Old South Head Road will require ground disturbance, excavation and stockpiling of soil, which could result in potential offsite erosion and sedimentation of surrounding land and waterways.</p> <p>The area surrounding the works slopes down to the west, allowing for adequate surface water drainage following ground disturbance. The proposal will not permanently change the surface topography and drainage patterns of the construction area. An EPA notified contaminated site, Caltex Rose Bay Service Station, is located 270 m from the proposal. No contamination from this service station is anticipated to be present within the construction area due to the distance between the contaminated site and the construction area.</p> <p>Additional vegetation impacts at Diamond Bay have potential to make the construction area more susceptible to erosion and sedimentation. This will be addressed by implementation of mitigation measures in the approved REF.</p> <p>Potential impacts on topography, geology, and soils associated with the proposal at Old South Head Road, Diamond Bay, and Eastern Reserve can be effectively managed through the mitigation measures outlined in the approved REF. Any residual impacts are expected to be minor, and no additional mitigation measures beyond those in the approved REF are required.</p> <p>No additional operational impacts are anticipated as a result of the proposal changes as the infrastructure will be almost completely below ground, drainage patterns will not be altered more than a minor extent and ground surfaces will be stabilised during or post construction.</p>
Water and drainage	<p>The waterway closest to the proposal at Old South Head Road is Sydney Harbour, about 650 m away, which is also key fish habitat. The site is not mapped as a flood risk area. Disturbance of soils has potential to generate indirect impacts on waterways through uncontrolled sediment flow, erosion and the movement of disturbed materials and spoil into the stormwater and off-site during construction. With the implementation of mitigation measures in the approved REF no impacts to waterways or drainage are anticipated.</p> <p>Given the shallow depth of excavation, it is unlikely groundwater would be encountered. Sydney Water has an existing Water Supply Works Approval (WSWA) for the Refresh Vacluse Diamond Bay project. If, after determining this REFA, it is identified that groundwater interception may occur and dewatering is required, Sydney Water would amend the WSWA or obtain a new WSWA.</p> <p>Potential impacts on water and drainage associated with the proposal at Old South Head Road, Diamond Bay, and Eastern Reserve can be effectively managed through the mitigation measures outlined in the approved REF. Any residual impacts are expected to be minor, and no additional mitigation measures beyond those in the approved REF are required.</p>



Aspect	Potential additional impacts
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During operation, no impacts to water quality, groundwater or drainage are anticipated as the infrastructure will improve the wastewater network, drainage patterns will not be altered more than a minor extent and ground surfaces will be stabilised during or post construction.

Flora and fauna

Old South Head Road

Potential impacts during construction would include:

- minor trimming of overhanging street trees to accommodate machinery access
- minor trimming of roots of mature street trees if they extend into the proposed work area in the roadway.

There are no native vegetation communities or threatened flora species within the construction area. Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as 'Vulnerable' under the BC Act & EPBC Act, and is recorded 40 m east of the construction area at Old South Head Road. The closest known Grey-headed Flying-fox camp is located at Centennial Park about 3.8km from the proposal. Nearby street trees may provide suitable foraging habitat for the species. The pipeline works have the potential to disturb Grey-headed Flying-fox through lighting at night, loud noises and minor trimming of street trees. However Old South Head Road has existing light and noise at night as it is a busy roadway in a medium density residential and commercial area. Impacts to the Grey-headed Flying-fox are therefore considered unlikely due to the existing environment, high mobility of the species, minor scale of vegetation impacts and the temporary nature of the works.

The excavation depth will be shallow and within a narrow corridor. There is the potential that the construction activities may disturb roots of some trees, however, due to the small excavation required impacts are expected to be minimal. Standard root protection mitigation measures would be followed.

Eastern Reserve

Flora and fauna considerations remain unchanged from the approved REF.

With the implementation of the mitigation measures listed in the approved REF, impacts to flora and fauna can be adequately managed, and residual impacts are expected to be minor.

Diamond Bay

The approved REF and flora and fauna impact assessment (GHD, 2020) identified a 5–10 m disturbance corridor, affecting about 0.13 ha of vegetation at Diamond Bay. This included 0.08 ha of Sydney Coastal Headland Cliff Scrub and 0.01 ha of Coastal Cliff-top Shrubby Marsh, with the remainder comprising planted exotic trees and weeds.

A Biodiversity Assessment Report was completed by Sydney Water in March 2026 to assess the potential changes to vegetation impacts at Diamond Bay.

The revised construction area at Diamond Bay has changed impacts to all vegetation types. Impacts have been calculated to a 12% decrease in Sydney Coastal Headland Cliff Scrub impacts from what was assessed in the approved REF, and an increase in Coastal Cliff-top Shrubby Marsh impacts. A larger impact is also proposed for areas containing exotic vegetation and mixed exotic/planted native vegetation.

The affected vegetation communities are highly degraded and largely consist of previously replanted areas with high cover of exotic species and high threat weeds. Overall impacts remain minor in extent and are unlikely to result in a significant impact



Aspect Potential additional impacts

given the highly modified condition of the affected vegetation and the limited ecological value of the areas subject to change. In addition, mitigation measures will result in impacts being avoided and minimised where possible. Therefore, the actual on-ground native vegetation impact of the proposal change is likely to be less than original estimates.

Table 4-2 compares vegetation impacts of the approved REF and the proposed changes assessed in this REFA. The Biodiversity Assessment Report recommended additional mitigation measures, which are listed in Table 4-5 of this REFA. With the implementation of the mitigation measures listed in the approved REF and this REFA, impacts associated with flora and fauna are expected to be minor.

Table 4-2 Impact comparison

PCT	Description	Previous Impact Area (ha)	Revised Impact Area (ha)	Change in Impact Area (ha)
PCT 3811	Sydney Coastal Headland Cliff Scrub	0.08	0.07	-0.01
PCT 3920	Coastal Clifftop Shrubby Marsh	0.01	0.02	+0.01
Exotic / planted native vegetation	Highly modified planted native and exotic heath community with a dominant cover of invasive weeds.	0.01	0.05	+0.04
Exotic vegetation	Exotic dominated vegetation with a high cover of High Threat Weeds (HTWs).	0.03	0.17	+0.14

During operation, no impacts to flora and fauna are anticipated as a result of the proposal changes.

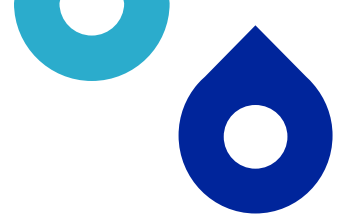
Heritage

Old South Head Road

The proposal is not in a high-risk landscape for Aboriginal heritage (<200 m from waterways). A basic search of the Office of Environment and Heritage Aboriginal Heritage information System (AHIMS) was conducted in May 2026 (Service ID 1118842) to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the site footprints. AHIMS records show 4 previously registered sites within 500 m of the construction area but none within 280 m.

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

An Aboriginal Heritage Impact Permit (AHIP) for test excavations at Wilberforce Avenue Carpark redevelopment is located about 380 m from the proposal.



Aspect

Potential additional impacts

Contemporary land use has led to high levels of disturbance due to urban developments, existing water-related infrastructure, landscaping and installation of utilities. Due to the distance of the site from known Aboriginal heritage sites and the disturbed nature of the construction area, no impacts to Aboriginal heritage are anticipated.

The proposal is located within 200 m of the following local heritage items:

- Rose Bay Uniting Church and Wesley Hall Group – I683 (Waverley LEP 2012 Amendment No 29) located about 100 m south of the proposal
- Late Victorian style terrace – I436 (Waverley LEP 2012) located about 120 m east of the proposal
- House, interiors and grounds – I336 (Waverley LEP Amendment No 29) located about 45 m west of the proposal.

No other listed non-Aboriginal heritage items are located within 300 m of the proposal at Old South Head Road. Due to the distance from the proposal to listed non-Aboriginal heritage items, no impacts to non-Aboriginal heritage are anticipated at the Old South Head Road construction area.

Eastern Reserve

Aboriginal and non-Aboriginal heritage considerations remain unchanged from the approved REF.

With the implementation of the mitigation measures listed in the approved REF, impacts to heritage can be adequately managed, and residual impacts are expected to be minor.

Diamond Bay

Aboriginal heritage considerations remain unchanged from the approved REF.

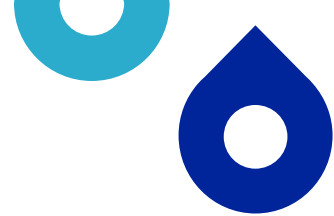
The proposal changes are located within the curtilage of the following non-Aboriginal heritage items at Diamond Bay:

- Coastal Sandstone Escarpment Conservation Area – C37 (Waverley LEP 2012)
- Diamond Bay Outfall (No. 1 & No. 2) – 4574204 (Sydney Water Section 170 SHI).

The proposal change may require additional vegetation impacts within the curtilage of the 'Sandstone Escarpment Conservation Area' heritage item. The heritage significance of this heritage area includes remnant coastal cliff vegetation. The additional vegetation impacts assessed in this REFA would cause a minor increase in impact on the heritage significance of the conservation Sandstone Escarpment Conservation Area. Impacts to the heritage significance of this heritage item are considered minor and will continue to be minimised where possible. Vegetation offsetting and replanting will be completed in consultation with Council to minimise longer term impacts to the heritage significance of the conservation area.

The proposal change will not impact the S170 listed Diamond Bay Outfall (No. 1 & No. 2).

With the implementation of the mitigation measures listed in the approved REF and this REFA, impacts to heritage are expected to be minor.



Aspect	Potential additional impacts
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During operation, no impacts to Aboriginal or non-Aboriginal heritage are anticipated as a result of the proposal changes as operation will not further alter the significance of nearby heritage items.

Noise and vibration

Construction noise and vibration impacts for the Refresh Vaucluse Diamond Bay Project were assessed in the approved REF. Noise and vibration impacts associated with the proposed changes were assessed in a new Construction Noise and Vibration Impact Assessment (CNVIA, 2026) (Appendix F).

The existing acoustic environment within the project area was established as part of the 2020 REF, based on long-term unattended noise monitoring undertaken in December 2019 at representative residential locations. The 2026 CNVIA confirms that the surrounding environment has not changed materially since that time and that the background noise levels derived for the approved REF remain representative of current conditions. Therefore, the Noise Management Levels (NMLs) and vibration criteria adopted in the approved REF remain applicable.

Construction noise impacts are classified as clearly audible, moderately intrusive or highly intrusive, depending on the magnitude above the NML.

Table 4-3 Construction noise perception definitions

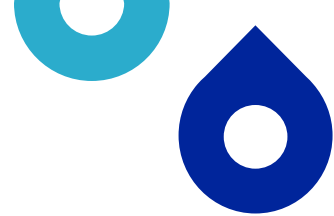
Classification	Noise exceedance definition
Clearly audible	Up to 10 dB(A) above NML
Moderately intrusive	>10 to 20 dB(A) above NML
Highly intrusive	>20 dB(A) above NML
Highly Noise Affected	≥75 dB(A) LAeq(15 min)

Ground-borne noise objectives for residential receivers are 40 dB(A) LAeq(15 min) (evening) and 35 dB(A) LAeq(15 min) (night).

Construction Noise and Vibration Impacts

Table 4-4 Summary of peak construction noise impacts and durations

Location	Primary high-noise activities	Peak impacts	Typical duration of peak impacts	Overall construction duration
Old South Head Road	Rock breaking (night-time)	Highly intrusive (night-time) within 200-400 m. Highly noise affected (night-time) within 80-150 m.	8-12 weeks as work moves	26 weeks
Eastern Reserve	Excavation, rock breaking and drilling	Highly intrusive and highly noise affected within 120 m	About 20 weeks	20 weeks



Aspect	Potential additional impacts			
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Diamond Bay	Rock breaking, excavation	Highly intrusive and highly noise affected within 80 m	8-16 weeks	78 weeks
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The propagation of noise through the environment is affected by topography and structures. As the surrounding areas contain structures and changes in topography, receivers with direct line of site are likely to experience the most significant noise impacts, with receivers located behind apartment blocks and other structures experiencing reduced noise impacts. Noise exceedance maps are shown in Appendix F.

Old South Head Road

Construction is expected to occur predominantly during evening and night-time periods for an overall duration of about 26 weeks. Modelling indicates that during periods of rock breaking and concrete sawing, residential receivers located within about 200-400 m of the construction area may experience construction noise levels exceeding the night-time NML by more than 25 dB(A). These locations are predicted to experience highly intrusive noise, with short periods where noise levels may approach or reach the highly noise affected threshold of 75 dB(A) for receivers within 80-150 m. Receivers located further from the alignment may experience moderately intrusive noise during these peak activities.

These impacts are predicted to be intermittent and will shift as work progresses, with elevated noise occurring only when high-noise plant equipment operates close to individual receivers. As the work progresses, individual receivers are expected to experience highly intrusive noise for 8-12 weeks, rather than continuously over the entire construction program. During lower-noise construction activities, noise impacts at surrounding receivers are predicted to reduce to the clearly audible to moderately intrusive range.

Night-time micro-tunnelling works may result in ground-borne noise that is perceptible at residences within about 35-50 m of tunnelling. These impacts are expected to be short-term and progressive, occurring only while tunnelling passes beneath or adjacent to individual properties.

Eastern Reserve

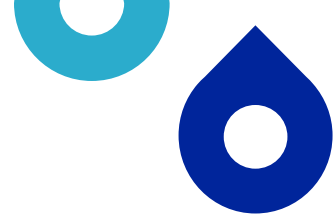
Construction activities within Eastern Reserve are largely unchanged from those assessed in the approved REF. The new location of the entry/exit pit at Eastern Reserve will require noise-intensive excavation activities over a period of about 20 weeks.

During peak excavation and rock-breaking works, predicted noise levels exceed the daytime NML by 10–20 dB(A), which is classified as highly intrusive and highly noise affected, for receivers within 120 m. Noise impacts are temporary, with individual receivers affected for portions of the works rather than continuously.

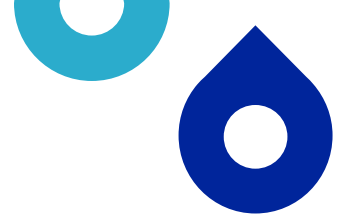
While the scale and duration of impacts are comparable to those assessed in the approved REF, the relocation of the entry/exit pit to the north would change the spatial distribution of impacts, resulting in a different grouping of receivers being affected

Diamond Bay

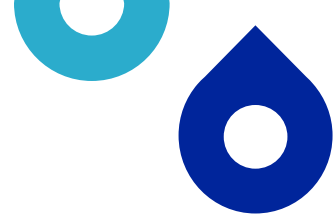
The revised alignment brings construction works into closer proximity to ■ Kimberley Street than previously assessed in the approved REF. Construction is anticipated to extend over about 78 weeks, with high-noise activities associated with excavation and network connection works limited to about two months.



Aspect	Potential additional impacts
	<p>During rock-breaking and concrete sawing for connection works, predicted construction noise levels exceed the daytime NML by 30–35 dB(A), corresponding to highly intrusive noise and highly noise affected conditions, for short periods, for receivers within 80 m of the proposal. These impacts are highly localised and temporary, occurring primarily at the closest receiver and would reduce significantly once connection works are completed.</p> <p><u>Vibration Impacts</u></p> <p>Vibration impacts associated with the proposed works arise primarily from rock-breaking, compaction and micro-tunnelling activities. Some receivers may experience perceptible vibration and temporary human comfort impacts where works occur within recommended minimum working distances. The duration of vibration-intensive activities is limited to short portions of the overall construction timeframe at each location.</p> <p>Vibration impacts at Diamond Bay and Eastern Reserve are consistent with those assessed in the approved REF. Vibration impacts at Old South Head Road are new, but vibration levels are comparable in scale and duration to other project areas..</p> <p><u>Residual Impacts</u></p> <p>Construction noise and vibration impacts will be managed through implementation of mitigation measures listed in the approved REF and this REFA. A Construction Noise and Vibration Management Plan will be prepared by the contractor, incorporating targeted mitigation and monitoring measures for sensitive locations. Residual noise and vibration impacts are likely to be experienced by receivers during excavation in the basement/carpark at ■ Kimberley Street at Diamond Bay. These will be managed with the implementation of mitigation measures listed in the approved REF and this REFA.</p> <p>The additional mitigation measures recommended in the CNVIA are listed in Table 4-5 of this REFA. With mitigation in place, residual impacts are expected to be clearly audible to moderately intrusive, with highly intrusive noise limited to short-duration, activity-specific periods.</p> <p>The proposal changes do not include additional noisy or high vibration components that would impact receivers during operation. As a result, operational noise and vibration are not expected to be noticeably different from the approved REF.</p>
Air and energy	<p>Air and energy impacts would be consistent with the approved REF. However, construction has moved from Carlisle St to Old South Head Rd.</p> <p>The proposal changes are not expected to result in materially different operational air quality or energy impacts compared to those assessed in the approved REF as the function and operation of the infrastructure remain unchanged.</p> <p>With the implementation of the mitigation measures listed in the approved REF, impacts associated with air and energy are expected to be minor.</p>
Waste and hazardous materials	<p>Waste and hazardous materials impacts would be consistent with those described in the approved REF. The proposal at Old South Head Road would generate spoil during excavation works, including approximately 2,100 m³ of material, which site investigations indicate is expected to be VENM and ENM. The contractor would undertake in situ waste classification prior to excavation and disposal to confirm material classification and ensure appropriate handling, disposal or reuse.</p> <p>The proposal changes are not expected to result in materially different operational waste or hazardous materials impacts compared to those assessed in the approved</p>



Aspect	Potential additional impacts
	<p>REF, as no additional waste or hazardous material will be generated during operation as a result of the proposal changes.</p> <p>With the implementation of the mitigation measures listed in the approved REF, impacts associated with waste and hazardous materials are expected to be minor.</p> <p>Traffic and access</p> <p><u>Old South Head Road</u></p> <p>Construction is located in public areas, along or adjacent to public roads. Access to the work areas would be via the existing public road network and access paths.</p> <p>During construction, the proposal will generate traffic from the following key work activities:</p> <ul style="list-style-type: none">• pipeline construction by a mix of open trenching and trenchless methods, such as horizontal directional drilling (HDD) and micro-tunneling – mainly the removal and disposal of spoil from drilling operations, and the delivery of pipe segments. <p>Expected construction traffic volumes at Old South Head Road would be:</p> <ul style="list-style-type: none">• 30 daily light vehicle movements• 5-10 daily heavy vehicle movements. <p>Street parking would be impacted along Old South Head Road due to trenching for wastewater pipelines and site access. All impacts would be temporary and short term as the works progress along the alignment. Access to adjacent properties would be maintained during construction with any temporary changes managed in consultation with affected residents and businesses.</p> <p>A Traffic Management Plan will be developed by the Contractor in consultation with the relevant traffic authority prior to construction, in line with the approved REF. Footpaths are expected to remain open during works, maintaining active transport access. Temporary changes to public transport such as bus stop relocations may be required as works progress and would be managed through the Traffic Management Plan during detailed design and construction stages.</p> <p><u>Diamond Bay and Eastern Reserve</u></p> <p>Traffic and access considerations would be consistent with those described in the approved REF.</p> <p>The proposal changes are not expected to result in materially different operational traffic and access impacts compared to those assessed in the approved REF, as ongoing operation and maintenance activities remain consistent with the approved project except for Old South Head Road. Maintenance activities that would have occurred at Carlisle Street based on the approved REF scope would now occur at Old South Head Road. Any maintenance activities would be infrequent and temporary as needed and any impacts due to maintenance activities would be appropriately assessed when the need for maintenance occurs. With the implementation of the mitigation measures listed in the approved REF, impacts to traffic and access can be adequately managed, and residual impacts are expected to be minor.</p>
Social and visual	<p><u>Old South Head Road</u></p> <p>The potential social impacts from noise, vibration, traffic, air quality and access are considered in the sections above. Visual amenity and functionality of public spaces would be impacted during construction. The increased presence of heavy equipment,</p>



Aspect	Potential additional impacts
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machinery and vehicles would be noticeable to surrounding receivers. Construction activities and site compounds may be visible from residences adjacent to the proposal.

While some vegetation trimming may be required, the proposal has been designed to minimise clearing as far as practicable. A minor and localised visual impact may be experienced due to vegetation removal in some locations. We will offset vegetation removal impacts in accordance with the mitigation measures in the approved REF and this REFA.

During operation, potential for visual impact is negligible as the proposal is below ground and disturbed areas would be backfilled and rehabilitated in consultation with Council.

Diamond Bay and Eastern Reserve

At Diamond Bay, the proposal changes require additional vegetation impacts and will result in a noticeable reduction in vegetation in some areas. This may change the views from nearby homes and public areas. In some locations, there may be more open sightlines. These effects would be localised and would be addressed through revegetation in consultation with Council.

With the implementation of the mitigation measures listed in the approved REF and this REFA, social and visual impacts can be adequately managed, and residual impacts are expected to be minor.

Cumulative and future trends

A search of the NSW Planning Portal identified 5 State Significant Developments (SSDs) within 500 m of the construction area, mostly located in Rose Bay, with one site in Double Bay.

State Significant Developments located within about 500 m of the construction area include:

- Seniors Housing at 669-683 Old South Head Road, Vaucluse – about 50 m from the proposal at Eastern Avenue in the approved REF, 400 m from the proposal change at Eastern Reserve and 400 m from the proposal at Old South Head Road.
- Pathways Rose Bay Seniors Housing, 20–30 Wilberforce Avenue and 33–37 Dover Road, Rose Bay – about 300 m west of the proposal at Old South Head Road.
- Residential development with infill affordable housing, 23–31 Dover Road, Rose Bay – about 380 m west of the proposal at Old South Head Road.
- Residential flat building with infill affordable housing, 36–56 Dover Road and 27–31 Hamilton Street, Rose Bay – about 50 m west of the proposal at Old South Head Road.
- Residential development with infill affordable housing, 2–6 Conway Avenue, 15–15A Fernleigh Avenue and 38–40 Carlisle Street, Rose Bay – about 270 m west of the Old South Head Road proposal.
- Residential development with infill affordable housing, 2–16 Spencer Street, Rose Bay – about 150 m west of the Old South Head Road proposal.

During construction, the main potential cumulative impacts of the proposal relate to noise and traffic, particularly where works associated with nearby SSDs occur at the same time and close to sensitive receivers. The potential for cumulative noise impacts is greater where the proposal is closer to SSD construction sites or where works remain



Aspect Potential additional impacts

in one location for longer periods. This is most relevant at the southern end of Old South Head Road adjacent to Dover Road and at the proposal location on Eastern Avenue in the approved REF.

Through appropriate staging, effective community consultation, and coordination with nearby projects, potential impacts can be managed using the mitigation measures identified in this REFA.

The proposal will also result in temporary increases in construction traffic along Old South Head Road. The potential to generate cumulative traffic impacts is higher where SSD construction traffic is also using Old South Head Road, and lower on local streets. Once staging of Sydney Water works along the corridor is confirmed, nearby development activity can be checked and coordination undertaken where required. Traffic and access impacts will be managed in accordance with the mitigation measures outlined in this REFA and through liaison with council and relevant stakeholders.

Climate change and future trends are predicted to cause the following changes to the area:

- higher temperatures
- longer dry periods and more extreme weather events such as high-intensity storms
- population growth in the local area requiring increased capacity of the wastewater network.

The proposal has considered these future trends and is unlikely to be impacted by, or contribute to, future trends, since:

- a small amount of vegetation removal is required which is unlikely to change local temperatures or bushfire risk
- it is outside of flood prone land and is not expected to cause any changes to existing flood patterns
- the proposal will improve the resilience of the local wastewater network to climate change and an increased population.

The potential environmental impacts of the proposal changes are generally consistent with those described in the approved REF and can be managed by the mitigation measures listed in the approved REF.

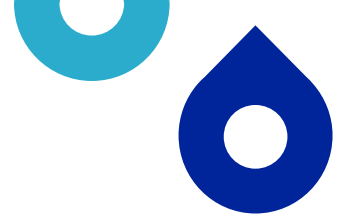
Additional mitigation measures have been included in Table 4-5 as required.

The proposal changes assessed in this REFA will be carried out in accordance with the mitigation measures listed in the approved REF and the additional mitigation measures listed in Table 4-5 of this REFA.

Table 4-5 Additional mitigation measures

Additional mitigation measures

At Diamond Bay an environmental constructability meeting and on-site walkthrough must be conducted with the Site Environmental Manager and Project Ecologist prior to finalising the development footprint. This process will help guide siting decisions and provide additional opportunities to avoid and minimise clearing and disturbance to PCT 3811 and PCT 3920 wherever practicable.



Additional mitigation measures

Minimise vegetation clearing and disturbance within areas containing PCT 3811 and 3920. Limit clearing to trimming rather than the removal of whole plants where possible.

Ensure all retained vegetation is protected in accordance with AS4970 – Protection of vegetation on development sites. This requires exclusion zone fencing installed around retained trees using temporary fencing or flagging tape and Tree Protection Zone (TPZ) signs. It is recommended that star pickets or hazard flagging be installed at 4m intervals along the TPZ. The Environmental Manager should confirm that the protection has been correctly installed before clearing works commence.

All selective pruning is recommended to be undertaken in accordance with AS4970 and AS 4373 Pruning of Amenity Trees.

Where a tree is proposed for retention and more than 10% of a Tree Protection Zone (TPZ) will be impacted, engage an AQF Level 5 qualified Project Arborist to oversee works and implement measures to protect and retain affected trees.

If pruning of public tree branches or roots within Woollahra LGA are required, the contractor should contact [REDACTED], Council's Tree Maintenance Coordinator at [REDACTED] to discuss the proposal.

Retain felled trees, hollows or logs in-situ unless they are within the impact area where possible. Material can be repositioned within rehabilitation areas or approved adjacent sites.

Inspect vegetation for potential fauna prior clearing, selective pruning or trimming of vegetation. If fauna is present, or the inspection has determined high likelihood of native fauna presence, engage a licensed ecologist to inspect and relocate fauna before works commence.

In the event an unexpected fauna species is identified during clearing:

- cease work immediately and inform the site supervisor and any other relevant personnel about the find
- establish a buffer zone around the area where the fauna was found using temporary barriers or signage to prevent unauthorised access to the area
- immediately contact the licensed fauna spotter-catcher assigned to the project providing details about the type of fauna found and its location
- the Fauna Spotter Catcher will assess the find, determine the species, its health and the course of action leading to the relocation of the fauna to the closest fauna safe haven, veterinary clinic or wildlife rehabilitation centre where possible.

Where reasonable and relevant, weed species should be managed in accordance with the control measures recommended by NSW Weed Wise (weeds.dpi.nsw.gov.au).

Manage biosecurity in accordance with:

- *Biosecurity Act 2015* (see [NSW Weedwise](#)), including reporting new weed infestations or invasive pests
- contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility.



Additional mitigation measures

Record pesticides and herbicides use in accordance with SWEMS0017.

Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline (SWEMS0019.13) and generally in accordance with the preliminary impacts and associated non-statutory offsets shown below.

Biodiversity value	Impact Area	Offset multiplier	Offset required (ha)
Sydney Coastal Headland Cliff Scrub	0.07	2	0.14
Coastal Clifftop Shrubby Marsh	0.02	2	0.04

Engage with Waverley Council when designing the biodiversity offset revegetation.

The Impact and Offset area must be revised to avoid impacts to PCTs where reasonable and feasible.

Offset revegetation should be designed to include weed removal and replanting in exotic/planted native vegetation areas within the Biodiversity Assessment Report Study Area.

For excavation of roads within Woollahra LGA the contractor should contact Council's Infrastructure Assets Team Leader, [REDACTED]

For closure of roads within Woollahra LGA the contractor should contact Council's Traffic and Transport Team Leader, [REDACTED]

The CEMP must be readily available on site and include a site plan which shows:

- the Impact Area clearly delineating the boundary from the retained area (outside impact area) including locations of lay-down and storage areas for materials and equipment located outside of the mapped vegetation communities.
- location of environmental controls (such as erosion and sediment controls, fences or other measures to protect vegetation or fauna, spill kits)
- location and full extent of any vegetation disturbance.
- an Erosion and Sediment Control Plan (ESCP) should be prepared and developed in accordance with the Blue Book – Managing Urban Stormwater.

The CEMP will determine the full extent of the Impact Area prior to construction.

Works must comply with the EPA Construction Noise Guideline (Draft, 2021), including scheduling work and deliveries during standard daytime working hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday. No work to be scheduled on Sunday nights or public holidays. Any proposed work outside of these hours must be justified.

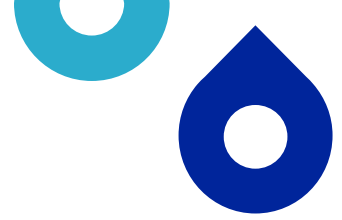
The Proposal will also be carried out in accordance with:

- Sydney Water's Noise Management Procedure SWEMS0056
- Noise Policy for Industry (EPA, 2017) (include if relevant).

All reasonable and feasible noise mitigation measures should be justified, documented and implemented on-site to mitigate noise impacts.

If works beyond the hours identified in this REF are needed, the Delivery Contractor would:

- justify the need for out of hours work (OOHW) and why it is not possible to carry out the works during these hours



Additional mitigation measures

- consider potential noise impacts and implement the relevant standard daytime hours safeguards, follow Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and document all reasonable and feasible management measures to be implemented
- identify additional community notification requirements and outcomes of targeted community consultation
- seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.
- consider potential noise impacts and implement the relevant standard daytime hours safeguards, follow Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and document all reasonable and feasible management measures to be implemented

If works on Sundays or public holidays are required, the Delivery Contractor would:

- justify why all other times are not feasible
- consider potential noise impacts and implement relevant standard daytime, out of hours and night-time safeguards and other reasonable and feasible management measures
- identify community notification requirements
- seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.

Monitor compliance with the recommended vibration levels in *DIN 4150-3 1999: Structural Vibration – Part 3; Effects of vibration on structures*.

Consider less vibration intensive methodologies where practicable and use only the necessary sized and powered equipment.

A Construction Noise and Vibration Management Plan (CNVMP) and/or Construction Environmental Management Plan (CEMP) shall be prepared. This will specify the actual plant to be used and will include updated estimates of the likely levels of noise and the scheduling of activities.

The CNVMP/CEMP should include but not be limited to the following:

- roles and responsibilities
- noise and vibration sensitive receiver locations and structures
- identify works that have the potential to cause impact, accompanied by an appropriate assessment (predictive assessment or risk evaluation)
- mitigation and management strategy
- monitoring methodology (as relevant)
- community engagement strategy.

Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.

Appoint a named member of the site staff who will act as the Responsible Person with respect to noise and vibration;

- site managers to periodically check the site and subjectively assess emissions to nearby receivers to proactively manage works.
- all employees, contractors, and subcontractors to receive an environmental induction which should include:



Additional mitigation measures

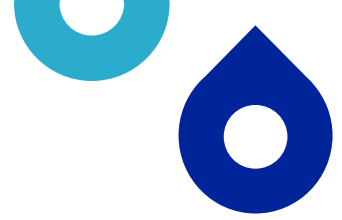
- standard noise and vibration mitigation measures
- permissible hours of work
- limitations on high noise and vibration generating activities
- location of nearest sensitive receivers
- regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise, including driving on local roads;
- ensure good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable;
- avoid the use of radios or stereos outdoors; and
- avoid shouting and minimise talking loudly and slamming vehicle doors.

General recommended provisions which should be implemented initially include:

- situate noisy equipment away from noise-sensitive areas.
- consideration should be given to the installation of onsite barriers such as hoardings or temporary screens at any specific locations where necessary to provide attenuation between particularly noisy construction works and nearby sensitive receptors. Type of screens could include noise curtains or hoarding (plywood board, panels of steel sheeting or compressed fibre cement board). This mitigation measure should be considered as a minimum, and wherever practicable, for noisy works in areas where sensitive receivers are predicted to be highly affected for extended periods of time.
- noise screens should be considered, where feasible, during trenching works and activities involving high-noise plant and equipment (such as rock breakers and concrete saws), particularly during Out-of-Hours Works (OOHW) periods along Old South Head Road. To maximise noise reduction, screens should be located as close as practicable to the noise source.
- in Diamond Bay, noise screens should also be considered where works are undertaken near the manhole connection point. While screening may be less effective for upper-level receivers, screens are still expected to provide a degree of noise reduction for lower-level. Noise screens should also be considered around the large construction area and compound area at Kimberley Street.
- noise screens should be considered around the construction area in Eastern Reserve.

Use quieter construction methods where feasible and reasonable.

- examine and implement, if feasible and reasonable, alternatives to rock-breaking work methods, such
- as chemical rock and concrete splitting for works at ■ Kimberley Street and the Old South Head Road.
- use only the necessary size and power of equipment
- all plant and equipment used on site must be:
 - maintained in a proper and efficient condition; and
 - operated in a proper and efficient manner.
- turn off all plant and equipment when not in use
- ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable.
- where vibration from tunnelling activities are considered excessive, the tunnelling operations could be operated at a slower speed. Note that a slower operation of the tunnelling operations may result in an increase of duration of works and should be considered in conjunction with community views to complete works in shorter duration



Additional mitigation measures

- plan traffic flow, parking and loading/unloading areas to minimise reversing movements and idling traffic within the site and before entering site.
- route heavy vehicle movements on major arterial roads and highways away from noise sensitive areas where possible.
- provide driver training to minimise loud noise generating vehicle behaviour and to avoid engine compression braking near sensitive receivers.

Where possible, noise from mobile plant should be reduced using additional noise-control fittings, including residential-grade mufflers and damped hammers (such as “City” model rammer hammers). These measures are applicable across all construction activities and are particularly important during night-time and OOHW at Old South Head Road, where the use of silencers and other noise-reduction fittings should be prioritised.

The noise levels of plant and equipment items are to be considered in plant and equipment rental decisions.

Vibration monitoring should be conducted at the commencement of vibration generating activities that are proposed within the minimum working distances (Refer to Section 7.2 and 8.4.1 of the CNVIA).

Structural surveys (dilapidation surveys):

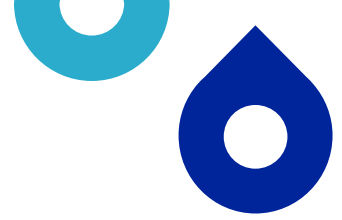
- Select equipment to minimise vibration. Where nearby buildings/structures are located within the safe working distance, pre-construction surveys and/or minimum work distance trials should be conducted as per Section 8.1 and Section 8.4 of the CNVIA.
- The findings of the survey may require amendment to proposed vibration criteria or management measures and therefore should be undertaken in suitable advance of the start date.
- The sensitivity of potentially at-risk structures are subject to confirmation by the contractor prior to start of any works.

Building and buried services (and Sydney Water assets) condition surveys:

- Structures should be considered in the Construction Noise and Vibration Management Plan (CNVMP).
- Property surveys (or dilapidation surveys) should be conducted before start of construction works where it has been established that the property, structure or utility is at risk of damage during the construction work.
- This could be where a property, structure, utility or Sydney Water asset is located within the minimum working distance for example (refer to Section 8.4 of the CNVIA). The survey findings could require amendment to proposed vibration criteria or management measures and therefore should be undertaken in suitable advance of when the works start.
- Where Sydney Water assets are located within minimum working distances risking exceedance of Sydney Water threshold vibration limits further asset protection measures may be applicable as per the Sydney Water Specialist Engineering Assessment procedure. Further details on Sydney Water vibration limits are provided in Appendix C.3.4 of the CNVIA.

Community consultation (periodic notification and specific notification) as identified in Table 13 of the CNVIA should occur prior to, and during works as follows:

- notify affected stakeholders (through methods such as letterbox drops, individual briefings or phone calls) of upcoming works with details of what the works will entail (such as the works



Additional mitigation measures

purpose, duration, expected impacts and mitigation measures, complaints procedure, who is responsible for undertaking the works)

- notification should be as specific as practicable regarding nature and timing of works and any scheduled respite periods
- discuss with affected receivers about any atypical sensitivities and review how scheduling of activities and other mitigation measures may aid to minimise impacts
 - (affected receivers = receivers mapped as experiencing non-compliant noise impacts)
 - (atypical sensitivities = such as vibration sensitive equipment/processes in medical establishments, exam periods or school holidays for education establishments)
- establish long-term personnel or processes (e.g. project email, phone number) to centralise project enquiries
- periodic notification should be sent out to the community at a reasonable frequency for all impacted receivers to provide information on the proposed construction schedule and mitigation measures to be implemented to minimise the potential impacts. Impacted receivers have been identified over 500 m from the construction impact area. Notifications should be sent a minimum of seven (7) days prior to start of works.
- follow the complaints management process in section 8.3 of the CNVIA for any complaints, including complaints registers and standard response times.

Community consultation – including duration reduction (DR), respite offer (RO) and respite periods (RP):

- Project-specific mitigation measures will be determined based on a reasonable and feasible assessment performed by suitably qualified project representatives (community and stakeholder, project management, environment) and refined through community feedback.
- Community views should be taken into consideration when offering respite periods (RO and RP).
 - It may be considered beneficial to increase the number of work shifts to allow for a duration reduction (DR).
 - Respite periods when scheduling work.

Example includes:

- scheduling the highest noise generating activities during the least sensitive times, where practicable,
- conducting activities in blocks of up to three hours
- implementing cut-off times for particularly noisy works, such as scheduling the use of rock breakers and concrete saws to occur before 10:00 pm or 11:00 pm for works along Old South Head Road.

Noise monitoring:

- Short-term attended measurements should be conducted in response of a complaint and to confirm alignment with predicted noise levels in the impact assessment and management measures.

Alternative accommodation:

- Applies only to residential receivers for works proposed during the late night and early morning time periods. Where practicable, high-noise activities such as rock breaking and concrete sawing



Additional mitigation measures

should be scheduled to occur earlier in the night (e.g. before 10:00 pm or 11:00 pm). The need for alternative accommodation should be reviewed further and may be considered on a case-by-case basis under exceptional circumstances.



5. Conclusion

Sydney Water has prepared this REFA to assess the potential environmental impacts of Refresh Vacluse Diamond Bay – Diamond Bay proposal change. The proposal is required to service growth and improve environmental outcomes in the area.

These proposal changes were required due to:

- new hydraulic modelling which showed a section of the existing wastewater gravity main on Old South Head required amplification to accommodate the increase in flow created by SP1217
- new geotechnical investigations encountering poor rock quality near the Diamond Bay outfalls required redesign to intercept flows beneath ■ Kimberley Street.

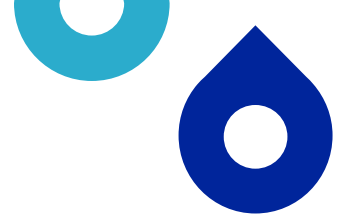
The main potential additional construction environmental impacts of the proposal change include impacts associated with biodiversity, noise, vibration and traffic. Potential operational impacts remain generally consistent with the approved REF. Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in this REFA and the approved REF, the proposal is unlikely to have a significant impact on the environment. Therefore, an environmental impact statement is not required under Division 5.1 of the EP&A Act.

The REF considers how the proposal aligns with the principles of Ecologically Sustainable Development (ESD) (Appendix B). The proposal will result in positive long-term environmental improvements. The proposal is unlikely to result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment.

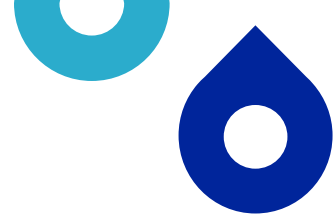
Appendix A – Section 171 and Section 171A checklist

Requirements in addition to the approved REF are considered in the table below.

Section 171 checklist	REFA finding
Any environmental impact on a community	<p>As noted in the approved REF, there may be short-term impacts on the community from traffic, dust and noise. There is also potential for medium term impacts due to the vegetation removal proposed at Diamond Bay. Impacts to native vegetation will be offset in consultation with Council.</p> <p>There will be environmental improvements by eliminating the continuous flow of untreated wastewater into the surrounding environment.</p>
Any transformation of a locality	The proposal change will cause localised transformation of the locality due to vegetation impacts. These will be offset in consultation with Council.
Any environmental impact on the ecosystems of the locality	The proposal change will result in the removal of some vegetation at Diamond Bay which may have a minor environmental impact to ecosystems of the locality. The proposal will lead to environmental improvements by ensuring a reliable wastewater service to collect and treat wastewater, minimising any impacts on the ecosystem.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposed work may result in a minor reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality due to the vegetation impacts proposed at Diamond Bay. These will be offset in consultation with Council and vegetation replanting will be completed within the construction area where possible. The proposal will reduce the environmental impact associated with discharge of untreated wastewater at the three ocean outfalls at Vaucluse and Diamond Bay.
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The proposal change may cause a minor additional impact on the heritage significance of Coastal Sandstone Escarpment Conservation Area at Diamond Bay. Vegetation offsetting and replanting will be completed in consultation with Council to minimise longer term impacts to the heritage significance of the conservation area.
Any impact on the habitat of any protected animals (within the meaning of the <i>Biodiversity Conservation Act 2016</i>)	The proposed vegetation impacts are a minor impact to the habitat of protected species. The proposal will minimise vegetation clearance as far as practicable and will not clear any threatened ecological communities.
Any endangering of any species of animal or plant or other form of	The proposal will not endanger any species.



Section 171 checklist	REFA finding
life, whether living on land, in water or in the air	
Any long-term effects on the environment	The proposed work will not have any long-term impacts on the environment but will have a long-term benefit by providing a reliable and modern wastewater service for the area. The reduction of untreated wastewater discharge to the environment at the three ocean outfalls will result in long-term positive impacts on the receiving environment.
Any degradation of the quality of the environment	The proposed work will cause a minor degradation of the quality of the environment due to vegetation impacts at Old South Head Road and Diamond Bay. However works will also increase the quality of the environment by reducing the amount of untreated wastewater entering the environment.
Any risk to the safety of the environment	The proposed work will not increase risk to the safety of the environment. The proposal will reduce the risk to human health near the ocean outfalls by providing a reliable and modern wastewater service for the area.
Any reduction in the range of beneficial uses of the environment	The proposal will maintain the range of beneficial uses of the environment.
Any pollution of the environment	Environmental safeguards will mitigate the potential for the proposed work to pollute the environment. No pollution of the environment is expected. The proposal will significantly reduce pollution to the environment by eliminating dry weather wastewater discharges entering the environment from the existing ocean outfalls.
Any environmental problems associated with the disposal of waste	Waste disposal will be managed according to the environmental mitigation measures in the approved REF and this REFA. No environmental issues associated with the disposal of waste are expected.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposal will not affect demand on resources.
Any cumulative environmental effect with other existing or likely future activities	The proposal has potential to contribute to cumulative environmental effects with other existing or likely future activities, particularly where construction works occur concurrently with nearby developments, resulting in combined impacts to noise, traffic, and local amenity.



Section 171 checklist	REFA finding
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Any impact on coastal processes and coastal hazards, including those under projected climate change conditions

The proposed work will not have any impact on coastal processes or hazards, and coastal processes and coastal hazards will not have any impact on the proposed activity.

Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the EP&A Act, Division 3.1

There are no applicable strategic planning statements or plans.

Any other relevant environmental factors.

The proposal has been assessed against the factors listed above, and there are no other relevant environmental factors to consider.

Section 171A of the EP&A Regulation imposes additional requirements on a determining authority to consider certain matters under Part 6.2 of the BCSEPP for a proposal within a 'regulated catchment'. The regulated catchments are defined under the BCSEPP, and include the:

- Sydney Drinking Water Catchment
- Sydney Harbour Catchment
- Georges River Catchment
- Hawkesbury-Nepean Catchment.

As the proposal is partially within the Sydney Harbour Catchment, the requirements of Section 171A(1) are applicable guidelines for the proposed scope at Old South Head Road, and are considered below.

Section 171A checklist	REF finding
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BCSEPP – Section 6.6(1) - Water quality and quantity

In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following:

(a) whether the development will have a neutral or beneficial effect on the quality of water entering a waterway

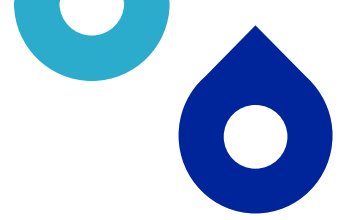
Mitigation measures will be implemented during construction and operation to ensure that the proposal scope at Old South Head Road, the only scope within the catchment, has a neutral impact on water quality in Sydney Harbour.

(b) whether the development will have an adverse impact on water flow in a natural waterbody

The proposal will not modify or adversely affect water flows within Sydney Harbour during construction or operation.

(c) whether the development will increase the amount of stormwater run-off from a site

The proposal will not increase the area of impervious surfaces within the Sydney Harbour Catchment and therefore will not increase the volume of stormwater run-off.



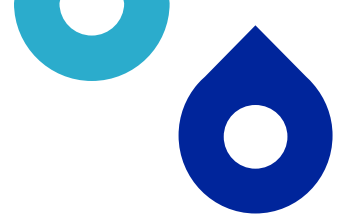
Section 171A checklist	REF finding
(d) whether the development will incorporate on site stormwater retention, infiltration or reuse	Provision for on-site stormwater retention, infiltration or reuse is not required. The works will use the existing stormwater management system in the surrounding area.
(e) the impact of the development on the level and quality of the water table	The works will not impact the level and quality of the water table.
(f) the cumulative environmental impact of the development on the regulated catchment	The proposal scope within the regulated catchment is within a previously disturbed road reserve. Therefore, the proposal is unlikely to contribute to cumulative impacts. Provided the mitigation measures are implemented, adverse cumulative environmental impact would be minor.
(g) whether the development makes adequate provision to protect the quality and quantity of ground water.	As detailed in item 6.6(1)(e) above, impacts to the level and quality of groundwater are expected to be negligible.

BCSEPP – Section 6.6(2) - Water quality and quantity
 Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied the development ensures:

(a) the effect on the quality of water entering a natural waterbody will be as close as possible to neutral or beneficial	Appropriate mitigation measures are included to ensure that the proposal will have a neutral or beneficial effect on the water quality of Sydney Harbour.
(b) the impact on water flow in a natural waterbody will be minimised	The proposal will not modify or adversely affect water flows within Sydney Harbour during construction or operation.

BCSEPP – Section 6.7(1) - Aquatic Ecology
 In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following:

(a) whether the development will have a direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation	<p>The proposal scope within the regulated catchment may require minor trimming to the roots and branches of street trees along Old South Head Road.</p> <p>Direct, indirect or cumulative adverse impacts to terrestrial, aquatic or migratory animals or vegetation of the locality will be minor.</p>
(b) whether the development involves the clearing of riparian vegetation and, if so, whether the development will require: (i) a controlled activity approval under the Water Management Act 2000, or	The proposed works within the regulated catchment do not require clearing of riparian vegetation or a permit under the <i>Fisheries Management Act 1994</i> .
(c) (Development in regulated catchments) REF finding (ii) a permit	



Section 171A checklist	REF finding
------------------------	-------------

under the Fisheries Management Act 1994

(d) whether the development will minimise or avoid: <ul style="list-style-type: none"> i. the erosion of land abutting a natural waterbody, or ii. the sedimentation of a natural waterbody 	Mitigation measures to minimise the potential for erosion and sedimentation impacts are included in the approved REF and this REFA.
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(e) whether the development will have an adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area	There are no wetlands in proximity to the proposal.
--	---

(f) whether the development includes adequate safeguards and rehabilitation measures to protect aquatic ecology	Mitigation measures to minimise the potential for erosion and sedimentation impacts are included in the approved REF and this REFA.
---	---

(g) if the development site adjoins a natural waterbody, whether additional measures are required to ensure a neutral or beneficial effect on the water quality of the waterbody	Appropriate mitigation measures are included in the approved REF and this REFA to ensure that the proposal will have a neutral or beneficial effect on the water quality of Sydney Harbour.
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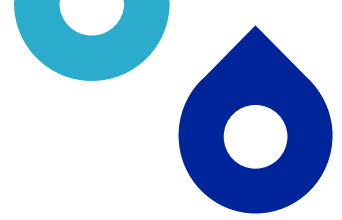
BCSEPP – Section 6.7(2) - Aquatic Ecology

Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied of the following:

(a) the direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation will be kept to the minimum necessary for the carrying out of the development	Appropriate mitigation measures are included in the approved REF and this REFA to ensure that the cumulative impacts of the proposal on terrestrial, aquatic or migratory animal or vegetation are limited to the minimum extent necessary.
--	---

(b) the development will not have a direct, indirect or cumulative adverse impact on aquatic reserves	There are no aquatic reserves in proximity to the proposal.
---	---

(c) if a controlled activity approval under the Water Management Act 2000 or a permit under the Fisheries Management Act 1994 is required in relation to the clearing of riparian vegetation—the approval or permit has been obtained	<p>Sydney Water is exempt from the need to obtain a controlled activity approval under the <i>Water Management Act 2000</i>.</p> <p>A permit under the FM Act is not required for the proposal.</p>
---	---



Section 171A checklist	REF finding
(d) the erosion of land abutting a natural waterbody or the sedimentation of a natural waterbody will be minimised	Mitigation measures to minimise the potential for erosion and sedimentation impacts to be included in the approved REF and this REFA.
(e) the adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area will be minimised	There are no wetlands in proximity to the proposal.

BCSEPP – Section 6.8(1) – Flooding

(a) In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the likely impact of the development on periodic flooding that benefits wetlands and other riverine ecosystems	The proposal is not located within a flood prone area. The proposal involves excavation and will be restored to the existing condition. The risk of adverse impact from future flood events that benefit riverine ecosystem during operation is negligible.
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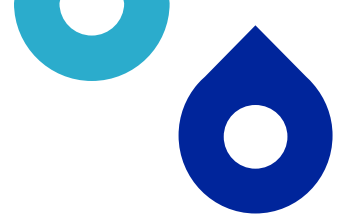
BCSEPP – Section 6.8(2) – Flooding
Development consent must not be granted to development on flood liable land in a regulated catchment unless the consent authority is satisfied the development will not

(a) if there is a flood, result in a release of pollutants that may have an adverse impact on the water quality of a natural waterbody, or	Mitigation measures to minimise the potential for erosion and sedimentation impacts are included in the approved REF and this REFA.
(b) have an adverse impact on the natural recession of floodwaters into wetlands and other riverine ecosystems	The proposal will not alter existing contours of the land.

BCSEPP – Section 6.9(1) - Recreation and public access

In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider:

(a) the likely impact of the development on recreational land uses in the regulated catchment	The proposed works at Old South Head Road are the only works within a regulated catchment. These works are within the road reserve and would not impact recreational land uses.
(b) whether the development will maintain or improve public access to and around foreshores without adverse impact on natural	The proposed works within the regulated catchment will not impact public access to and around foreshores. The operation of the proposal will not affect existing public access arrangements.



Section 171A checklist

REF finding

waterbodies, watercourses, wetlands
or riparian vegetation

BCSEPP – Section 6.9(2) - Recreation and public access

Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied of the following:

- | | |
|---|---|
| (a) the development will maintain or improve public access to and from natural waterbodies for recreational purposes, including fishing, swimming and boating, without adverse impact on natural waterbodies, watercourses, wetlands or riparian vegetation | Impact to public access to and from natural waterbodies for recreational activities is not anticipated.

Mitigation measures will be implemented to ensure that there are no adverse impact to natural waterbodies, water courses, wetlands or riparian vegetation. |
| (b) new or existing points of public access between natural waterbodies and the site of the development will be stable and safe | The proposed works within the regulated catchment will not change public access between natural waterbodies. No additional access points are proposed within the regulated catchment. |
| (c) if land forming part of the foreshore of a natural waterbody will be made available for public access as a result of the development but is not in public ownership—public access to and use of the land will be safeguarded | Public access and use of foreshore areas will not be affected by the proposed works within the regulated catchment. |



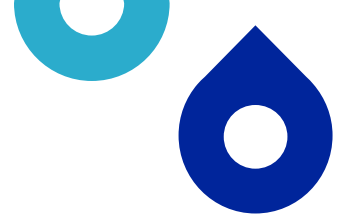
Appendix B – Consideration of Ecologically Sustainable Development

Additional ESD considerations are covered in the table below.

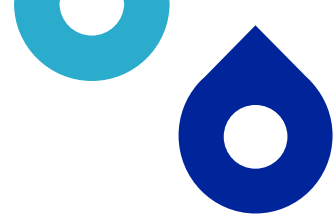
Principle	Proposal alignment
Precautionary principle – <i>if there are threats of serious or irreversible environmental damage, lack of scientific uncertainty should not be a reason for postponing measures to prevent environmental degradation. Public and private decisions should be guided by careful evaluation to avoid serious or irreversible damage to the environment where practicable, and an assessment of the risk-weighted consequences of various options.</i>	The proposal will not result in serious or irreversible environmental damage and mitigation measures have been designed to reduce scientific uncertainty relating to the proposal.
Inter-generational equity – <i>the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.</i>	The proposal will help to meet the needs of future generations by providing a reliable wastewater service.
Conservation of biological diversity and ecological integrity – <i>conservation of the biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes.</i>	The proposal will not significantly impact on biological diversity or impact ecological integrity. The proposal will occur in an urban environment, will involve minor vegetation clearing and will not impact any threatened ecological communities.
Improved valuation, pricing and incentive mechanisms — <i>environmental factors should be included in the valuation of assets and services, such as ‘polluter pays’, the users of goods and services should pay prices based on the full life cycle costs (including use of natural resources and ultimate disposal of waste) and environmental goals</i>	The proposal will provide cost efficient use of resources and provide optimum outcomes for the community and environment.

Appendix C – Consideration of TISEPP consultation

TISEPP section	Yes	No
Section 2.10, council related infrastructure or services – consultation with council		
Will the work:		
Potentially have a substantial impact on stormwater management services provided by council?		N
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		N
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		N
Connect to, and use a substantial volume of water from a council owned water supply system?		N
Require temporary structures on, or enclose, a public space under council's control that will disrupt pedestrian or vehicular traffic that is not minor or inconsequential?	Y	
Excavate a road, or a footpath adjacent to a road, for which the council is the roads authority, that is not minor or inconsequential?	Y	
Section 2.11, local heritage – consultation with council		
Is the work likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (not also a State heritage item) more than a minor or inconsequential amount?		N
Section 2.12, flood liable land – consultation with council		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and will works alter flood patterns other than to a minor extent?		N
Section 2.13, flood liable land – consultation with State Emergency Services		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and undertaken under a relevant provision*, but not the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? * (e) Div.14 (Public admin buildings), (g) Div.16 (Research/ monitoring stations), (i) Div.20 (Stormwater systems)?		N
Section 2.14, development with impacts on certain land within the coastal zone– council consultation		
Is the work on land mapped as coastal vulnerability area and inconsistent with a certified coastal management program?		N
Section 2.15, consultation with public authorities other than councils		



TISEPP section	Yes	No
Will the proposal be on land adjacent to land reserved under the <i>National Parks and Wildlife Act 1974</i> or land acquired under Part 11 of that Act? <i>If so, consult with DPE (NPWS).</i>		N
Will the proposal be on land in Zone C1 National Parks and Nature Reserves or on a land use zone that is equivalent to that zone? <i>If so, consult with DPE (NPWS).</i>		N
Will the proposal include a fixed or floating structure in or over navigable waters? <i>If so, consult TfNSW.</i>		N
Will the proposal be on land in a mine subsidence district within the meaning of the <i>Coal Mine Subsidence Compensation Act 2017</i> ? <i>If so, consult with Subsidence Advisory NSW.</i>		N
Will the proposal be on land in a Western City operational area specified in the <i>Western Parkland City Authority Act 2018</i> , Schedule 2 and have a capital investment value of \$30 million or more? <i>If so, consult the Western Parkland City Authority.</i>		N
Will the proposal clear native vegetation on land that is not subject land (ie non-certified land)? <i>If so, notify DPE at least 21 days prior to work commencing. (Requirement under s3.24 Chapter 3 Sydney Region Growth Centres - of the SEPP (Precincts – Central River City) 2021).</i>		N



Appendix D – Council Consultation

3 March 2026

██████████
Woollahra Municipal Council, 536 New South Head Road, Double Bay, NSW 2028

Refresh Vacluse Diamond Bay – Diamond Bay, Review of Environmental Factors Addendum (REFA)

Dear ██████████

Sydney Water will be undertaking construction and upgrades of wastewater infrastructure at various locations in Rose Bay and Vacluse. Most of the proposed work is covered under an existing REF from 2020. However, an REFA is currently being drafted to address changes to the construction scope that are required to address operational and construction constraints. Changes to the construction scope within Woollahra Municipal Council LGA are outlined below.

Construction is now proposed at Old South Head Road from Lot A, DP320051 to Lot 17, DP168020. Figure 1 outlines the proposal changes which includes sewer amplification of approximately 550 m on Old South Head Rd.

The methodology consists of the following main aspects:

- Geotechnical surveying and soil sampling
- Potholing and service locating
- Site demarcation and establishment
- Saw cutting and excavation of the existing ground surface
- Trench excavation
- Removal of waste, spoil and the existing redundant pipe
- Installation of pipes and fittings
- Backfilling and temporary restoration of the completed sections
- Open trenches would have road plates installed at the end of each shift where required
- Connection of the new infrastructure to the surrounding network

- Reinstatement of ground surfaces to their pre-construction condition

The new infrastructure will address operational requirements for growth, improve reliability of the wastewater systems and reduce the risk of wastewater overflows.

The works will be performed under a Review of Environmental Factors (REF), prepared under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Accordingly, this notification is provided in compliance with section 2.10 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP), as works will impact council related infrastructure and services. Impacts related to this TISEPP section includes:

- Excavation of a road, or a footpath adjacent to a road (Old South Head Road), for which the council is the roads authority, that is not minor or inconsequential. Excavation would be required for the construction of wastewater infrastructure and would require traffic control and night work.

The below figure shows the proposal location. Sydney Water will continue to liaise with council regarding these impacts and provide more detail, including traffic management plans closer to the start of construction in these areas (indicative start date: April 2026). As project design develops there may be minor changes, though the general area of the works would remain the same.

Woollahra Municipal Council is invited to provide comment on the proposal impacts in accordance with TISEPP within 21 days of this notice (by 24/03/2025).

For more information on the following:

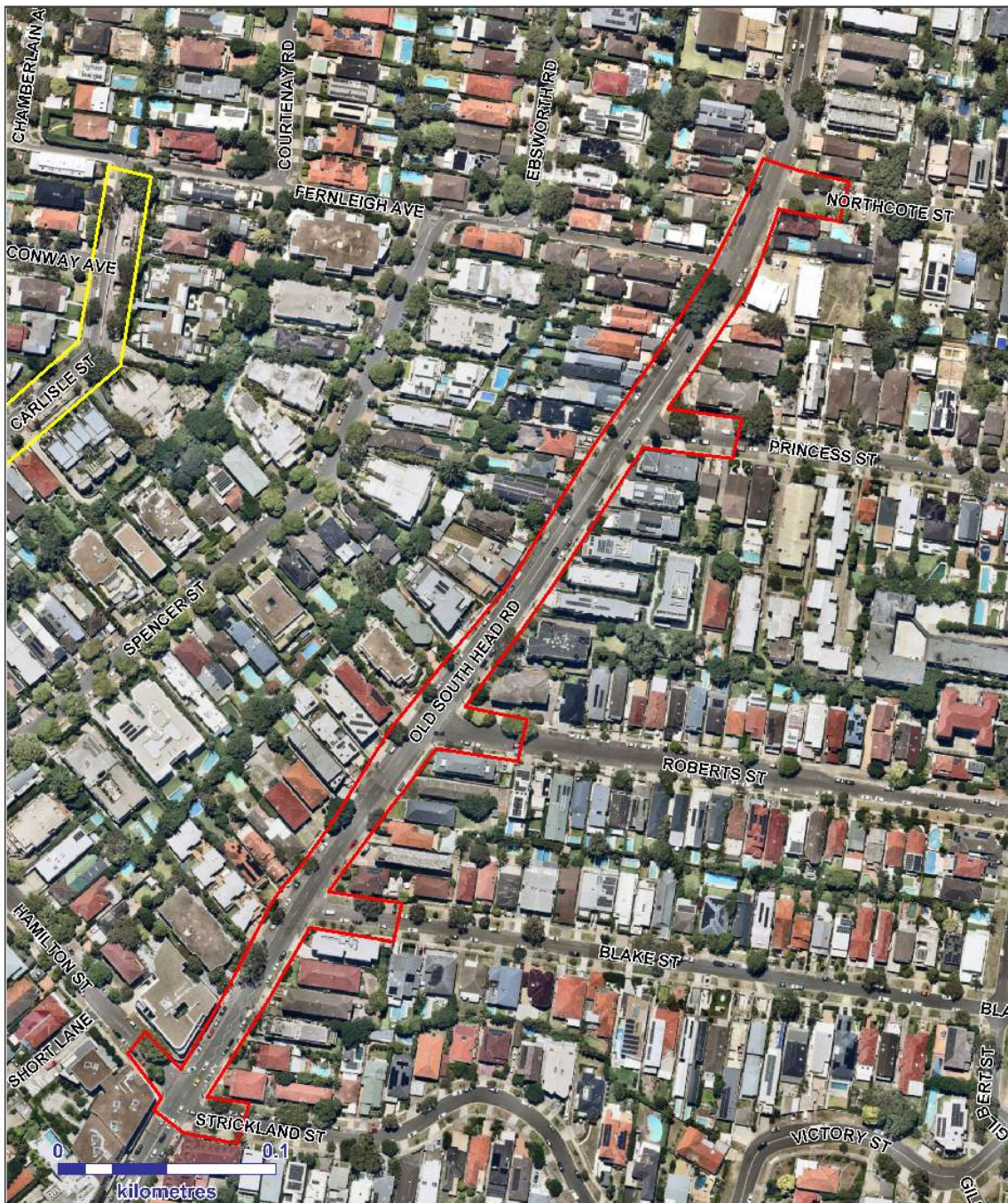
- REF – please contact: [REDACTED], Senior Environmental Scientist, [REDACTED]
- Project – please contact: [REDACTED], Project Manager, [REDACTED]

Yours sincerely,

[REDACTED]

Senior Environmental Scientist

Figure 1: Old South Head Road proposal area



- REF Addendum Construction Area
- REF Addendum Construction Area
- Approved 2020 REF Construction Area



Do not make publicly available or publish this map in any form.
AHILA#116, date 20/11/25.

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Sydney Water
NSW Department of Planning, Industry & Environment
NSW Spatial Services
Australian Government Department of Environment

Date Created: 13/02/2026



From:
Sent:
To:
Cc:
Subject:

Hi [REDACTED],

Thank you for your comments.

We have considered the matters raised in your email during development of the REF Addendum (REFA). Please see responses below.

Public street trees along Old South Head Road (Woollahra Council side)

Council's comments regarding the protection of public street trees and any potential pruning are noted. The proposed works have been designed to avoid public tree removal. Pruning of some branches or roots may be required. Ongoing consultation with Council will occur prior to and during construction should any pruning or root disturbance be required, including liaison with Council's nominated arboricultural representative.

Sediment and erosion controls

Environmental mitigation measures addressing erosion, sedimentation and pollution control are included in the 2020 REF and proposed REF Addendum.

Road opening/closures

Thank you for providing these contacts. Council's requirements for coordination regarding road opening works are noted. Relevant consultation and approvals with Council will be undertaken prior to any road opening activities.

Traffic management and road closures

Council's request for notification of partial road closures and coordination in relation to any full road closures is noted. Sydney Water will continue consultation during the detailed design and delivery phases of the project where further coordination, notification or approvals are required.

REFA Review

Council's comments have been considered in the REF Addendum. The REF Addendum is currently being finalised and is unable to be issued for review at this stage. Sydney Water can provide a copy of the final REF Addendum to Council.

Regards,

[REDACTED]





Sydney Water respectfully acknowledges the traditional custodians of the land and waters on which we work, live and learn. We pay respect to Elders past and present.

[Read more](#) about our commitment to reconciliation.

CAUTION: This email originated from outside the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear [REDACTED]

Thank you for your letter regarding the REF Addendum and revised plans.

Council's comments are as follows:

Public street trees along Old South Head Road (Woollahra Council side)

We strongly insist that no public tree removal is undertaken as part of these works. All trees along Old South Head Road should be adequately protected including structural tree roots.

If pruning of public trees (including roots) are required as part of these works, Sydney Water / Abergeldie are to contact [REDACTED] Council's Tree Maintenance Coordinator at [REDACTED] to discuss the proposal backed by a qualified AQF5 Qualified Arborist.

Sediment and erosion controls

Please ensure that all works have appropriate sediment and erosion controls in place to prevent any pollutants entering Council's stormwater system.

Road opening

For any works involving road opening please contact Council's Infrastructure Assets Team Leader, [REDACTED] at [REDACTED]

Road closures

Please provide Council with advance notice of any partial road closures, and continue to provide notification to the community as has been done to date. For any works which may require a full-road closure please contact Council's Traffic and Transport Team Leader, [REDACTED]

REF Addendum

Council would appreciate the opportunity to review and comment on the draft REF Addendum prior to finalisation.

Kind regards

Our Values: Respect | Open | Accountable | Responsive | Excellence

We acknowledge the Gadigal and Birrabirragal people as the Traditional Custodians of the land in our local area.



Hi [REDACTED],

Hope you're doing well.

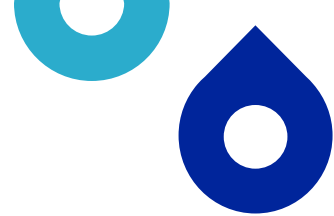
I understand our Community Engagement team have been in contact with you regarding our Refresh Vaucluse Diamond Bay project.

You may be aware that we are drafting an REF Addendum to our 2020 REF to address construction changes at and around Diamond Bay. Some of the proposal changes require formal notification to Council under the TISEPP 2021.

Please see the attached letter for more information.

Woollahra Municipal Council is invited to provide comment on the proposal impacts in accordance with TISEPP within 21 days of this notice. Please let me know if you would like to discuss the proposal further.

Regards,



Appendix E – Biodiversity Assessment Report



Biodiversity Assessment Report

Vaucluse Diamond Bay Addendum

March 2026

Sydney
WATER
Water IS OUR LIFE



Acknowledgement of Country

Sydney Water respectfully acknowledges the Traditional Custodians of the land and waters on which we work, live and learn. We pay respect to Elders past and present.

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1 Executive Summary

Sydney Water undertook a Flora & Fauna Assessment to evaluate potential ecological impacts of the Diamond Bay Vauclose Addendum.

Direct impacts to Plant Community Types (PCTs) and other vegetated areas are shown on Figure 5-1 and include:

- 0.07ha of replanted PCT 3811 - Sydney Coastal Headland Cliff Scrub
- 0.02ha of PCT 3920 - Coastal Clifftop Shrubby Marsh
- 0.05ha of Planted native and exotic vegetation
- 0.17ha of Exotic vegetation.

This represents an increased impact from the Review of Environmental Factors (REF) decided in December 2020. However, the affected communities are highly degraded and largely consist of previously replanted areas with a high cover of exotic species.

Recommended safeguards and management measures identified in Table 7-2 aim to avoid and minimise impacts during detailed design, meaning the actual on-ground impacts are likely to be less than the current estimate. Despite this, the Project has adopted a conservative approach by assuming full impact across the defined area for assessment purposes.

No threatened flora or fauna species were recorded during surveys. The proposed works involve small-scale clearing of low-quality habitat that does not appear to provide critical foraging, breeding or roosting habitat for threatened species. Therefore, the Project is unlikely to result in a significant impact under the BC Act or EPBC Act, subject to implementation of safeguards.

2 Introduction

2.1 Context

Sydney Water is proposing the construction and operation of sewerage infrastructure at Diamond Bay in Vaucluse, Sydney herein referred to as 'the Project'. This includes a new Sewage Pumping Station (SP1217) located at Lot 7030, Eastern Avenue, Dover Heights. The works form part of a broader initiative to redirect untreated wastewater currently discharged via ocean outfalls at Vaucluse and Diamond Bay to the Bondi Wastewater Treatment Plant for treatment. This proposal was originally assessed under the Review of Environmental Factors (REF) for the Refresh Vaucluse Diamond Bay project in June 2020, followed by a Decision Report in December 2020.

The project involves vegetation clearing and trimming to allow plant and equipment access for excavation and trenching along the pressure main alignment within Lot 1 DP176625, referred to as the Impact Area. Flora and fauna surveys were undertaken within this Impact Area and the surrounding Study Area.

Biodiversity impacts at Diamond Bay and Study Area were initially assessed as part of the REF. However, due to constructability challenges associated with the cliff face at Diamond Bay, the Impact Area needs to be expanded.

The Diamond Bay component of the Project includes constructing the sewerage infrastructure alignment and connect to the Sewage Pumping Station (SP1217) at Eastern Avenue Reserve. The indicative construction footprint spans cliff-line vegetation along Diamond Bay Headland, extending from the southern side of Diamond Bay Reserve at Craig Avenue to the northern edge of Kimberley Street.

2.2 Purpose & objectives

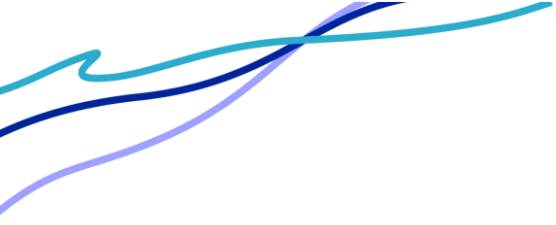
The purpose of this report is to review the legislative frameworks relevant to Biodiversity and the Project proposal, describe the Project proposal and document the biodiversity features and values present or considered likely to occur within the Study Area. The report assesses the likely impacts of the proposal under Section 7.2 and 7.3 of the BC Act and the EPBC Significant Impact Guidelines (DoE 2013) on threatened species, populations and ecological communities. In addition, the addendum details any changes to the protective measures, identified in the REF, to be implemented to mitigate impacts.

2.3 Project location and Study Area

Table 2-1 describes the proposal and Figure 2-1 shows the location of the Project and Study Area.

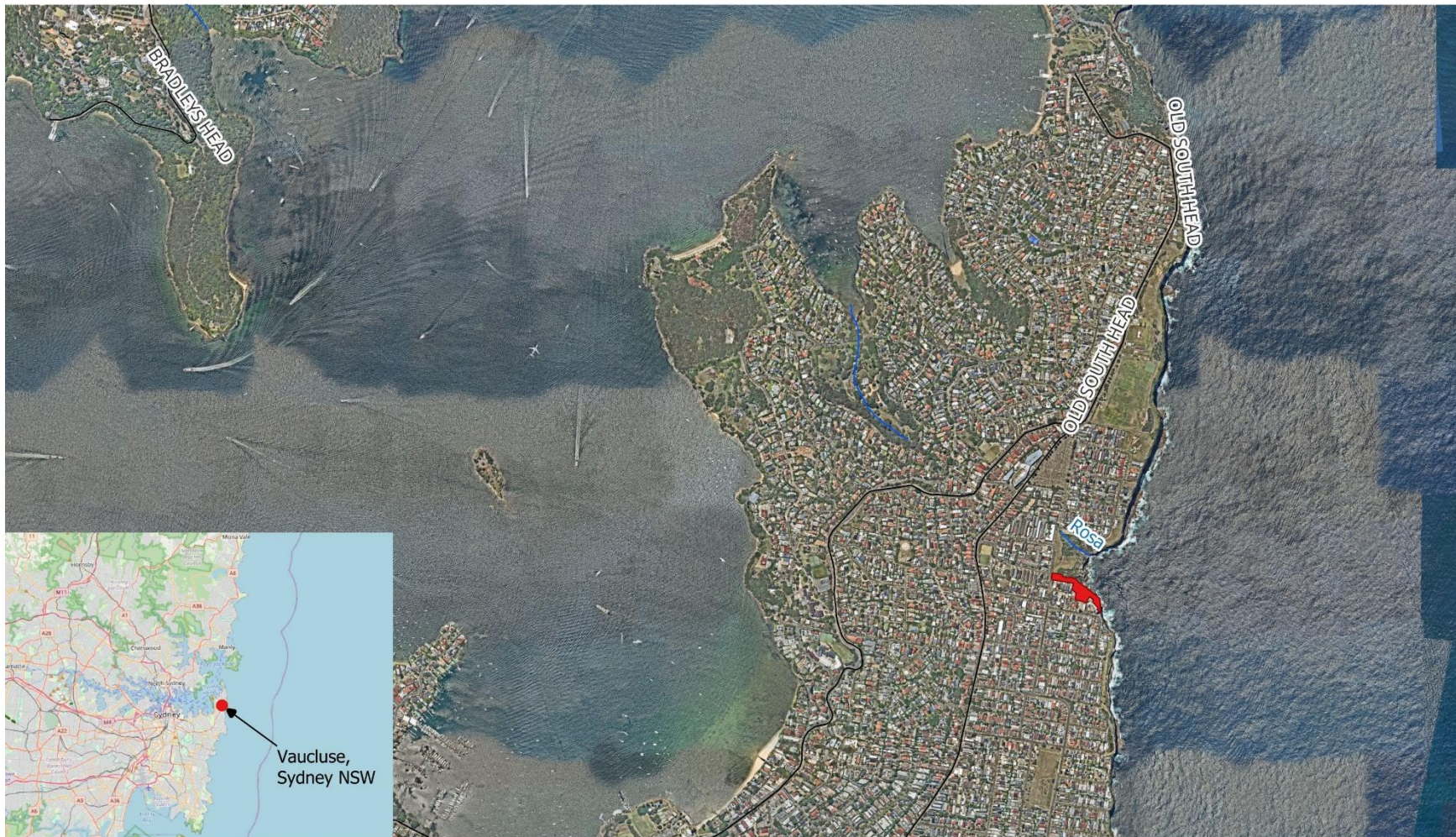
Table 2-1 Description of proposal

Item	Description
Item	<ul style="list-style-type: none">Description



<p>Study Area</p>	<p>The Study Area is shown on Figure 5-1 and is located within Diamond Bay Reserve at Lot 1 Diamond Bay Rd, Vaucluse NSW (Plan DP450333 Lot 1). It extends to Lot 1 Kimberley St, Vaucluse (Plan DP218961 Lot 1). The alignment also intersects:</p> <ul style="list-style-type: none">• Plan DP573864 Lot 2• Plan DP433771 Lot 1• Plan DP560890 Lot 2• Plan DP1056298 Lot 1• Plan DP615418 Lot 102.
<p>Impact Area</p>	<p>The Impact Area intersects the above lots and is also shown on Figure 5-1. It includes plant and equipment access, open trenching and other excavation areas.</p>
<p>General biodiversity features</p>	<p>The study area represents a highly modified ecotone along a sandstone cliffline within a fragmented, urbanised environment. Historically replanted to restore native vegetation, the area has undergone significant degradation due to heavy weed invasion, reducing the extent of native species and altering structural integrity.</p>

Figure 2-1 Project location



Legend

- Watercourse
- Study Area
- Classified_Roads

0 0.5 1 km

Project location



3 Legislative context

Table 3-1 identifies biodiversity legislation relevant to the Project.

Table 3-1 Environmental planning instruments relevant to the Project

Legislation	Relevance to proposal
Commonwealth Legislation	
<p><i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i></p>	<p>The Commonwealth EPBC Act aims to protect Matters of National Environmental Significance (MNES) and outlines the requirements for development application and approval of projects that impact MNES. The Project has the potential to impact threatened species, ecological communities and/or migratory species in accordance with the EPBC Significant Impact Guidelines (DCCEEW, 2025d). Activities that could trigger the EPBC Act include habitat clearing, impacts on species or ecosystems listed under the EPBC Act. Should such impacts be identified, the Project would require referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (Clth DCCEEW) for assessment and approval. Compliance under the EPBC Act can also be assessed via the Bilateral agreement between the Commonwealth and NSW.</p> <p>No species listed under the EPBC Act were targeted for a significant impact assessment.</p>
State Legislation	
<p><i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i></p>	<p>The proposed works are to be assessed as ‘development permissible without consent’ under Part 5 of the EP&A Act. Sydney Water is required to comply with Sections 5.5 and 5.6 of the Act by thoroughly examining and considering all environmental factors that may be affected by the activity. This Flora and Fauna Impact Assessment has been prepared to support and ensure compliance with these statutory obligations.</p>
<p><i>Biodiversity Conservation Act 2016 (BC Act)</i></p>	<p>The BC Act is the primary legislative framework for managing biodiversity in NSW. For this Project, the BC Act applies through protecting threatened flora, fauna and ecological communities. In accordance with the BC Act, entry into the Biodiversity Offsets Scheme (BOS) is not required for the Project due to the following:</p> <ul style="list-style-type: none"> • The proposed development is not deemed to be ‘State Significant’ under the NSW EP&A Act. • The proposed development will not impact an Area of Outstanding Biodiversity Value (AOBV) as listed under Part 3 of the NSW BC Act. • The proposed development is unlikely to cause a significant impact on a threatened species, population or ecological community, as listed under Schedules 1 and 2 of the BC Act.

No species or Ecological Communities were targeted for an assessment of significance under the BC Act.

<i>Biosecurity Act 2016</i>	Priority weeds must be managed and controlled in compliance with the Biosecurity Act 2015, which outlines obligations for landowners and occupiers to prevent, eliminate, or minimise biosecurity risks associated with invasive plant species.
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<i>Fisheries Management Act 1994 (FM Act)</i>	Ensures protection of aquatic habitats. No Key Fish Habitat was identified within the Study Area or Impact Area.
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State Environmental Planning Policy (Resilience and Hazards)	<p>The State Environmental Planning Policy (Resilience and Hazards) 2021 (SEPP RH) provides the primary statewide planning framework for developments within the coastal zone, natural hazard areas, and lands where vegetation, coastal processes, and contamination risks require specific environmental assessment.</p> <p>Key provisions relevant to Diamond Bay include:</p> <ul style="list-style-type: none"> • Coastal Management, which identifies and maps the Coastal Wetlands and Littoral Rainforests Area, Coastal Vulnerability Area, Coastal Environment Area, and Coastal Use Area, and applies specific development controls for each. • The SEPP requires that development in the coastal zone must not increase coastal hazard risk, and must consider relevant coastal management programs. • Mapping under this SEPP is legally integrated with the Coastal Management Act 2016, linking coastal hazard, environmental and use controls to statutory mapping.
--	--

Guidelines

Biodiversity Assessment Method (DPIE 2020)	Although the implementation of the Biodiversity Assessment Method (BAM) was not a legislative requirement, parts of its methodologies were applied to ensure a robust ecological assessment.
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Australian Standard AS 4373	Pruning of Amenity Trees
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Australian Standard 4970 – 2009	Protection of Trees on Development Sites
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4 Methodology

4.1 Desktop assessment

A comprehensive desktop review was undertaken to identify potential biodiversity features and values within the Study Area and surrounding locality. Data sources included:

- flora and fauna records derived from NSW BioNet records database (DCCEEW, 2026a) and the Protected Matters Search Tool (PMST) (DCCEEW, 2026b)
- NSW State Vegetation Type Map (DCCEEW, 2026c)
- NSW BioNet Vegetation and Threatened Ecological Community Classifications (DCCEEW, 2026e)
- IBRA Regions (DCCEEW, 2026d)
- eSPADE soil mapping (DPE 2026)
- Key Fish Habitat Mapping (DCCEEW, 2026f)
- Nearmap aerial imagery (Nearmap, 2026)
- Historical aerial imagery (NSW Spatial Services, 2026)

Threatened species were assessed for their Likelihood of Occurrence (LoO). This assessment is detailed in **Impacts to Threatened Raptor species under Section 7.3 of the BC Act**

Records of the following species were identified within 5 km of the Study Area. Although not recorded during survey, it has been assumed the following species may utilise the Project area as a flyway transiently or for low quality foraging habitat:

- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Eastern Osprey (*Pandion cristatus*).

Both species primarily utilise coastal cliffs, foreshores, beaches, open water and tall trees for foraging and nesting. Neither species relies on small patches of planted or exotic vegetation, and both are highly mobile, wide-ranging raptors capable of flying tens of kilometres in a single foraging circuit.

The table below evaluates the potential for significant impacts to the Raptor species under the BC Act.

Test of Significance

Criterion	Response
(a) Adverse effect on life cycle of threatened species	The White-bellied Sea-Eagle and Eastern Osprey rely on large waterbodies for foraging and on large emergent trees or cliff platforms for nesting. The vegetation proposed for removal consists of low-height planted natives and exotic species with no characteristics of raptor nesting habitat no tall forest, no dead-topped emergent trees, no natural nest platforms, and no coastal perches. The works occur away from foraging waters, and no coastline,

beach, lagoon, estuary, or aquatic habitat will be modified. Occasional overflight is possible, but the scale, type and location of clearing is unlikely to impede movement or reduce access to foraging areas. The life cycles of these species will not be disrupted and no local breeding territories will be affected.

<p>(b)(i) & (b)(ii) Impact on endangered or critically endangered ecological community</p>	<p>Not applicable.</p>
<p>(c)(i) Extent of habitat removal or modification</p>	<p>Approximately 0.31ha of non-critical vegetation will be removed. Both raptors depend on aquatic foraging habitat and tall forest or dead trees for nesting. The vegetation to be cleared does not contain nesting structures nor provides meaningful foraging habitat. Removal of this vegetation is unlikely to materially reduce habitat resources for either species.</p>
<p>(c)(ii) Habitat fragmentation or isolation</p>	<p>The species utilise large open airspaces and coastlines for movement. As no coastal habitats or forested nesting habitats are removed, and the clearing is localised and linear, the Project would not create fragmentation relevant to these species. Connectivity across their movement corridors (coastal margins and open airspace) remains unchanged.</p>
<p>(c)(iii) Importance of habitat to long-term survival</p>	<p>The affected vegetation is not critical for the survival of either species. The species habitat comprises coastal waters, estuaries, and tall forest suitable for nesting, none of which occur in the footprint. The small areas of mixed exotic and planted native vegetation do not provide essential foraging or breeding resources.</p>
<p>(d) Adverse effect on declared area of outstanding biodiversity value</p>	<p>No AOBV occurs at or near the site.</p>
<p>(e) Contribution to a key threatening process</p>	<p>The vegetation removal is minor and does not remove any nest trees, aquatic foraging habitat, or coastal perches. The works would not result in impacts to roosting or key foraging habitat, nor would it degrade coastal or estuarine habitat. As such, the action is unlikely to contribute meaningfully to any Key Threatening Process that affects these raptors.</p>
<p>Conclusion</p>	<p>The vegetation proposed for clearing does not constitute important foraging, roosting or nesting habitat. The area to be disturbed is small, contains low-value vegetation, and is not functionally important to either species. No coastal or aquatic habitat will be modified. Connectivity across the landscape would remain unaffected. Therefore, the Project would be unlikely to result in a significant impact for these species.</p>

- Appendix C – Species searches & Likelihood of Occurrence

- A candidate species list was developed to account for species with a moderate or higher LoO and potential seasonal flora.
- A literature review was undertaken on the following reports:
 - GHD. 2020. Vaucluse Diamond Bay Concept Design Biodiversity Assessment.
 - REF for the Refresh Vaucluse Diamond Bay 2020.

4.2 Field survey implementation

Senior Ecologist [REDACTED] conducted field surveys on 9 February 2026 and recorded the weather conditions for the survey period.

4.3 Flora survey methods

Flora survey effort included some elements of the Biodiversity Assessment Method (BAM) as well as the NSW guideline for surveying threatened plants and their habitats (DPHI, 2020). Flora surveys were undertaken and using the random-meander method and supplemented by rapid data points. Data recorded included species scientific names, growth form, stratum, cover and abundance estimates, counts of large trees, hollow-bearing trees, fallen logs and litter cover. Plant Community Type (PCT) validation was undertaken through comparing the floristic field data with predicted PCTs mapped under the NSW SVTM, Threatened Ecological Community (TEC) benchmarks, and diagnostic species as well as PCT descriptions within the BioNet vegetation classification database.

Where field inspection confirmed vegetation comprised of a mixed assemblage of planted native and exotic that did not reasonably correspond to a PCT in terms of floristics, structure or provenance, these areas were mapped as “Planted native vegetation”, not as a PCT.

A candidate species list was developed for seasonal flora or flora with a high likelihood of occurring however, no targeted surveys were undertaken. Areas with <15% native cover were mapped as exotic. Priority weed surveys identified and spatially mapped High Threat Weeds (HTWs).

4.4 Fauna Survey Methods

Fauna survey effort comprised opportunistic diurnal visual and aural census and habitat searches. Habitat surveys identified hollow-bearing trees, rocky outcrops, crevices, fallen logs, and other important roosting, breeding and foraging habitat for threatened fauna species. Observations of scats, scratch marks, nests, feeding scars, whitewash, regurgitation pellets and prey remains from raptor species and aural recognition of species calls.

Microbat roost inspections were also conducted under the boardwalk that runs adjacent to the Study Area on the Diamond Bay cliff edge.

4.5 Likelihood of Occurrence

An assessment of threatened flora, fauna, populations, and ecological communities was undertaken in accordance with Section 7.2 of the BC Act. This assessment involved database searches to identify conservation-significant species with the potential to occur within 5km of the Study Area.

A PMST search was conducted for Matters of National Environmental Significance (MNES) for Commonwealth-listed threatened species and ecological communities under the EPBC Act. A BioNet search was undertaken for species listed under the BC Act. Searches were completed on 20 January 2026 (DCCEEW, 2025a; DCCEEW, 2025b).

The Likelihood of Occurrence assessment was then undertaken for the species generated which considered the following aspects:

- habitat availability, connectivity and quality within the Study Area
- known species habitat constraints and species distributions
- the time, date, significance and quantity of each record.

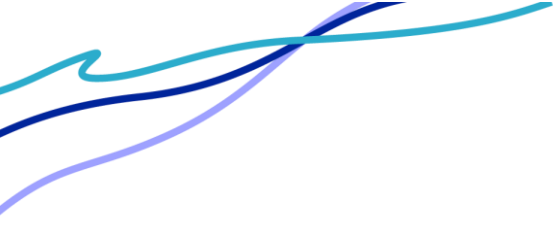
Threatened entities were then retained for further consideration where suitable habitat was present and records indicated regular or opportunistic presence, or where indirect impacts or Key Threatening Processes (KTPs) could affect them. Threatened entities were excluded from further assessment where no suitable habitat was present, the habitat was significantly degraded or unsuitable making it improbable for the entity to be present or the Study Area was outside the known distribution for that species, population or TEC. In addition, limited records, barriers to fauna movement, and field surveys further refined the LoO assessment. These justifications were documented, summarised and integrated into this report.

4.6 Data Collection and Analysis

Field data was recorded using digital and hardcopy proformas. All species observations, survey locations, and habitat features were georeferenced using handheld GPS devices for subsequent GIS-based mapping and analysis.

4.7 Limitations

The flora and fauna surveys were conducted within a defined temporal window and specific project boundaries, which may not fully capture seasonal variations or broader ecological interactions. Detection of certain species, particularly those that are cryptic, nocturnal or seasonal, may have been limited despite comprehensive survey methods. Adverse weather conditions during surveys can also potentially impact species detectability. These limitations should be considered when interpreting the survey results and recommendations.



5 Results

5.1 General biodiversity features and values

Biodiversity features identified within the Study Area and Impact Area are illustrated in Figure 5-1. A summary of these features and associated ecological values across the Study Area is provided in Table 5-1.

Table 5-1 Biodiversity features & values

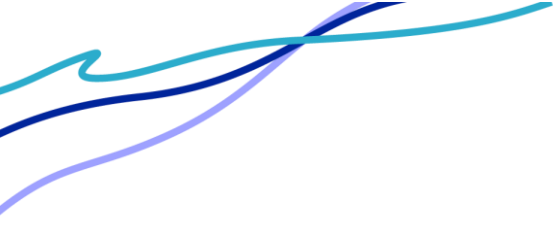
Biodiversity Feature	Description
IBRA Bioregion	Sydney Basin
IBRA Subregion	Pittwater
Watercourses	The Study Area is directly adjacent Diamond Bay and mapped as Coastal Environment Area under the Natural hazard and resilience SEPP. In addition, Rosa Gully is located approximately 117m north of the Study Area.
Key Fish Habitat (NSW Fisheries Management Act, 1994)	Key Fish Habitat is mapped over Diamond Bay and State Coastal Waters which are directly adjacent the Study Area to the east.
Soil Landscape (DPE, 2025)	The Study Area lies within the Lambert Soil Landscape. The Lambert landscape is described as Exposed plateau surfaces, convex ridges and coastal headlands of the Hornsby Plateau. Typical areas include much of Brisbane Water National Park and the Lambert Peninsula in Ku-ring-gai Chase National Park. Smaller occurrences are found at Terrey Hills and in the Manly Warringah area, Dover Heights and La Perouse. The area contains undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief 20–120 m, slopes 20%. Rock outcrop >50%. Broad ridges, gently to moderately inclined slopes, wide rock benches with low broken scarps, small hanging valleys and areas of poor drainage. Vegetation includes open and closed-heathland, scrub and occasional low eucalypt open-woodland.
Elevation	Approximately 30m to 41m

5.2 Literature Review

A literature review was undertaken of the Vaucluse Diamond Bay Concept Design Biodiversity Assessment (GHD, 2020). The key findings are summarised in Table 5-2.

Table 5-2 Literature review

Ecological Component	Key Findings
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Plant Community Types

The vegetation communities mapped included:

- Coastal Headland Banksia Heath - 1822, incorporating Coastal Headland Cliffline Scrub – 1823.
- Coastal Cliff-top Marsh – 1820.

Threatened Ecological Communities (TECs)

No TECs were identified.

Threatened species

No threatened flora or fauna species were identified.

5.3 Vegetation communities

5.3.1 Plant Community Types predicted to occur

The NSW STVTM identified two (2) PCTs predicted to occur in the Study Area and surrounding vicinity as detailed in Table 5-3.

Table 5-3 PCTs predicted to occur

PCT	Description	Associated TEC	Conservation Status	
			BC Act	EPBC Act
PCT 3924	Sydney Coastal Upland Swamp Heath	Coastal Upland Swamp in the Sydney Basin Bioregion	E	-
		Coastal Upland Swamps in the Sydney Basin Bioregion	-	E
PCT 3811	Sydney Coastal Headland Cliff Scrub	No associated TEC	-	-

E – Endangered, CE – Critically Endangered

5.3.2 Validated Plant Community Types

Two (2) PCTs were validated during field surveys including PCT 3811 and PCT 3920. Both PCTs were highly degraded, likely planted and have experienced significant dieback and smothering due to weed encroachment.

Table 5-4 details the PCTs and Figure 5-1 illustrates their extent throughout the Impact Area and Study Area.

Detailed descriptions for each PCT are presented in Table 5-5 and Table 5-6.

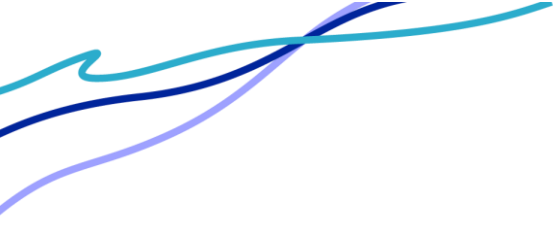
Flora species identified during surveys are shown in Appendix A – Survey data.

Table 5-4 Validated PCTs

PCT	Description	Associated TEC	Conservation Status	
			BC Act	EPBC Act
PCT 3811	Sydney Coastal Headland Cliff Scrub	No associated TEC	-	-
PCT 3920	Coastal Cliff-top Shrubby Marsh	No associated TEC	-	-

Table 5-5 Summary of PCT 3811

Validated PCT	PCT 3811 - Sydney Coastal Headland Cliff Scrub
Vegetation Formation	Freshwater Wetlands
Vegetation Class	Coastal Heath Swamps
Species relied upon for PCT identification	<p><i>Banksia ericifolia</i></p> <p><i>Melaleuca armillaris</i></p> <p><i>Allocasuarina distyle</i></p> <p><i>Westringia fruticosa</i></p> <p><i>Leptospermum laevigatum</i></p> <p><i>Acacia longifolia</i></p>
Justification of PCT selection	<p>PCT 3811 is defined by a heathland structure, typically dominated by <i>Melaleuca armillaris</i> and <i>Banksia ericifolia</i>, with frequent occurrence of <i>Allocasuarina distyla</i>. Other characteristic species include <i>Westringia fruticosa</i>, <i>Leptospermum laevigatum</i>, and <i>Acacia longifolia</i>.</p> <p>PCT 3811 is represented in a degraded state throughout the Study Area. Its extent has reduced significantly since 2020 (GHD, 2020) likely due to heavy weed encroachment. It now persists in a narrower and more fragmented patch along the sandstone cliff directly adjacent the boardwalk.</p> <p>The canopy was predominantly composed of <i>Banksia integrifolia</i>, with scattered occurrences of <i>Banksia ericifolia</i>, <i>Westringia fruticosa</i> and one <i>Allocasuarina distyla</i> specimen amongst exotic species.</p> <p>Although the assemblage did not fully conform to the diagnostic profile of PCT 3811, the presence of key indicator species and evidence of anthropogenic replanting suggest a modified representation of this community. Weed invasion was extensive, restricting intact PCT 3811 vegetation to a narrow linear remnant along the cliff edge.</p> <p>The ground layer in this PCT is usually sparse however, runoff from the sandstone escarpment has created localised soaks, facilitating dense groundcover that is dominated by mixed native grasses and sedges likely introduced during restoration activities.</p> <p>The southeastern portion of the Study Area contained fragmented patches of the PCT with a high cover of <i>Acacia longifolia</i> and <i>Leptospermum laevigatum</i>, contributing to structural variation within the community.</p> <p>The western most section of the Study Area had experienced almost complete dieback due to encroachment by HTWs specifically Morning glory species.</p> <p>The observed composition indicates a replanted ecotone, likely established following historical disturbance and clearing.</p>
Previously mapped vegetation community (GHD, 2020)	<p>This community was previously mapped as Coastal Headland Banksia Heath - 1822, incorporating Coastal Headland Cliffline Scrub - 1823. Following systematic updates to the NSW Plant Community Type framework, PCT 1823 was reclassified to PCT 3811, with a strong correlation between the legacy and revised classifications.</p>



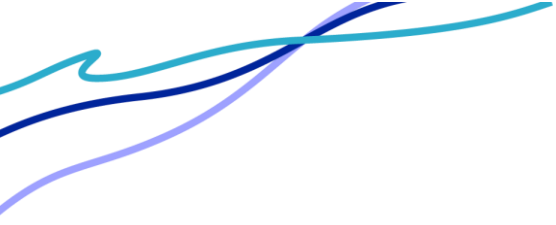
Conversely, PCT 1822 shares only a weak relationship with PCT 3812, which is considered the most likely historical community prior to significant weed invasion and dieback of revegetation. Based on floristic composition and structural attributes, PCT 3811 represents the best fit for the current vegetation assemblage and was confirmed as present during the 2020 survey (GHD, 2020).

Photos



Table 5-6 Summary of PCT 3920

Validated PCT	PCT 3920 - Coastal Cliff-top Shrubby Marsh
Vegetation formation	Freshwater Wetlands
Vegetation class	Coastal Heath Swamps
Species relied upon for PCT identification	<p><i>Westringia fruticosa</i></p> <p><i>Isolepis nodosa</i></p> <p><i>Imperata cylindrica</i></p> <p><i>Sporobolus virginicus</i></p> <p><i>Baumea juncea</i></p>
Justification of PCT selection	<p>PCT 3920 represents a low to mid-high closed shrubland or shrubland with a marshy ground layer, occurring on cliffline soaks and seepages on exposed coastal headlands and offshore islands of NSW. The shrub layer is typically wind-pruned due to exposure and includes species such as <i>Correa alba var. alba</i>, <i>Westringia fruticosa</i>, <i>Monotoca elliptica</i>, <i>Baeckea imbricata</i>, and occasionally stunted <i>Casuarina glauca</i>.</p> <p>This area contained a highly degraded form of PCT 3920 with a very high cover of exotic weed species. <i>Westringia fruticosa</i> was recorded in a low cover with the dominant indicator of marsh habitat being the native portions of the ground layer, which included <i>isolepis nodosa</i>, <i>Sporobolus virginicus</i>, <i>Baumea juncea</i>, <i>Zoysia macrantha</i>, <i>Imperata cylindrica</i>, and <i>Lepidosperma</i> species. These species are characteristic of damp to wet soils near the sea spray zone and confirm the persistence of a soak-dependent vegetation structure as per PCT 3920.</p> <p>However, these areas were smothered in exotic weed species including <i>Hydrocotyle bonariensis</i>, <i>Mentha aquatica</i> and <i>Pelargonium capitatum</i>, resulting in the low quality PCT.</p>
Previously mapped vegetation community (GHD, 2020)	This community was previously mapped as Coastal Cliff-top Marsh – 1820 which was systematically revised to PCT 3920. The relationship between the legacy PCT and new PCTs is very strong.



Photos



5.3.3 Planted native and exotic vegetation

Table 5-7 details the floristic structure and assemblage of the Planted native and exotic vegetation community and Figure 2-1 illustrates its extent within the Study Area.

Table 5-7 Planted native and exotic vegetation

Vegetation	Planted native and exotic vegetation
Vegetation formation	Highly modified planted native and exotic heath community with a dominant cover of invasive weeds.
Species	This vegetation type primarily consists of planted exotic coastal trees and shrubs. Common species include Pohutukawa (<i>Metrosideros excelsa</i>), Taupata (<i>Coprosma repens</i>), and Norfolk Island Hibiscus (<i>Lagunaria patersonii</i>). Areas of replanting included, <i>Imperata cylindrica</i> , <i>Themada australis</i> , <i>Isolepis nodosus</i> and <i>dichelachne micrantha</i> .

Photos



1

5.3.4 Exotic vegetation

Table 5-8 details the floristic structure and assemblage of the Exotic vegetation community and Figure 2-1 illustrates its extent within the Study Area.

Table 5-8 Exotic vegetation

Vegetation	Exotic areas
Vegetation formation	The community is dominated by exotic species and heavily infested with High Threat Weeds (HTWs).

Species

This community contained a very high cover of the following weed species:

- Large leaf pennywort (*Hydrocotyle bonariensis*)
- Coastal morning glory (*Ipomoea cairica*)
- White morning glory (*Ipomoea alba*)
- Morning glory (*Ipomoea purpurea*)
- Panic veldt grass (*Ehrharter erecta*)
- *Parietaria Judaica*
- Rambling dock (*Rumex saggitattus*)

Other exotic species with a high cover included:

- Kikuyu (*Cenchrus clandestinus*)
- Canna Lilly (*Cana x hybrida rodigas*)
- Green cestrum (*Cestrum parqui*)
- Brome grass (*Bromos catharticus*).
- Pelargonium capitatum.

Photos





5.4 Threatened Ecological Communities

No TECs were identified within the Study Area.

5.5 Habitat

5.5.1 Bridges, culverts, stormwater channels or other microhabitat features

Microhabitat searches were undertaken throughout the Study Area and Impact Area, including inspections of the concrete and steel elements of the boardwalk and associated structures for signs of microbat activity. No evidence of microbat uses such as guano deposits, staining, scratch marks, odour, feeding remains, or roost entrances was detected.

No culverts or stormwater channels exist within the Study Area.

5.5.2 Connectivity

The Study Area is highly fragmented and lacks connectivity to the surrounding landscape due to extensive residential development. It is situated along a sandstone cliff face, which further limits habitat continuity. Movement through the area is only feasible for highly mobile fauna capable of traversing urban environments.

5.5.3 Habitat Trees

No Hollow Bearing Trees (HBTs), Stags or stick nests were recorded during fauna habitat searches within the Study Area.

5.5.4 Fallen logs & rocky outcrops

Rocky sandstone outcrops were recorded throughout the Study Area but were mostly smothered in exotic vines and creeper species such as Morning glory (*Ipomea sp.*).

5.6 Threatened flora & fauna

5.6.1 Target species

Table 5-9 lists these threatened species with the addition of flora species that were surveyed during optimal survey conditions.

Species identified during field surveys are shown in Appendix B – Assessments of Significance.

Table 5-9 Species considered to have a moderate to high likelihood of occurrence.

Scientific name / description	Common name	Status	
		BC Act	EPBC Act
Bats			
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	

<i>Myotis macropus</i>	Southern Myotis	V	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
Birds			
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	
<i>Pandion cristatus</i>	Eastern Osprey	V	
Flora			
<i>Allocasuarina portuensis</i>	Nielsen Park She-oak	E	E
<i>Melaleuca deanei</i>	Deane's Melaleuca	E	E
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V	
<i>Prostanthera densa</i>	Villous Mint-bush	V	V
<i>Acacia terminalis</i> subsp. Eastern Sydney	Endangered	E	
<i>Eucalyptus nicholii</i>	Vulnerable	V	
<i>Syzygium paniculatum</i>	Vulnerable	V	

V – Vulnerable, E – Endangered, CE – Critically Endangered

5.6.2 Threatened flora

No threatened flora species were recorded during field surveys.

A full list of flora species recorded during the field surveys is provided in Appendix A – Survey data.

5.6.3 Threatened fauna

No threatened fauna species were observed during diurnal opportunistic field surveys within the Study Area, however, the LoO assessment identified threatened fauna species listed in Table 5-10 that may transiently flyover the area or forage opportunistically on their way to higher quality habitat along the coastline. Impact assessments were completed for these species and are detailed within Section 6.2.2 and – Assessments of Significance.

A full list of fauna species recorded during the field surveys is provided in Appendix A – Survey data.

Table 5-10 Species assumed present

Scientific name / description	Common name	Status	
		BC Act	EPBC Act
Bats			
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	
<i>Myotis macropus</i>	Southern Myotis	V	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
Birds			
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	
<i>Pandion cristatus</i>	Eastern Osprey	V	
V – Vulnerable, E – Endangered, CE – Critically Endangered			

5.7 High Threat Weeds

Table 5-11 details HTWs identified in the Study Area. These species should be managed in accordance with the profile descriptions, control measures and biosecurity duties identified by the NSW WeedWise website.

Table 5-11 High Threat Weeds

Scientific Name	Common Name	NSW Weed Status	Management Type (as per NSW WeedWise)
<i>Alternanthera pungens</i>	Khaki Weed	Listed weed with Biosecurity Duty and is widespread in NSW.	Manual removal (small plants), Chemical removal (Triclopyr + Picloram).
<i>Axonopus fissifolius</i>	Narrow-leaf Carpet Grass	HTW (BioNet)	Avoid spread by disposing of seed heads and cleaning clothing and footwear, plant and equipment.
<i>Cenchrus clandestinus</i>	Kikuyu Grass	HTW (BioNet)	Avoid spread of stolons by disposing of seed heads and cleaning clothing and footwear, plant and equipment.
<i>Cenchrus setaceus</i>	Fountain Grass	Listed in NSW WeedWise as invasive	Manual removal, Chemical removal (herbicide recommended).

		grass with Biosecurity Duty.	
<i>Cyperus eragrostis</i>	Umbrella Sedge	HTW (BioNet)	Avoid spread by preventing movement of rhizome-containing soil.
<i>Ehrharta erecta</i>	Panic Veldtgrass	HTW (BioNet)	Avoid spread by disposing of seed heads and cleaning clothing and footwear, plant and equipment.
<i>Ipomoea alba</i>	Moonflower	Listed weed with Biosecurity Duty; must not be sold in parts of NSW.	Manual removal, Chemical removal (cut-stump / foliar).
<i>Ipomoea cairica</i>	Coastal Morning Glory	Listed weed with Biosecurity Duty; serious invasive vine.	Manual removal, Chemical removal (cut-stump / foliar).
<i>Ipomoea purpurea</i>	Common Morning Glory	Listed weed with Biosecurity Duty.	Manual removal, Chemical removal
<i>Ligustrum sinense</i>	Small-leaved Privet	Listed weed with Biosecurity Duty and must not be sold in parts of NSW.	Manual removal, Chemical removal (cut-stump / drill-fill).
<i>Paspalum dilatatum</i>	Paspalum	HTW (BioNet)	Avoid spread by disposing of seed heads and cleaning clothing and footwear, plant and equipment.
<i>Asparagus asparagoides</i>	Asparagus Fern / Bridal Creeper	Listed under Asparagus weeds in WeedWise.	Manual removal, Chemical removal
<i>Bidens pilosa</i>	Cobbler's Pegs	HTW (BioNet)	Avoid spread of barbed seeds on clothing, plant and equipment.
<i>Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush	Listed WeedWise weed (Bitou bush).	Manual removal, Chemical removal

Figure 5-1 Validated biodiversity features & values



Legend

- Study Area
- Exotic vegetation
- Impact Area
- Planted native and exotic vegetation
- PCT 3811
- PCT 3920



Validated biodiversity features and values



6 Impact Assessment

6.1 Direct impacts to vegetation communities

Table 6-1 outlines the extent of proposed impacts to vegetation communities, with their spatial distribution illustrated in Figure 5-1.. The Project would result in minor impacts to PCT 3811 and PCT 3920, both of which were assessed as being in low condition within the Study Area. In total, the Project would impact 0.12 ha of low-condition native vegetation, characterised by a high proportion of exotic understorey species, reduced native structural integrity and a generally degraded condition.

The majority of the impacted area comprises exotic vegetation (0.2 ha), with an additional 0.05 ha of planted native vegetation and exotic plantings also proposed to be impacted. These areas provide limited ecological function due to their degraded condition and low native species representation.

Management and mitigation measures are presented in Section 6, Table 7-2.

Table 6-1 Vegetation community impacts

Vegetation community	Description	Project Impact Area (ha)
PCT 3811	Sydney Coastal Headland Cliff Scrub	0.07
PCT 3920	Coastal Clifftop Shrubby Marsh	0.02
Planted native and exotic vegetation	Highly modified planted native and exotic heath community with a dominant cover of invasive weeds.	0.05
Exotic vegetation	Exotic dominated vegetation with a high cover of invasive weeds.	0.17

6.2 Species impacts

6.2.1 Flora

Field surveys did not identify any threatened flora species within the Impact Area.

6.2.2 Fauna

Field surveys did not record any threatened fauna species within the Impact Area. However, it was assumed (3) threatened bat and (2) bird species may use the area transiently due to the presence of surrounding suitable habitat.

Appendix B – Assessments of Significance concluded that given the restricted scale of habitat modification, the absence of species-specific ecological constraints, and the low probability that the area supports important populations or essential habitat functions, the potential impacts on all threatened species considered were assessed as low. Consequently, the Project is unlikely to result in a significant impact, and further detailed

Assessments of Significance (AoS) under Section 7.3 of the BC Act or the EPBC Act Significant Impact Guidelines were not required (DCCEEW 2025d).

6.3 Indirect impacts

Due to the small scale and temporary nature of the impacts, the potential for indirect impacts is minimal provided management measures presented in Section 7 and Table 7-2 including erosion and sediment control measures. Over time, the significance of these impacts is expected to diminish as the site stabilises, and rehabilitation measures take effect.

6.4 Impact comparison

Due to construction constraints along the cliff face, the overall impact footprint has changed across all vegetation types. Impacts to Sydney Coastal Headland Cliff Scrub (PCT 3811) have decreased by approximately 12.5%, reflecting a minor reduction in the revised footprint within this community. In contrast, Coastal Clifftop Shrubby Marsh (PCT 3920) has increased, representing a doubling of the area affected. The revised design also substantially increases impacts to modified vegetation types, with planted native and exotic vegetation and exotic-dominated vegetation experiencing the largest proportional increases due to the redistribution of works into already degraded areas. However, overall impacts remain minor in extent and are unlikely to result in a significant impact given the highly modified condition of the affected vegetation and the limited ecological value of the areas subject to change.

Table 6-2 shows the change between the impact areas from the initial (GHD, 2020) and this report.

Table 6-2 Impact comparison

PCT	Description	Previous Impact Area (ha)	Revised Impact Area (ha)	Change in Impact Area (ha)
PCT 3811	Sydney Coastal Headland Cliff Scrub	0.08	0.07	-0.01
PCT 3920	Coastal Clifftop Shrubby Marsh	0.01	0.02	+0.01
Planted native and exotic vegetation	Highly modified planted native and exotic heath community with a dominant cover of invasive weeds.	0.01	0.05	+0.04
Exotic vegetation	Exotic dominated vegetation with a high cover of High Threat Weeds (HTWs).	0.03	0.17	+0.14

7 Avoiding & minimising impacts

7.1 Avoidance and minimisation

Although revisions to the Project area would still result in the removal of native vegetation communities, design refinements have incorporated targeted avoidance measures to limit impacts wherever feasible. The PCTs affected are highly degraded, consisting largely of previously replanted areas with a high cover of exotic species, including HTWs. Furthermore, additional mitigation measures will continue to avoid and minimise disturbance during construction where practicable, meaning the actual on-ground impact area is expected to be less than the current preliminary estimate.

The development footprint would be sited and guided within the defined Impact Area with the aim to retain biodiversity features where possible and identify a suitable alignment. This process will consider engineering requirements, environmental constructability, the presence of PCTs, and opportunities to utilise surrounding exotic or highly degraded areas to minimise clearing of native vegetation where feasible. Despite this, the Project has adopted a conservative approach by assuming full impact across the defined area for assessment purposes.

7.2 Non-statutory biodiversity offsets

Residual Impacts to PCTs are recommended to be offset in accordance with the Biodiversity Offset Guideline. Table 7-1 shows the preliminary impacts and associated non-statutory offsets recommended to be implemented as a result of the Project.

Table 7-1 Preliminary non-statutory offset areas

Biodiversity value	Impact Area	Offset multiplier	Offset required (ha)
PCT 3811 - Sydney Coastal Headland Cliff Scrub	0.07	2	0.14
PCT 3920 - Coastal Clifftop Shrubby Marsh	0.02	2	0.04
Planted native and exotic vegetation	0.05	1	0.05

Safeguards & mitigation measures

Recommended management measures to protect, retain and enhance biodiversity are summarised in Table 7-2.

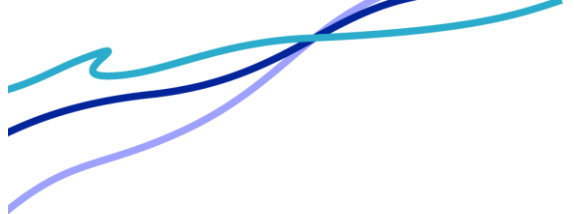
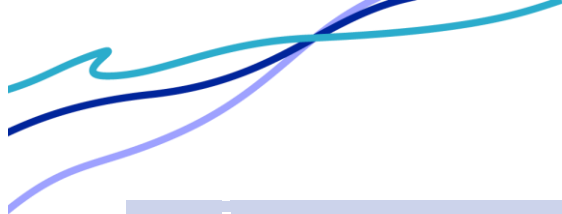


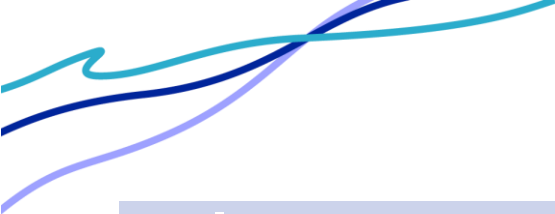
Table 7-2 Recommended safeguards and management measures

Item	Description	Biodiversity safeguard	Timing	Responsibility
1	Ecological constructability	It is recommended that an environmental constructability meeting and on-site walkthrough be conducted prior to finalising the development footprint. This process will help guide siting decisions and provide opportunities to avoid and minimise clearing and disturbance to PCT 3811 and PCT 3920 wherever practicable.	Pre-construction	Site Environmental Manager and Project Ecologist
2	Avoid and minimise	It is recommended the proposed development footprint is located within areas containing Exotic and Planted native vegetation as shown on Figure 5-1. Effort should be undertaken to minimise vegetation clearing and disturbance, within areas containing PCT 3811 and 3920. Where possible, limit clearing to trimming rather than the removal of whole plants.	Prior to vegetation clearing commencing	Site Environmental Manager and all staff inducted on the Project
4	Vegetation protection	<p>Ensure all retained vegetation is protected in accordance with AS4970 – Protection of vegetation on development sites. This requires exclusion zone fencing installed around retained trees using temporary fencing or flagging tape and Tree Protection Zone (TPZ) signs. It is recommended to use star pickets or hazard flagging at 4m centres along the TPZ and confirm with the Environmental Manager it has been correctly installed before clearing works.</p> <p>All selective pruning is recommended to be undertaken in accordance with AS4970 and AS 4373 Pruning of Amenity Trees.</p>	Prior to construction	Project Manager, Environmental Representative

5	Arboriculture	Where a tree is proposed for retention and more than 10% of a Tree Protection Zone (TPZ) will be impacted, engage an AQF Level 5 qualified Project Arborist to oversee works and implement measures to protect and retain affected trees.	Prior to and during construction	Site Environmental Manager and Project Arborist
7	Habitat retention	Where possible, retain felled trees, hollows or logs in-situ unless they are within the impact area. Material can be repositioned within rehabilitation areas or approved adjacent sites.	Post clearing	Site Environmental Manager
8	Fauna inspection	Inspect vegetation for potential fauna prior clearing, selective pruning or trimming of vegetation. If fauna is present, or the inspection has determined high likelihood of native fauna presence, engage a licensed ecologist to inspect and relocate fauna before works.	During clearing activities	Any inducted staff or Project Ecologist (where reasonable and relevant)
9	Unexpected fauna encounters	<p>In the event an unexpected fauna species is identified during clearing:</p> <p>Cease work immediately and inform the site supervisor and any other relevant personnel about the find</p> <p>Establish a buffer zone around the area where the fauna was found using temporary barriers or signage to prevent unauthorised access to the area</p> <p>Immediately contact the licensed fauna spotter-catcher assigned to the project providing details about the type of fauna found and its location</p> <p>The Fauna Spotter Catcher will assess the find, determine the species, its health and the course of action leading to the relocation of the fauna to the closest fauna safe haven, veterinary clinic or wildlife rehabilitation centre where possible.</p>	During and post clearing activities	Site Environmental Manager Project Ecologist/Fauna Spotter Catcher (where relevant)



10	Weed management	Where reasonable and relevant, weed species should be managed in accordance with the control measures recommended by NSW Weed Wise (weeds.dpi.nsw.gov.au).	During and post clearing activities	Site Environmental Manager												
11	Biosecurity and weed management	<p>Manage biosecurity and weeds as follows:</p> <ul style="list-style-type: none"> weed species should be managed in accordance with the control measures recommended by NSW Weed Wise (weeds.dpi.nsw.gov.au). Biosecurity Act 2015 (see NSW Weedwise), including reporting new weed infestations or invasive pests contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility. <p>Record Pesticides and Herbicides use in accordance with SWEMS0017.</p>	During and post clearing activities	Site Environmental Manager												
12	Non-statutory Biodiversity Offsets	<p>Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline (SWEMS0019.13) and generally in accordance with the preliminary impacts and associated non-statutory offsets shown below.</p> <table border="1"> <thead> <tr> <th>Biodiversity value</th> <th>Impact Area</th> <th>Offset multiplier</th> <th>Offset required (ha)</th> </tr> </thead> <tbody> <tr> <td>PCT 3811 - Sydney Coastal Headland Cliff Scrub</td> <td>0.07</td> <td>2</td> <td>0.14</td> </tr> <tr> <td>PCT 3920 - Coastal Clifftop Shrubby Marsh</td> <td>0.02</td> <td>2</td> <td>0.04</td> </tr> </tbody> </table>	Biodiversity value	Impact Area	Offset multiplier	Offset required (ha)	PCT 3811 - Sydney Coastal Headland Cliff Scrub	0.07	2	0.14	PCT 3920 - Coastal Clifftop Shrubby Marsh	0.02	2	0.04	Post construction	Site Environmental Manager
Biodiversity value	Impact Area	Offset multiplier	Offset required (ha)													
PCT 3811 - Sydney Coastal Headland Cliff Scrub	0.07	2	0.14													
PCT 3920 - Coastal Clifftop Shrubby Marsh	0.02	2	0.04													



		Planted native and exotic vegetation	0.05	1	0.05		
<p>It is recommended:</p> <ul style="list-style-type: none">• Revegetation works target species associated with PCT 3811.• To engage with Waverley Council when designing the biodiversity offset revegetation.							

8 Conclusion

This Biodiversity Assessment Report outlines the updated impacts associated with amendments to the Project Impact Area at Diamond Bay, Vacluse. The revised impact footprint totals 0.31 ha, comprising 0.07 ha of Sydney Coastal Headland Cliff Scrub (PCT 3811) and 0.02 ha of Coastal Clifftop Shrubby Marsh (PCT 3920), with the remainder consisting of 0.05 ha of planted native and exotic vegetation and 0.17 ha of exotic-dominated vegetation with a high cover of HTWs.

No threatened flora, fauna, or ecological communities were recorded within the Study Area or Impact Area. The PCTs and non PCT vegetation communities are highly degraded, with extensive weed invasion, particularly coastal morning glory (*Ipomoea cairica*), large-leaf pennywort (*Hydrocotyle bonariensis*), Panic veldt grass (*Ehrharter erecta*) resulting in a reduced extent of the PCTs. Localised soaks from escarpment runoff have facilitated dense groundcover of mixed grasses and sedges, likely introduced during past restoration efforts.

Revised safeguards and management measures have been recommended including undertaking ecological constructability assessment and siting and guiding the development footprint within the Study Area.

The Project is unlikely to result in a significant impact on threatened species or ecological communities under the BC Act, confirming that a Biodiversity Development Assessment Report and entry into the Biodiversity Offset Scheme (BOS) is not required. Similarly, the works are unlikely to significantly impact MNES under the EPBC Act, negating the need for referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

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Appendices

Appendix A – Survey data

Fauna List

Scientific name	Common name	Status	
		BC Act	EPBC Act
<i>Eopsaltria australis</i>	Eastern Yellow Robin	Not listed	Not listed
<i>Hirundo neoxena</i>	Welcome Swallow	Not listed	Not listed
<i>Neochmia temporalis</i>	Red-Browed Finch	Not listed	Not listed
<i>Acanthiza nana</i>	Yellow Thornbill	Not listed	Not listed
<i>Grallina cyanoleuca</i>	Magpie-lark	Not listed	Not listed
<i>Gymnorhina tibicen</i>	Australian Magpie	Not listed	Not listed
<i>Malurus cyaneus</i>	Superb Fairy-wren	Not listed	Not listed
<i>Manorina melanocephala</i>	Noisy Miner	Not listed	Not listed
<i>Rhipidura leucophrys</i>	Willie Wagtail	Not listed	Not listed
<i>Corcorax melanorhamphos</i>	White-winged Chough	Not listed	Not listed
<i>Lampropholis guichenoti</i>	Common Garden Skink	Not listed	Not listed
<i>Corvus coronoides</i>	Australian raven	Not listed	Not listed
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	Not listed	Not listed
<i>Anthochaera carunculata</i>	Red wattlebird	Not listed	Not listed

Flora list

Scientific name	Common name	Status	
		BC Act	EPBC Act
<i>Lonicera japonica</i> *	Japanese honeysuckle	Not listed	Not listed
<i>Asparagus asparagoides</i> **	Asparagus fern	Not listed	Not listed
<i>Cestrum parqui</i> **	Green cestrum	Not listed	Not listed
<i>Tradescantia fluminensis</i> **	Wandering trad	Not listed	Not listed
<i>Sporadanthus gracillis</i>		Not listed	Not listed
<i>Gamochaeta americana</i> *	Cudweed	Not listed	Not listed
<i>Carex appressa</i>	Tall Carex	Not listed	Not listed
<i>Hydrocotyle bonariensis</i> *	Large leaf pennywort	Not listed	Not listed
<i>Cupaniopsis anacardioides</i>	Tuckeroo	Not listed	Not listed
<i>Dianella caerulea var. producta</i>	Blue Flax Lily	Not listed	Not listed
<i>Lomandra longifolia</i>	Spiny headed matt rush		
<i>Dianella longifolia</i>	Flax Lily	Not listed	Not listed
<i>Dichondra repens</i>	Kidney Weed	Not listed	Not listed
<i>Euchiton japonicus</i> *	Creeping Cudweed	Not listed	Not listed
<i>Isolepis nodosa</i>	Knobby Club-rush	Not listed	Not listed
<i>Pittosporum undulatum</i>	Sweet pittosporum	Not listed	Not listed
<i>Trifolium repens</i> *	White Clover	Not listed	Not listed
<i>Carpobrotus glaucescens</i>	Pigface	Not listed	Not listed
<i>Tetragonia tetragonioides</i>	Warrigal greens	Not listed	Not listed
<i>Alternanthera denticulata</i> *	Lesser joyweed	Not listed	Not listed
<i>Alternanthera pungens</i> **	Khaki weed	Not listed	Not listed
<i>Gomphocarpus fruticosus</i> *	Narrow-leaved cotton bush	Not listed	Not listed

<i>Aster subulatus*</i>	Bushy starwort	Not listed	Not listed
<i>Leptinella longipes</i>		Not listed	Not listed
<i>Cerastium fontanum*</i>	Mouse-ear Chickweed	Not listed	Not listed
<i>Mentha aquatica*</i>	Water mint	Not listed	Not listed
<i>Allocasuarina distyla</i>	Scrub Oak	Not listed	Not listed
<i>Ipomoea cairica**</i>	Coastal morning glory	Not listed	Not listed
<i>Ipomoea alba**</i>	White morning glory	Not listed	Not listed
<i>Ipomoea purpurea**</i>	Morning glory	Not listed	Not listed
<i>Hibbertia scandens</i>	Golden Guinea Flower	Not listed	Not listed
<i>Monotoca elliptica</i>	Tree Broom-heath	Not listed	Not listed
<i>Euphorbia prostrata*</i>	Red Caustic Weed	Not listed	Not listed
<i>Glycine clandestina</i>		Not listed	Not listed
<i>Kennedia rubicunda</i>	Dusky Coral pea	Not listed	Not listed
<i>Acacia longifolia subsp. longifolia</i>	Sydney Golden Wattle	Not listed	Not listed
<i>Westringia fruticosa</i>	Coastal Rosemary	Not listed	Not listed
<i>Lagunaria patersonii*</i>	Norfolk Island Hibiscus	Not listed	Not listed
<i>malva parviflora*</i>	Mallow	Not listed	Not listed
<i>Stephania japonica var. discolor</i>	Snake Vine	Not listed	Not listed
<i>Leptospermum laevigatum</i>	Coast Tea-tree	Not listed	Not listed
<i>Melaleuca armillaris subsp. Armillaris</i>	Honey Bracelet-myrtle	Not listed	Not listed
<i>Metrosideros excelsa</i>	Pohutukawa	Not listed	Not listed
<i>Ligustrum sinense</i>	Small-leaved Privet	Not listed	Not listed
<i>Olea europaea subsp. cuspidata</i>	Olive	Not listed	Not listed

<i>Epilobium billardierianum</i> <i>subsp. cinereum</i>	Willow Herb	Not listed	Not listed
<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese tree	Not listed	Not listed
<i>Pittosporum undulatum</i>	Sweet pittosporum	Not listed	Not listed
<i>Plantago debilis</i>	Slender Plantain	Not listed	Not listed
<i>Plantago hispida</i>	Coastal Plantain	Not listed	Not listed
<i>Plantago lanceolata</i>	Plantain	Not listed	Not listed
<i>Rumex sagittata</i>	Rambling dock	Not listed	Not listed
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coastal banksia	Not listed	Not listed
<i>Banksia ericifolia</i> subsp. <i>ericifolia</i>	Wadanggari	Not listed	Not listed
<i>Avena barbata</i>	Wild oat	Not listed	Not listed
<i>Axonopus fissifolius</i> **	Carpet Grass	Not listed	Not listed
<i>Cenchrus clandestinus</i> **	Kikuyu	Not listed	Not listed
<i>Cenchrus setaceus</i> **	Fountain Grass	Not listed	Not listed
<i>Cynodon dactylon</i>	Couch	Not listed	Not listed
<i>Dichelachne crinita</i>	Longhair Plumegrass	Not listed	Not listed
<i>Entolasia marginata</i>	Bordered Panic	Not listed	Not listed
<i>Entolasia stricta</i>	Wiry Panic	Not listed	Not listed
<i>Ehrharta erecta</i> **	Panic Veldtgrass	Not listed	Not listed
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	Not listed	Not listed
<i>Baumea juncea</i>		Not listed	Not listed
<i>Paspalum dilatatum</i> **	Paspalum	Not listed	Not listed
<i>Cyperus brevifolius</i> *	Mullumbimby Couch	Not listed	Not listed

<i>Cyperus eragrostis</i> *		Not listed	Not listed
<i>Cyperus gracilis</i>		Not listed	Not listed
<i>Lepidosperma concavum</i>		Not listed	Not listed
<i>Lepidosperma laterale</i>		Not listed	Not listed
<i>Lepidosperma neesi</i>		Not listed	Not listed
<i>Schoenus brevifolius</i>	Zig-zag Bog Rush	Not listed	Not listed
<i>Romulea longifolia</i> *		Not listed	Not listed
<i>Lolium perrene</i> *	Lolium	Not listed	Not listed
Tomato*	Tomato	Not listed	Not listed
<i>Salpichroa organifolia</i>		Not listed	Not listed
<i>Cana x hybrida rodigas</i>	Canna Lilly	Not listed	Not listed
<i>Pelargonium capitatum</i> *		Not listed	Not listed

* Exotic, HTW**



Appendix B – Assessments of Significance

Impacts to Microchiropteran bats under Section 7.3 of the BC Act

Records of the following species were identified within 5 km of the Study Area. Although not recorded during survey, it has been assumed the following species may utilise the Project area as a flyway transiently or for low quality foraging habitat:

- Southern Myotis (*Myotis macrpus*)
- Little Bent-winged Bat (*Miniopterus australis*).
- Large Bent-winged Bat (*Miniopterus oriana oceanensis*).

The table below evaluates the potential for significant impacts to the Microchiropteran bats under the BC Act.

Test of Significance

Criterion	Response
(a) Adverse effect on life cycle of threatened species	<p>These species are generally cave-dependent breeders roosting in caves and underground structures as well as derelict mines, culverts, bridges and buildings. The species forage mainly over or within forest canopies. However, the Southern Myotis forages over waterbodies including marine areas.</p> <p>No roosting features or areas with maternity or winter roosts exist within the Study Area. The sandstone rocky outcrops and the raised pedestrian boardwalk were assessed for microbat habitat suitability, and no evidence of use or potential use was recorded. Further, sections of the boardwalk would be avoided and temporarily dismantled and reinstated if required.</p> <p>The Impact Area constitutes 0.07 ha of Sydney Coastal Headland Cliff Scrub (PCT 3811), 0.02 ha of Coastal Clifftop Shrubby Marsh (PCT 3920) and 0.05 ha of planted native and exotic vegetation. It reflects low-quality foraging habitat that is not critical for these species, nor would it be a key commuting bottleneck for a known roost location.</p> <p>The lifecycle of these species depends on roosting habitat and connectivity to adjacent waterbodies and surrounding native vegetation communities or urban gardens for foraging areas which will remain intact. The removal of vegetation would be a short term impact in that it would be reinstated post construction. The net functional foraging availability would therefore, remain unchanged at the local scale.</p> <p>While individuals may occasionally fly over or along the edge of the Impact Area during nightly movements, the scale, duration, and habitat quality are such that no material reduction in food supply, roost access, breeding success, or survivorship in the local population is expected.</p> <p>Given the small scale of disturbance, the absence of critical roosting or breeding habitat, and the fact that the vegetation is not essential to the long-term survival of these species in the locality, the proposed works are unlikely to have an adverse effect on the species' life cycles to the extent that a viable local population is placed at risk of extinction.</p>
(b)(i) & (b)(ii) Impact on endangered or critically	Not applicable.

endangered ecological community	
(c)(i) Extent of habitat removal or modification	The Project proposes impacts to 0.07 ha of Sydney Coastal Headland Cliff Scrub (PCT 3811), 0.02 ha of Coastal Clifftop Shrubby Marsh (PCT 3920) and 0.05 ha of planted native and exotic vegetation. Connectivity is currently fragmented and the native vegetation communities may act as stepping stone habitat however, it does not represent critical habitat. The extent of habitat modification is unlikely to result in a significant impact to these species.
(c)(ii) Habitat fragmentation or isolation	The area is already highly fragmented and although modification would occur through vegetation removal, it would be reinstated post construction. The habitat would be fragmented in the short term. The Little Bent-winged Bat and Large Bent-winged Bat forage over the canopy of vegetation and they may flyover this area transiently however, the habitat would not reflect critical habitat for these species.
(c)(iii) Importance of habitat to long-term survival	The habitat is not critical for the species' long-term survival.
(d) Adverse effect on declared area of outstanding biodiversity value	No declared AOBV present.
(e) Key threatening process	The proposed works will involve clearing approximately The Impact Area constitutes 0.07 ha of Sydney Coastal Headland Cliff Scrub (PCT 3811), 0.02 ha of Coastal Clifftop Shrubby Marsh (PCT 3920) and 0.05 ha of planted native and exotic vegetation. vegetation within the Impact Area. While this constitutes habitat removal, the vegetation quality is low. No roosting or critical foraging habitat for the assessed microchiropteran bat species is present. No hollow-bearing trees, caves, crevices, or stormwater structures would be impacted, and connectivity to the surrounding landscape would remain.
Conclusion	A significant impact to the assessed microchiropteran bat species is unlikely.

Impacts to Threatened Raptor species under Section 7.3 of the BC Act

Records of the following species were identified within 5 km of the Study Area. Although not recorded during survey, it has been assumed the following species may utilise the Project area as a flyway transiently or for low quality foraging habitat:

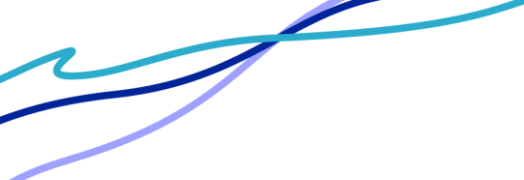
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Eastern Osprey (*Pandion cristatus*).

Both species primarily utilise coastal cliffs, foreshores, beaches, open water and tall trees for foraging and nesting. Neither species relies on small patches of planted or exotic vegetation, and both are highly mobile, wide-ranging raptors capable of flying tens of kilometres in a single foraging circuit.

The table below evaluates the potential for significant impacts to the Raptor species under the BC Act.

Test of Significance

Criterion	Response
(a) Adverse effect on life cycle of threatened species	The White-bellied Sea-Eagle and Eastern Osprey rely on large waterbodies for foraging and on large emergent trees or cliff platforms for nesting. The vegetation proposed for removal consists of low-height planted natives and exotic species with no characteristics of raptor nesting habitat no tall forest, no dead-topped emergent trees, no natural nest platforms, and no coastal perches. The works occur away from foraging waters, and no coastline, beach, lagoon, estuary, or aquatic habitat will be modified. Occasional overflight is possible, but the scale, type and location of clearing is unlikely to impede movement or reduce access to foraging areas. The life cycles of these species will not be disrupted and no local breeding territories will be affected.
(b)(i) & (b)(ii) Impact on endangered or critically endangered ecological community	Not applicable.
(c)(i) Extent of habitat removal or modification	Approximately 0.31 ha of non-critical vegetation will be removed. Both raptors depend on aquatic foraging habitat and tall forest or dead trees for nesting. The vegetation to be cleared does not contain nesting structures nor provides meaningful foraging habitat. Removal of this vegetation is unlikely to materially reduce habitat resources for either species.
(c)(ii) Habitat fragmentation or isolation	The species utilise large open airspaces and coastlines for movement. As no coastal habitats or forested nesting habitats are removed, and the clearing is localised and linear, the Project would not create fragmentation relevant to these species. Connectivity across their movement corridors (coastal margins and open airspace) remains unchanged.
(c)(iii) Importance of habitat to long-term survival	The affected vegetation is not critical for the survival of either species. The species habitat comprises coastal waters, estuaries, and tall forest suitable for nesting, none of which occur in the footprint. The small areas of mixed



exotic and planted native vegetation do not provide essential foraging or breeding resources.

<p>(d) Adverse effect on declared area of outstanding biodiversity value</p>	<p>No AOBV occurs at or near the site.</p>
<p>(e) Contribution to a key threatening process</p>	<p>The vegetation removal is minor and does not remove any nest trees, aquatic foraging habitat, or coastal perches. The works would not result in impacts to roosting or key foraging habitat, nor would it degrade coastal or estuarine habitat. As such, the action is unlikely to contribute meaningfully to any Key Threatening Process that affects these raptors.</p>
<p>Conclusion</p>	<p>The vegetation proposed for clearing does not constitute important foraging, roosting or nesting habitat. The area to be disturbed is small, contains low-value vegetation, and is not functionally important to either species. No coastal or aquatic habitat will be modified. Connectivity across the landscape would remain unaffected. Therefore, the Project would be unlikely to result in a significant impact for these species.</p>



Appendix C – Species searches & Likelihood of Occurrence

Scientific / Community Name	Common Name	BC Act Status	EPBC Act Status	Kingdom	Family	Type	Habitat Requirements	Likelihood of Occurrence	Justification	Significance Assessment Undertaken
<i>Litoria aurea</i>	Green and Golden Bell Frog	Endangered	Vulnerable	Animalia	Hylidae	Amphibians	<p>Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.</p> <p>Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spike rushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter. Preyed upon by various wading birds and snakes.</p>	Low	Suitable habitat may exist within the area however, no BioNet records exist within 5km of the Study Area. This species is not often found on sandstone cliffs such as this.	No
<i>Mixophyes balbus</i>	Stuttering Frog, Southern Barred Frog (in Victoria)	Endangered	Vulnerable	Animalia	Myobatrachidae	Amphibians	<p>Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only <i>Mixophyes</i> species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Feed on insects and smaller frogs. Breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. As the tadpoles grow they move to deep permanent pools and take approximately 12 months to metamorphose.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

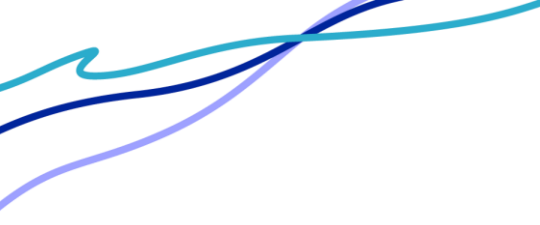
<i>Heleioporus australiacus australiacus</i>	Giant Burrowing Frog, Eastern Owl Frog	Vulnerable	Vulnerable	Animalia	Limnodynastidae	Amphibians	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	Low	Suitable habitat does not occur in the site and no records are present within 5km.	No
<i>Heleioporus australiacus australiacus</i>	Giant Burrowing Frog, Eastern Owl Frog	Vulnerable	Vulnerable	Animalia	Limnodynastidae	Amphibians	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Pseudophryne australis</i>	Red-crowned Toadlet	Vulnerable	Not Listed	Animalia	Myobatrachidae	Amphibians	<p>The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site.</p>	Low	The Study Area does not contain the open forests with wet drainage lines below sandstone ridges that often have shale lenses or cappings. It is a heathland with soaks that are impacted by surrounding stormwater and wastewater treatment.	No
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat, Large Pied Bat	Endangered	Endangered	Animalia	Vespertilionidae	Bats	<p>It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in caves, overhangs, mine adits and concrete structures such as derelict buildings. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.</p>	Low	There are records within 5km however, the Study Area does not represent key habitat for this species.	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Vulnerable	Not Listed	Animalia	Vespertilionidae	Bats	<p>The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.</p>	Low	The Study Area does not contain eucalypt habitat or other features consistent with this species habitat requirements.	No

<i>Miniopterus australis</i>	Little Bent-winged Bat	Vulnerable	Not Listed	Animalia	Miniopteridae	Bats	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (<i>Miniopterus schreibersii</i>) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia.	Moderate	The Study Area does not contain eucalypt habitat or other features consistent with this species habitat requirements.	Yes
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Vulnerable	Not Listed	Animalia	Miniopteridae	Bats	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Old caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Moderate	The Study Area may contain habitat for this species with surrounding manmade structures providing potential roosting opportunities. There are records within 5km however, it is unlikely to utilise the area for critical habitat and would likely be transient flying over the Study Area.	Yes
<i>Myotis macropus</i>	Southern Myotis	Vulnerable	Not Listed	Animalia	Vespertilionidae	Bats	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December. This species needs waterbodies 3m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200m of the site.	High	The Study Area may contain habitat for this species with surrounding manmade structures providing potential roosting opportunities. There are records within 5km however, it is unlikely to utilise the area for critical habitat and would likely be transient flying over the Study Area.	Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Vulnerable	Animalia	Pteropodidae	Bats	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May. Site fidelity to camps is	Moderate	Suitable habitat exists within the subject land and impact area. The species may transiently use these areas however it would not reflect critical habitat due to the lack of food trees.	Yes

high. Can travel up to 50 km from the camp to forage. Also forage in cultivated gardens and fruit crops.

<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	Vulnerable	Not Listed	Animalia	Emballonuridae	Bats	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Low	The Subject Land provides some forms of foraging habitat for this species. However, the low records within 5km suggest the Study Area does not provide key habitat for this species.	No
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	Vulnerable	Not Listed	Animalia	Vespertilionidae	Bats	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Anseranas semipalmata</i>	Magpie Goose	Vulnerable	Not Listed	Animalia	Anseranatidae	Birds	The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands less than one metre deep with dense growth of rushes or sedges, this species is equally at home in aquatic and terrestrial habitats. It is often seen walking and grazing on land, feeding on grasses, bulbs and rhizomes. Activities are centred on wetlands, particularly those on river floodplains and large shallow wetlands formed by run-off. Breeding can occur in both summer- and winter-dominated rainfall areas and is strongly influenced by water levels, with most breeding now occurring in monsoonal regions. Nests are formed in trees over deep water, and breeding is unlikely in south-eastern NSW. The species is often observed in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains, and typically roosts in tall vegetation.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No



<i>Dasyornis brachypterus</i>	Eastern Bristlebird	Endangered	Endangered	Animalia	Dasyornithidae	Birds	<p>The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia, comprising three main populations: Northern (southern Queensland and northern NSW), Central (Barren Grounds Nature Reserve, Budderoo National Park, Woronora Plateau, Jervis Bay National Park, Booderee National Park and Beecroft Peninsula) and Southern (Nadgee Nature Reserve and Croajingolong National Park near the NSW/Victorian border). The estimated population size is fewer than 2,000 individuals occupying about 120 km². In southern Queensland and northern NSW, only four populations remain with a total of 35 birds, compared to 14 populations and 154 birds recorded 15 years ago. This northern population once extended as far south as Dorrigo and has recently been identified as a separate ultrataxon (monoides), though further research is needed to confirm this. The remaining populations are the nominate ultrataxon (brachypterus), which formerly extended at least to what is now the Sydney urban area. The central population comprises an estimated 1,600 birds, mainly in Barren Grounds, Budderoo and Jervis Bay areas, while the southern population in Nadgee and Howe's Flat is around 200 birds. Further surveys are required in parts of Ben Boyd National Park and Sydney Catchment Authority lands to determine if additional populations occur. Habitat for central and southern populations consists of dense, low vegetation including heath and open woodland with a heathy understorey, while in northern NSW it occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotones; all are fire-prone. Fire-age is critical: Illawarra and southern populations reach maximum densities in habitat unburnt for at least 15 years, whereas northern habitats require frequent fires every 3–6 years of variable intensity to maintain suitability. Eastern Bristlebirds are shy and cryptic, rarely fly, and typically scamper over the ground; when disturbed, they may perch briefly before retreating into dense vegetation. They feed mainly on insects, particularly ants, and nest in elliptical domes constructed on or near the ground among dense vegetation. Two eggs are laid between August and February; multiple clutches are rare and recruitment is low. Males are strongly territorial.</p>	Low	Outside species distribution.	No
<i>Grantiella picta</i>	Painted Honeyeater	Vulnerable	Vulnerable	Animalia	Meliphagidae	Birds	<p>The Painted Honeyeater inhabits Boree/Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>), Box-Gum Woodlands and Box-Ironbark Forests. It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring mistletoes of the genus <i>Amyema</i>. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nesting occurs from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. The Painted Honeyeater is nomadic and occurs at low densities throughout its range, with the greatest concentrations and almost all breeding</p>	Low	No records within 10km and the Study Area is outside of its distribution.	No

							occurring on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During winter, it is more likely to be found in the northern part of its distribution.			
<i>Anthochaera phrygia</i>	Regent Honeyeater	Critically Endangered	Critically Endangered	Animalia	Meliphagidae	Birds	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Low	No records within 10km and the Study Area is outside of its distribution.	No
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Vulnerable	Vulnerable	Animalia	Scolopacidae	Birds	The species utilises fresh and hypersaline environments, feeding along the edge of water on mudflats, coastal and inland wetlands, and sewage ponds. After rainfall events, the species may also feed on areas of agricultural pasture. On migration, the species forages and roosts on rocky and sandy beaches, freshwater habitats, and inland saltwater habitats. During the non-breeding season, approximately 91 percent of the East Asian - Australasian population occurs in Australia and New Zealand (Bamford et al. 2008). Sharp-tailed sandpipers occur within all states of Australia. Occurs in freshwater and saline habitats. The species is widespread in most regions of New South Wales and Victoria, especially in coastal areas.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	Critically Endangered	Animalia	Scolopacidae	Birds	The species generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on shingle, shell or sand beaches. Curlew Sandpipers are omnivorous, feeding on worms, molluscs, crustaceans, insects and some seeds.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Endangered	Endangered	Animalia	Cacatuidae	Birds	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in	Low	The Subject Land contains some suitable habitat for this species however, the heathland structure is not consistent with this species preferred habitat.	No

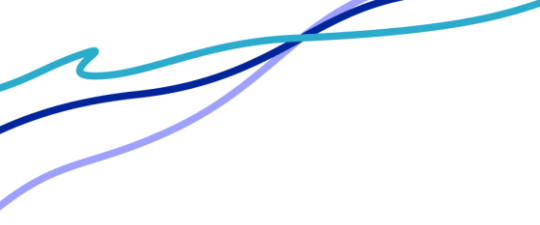
							hollows that are 7 cm in diameter or larger in eucalypts and 3 m or more above the ground.			
<i>Calyptorhynchus lathamii</i>	South-eastern Glossy Black-Cockatoo	Vulnerable	Vulnerable	Animalia	Cacatuidae	Birds	<p>South-eastern glossy black cockatoos rely on nine species of sheoaks (<i>Allocasuarina</i> spp. and <i>Casuarina</i> spp.) for feeding, with species used varying depending on the region. In inland NSW, drooping sheoak (<i>A. verticillata</i>), broombush sheoak (<i>A. diminuta</i>), mallee sheoak (<i>A. gymnanathera</i>), Belah (<i>C. cristata</i>) are all important food, although other species (e.g., buloke (<i>A. luehmannii</i>)) may be utilised in some years. As a guide, potential nest hollows for the subspecies have the following traits:</p> <ol style="list-style-type: none"> >8 m above ground. Located in branches >30 cm in diameter. Branch or stem no more than 45o from vertical. Minimum entrance diameter of >15 cm. 	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (south-eastern)	Vulnerable	Vulnerable	Animalia	Climacteridae	Birds	<p>Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range. Sedentary, considered to be resident in many locations throughout its range. Gregarious and usually observed in pairs or small groups of 8-12 birds. When foraging in trees and on the ground, they peck and probe for insects, mostly ants, amongst the litter, tussocks and fallen timber, and along trunks and lateral branches. Hollows in standing dead or live trees and tree stumps are essential for nesting. The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha). Each group is composed of a breeding pair with retained male offspring and, rarely, retained female offspring. Often in pairs or cooperatively breeding groups of two to five birds.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Vulnerable	Not Listed	Animalia	Neosittidae	Birds	<p>Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Erythrotriorchis radiatus</i>	Red Goshawk	Endangered	Endangered	Animalia	Accipitridae	Birds	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Population in NSW is naturally small (probably only one pair), and lies at extreme of the natural range of species in Australia. Identification may be problematic, it is easily confused with other more common species. Large mature trees are used for nesting.	Low	The species has not been recorded within 10 km of the site and is generally outside of its distribution.	No
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<i>Falco hypoleucos</i>	Grey Falcon	Vulnerable	Vulnerable	Animalia	Falconidae	Birds	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Low	The species has not been recorded within 10 km of the site.	No
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<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Vulnerable	Vulnerable	Animalia	Scolopacidae	Birds	In Australia, Latham's Snipe occurs in a wide variety of permanent and ephemeral wetlands have some form of shelter (usually low and dense vegetation) nearby or semi-permanent swamps, or open waters, but various other freshwater habitats can be used including bogs, waterholes, billabongs, lagoons, lakes, creek or river margins, river pools and floodplains. Latham's snipe depart their breeding grounds from July to November (Naarding 1985; Higgins & Davies 1996) and arrive in northern Australia from late July to early August onwards (Frith et al. 1977; Higgins & Davies 1996). Individuals then move southward, passing along the coastline (Frith et al. 1977; Storr 1984) and arriving in south-eastern Australia between August and November (Naarding 1982, 1983; Lane 1987; Higgins & Davies 1996). Most individuals are found south of the Richmond River in New South Wales (Frith et al. 1977), and few (if any) remain in northern Australia over the southern summer (Lane 1987; Higgins & Davies 1996). Latham's snipe is dispersive during its stay in Australia. The species probably moves in response to rainfall and the availability of food (Frith et al. 1977). For example, the species abandons seasonally drying wetlands and moves to wetter or more permanent habitats elsewhere (Naarding 1982, 1983). Data from regular counts in southern Australia indicate that the species is highly mobile during the non-breeding season (Naarding 1983, 1984). Latham's snipe feed in soft mudflats or shallow water typically at night, early morning or evening. They shelter in small wetlands during the day including urban water bodies, saltmarches and creek edges. They also use crops and pasture but mostly found among dense cover of sedges, grasses, lignum, reeds and rushes.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Hieraaetus morphnoides</i>	Little Eagle	Vulnerable	Not Listed	Animalia	Accipitridae	Birds	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Hirundapus caudacutus</i>	White-throated Needletail	Vulnerable	Vulnerable	Animalia	Apodidae	Birds	This species is listed under the Commonwealth EPBC Act only, not the NSW BC Act. In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (Coventry 1989; Tarburton 1993; Watson 1955). Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Higgins 1999). The species has been recorded roosting in trees in forests and	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

							woodlands, both among dense foliage in the canopy or in hollows.			
<i>Lathamus discolor</i>	Swift Parrot	Endangered	Critically Endangered	Animalia	Psittaci dae	Birds	Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxyton, and White Box E. albens. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana, Blackbutt E. pilularis, and Yellow Box E. melliodora. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus	Low	Suitable habitat and some records exist within 10km of the Study Area. These records (5) are from between 1978 and 2014. The area is unlikely to be utilised by the species.	No
<i>Melanodryas cucullata cucullata</i>	South-eastern Hooded Robin, Hooded Robin (south-eastern)	Endangered	Endangered	Animalia	Petroici dae	Birds	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. May breed any time between July and November, often rearing several broods. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. The nest is defended by both sexes with displays of injury-feigning, tumbling across the ground. A clutch of two to three is laid and incubated for fourteen days by the female. Two females often cooperate in brooding.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Neophema chrysostoma</i>	Blue-winged Parrot	Vulnerable	Vulnerable	Animalia	Psittaci dae	Birds	Blue-winged parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semiarid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones (Higgins 1999; Holdsworth et al. 2021). The species can also be seen in altered environments such as airfields, golf-courses and paddocks. Pairs or small parties of blue-winged parrots	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No



forage mainly near or on the ground for seeds of a wide range of native and introduced grasses, herbs and shrubs.
 Habitat critical to the survival of the blue-winged parrot include areas that include: Foraging and staging habitats found from coastal, sub-coastal and inland areas, right through to semi-arid zones including: grasslands, grassy woodlands and semi-arid chenopod shrubland with native and introduced grasses, herbs and shrubs. Wetlands both near the coast and in semi-arid zones used for foraging and staging. Eucalypt forests and woodlands within the breeding range in Tasmania, coastal south-eastern SA and southern VIC. Live and dead trees and stumps with suitable hollows within the breeding range.

<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Critically Endangered	Animalia	Scolopacidae	Birds	It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. May also roost on wooden oyster leases or other similar structures. The Eastern Curlew is carnivorous, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects. The birds may delay breeding until three to four years of age. Within Australia, immature birds, which do not migrate, move northward in winter.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Parvipsitta pusilla</i>	Little Lorikeet	Vulnerable	Not Listed	Animalia	Psittacidae	Birds	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smoothbarked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.	Low	Plant communities present do not reflect preferred habitat for this species. It is unlikely to utilise the Study Area outside of flying over.	No

<i>Pycnoptilus floccosus</i>	Pilotbird	Vulnerable	Vulnerable	Animalia	Dasyornithidae	Birds	<p>Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth (Higgins & Peter 2002). Largely sedentary, they are typically seen hopping briskly over the forest floor and foraging on damp ground or among leaf-litter. Flight is described as fairly weak, though, if disturbed, birds can sometimes ascend into shrubs (but no more than 1–2 m from the ground) (Higgins & Peter 2002). They are typically seen in pairs or occasionally in family parties, occupying small territories all year round. Habitat critical to the survival of the Pilotbird includes:</p> <ul style="list-style-type: none"> • wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth (Higgins & Peter 2002) • dry sclerophyll forests and woodlands occupying dry slopes and ridges. 	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered	Endangered	Animalia	Rostratulidae	Birds	<p>The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Tringa nebularia</i>	Common Greenshank, Greenshank	Endangered	Endangered	Animalia	Scolopacidae	Birds	<p>The common greenshank forages at the edge of wetlands, in soft mud on mudflats, in channels, or within shallows around the edge of waterbodies. These locations are often situated near or among mangroves or other sparse, emergent or fringing vegetation such as sedges or saltmarsh. The bird occasionally feeds amongst seagrass beds.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Pandion cristatus</i>	Eastern Osprey	Vulnerable	Not Listed	Animalia	Accipitridae	Birds	<p>In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 7 cm in diameter or larger in eucalypts and 3 m or more above the ground.</p>	Moderate	Despite the low BioNet records, this species may use the Study Area transiently as they are highly mobile along the east coast of Sydney. However, due to the lack of heavily timbered forests nearby, the area does not represent critical habitat.	Yes

<i>^^Ninox connivens</i>	Barking Owl	Vulnerable	Not Listed	Animalia	Strigidae	Birds	<p>The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Many populations crashed as woodland on fertile soils was cleared over the past century, leaving linear riparian strips of remnant trees as the last inhabitable areas. Surveys in 2001 demonstrated that the Pilliga Forest supported the largest population in southern Australia. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats.</p>	Low	Only a single record within 10km from 1997 and the Study Area does not contain habitat consistent with this species requirements.	No
<i>^^Tyto novaehollandiae</i>	Masked Owl	Vulnerable	Not Listed	Animalia	Tytonidae	Birds	<p>Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Botaurus poiciloptilus</i>	Australian Bittern	Endangered	Endangered	Animalia	Ardeidae	Birds	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spike rushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
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<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Vulnerable	Not Listed	Animalia	Accipitridae	Birds	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Hunts its prey from a perch or whilst in flight (by circling slowly, or by sailing along 10–20 m above the shore). Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground. May be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young.	Moderate	The Study Area and Impact Area represents suitable foraging habitat for this species. However, breeding habitat is not present. However, the species may fly over the Study Area transiently.	Yes
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<i>Haematopus longirostris</i>	Pied Oystercatcher	Endangered	Not Listed	Animalia	Haematopodidae	Birds	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. 'Pied' Oystercatchers are occasionally recorded on Lord Howe island but it is uncertain which species is involved. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Charadrius leschenaultii</i>	Greater Sand-plover	Vulnerable	Vulnerable	Animalia	Charadriidae	Birds	The Greater Sand-plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders. Diet includes insects, crustaceans, polychaete worms and molluscs. Prey is detected visually by running a short distance, stopping to look, then running to collect the prey.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

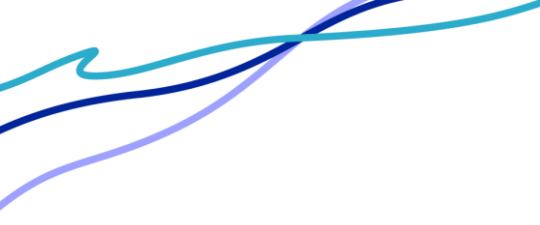
<i>Calidris canutus</i>	Red Knot	Vulnerable	Endangered	Animalia	Scolopacidae	Birds	The Red Knot is a non-breeding migratory visitor from Arctic regions of Siberia. It is capable of flying non-stop between north-eastern China and northern Australia. Birds arrive between September and October and leave between March and April, with a small number of individuals overwintering. In NSW it is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary. This environment is used as a staging area for birds to rest and replenish fat resources; large numbers arrive in September then most move south to Victoria by October. The Red Knot is a rare visitor to wetlands away from the coast with a few records (mostly during southward migration) as far west as Lake Menindee and the Riverina. In NSW the Red Knot mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps. It usually forages near the water's edge, with feeding activity regulated by the tide as birds closely follow the tide-edge. The diet consists of worms, bivalves, gastropods, crustaceans and echinoderms. The birds roost on sandy beaches, spits, islets and mudflats close to feeding grounds, usually in open areas. It is rarely found on inland lakes or swamps.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
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<i>Sternula albifrons</i>	Little Tern	Endangered	Not Listed	Animalia	Laridae	Birds	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. The nest is a scrape in the sand, which may be lined with shell grit, seaweed or small pebbles. Both parents incubate up to three well-camouflaged eggs for up to 22 days, aggressively defending the nest against intruders until the young fledge at 17 - 19 days. Often seen feeding in flocks, foraging for small fish, crustaceans, insects, worms and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
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<i>Parvipsitta pusilla</i>	Little Lorikeet	Vulnerable	Not Listed	Animalia	Psittacidae	Birds	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.	Low	The Study Area may contain forms of habitat for this species however, given there is only 3 records within 10km, it is unlikely to use the Study Area.	No
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<i>Ninox strenua</i>	Powerful Owl	Vulnerable	Not Listed	Animalia	Strigidae	Birds	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. Recent increases in population density across Sydney and some other semi-urban areas do not seem to be solely due to increased awareness of this flagship species. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	Low	This species may transiently fly over the Study Area however, it lacks key habitat features for this species and would not represent critical habitat due to containing a planned heath structure with a high cover of exotic species in a highly fragmented location.	No
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<i>Anthochaera phrygia</i>	Regent Honeyeater	Critically Endangered	Critically Endangered	Animalia	Meliphagidae	Birds	<p>The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are very few breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Mudgee/Wollar, Lower Hunter Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark Eucalyptus eugenioides and other Stringybark species, and Broad-leaved Ironbark E. fibrosa can also contribute important nectar flows at times. Nectar and fruit from the mistletoes Amyema miquelii, A. pendula and A. cambagei are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.</p>	Low	There are no records within 10km of the Study Area. This species is unlikely to utilise the Study Area.	No
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<i>Petroica boodang</i>	Scarlet Robin	Vulnerable	Not Listed	Animalia	Petroici dae	Birds	<p>The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. The Scarlet Robin is a quiet and unobtrusive species which is often quite tame and easily approached. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. Eggs are pale greenish-, bluish- or brownish-white, spotted with brown; clutch size ranges from one to four. Birds usually occur singly or in pairs, occasionally in small family parties; pairs stay together year-round. In autumn and winter, the Scarlet Robin joins mixed flocks of other small insectivorous birds which forage through dry forests and woodlands.</p>	Low	There is a single record within 5km from 1991. Generally, outside of its distribution and the Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
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<i>Diomedea antipodensis</i>	Antipodean Albatross	Vulnerable	Vulnerable	Animalia	Diomedidae	Birds	The species ranges across the southern Pacific Ocean, east to the coast of Chile and west to eastern Australia. The majority of birds breed on Antipodes Island, with a small number of pairs breeding on Campbell Island. The Antipodean Albatross breeds biennially in colonies on ridges, slopes and plateaus of isolated subantarctic islands, usually in vegetation such as grass tussocks. Egg laying begins in January (Antipodes Island) and February (Campbell Island), and chicks usually fledge the following year in January and March. The annual breeding population is relatively small and has been estimated at 5,154 pairs. This species regularly occurs in small numbers off the NSW south coast from Green Cape to Newcastle during winter where they feed on cuttlefish. Although representing a small proportion on its total foraging area, potential forage in NSW waters is nonetheless considered significant for the species. Forage for the Antipodean Albatross is extremely patchy, both spatially and temporally, and individuals traverse great distances in search of food. This species feeds pelagically on squid, fish and crustaceans.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
<i>Diomedea exulans</i>	Wandering Albatross	Endangered	Vulnerable	Animalia	Diomedidae	Birds	The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and September. It has been recorded along the length of the NSW coast. At other times birds roam the southern oceans and commonly follow fishing vessels for several days. Wandering albatross spend the majority of their time in flight, soaring over the southern oceans. They breed on a number of islands just north of the Antarctic Circle: South Georgia Island (belonging to the UK), Prince Edward and Marion Islands (South Africa), Crozet and Kerguelen Islands (French Southern Territories) and Macquarie Island (Australia). Breeding takes place on exposed ridges and hillocks, amongst open and patchy vegetation. Wandering albatross pairs mate for life; these long-lived birds do not reach sexual maturity until 9-11 years of age.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
<i>Diomedea sanfordi</i>	Northern Royal Albatross	Not Listed	Endangered	Animalia	Diomedidae	Birds	The Northern Royal Albatross breeds in New Zealand waters. The main population (estimated at 6,500 to 7,000 pairs) nests on islands off the Chatham Islands, and up to 50 pairs nest at Taiaroa Head on the South Island. Away from its nesting sites this Albatross is circumpolar between 30 and 45 degrees south. Most the population spends the non-breeding period off both coasts of southern South America, especially off Chile and Argentina. It is a rare visitor to NSW waters, predominantly visiting southern waters in the winter and early spring period. The Northern Royal Albatross primarily forages in inshore and offshore waters over the continental shelf to the shelf edge. It feeds mainly on cephalopods and fish, but also salps, crustacea and carrion.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No

<i>Macronectes giganteus</i>	Southern Giant-Petrel, Southern Giant Petrel	Endangered	Endangered	Animalia	Procellariidae	Birds	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population does not nest. It is an opportunistic scavenger and predator, and scavenges from fishing vessels and animal carcasses on land. It is also an active predator of cephalopods and euphausiids, as well as smaller birds (particularly penguins) both at land and at sea. Birds will desert their nests if disturbed at the breeding colony.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
<i>Macronectes halli</i>	Northern Giant Petrel	Vulnerable	Vulnerable	Animalia	Procellariidae	Birds	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population do not nest. There are marked differences in diet between the sexes. Females obtain most of their prey live from the sea, while males also scavenge from the carcasses of penguins and seals on land. At sea, both sexes are aggressive opportunists, feeding on fish, cephalopods, birds and crustaceans, including euphausiids or krill, and regularly scavenge on fishing vessels. During the vulnerable early chick phase adult birds utilise land-based carrion resources (e.g. seals) extensively.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
<i>Thalassarche bulleri</i>	Buller's Albatross, Pacific Albatross	Not Listed	Vulnerable	Animalia	Diomedidae	Birds	This albatross only nests on islands off New Zealand. The northern subspecies (<i>platei</i>) nests on islands off Chatham Island with an estimated population of around 18,200 breeding pairs. The southern subspecies (<i>bulleri</i>) breeds on the Snares and Solander islands with a total population of around 13,600 breeding pairs. After breeding both subspecies migrate to the seas off Peru and Chile. In NSW waters it is a relatively common visitor between March and October, with few sightings outside this period. Occurs in both inshore and offshore waters, including the continental shelf break and pelagic	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of	No

waters. Feeds mainly on squid, fish, tunicates, octopus and crustacea.

occurrence at an inland or urban cliff face is extremely unlikely.

<i>Thalassarche cauta</i>	Shy Albatross	Endangered	Endangered	Animalia	Diomed eidae	Birds	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Although uncommon north of Sydney, the species is commonly recorded off southeast NSW, particularly between July and November, and has been recorded in Ben Boyd National Park. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Parents are territorial while nesting, having both defensive and mating displays. Breeding occurs September-December, when a single egg is laid and incubated for 72 days. Both parents feed and guard the young for approximately 5 months before they fledge and become independent.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
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<i>Thalassarche eremita</i>	Chatham Albatross	Not Listed	Endangered	Animalia	Diomed eidae	Birds	This albatross principally breeds on Pyramid Rock in the Chatham Islands with one pair nesting on the Western Chain in the Snares Islands. The known population is estimated to be between 18,000 and 20,000 individuals. Satellite tracking has shown it ranges at sea west to the south and east coast of New Zealand and occasionally west to Tasmania. It is a rare winter visitor to waters off the east coast of Australia. This species predominantly ranges east to Chile and Peru where the majority of the population winter. Occasional individuals are encountered both in inshore and offshore over the continental shelf and in pelagic waters off the shelf break.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
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<i>Thalassarche impavida</i>	Campbell Albatross, Campbell Black-browed Albatross	Not Listed	Vulnerable	Animalia	Diomed eidae	Birds	This species nests only at Campbell Island and the adjacent Isle de Jeanette Marie south of New Zealand, with a total population estimated at 24,600 pairs. It ranges widely in Australasian seas. In NSW waters it is probably frequently overlooked due to the difficulties of separating it from the Black-browed Albatross. However, it appears to be a regular visitor occurring in most months of the year with peaks in winter during the non-breeding season. Occurs in both inshore and offshore waters, including the continental shelf break and pelagic waters. Forages on fish, squid, crustacea, carrion and gelatinous organisms.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
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<i>Thalassarche melanophris</i>	Black-browed Albatross	Vulnerable	Vulnerable	Animalia	Diomed eidae	Birds	The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. The species has also been recorded in Botany Bay National Park. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0°C and 24°C. Spends most of its time at sea, breeding on small isolated islands. When at sea, individuals soar on strong winds and rest on the ocean, when calm, often in groups. This species feeds on fish, crustaceans, offal and squid and often forages in flocks with other seabirds. Individuals seize prey from the surface while swimming or landing, sometimes submerging their head and body to capture prey underwater, and they scavenge in large flocks behind fishing vessels. This species nests annually on a mound of soil and vegetation, on the cliffs or steep slopes of vegetated antarctic and subantarctic islands. Colonies of up to 100,000 nests are formed, occasionally containing other species such as the Grey-headed Albatross, during which time the birds are territorial while nesting. Breeding occurs September-December, when a single egg is laid and incubated for 65-72 days by both parents. Both parents feed and guard the young for 4-5 months before they fledge and become independent. After breeding, the fledgling and adults leave the breeding colony, with the young reaching breeding age at approximately 11 years of age.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
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<i>Thalassarche salvini</i>	Salvin's Albatross	Not Listed	Vulnerable	Animalia	Diomedidae	Birds	This species principally nests on the Bounty Islands, with small numbers on the Western Chain Islets in the Snares Islands and a few pairs nesting on Pyramid Rock and The Forty-Fours in the Chatham Islands of New Zealand. A small number of pairs also nest on Iles Crozet in the French Southern Territories. The total population is estimated between 350,000 and 380,000 individuals, with 99% nesting on the Bounty Islands. It ranges widely through the South Pacific Ocean, particularly in the Humboldt Current off western South America. In NSW waters it is an uncommon visitor principally occurring between June and October, with the majority of sightings from waters south of Sydney. Occasional individuals are encountered both in inshore and offshore over the continental shelf and in pelagic waters off the shelf break.	Low	This species is a pelagic seabird that forages far offshore and breeds on remote subantarctic islands. It does not use terrestrial habitats such as cliffs in urban coastal areas for roosting or nesting. While individuals may occasionally fly over NSW coastal waters during winter, the probability of occurrence at an inland or urban cliff face is extremely unlikely.	No
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	Vulnerable	Not Listed	Animalia	Haematopodidae	Birds	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	Critically Endangered	Critically Endangered	Animalia	Psittacidae	Birds	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be being more frequently utilised than observations suggest. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. The species can be found foraging in weedy areas associated with these coastal habitats or even in totally modified landscapes such as pastures, seed crops and golf courses. On the mainland, the Orange-bellied Parrot spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland. Diet mainly comprises seeds and fruits of sedges and salt-tolerant coastal and saltmarsh plants. Occasionally, flowers and stems are eaten. Orange-bellied Parrots are known to forage among flocks of Blue-winged Parrots. Recent records from unexpected places, including	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

							Shellharbour and Maroubra suggest that the species may be expanding their selection of habitats and foraging plant species. Birds seen in NSW in 2003 were foraging on weed species several hundred metres from the coast.			
<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	Vulnerable	Not Listed	Animalia	Phaethontidae	Birds	Ranges throughout tropical and subtropical zones of the Indian and West Pacific Oceans, breeding on oceanic islands. Lord Howe Island is said to have the greatest breeding concentration in the world. Marine Breeds in coastal cliffs and under bushes in tropical Australia. Nests on cliffs of the northern hills and southern mountains on the main island at Lord Howe Island. Nest consists of a mere scrape on the ground on an inaccessible cliff ledge. Vagrant birds occur in coastal NSW waters, and occasionally even inland, particularly after storm events.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	Vulnerable	Not Listed	Animalia	Columbidae	Birds	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	Vulnerable	Not Listed	Animalia	Columbidae	Birds	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn. Breeding takes place from September to January. The nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species. The male incubates the single egg by day, the female incubates at night.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Stagonopleura guttata</i>	Diamond Firetail	Vulnerable	Vulnerable	Animalia	Estrildidae	Birds	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between 5 to 40 birds, occasionally more. Groups separate into small colonies to breed, between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. Appears to be sedentary, though some populations move locally, especially those in the south. Has been recorded in some towns and near farm houses.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Onychoprion fuscatus</i>	Sooty Tern	Vulnerable	Not Listed	Animalia	Laridae	Birds	The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Pterodroma neglecta neglecta</i>	Kermadec Petrel (west Pacific subspecies)	Vulnerable	Vulnerable	Animalia	Procellariidae	Birds	Ranges over subtropical and tropical waters of the South Pacific. Balls Pyramid (near Lord Howe Island) and Phillip Island (near Norfolk Island) are the only known breeding sites in Australian waters. MarineBreeds on islands across the South Pacific. In Australia it breeds on Ball's Pyramid and Phillip Island (near Norfolk Island). Nests in a crevice amongst rocks. Diet is squid and crustaceans. Vagrant birds occur in coastal NSW waters, particularly after storm events.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Puffinus assimilis</i>	Little Shearwater	Vulnerable	Not Listed	Animalia	Procellariidae	Birds	A widespread species in the subtropical Atlantic, Pacific and Indian Oceans. Lord Howe Island has one of the larger breeding colonies in the Australian region. MarineBreeding sites at Lord Howe Island include Roach Island, Muttonbird Island, Blackburn Island and on the main Island at Muttonbird Point and Transit Hill.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Ardenna carneipes</i>	Flesh-footed Shearwater	Vulnerable	Not Listed	Animalia	Procellariidae	Birds	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia. MarineNest on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1 - 2 metres in length.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Phoebastria fusca</i>	Sooty Albatross	Vulnerable	Vulnerable	Animalia	Diomedidae	Birds	The Sooty Albatross occurs in the South Atlantic and southern Indian Oceans, and has not been recorded in the Pacific Ocean between Australia and South America. In Australian waters, this species is generally recorded in winter off the south coast from Tasmania to Western Australia, while there are occasional sightings off the NSW coast, north of Grafton. The species has not been recorded in any NSW conservation reserves. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea, and rarely occurs in continental shelf waters. While at sea, this agile species soars on strong winds and when calm, rests on the ocean. Individuals are generally solitary while at sea, although small groups of 2-3 birds have been recorded. The species feeds on fish, crustaceans, offal and squid and although solitary, individuals may forage at night in mixed-species flocks. The species is thought to capture food by seizing prey from the water's surface while swimming, by landing on top of prey, and the species may follow fishing vessels for short periods. This species nests in small breeding colonies of up to 100 nests, on subantarctic islands including Prince Edwards Island, Iles Crozet, Iles des Apotres and Iles Kerguelen. Nests are located amongst vegetation on steep cliffs and consist of a mound of mud and plant matter, lined with grass. Pairs bond for life and these bonds are re-established with complex displays at nest sites on arrival at breeding areas. The species is highly territorial and defends its nests with threat displays. Breeding occurs August-December, when a single egg is laid and incubated for 65-75 days by both parents. Both parents feed and guard the young for approximately 5 months before they fledge and become independent. Life bonds are made at 3-4 years and first breeding is at 9-15 years.		The Sooty Albatross is a pelagic species that spends almost all its life in subantarctic and subtropical marine waters, far offshore. It does not use terrestrial habitats in mainland Australia for roosting or nesting. While occasional sightings occur off the NSW coast (north of Grafton), these are rare and limited to oceanic waters. The species has never been recorded in NSW conservation reserves and would not occur at an urban cliff face.	No
<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel	Vulnerable	Endangered	Animalia	Procellariidae	Birds	Breeds on both Cabbage Tree Island, 1.4 km offshore from Port Stephens and on nearby Boondelbah island. The range and feeding areas of non-breeding petrels are unknown. The first arrival of Gould's petrel on Cabbage Tree Island occurs from mid to late September. Principal nesting habitat is located within two gullies which are characterised by steeply sloping rock scree with a canopy of Cabbage Tree Palms. They nest predominantly in natural rock crevices among the rock scree and also in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees.	Low	Gould's Petrel breeds exclusively on offshore islands (Cabbage Tree Island and Boondelbah Island near Port Stephens) in highly specific habitats dominated by Cabbage Tree Palms and rock scree gullies. It does not nest or roost on mainland cliffs, and its non-breeding range	No

							They breed colonially and the nests are clumped and often less than 1 m apart. Egg laying takes place over a six week period commencing in early November.		is poorly known but considered pelagic. Therefore, the probability of occurrence at an urban cliff face is extremely unlikely.	
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	Not Listed	Endangered	Animalia	Diomedidae	Birds	In Australian territory, Grey-headed Albatross breed on the southern and western flanks of Petrel Peak, Macquarie Island. The Grey-headed Albatross has bred in this same restricted area on Macquarie Island for at least the past 30 years. This nesting area has been included on the EPBC Act register of Critical Habitat. Birds disperse widely across the Southern Ocean, at more southerly latitudes in summer than in winter, when they frequent the waters off southern Australia and New Zealand. Most Australian records come from south and west of Tasmania, occasionally in Victorian waters, rarely in South Australia and Western Australia, and only as a vagrant in NSW. It has only been recorded once in southern Queensland. The Grey-headed Albatross is marine, pelagic and migratory. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters in the Pacific, Indian, Atlantic and Southern Oceans. During summer, they feed mainly in the cold waters on either side of the Antarctic Convergence in the subantarctic and Antarctic seas. In winter, most leave the Antarctic Zone and their range extends into the warmer southern Subtropics. Grey-headed Albatrosses fly low to fairly high over open waters, using updraft from wave fronts for lift. They remain at sea outside of the breeding season and generally only come onto land to find a nest site, find a mate and to breed. Juvenile Grey-headed Albatrosses spend up to 11 years at sea before returning to their natal island.	Low	This species is a marine, pelagic bird that breeds exclusively on Macquarie Island in Australia, within a very restricted area designated as Critical Habitat. It spends most of its life at sea in subantarctic and Antarctic waters, only coming to land to breed. Records in NSW are extremely rare and limited to vagrants offshore. It does not use mainland cliffs or urban habitats for nesting or roosting, making its presence almost impossible.	No
<i>Sternula nereis nereis</i>	Fairy Tern	Not Listed	Vulnerable	Animalia	Laridae	Birds	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there (Birdlife International 2010; Garnett & Crowley 2000). The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (Higgins & Davies 1996; Lindsey 1986a). The bird roosts on beaches at night (Higgins & Davies 1996).	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No

<i>Limosa lapponica baueri</i>	Alaskan Bar-tailed Godwit	Endangered	Vulnerable	Animalia	Scolopacidae	Birds	<p>The Bar-tailed Godwit is a migratory wader which undertakes the largest non-stop flight of any bird. The trans-Pacific route from its breeding grounds in the Arctic to its non-breeding grounds in the southern hemisphere covers over 11,000 km. Birds arrive in New South Wales between August and October and then leave between February and April, with a small number of individuals overwintering. The subspecies is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries, Port Stephens and Botany Bay. It is a rare visitor to wetlands away from the coast with scattered records as far west as along the Darling River and the Riverina. It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms. It often occurs around beds of seagrass, and sometimes in nearby saltmarsh or the outer margins of mangrove areas. It forages at low to mid tide in shallow water or along the water's edge on sandy substrates on intertidal flats, banks and beaches or on soft mud substrates. Its diet consists of worms, molluscs, crustaceans, insects and some plant material. In NSW its high tide roost areas on sandy beaches, sandbars, spits and near-coastal saltmarsh are frequently shared with other shorebirds. It is rarely found on inland wetlands or in areas of short grass such as farmland, paddocks and airstrips. In large part, the observed decline in Bar-tailed Godwit (Western Alaskan) numbers across Australia stems from ongoing loss of intertidal mudflat habitat at key migration staging sites in the Yellow Sea.</p>	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Diomedea gibsoni</i>	Gibson's Albatross	Vulnerable	Vulnerable	Animalia	Diomedidae	Birds	<p>Essentially endemic to the Auckland Islands of New Zealand. The non-breeding range is poorly known however the species probably disperses across the southern Pacific. The species is regularly encountered on trans-Tasman shipping routes and at seas off Sydney, and regularly occurs off the NSW coast usually between Green Cape and Newcastle. This species is known only to breed on the Adams, Disappointment and Auckland Islands in the subantarctic Auckland Island group. Breeds biennially in colonies among grass tussocks on isolated subantarctic islands, using the wind to travel great distances both during and between breeding seasons. Most eggs are laid in December and January, with chicks fledging the following year in January and February. The annual breeding population is relatively small and has been estimated at 6,077 pairs. This species regularly occurs off the NSW coast from Green Cape to Newcastle. Although representing a small proportion on its total foraging area, potential forage in NSW waters during the winter is nonetheless considered significant for the species. Forage for Gibson's Albatross is extremely</p>	Low	Pelagic seabird that would not utilise the Study Area.	No

							patchy, both spatially and temporally, and individuals traverse great distances in search of food. This species feeds pelagically on squid, fish and crustaceans. Satellite tracking studies have shown that foraging areas used by males and females are mutually exclusive; females frequent the Tasman Sea, whereas males disperse to lower latitudes or move north-east into the mid-Pacific Ocean.			
<i>Fregetta grallaria</i>	White-bellied Storm-Petrel	Vulnerable	Vulnerable	Animalia	Oceanitidae	Birds	A wide oceanic distribution in the south Pacific and Atlantic Oceans, ranging into tropical waters from various breeding grounds. Known to breed at various island groups including Lord Howe Island. Marine In Australia breeds only on offshore islands in the Lord Howe Island group. Nest consists of a chamber usually located amongst large rocks. Vagrant birds occur in coastal NSW waters, particularly after storm events.	Low	Pelagic seabird that would not utilise the Study Area.	No
<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	Endangered	Not Listed	Plantae	Grammitidaceae	Ferns and Cycads	Grammitis stenophylla is known from 30 locations across New South Wales and occurs in 24 conservation reserves. It is common in several areas, including the Mount Warning Shield, the sandstone reserves of the lower Clarence, the granites of Washpool, Gibraltar and Nymboida National Parks, and also Dorrigo, Mount Jerusalem and Nightcap National Parks. The species was recently recorded from New England National Park. The current Endangered status of this species does not appear to be warranted and requires review. It inhabits Boree/Weeping Myall (Acacia pendula), Brigalow (A. harpophylla), Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, it prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nesting occurs from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Low	Records are minimal and the Study Area is outside its distribution.	No
<i>Persicaria elatior</i>	Knotweed, Tall Knotweed	Vulnerable	Vulnerable	Plantae	Polygonaceae	Herbs and Forbs	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Thesium australe</i>	Austral Toadflax, Toadflax	Vulnerable	Vulnerable	Plantae	Santalaceae	Herbs and Forbs	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (Themeda australis). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Low	Suitable habitat exists within the Subject Land. However, there are no records within 10km of the Subject Land.	No

<i>Allocasuarina portuensis</i>	Nielsen Park She-oak	Endangered	Endangered	Plantae	Casuarinaceae		The original known habitat of the Nielsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vaucluse House. The original habitat is tall closed woodland. Canopy species include: <i>Ficus rubiginosa</i> , <i>Angophora costata</i> , <i>Elaeocarpus reticulatus</i> and <i>Glochidion ferdinandi</i> with a shrub layer of <i>Pittosporum revolutum</i> , <i>Kunzea ambigua</i> and <i>Monotoca elliptica</i> . The original habitat occurs above a sandstone shelf approximately 20 m above the harbour. The shallow sandy soils are highly siliceous, coarsely textured and devoid of a soil profile. The plantings have occurred on similar soils. Flowering occurs throughout the winter months (April-August), though many of the in situ plantings have also been observed to flower during January and March. The species is probably wind pollinated.	Not present	Targeted surveys did not identify this species.	No
<i>Doryanthes palmeri</i>	Giant Spear Lily	Vulnerable	Not Listed	Plantae	Doryanthaceae	Herbs and Forbs	Coastal ranges that are part of the Mt Warning Caldera; north from Mt Warning. Also in SE Qld. grows on exposed rocky outcrops in wet sclerophyll forest. Giant Spear Lily occurs in far north-east NSW and south-east Queensland. In NSW, it occurs on the coastal ranges that are part of the Mt Warning Caldera. Its southern distributional limit is Mount Billen. The species is currently known from eleven sites within NSW, five of which are conservation reserves. Most populations consist of only a few hundred individuals. Giant Spear Lily occurs on exposed rocky outcrops on infertile soils or on bare rock. It grows in a narrow band of vegetation along the cliff-tops and on steep cliff-faces or rocky ledges in montane heath next to subtropical rainforest, warm temperate rainforest or wet eucalypt forest.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Meridolum maryae</i>	Maroubra Woodland Snail	Endangered	Endangered	Animalia	Camaenidae	Invertebrates	This species is confined to a narrow band of habitat along the coast from the north-eastern corner of the Royal National Park to Palm Beach in Sydney. Records of the species are generally within 1 km of the ocean but occur up to 5 km inland. The species is found in the leaf litter of coastal vegetation communities, most commonly in heathland on foredunes also from areas of podsolised dunes/sand plains that support taller heath communities including Eastern Suburbs Banksia Scrub. Can dig several centimetres into soil during dry conditions. The species is typically active at night but can also move about on overcast or rainy days. The ability for individuals to disperse is expected to be similar to closely related camaenids which can move around 3.5 m in a day and 350 m in a lifetime.	Low	The Study Area does not contain suitable habitat for this species.	No

<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	Vulnerable	Vulnerable	Plantae	Myrtaceae	Mallees	Restricted distribution in a narrow band with the most northerly records in the the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Aepyprymnus rufescens</i>	Rufous Bettong	Vulnerable	Not Listed	Animalia	Potoroidae	Marsupials	The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. Rufous Bettongs inhabit a range of forest types, from tall, moist eucalypt forests to open woodlands with a tussock grass understorey, preferring areas with dense cover of tall native grasses for shelter. During the day, they rest in cone-shaped nests made of grass, constructed in shallow depressions at the base of tussocks or fallen logs. At night, they forage for grasses, herbs, seeds, flowers, roots, tubers, fungi, and occasionally insects.	Low	Not present outside distribution.	No
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Vulnerable	Not Listed	Animalia	Burramyidae	Marsupials	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. ound in a broad range of habitats from rainforest through sclerophyll forest (including Box-Ironbark) and woodland to heath, though woodlands and heath are generally preferred except in north-eastern NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and, while the species prefers habitat with a rich shrub understorey, it is also known to occur in grassy woodlands; the presence of eucalypts alone can support populations at low densities. Their diet consists largely of nectar and pollen from banksias, eucalypts and bottlebrushes, making them important pollinators of heathland plants such as banksias. Soft fruits are eaten when flowers are scarce, and insects are consumed year-round, particularly in habitats where flowers are less abundant, such as wet forests. They shelter in tree hollows, rotten stumps, holes in the ground, abandoned bird nests, Ringtail Possum dreys or dense vegetation such as grass-tree skirts. Nest-building appears to be restricted to breeding females; tree hollows are favoured, but spherical nests have been found under eucalypt bark and in shredded bark in tree forks. Individuals are mainly	Low	Landscape to fragmented with a lack of foraging habitat to support this species.	No

							solitary, each using several nests, with males having non-exclusive home ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food is available, though most births occur between late spring and early autumn. Agile climbers, they can also be caught on the ground in traps, pitfalls or postholes, and are generally nocturnal. They frequently enter torpor, especially in winter, curling their body with ears folded and body temperature close to ambient.			
<i>Notamacropus parma</i>	Parma Wallaby	Vulnerable	Vulnerable	Animalia	Macropodidae	Marsupials	The optimum habitat for the Parma wallaby is wet sclerophyll forest with a thick, shrubby understorey and nearby grassy patches. The species also occurs in dry sclerophyll forest with a dense understorey and occasionally in rainforest.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Petauroides volans</i>	Greater Glider (southern and central)	Endangered	Endangered	Animalia	Pseudocheiridae	Marsupials	The Southern Greater Glider occurs in eastern Australia, in eucalypt forests and woodlands, where it has a broad distribution from around Proserpine in Queensland, south through NSW and the Australian Capital Territory into Victoria. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range. Recorded using hollows with a minimum diameter of 8 cm.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Phascolarctos cinereus</i>	Koala	Endangered	Endangered	Animalia	Phascolarctidae	Marsupials	In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Petaurus norfolcensis</i>	Squirrel Glider	Vulnerable	Not Listed	Animalia	Petauridae	Marsupials	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein. Shelter mostly under older houses and buildings. Forage in parkland and back-yards. There are apparently no large blocks of suitable habitat, likely to support a large source population, on the Cooks River to the south, or along the southern foreshore of Parramatta River and Sydney Harbour to the north.	Low	The Study Area does not contain suitable habitat for this species.	No

<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)	Endangered	Endangered	Animalia	Peramelidae	Marsupials	The Southern Brown Bandicoot has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruited) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees <i>Xanthorrhoea</i> spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest. Mating occurs any time of the year, usually following heavy rain. Two or three litters of 2-4 young may be produced annually. The gestation period of 11-12 days is the shortest known of any marsupial while young remarkably become independent around 60 days after being born.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Petaurus australis australis</i>	Yellow-bellied Glider (south-eastern)	Vulnerable	Vulnerable	Animalia	Petauridae	Marsupials	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein.	Low	The Study Area does not contain suitable habitat for this species.	No
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Vulnerable	Endangered	Animalia	Dasyuridae	Marsupials	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. A generalist	Low	The Study Area does not contain suitable habitat for this species.	No

predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	Vulnerable	Vulnerable	Plantae	Orchidaceae	Orchids	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>). Little is known about the ecology of the species. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site. On the Central Coast of NSW, populations have been recorded in woodland dominated by Scribbly Gum (<i>Eucalyptus haemastoma</i>), Brown Stringybark (<i>Eucalyptus capitellata</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and also associated with Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>).	Low	The Study Area may contain minor forms of habitat however, is generally not consistent with where larger populations of the species typically occur. In addition, there are no known BioNet records within 10km of the Study Area.	No
<i>Genoplesium baueri</i>	Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid	Endangered	Endangered	Plantae	Orchidaceae	Orchids	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March.	Not present	Suitable habitat does not occur in the site and no records are present within 10km.	No
<i>Rhizanthella slateri</i>	Eastern Underground Orchid	Vulnerable	Endangered	Plantae	Orchidaceae	Orchids	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed.	Low	The Study Area does not contain suitable habitat for this species.	No

<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Vulnerable	Plantae	Orchidaceae	Orchids	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	Endangered	Endangered	Animalia	Elapidae	Reptiles	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. Nocturnal. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in crevices or hollows in large trees within 500m of escarpments in summer. Feeds mostly on geckos and small skinks; will also eat frogs and small mammals occasionally. Females produce four to 12 live young from January to March, which is a relatively low level of fecundity.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Pseudomys novaehollandiae</i>	New Holland Mouse, Pookila	Vulnerable	Vulnerable	Animalia	Muridae	Rodents	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals.	Low	No records within 10km and the Study Area does not contain sand dunes.	No
<i>Grevillea caleyi</i>	Caley's Grevillea	Critically Endangered	Critically Endangered	Plantae	Proteaceae	Shrubs	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Northern Beaches Local Government Areas.	Low	Records are minimal and the Study Area is outside its distribution.	No
<i>Acacia bynoeana</i>	Bynoe's Wattle, Tiny Wattle	Endangered	Vulnerable	Plantae	Fabaceae (Mimosoideae)	Shrubs	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Melaleuca deanei</i>	Deane's Melaleuca	Vulnerable	Vulnerable	Plantae	Myrtaceae	Shrubs	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.	Low	Suitable habitat may exist within the surrounding locality however, targeted surveys did not identify this species.	No

<i>Persoonia hirsuta</i>	Hairy Geebung, Hairy Persoonia	Endangered	Endangered	Plantae	Proteaceae	Shrubs	The Hairy Geebung is found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone. It is usually present as isolated individuals or very small populations. Plants are generally killed by all but the lowest intensity fire or partial burning. Fire may promote germination of soil-stored seed, although it may also kill some of the seedbank if it is of high severity. Extreme wet-dry weather cycles may also promote germination of soil-stored seed. <i>Persoonia hirsuta</i> has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. <i>Persoonia hirsuta</i> has a large area of occurrence, but occurs in small populations or isolated individuals, increasing the species' fragmentation in the landscape.	Low	The Hairy Geebung is found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath. These vegetation communities are not present within the Study Area.	No
<i>Pimelea curviflora</i> var. <i>curviflora</i>		Vulnerable	Vulnerable	Plantae	Thymelaeaceae	Shrubs	Confined to the coastal area of the Sydney and Illawarra regions. Populations are known between northern Sydney and Maroota in the north-west. New population discovered at Croom Reserve near Albion Park in Shellharbour LGA in August 2011. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain	Low	No records exist within 10km for this species. In addition, woodland habitat is not present within the Study Area.	No
<i>Rhodamnia rubescens</i>	Scrub Turpentine, Brown Malletwood	Critically Endangered	Critically Endangered	Plantae	Myrtaceae	Shrubs	Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Low	Suitable habitat does not exist within the Study Area.	No
<i>Callistemon linearifolius</i>	Netted Bottle Brush	Vulnerable	Not Listed	Plantae	Myrtaceae	Shrubs	Grows in dry sclerophyll forest on the coast and adjacent ranges. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded in the Sydney area. Three of the remaining populations are reserved in Kuring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park. <i>Callistemon linearifolius</i> also occurs in several locations in the Clarence Sandstones subregion of the north coast	Not present	Targeted surveys did not identify this species.	No

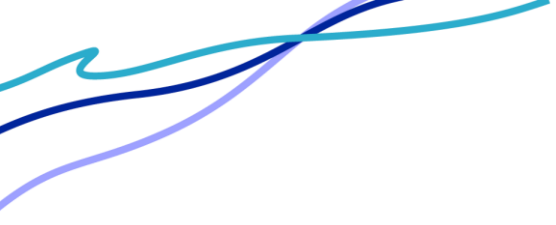
							including Wombat Creek State Conservation Area, Fortis Creek National Park, Yuraygir State Conservation Area, Shannon Creek Dam, Sherwood Nature Reserve and Pine Brush State Forest.			
<i>Prostanthera densa</i>	Villous Mint-bush	Vulnerable	Vulnerable	Plantae	Lamiaceae	Shrubs	Prostanthera densa generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea. Plants regenerate from rootstock after fire and flower within the first year or two. This species has been recorded from the Currarong area in Jervis Bay, Royal National Park (Marley), Cronulla, Helensburgh and Port Stephens (Nelson Bay). The Sydney and Royal National Park populations were thought possibly extinct, but the species is now known to occur at Bass and Flinders Point in Cronulla.	Not present	Targeted surveys did not identify this species in the Subject Land or Impact Area.	No
<i>Acacia bynoeana</i>	Bynoe's Wattle, Tiny Wattle	Endangered	Vulnerable	Plantae	Fabaceae (Mimosoideae)	Shrubs	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. The species is currently known from about 30 locations, with the size of the populations at most locations being very small (1-5 plants). It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Low	No records exist within 10km for this species. In addition, woodland habitat is not present within the Study Area.	No
<i>Persoonia hirsuta</i>	Hairy Geebung, Hairy Persoonia	Endangered	Endangered	Plantae	Proteaceae	Shrubs	Persoonia hirsuta has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. Persoonia hirsuta has a large area of occurrence, but occurs in small populations or isolated individuals, increasing the species' fragmentation in the landscape. The Hairy Geebung is found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone. It is usually present as isolated individuals or very small populations. Plants are generally killed by all but the lowest intensity fire or partial burning. Fire may promote germination of soil-stored seed, although it may also kill some of the seedbank if it is of high severity. Extreme wet-dry weather cycles may also promote germination of soil-stored seed.	Low	A small number of records exist within 5km for this species. In addition, woodland habitat is not present within the Study Area.	No

<i>Rhodomyrtus psidioides</i>	Native Guava	Critically Endangered	Critically Endangered	Plantae	Myrtaceae	Shrubs	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Low	The Study Area does not contain habitat or other features consistent with this species habitat requirements.	No
<i>Acacia terminalis</i> subsp. <i>Eastern Sydney</i>	Sunshine wattle	Endangered	Endangered	Plantae	Fabaceae (Mimosoideae)	Shrubs	Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Recorded from North Head, Middle Head, Dover Heights, Parsely Bay, Nielsen Park, Cooper Park, Chifley, Watsons Bays, Wollstonecraft and Waverley. Coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated. Most sites are highly modified or disturbed due to surrounding urban development. Flowers in autumn but may be through to early winter. Small birds and bees are natural pollinators. Seeds mature in November and are dispersed by ants. Seed viability is high and recruitment occurs mainly after fire. A fire temperature of 60 degrees is required for optimum germination. Although plants are killed by fire, they have been recorded sprouting from the base.	Not present	Targeted flora surveys did not identify this species.	No
<i>Asterolasia buxifolia</i>	<i>Asterolasia buxifolia</i>	Critically Endangered	Critically Endangered	Plantae	Rutaceae	Shrubs	Known from a single site associated with granite geology in the riparian zone of the Lett River. Rediscovered in 2000, little is known about the species. The growth rate appears to be very slow, and the flowering season short. Apparently restricted to the riparian zone of a granitic rocky section of the Lett River.	Not present	Outside species distribution.	No

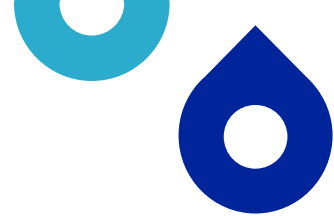
<i>Asterolasia elegans</i>	Asterolasia elegans	Endangered	Endangered	Plantae	Rutaceae	Shrubs	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e. g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>), Smooth-barked Apple (<i>Angophora costata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>), Forest Oak (<i>Allocasuarina torulosa</i>) and Christmas Bush (<i>Ceratopetalum gummiferum</i>). Ecological knowledge about this species is very limited. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so for a number of years following fire or other disturbance the species may not be apparent, but be present only as seed in the soil. The size of the seedbank depends not only on the amount of seed contributed by mature plants each season, but on the level of dormancy of the seed which can vary from year to year. The longevity of each crop of seed in the soil is probably relatively short (perhaps 5 - 10 years). Either heat or smoke or a combination of these factors may play a role in breaking soil-stored seed dormancy. Both the amount of smoke and the level of heating could influence germination success. A certain level of heat may be optimal for breaking seed dormancy (such that too little heat results in seeds staying dormant, while too much heat kills seeds).	Not present	Outside species distribution.	No
<i>Haloragodendron lucasii</i>	Haloragodendron lucasii	Endangered	Endangered	Plantae	Haloragaceae	Shrubs	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels. Highly clonal, which implies the true population size may be considerably smaller than expected. Flowering occurs from August to November with fruits appearing from October to December. Has demonstrated an ability to resprout from its rootstock.	Not present	Outside species distribution.	No
<i>Lasiopetalum joyceae</i>	Lasiopetalum joyceae	Vulnerable	Vulnerable	Plantae	Malvaceae	Shrubs	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved. Grows in heath on sandstone.	Not present	Outside species distribution.	No

<i>Tetratheca glandulosa</i>	<i>Tetratheca glandulosa</i>	Vulnerable	Not Listed	Plantae	Elaeocarpaceae	Shrubs	Restricted to the following Local Government Areas: The Hills Shire, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Northern Beaches, Ryde and Wyong. There are approximately 150 populations of this plant ranging from Sampons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Northern Beaches LGA) and the western limit is at East Kurrajong (Wollemi NP). There are historical collections of this species south to Manly, Willoughby and Mosman, however these populations are now extinct. The current north-south range is approximately 65km. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gynea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar).	Low	Limited records within 5km (2) and the Study Area generally does not contain habitat for the species.	No
<i>Tetratheca juncea</i>	Black-eyed Susan	Vulnerable	Vulnerable	Plantae	Elaeocarpaceae	Shrubs	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. It usually spreads via underground stems which can be up to 50 cm long. Consequently, individual plants may be difficult to identify. It also reproduces sexually but this requires insect pollination. Large populations of this species are particularly important.	Low	Limited records within 5km (1) from 2008 and the Study Area generally does not contain habitat for the species.	No
<i>Triplarina imbricata</i>	Creek Triplarina	Endangered	Endangered	Plantae	Myrtaceae	Shrubs	Found only in a few locations in the escarpment ranges and near Tabulam in north-east NSW. The species was previously recorded in Parramatta, near Sydney, however, the species is no longer thought to occur in this area. Occurs along watercourses in low open forest and shrubland with Water Gum or in montane bogs. .	Not present	Outside species distribution.	No

<i>Prostanthera marifolia</i>	Seaforth Mintbush	Critically Endangered	Critically Endangered	Plantae	Lamiaceae	Shrubs	Prostanthera marifolia is currently only known from the northern Sydney suburb of Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. The single population is fragmented by urbanisation into three small sites. All known sites are within an area of 2x2 km. The sites are within the local government area of Northern Beaches Council. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.	Not present	Outside species distribution.	No
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	Vulnerable	Vulnerable	Plantae	Myrtaceae	Trees	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland on shallow soils of slopes and ridges, primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. The species tends to occur on lower slopes within the landscape.	Not present	Often planted in Sydney and other urban environments, however, is outside of its distribution. This species was not recorded during targeted surveys.	No
<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	Vulnerable	Vulnerable	Plantae	Proteaceae	Trees	Found in subtropical rainforest, usually near the coast.	Not present	Targeted surveys did not identify this species.	No
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry	Vulnerable	Vulnerable	Plantae	Myrtaceae	Trees	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Not present	Suitable habitat for this species does not exist however, it can be planted in revegetated areas. No syzygium species were identified during the field survey.	No
<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	Vulnerable	Vulnerable	Plantae	Proteaceae	Trees	Confined chiefly to the north of the Richmond River in north-east NSW, extending just across the border into Queensland. Many records, particularly those further south, are thought to be propagated. Found in subtropical rainforest, usually near the coast.	Not present	The Study Area is outside of the known distribution for this species. Surrounding records are likely planted.	No
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	Vulnerable	Vulnerable	Plantae	Myrtaceae	Trees	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. Resprouts following fire.	Low	Outside species distribution.	No



<i>Macadamia integrifolia</i>	Macadamia Nut	Not Listed	Vulnerable	Plantae	Proteaceae	Trees	Not known to occur naturally in the wild in NSW.	Low	The Study Area is outside of the known distribution for this species. Surrounding records are likely planted however, no records exist within 5km.	No
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Appendix F – Construction Noise and Vibration Impact Assessment

SWXXX XX/XX [Insert a publication number if publicly displayed/published]

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Sydney Water Corporation

Refresh Vacluse Diamond Bay

Construction Noise and Vibration Impact Assessment

Reference: ACD01

V2 | 27 March 2026

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 269901

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Executive Summary

Sydney Water proposes to undertake design changes to sewerage infrastructure works at Old South Head Road, Vacluse, Diamond Bay and Eastern Reserve as part of the Refresh Vacluse Diamond Bay Project. These changes require assessment under a Review of Environmental Factors Addendum (REFA). Arup has been engaged under the Sydney Water Planning Partnership to prepare a Construction Noise and Vibration Impact Assessment (CNVIA) addressing the proposed design changes.

This CNVIA assesses the potential airborne construction noise, ground-borne noise and vibration impacts associated with the proposed works and identifies appropriate mitigation and management measures to minimise impacts on nearby sensitive receivers. The assessment has been undertaken with reference to relevant NSW policies and guidelines, including the Interim Construction Noise Guideline (ICNG), the Transport for NSW Construction Noise and Vibration Guideline (CNVG), and the NSW Assessing Vibration guideline.

The assessment considered the location of the proposed works, anticipated construction activities and plant, proposed construction hours, and the proximity of surrounding sensitive receivers. Airborne construction noise was assessed using detailed noise modelling to predict noise levels at nearby receivers and compare them against the applicable Noise Management Levels (NMLs). Ground-borne noise was assessed for evening and night-time construction activities using a distance-based screening approach to identify the indicative extent of potential impacts. Vibration impacts were assessed using minimum working distance criteria to identify areas where vibration may pose a risk of human discomfort or cosmetic building damage.

The assessment indicates that exceedances of the applicable construction noise criteria are predicted during certain activities, with higher exceedances predicted during activities involving high-noise plant such as rock breakers and concrete saws.

Construction noise and vibration impacts are expected to be temporary and transient, varying as works progress and plant and equipment move within the construction areas. The assessment adopts a conservative, worst-case approach, and predicted exceedances have been interpreted with reference to the CNVG receiver perception framework to inform the level of mitigation and management required.

A suite of feasible and reasonable mitigation and management measures has been identified to minimise potential construction noise and vibration impacts on nearby sensitive receivers. These measures have been informed by the magnitude of predicted exceedances and the relevant CNVG receiver perception categories and include controls relating to work scheduling, selection and operation of plant and equipment, use of temporary noise controls (such as noise screens), site planning, community notification and consultation, noise and vibration monitoring, and complaint management.

Where higher noise impacts are predicted during daytime works, particularly for activities involving rock breakers or concrete saws, additional management measures such as the provision of respite periods may be considered where feasible and reasonable. For evening and night-time works, additional management measures may be required, including restrictions on the timing and duration of high-noise activities and the provision of respite or other community-focused measures.

For vibration, mitigation measures focus on equipment selection, method optimisation, monitoring to manage the risk of human discomfort or cosmetic building damage.

These mitigation and management measures are consistent with Sydney Water safeguards and relevant NSW guidelines and are to be incorporated into the Construction Noise and Vibration Management Plan (CNVMP) prior to the commencement of works.

Provided that the recommended mitigation and management measures are implemented, the potential construction noise and vibration impacts associated with the proposed design changes are considered manageable and consistent with the intent of the relevant NSW policies and guidelines.

1. Introduction

Sydney Water proposes to construct sewerage infrastructure facilities at Vacluse (Package 1) and Diamond Bay (Package 2) as part of the Refresh Vacluse Diamond Bay Project to redirect untreated wastewater from existing ocean outfalls to the Bondi Wastewater Treatment Plant for treatment. A Review of Environmental Factors (REF) was previously prepared for the project; however, subsequent design changes have occurred, requiring preparation of a Review of Environmental Factors Addendum (REFA).

A Noise and Vibration Impact Assessment was prepared for the REF in May 2020 referred to as the REF NVIA [1] herein).

The design changes to be assessed are identified below; all other works assessed during the REF remain valid, with mitigation measures unchanged:

- Old South Head Road, Vacluse: Sewer amplification works from Fernleigh Avenue to Hamilton Street to accommodate the increase in flow created by SP1217.
- Kimberley Street, Diamond Bay: Revised alignment to now intercept flows beneath the Kimberley Street building in response to identified geotechnical risks.
- Eastern Avenue, Dover Height: Relocated a few metres north of the original location identified in the REF.

Arup has been engaged under the Sydney Water Planning Partnership to undertake a Construction Noise and Vibration Impact Assessment (CNVIA) of the proposed design changes.

This CNVIA:

- Identifies location of the proposed construction works and the reasonably nearest affected sensitive receivers;
- Identifies proposed hours of construction for the proposed works
- Adopts the construction noise management levels and vibration criteria as previously determined in the REF, which were established in accordance with NSW Policies and Guidelines, relevant Australian and International Standards, and site noise measurements.
- Assesses predicted noise and vibration impacts against established criteria; and
- Identifies reasonable and feasible noise and vibration mitigation and management measures required to minimise construction noise and vibration impacts onto nearest sensitive receivers.

This CNVIA has been prepared with reference to the following:

- NSW Department of Environment and Climate Change (DECC) *Interim Construction Noise Guideline* (ICNG), 2009 [2]
- NSW Department of Environment and Conservation (DEC) *Assessing Vibration: a technical guideline* (AVATG), 2006 [3]
- NSW Environment Protection Authority (EPA) *Noise Policy for Industry* (NPfI), 2017 [4]
- NSW Department of Environment, Climate Change and Water (DECCW) *Road Noise Policy* (RNP), 2011 [5]
- Transport for NSW (TfNSW) *Construction Noise and Vibration Guideline Public Transport Infrastructure* (CNVG), 2023 [6]

- Australian Standard AS 1055-2018 – Acoustics—Description and measurement of environmental noise, 2018 [7]
- Australian Standard AS IEC 61672.1-2019 – Electroacoustics – Sound Level Meters Specifications, 2019 [8]
- Australian Standard AS 2436-2010 – Guide to noise and vibration control on construction, demolition and maintenance sites, 2010 [9]
- British Standard BS 5228: Part 1 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise, 2009 including Amendment 1, 2014 [10]
- British Standard BS 6472: Evaluation of human exposure to vibration in buildings (1-80 Hz), 2008 [11]
- British Standard BS 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings, 1993 [12]
- German Institute for Standardisation DIN 4150: Part 3 2016 Vibration in Buildings – Effects of Structures, 2016 [13]

A glossary of the acoustic terminology used in this document is presented in Appendix A.

2. Project description

Construction work activities are identified as follows:

- Old South Head Road, Vacluse:
 - Wastewater infrastructure amplification within the road reserve along Old South Head Rd
 - Construction to involve a combination of open trenching and microtunnelling
 - Plant expected to include noisy items of equipment such as a 25-tonne excavator rock breaker and a concrete saw
 - Works proposed during evening/night-time hours (7:00 pm to 5:00 am), 5 nights per week
 - Overall construction duration anticipated to be approximately 26 weeks (6 months)
- Kimberley Street, Diamond Bay:
 - Construction of a temporary driveway behind Kimberley Street
 - Excavation of the launch pit for Line 6 (pipeline between the Diamond Bay weir, located behind Kimberley Street, and Eastern Reserve at the end of Eastern Avenue) - Construction of Line 6 has been assessed in the REF NVIA [1]
 - Construction of Line 5 (microtunnelling) between the weir and the connection point at ■ Kimberley Street
 - Construction of a maintenance hole near the building at ■ Kimberley Street (~2 months)
 - Connection of pipeline works below and adjacent to the building at ■ Kimberley Street (at the connection point accessed via the maintenance hole) (~2 months)
 - Decommissioning of existing sewer lines near and below the building at ■ Kimberley Street
 - Plant expected to include noisy items of equipment such as a 32-tonne and 25-tonne excavator rock breaker and a concrete saw
 - Works to be conducted during daytime hours
 - Total duration of works anticipated to be approximately 78 weeks (18 months).
- Eastern Avenue, Dover Height (Eastern Reserve):
 - Excavation of launch and retrieval shaft
 - Plant expected to include noisy items of equipment such as a 25-tonne excavator rock breaker and a concrete saw
 - Works to be conducted during daytime hours
 - Other construction activities within Eastern Reserve remain unchanged from those assessed in the 2020 REF. These works were previously assessed for standard daytime construction hours and are not reassessed as part of the REF Addendum, except where the entry/exit pit location has been modified.
 - Total duration of works anticipated to be approximately 29 months. The excavation of the launch and retrieval shaft is anticipated to be conducted over a period of 5 months.

The works at Diamond Bay and in the Eastern Reserve will be conducted sequentially.

Some of the works at the three locations may occur concurrently.

Appendix B presents an aerial view of the proposed works.

3. Existing acoustic environment

3.1 Sensitive receivers and land uses

Receivers potentially impacted by construction activities associated with the proposed design changes are identified in Appendix B. The receivers were identified during the REF, and the associated GIS files were provided by Sydney Water on 11/02/2026. Receivers were defined based on occupancy type and sensitivity to noise and vibration (in accordance with the Interim Construction Noise and Vibration Guideline (ICNG [2])). Noise sensitive receivers include residential, mixed use, community use, educational, places of worship, recreational, commercial and industrial land uses. Residential receivers were grouped into Noise Catchment Areas (NCAs) in the REF (based on their likely similar acoustic environment), as shown in Appendix B.

A nominal study area of 500 m from the construction works has been adopted for this assessment as a screening analysis for any sensitive receivers that are reasonably expected to be impacted by construction noise and vibration.

Prior to the start of the works, noise sensitive receivers and land uses are to be reviewed.

3.2 Background noise levels

For residential receivers, construction noise targets are derived from the background noise levels in the affected areas. Long-term (unattended) noise monitoring was conducted for the REF over a 15-day period between 2 and 17 December 2019. The results were processed in accordance with the Noise Policy for Industry (NPI [4]). As the surrounding environment has not changed materially since that time, the measured ambient noise levels are considered representative of current conditions and have been adopted for this assessment.

All other non-residential sensitive receivers have fixed criteria.

The results of the noise survey are presented in Section 3.3. The construction noise criteria are detailed in Section 4.

3.3 Noise monitoring survey

Relevant noise monitoring locations are shown in Appendix B. Results of the long-term noise monitoring from the REF NVIA [1] are detailed in Table 1.

Table 1: Unattended long term noise monitoring results, dBA

ID	Location	NCA	Rating Background Level (RBL) – dBA ⁴			Ambient Noise Level – dBA		
			Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
M01	1A Conway Avenue	NCA01	39	35	26	52	50	43
M03	23 Kimberley Street	NCA03	39	37	34	53	48	45
M04	56 Oceanview Avenue	NCA04	37	35	32	55	46	45

Notes:

1_ Day is 8:00 am to 6:00 pm on Sundays and 7:00 am to 6:00 pm at other times

2_ Evening is 6:00 pm to 10:00 pm

3_ Night is the remaining periods

4_ Assessment Background Level (ABL) for individual days

5_ Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

4. Construction hours

Construction noise management levels (NML) often vary by time of day and are adjusted to reflect people’s response to noise and vibration and provide reasonable respite. The ICNG [2] outlines recommended ‘standard hours’ for construction, while the Construction Noise and Vibration Guideline (CNVG [6]) provides additional guidance in the defining of periods out of the standard hours (out of hours work (OOHW)) that account for times when people are more sensitive to noise and vibration.

The recommended construction hours derived from the ICNG [2] and CNVG [6] are summarised in Table 2 below.

Wherever possible, construction would be undertaken during standard hours; however, some activities would be required outside standard hours, such as works at Old South Head Road as per Section 2.

Table 2: Construction periods (as per CNVG [6])

Hour Commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday	Standard							Standard							OOHW			Standard						
Tuesday	Standard							Standard							OOHW			Standard						
Wednesday	OOHW							Standard							OOHW			Standard						
Thursday	Period 2							Hours							Period 1			Standard						
Friday	Standard							Standard							Evening			Standard						
Saturday	Standard							OOHW			Standard			OOHW			Standard							
Sunday	Standard							OOHW Period 1							OOHW									
Public Holiday	Standard							Day							Period 2									

5. Construction noise criteria

5.1 Airborne construction noise management levels (NMLs)

The NMLs (which were determined in the REF NVIA based on the noise monitoring results presented in Section 3.3 for residences and are considered still applicable to this project) are summarised in Table 3.

Table 3: Residential and mixed-use receivers noise management levels NMLs - external noise levels

NCA	Standard Hours ^{1,2} dBL _{Aeq} (15min)	Out of Hours – Period 1 Day ^{1,2} dBL _{Aeq} (15min)	Out of Hours – Period 1 Evening ^{1,2} dBL _{Aeq} (15min)	Out of Hours – Period 2 ^{1,2} dBL _{Aeq} (15min)	Highly noise affected
NCA01	49	44	40	35	75
NCA03	49	44	42	39	
NCA04	47	42	40	37	

Notes:

- Construction hours are extracted from Table 1 of the CNVG (Refer to Section 4)
Standard Hours: Monday – Friday 7:00 am – 6:00 pm, Saturday 8:00 am to 1:00 pm.
Out of hour Period 1 Day: Saturday 7:00 am – 8:00 am, 1:00 pm to 6:00 pm, Sunday and Public Holiday 8:00 am to 6:00pm.
Out of hour Period 1 Evening: Monday to Saturday 6:00 pm – 10:00 pm.
Out of hour Period 2: Monday to Friday 10:00 pm to 7:00 am, Saturday 12:00 am to 7:00 am and 10:00 pm to 12:00 am, Sunday and Public holiday 12:00 am– 8:00 am and 6:00 pm to 12:00 am.
- NNMLs are set at RBL + 10 dB for standard hours and OOH background + 5 dB for OOH works in accordance with the ICNG [2]
- Where the RBL is below the minimum background level, the minimum background level is adopted in accordance with the NPfI [4] when determining NMLs.

Table 4: Non-residential receivers noise management levels - external noise levels

Type of receiver	Time period	Noise management level, dBL _{Aeq} (15min)
Active recreation	When in use	65
Commercial	When in use	70
Educational	When in use	55
Health	When in use	55
Industrial	When in use	75
Passive Recreation	When in use	60
Place of Worship	When in use	55

5.2 Ground-borne noise management levels (GBNMLs)

The following ground-borne noise levels from the ICNG [2] for residences indicate when management action should be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

Table 5: Ground-borne Noise Management Levels – internal noise levels – for residential properties

Land use	Period	Ground-borne Noise Management Levels L _{Aeq} (15min)
Residential	Evening (6pm to 10pm)	40 dBA
	Night (10pm to 7am)	35 dBA

5.3 Construction traffic noise criteria

When trucks and other vehicles are operating within the boundaries of the various construction sites, vehicle noise contributions are included in the overall predicted $L_{Aeq(15\text{minute})}$ construction site noise emissions. When construction related traffic moves onto the public road network, traffic generated noise is assessed in accordance with the NSW *Road Noise Policy* (RNP) [5].

When assessing off-site traffic noise generated on an existing road network, an initial screening test is adopted that evaluates whether existing road traffic noise levels are expected to increase by more than 2 dBA due to the additional traffic generated by the Project. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Where noise levels are predicted to increase by more than 2 dBA (i.e. 2.1 dBA or greater) more detailed assessment is required in accordance with the RNP and against the criteria outlined in Table 6 (reproduced from Table 3 of the RNP).

Table 6: Road traffic criteria for traffic generating development – residential receivers

Road category	Type of project / land use	Assessment criteria – dBL_{Aeq}	
		Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
Freeway/ arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	$L_{Aeq,(15\text{ hour})}$ 60 (external)	$L_{Aeq,(9\text{ hour})}$ 55 (external)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1\text{hour})}$ 55 (external)	$L_{Aeq(1\text{hour})}$ 50 (external)

Note: These criteria are for assessment against façade corrected noise levels 1 metre in front of a building façade.

5.4 Sleep disturbance

The ICNG [2] recommends that where construction works occurs during the night-time period, potential of sleep disturbance should be considered. Sleep disturbance relates to both awakenings and disturbance to sleep stages. Current criteria to assess sleep disturbance can be found in the NPfI [4]. The NPfI [4] outlines the following noise trigger levels for assessment of night-time noise levels at residential locations:

- $L_{Aeq,15\text{min}}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- $L_{AF\text{max}}$ 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater

Where these trigger levels are exceeded, a detailed maximum noise level ($L_{A\text{max}}$) event assessment should be undertaken.

For airborne noise, the ICNG night-time NMLs (Refer to Section 5.1) are more stringent than the NPfI sleep disturbance criteria above. Accordingly, assessment of night-time airborne noise emissions against the ICNG L_{Aeq} NMLs are considered sufficient to address potential sleep disturbance for this project.

For ground-borne noise, the ICNG night-time ground-borne noise criteria are specifically intended to protect against sleep disturbance. Therefore, assessment of ground-borne noise impacts against the ICNG ground-borne noise criteria is considered an appropriate basis for addressing potential sleep disturbance from ground-borne noise.

6. Construction noise assessment

6.1 Assessment methodology

The following methodology has been used to assess airborne construction noise:

- Anticipated construction activities and equipment to be used were provided in the REF NVIA and discussed with Sydney Water

Airborne noise assessment

- A noise model was developed using the environmental noise modelling software package SoundPLAN version 9.1 to predict airborne noise impacts at the nearest receivers. The model was used to predict noise levels at the nearest surrounding receiver locations. The model includes:
 - Existing topography
 - Existing building structures
 - Noise sources
 - Noise sensitive receivers. Each floor has been assessed for multi-storey buildings.
 - Ground and air absorption
- ISO 9613-2:2024 [14] was used to predict construction noise levels at the receivers for typical scenarios of construction activity. This includes corrections for screening, topographical effects, atmospheric absorption, and reflective surfaces.
- For each proposed construction scenario, the overall L_{Aeq} of the activity was calculated. The plant and equipment item contributing the highest noise level was identified.
- Predicted noise levels were based on either the loudest individual item of plant and equipment positioned at the worst-case location within the construction area relative to each individual receiver over a 15-minute assessment period, and/or the concurrent operation of plant and equipment distributed across the construction area. Where both approaches were assessed, the maximum predicted noise levels were adopted.
- No noise mitigation measures were included in the assessment.
- Predicted construction noise levels were used to generate building noise exceedance maps to establish if/where noise management levels as defined in Section 5.1 are predicted to be exceeded.
- Exceedances of the criteria are presented in Appendix D as colour coded buildings. The results shown in Appendix D are indicative and present the maximum predicted construction noise level for each building. It should be noted that different floors and facades may be impacted by different levels of construction noise.
- Predicted airborne construction noise exceedances are interpreted with reference to the CNVG [6] receiver perception categories, which relate the magnitude of exceedance above the applicable NMLs to indicative mitigation and management measures. These relationships are summarised in Table 13 and are used to inform the assessment findings and mitigation measures presented later in this report.

Construction noise levels are expected to be transient and will rise and fall at a particular receiver location in accordance with the varying offset distance of the works, the intensity and location of construction activities, the intervening terrain and structure and the type of equipment used. It is unlikely that all construction equipment will be operating at their maximum sound levels

simultaneously. In any given period, typically construction equipment would be used with maximum sound levels for only a brief amount of time and at other times the equipment may emit lower sound levels carrying out activities.

Hence, the assessment methodology above is considered to be conservative.

Ground-borne noise assessment

- Ground-borne noise was assessed for works at Old Northern Road proposed during the evening and night-time periods.
- Ground-borne noise impacts were assessed using an empirical, distance-based screening approach [15] to estimate the extent within which ground-borne noise impacts may occur from the construction activities.
- A ground-borne noise map was prepared to illustrate the indicative extent of potential impacts relative to the proposed works (for works conducted during the evening and night-time periods). The map is provided in Appendix E.

Traffic noise assessment

- A qualitative review of potential noise impacts from construction vehicle movements was undertaken by reviewing the construction areas and relevant information presented in the REF NVIA [1].

Vibration assessment

- Vibration impacts were assessed through review of the proposed construction activities and equipment, with minimum working distance criteria used to establish an indicative buffer zone within which vibration may pose a risk. Vibration maps are provided in Appendix F.

6.2 Construction activities and assessment scenarios

Construction assessment scenarios have been based on construction work methodologies and equipment schedules provided for the proposed construction works and our understanding of the proposal (as described in Section 2). The scenarios are based on construction areas and construction activities in each area.

Equipment sound power levels (L_w) have been sourced from AS2436 [9], CNVG [6], DEFRA [16] and Arup databases.

Assessed construction scenarios for proposed construction works are presented in Section 6.2.1.

6.2.1 Proposed construction works

Table 8 provides a summary of proposed construction works and corresponding work hours. The assessed construction scenarios and the associated equipment and sound power levels informed by Sydney Water and previous construction scenarios assessed in the REF NVIA [1] for those activities are detailed in Table 8.

Table 7: Proposed construction activities and work hours

Works location	Construction Activities	Standard hours works	Out-of-hours works
Old South Head Road	CS06 Excavation and backfill CS07 Material delivery, ancillary facilities CS08 Pipeline drilling CS09 Pipeline welding CS10 Compound	No	Yes (OOHW during period 1 evening and period 2 night)
Diamond Bay	CS04 Road and utilities works CS05 De-watering CS08 Pipeline drilling CS10 Compound	Yes	No
Eastern Reserve	CS01 Excavation CS02 Foundation works CS03 Building works/Equipment installation CS04 Road and utilities works CS05 De-watering CS06 Excavation and backfill CS07 Material delivery, ancillary facilities CS08 Pipeline drilling CS10 Compound	Yes	No

Table 8: Proposed construction works, equipment / plant and Sound Power Levels (SWL)

Plant item	Plant item sound power level, dBLAeq	Penalty, dB	% of use in worst case 15 mins	Excavation CS01 ¹	Foundation works CS02 ¹	Building works/Equipment installation CS03 ¹	Road and utilities works CS04 ¹	De-watering CS05 ¹	Excavation and backfill CS06 ¹	Material delivery, ancillary facilities CS07 ¹	Pipeline drilling (including a Concrete Saw) CS08a ¹	Pipeline drilling (including a rock breaker) CS08b	Pipeline drilling (including a 32t excavator with rock breaker) CS08c	Pipeline welding CS09 ¹	Compound CS10 ¹
Loudest piece of equipment per stage				Rock Breaker	Concrete Agitator Truck	Crane (Truck Mounted)	Truck (Water Cart)	Filtration Unit	Rock Breaker	Crane (Truck Mounted)	Concrete Saw	Rock Breaker	Rock Breaker (32t excavator)	Concrete Agitator Truck	Crane (Truck Mounted)
Loudest equipment, dBLAeq				120	109	108	108	109	120	108	117	120	124	109	108
Filtration Unit	109	0	100					1		1	1	1	1		
Hand Tools (Electric)	110	0	50			1									
Truck (>20 Tonne)	107	0	100		1										
Compactor	106	0	50	1			1		1						
Crane (Truck Mounted)	108	0	100			1				1	1	1	1		1
Rock Breaker	118	5	50	1					1	1		1			
Rock Breaker (32t)	122	5	50										1		
Excavator (25t)	105	0	50	1			1		1	1	1	1		1	1
Excavator (32t)	110	0	50										1		
Generator Attenuated	92	0	100	1	1	1		1		1	1	1	1		1
Lighting - Daymakers	98	0	100												1
Roller (Smooth-drum)	107	0	100				1		1						
Concrete Saw	118	5	25	1					1		1				
Scraper	113	0	25				1								
Concrete Agitator Truck	109	0	100		1					1	1	1	1	1	
Truck (Dump)	110	0	100							1	1	1	1		
Rigid Road Lorry	103	0	25												1
Truck (Road Truck/Truck & Dog)	108	0	25			1	1		1						1
Truck (Vacuum)	109	0	100							1	1	1	1		

Plant item	Plant item sound power level, dBLAeq	Penalty, dB	% of use in worst case 15 mins	Excavation CS01 ¹	Foundation works CS02 ¹	Building works/Equipment installation CS03 ¹	Road and utilities works CS04 ¹	De-watering CS05 ¹	Excavation and backfill CS06 ¹	Material delivery, ancillary facilities CS07 ¹	Pipeline drilling (including a Concrete Saw) CS08a ¹	Pipeline drilling (including a rock breaker) CS08b	Pipeline drilling (including a 32t excavator with rock breaker) CS08c	Pipeline welding CS09 ¹	Compound CS10 ¹
Truck (Water Cart)	108	0	100			1	1		1						1
Welder	110	0	50			1								1	
Trenching Machine (25kW)	105	0	100						1						
Horizontal directional drilling HDD rig/micro-tunnelling	104	0	100							1	1	1	1		
Shaker, de-sander	108	0	100							1	1	1	1		
Mud pump	112	0	100							1	1	1	1		
Total L _{eq} of construction phase				122	111	114	112	109	122	109	121	122	125	112	112

Note 1: Informed by the REF NVIA [1]

6.3 Airborne noise assessment

Construction noise scenarios as presented in Section 6.2 have been utilised to predict construction noise impacts at surrounding receiver locations.

Noise maps have been prepared for each work area, showing predicted exceedances of the applicable NMLs.

The level of exceedance above the NMLs for each assessment scenario for sensitive receivers in each NCA has been presented corresponding to the receiver perception and the mitigation level based on the CNVG [6] as summarised in Table 9. Further details regarding additional mitigation measures triggered by the receiver perception category are presented in Section 8.2.

Table 9: CNVG receiver perception categories triggering additional mitigation measures

Receiver Perception	Standard Hours dB(A) above NML	OOHW Period 2 dB(A) above NML
Noticeable	0	≤5
Clearly audible	≤10	>5 to ≤15
Moderately intrusive	>10 to ≤20	>15 to ≤25
The level of exceedance above the NML Highly intrusive	>20	>25
Highly Noise Affected (HNA)	Predicted noise level ≥75 dB(A)	

6.3.1 Old South Head Road

For the assessment along Old South Head Road (as detailed in Section 2 and Section 6.2.1), two representative construction noise scenarios were modelled.

- The first scenario represents noise impacts from activities involving the loudest item of plant, being the rock breaker (i.e. Activity CS06 and CS08b in Table 8). This scenario is also considered representative of activities involving use of a concrete saw (i.e. Activity CS08a in Table 8), as noise levels associated with the concrete saw use are comparable, albeit marginally lower.
- The second scenario represents other construction activities involving significantly quieter plant and equipment. (i.e. Activity CS07, CS09, CS10 in Table 8)

Noise maps were prepared for each scenario, showing predicted exceedances of the most stringent applicable NMLs (OOHW Period 2). Maps are presented in Appendix D.

The assessment indicates widespread and high exceedances of the applicable NMLs during activities involving the rock breaker or concrete saw, due to high predicted noise levels relative to the low applicable NMLs, as illustrated on the corresponding noise exceedances maps.

During other construction activities that do not involve rock breaking or concrete sawing, the extent and magnitude of predicted exceedances are reduced, although exceedances of the NMLs are still predicted.

Plant and equipment will move progressively within the construction area along the proposed pipeline alignment as works advance. As a result, noise levels experienced at a particular receiver are expected to rise and fall depending on the proximity of the works, as well as the type, intensity,

and location of construction activities at any given time. Noise impacts at individual locations are therefore anticipated to be transient rather than continuous over the full duration of the works.

Notwithstanding this, the assessment indicates that construction noise levels may be significant during certain activities. Accordingly, noise mitigation and management measures, as outlined in Section 8, should be considered.

6.3.2 Diamond Bay

For the assessment in Diamond Bay (as detailed in Section 2 and Section 6.2.1), two representative construction noise scenarios were modelled.

- The first scenario represents noise impacts from activities involving the loudest item of plant, being the 32t rock breaker at the localised areas near the weir and within ■ Kimberley Street site (i.e. Activity CS08c in Table 8).
- The second scenario represents noise impacts from activities involving a 25t rock breaker at the localised areas near the weir and within ■ Kimberley Street site (i.e. Activity CS06 and CS08b in Table 8). This scenario is also considered representative of activities involving use of a concrete saw (i.e. Activity CS08a in Table 8), as noise levels associated with the concrete saw use are comparable, albeit marginally lower.
- The third scenario represents other construction activities involving significantly quieter plant and equipment operating within the wider construction area (i.e. Activity CS07, CS09, CS10 in Table 8).

Noise maps were prepared for each scenario, showing predicted exceedances of the applicable NMLs (Standard Hours). Maps are presented in Appendix D.

The assessment indicates that exceedances of the NMLs are predicted. The highest exceedances are predicted at the building located at ■ Kimberley Street, primarily due to the close proximity of the works. Very high noise levels are predicted during operation of the rock breaker at the ■ Kimberley Street site, resulting in significant exceedances of the relevant NMLs.

Exceedances of the applicable NMLs are also predicted for other construction activities; however, these exceedances are generally of a lower magnitude compared to those associated with rock breaking or concrete sawing activities.

The assessment indicates that construction noise levels may be significant during certain activities. Accordingly, noise mitigation and management measures, as described in Section 8, should be implemented.

6.3.3 Eastern Reserve

For the assessment in Eastern Reserve (as detailed in Section 2 and Section 6.2.1), two representative construction noise scenarios were modelled.

- The first scenario represents noise impacts from activities involving the loudest item of plant, being the rock breaker (i.e. Activity CS01, CS06, CS08b in Table 8). This scenario is also considered representative of activities involving use of a concrete saw (i.e. Activity CS08a in Table 8), as noise levels associated with the concrete saw use are comparable, albeit marginally lower.
- The second scenario represents other construction activities involving significantly quieter plant and equipment. (i.e. Activity CS02, CS03, CS04, CS05, CS07, CS10 in Table 8)

Noise maps were prepared for each scenario, showing predicted exceedances of the applicable NMLs (Standard Hours). Maps are presented in Appendix D.

The assessment indicates that exceedances of the applicable NMLs are predicted, particularly under the first scenario. Noise mitigation and management measure should be implemented, as detailed in Section 8.

6.4 Ground-borne noise assessment

Ground-borne noise (GBN) should be assessed for works conducted during the evening and the night-time period as per Section 5.2.

As outlined in Section 2 and Section 6.2.1, construction works at Old South Head Road may involve open trenching and micro tunnelling during the evening and night periods. The exact location of the micro tunnelling works is currently not confirmed.

Table 10 presents indicative distances, from tunnel to receiver, within which ground-borne noise screening criteria may be exceeded. The predictions have been based on international standards and guidance, however based on propagation under typical geotechnical conditions that should be verified based on the actual plant to be used and site-specific ground conditions. It is also noted that the duration of exposure should be factored into any assessment as tunnelling equipment will not be in any one place for an extended period.

Table 10: Indicative slant distances from tunnel to receiver for compliance with GBNMLs criteria

Plant Item	Slant distance from tunnel to receiver	
	GBNMLs 40 dBL _{Aeq(15min)} Evening	GBNMLs 35 dBL _{Aeq(15min)} Night
Mechanised bored tunnelling works (Tunnel Boring Machine, Horizontal Directional Drilling, Micro-tunnelling)	40 m	50 m

Note: calculation based on TRL document [17] using equation 25

Residences located within 50 m of the pipeline are potentially impacted by tunnelling works during the night -time period.

Alternative accommodation (AA) should be considered where predicted internal ground-borne noise levels exceed the trigger level of 45 dBL_{Aeq(15min)} (Refer to

Table 13 in Section 8.2), which corresponds to an indicative slant distance of approximately 35 m from the construction works.

It is noted that external airborne noise levels are likely to be higher than ground-borne noise levels for the proposed works; however, a ground-borne noise map has been prepared to illustrate the indicative extent of potential ground-borne noise impacts. The map in Appendix E shows the locations at which GBNMLs trigger levels may be exceeded, as well as the distance from the works at which AA may be triggered.

6.5 Construction traffic

The construction of the Project will generate an increase in vehicle movements on the surrounding road network. Additional vehicle movements will potentially be generated by the arrival and departure of construction plant/equipment, material and vehicles including:

- The haulage and delivery of road work materials, and removal of waste to and from the construction zones and between works / ancillary sites;
- The arrival and departure of construction workers at the start and end of each work day/night shift; and
- Potential traffic diversion due to lane closures because of construction works.

The potential for traffic noise levels to meet the 2 dB increase screening criteria and/or the RNP [5] criteria will depend on the access and haulage routes used to access construction sites, the existing traffic travelling on those roads and the traffic generated by the construction works.

Where construction traffic is directed to arterial or collector roads (such as Old South Head Road), any increase in traffic noise is likely to be negligible. On local roads, there is greater potential for impacts, especially during the night period.

Construction traffic noise impacts associated with increased vehicle movements on the road network were assessed in the REF NVIA [1] for works on Kimberley Street and Eastern Avenue. The assessment predicted traffic noise impacts to be below the relevant criteria and therefore negligible.

Traffic noise was also assessed for works near Old South Head Road, where construction vehicles would access the site via Old South Head Road. The assessment identified Old South Head Road as a collector road and confirmed that the applicable criteria were met. As the proposed works have been relocated to Old South Head Road and are expected to generate similar levels of additional construction traffic, traffic noise impacts are anticipated to remain negligible.

6.6 Cumulative impacts

Cumulative impacts within a construction area

While some construction activities within a given construction area may occur concurrently, the assessment adopts a worst-case approach. As such, it is considered unlikely that concurrent activities would result in noise levels exceeding those predicted, or alter the mitigation measures identified.

Cumulative impacts between construction areas

Where works are undertaken concurrently across the three construction areas, cumulative noise impacts at individual residential receivers are not expected to increase materially. This is due to the spatial separation of the construction areas and the fact that each area has been assessed independently on a worst-case basis.

Cumulative impacts from unrelated Project activities

There could be a risk of cumulative acoustic impacts where other construction works unrelated to this Project are being undertaken in the area concurrently. Should other construction works be scheduled simultaneously, the contractor(s) should liaise with other project teams to minimise cumulative noise impacts.

7. Vibration

7.1 Criteria

The effect of vibration in buildings can be divided into three main categories:

1. **Human perception of vibration:** when the occupants or users of the building are potentially disturbed by vibration. Relevant guidance is provided in NSW *Assessing Vibration: a technical guideline* [3]. This document is based on BS 6472:1992 [11].
2. **Effects on building contents:** People can perceive floor vibration at levels well below those likely to cause damage to typical building contents. However, some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort. Where appropriate, objectives for the satisfactory operation of critical instruments or manufacturing processes should be sourced from manufacturer's data and/or other published objectives [18, 19, 20, 21].

No receivers have been identified as containing any sensitive equipment. This may require review following the consultation process.

3. **Effects of vibration on structures:** A level of vibration where the integrity of the building or the structure itself may be affected, ranging from cosmetic to major structural damage. The relevant criteria are typically well above the level of vibration which people may consider intrusive. Guidance may be found in AS 2187:Part 2 [22], BS 7385 Part 2 [12], DIN 4150 Part 3 [13], and Sydney Water Specialist Engineering Assessment Procedure [23] which also has criteria of particular reference for heritage structures and buried pipework. DIN 4150 Part 3 [13] is generally recognised to be conservative and is often referred to for the purpose of assessing structurally sensitive buildings.

Heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound and should otherwise be assessed in accordance with BS7385 Part 2 [12]. No heritage areas and structures as per the NSW State Heritage Inventory have been identified in the study area.

4. **Effects on buried services and Sydney Water assets:** Guidance is provided in DIN 4150-2:2016 for vibration effects on buried pipework.

Sydney Water specifies vibration limits for Sydney Water assets based on the asset type (as per the Sydney Water Specialist Engineering Assessment Procedure [23]). The susceptibility of Sydney Water assets to vibration damage depends on a range of factors including the nature of the ground, the geometry, materials and condition of the structure, the nature of the vibrations and their proximity to the structure and whether they are long acting or intermittent.

Vibration criteria are described further in Appendix C.

7.2 Vibration assessment

The minimum working distances in Table 14 provide an indication of the possibility of impact on nearby receivers due to vibration generating plant and equipment. The minimum working distances are indicative only and will vary depending on the item of plant and local geotechnical conditions. Notwithstanding, if receivers were to be located within the recommended minimum distance for cosmetic damage, mitigation measures should be implemented.

Details of exact construction plant/equipment items and locations are yet to be finalised, however a preliminary screening assessment has been undertaken for cosmetic damage and human comfort based on the following equipment:

- Roller (<200 kN; ~4 to 6t)
- Large hydraulic hammer (1600kg; 18-34t excavator)
- Mechanised bored tunnelling plant (Trenchless techniques)
- Compactor

The screening assessment is presented graphically in Appendix F.

Review of the sites indicates that some nearby sensitive receivers may fall within minimum working distances and be at risk of cosmetic damage and human discomfort; therefore, vibration mitigation measures described in Section 8 should be considered and implemented where relevant.

8. Mitigation and management measures

It should be emphasised that the Construction Contractor(s) will have a key role in managing potential noise and vibration impacts during the works and should review and implement the following noise mitigation and management measures in Table 11 and Table 12 below where feasible and reasonable. The mitigation measures in Table 11 are Sydney Water safeguards. The mitigation measures in Table 12 presents the specific construction noise and vibration and management measures for the project.

Table 12 are Project specific construction noise mitigation and management measures.

Prior to the start of the works mitigation measures to reduce noise and vibration impacts are to be reviewed.

8.1 Sydney Water Safeguards

Table 11: Construction noise mitigation and management measures – Sydney Water Safeguards

Noise and vibration	
8.1	<p>Works must comply with Interim Construction Noise Guideline (ICNG) [2], including scheduling work and deliveries during standard daytime working hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday. No work to be scheduled on Sunday nights or public holidays. Any proposed work outside of standards hours of construction must be justified.</p> <p>The Proposal will also be carried out in accordance with:</p> <ul style="list-style-type: none"> • Sydney Water's Noise Management Procedure SWEMS0056 which outlines the behaviours required to minimise noise impacts on the community when working outside standard hours and on public holidays <p>All reasonable and feasible noise mitigation measures should be justified, documented and implemented on-site to mitigate noise impacts.</p> <p>Work may sometimes need to be scheduled outside of standard hours in certain situations, including:</p> <ul style="list-style-type: none"> • delivery of oversized equipment / structures • where an ROL is required for an activity impacting on traffic flow • emergency work to protect human health or avoid loss of life or damage to property • maintenance and repair of public infrastructure where disruption to essential services (such as water/ sewer) require work out of hours • any other work which can be justified (work schedule, convenience or cost are not considered sufficient justification) <p>If justified, the following hierarchy should be implemented for out of (standard) hours works (OOHW) (from most to least preferable, in accordance with the ICNG [2] and CNVG [6]):</p> <ul style="list-style-type: none"> • Saturday afternoons (1pm to 5pm) • Sunday daytime (8am to 6pm) • weekday evening periods (6pm to 10pm) • weekday nights (10pm to 7am) • all other times (eg Sunday night)
8.2	<p>Incorporate standard daytime hours noise management safeguards into the CEMP, including but not limited to:</p> <ul style="list-style-type: none"> • identify and consult with the potentially affected residents prior to the commencement: <ul style="list-style-type: none"> – describe the nature of works; the expected noise impacts; approved hours of work; duration, complaints handling and contact details. – determine need for, and appropriate timing of respite periods (eg times identified by the community that are less sensitive to noise such as mid-morning or mid-afternoon for works near residences) • implement a noise complaint handling procedure (Guidance regarding noise and vibration complaints management process is included in Section 8.3 • plant or machinery will not be permitted to warm-up near residential dwellings before the nominated working hours • appropriate plant will be selected for each task, to minimise the noise impact (eg all stationary and mobile plant will be fitted with residential type silencers) • engine brakes will not be used when entering or leaving the work site(s) or within work areas • regularly inspect and maintain equipment in good working order

Noise and vibration	
	<ul style="list-style-type: none"> • arrange work sites where possible to minimise noise (eg generators away from sensitive receivers, site set up to minimise use of vehicle reversing alarms, site amenities and/ or entrances away from noise sensitive receivers) • use natural landforms/ mounds or site sheds as noise barriers • schedule noisy activities around times of surrounding high background noise (local road traffic or when other noise sources are active)
8.3	<p>As/if works beyond standard daytime hours are needed, the Contractor(s) would:</p> <ul style="list-style-type: none"> • justify the need for out of hours work (OOHW) and why it is not possible to carry out the works during standard daytime hours • consider potential noise impacts and: implement the relevant standard daytime hours safeguards; Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and document in the CEMP all reasonable and feasible management measures to be implemented • identify additional community notification requirements and outcomes of targeted community consultation • seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives. <p>SWEMS0056.01 suggests some additional safeguards such as:</p> <ul style="list-style-type: none"> • truck radios (commercial) switched off upon arrival at site • truck CB radios used with the truck cabin doors closed • extra care taken while loading or unloading trucks • no unnecessary loud voices (eg using CB radios, mobile phones or conversing).
8.4	<p>As/if night works are needed, the Contractor(s) would:</p> <ul style="list-style-type: none"> • justify the need for night works • consider potential noise impacts and implement the relevant standard daytime and out of hours safeguards and document consideration of all reasonable and feasible management measures into the CEMP. • identify community notification requirements (ie for scheduled night work (not emergency works)), • notify all potentially impacted residents and sensitive noise receivers not less than one week prior to commencing night work. • seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.
8.5	<p>As/if works on Sundays or public holidays are required, the Contractor(s) would:</p> <ul style="list-style-type: none"> • justify why all other times are not feasible • consider potential noise impacts and, implement relevant standard daytime, out of hours and night-time safeguards and other reasonable and feasible management measures • identify community notification requirements • seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives. <p>Noise and vibration management safeguards for those works should be documented into the CEMP.</p>
8.6	Conduct a dilapidation survey / asset condition assessment prior to works which have potential to damage existing structures.
8.7	Monitor compliance with the recommended vibration levels in DIN 4150-3 2016: <i>Structural Vibration – Part 3; Effects of vibration on structures for heritage buildings and other potentially at-risk structures</i> [13] following confirmation by the contractor(s) prior to start of any works of the sensitivity of those buildings/structures.
8.8	Consider less vibration intensive methodologies where practicable and use only the necessary sized and powered equipment.

8.2 Project specific noise and vibration mitigation and management measures

Table 12 presents the specific construction noise and vibration and management measures for the project.

Table 12: Project specific construction noise and vibration mitigation and management measures

Item	Detail
Construction noise and vibration management plan (CNVMP)	<p>A Construction Noise and Vibration Management Plan (CNVMP) and/or Construction Environmental Management Plan (CEMP) shall be prepared. This will specify the actual plant to be used and will include updated estimates of the likely levels of noise and the scheduling of activities.</p> <p>The CNVMP/CEMP should include but not be limited to the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities • Noise and vibration sensitive receiver locations and structures • Identify works that have the potential to cause impact, accompanied by an appropriate assessment (predictive assessment or risk evaluation) • Mitigation and management strategy • Monitoring methodology (as relevant) • Community engagement strategy.
Non-tonal and ambient sensitive reversing alarms	<p>Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.</p>
Staffing	<ul style="list-style-type: none"> • Appoint a named member of the site staff who will act as the Responsible Person with respect to noise and vibration; • Site managers to periodically check the site and subjectively assess emissions to nearby receivers to proactively manage works. • All employees, contractors, and subcontractors to receive an environmental induction which should include: <ul style="list-style-type: none"> – Standard noise and vibration mitigation measures – Permissible hours of work – Limitations on high noise and vibration generating activities – Location of nearest sensitive receivers • Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise, including driving on local roads; • Ensure good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable; • Avoid the use of radios or stereos outdoors; and • Avoid shouting and minimise talking loudly and slamming vehicle doors.
Equipment location/site planning/Temporary screen and shed	<p>General recommended provisions which should be implemented initially include:</p> <ul style="list-style-type: none"> • Situate noisy equipment away from noise-sensitive areas. • Consideration should be given to the installation of onsite barriers such as hoardings or temporary screens at any specific locations where necessary to provide attenuation between particularly noisy construction works and nearby sensitive receptors. Type of screens could include noise curtains or hoarding (plywood board, panels of steel sheeting or compressed fibre cement board). This mitigation measure should be considered as a minimum, and wherever practicable, for noisy works in areas where sensitive receivers are predicted to be highly affected for extended periods of time. • Noise screens should be considered, where feasible, during trenching works and activities involving high-noise plant and equipment (such as rock breakers and concrete saws), particularly during Out-of-Hours Works (OOHW) periods along Old South Head Road. To maximise noise reduction, screens should be located as close as practicable to the noise source. • In Diamond Bay, noise screens should also be considered where works are undertaken near the manhole connection point. While screening may be less effective for upper-level receivers, screens are still expected to provide a degree of noise reduction for lower-level. Noise screens should also be considered around the large construction area and compound area (to minimise impacts to receivers behind Kimberley Street). • Noise screens should be considered around the construction area in Eastern Reserve.

Item	Detail
Plant and equipment	<ul style="list-style-type: none"> • Use quieter construction methods where feasible and reasonable. • Examine and implement, if feasible and reasonable, alternatives to rock-breaking work methods, such as chemical rock and concrete splitting for works at ■ Kimberley Street and the Old South Head Road. • Use only the necessary size and power of equipment • All plant and equipment used on site must be: <ul style="list-style-type: none"> – maintained in a proper and efficient condition; and – operated in a proper and efficient manner. • Turn off all plant and equipment when not in use • Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable. • Where vibration from tunnelling activities are considered excessive, the tunnelling operations could be operated at a slower speed. Note that a slower operation of the tunnelling operations may result in an increase of duration of works and should be considered in conjunction with community views to complete works in shorter duration.
Traffic and loading areas	<ul style="list-style-type: none"> • Plan traffic flow, parking and loading/unloading areas to minimise reversing movements and idling traffic within the site and before entering site. • Route heavy vehicle movements on major arterial roads and highways away from noise sensitive areas where possible. • Provide driver training to minimise loud noise generating vehicle behaviour and to avoid engine compression braking near sensitive receivers.
Silencers on mobile plant	<ul style="list-style-type: none"> • Where possible, noise from mobile plant should be reduced through the use of additional noise-control fittings, including residential-grade mufflers and damped hammers (such as “City” model rammer hammers). These measures are applicable across all construction activities and are particularly important during night-time and OOHW at Old South Head Road, where the use of silencers and other noise-reduction fittings should be prioritised.
Rental plant and equipment	<ul style="list-style-type: none"> • The noise levels of plant and equipment items are to be considered in rental decisions
Vibration monitoring	<ul style="list-style-type: none"> • Vibration monitoring should be conducted at the commencement of vibration generating activities that are proposed within the minimum working distances (Refer to Section 7.2 and 8.4.1)
Structural surveys (dilapidation surveys)	<ul style="list-style-type: none"> • Select equipment to minimise vibration. Where nearby buildings/structures are located within the safe working distance, pre-construction surveys and/or minimum work distance trials should be conducted as per Section 8.1 and Section 8.4. • The findings of the survey may require amendment to proposed vibration criteria or management measures and therefore should be undertaken in suitable advance of the start date. • The sensitivity of potentially at-risk structures is subject to confirmation by the contractor prior to start of any works.
Building and buried services (and Sydney Water assets) condition surveys	<ul style="list-style-type: none"> • Structures should be considered in the Construction Noise and Vibration Management Plan (CNVMP). Property surveys (or dilapidation surveys) should be conducted before start of construction works where it has been established that the property, structure or utility is at risk of damage during the construction work. • This could be where a property, structure, utility or Sydney Water asset is located within the minimum working distance for example (refer to Section 8.4). The survey findings could require amendment to proposed vibration criteria or management measures and therefore should be undertaken in suitable advance of when the works start. • Where Sydney Water assets are located within minimum working distances risking exceedance of Sydney Water threshold vibration limits further asset protection measures may be applicable as per the Sydney Water Specialist Engineering Assessment procedure [23]. Further details on Sydney Water vibration limits are provided in Appendix C.3.4.

Item	Detail
Additional measures, dependent on predicted noise impacts / exceedances (With reference to Table 13)	
Community consultation – process (PN; SN)	<p>Community consultation should occur prior to, and during works as follows:</p> <ul style="list-style-type: none"> • Notify affected stakeholders (through methods such as letterbox drops, individual briefings or phone calls) of upcoming works with details of what the works will entail (such as the works purpose, duration, expected impacts and mitigation measures, complaints procedure, who is responsible for undertaking the works) • Notification should be as specific as practicable regarding nature and timing of works and any scheduled respite periods • Discuss with affected receivers about any atypical sensitivities and review how scheduling of activities and other mitigation measures may aid to minimise impacts <ul style="list-style-type: none"> – (affected receivers = receivers mapped as experiencing non-compliant noise impacts) – (atypical sensitivities = such as vibration sensitive equipment/processes in medical establishments, exam periods or school holidays for education establishments) • Establish long-term personnel or processes (e.g. project email, phone number) to centralise project enquiries • Periodic notification (PN) should be sent out to the community at a reasonable frequency for all impacted receivers to provide information on the proposed construction schedule and mitigation measures to be implemented to minimise the potential impacts. Impacted receivers have been identified up to approximately 500 metres of the construction impact area. Notifications should be sent a minimum of seven (7) days prior to start of works. • Follow the complaints management process in section 8.3 of this report for any complaints, including complaints registers and standard response times.
Community consultation – assessment (DR; RO; RP)	<ul style="list-style-type: none"> • Project-specific mitigation measures will be determined based on a reasonable and feasible assessment performed by suitably qualified project representatives (eg community and stakeholder, project management, environment) and refined through community feedback. • Community views should be taken into consideration when offering respite periods (RO and RP). <ul style="list-style-type: none"> – It may be considered beneficial to increase the number of work shifts to allow for a duration reduction (DR). – Respite periods when scheduling work <ul style="list-style-type: none"> Example includes: <ul style="list-style-type: none"> – scheduling the highest noise generating activities during the least sensitive times, where practicable, – conducting activities in blocks of up to three hours – Implementing cut-off times for particularly noisy works, such as scheduling the use of rock breakers and concrete saws to occur before 10:00 pm or 11:00 pm for works along Old South Head Road.
Noise monitoring (V)	<ul style="list-style-type: none"> • Short-term attended measurements should be conducted in response of a complaint and to confirm alignment with predicted noise levels in the impact assessment and management measures.
Alternative accommodation (AA)	<ul style="list-style-type: none"> • Applies only to residential receivers for works proposed during the late night and early morning time periods. Where practicable, high-noise activities such as rock breaking and concrete sawing should be scheduled to occur earlier in the night (e.g. before 10:00 pm or 11:00 pm). The need for alternative accommodation should be reviewed further and may be considered on a case-by-case basis under exceptional circumstances.

Table 13: Indicative additional airborne management measures

Construction hours	Receiver perception	Above NML	Management Measures ¹
Airborne			
Standard Hours Mon – Fri: 7am-6pm Sat: 8am-1pm	Noticeable	0	-
	Clearly audible	≤10	-
	Moderately intrusive	>10 to ≤20	PN, V
	Highly intrusive	>20	PN, V
OOHW Period 1 Mon-Fri: 6pm-10pm Sat: 7am-8am & 1pm-10pm Sun/PH: 8am-6pm	Noticeable	≤5	-
	Clearly audible	>5 to ≤15	PN, RP, DR
	Moderately intrusive	>15 to ≤25	PN, V, SN, RO, RP, DR
	Highly intrusive	>25	PN, V, SN, RO, RP, DR
OOHW Period 2 Mon-Sat: 12am-7am & 10pm-12am Sun/PH: 12am-8am & 6pm-12am	Noticeable	≤5	PN
	Clearly audible	>5 to ≤15	PN, V, SN, RO, RP, DR
	Moderately intrusive	>15 to ≤25	PN, V, SN, RO, RP, DR
	Highly intrusive	>25	PN, V, SN, RO, RP, DR, AA
All periods	High noise affected (75 dBA or greater)	≥ 75 dBA	PN, V, SN
Ground-borne		Above GNML	
OOHW Period 2 Mon-Sat: 12am-7am & 10pm-12am Sun/PH: 12am-8am & 6pm-12am	Noticeable		-
	Clearly audible	≤10	PN, V, SN
	Moderately intrusive	>10 to 20	PN, V, SN, RP, DR, AA
	Highly intrusive	> 20	PN, V, SN, RP, DR, AA

Notes:

- | | |
|-------------------------------------|---|
| 1. PN = Periodic notification; | SN = Specific notification, individual briefings or phone calls |
| V = Verification monitoring | DR = Duration reduction |
| RO = Project specific respite offer | RP = Respite period |
| AA = Alternative accommodation | |

8.3 Complaint management

Complaints handling should be performed in accordance with Sydney Water’s Complaints Handling Process and Sydney Water’s Stakeholder Engagement Policy.

Noise or vibration complaints, once received, will be recorded in complaints register. Information recorded will include:

- the name and address of the complainant (if provided);
- the time and date the complaint was received;
- the nature of the complaint and the time and date the noise was heard;
- the name of the employee who received the complaint;
- actions taken to investigate the complaint, and a summary of the results of the investigation;
- required remedial action, if required;
- validation of the remedial action; and
- summary of feedback to the complainant.

All complaints received will be fully investigated and reported to management. The complainant will also be notified of the results and actions arising from the investigation.

The investigation of a complaint will involve where applicable:

- noise or vibration measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise or vibration is being emitted by equipment; and
- whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise or vibration, the cause is to be rectified as soon as possible.

Site investigation, site inspection and /or measurements may be used to validate the results of any corrective actions arising from a complaint where applicable.

Further guidance regarding noise and vibration complaints management process is included in Appendix G.

8.4 Vibration – minimum working distances

As a guide, the recommended minimum working distances for vibration intensive plant in Table 14 (derived from Table 20 of the CNVG [6]) provide an indication of the possibility of impact due to vibration generating plant and equipment onto nearby sensitive receivers. While the minimum working distances are indicative only and will vary depending on the item of plant and local geotechnical conditions, if a receiver is located within the minimum working distance, vibration monitoring may be required, and equipment selection and/or method of construction should be reviewed.

Vibration minimum work distance trials may be undertaken to establish new minimum working distances specifically for the proposed work activity/equipment at a particular receiver location where ground conditions may vary.

For residential receivers, it is anticipated that the minimum working distance for cosmetic damage corresponding to BS 7385 – Line 2 criteria would apply.

Should heritage buildings and other potentially at-risk structures be identified as being more sensitive to vibration, the minimum working distance for cosmetic damage corresponding to DIN 4150 criteria would apply.

Table 14: Recommended minimum working distances for vibration generating plant

Plant Item	Rating / Description	Minimum working distance (m)			
		Cosmetic damage			Human response – disturbance to building occupants [3]
		BS 7385 – Line 1 ¹	BS 7385 – Line 2 ²	DIN 4150 ³	
Small Hydraulic Hammer	300 kg – 5 to 12t excavator	1 m	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg – 12 to 18t excavator	3 m	7 m	15 m	23 m
Large Hydraulic Hammer	1600 kg- 18 to 34t excavator	9 m	22 m	44 m	73 m
Piling – Vibratory	Sheet piles	9 m	22 m	44 m	73 m

Plant Item	Rating / Description	Minimum working distance (m)			
		Cosmetic damage			Human response – disturbance to building occupants [3]
		BS 7385 – Line 1 ¹	BS 7385 – Line 2 ²	DIN 4150 ³	
Piling – Bored	≤ 800 mm	1 m (nominal)	2 m	5 m	10 m
Vibratory roller	< 50 kN (~ 1 to 2t)	2 m	5 m	11 m	15 m to 20 m
	< 100 kN (~ 2 to 4t)	2 m	6 m	13 m	20 m
	< 200 kN (~ 4 to 6t)	5 m	12 m	26 m	40 m
	< 300 kN (~ 7 to 13t)	6 m	15 m	31 m	100 m
	> 300 kN (~ 13 to 18t)	8 m	20 m	40 m	100 m
	> 300 kN (> 18t)	10 m	25 m	50 m	100 m
Compactor ⁴	Jumping Jack and plate compactor	3 m	5 m	9 m	55 m
Jackhammer	Hand-held	1 m (nominal)	1 m (nominal)	3 m	5 m
Mechanised bored tunnelling works (Tunnel Boring Machine, Horizontal Directional Drilling, Micro-tunnelling) ⁵	-	5 m	12 m	21 m	40 m

Notes:

1. Refer to Table 19 Line 1. Minimum working distance based screening criterion of 25 mm/s as per Section D.3. Type of structure: Reinforced or framed structures, Industrial and heavy commercial buildings.
2. Refer to Table 19 Line 2. Minimum working distance based screening criterion of 7.5 mm/s as per Section D.3. Type of structure: Unreinforced of light framed structures, residential or light commercial type buildings.
3. Refer to Table 20 Line 3. Minimum working distance based on screening criterion of 3 mm/s as per Section D.3. Type of structure: Structures that because of their particular sensitivity to vibration, cannot be classified under:
 - buildings used for commercial purposes, industrial buildings and buildings of similar design or
 - residential buildings and buildings of similar design and/or occupancy and are of great intrinsic value (e.g. listed buildings under a preservation order)
4. Based on data for previous project.
5. Based on TRL document [15] using Godio et al formula, equation 24.

8.4.1 Monitoring

Attended vibration measurements would be required at the commencement of vibration generating activities that are proposed within the minimum working distances, identified in Section 7.

Where works are at risk of exceeding criteria, long-term monitoring would be required. The monitors should provide ‘real-time’ alerts when vibration criteria are exceeded.

An exceedance of the vibration criterion may necessitate a change in work method. This could include:

- Re-evaluation of the vibration criterion based on results of the initial condition investigation and inspections of the structure following the commencement of works.
- Maintain vibration monitoring throughout works within ‘minimum working distances’.
- Reduce the size of demolition and construction equipment and develop alternative methodologies to minimise vibration.
- Use less vibration emitting demolition methods if necessary closer to the sensitive building or structure

- Reduction of tunnelling operation speed
- Balance variable speed vibrating plant and operate at speeds that do not produce resonance.

9. Conclusion

This Construction Noise and Vibration Impact Assessment has assessed the potential airborne noise, ground-borne noise and vibration impacts associated with the proposed construction works for the Refresh Vacluse Diamond Bay Project design changes at Old South Head Road, Diamond Bay and Eastern Reserve.

The assessment has identified nearby sensitive receivers that may be affected by construction activities and has evaluated predicted noise and vibration impacts against the applicable Noise Management Levels and vibration criteria established in the REF, and in accordance with relevant NSW policies and guidelines. The assessment indicates that exceedances of the applicable construction noise criteria are predicted during certain activities, particularly those involving high-noise plant such as rock breakers and concrete saws. Ground-borne noise impacts may also occur during evening and night-time tunnelling works in proximity to residential receivers associated with works at Old South Head Road.

Construction noise and vibration impacts are expected to be temporary and transient, varying as works progress and plant and equipment move within the construction areas. Nevertheless, where exceedances are predicted, mitigation and management measures are required to minimise potential impacts on nearby receivers. A suite of feasible and reasonable mitigation and management measures has been identified in this report, informed by the magnitude of predicted exceedances and relevant receiver perception categories.

Provided that the recommended mitigation and management measures are implemented and incorporated into the Construction Noise and Vibration Management Plan, the potential noise and vibration impacts associated with the proposed works are considered manageable.

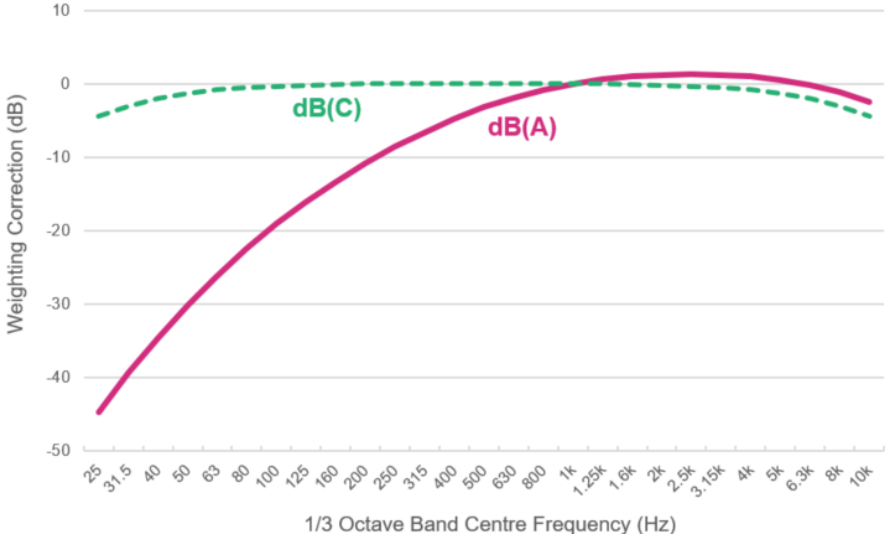
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- [7] Standards Australia, “AS 1055 Acoustics—Description and measurement of environmental noise,” Standards Australia, Sydney, 2018.
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Appendix A

Acoustic glossary

Term	Definition
Ambient noise level	The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a building is being investigated, the ambient noise level is the noise level from all other sources without the fan operating, such as traffic, birds, people talking and other noise from other buildings.
Background noise level	<p>The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.</p> <p>Assessment Background Level (ABL): A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.</p> <p>Rating Background Level (RBL / $\min L_{A90,1\text{hour}}$): A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.</p>
Decibel (dB)	<p>The logarithmic scale used to measure sound and vibration.</p> <p>Human hearing is not linear and involves hearing over a large range of sound pressures, which would be challenging to present on a linear scale. A logarithmic scale allows all sound levels to be expressed based on how loud they are relative to a reference sound (typically 20 μPa, which is the approximate human threshold of hearing). For sound in other media (e.g. underwater noise) a different reference level (1 μPa) is used instead.</p> <p>An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.</p>
dB weighting curves	<p>The frequency of a sound affects its perceived loudness and human hearing is less sensitive at low and very high frequencies. When seeking to represent the summation of sound pressure levels across the frequency range of human hearing into a single number, weighting is typically applied. Most commonly, A-weighting, denoted as dB(A), is used for environmental noise assessment. This is often supplemented by the linear or C-weighting curves, where there is the potential for excess low-frequency sound at higher sound pressure levels.</p> 
dB(A)	dB(A) denotes a single-number sound pressure level that includes a frequency weighting ('A-weighting') to reflect the subjective loudness of the sound level.

Term	Definition
	The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).
dB_{peak}	The peak value is the maximum amplitude identified during a measurement period.
dB_{rms}	The root mean squared (rms) value takes into account both time history variation and energy content. The rms value is typically equal to 0.707 (1/√2) times the peak value
Frequency	<p>Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as ‘pitch’. Sounds towards the lower end of the human hearing frequency range are perceived as ‘bass’ or ‘low-pitched’ and sounds with a higher frequency are perceived as ‘treble’ or ‘high pitched’.</p> <p>The unit of frequency is the hertz (Hz), which is identical to cycles per second. A thousand Hz is generally denoted as kHz. Human hearing ranges approximately from 20 Hz to 20 kHz.</p> <p>While single weighted sound pressure levels simplify the assessment and evaluation of sound levels, frequency analysis is often undertaken. ‘Octave bands’, either 1/1 or 1/3 octave bands are most commonly utilised and are referred to by the nominal centre frequency of the band (e.g. 31.5 Hz), while being the summation of all frequencies between a defined lower and upper frequency.</p>
L₁(period)	The sound level exceeded for 1% of the measurement period. For example, 65 dB _{L_{A1,1min}} indicates that the A-weighted sound level would not exceed 65 dB for more than 0.6 seconds in the 1-minute measurement period.
L₁₀(period)	The sound level exceeded for 10% of the measurement period, or alternatively, the sound levels would be lower for 90% of the time. The L ₁₀ is often defined as the ‘average maximum’ sound levels, as in AS1055-2018 with the advent of statistical sound level meters.
L₉₀(period)	The sound level exceeded for 90% of the measurement period. The L ₉₀ is often defined as the ‘average minimum’ or ‘background’ noise level for a period of measurement. For example, 45 dB _{L_{A90,15min}} indicates that the sound level is higher than 45 dB(A) for 90% of the 15-minute measurement period.
L_{eq}(period)	The equivalent (‘eq’) continuous sound level, used to describe the level of a time-varying sound or vibration measurement. The L _{eq} is often defined as the ‘average’ level, and mathematically, is the energy-average level over a measurement period – i.e. the level of a constant sound that contains the same sound energy as the measured sound.
L_{max}	The L _{max} is the ‘absolute maximum’ level of a sound or vibration recorded over the measurement period. As the L _{max} is often caused by an instantaneous event, it can vary significantly between measurements.
Noise Management Level (NML)	Construction noise management levels (NMLs) are noise levels determined in accordance with the Interim Construction Noise Guideline (ICNG). The NML are noise levels above which all ‘feasible and reasonable’ work practices should be applied to minimise the construction noise

Term	Definition
	impact. The ICNG works on the principle of a ‘screening’ criterion – if predicted or measured construction noise exceeds the NMLs levels then the construction activity must implement all ‘feasible and reasonable’ work practices to reduce noise levels.
Peak Particle Velocity (PPV)	The highest velocity of a particle (such as part of a building structure) as it vibrates. PPV is commonly used as a vibration criteria, and is often interpreted as a PPV based on the L_{max} or $L_{max,spec}$ index.
Sound Power and Sound Pressure	<p>The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of the environment and distance from a source.</p> <p>The sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.</p>
Structureborne noise	The transmission of noise energy as vibration of building elements. The energy may then be re-radiated as airborne noise. Structureborne noise is controlled by structural discontinuities, i.e. expansion joints and floating floors.
Vibration	<p>Waves in a solid material are called ‘vibration’, as opposed to similar waves in air, which are called ‘sound’ or ‘noise’. If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage.</p> <p>A vibrating structure (e.g. a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structureborne vibration limits are sometimes set to control the noise level in a space.</p> <p>Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for structureborne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s²) or else using a decibel scale.</p>

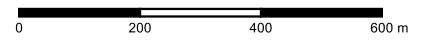
Appendix B

Sensitive receivers, land uses, NCAs, noise monitoring locations and construction areas



- ### Legend
- Assessment Area
 - Noise Catchment Area
 - Construction area
 - Noise Monitoring Locations

- ### Buildings
- Commercial
 - Educational institute
 - Industrial
 - Passive recreation
 - Place of worship
 - Residential



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Client
Sydney Water Corporation

Project Name
Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

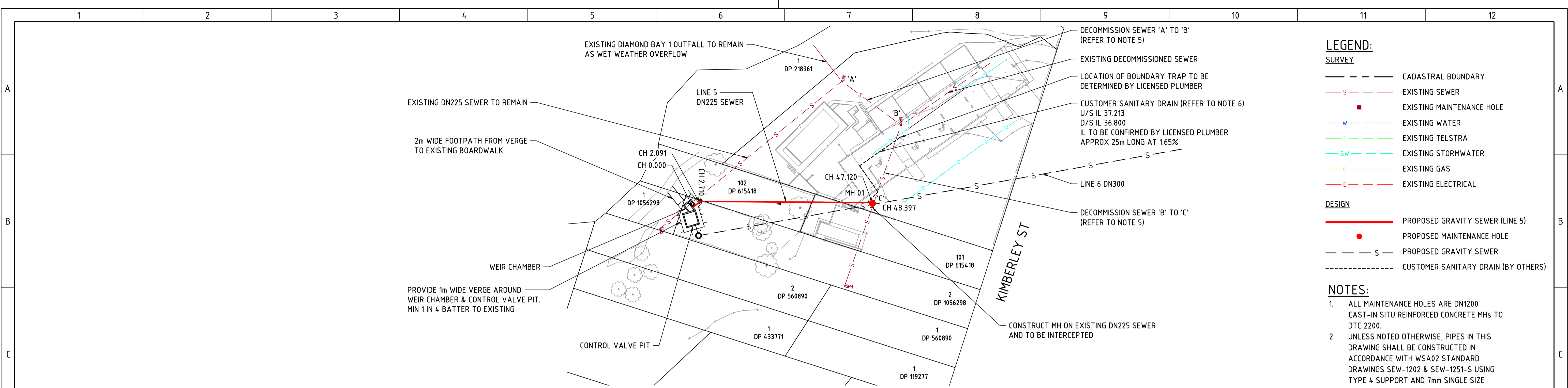
Project Number 269901-00	Rev 1
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Drawing Title
Sensitive receivers, land uses, NCAs and noise monitoring locations

Old South Head Road construction area

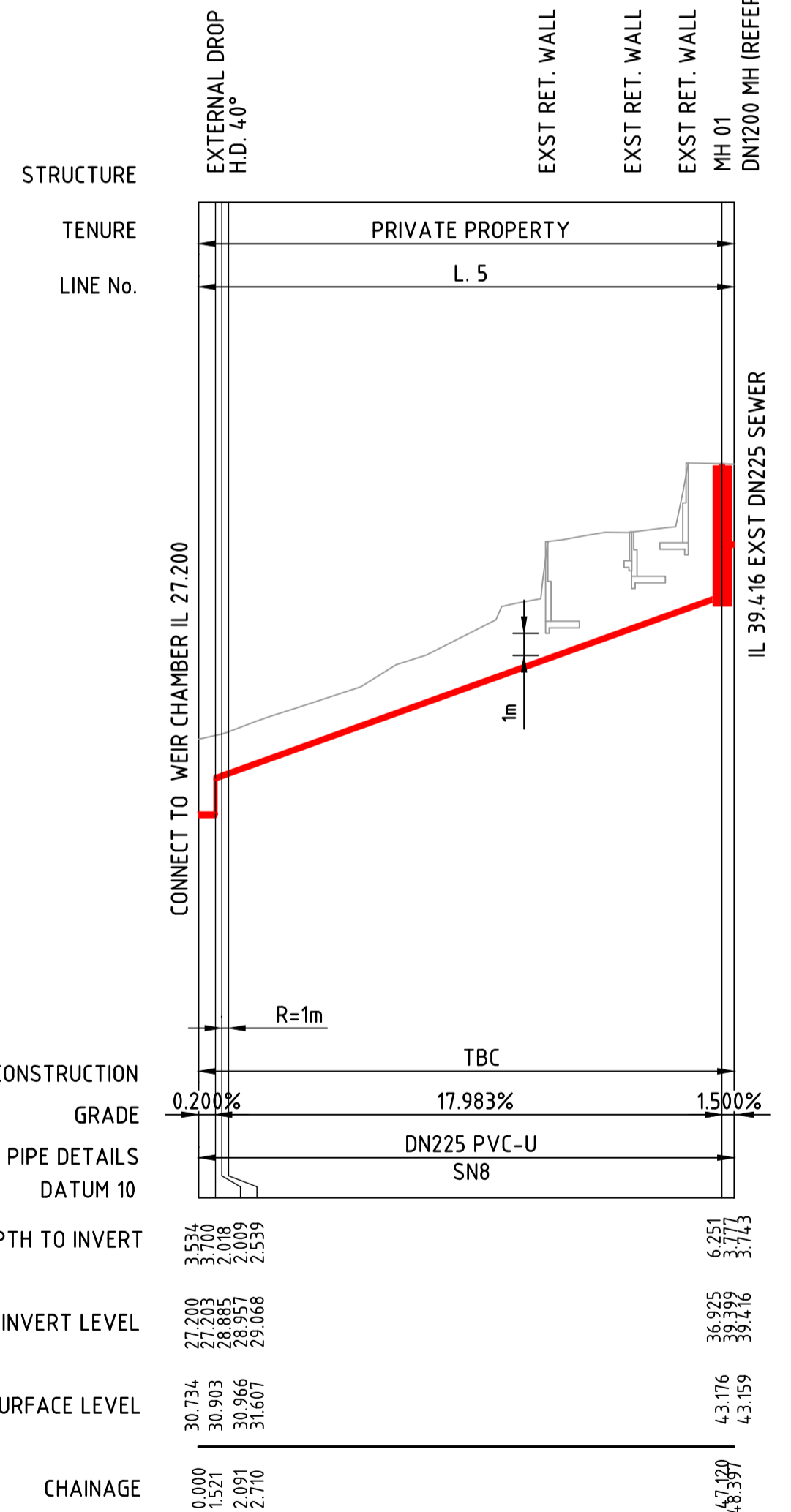
Diamond Bay construction area

Eastern Reserve construction area



PLAN

SCALE 1:500



LONGITUDINAL SECTION - LINE 5

SCALE 1:500 (HORZ, 1:250 (VERT))

NOT FOR CONSTRUCTION

VERTICAL 1:250 AT ORIGINAL SIZE HORIZONTAL 1:500 AT ORIGINAL SIZE 		<p>GHD PTY LTD ABN: 39 008 488 373 L15, 133 CASTLEREAGH ST, SYDNEY NSW 2000 EMAIL: sydnin@ghd.com PHONE: 1021 9239 7100</p>	DESIGNED M. LINGARD <small>GHD</small> 24.09.25	DRAWN N. URRIZA <small>GHD</small> 24.09.25	VERIFIED <small>GHD</small>	APPROVED <small>GHD</small>	1 ISSUED FOR 80% DETAILED DESIGN	PE 24.09.25	APP'D DATE	COPYRIGHT THIS DESIGN IS NOT TO BE COPIED OR AMENDED WITHOUT WRITTEN PERMISSION FROM SYDNEY WATER 	THIS DRAWING SUPERSEDES RECOMMENDED SYDNEY WATER ACCEPTED CLIENT SYDNEY WATER	REFRESH VAUCLUSE DIAMOND BAY INDEX 601 DIAMOND BAY GRAVITY SEWERS - LINE 5 PLAN AND LONG SECTION		DRAWING No. INDEX601 2040	
			A1 PROJ No. 20035188 DRAWING STATUS: PRELIMINARY									DRAFT SHEET No. 1			

Appendix C

Vibration criteria

C.1 Disturbance to building occupant

Potential vibration disturbance to human occupants of buildings is made in accordance with the NSW DEC *Assessing Vibration; a technical guideline* [3]. The criteria outlined in the guideline is based on the British Standard BS 6472-1992 *Evaluation of human exposure to vibration in buildings (1-80Hz)* [11]. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent', as described in Table 15.

Table 15: Types of vibration - Definition

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day and/or night)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Table 16 reproduces the 'Preferred' and 'Maximum' values for continuous and impulsive vibration from Table 2.2 of the Guideline.

Table 16: Preferred and maximum vibration acceleration levels for human comfort, m/s²

Location	Assessment period ¹	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration (weighted RMS acceleration, m/s², 1-80Hz)					
Residences	Day	0.010	0.0071	0.020	0.014
	Night	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night	0.020	0.014	0.040	0.028
Workshops	Day or night	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s², 1-80Hz)					
Residences	Day	0.30	0.21	0.60	0.42
	Night	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night	0.64	0.46	1.28	0.92

Note 1 - Day is 7:00am to 10:00pm and night is 10:00pm to 7:00am

Table 17 reproduces the 'Preferred' and 'Maximum' values for intermittent vibration from Table 2.4 of the Guideline. The VDV is dependent upon the level and duration of the vibration episode and the number of vibration episodes occurring during the assessment period; a higher vibration level is permitted if the total duration of the vibration event(s) is small.

Table 17: Acceptable vibration dose values (VDV) for intermittent vibration ($m/s^{1.75}$)

Location	Day ¹		Night ¹	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note:

1_ Day is 7:00am to 10:00pm and night is 10:00pm to 7:00am

C.2 Impact on building contents – sensitive equipment

Some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort. Where vibration sensitive scientific and/or medical instruments are in use within an identified vibration sensitive receiver, objectives for the satisfactory operation of the instrument should be sourced from manufacturer’s data. Where manufacturer’s data is not available, generic vibration criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers [19] or the ASHRAE Chapter 49 [20] may be adopted, as presented in Table 18. Baseline vibration levels could also be measured to inform the establishment of appropriate criteria.

Table 18: Application and interpretation of the generic Vibration Criterion (VC) curves (as defined in the CNVG)

Criterion Curve	Max Level ($\mu m/sec, rms$) ¹	Detail size (micron) ²	Description of use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
VC-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

Note 1: As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz

Note 2: The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given consider the observation that the vibration requirements of many items depend upon the detail size of the process.

C.3 Impact on structures and services

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 Part 2 [12] and/or German Standard DIN4150-3 [13]. Additional information is also provided in the CNVG [6].

C.3.1 Standard structures

British Standard 7385 Part 1: 1993, defines different levels of structural damage as:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.*

- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

Table 1 and Section 7.4.2 of BS7385-2 sets limits for the protection against the different levels of structural damage and those levels are reproduced in Table 19 below.

Table 19: BS 7385-2 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s ¹		
			4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor ²	100		
		Major ²	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor ²	30 to 40	40 to 100	100
		Major ²	60 to 80	80 to 200	200

Notes:

- 1_ Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.
- 2_ Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2
- 3_ All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

The guide values in Table 19 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 19 may need to be reduced by up to 50%.

Activities considered to have the potential to cause dynamic loading in some structures (e.g. residences) include rock breaking/hammering and sheet piling activities. On the basis that the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range) a conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures: 25.0 mm/s PCPV
- Unreinforced or light framed structures: 7.5 mm/s PCPV

At locations where the predicted and/or measured vibration levels are greater than above, a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level.

C.3.2 Sensitive structures

German Standard *DIN 4150 – Part 3 ‘Structural vibration in buildings – Effects on Structure’* [13] is generally recognised to be conservative and is often referred to for the purpose of assessing structurally sensitive buildings.

Heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound and should otherwise be assessed in accordance with BS7385-2. If a heritage building or structure is found to be structurally unsound (following inspection) DIN 4150-3, line 3 as outlined in Table 20, provides a conservative cosmetic damage objective that should be adopted unless alternative limits are justified by a dilapidation or structural survey. The sensitivity of heritage buildings and other potentially at-risk structures are subject to confirmation by the contractor prior to start of any works.

Table 20: DIN 4150-3 structural damage guideline values

Line	Type of structure	Peak component particle velocity (PCPV), mm/s				
		Vibration at the foundation at a frequency of			At horizontal plane of highest floor	In the vertical direction, at floor slabs
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹	All frequencies	All frequencies
3	Structures that because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under a preservation order) ³	3	3 to 8	8 to 10	8	20 ²

Notes:

1_ At frequencies above 100 Hz, the values given in this column may be used as minimum values.

2_ Guideline value might have to be lowered to prevent minor damage

3_ Line 1 refer to buildings used for commercial purposes, industrial buildings and buildings of similar design, while Line 2 refers to residential buildings and buildings of similar design and/or occupancy

Note that no sensitive structures have been identified near the site.

C.3.3 Buried services

It is not expected that the proposed works will impact upon buried services, however the following is nonetheless provided for guidance.

DIN 4150-2:2016 sets out guideline values for vibration effects on buried pipework (see Table 21).

Table 21: Guideline values for short-term vibration impacts on buried pipework

Line	Pipe material	Peak component particle velocity (PCPV) measured on pipe, mm/s
1	Steel, welded	100
2	Vitrified clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50
-	High pressure gas pipelines*	75 Monitoring required if predicted above 50. No piling within 15 m of pipeline without detailed assessment.

Notes:

- For gas and water supply pipes within 2 m of buildings, the levels given in DIN4150-3 [13] should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

- For Rock breaking/hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures and it may therefore be appropriate to reduce the transient values by 50%.

* Based on UK National Grid’s specification [24]

Other services that maybe encountered include electrical cables and telecommunication services such as fibre optic cables. While these may sustain vibration velocity levels from between 50 mm/s and 100 mm/s, the connected services such as transformers and switchgear, may not. Where encountered, site specific vibration assessment in consultation with the utility provider should be carried out.

C.3.4 Vibration limits – Sydney Water assets

Sydney Water specifies vibration limits for Sydney Water assets based on the asset type as presented in Table 22 (as per the Sydney Water Specialist Engineering Assessment [23]). The susceptibility of Sydney Water assets to vibration damage depends on a range of factors including

the nature of the ground, the geometry, materials and condition of the structure, the nature of the vibrations and their proximity to the structure and whether they are long acting or intermittent.

Table 22: Threshold vibration limits [23]

Line	Asset Type	Threshold values for velocity (PPV) measured on the asset in mm/s
1	Brittle Pipe assets – RC, VC/ EW, CICL	Maximum PPV for intermittent vibrations: 10mm/s Maximum PPV for continuous vibrations: 5mm/s
2	Ductile Pipe assets – SCL, DI, PVC, PE, PP, GRP	Maximum PPV for intermittent vibrations: 20mm/s Maximum PPV for continuous vibrations: 10mm/s
3	Masonry	3mm/s
4	Unreinforced concrete	3mm/s

Note:

This table is applicable for buried assets, in sound condition, and laid in a typical soil trench in stable ground. Alternative criteria shall be developed for other asset types, above ground assets, concrete encased pipes, pipes on piled/ special supports and pipes in tunnels or of other unusual construction or ground conditions.

Appendix D

Airborne Noise Exceedance Maps

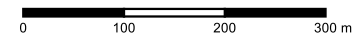


Legend

- Buildings
- 500m Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

- Exceedance of NML*,
OOHW Period 2 dBL_{Aeq}(15min)
- <5 (Noticeable)
 - >5 to ≤15 (Clearly audible)
 - >15 to ≤25 (Moderately intrusive)
 - >25 (Highly intrusive)

*based on maximum predicted facade noise level for each building



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Scale at A4

1:7500

Client

Sydney Water Corporation

Project Name
Refresh Vacluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number 269901-00	Rev 3
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Drawing Title
**Old South Head Road
Airborne Noise Assessment
CS06, CS08b
Assessed against the OOHW Period 2 NMLs**



Legend

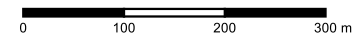
- Buildings
- 500m Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

Exceedance of NML*,

OOHW Period 2 dBL_{Aeq}(15min)

- <5 (Noticeable)
- >5 to ≤15 (Clearly audible)
- >15 to ≤25 (Moderately intrusive)
- >25 (Highly intrusive)

*based on maximum predicted facade noise level for each building



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Sydney Water Corporation

Project Name

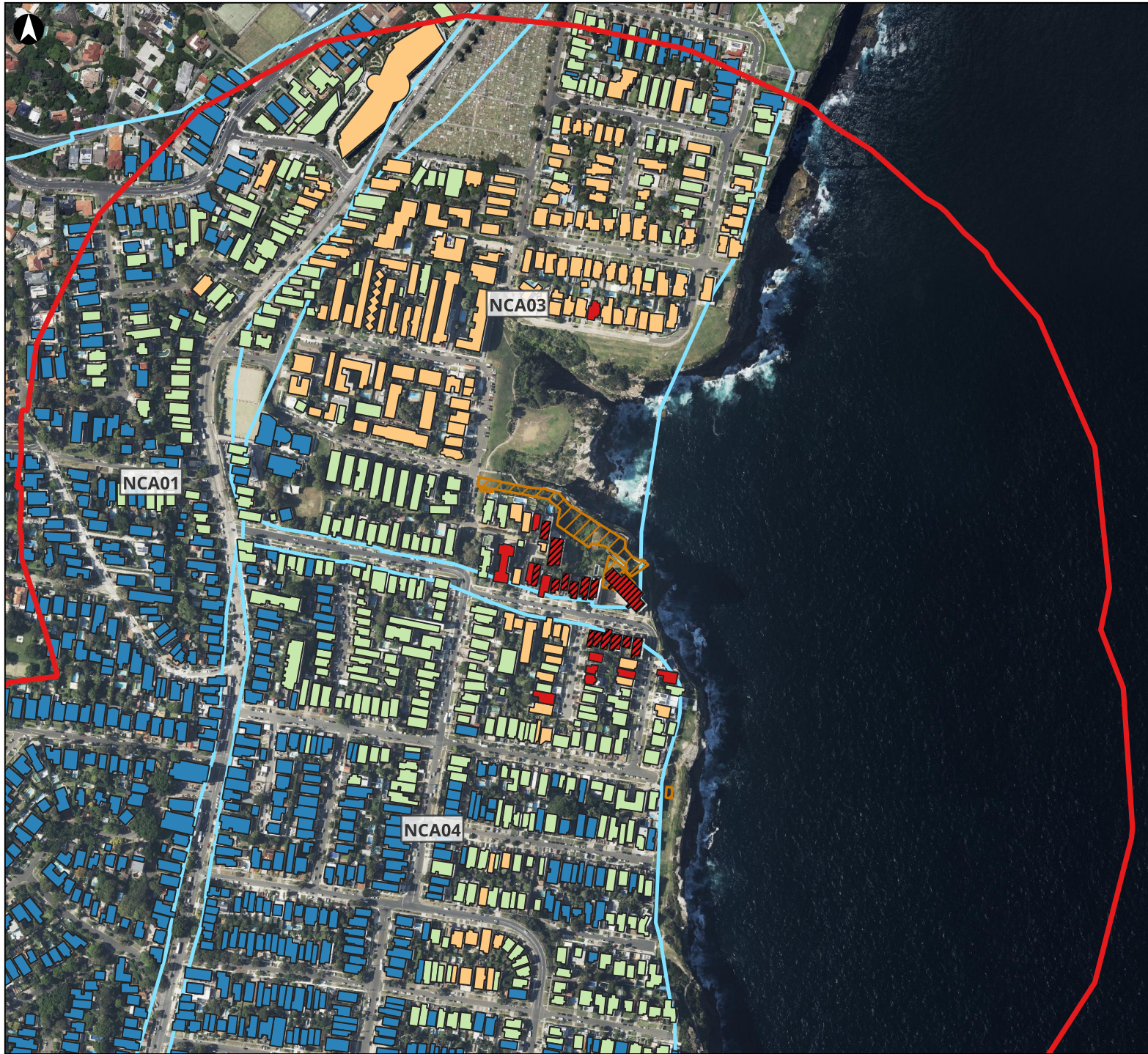
Refresh Vacluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number
269901-00

Rev
3

Drawing Title

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Airborne Noise Assessment
CS07, CS09, CS10
Assessed against the OOHW Period 2 NMLs**

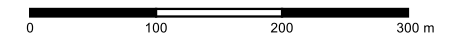


Legend

- Buildings
- Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

- Exceedance of NML*,
Standard Hours dBL_{Aeq}(15min)
- 0 (Noticeable)
 - >0 to ≤10 (Clearly audible)
 - >10 to ≤20 (Moderately intrusive)
 - >20 (Highly intrusive)

*based on maximum predicted facade noise level for each building



2	23/03/2026	HS	--	--	--
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Drawing Title
Diamond Bay Airborne Noise Assessment CS08c Assessment against the Standard Hours NMLs

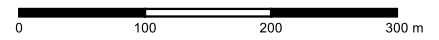


Legend

- Buildings
- Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

- Exceedance of NML*,
Standard Hours dBL_{Aeq}(15min)
- 0 (Noticeable)
 - >0 to ≤10 (Clearly audible)
 - >10 to ≤20 (Moderately intrusive)
 - >20 (Highly intrusive)

*based on maximum predicted facade noise level for each building



2	23/03/2026	HS	--	--	--
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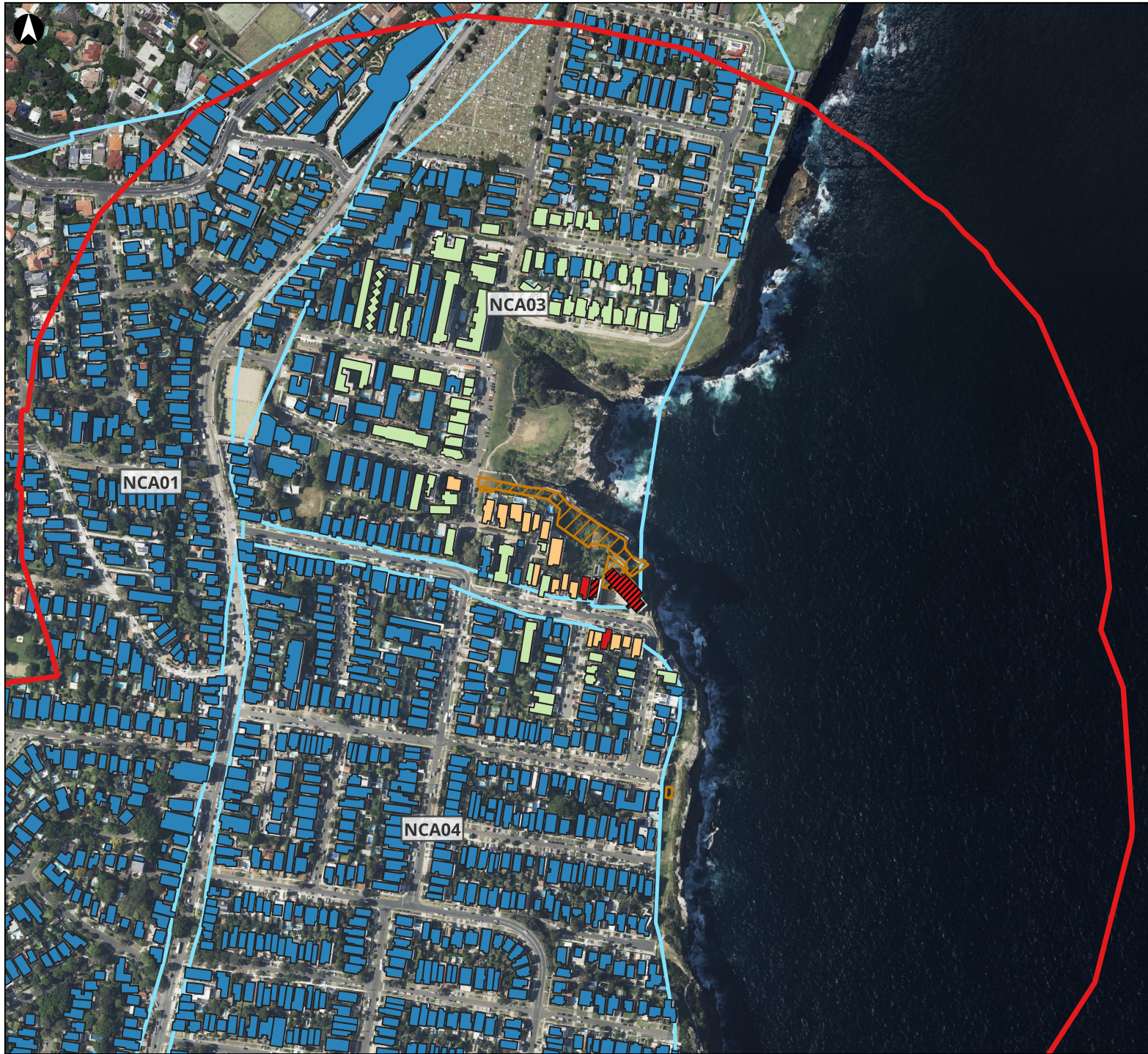
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Client
Sydney Water Corporation

Project Name
Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number 269901-00	Rev 2
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Drawing Title
Diamond Bay Airborne Noise Assessment CS08b Assessment against the Standard Hours NMLs

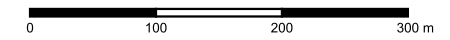


Legend

- Buildings
- Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

- Exceedance of NML*,
Standard Hours dBL_{Aeq}(15min)
- 0 (Noticeable)
 - >0 to ≤10 (Clearly audible)
 - >10 to ≤20 (Moderately intrusive)
 - >20 (Highly intrusive)

*based on maximum predicted facade noise level for each building



2	26/03/2026	HS	--	--	--
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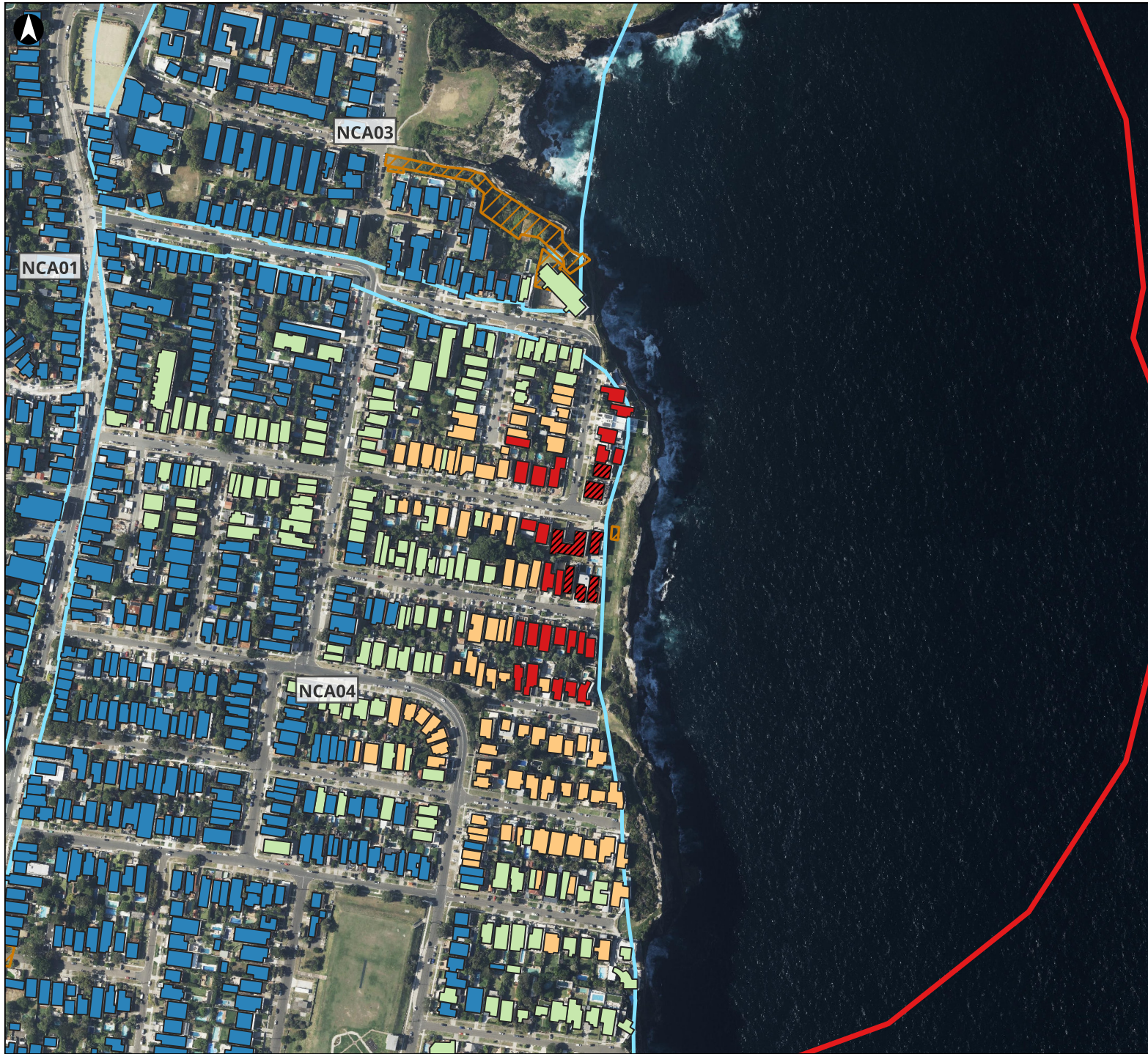
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Client
Sydney Water Corporation

Project Name
Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number 269901-00	Rev 2
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Drawing Title
Diamond Bay Airborne Noise Assessment CS04, CS05, CS10 Assessment against the Standard Hours NMLs



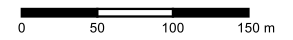
Legend

- Buildings
- Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

Exceedance of NML*,
Standard Hours dBL_{Aeq}(15min)

- 0 (Noticeable)
- >0 to ≤10 (Clearly audible)
- >10 to ≤20 (Moderately intrusive)
- >20 (Highly intrusive)

*based on maximum predicted facade noise level for each building



2	23/03/2026	HS	--	--	--
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Scale at A4

1:5000

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Project Name

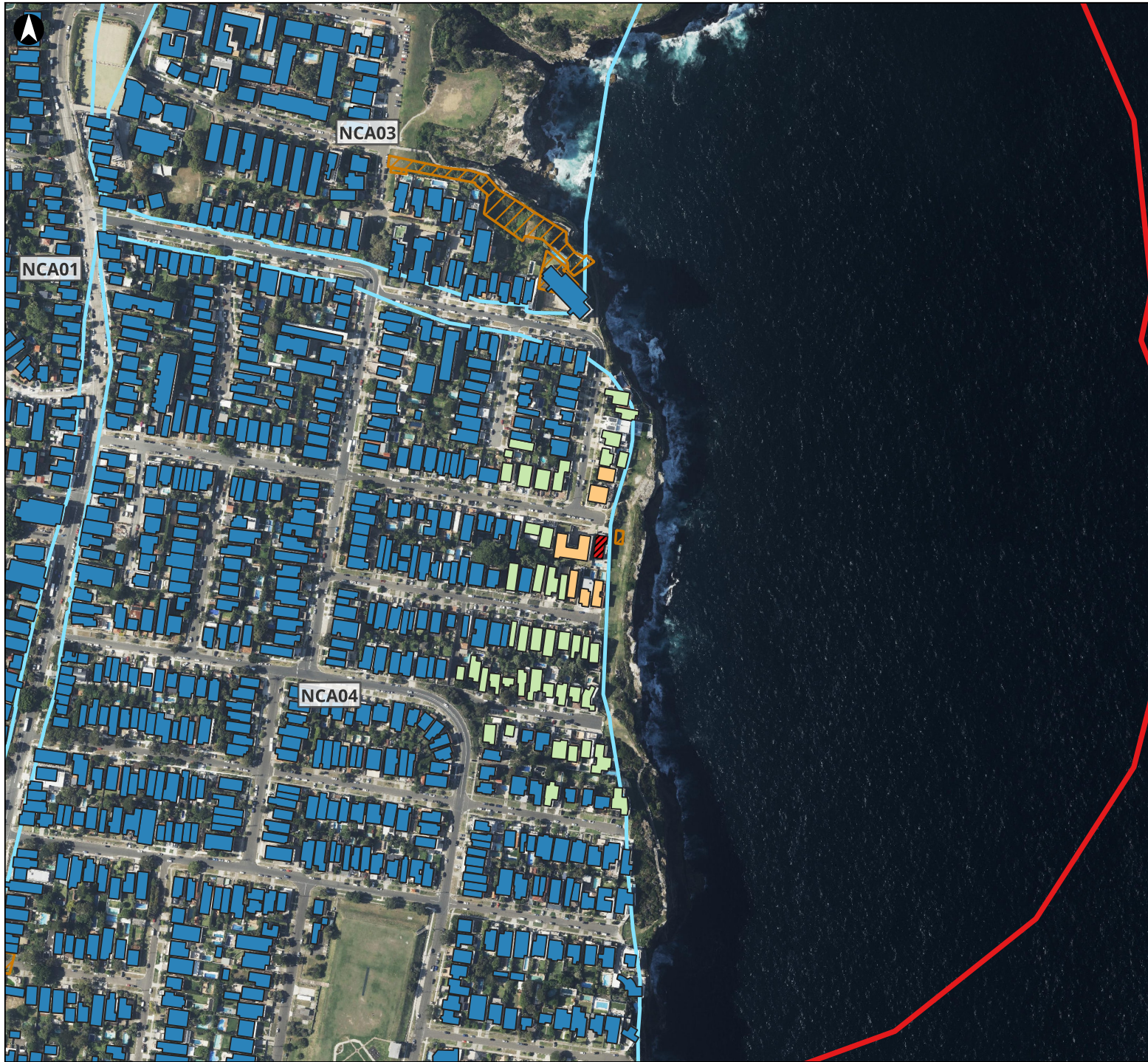
Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number
269901-00

Rev
2

Drawing Title

Eastern Reserve Airborne Noise Assessment CS01, CS06, CS08b Assessment against the Standard Hours NMLs



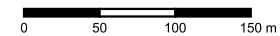
Legend

- Buildings
- Assessment Area
- Noise Catchment Area
- Construction area
- Highly noise affected receiver

Exceedance of NML*,
Standard Hours dBL_{Aeq}(15min)

- 0 (Noticeable)
- >0 to ≤10 (Clearly audible)
- >10 to ≤20 (Moderately intrusive)
- >20 (Highly intrusive)

*based on maximum predicted facade noise level for each building



3	26/03/2026	HS	--	--	--
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Scale at A4

1:5000

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Project Name

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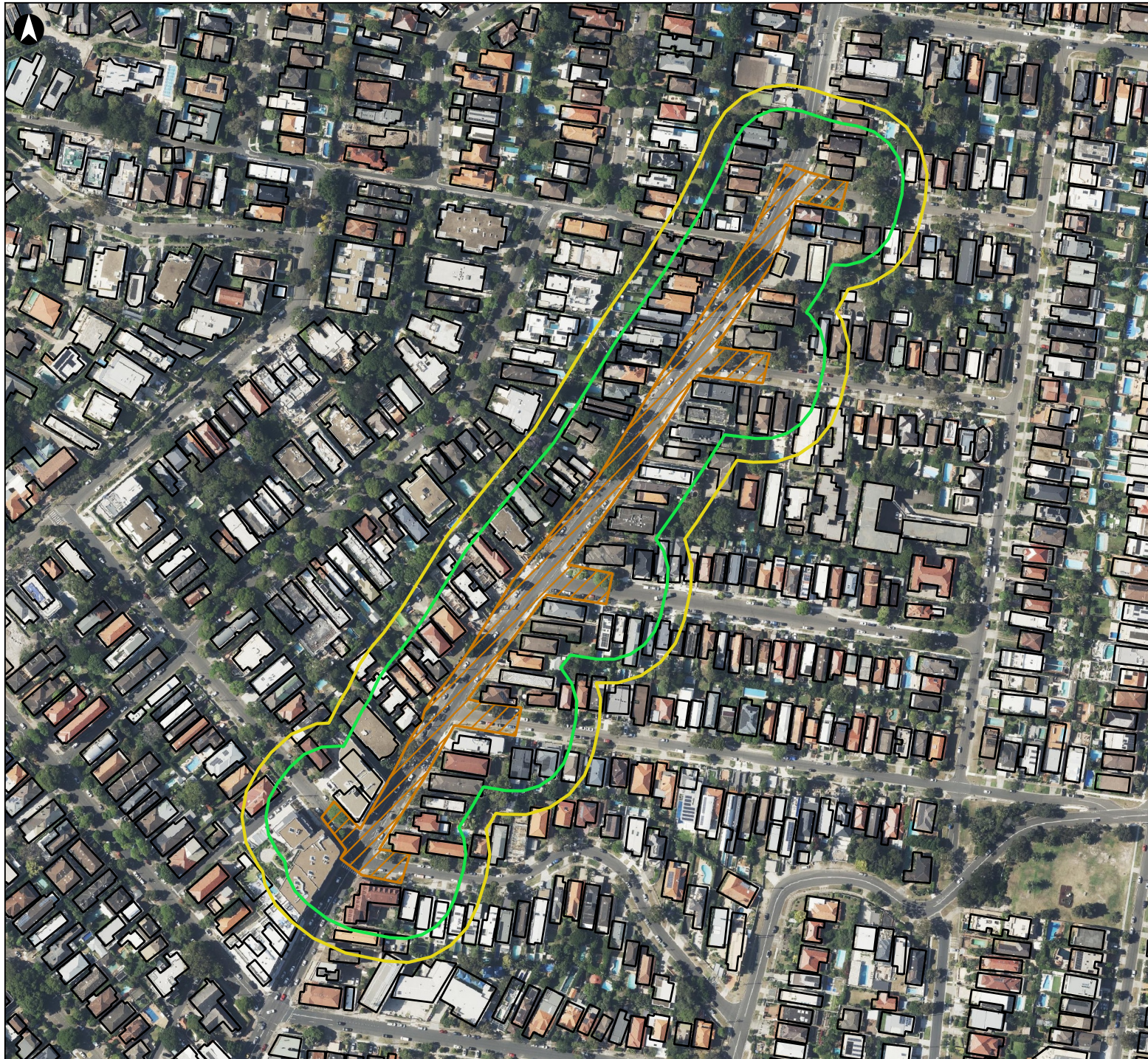
Rev
3

Drawing Title



Eastern Reserve Airborne Noise Assessment CS02, CS03, CS04, CS05, CS07, CS10 Assessment against the Standard Hours NMLs

Appendix E



Ground-borne Noise Exceedance Maps

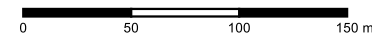


Legend

-  Buildings
-  Assessment Area

Exceedance of GNML*,
OOHW Period 2 dBLeq(15min)

-  Trigger for AA (35m)
-  Meets GNML (50m)



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1:3500

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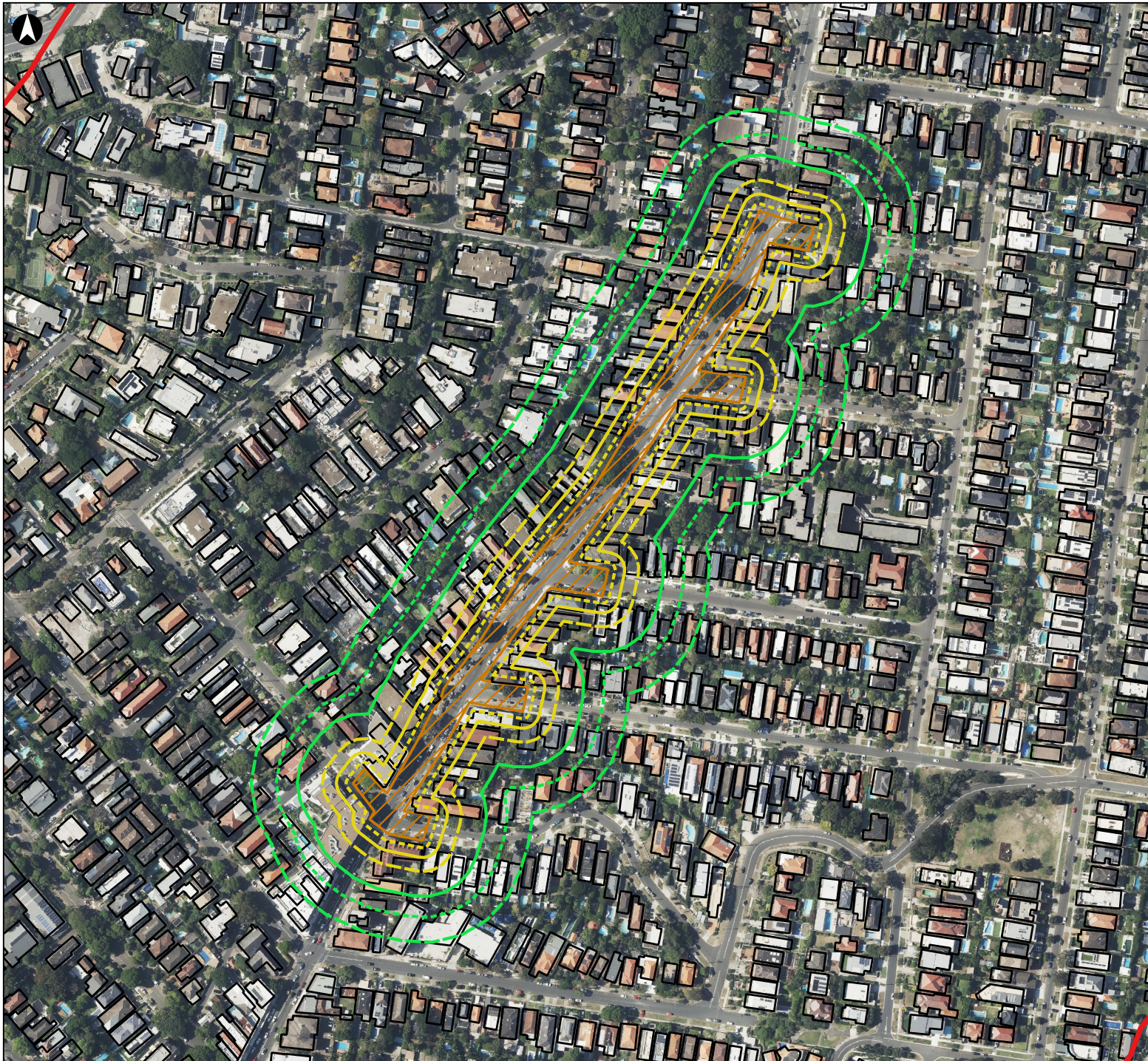
1

Drawing Title


**Old South Head Road
Ground-borne Noise Assessment
Trenchless Techniques
Assessed against the OOHW Period 2 GNML**

Appendix F

Vibration Limit Maps



Legend

-  Buildings
-  Construction area
-  500m Assessment area
- Minimum working distances (vibration)**
-  Trenchless techniques/roller 4 - 6t cosmetic damage residential /light commercial
-  Compactor cosmetic damage residential /light commercial
-  Rock Breaker 25t cosmetic damage residential/light commercial
-  Trenchless techniques/roller 4 - 6t human comfort
-  Compactor human comfort
-  Rock Breaker 25t human comfort



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Scale at A4

1:4000

Client

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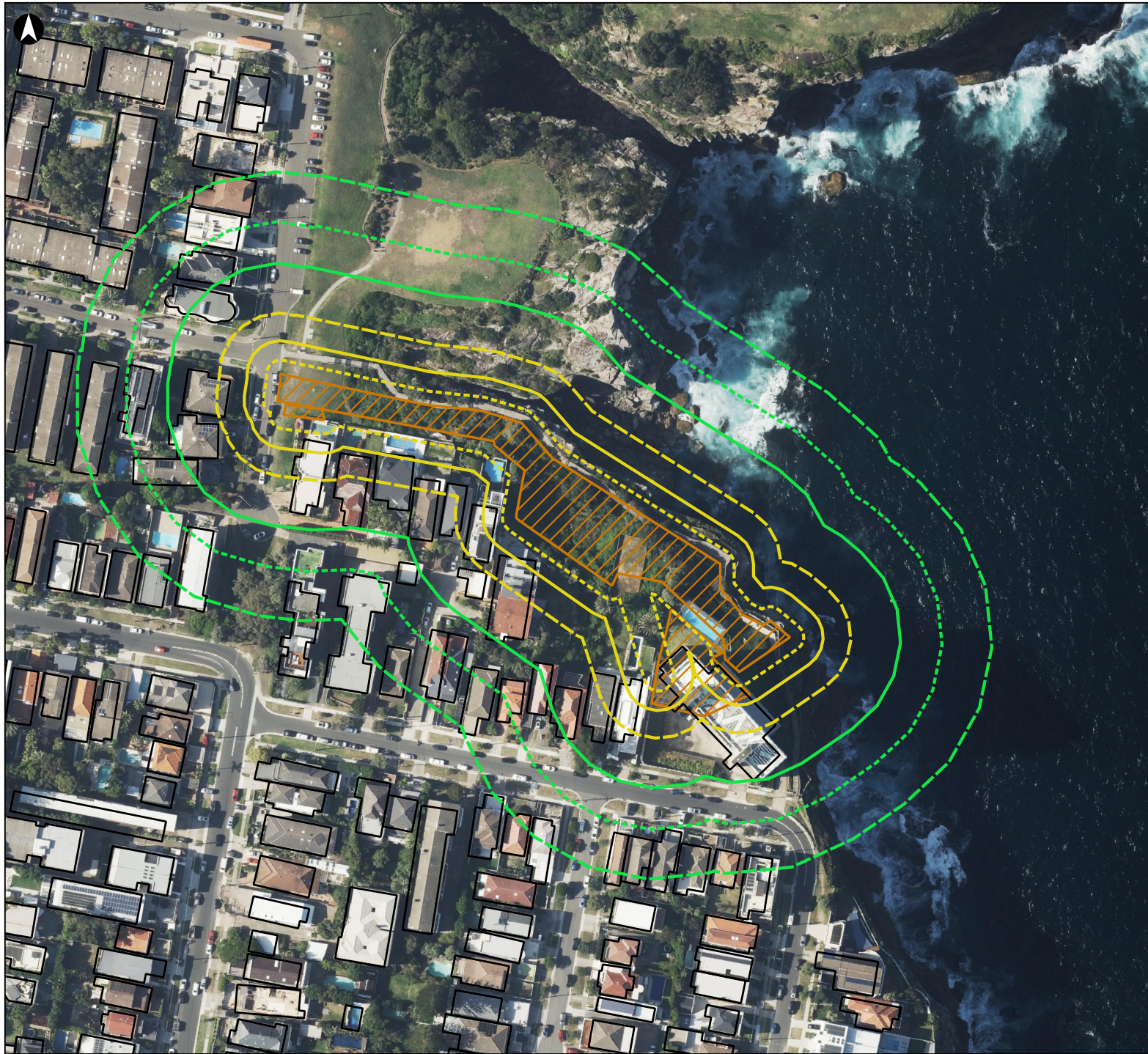
Refresh Vacluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number
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1

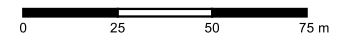
Drawing Title

Old South Head Road, Minimum working distance (Vibration)



Legend

- Buildings
- Construction area
- 500m Assessment area
- Minimum working distances (vibration)**
- Trenchless techniques/roller 4 - 6t cosmetic damage residential /light commercial
- Compactor cosmetic damage residential/light commercial
- Rock breaker 32t cosmetic damage residential/light commercial
- Trenchless techniques/roller 4 - 6t human comfort
- Compactor human comfort
- Rock breaker 32t human comfort



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Scale at A4

1:2000

Client

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Project Name

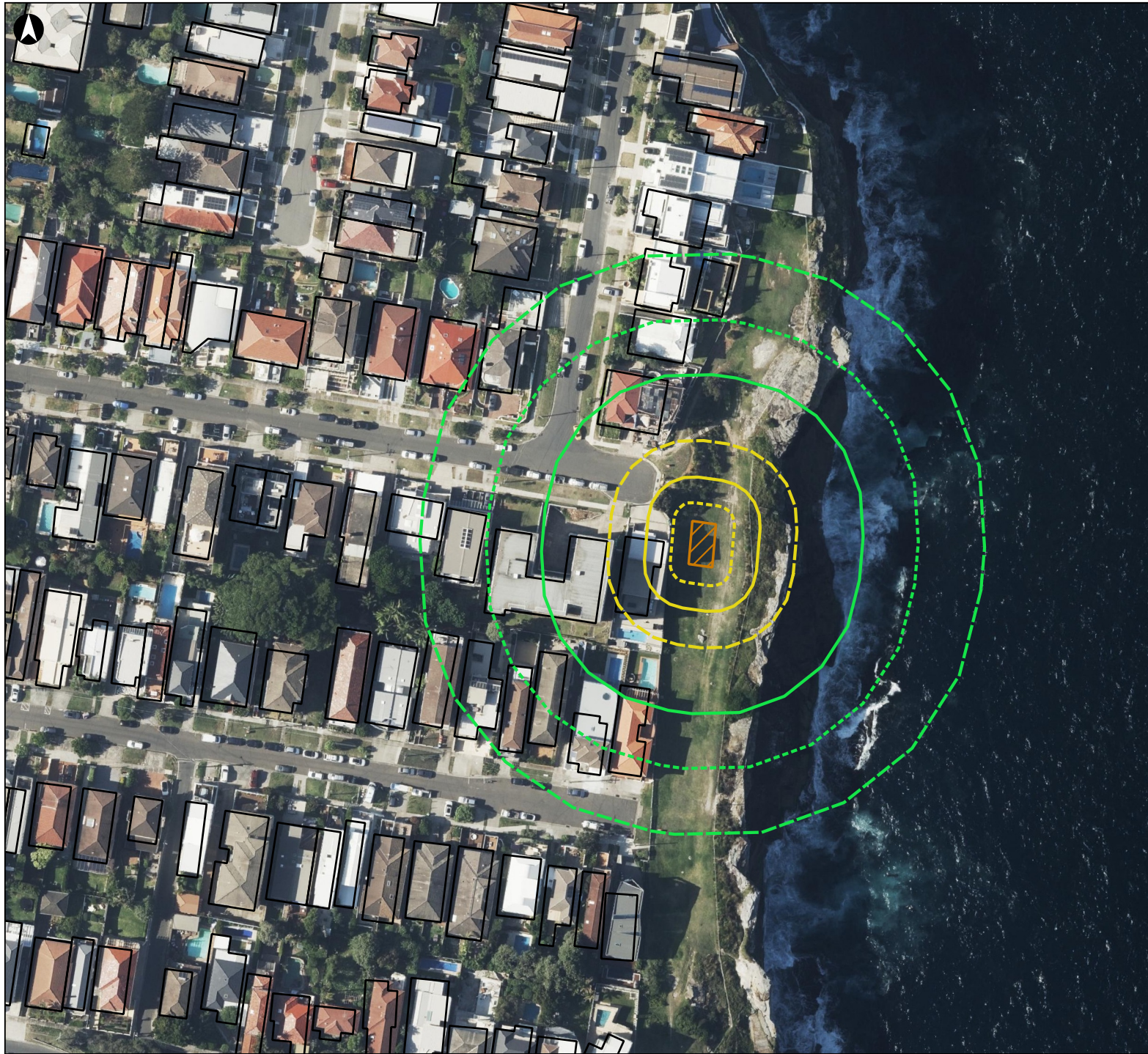
Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number
269901-00

Rev
2

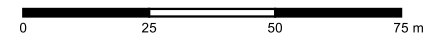
Drawing Title

Diamond Bay, Minimum working distance (Vibration)



Legend

- Buildings
- Construction area
- 500m Assessment area
- Minimum working distances (vibration)**
- Roller 4 - 6t cosmetic damage residential/light commercial
- Compactor cosmetic damage residential/light commercial
- Rock Breaker 25t cosmetic damage residential/light commercial
- Roller 4 - 6t human comfort
- Compactor human comfort
- Rock Breaker 25t human comfort



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Scale at A4

1:1500

Client

Sydney Water Corporation

Project Name

Refresh Vaucluse Diamond Bay - Noise and Vibration Impact Assessment

Project Number
269901-00

Rev
1

Drawing Title

Eastern Reserve, Minimum working distance (Vibration)

Appendix G

Noise and vibration complaint management procedure

