

Review of Environmental Factors

Bondi Ocean Outfall Sewer Rehabilitation (April, 2026)

Sydney WATER

sydneywater.com.au

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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.

Sydney Water recognises the physical and cultural connection of local Aboriginal communities to waters and the land.

Determination

This Review of Environmental Factors (REF) assesses potential environmental impacts of rehabilitation of the Bondi Ocean Outfall Sewer (BOOS). The REF 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 REF. Additional environmental impact assessment may be required if the scope of work or work methods described in this REF change significantly following determination.

Certification

I certify that I have reviewed and endorsed this REF 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:
[redacted]	[redacted]	[redacted]
Sam Campbell Environmental Scientist Sydney Water Date: 5/05/2026	Felix Salmon Senior Environmental Scientist Sydney Water Date: 05/05/2026	Wajeeh Malik Project Manager Sydney Water Date: 07/05/2026

Decision Statement

The main potential construction environmental impacts of the proposal include impacts associated with waste and hazardous materials, non-Aboriginal heritage, noise and vibration, traffic and social and visual. No operational impacts are anticipated. 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) or Biodiversity Development Assessment Report (BDAR) are 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 have a significant impact on the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.

Determined by:	[redacted] Elissa Howie, Acting Senior Manager, Environment and Heritage, Sydney Water Date: 8 May 2026

1. Introduction

1.1 Context

Sydney Water provides water, wastewater, recycled water and some stormwater services to over five million people. We operate under the *Sydney Water Act 1994* and have three equal objectives to protect public health, protect the environment and be a successful business.

We are a statutory State-owned corporation and are classified as a public authority, and a determining authority for the proposal under Division 5.1 of the EP&A Act. This REF assesses the potential environmental impacts associated with rehabilitation of the BOOS and identifies mitigation measures that avoid or minimise potential impacts.

1.2 Proposal background and need

Table 1-1 summarises the proposal need, objectives and consideration of alternatives.

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

Aspect	Relevance to proposal
Proposal need	The BOOS is a 6.1 kilometre brick-lined tunnel constructed between 1880 and 1889. It is a major trunk sewer serving the CBD, Eastern Suburbs and part of the Inner West suburbs. It is a state heritage listed critical trunk wastewater asset that transports wastewater to the Bondi Water Resource Recovery Facility (WRRF). The BOOS is about 2.2 metres (m) high and 1.9 m wide and was installed mostly in a rock tunnel. As part of ongoing maintenance and environmental compliance activities related to Environment Protection Licence (EPL) 1688, remedial works are planned for the BOOS. While structurally intact, inspections have identified age related issues including mortar loss and occasional brick dislodgement. Several sections are approaching the end of their service life and require rehabilitation. The consequence of any failure involves higher repair cost and adverse impacts on Sydney Water customers, the environment, licence compliance and reputation.
Proposal objectives	The proposal objectives are to: • extend asset life by at least 50 years • minimise life cycle cost • desilt and rehabilitate the BOOS to meet EPL requirements for wastewater discharges and pollution of water from wet weather overflows • reduce corporate risk exposure and ensure customer satisfaction • minimise ongoing maintenance frequency and eliminate ongoing deterioration.

Aspect	Relevance to proposal
Consideration of alternatives/options	Several options were considered, including a 'do-nothing' approach. This could lead to structural failures, flow impediment, hydraulic capacity reduction, increases in wastewater overflow events to the Sydney Harbour and damage to the inlet bar screens at Bondi WRRF from fallen bricks. Other shortlisted options included the following: • full Glass Reinforced Plastic (GRP) relining for the entire length • full GRP on straight section with Calcium Aluminate Cement (CAC) in segments impacted by major inlets (and the central curve section due to surface access challenges) • partial CAC for the entire length • partial spiral wound panel Lok lining with CAC on inlets and central curve section. The preferred option was chosen using a multi-criteria analysis (MCA) based on functionality, constructability/practicality, and external stakeholder impact. The assessment found that the preferred option is a hybrid approach of installing GRP in straight sections and CAC in the inlet affected zones and central curve, which provides the optimal solution with sufficient flexibility of methods.

1.3 Consideration of Ecologically Sustainable Development

Table 1-2 considers how the proposal aligns with the principles of ecologically sustainable development (ESD).

Table 1-2 Consideration of principles of ecologically sustainable development (ESD)

Principle	Proposal alignment
Precautionary principle – *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.*	The proposal will not result in serious or irreversible environmental damage. The proposal equipment and methodologies are proven and will be delivered by experienced contractors. Potential impacts have been assessed and minimised to the greatest extent possible during the concept design phase. There is minimal scientific uncertainty relating to the proposal.
Inter-generational equity – *the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*	The proposal will help to meet the needs of future generations by providing a reliable wastewater service. The proposal will enable improvements to reliability and performance of the wastewater network.

Principle	Proposal alignment
Conservation of biological diversity and ecological integrity – *conservation of the biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes.*	The proposal will not significantly impact biological diversity or impact ecological integrity. Vegetation trimming and clearing has been minimised and limited to planted native and exotic species. This minimises the impact to threatened species and habitat features. The proposal will improve protection against wastewater overflows by maintaining BOOS functionality.
Improved valuation, pricing and incentive mechanisms–- *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*	The proposal is an essential maintenance activity and would provide cost efficient use of resources and provide optimum outcomes for the community and environment.

2. Proposal description

2.1 Proposal details

Table 2-1 describes the proposal and Figures 2-1 to 2-5 show the location and key environmental constraints.

Table 2-1 Description of proposal

Aspect	Detailed description
Proposal description	The proposal involves the following activities: • desilting • slip lining of deteriorated oviform sections with segmental GRP installed by jacking • GRP annulus grouting in live flow conditions • CAC relining of deteriorated oviform sections, transitions to GRP and access chambers • construction of new deep bored GRP maintenance holes • associated temporary works including access shafts, flow management, ventilation, and odour control.
Location and land ownership	Figure 2-1 provides an overview of the proposal, including the extent of the REF area. The proposal involves above-ground works at four sites along the BOOS to construct the new deep bored GRP maintenance holes, enabling desilting and rehabilitation activities: • Site 1 - Dillon Street Playground, Paddington (Lot 20, DP1255181) • Site 2 - Elizabeth Street, Paddington (Lot 2-7 DP443995) • Site 3 - Trelawney Street, Edgecliff (Lot CP, Plan SP 1389) • Site 4 - Lough Playing Fields, Double Bay (Lot 1, A and B, DP85237 and DP191253) The proposal is within the Woollahra Local Government Area (LGA), and all four above-ground sites are on land owned and managed by Woollahra Municipal Council (WMC). Below ground works between these sites are exclusively within the BOOS, which is owned and managed by Sydney Water.
Site establishment and access tracks	Site establishment is required to enable works and includes: • delineating the construction sites, storage and laydown areas • installing erosion and sediment controls • traffic management • trimming and/or vegetation removal.

Aspect	Detailed description
	Site establishment may also include surveys, service location, geotechnical or other investigations required prior to construction. It may also include service relocation where services are identified that may be affected. Access to the BOOS and construction sites will be via existing roads. Temporary site access driveways and pedestrian access tracks around the construction area will be established at Site 1 and Site 4 (see Figures 2-2 and 2-5). Project Manager as described in the mitigation measures in Section 5. Temporary access tracks will be removed at the completion of construction.
Ancillary facilities (compounds)	Construction compounds will be required to house site sheds, construction amenities and materials laydown. The compound locations are within the 'BOOS site footprint' on Figures 2-1 to 2-5.
Methodology	Site 1 (Dillon Street Playground) and Site 4 (Lough Playing Fields) 1. mobilisation 2. hardstand establishment 3. potholing 4. sheet piling 5. excavation 6. acoustic shed establishment 7. pouring concrete base slab 8. break in via concrete saw 9. desilting (removal via vacuum truck) 10. local bypass of maintenance hole inlet across the site to the shaft 11. jacking equipment establishment & jacking to install GRP 12. grouting and shotcrete pumping of CAC 13. pack-up, backfill, removal of piles, landscaping and reinstatement of the site. Site 2 (Elizabeth Street) and Site 3 (Trelawny Street) 1. mobilisation 2. hardstand establishment 3. potholing 4. pilot hole drilling 5. excavation 6. acoustic shed establishment 7. direct boring 8. desilting (removal via vacuum truck) 9. GRP maintenance hole installation 10. grouting and shotcrete pumping of CAC 11. reinstatement of the site.

Aspect	Detailed description
Commissioning	Commissioning involves surveying and testing new and rehabilitated infrastructure to ensure it works correctly and is integrated with existing plant operations. The exact commissioning steps depend on the type of the equipment, but typically include: • annulus grout verification • CCTV inspection of GRP and CAC lining • maintenance hole acceptance.
Restoration	Upon completion, the work site will be restored to pre-existing conditions where possible. Council will be consulted for restoration of WMC owned areas.
Materials/ equipment	Site 1 (Dillon Street Playground) and Site 4 (Lough Playing Fields) • concrete pumps/shotcrete machine • air compressor • generators • power pack for jacking unit • 20 tonne winch • overhead gantry crane • 2 ventilation systems (fans) • concrete saw • 2 deodorizers • 25 tonne pick and carry crane • 3.5 tonne offroad telehandler • skid steer • water truck or non-destructive digging (NDD) truck • flatbed trucks • tipper trucks • light vehicles • skip bins • tools (various) • confined spaces safety equipment (e.g. gantry/davit) • site facilities and amenities Site 2 (Elizabeth Street) and Site 3 (Trelawny Street)

Aspect	Detailed description
	• 105-120 tonne piling rig • concrete pumps • water truck • flatbed trucks • compactor • light vehicles • skip bins • confined spaces safety equipment (e.g. gantry/davit) • site facilities and amenities.
Work hours	Work and deliveries will be scheduled to occur during standard daytime hours where possible, these are: • 7am to 6pm, Monday to Friday • 8am to 1pm, Saturdays. Non-standard works are proposed, being night shifts (8pm to 5am) for safety, and to reduce traffic impacts and pending traffic management plan (TMP) requirements. About half of the indicative 1160 shifts across all sites are proposed to be night shifts
Proposal timing	Construction is expected to start in early 2027 and take about 2 years. Some activities will take place simultaneously. The indicative duration at each site is: • 12 months at Site 1 Dillon Park • 9 months at Site 2 Elizabeth Street • 9 months at Site 3 Trelawney Street • 14 months at Site 4 Lough Park Playing Fields.
Operational requirements	There are no changes to the existing operational requirements of the BOOS.

Figure 2-1 Overview of proposal locations

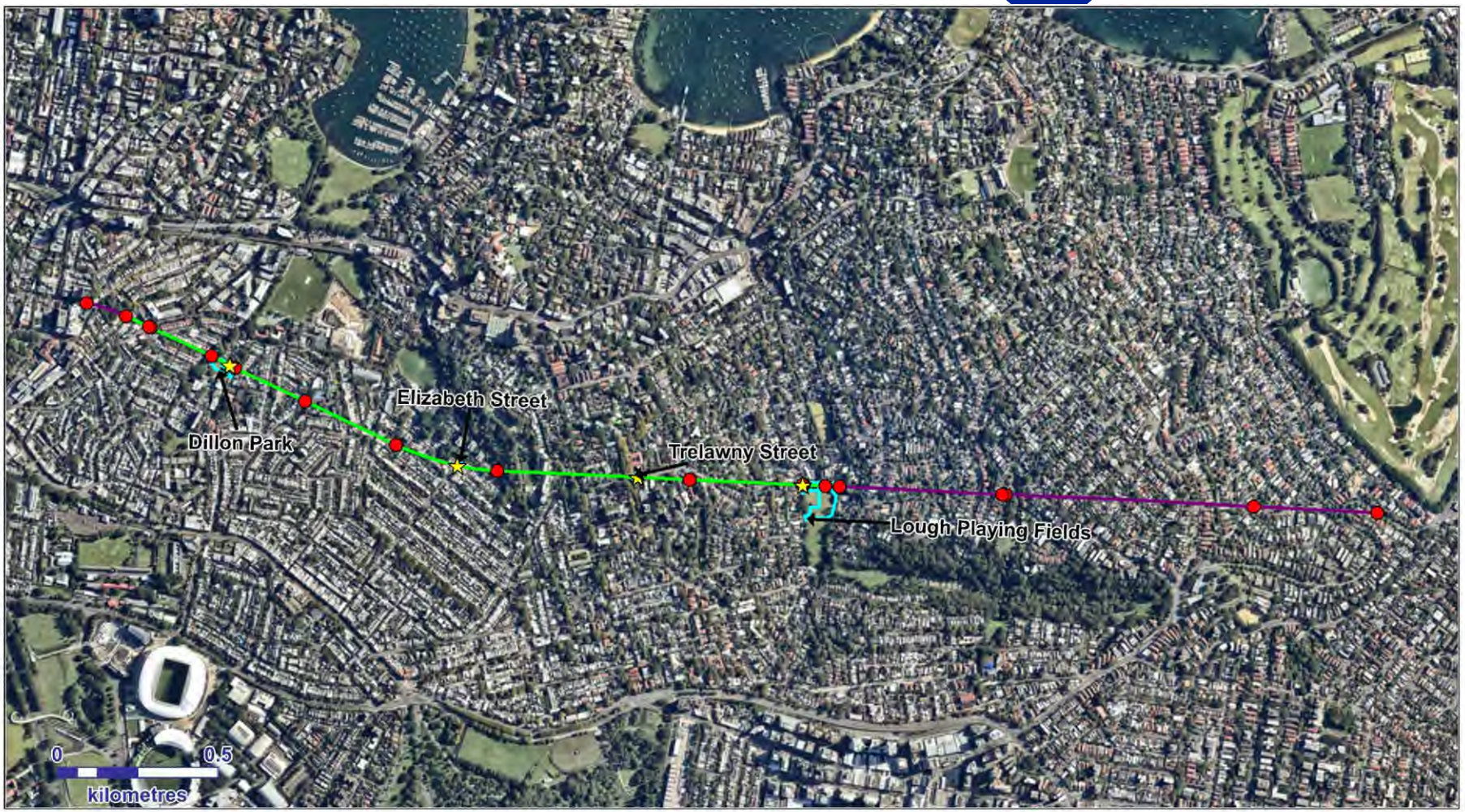


Figure 2-2 Location of Site 1 (Dillon Park) and key environmental constraints

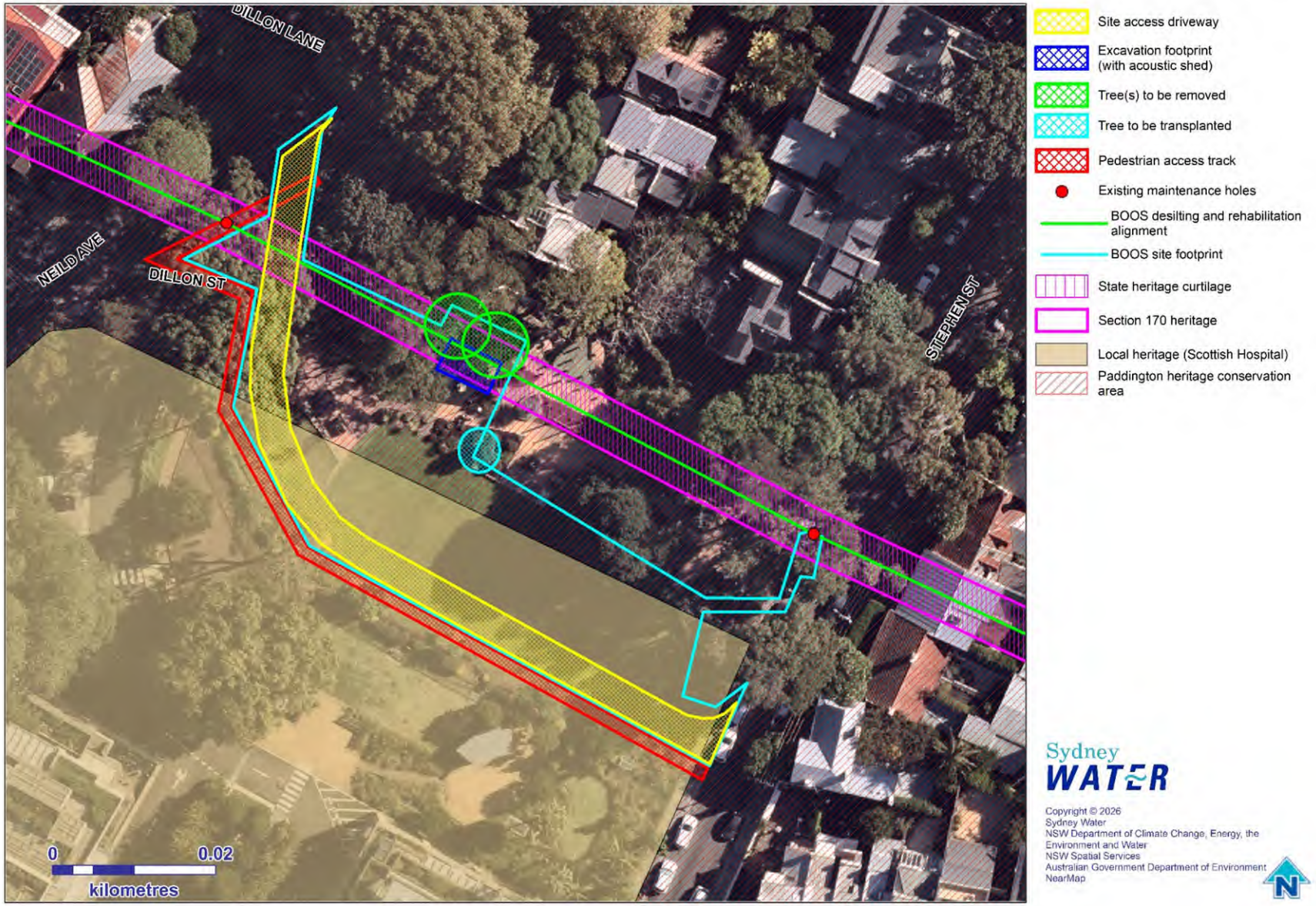


Figure 2-3 Location of Site 2 (Elizabeth Street) and key environmental constraints

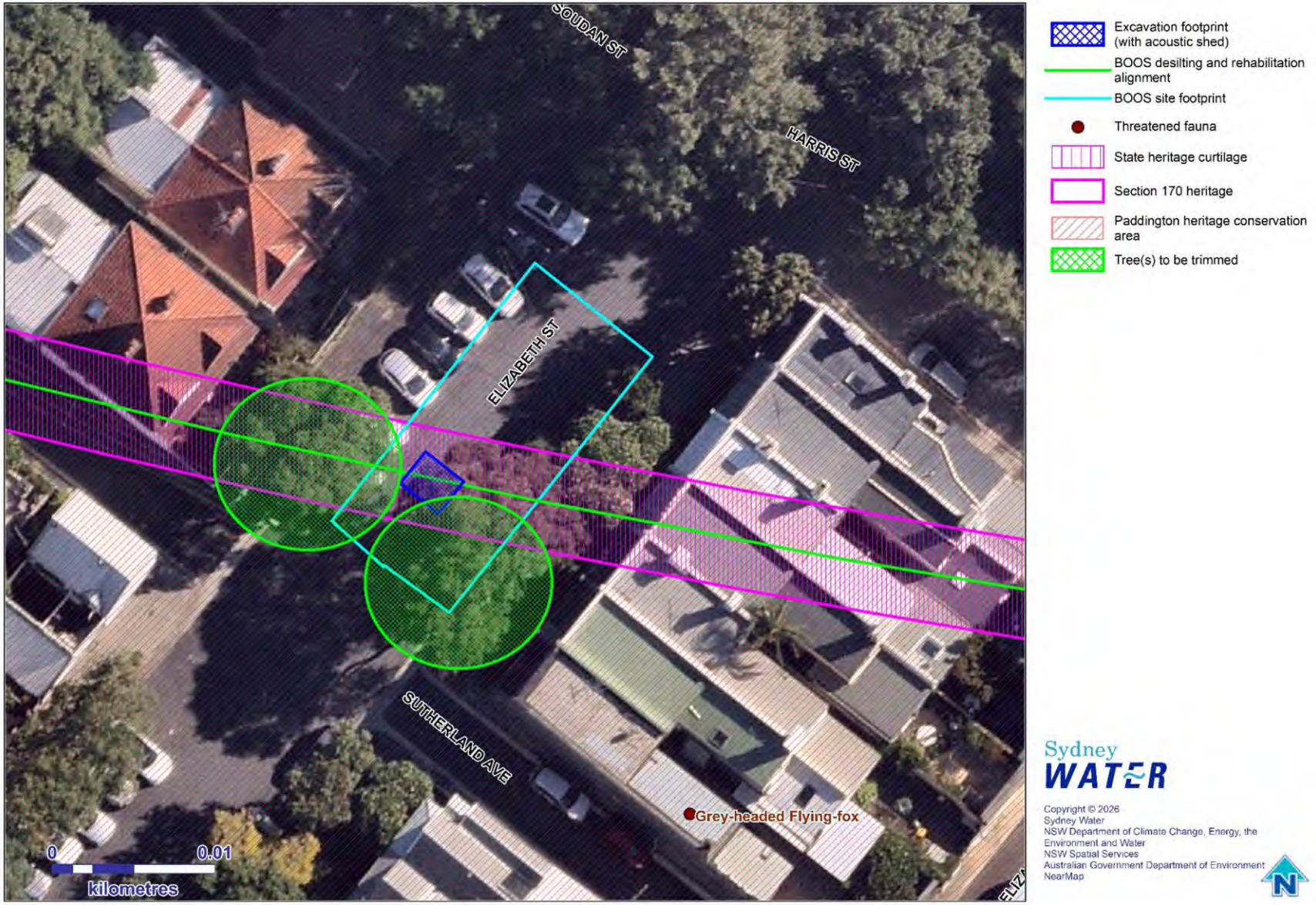


Figure 2-4 Location of Site 3 (Trelawney Street) and key environmental constraints

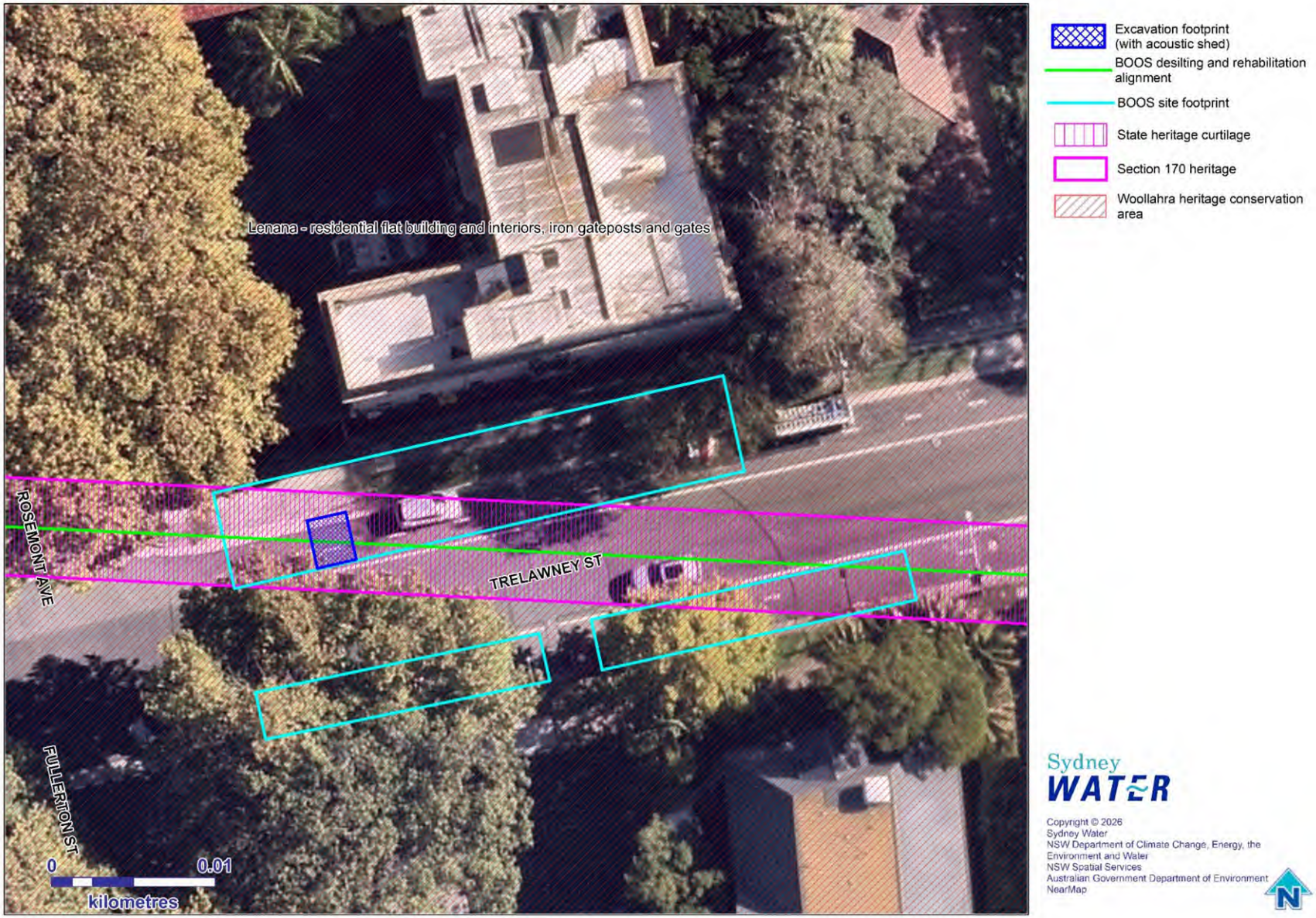


Figure 2-5 Location of Site 4 (Lough Playing Fields) and key environmental constraints



2.2 Changes to the scope of work

The proposal shown in this REF is indicative and based on the latest concept design at the time of REF preparation. The final proposal may change based on detailed design and construction planning. The general mitigation measures outline when changes to the proposal trigger supplementary environmental impact assessment. If required, further assessment must be prepared in accordance with SWEMS0019.

3. Consultation

3.1 Community and stakeholder consultation

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, 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 REF. 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.

Sydney Water has only engaged with WMC to date. The community engagement team will inform nearby residents and stakeholders about:

- the proposal start date
- where we will be working and when
- temporary road closures
- what to expect during each stage of the proposal's progress.

Before and during construction, Sydney Water would ensure the Delivery Contractor is mindful of the community, that they inform the community about any work that may impact nearby residents, and that they leave a positive legacy when the work is done.

Engaging with the community enables Sydney Water and its contractors to listen and understand community values. Feedback would be used to improve our performance and all complaints during the construction of the proposal. Following its commissioning, feedback would be managed according to Sydney Water's Customer Complaint Policy and Procedure.

3.2 Consultation required under State Environmental Planning Policies and other legislation

Sydney Water must consult with councils and other authorities for work in sensitive locations or where the work may impact other agencies' infrastructure or land. This is specified in the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP). Consultation is required under Section 2.10(1)(e) and (f) of the TISEPP as the proposal requires temporary structures on council owned land and excavation on a council owned road or footpath that is more than minor or inconsequential. Consultation with WMC

commenced on 7 May 2025 and is ongoing. Their key concerns involve traffic management, community engagement, work site reinstatement, vegetation impacts, erosion, sedimentation and heritage considerations.

We will provide WMC with reasonable notice when we would like to commence works. WMC is being consulted about matters such as vegetation trimming and removal, temporary impacts to public recreation, temporary works on council land, public safety, and full or partial road closures of council managed roads. The proposal requires temporary and partial closures of sections of Elizabeth Street, Trelawney Street, Stephen Street, Manning Road and Nield Avenue. TMPs will be agreed with WMC prior to works commencing, and they will be notified one week prior. Recommendations from WMC have been addressed in Sections 5.3, 5.8 and 5.9 of this REF.

4. Legislative requirements

4.1 Environmental legislation

Sydney Water is the proponent and determining authority under the EP&A Act. The proposal does not require development consent and is not classified as State significant infrastructure. We have assessed this proposal under Division 5.1 of the EP&A Act. This REF has concluded that the proposal is unlikely to have a significant impact on the environment.

The following environmental planning instruments (Table 4-1) and legislation (Table 4-2) are relevant to the proposal. Table 4-2 also documents any licences and permits required, and timing and responsibility for obtaining them.

Table 4-1 Environmental planning instruments relevant to the proposal

Environmental Planning Instrument	Relevance to proposal
Woollahra Local Environmental Plan (LEP) 2014	The above-ground sites are located on land zoned as Infrastructure (SP2), Low density residential (R2), Public recreation (RE1) and Medium density residential (R3). The below ground components of the proposal are beneath a range of land use zonings.
State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)	Section 2.126(6) of the TISEPP permits development by or on behalf of a public authority for sewerage reticulation systems without consent on any land. As Sydney Water is a public authority, the proposal is permissible without consent.
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BCSEPP)	**Vegetation in non-rural areas (Chapter 2)** The proposal is in an area or zone listed in subsection 2.3(1). However, subsection 2.4(1) states: '*This Policy does not affect the provisions of any other SEPP….*', and as the works are permissible under the TISEPP, a council permit to clear vegetation under this SEPP is not required. **Water catchments (Chapter 6)** Chapter 6 of this SEPP applies as the proposal is within the Sydney Harbour Catchment, a regulated catchment. Section 5 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 negligible and meet the requirements of part 6.2 of the SEPP (refer to Appendix A).

Table 4-2 Consideration of key environmental legislation

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
Heritage Act 1977	The proposal is within the curtilages of local and state listed heritage items protected under this act. Potential impacts to local heritage listed items are assessed as minor or inconsequential. A Statement of Heritage Impact (SoHI) found that the proposal would ordinarily require approval under Section 60 of the *Heritage Act 1977*. However, Sydney Water has delegated authority under Section 63 of the *Heritage Act 1977* to approve works to State Heritage Items in circumstances set out in the *Government Gazette Notice Number 636– Planning and Heritage, Friday, 10 December 2021*. The proposal meets the gazetted circumstances and Sydney Water will issue a Section 63 approval. Potential impacts of the proposal on non-Aboriginal heritage are assessed in Section 5.4.	REF & Section 63 approval	Post REF, pre-construction, Sydney Water
Water Act 1912/ Water Management Act 2000	Groundwater dewatering is needed during excavation. Any groundwater dewatering requires a Water Supply Works Approval (WSWA) before dewatering starts.	WSWA	Dewatering information was not confirmed during development of the REF. Therefore, a WSWA application will be prepared by the contractor after the REF is determined, submitted by Sydney Water and obtained pre-construction.

5. Environmental assessment

This section describes the existing environment and assesses direct and indirect impacts of construction and operation. It also identifies mitigation measures to minimise impacts. These will be incorporated into contract documents and a Construction Environmental Management Plan (or similar) prior to starting work.

5.1 Topography, geology and soils

Existing environment

The topography of the region is gently undulating and largely follows natural contours. The alignment trends downward towards Double Bay, with Site 4 being within a gully. A desktop search identified the geology of the surrounding area as a mix of man-made fill, quartz sandstone and marine sand. All sites have a low salinity hazard. Geotechnical investigations (D4C, February 2023) and waste classification (D4C, January 2026) found a low probability of Acid Sulfate Soils (ASS), however, ASS are likely present at 1 m below the natural ground surface of Lough Playing Fields (Site 4). The proposal is not in a mine subsidence area.

Potential impacts

During construction there will be ground disturbance, excavation and stockpiling. The main potential impacts to geology and soils would be from:

- Erosion and sedimentation from excavation and poor spoil management, especially in wet weather
- Contamination from accidental chemical, fluid and fuel spills
- Leaching of acid from disturbance of ASS at Lough Playing Fields (Site 4).

Poor erosion control can lead to offsite sedimentation and could impact water quality if it reaches a waterway. Waterways and land surrounding Lough Playing Fields (site 4) may also be impacted by inappropriate management of ASS and contaminated soils from offsite leaching of acid and contaminants (see section 5.7).

Construction activities will temporarily alter the surface topography and associated drainage patterns during trenching and stockpiling. The excavations will be backfilled and restored to existing conditions and no long-term impacts from the proposal are expected.

Impacts to topography, geology and soils are not expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to topography, geology and soils can be adequately managed, and residual impacts are expected to be minor.

Table 5-1 Environmental mitigation measures — topography, geology and soils

Mitigation measures
Any soil removed that cannot be reused would be disposed of at an appropriately licensed facility.

Mitigation measures

Prevent sediment moving offsite in accordance with Managing Urban Stormwater, Soils and Construction, Volume 1 and 2A (Landcom 2004 and DECC 2008), including, but not limited to:

- develop a Soil and Water Management Plan (SWMP) as part of the CEMP
- divert surface runoff away from disturbed soil and stockpiles
- install sediment and erosion controls before construction starts
- reuse topsoil where possible and stockpile separately
- inspect controls at least weekly and immediately after rainfall
- rectify damaged controls immediately
- remove controls once surfaces have been stabilised, including removing trapped sediment in drainage lines.

Include a Stockpile Management Plan (SMP) as part of the SWMP to adequately manage any proposed temporary and permanent stockpiles. This will include detail on:

- exact location of stockpiles
- minimising stockpile size
- height, slopes and batters
- preventing mixing and cross contamination
- consideration of future maintenance
- capping
- erosion and sediment control
- restoration.

The Stockpile Management Plan will be approved by the Sydney Water Project Manager in consultation with the Environmental Representative and the Contamination and Hazardous Materials team.

Minimise ground disturbance and stabilise disturbed areas progressively.

Delivery Contractor to ensure imported material is Virgin Excavated Natural Materials (VENM) or meets a relevant NSW EPA Resource Recovery Order and Resource Recovery Exemption, or is a commercially supplied material that is not waste.

If using materials that are subject to a NSW EPA Resource Recovery Order/Exemption the Delivery Contractor must ensure the conditions in that Order/Exemption are strictly adhered to.

Stop work in the immediate vicinity of suspected contamination. Indicators of contamination include discoloured soil, anthropogenic material within fill, asbestos, chemical or petrol odours and leachate. Contain disturbed material on an impermeable surface and cordon areas off. Notify the Sydney Water Project Manager and the Environmental Representative (who will contact the Contamination and Hazardous Materials team) to agree on proposed management approach.

Stop work during heavy rainfall or in waterlogged conditions when there is a risk of sediment loss offsite.

Mitigation measures
Sweep up any sediment/soil transferred offsite at least daily, or before rainfall.
Eliminate ponding and erosion by restoring natural landforms to the pre-works condition.
Soil testing is to be undertaken to confirm the presence and depth of acid sulfate soils within the proposal area. Where acid sulfate soils could be disturbed by construction activities, an Acid Sulfate Soil Management Plan is to be prepared and implemented in accordance with the Acid Sulfate Soils Assessment Guidelines (Acid Sulfate Soils Management Advisory Committee, 1998).
Excavations to be backfilled or otherwise contained/covered to minimise water ingress.

5.2 Water and drainage

Existing environment

The main waterway in the region is Sydney Harbour and its tributaries Double Bay Creek and Rushcutters Creek. None of the above-ground sites are within 400 m of a water body, with the exception of Site 4, which is 3 m from a stormwater culvert that leads to Double Bay Creek.

Preliminary groundwater investigations found that groundwater is shallower near waterways and deeper in areas of higher elevation. Data from 3 D4C boreholes positioned along the alignment found groundwater levels between 4 and 20 m below the top of the bore (D4C, February 2023).

WMC flood mapping indicated the proposal is not in flood planning areas (Woollahra LEP 2014).

Potential impacts

The proposal requires excavation, wastewater bypasses, pipe works, temporary soil stockpiles and fuels and chemical storage. The proposal has the potential to impact water and drainage from:

- Sedimentation from poor site management of excavations and stockpiles
- Contamination from accidental chemical/fuel/wastewater spills
- Pollution from sewer bypass failure
- Groundwater drawdown from dewatering open excavations.

Potential sedimentation and contamination impacts are assessed in Section 5.1 and can be managed by the above mitigation measures.

The proposal will not increase the area of impervious surfaces and therefore will not increase the volume of surface water or stormwater run-off during construction and operation.

Excavation will be below expected groundwater levels. Therefore, groundwater dewatering is likely, and a WSWA must be obtained before dewatering starts. Additional groundwater investigations during the detailed design will confirm standing groundwater levels and groundwater dewatering calculations.

Impacts to water and drainage are not expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to water and drainage can be adequately managed, and residual impacts are expected to be minor.

Table 5-2 Environmental mitigation measures — water and drainage

Mitigation measures
Bund open maintenance holes if there is a risk of wastewater spills.
Bund potential contaminants and store on robust waterproof membrane, away from drainage lines.
Keep functioning spill kit on site for clean-up of accidental chemical/fuel spills. Keep the spill kits stocked and located for easy access.
Locate portable site amenities, chemical storage and stockpiles of erodible materials away from watercourses, drainage lines and flood prone areas.
Sydney Water will obtain a groundwater Water Supply Works Approval. The Delivery Contractor is responsible for: • providing expert hydrogeological technical information to obtain the approvals • preparing a Dewatering Management Plan prior to construction • complying with the conditions of the approvals (such as protecting water quality; minimising aquifer extraction volumes, monitoring extraction with flow metres and recording volumes).
Seek approval and discharge criteria from the relevant Sydney Water Network Area Manager prior to discharge of water to the wastewater system. Otherwise tanker by a licensed waste contractor and dispose offsite to an appropriately licensed facility.
As a wastewater bypass is required: • pressure test hoses before, and monitor during bypass • monitor wastewater flows to ensure critical flows are not reached • stop bypass if leaks occur • bund access chambers • contain wastewater spills and pump back to wastewater system or disposal tanker.
Store all chemicals and fuels in accordance with relevant Australian Standards and Safety Data Sheets. Record stored chemicals on site register. Ensure bunded areas have 110% capacity of the largest chemical container, or an additional 25% capacity of the total volume stored within (whichever is greater). Tightly secure chemicals and fuels in vehicles. Clearly label all chemicals.
Conduct refuelling, fuel decanting and vehicle maintenance in compounds where possible. If field refuelling is necessary, designate an area away from waterways and drainage lines with functioning spill kits close by.
Conduct any equipment wash down within a designated washout area.

Mitigation measures
Ensure equipment is leak free. Repair oil/fuel leaks immediately or remove from site and replace with a leak-free item.

5.3 Flora and fauna

An arboricultural assessment was prepared by Canopy Consulting (2025) to assess the potential impacts of the proposal on flora and fauna. Findings and recommendations outlined in the report are summarised below and provided in full in Appendix C.

Existing environment and potential impacts

Vegetation in the site footprints consists of planted native or exotic trees, grassy turfed areas and landscaped garden beds. There are no threatened ecological communities (TECs) or threatened flora within the site footprints. A total of 86 trees were classified and assessed by the arborist. Visual tree assessments from ground level involved inspections for tree health, structural integrity, amenity value, heritage value, environmental significance and habitat characteristics.

Ten planted street trees will be impacted by the proposal:

- Remove 2 exotic Chinese Hackberry (*Celtis sinensis*) at Site 1
- Remove 5 exotic Oleander (*Nerium Oleander*) at Site 4.
- Transplant 1 native Queensland Bottletree (*Brachychiton rupestris*) at Site 1
- Trim 2 native Prickly-leaved Paperbark (*Melaleuca Styphelioides*) at Site 2.

Although the trees have been assessed as having low ecological value, cleared trees will be offset 1:1 in accordance with Sydney Water's Biodiversity Offset Guideline. This will also apply to the native Queensland Bottletree if transplantation is unsuccessful. The location for offsetting will be decided during detailed design in consultation with WMC.

Weeds

Under Schedule 1 of the *Biosecurity Act 2015* all private landowners, occupiers, public authorities and councils are required to control weeds on their land. Trees classified as environmental weeds under the NSW Department of Primary Industries and Regional Development (DPIRD) are present in the site footprints and have been selected for removal. These include the Chinese Hackberry (*Celtis sinensis*) at Site 1 and Oleander (*Nerium Oleander*) at Site 4. The risk of weed spread will be managed with the implementation of the mitigation measures below.

Threatened fauna

A desktop search found no threatened fauna species within the site footprints. A Grey-headed Flying-fox (*Pteropus poliocephalus*) (Vulnerable BC Act and EPBC Act) sighting was mapped within 20 m of Site 2. The existing environment is disturbed and highly urbanised with existing noise and night-time light pollution. At Site 2, the proposal will require tree trimming and generate temporary noise and light pollution. However, impacts to this species are not anticipated due to the disturbed nature of the site, high mobility of this species, available species habitat adjacent to the proposal and temporary nature of the proposal.

Groundwater dependent ecosystems

The construction sites do not intersect with any groundwater dependent ecosystems (GDEs). The nearest GDE is over 500 m from Site 4 and is categorised as low value under the GDE High Ecological Value Aquatic Ecosystems (HEVAE) framework. Given the minor excavation activities, impacts to this GDE are not anticipated.

No impacts to flora and fauna are expected during operation.

Mitigation measures

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

Table 5-3 Environmental mitigation measures — flora and fauna

Mitigation measures

Provided it is essential for delivering the project, Sydney Water's Project Manager can approve the following vegetation removal and tree trimming, without additional environmental assessment (but only after consultation with the Environmental and Community Representatives and affected landowners). Sydney Water considers vegetation removal in these circumstances has minimal environmental impact.
• Any minor:
  ○ vegetation trimming or
  ○ removal of exotic vegetation or
  ○ removal of planted native vegetation where the vegetation is not a threatened species (including a characteristic species of a threatened community or population), heritage listed, in declared critical habitat or in a declared area of outstanding biodiversity value.
• Any removal of remnant vegetation where there is no net change to environmental impact (e.g. a different area of vegetation is removed but the total area is the same or less than assessed in the EIA).
Written explanation of the application of this clause (including justification of the need for trimming or removal and any proposed revegetation) should be provided when seeking Project Manager approval. Any impacts to native vegetation and trees must be offset in accordance with the Biodiversity Offset Guideline (SWEMS0019.13).

Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline (SWEMS0019.13).
Minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. Where possible, limit clearing to trimming rather than the removal of whole plants.
Physically delineate vegetation to be cleared and/or protected on site and install appropriate signage prior to works commencing.
Adjust methodology (e.g. avoid area, hand excavate, implement exclusion fencing) to protect sensitive areas where possible (such as mature trees, known threatened species, populations or ecological communities).
Engage a suitably qualified arborist to carry out vegetation removal and/or trimming.

Mitigation measures

Protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites. Do not damage tree roots unless absolutely necessary, and engage a qualified arborist where roots >50mm are impacted within the Tree Protection Zone.

Notify potentially affected residents of any tree removal.

Retain dead tree trunks, bush rock or logs in-situ unless they are in the construction area and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites. If native fauna is likely to be present, a licenced ecologist should conduct a pre-clearance inspection and undertake fauna relocation.

Inspect vegetation for potential fauna prior to clearing or trimming. If fauna is present, or ecological assessment has determined high likelihood of native fauna presence (including hollow bearing trees), engage WIRES or a licenced ecologist to inspect and relocate fauna before works.

If native fauna is encountered on site, stop work and allow the fauna to move away unharassed. Engage WIRES or a licenced ecologist if assistance is required to move fauna.

If any threatened species (flora or fauna) is discovered during the works, stop work immediately and notify the Sydney Water Project Manager. Work will only recommence once the impact on the species has been assessed and appropriate control measures implemented.

If any damage occurs to vegetation outside of the construction area (as shown in the CEMP), notify the Sydney Water Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.

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.

Record Pesticides and Herbicides use in accordance with SWEMS0017.

Bag all plant parts and excavated topsoil that may be infested with weed propagules and dispose at a licensed waste disposal facility.

In TOBAN period:

- check specific TOBAN notice to confirm whether the work can be carried out under standard exemptions (Govt Gazette No18 Feb 2018)
- if the work is not covered by a standard exemption, apply to RFS for specific exemption

5.4 Heritage

Aboriginal heritage

Existing environment and potential impacts

A desktop Aboriginal Heritage Due Diligence Assessment (AHDD) was prepared for the proposal (refer to Appendix D). The report assesses the potential impact of the proposal on Aboriginal archaeological heritage.

The proposal is not in a high-risk landscape for Aboriginal heritage (<200 m from waterways). A basic search of the Aboriginal Heritage information System (AHIMS) was conducted in January 2026 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the site footprints. AHIMS records show that there are no previously registered sites within or adjacent to the construction corridor. [redacted] Contemporary land use has led to high levels of disturbance due to urban developments, existing water-related infrastructure, landscaping and installation of utilities. With the implementation of the mitigation measures below, potential impacts to Aboriginal heritage are not anticipated and can be managed by implementing the mitigation measures.

Non-Aboriginal heritage

A Statement of Heritage Impact (SoHI) was prepared by Everick Heritage (2026) to assess the potential impacts of the proposal on non-Aboriginal heritage. Findings and recommendations outlined in the report are summarised below and provided in full in Appendix E. The SoHI assesses both State and locally listed heritage items.

Existing environment and potential impacts – State heritage item

The BOOS was the first ocean outfall sewer of its type to be designed and built in the country. It has historical and engineering significance as a rare and representative example of an early wastewater system in Sydney. This is enhanced by the degree of integrity and intactness of the form of the sewer and its nineteenth-century fabric. The significance of Sydney's wastewater system primarily relates to its role in the growth of Sydney and the expansion of municipal services from the turn of the century to the present.

The proposed work to the BOOS has two main components, desilting and internal relining. Desilting involves the removal of built-up silt and the return of the conduit to its full capacity. Lining involves installing an additional inner layer to the conduit, protecting the fabric from further degradation.

The most potentially impactful activities are the creation of two new maintenance holes at Elizabeth Street (Site 2) and at Trelawney Street (Site 3), and the creation of access slots in the aqueduct sections of the BOOS at Dillon Park (Site 1) and Lough Playing Fields (Site 4).

The SoHI concluded that the proposed works do not comprehensively fall within the scope of the Standard or the State Agency (Sydney Water) Exemptions. However, analysis of the works identified that there will be no substantive adverse effect upon the heritage fabric of the BOOS. The proposed works will protect the fabric and maintain the sewer in service. The alterations are minor in relation to the overall scale of the sewer (e.g. the access slots and two new MH works represent about 0.1% of the overall fabric). The proposal will protect the BOOS' heritage values by prolonging its operational functionality. Consequently, the

proposed works to the BOOS may be approved by Sydney Water in accordance with its delegated authority under the *Heritage Act 1977*. This Section 63 approval will be completed before construction starts.

Existing environment and potential impacts – local heritage items

There are several locally listed non-Aboriginal heritage items in and near the site footprints, including houses, buildings and parks. Five items could potentially be impacted by the proposal, see Table 5-4 and Figures 2-2 to 2-5.

Table 5-4 Non-Aboriginal heritage items within and nearby the site footprints

Heritage item	Woollahra Local Environment Plan 2014
'Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area'	C8
'Woollahra Heritage Conservation Area'	C15
'Scottish Hospital main hospital building and interiors, grounds, gardens, terracing, 2 Moreton Bay Figs, Norfolk Island Pine, Kauri Pine, Weeping Lilli Pilli, Holm Oak' (the Scottish Hospital)	1245
'Leana – Residential flat building and interiors, iron gateposts and gates' (Leana)	1601
'Street Name Inlays - Woollahra I679 and Double Bay I673'	1679 and 1673

The 'Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' is significant historically and aesthetically for its exceptional unity of scale, character, history, architecture and urban form. Paddington retains many significant types of buildings, ranging from modest, small-scale, single storey timber and masonry cottages to former gentry mansions. Site 1 and Site 2 fall within its boundaries. Site 1 will temporarily occupy an area of Dillon Park during construction, however, it will not have any permanent impact on significant fabric or other heritage values of the listing. Similarly, Site 2 will temporarily occupy an area of the road reserve of Elizabeth Street during construction but will not have any permanent impact on the heritage values of the listing.

'Woollahra Heritage Conservation Area' is recognised for its historical and aesthetic values. These are expressed in the architectural qualities of buildings, the arrangement of streets and buildings and the spatial qualities of its settlement and subdivision. Site 3 is within its boundaries and will temporarily occupy some of Trelawney Street road reserve during construction. However, it will not have any permanent impact on the heritage values of this item.

The Scottish Hospital is valued for its Arts and Crafts architecture, its history of use as a residence and a hospital and for its terraced garden and mature tree plantings. Site 1 (Dillon Park) is partially within its curtilage, however, the part of the curtilage that is affected by the proposed works is proposed as a driveway

and parking area (see Figure 2-2). The use of this area will have no impact on the fabric or the values of the heritage item and there will be no long-term permanent change to the land arising from the works.

Leana is an exceptional and intact example of the prominent architectural firm of Joseland and Gilling during the Inter War period. This three-storey building demonstrates the emergence of the residential flat building in Sydney, and in particular in the Woollahra municipal area. Site 3 is directly outside the garage block of the residential apartment building, and while it may be a temporary inconvenience to access into the garages it will have no impact on the heritage values of the item.

The heritage item 'Street Name Inlays - Woollahra I679 and Double Bay I673' is a collection of 493 street name inlays on footpaths and kerbs in Woollahra and Double Bay. They have historic and social significance for their construction in the 1930s as part of a civic beautification scheme. The corner of Trelawney Street and Rosemont Avenue to the north and Fullerton Street to the south have street name inlays close to Site 3 (Trelawney Street). The proposed works will not impact the footpaths or kerbing of Trelawney Street, however, given the proximity to the work areas, measures to ensure the protection of these street name inlays are listed in Table 5-5.

No impacts to Aboriginal and non-Aboriginal heritage are expected during operation.

Mitigation measures

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

Table 5-5 Environmental mitigation measures — heritage

Mitigation measures
Do not make publicly available or publish, in any form, Aboriginal heritage information on sites / potential archaeological deposits, particularly regarding location.
Repeat the basic AHIMS search if it is older than 12 months. Conduct additional assessment if new sites are registered and could be impacted by the works.
If any Aboriginal object or non-Aboriginal relic is found, cease all excavation or disturbance in the area and notify Sydney Water Project Manager in accordance with SWEMS0009.
No impacts to the BOOS are permitted until Section 63 approval is completed. The works must comply with any conditions of the Section 63 approval.
If there are changes to the design assessed within the SoHI: • engage an appropriately qualified heritage consultant, to be confirmed with Sydney Water, to provide professional conservation expertise to achieve the heritage aspects of the project • assess any proposed changes in design and methodology for consistency against the heritage approvals. Note, changes may require additional or varied approvals • for any scope changes, heritage aspects to be prioritised include those described below: ○ ensuring durability, integrity, and viability of the original fabric of the BOOS through repointing/repairing with an appropriate materials/render prior to relining works.

Mitigation measures

All project team members, including contractors, should be informed about the heritage significance of the site(s) as part of the general site induction package prepared by an appropriately qualified heritage consultant. The induction would identify why the BOOS is significant, the contractors' statutory obligations relating to heritage and to unexpected finds and the protection methods to be used during construction to prevent accidental damage during construction works.

The Contractor must provide records of the project works and photographic records of the interior of the BOOS before, during and after the conduct of the works. These should be annotated to identify their subjects and added to the archival record of the BOOS.

Bricks removed from the BOOS as part of the development of new maintenance hole access shafts should, if their condition is assessed by the SW Heritage Team and deemed to be satisfactory, be saved and recycled for use as replacement bricks in other sections of the BOOS.

Limit parking at Site 3 to the areas designated in Figure 2-4, and avoid the 'Street Name Inlays - Woollahra I679 and Double Bay I673' where possible to ensure the protection of this item.

5.5 Noise and vibration

A Construction Noise and Vibration Impact Assessment (CNVIA) was prepared for the proposal by SLR Consulting (2025) (see Appendix F). Findings and recommendations outlined in the report are summarised below.

Existing environment

Land use surrounding Sites 1 to 4 includes residential, community use and recreational/open areas. The existing noise environment is influenced by local foot traffic and vehicle traffic including trucks and cars. The nearest sensitive receivers include low to medium density suburban residential premises, educational facilities, daycare centres, medical facilities, and small businesses that are located adjacent to the sites.

Potential impacts

Rating Background Noise Levels (RBLs) were derived from the residential receiver amenity noise categories outlined in the NSW EPA Noise Policy for Industry (NPfI). The 'suburban residential' amenity classification was selected for all sites based on land zoning and descriptions provided in the NPfI. The assumed RBLs are:

- 40 dBA in the daytime
- 35 dBA in the evening
- 30 dBA at night.

These RBLs are supported by the recommended RBLs in the Transport for NSW Construction Noise and Vibration Guideline (CNVG).

The proposal has the potential to cause noise and vibration impacts from:

- construction activities including open excavation and pipe jacking
- construction traffic

- equipment (e.g. generators, jackhammers, compactor).

The noise levels experienced at any one location will rise and fall relative to:

- the intensity and location of construction activities
- the intervening terrain or infrastructure
- the type of equipment used.

Construction noise

It is expected that some construction activities will take place simultaneously across the sites during the 2-year duration of the project. Cumulative noise impacts are not anticipated due to the large distances between each of the four site footprints (see Figure 2-1). The individual staging and duration of works at each site are:

- Site 1 (Dillon Park) - 12-month duration; consisting of approximately 2.5 months for site establishment/demobilisation, 3 months for access shaft construction (noisiest works), 3.5 months for desilting activities and 3 months for GRP Jacking.
- Site 2 (Elizabeth St) - 9-month duration; consisting of approximately 0.5 months for site establishment/demobilisation, 2.5 months for access shaft construction (noisiest works for 10-20 days while the ground is broken), 1 month for desilting activities and 5 months for CAC lining.
- Site 3 (Trelawney St) - 9-month duration; consisting of approximately 0.5 months for site establishment/demobilisation, 2.5 months for access shaft construction (noisiest works for 10-20 days while the ground is broken), 1 month for desilting activities and 5 months for CAC lining.
- Site 4 (Lough Playing Fields) - 14-month duration; consisting of approximately 4 months for site establishment/demobilisation, 4 months for access shaft construction (noisiest works), 3.5 months for desilting activities and 2.5 months for GRP Jacking.

Potential construction noise levels from the proposal were modelled. The noise model considered ground topography, ground type, buildings and representative worst-case noise sources from the proposal. For assessment purposes, all plant and equipment for each scenario was presumed to be operating concurrently. Therefore, most construction noise levels are expected to be lower than predicted.

The noise contour maps at the worst-case receivers are shown in Appendix F. The noise contours are presented at 1.5 m above ground height, which is representative of typical ground floor receivers. In built up environments, noise levels may be greater at height. Elevated (first floor) receivers were assessed, and the difference in results between receivers at ground level and higher floors was negligible.

Table 5-6 summarises the predicted typical and worst-case noise impacts for the most-affected residential receivers. The orange shading in the ‘Predicted Construction Noise Impact’ column represents sensitive receivers who will experience high noise impacts (> 20 dBA in the daytime and > 25 dBA for out of hours). The pink shading in the ‘Predicted Construction Noise Impact’ column identifies the highly noise affected sensitive receivers (> 75 dBA in the daytime). This table also includes some activities being completed in an acoustic shed. Acoustic shed reductions greater than 30 dB are not practically achievable. Therefore, the closest sensitive receivers at Dillon St Park, Elizabeth Street and Trelawney Street would likely experience residual noise impacts.

Table 5-6 Construction noise predictions at the most-affected sensitive receivers

Site Location	Receiver Address	Receiver Type	NML (dBA)	Period	Construction Scenario ID[1]	Predicted Construction Noise Impact $L_{Aeq(15minute)}$ (dBA)	
						Typical	Worst-case
Dillon St Park	36 Stephen St, Paddington	Residential	50	Day	W.001a - CFA Piling & Shaft Excavation	74	87
	36 Stephen St, Paddington		50	Day	W.001b - Site Establishment & General Operation	74	87
	17 Neild Av, Paddington		50	Day	O.001a - Operational – Day (all activities)	81	85
	17 Neild Av, Paddington		35	Night	O.001b – Operational- Night (shed activities only)	69	73
	36 Stephen St, Paddington		35	Night	O.001b – Operational – Night (all activities)	72	78
Lough Playing Fields	81 Manning Rd, Woollahra	Residential	50	Day	W.002a - CFA Piling & Shaft Excavation	71	84
			50	Day	W.002b - Site Establishment & General Operation	73	84
			50	Day	O.002a - Operational – Day (all activities)	75	79
			35	Night	O.002b – Operational- Night (shed activities only)	63	66
			35	Night	O.002b – Operational – Night (all activities)	65	73
Elizabeth Street	105 Elizabeth St, Paddington	Residential	50	Day	W.003a - Boring, Shaft Excavation & General Operation	85	91
			35	Night	O.003a – Operational (shed activities only)	76	80
			35	Night	O.003a – Operational (all activities)	82	87
Trelawney Street	2/1 Rosemont Av, Woollahra	Residential	50	Day	W.004a - Boring, Shaft Excavation & General Operation	89	106
			35	Night	O.004a – Operational (shed activities only)	80	90
			35	Night	O.004a – Operational (all activities)	99	100

Where the ‘mitigated’ construction noise levels shown in Table 5-6 are expected to remain above the NMLs, it is recommended that the Additional Mitigation Measures Matrix (AMMM) (Table 5-7) adapted from the CNVG is implemented. The approach, guided by the AMMM, is primarily aimed at proactive engagement with affected sensitive receptors rather than additional noise reducing mitigation.

Potential impacts from noise can be managed by applying the general mitigation measures in Table 5-8 and the additional mitigation measures in Table 5-7. The abbreviations listed in Table 5-7 represent: periodic notification (PN), verification monitoring (V), specific notification (SN), alternative construction methodology (AC), respite offer (RO), duration reduction (DR), alternative accommodation (AA) and respite period (RP).

Table 5-7 Airborne Noise – Additional Mitigation Measures Matrix

Time Period		Receiver perception	Exceedance of NML (dBA)	Additional management measures
Standard Hours	Monday-Friday 7 am-6pm Saturday 8am-1pm	Noticeable	No exceedance	-
		Low impact	1-10	-
		Moderate impact	11-20	PN
		High impact	>20	PN
		Highly Noise Affected	-	PN, V, SN
OOHW Period 1	Monday-Friday 6pm-10pm Saturday 7am-8am or 1pm-10pm Sunday/Public Holidays 8am-6pm	Noticeable	≤ 5	-
		Low impact	6 to 15	PN, RP[1], DR[1]
		Moderate impact	16 to 25	PN, V, SN, RO, RP[1], DR[1]
		High impact	>25	PN, V, SN, RO, RP[1], DR[1]
OOHW Period 2	Monday-Saturday 12am-7am 10pm-12am Sunday/Public Holidays 12am-8am 6pm-12am	Noticeable	≤ 5	PN
		Low impact	6 to 15	PN, V, SN, RO[2], RP, DR
		Moderate impact	16 to 25	PN, V, SN, RO[2], RP, DR
		High impact	>25	PN, V, SN, RO[2], RP, DR, AA

Note 1: Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only (i.e. Saturday 7am-8am & 1pm-6pm, Sundays / Public Holidays 8am-6pm)

Vibration impacts

The proposal has the potential to generate vibration from plant and equipment. A vibration screening assessment for building cosmetic damage and human comfort for the following activities was conducted:

- Site 1 - CFA/bored piling, 2T vibratory roller
- Site 2 - Bored piling
- Site 3 - Bored piling
- Site 4 - CFA/bored piling, 2T vibratory roller

The minimum working distance buffer areas have been determined and are described in the below mitigation measures. They show the possibility of vibration impacting buildings and heritage structures or causing a negative human response. The minimum working distances are indicative and vary depending local geotechnical conditions and plant.

Buildings within the minimum working distances may experience cosmetic damage. Potential impacts can be mitigated through monitoring and adjusting equipment size or type (see mitigation measures below).

Potential impact to the heritage-listed BOOS is discussed in Section 5.4. Potential vibration impacts to other heritage structures are not anticipated as they fall outside the minimum working distance.

It is expected that vibration impacts from bored piling for Sites 2 and 3 will be minimal, unless unusually competent/hard ground is encountered. Vibration monitoring would be completed if bored shaft locations are relocated within 4 m of any structures to avoid impacts.

Sensitive human receivers are within the minimum working distances. Human occupants within buildings that fall within the human comfort minimum working distance may have an increased likelihood of complaints, depending on their proximity and duration of the works. However, as vibration emissions are intermittent and short-term, negative human response is assessed as unlikely and can be adequately managed by the mitigation measures below.

No operational noise or vibration impacts are expected.

Mitigation measures

The table below outlines mitigation measures to manage noise and vibration impacts to minimise them as far as reasonable and feasible.

Table 5-8 Environmental mitigation measures — noise and vibration

Mitigation measures
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 where possible. The Proposal will also be carried out in accordance with Sydney Water's Noise Management Procedure SWEMS0056. All reasonable and feasible noise mitigation measures should be justified, documented and implemented onsite to mitigate noise impacts.

Incorporate **standard daytime hours noise management safeguards** into the CEMP, including but not limited to:
• Identify and consult with the potentially affected residents prior to commencement of works. This should:
  ○ 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 (e.g. 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 complaints handling procedure.
• Do not warm-up plant or machinery near residential dwellings before the nominated working hours.
• Select appropriate plant for each task, to minimise the noise impact (e.g. all stationary and mobile plant will be fitted with residential type silencers).
• Do not use engine brakes when entering or leaving the work site(s) or within work areas.
• Regularly inspect and maintain equipment in good working order.
• Arrange work sites where possible to minimise noise (e.g. 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).

Mitigation measures

- 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).

As works **beyond standard daytime hours are needed** the Delivery Contractor would:

- 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.

As **night works are needed** the Delivery Contractor would:

- 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
- identify community notification requirements (i.e. 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.

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.

RBLs should be confirmed by background monitoring.

Limit truck routes to major roads, and limit truck deliveries to standard construction hours where feasible.

Use acoustic sheds around noisy excavation/piling work.

Face doors/openings of acoustic sheds away from nearby sensitive receivers.

Carry out loading and unloading away from noise sensitive areas, where practicable.

Site huts, maintenance sheds and/or containers should be positioned between noisy equipment and the affected receivers. Take advantage of existing screening from local topography.

Conduct noise monitoring near some of the most-affected sensitive receivers.

Mitigation measures

Conduct a dilapidation survey / asset condition assessment prior to works which have potential to damage existing structures.

Do not work within the following minimum vibration working distances where possible.

Plant Item	Rating/Description	Minimum Working Distance	
		Cosmetic Damage	Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	20 m
	<200 kN (4–6 tonne)	12 m	40 m
	<300 kN (7–13 tonne)	15 m	100 m
	>300 kN (13–18 tonne)	20 m	100 m
	>300 kN (>18 tonne)	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	73 m
Vibratory Pile Driver[1]	Low Energy (nominally 2 kJ/cycle)	8 m	30 m
Vibratory Pile Driver[1]	Medium Energy (nominally 10 kJ/cycle)	18 m	100 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	N/A
Piling Rig – Bored[1]	≥ 800 mm and ≤ 2500 mm	4 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	2 m

Note 1: Vibration minimum working distances for these plant items are not from the CNVG and based on other empirical data.

Attended vibration measurements should be undertaken at the start of the works to determine actual vibration levels at the item. 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. E.g. for vibration generating works within the minimum working distances to buildings or assets.

Complete an assessment prior to construction to confirm vibration emitting equipment will not have any additional impact to the BOOS.

If the use of vibration intensive plant is required within the minimum working distances of the following premises, verification monitoring is required to confirm vibration levels:

- 11 Clarence Pl, Double Bay when a 12T vibratory roller is in use at Dillon Street Park
- 91 Manning Rd, Woollahra when a 12T vibratory roller is in use at Dillon Street Park
- Garage of 81 Manning Rd, Woollahra when a 12T vibratory roller is in use at Dillon Street Park
- 36 Stephen St, Paddington when a 12T vibratory roller is in use Lough Playing Fields

Mitigation measures
Vibration monitoring is recommended in response to vibration 'human comfort' complaints. If the thresholds are exceeded, respite offers (RO) should be implemented. Respite periods of 1 hour after every 3 hours of high noise/vibration generating work are also required.
Refer to Table 5-7 of this REF for proposal specific noise mitigation measures where the 'mitigated' construction noise levels are expected to remain above the NMLs.
Vibration monitoring would be completed if bored shaft locations are relocated within 4 m of any structures to avoid structure impacts.

5.6 Air and energy

Existing environment and potential impacts

The proposal is in urban residential, mixed use and recreational areas. Potential sensitive receivers include residential properties, local businesses and recreational users of Dillon Park and Lough Playing Fields.

The proposal could potentially impact air quality and energy use through:

- emissions from machinery, equipment and vehicles used during construction
- dust generated by construction
- odour emissions from desilting and opening the BOOS
- fuel used to power equipment.

Vehicle and equipment emissions have the potential to cause impacts where they are in place for longer. By implementing the mitigation measures such as maintaining vehicles and switching off equipment when not in use, impacts are expected to be minor.

There is potential to generate dust when disturbing the ground to expose the BOOS. However, installing acoustic sheds and applying standard mitigation measures such as dust suppression and covering loads will further reduce potential impacts.

Potential odour emissions are associated with opening the BOOS and the desilting process. The acoustic sheds enclosing the excavations at each site will maintain negative pressure, minimising odour escaping into the surrounding environment. Odour control and ventilation units will also be deployed at each site to treat air as it passes through the wastewater network. The silt removed from the BOOS will be stored and transported in sealed skip bins to prevent any additional odour issues.

Sydney Water's total energy usage would marginally increase during construction. The proposal has a relatively short duration and energy usage would be managed in accordance with the below mitigation measures.

No impacts to air or energy are expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to air and energy can be adequately managed, and residual impacts are expected to be minor.

Table 5-9 Environmental mitigation measures — air and energy

Mitigation measures
Use alternatives to fossil fuels where practical and cost-effective.
Track energy use as per SWEMS0015.28 Contractor NGER template.
Minimise the potential for odours (e.g. minimise the number of open access chambers, close maintenance holes overnight, store and transport silt in sealed skip bins).
Ensure odour control measures are available and ready to use during the works. Ventilation and odour control units would be deployed at each site.
Maintain equipment in good working order, comply with the clean air regulations of the *Protection of the Environment Operations Act 1997*, have appropriate exhaust pollution controls, and meet Australian Standards for exhaust emissions.
Switch off vehicles/machinery when not in use.
Implement measures to prevent offsite dust impacts, for example: • Water exposed areas (using non-potable water source where possible such as water from excavation pits). • Cover exposed areas with tarpaulins or geotextile fabric. • Modify or cease work in windy conditions. • Modify site layout (place stockpiles away from sensitive receivers). • Vegetate exposed areas using appropriate seeding. • Cover all transported waste.

5.7 Waste and hazardous materials

Existing environment and potential environmental impacts

Sydney Water's corporate objectives include to be a resource recovery business with an increasing portfolio of circular economy products and services. This includes reducing waste through recycling and re-use and encouraging suppliers to minimise wastes. The delivery contractor will manage materials in accordance with the 'avoid and reduce, reuse, recycle, recover, recover energy, treat and dispose' waste hierarchy. This will be documented in the Waste Management Plan in the CEMP.

Potential contamination sources in the site footprints include:

- Fill material
- Hazardous materials at Sites 1 (Dillon Park) and 4 (Lough playing fields)

The proposal will generate waste from:

- vegetation trimming and clearing
- earthworks
- construction material that can't be re-used

- desilting of the BOOS.

During construction, a large volume of waste will be generated in the form of excess spoil from excavations. Wherever possible, excavated spoil will be re-used on site for backfilling and other uses. If the spoil can't be reused it will be tested and classified according to the Waste Classification Guidelines (NSW EPA, 2014) and disposed of at an appropriately licensed facility. Soil will be temporarily stockpiled within the site footprint before offsite disposal. Sampling and analysis of excavated material during construction would be required to confirm whether spoil is likely to meet the criteria for general solid waste of excavated natural material.

About 500 tonnes of silt will be removed from the BOOS. It will be tested and classified according to the Waste Classification Guidelines (NSW EPA, 2014) and disposed of at an appropriately licensed facility.

The following hazardous materials have been identified:

- Dillon Park (Site 1):
    - Polycyclic Aromatic Hydrocarbons (PAHs), primarily as Benzo(a)pyrene (BaP), likely due to the presence of ash
- Lough Playing Fields (Site 4):
    - PAHs, primarily as BaP, likely due to the presence of ash
    - A fragment of bonded asbestos

Previous studies at Dillon Park (Site 1) suggest there is a layer of fill across the site impacted by BaP. A capping system was installed to protect above ground users from the impacted soils beneath. An EMP (2019) was prepared by Douglas Partners on behalf of Woollahra Council. The EMP notes the barrier system is 500 mm clean soil over a white geotextile marker layer in areas outside of tree root zones. Tree root zones were capped with 100mm of mulch. Excavation for the GRP maintenance hole at Site 1 requires excavation beneath the capping barrier system and may disturb impacted soils. Additional controls to mitigate the risks from BaP are required and the capping barrier system will be reinstated.

Sydney Water commissioned WSP to carry out a Detailed Site Investigation (DSI) at Lough Playing Fields (Site 4) in 2020. BaP was detected above NEPM 2013 Screening levels across the fill material encountered at all testing locations. However, a subsequent Human Health Risk Assessment (HHRA) revealed the bioavailability of the BaP was low and poses a low risk to passive recreational site users under the current site condition. With good grass cover, the risk is reduced further as direct contact/exposure is limited. It should be noted that the existing contamination still requires management during earthworks/construction of the new GRP maintenance hole at Site 4 to control the risks posed by disturbing the soil.

The excavation footprint at Site 4 does not intersect with the known bonded asbestos location. Should the work uncover asbestos or any other hazardous or contaminated material, it will be managed through an unexpected finds procedure.

No impacts from waste and hazardous materials are expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to waste and hazardous materials can be adequately managed, and residual impacts are expected to be minor.

Table 5-10 Environmental mitigation measures — waste and hazardous materials

Mitigation measures
Manage waste in accordance with relevant legislation and maintain records to show compliance e.g. waste register, transport and disposal records. Record and submit SWEMS0015.27 Contractor Waste Report.
Prevent pollutants from escaping including by covering skip bins.
Dispose excess vegetation (non-weed) that cannot be used for site stabilisation at an appropriate green waste disposal facility.
Provide adequate bins for general waste, hazardous waste and recyclable materials.
Minimise stockpile size and ensure delineation between different stockpiled materials.
Prepare a Waste and Resource Recovery Plan (WRRP) to appropriately manage and classify any materials including soils, construction/demolition wastes and associated stockpiles The plan will be prepared by the Delivery Contractor (or nominated environmental consultant) and approved by the Sydney Water Project Manager in consultation with the Environmental Representative and the Contamination and Hazardous Materials team. The WRRP should include: • expected waste types and their location • delineation of waste /resource types including identification of likely vertical and lateral extents (where warranted) • visual monitoring of materials during excavation and measures to be undertaken to prevent co-mingling / cross-contamination of waste / resource types • ex-situ waste and resource recovery classification program, including timing relative to project / excavation phases as well as proposed hold points • waste minimisation and resource recovery methodologies (including consideration of onsite reuse or management if contaminated) • roles and responsibilities in relation to stockpile and material management and monitoring program • proposed onsite reuse locations and reuse methodology (if applicable) • proposed offsite reuse, offsite recycling and / or offsite disposal locations / facilities • legislative compliance requirements • consideration of future maintenance • restoration.
If fibro or other asbestos containing material is identified, restrict access and follow Sydney Water's Asbestos Management – Minor Works procedure, Document Number 746607 and SafeWork NSW requirements. Contact Sydney Water Project Manager (who will consult with the Contamination and Hazardous Materials team propertyenvironmental@sydneywater.com.au).

Mitigation measures
Manage waste and excess spoil in accordance with the NSW EPA Resource Recovery Orders and Exemptions (if applicable) and / or Waste Classification Guidelines. Where materials are not suitable or cannot be reused onsite or offsite, recycle where appropriate. Recycle soils at a licensed soil recycling facility or dispose at an appropriately licenced landfill facility. Assess if the fill could be classified as a recovered resource and if deeper natural soils could be classed as VENM or ENM. Do not send VENM/ENM to landfill.
Engage an appropriately qualified Contamination Specialist to develop Contamination Management Plans (CMPs). Provide the **Lough Playing Fields** 2020 DSI report and the **Dillon Park** 2019 EMP to the Contamination Specialist to assist with the preparation of the CMPs
The CMPs must include control measures for excavation and reinstatement within the following areas with known contamination: • Lough Playing Fields Benzo(a)pyrene and asbestos contamination. • Dillon Park Benzo(a)pyrene contamination. Consider the requirements in Section 6 and 7 of the EMP.
Provide the CMP to the Sydney Water Contamination & Hazardous Materials team (propertyenvironmental@sydneywater.com.au) for review.
Contamination Specialist should carry out an in-situ soil Waste/Resource Classification as per NSW EPA Waste Classification Guidelines and NSW EPA Resource Recovery Schemes at Dillon Park (Site 1) and Lough Playing Fields (Site 4). Target excavation areas prior to breaking ground.
Consult with/seek endorsement from Council prior to any works on their land. Provide them with the CMPs to outline contamination management on their land. For Dillon Park, provide a remedial works report to the Council following reinstatement.

5.8 Traffic and access

Existing environment

The proposal sites are either on or accessed via local roads in residential and mixed-use areas. These include:

- Site 1 - Neild Avenue, Edgecliff and Stephen Street, Paddington
- Site 2 - Elizabeth Street, Paddington
- Site 3 - Trelawney Street, Woollahra
- Site 4 - Manning Road, Double Bay

These local roads have formal pedestrian footpaths. Bus route 327 Bondi Junction to Edgecliff passes through Manning Road, which is adjacent to Site 4.

A traffic volume sample counter at Glenmore Road recorded 5,284 vehicles travelling eastbound and 4,739 vehicles travelling westbound daily in 2009. This sample counter was about 200 m from Site 1 Dillon Park and was selected as the most representative nearby location for traffic volumes on local roads in the Woollahra LGA. However, traffic volumes have likely increased since this data was recorded.

Potential impacts

Activities with the potential to impact traffic, transport and access include:

- movement of workers, plant, equipment, and vehicles
- construction activities (such as compound use, trenching, laydown areas)
- construction worker parking.

Light and heavy vehicle movements will vary depending on work staging. Initial works and major activities, such as GRP lining and desilting, are expected to have a higher number of vehicle movements across all sites. Vehicle movements as a daily average across the four sites are as follows:

- Site 1 (Dillon Park) - 15 light vehicles and 20 heavy vehicles
- Site 2 (Elizabeth St) -15 light vehicles and 5 heavy vehicles
- Site 3 (Trelawney St) - 8 light vehicles and 2 heavy vehicles
- Site 4 (Lough Playing Fields) - 45 light vehicles and 25 heavy vehicles.

Heavy vehicles will transport material and equipment. Equipment, such as excavators, will be moving within the site footprint. Temporary partial road closures would be required where construction activities are taking place within the roadway (Sites 2 and 3) or to allow movements in and out of the site (Sites 1 and 4).

The proposal requires temporary laydown areas on council owned public roads. Potential impacts will be managed via a TMP and WMC will be consulted to approve the plan.

Construction will be staged to maintain traffic flow as far as reasonably practicable. No residential driveways will be impacted by the proposal, and property access and public transportation routes will be maintained at all times for all sites. Each site footprint will occupy 5 to 15 parking spaces for the duration of works to maintain access to Sites 1 and 4, and allow single-lane traffic flows at Site 2 and regular contra-flow traffic at Site 3. Workers will park within the site footprints where possible. Traffic, parking and plant movements will be managed in accordance with the proposed mitigation measures and are to minimise the impact on parking availability in areas surrounding the proposal.

Construction sites will be managed to ensure that pedestrians and cyclists can pass safely. Sites 1 and 4 will occupy land managed by Council. Construction areas will be temporarily inaccessible during construction.

No impacts to traffic and access are expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to traffic and access can be adequately managed, and residual impacts are expected to be minor.

Table 5-11 Environmental mitigation measures — traffic and access

Mitigation measures
Prepare a Traffic Management Plan (TMP) in consultation with Woollahra Council.

Mitigation measures
Minimise traffic impacts near residential properties, schools and businesses (e.g. no major materials deliveries at school drop off or pick up times etc.).
Manage sites to allow people to move safely past the works, including alternative pedestrian, bicycle, pram and wheelchair access.
Consult with Woollahra Council about managing impacts to pedestrian traffic, signposting, metres, parking, line-marking or if traffic control or pavement restoration is required.
Erect signs to inform road users of the proposed works and any temporary road closures.
Ensure work vehicles do not obstruct vehicular or pedestrian traffic, or private driveways, public facilities or business access unless necessary and only if appropriate notification has been provided.
Workers will park within the site footprints where possible.

5.9 Social and visual

Existing environment

The existing environment in the site footprints includes largely residential suburbs of Paddington, Woollahra and Double Bay. Future changes anticipated for the area include transportation infrastructure upgrades and higher density residential growth. The proposal area includes Dillon Park (Site 1) and Lough Playing Fields (Site 4).

Potential impacts

The potential social impacts from noise, vibration, traffic, air quality and access are considered in the sections above. Visual amenity and functionality of public recreation spaces would be impacted for up to 2 years during construction. The increased presence of heavy equipment, machinery and vehicles at Dillon Park (Site 1) and Lough Playing Fields (Site 4) would be noticeable to surrounding receivers. Construction activities and site compounds may be visible from residences adjacent to the proposal.

While some vegetation clearing is 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 Section 5.3.

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

Mitigation measures

With the implementation of the mitigation measures below, impacts to social and visual amenity can be adequately managed, and residual impacts are expected to be minor.

Table 5-12 Environmental mitigation measures — social and visual

Mitigation measures
Undertake works in accordance with Sydney Water Communications policies and requirements including: • Notify impacted residents and businesses. • Erect signs to inform the public on nature of work. • Treat community enquiries appropriately.
Restore work sites to pre-existing condition or better.
Minimise visual impacts (e.g. retain existing vegetation where possible).
Direct artificial light away from sensitive receivers where possible (ie residents, fauna or roadways).
Maintain work areas in a clean and tidy condition.
Retain the slide at Dillon Park and barricade the entry during construction.
Install the BOOS access shaft at Dillon Park on top of the existing playground as per instruction from Woollahra Council.

5.10 Cumulative and future trends

Potential environmental impacts

A search of the NSW Department of Planning Housing and Infrastructure major projects website in January 2026 did not identify any other projects in the Woollahra LGA. During construction, the main potential cumulative impacts of the proposal relate to noise and traffic.

The potential for cumulative noise impacts is dependent on the specific activities carried out simultaneously close to sensitive receivers. There is increased potential for cumulative impacts where the proposal is in one location for longer. Through effective community consultation and coordination with nearby projects, potential impacts can be managed by mitigation measures in this section and Section 5.5.

The proposal will generate increased construction traffic. The potential to generate cumulative impacts is lower on local roads. Impacts will be managed in accordance with the mitigation measures proposed in this section and Section 5.8.

Once staging of works along the BOOS alignment is known, the WMC council development application website can be checked for developments with the potential to cause cumulative impacts. The delivery contractor will coordinate works with ongoing or proposed developments and WMC to mitigate impacts if required.

No cumulative impacts during operation are expected.

Future trends

Climate change is predicted to cause:

- higher temperatures

- decreased annual rainfall
- longer dry periods and more extreme weather events such as high intensity storms and bushfires.

Increased frequency and/or severity of bushfires, flooding and extreme storm events are unlikely to impact the proposal during operation, as the BOOS is underground. Bushfire risk during construction is extremely low, given the urban setting of the proposal and low density of surrounding vegetation. Storms and floods have the potential to cause damage to Sydney Water property and infrastructure during construction. Although, the risk associated with this is extremely low as the proposal is not in a flood planning area (Woollahra LEP 2014). Any risks will be mitigated through standard safety mitigation measures. Further assessment will be carried out in detailed design and construction in line with Sydney Water's Climate Change Adaption guidelines.

The proposal has the potential to exacerbate future trends through greenhouse gas (GHG) emissions from fossil fuel use. GHG emissions have been assessed throughout concept design, using the Sydney Water GHG Estimation Tool. Key considerations and mitigations measures to reduce the carbon footprint of the proposal include construction methodology and material types. Upfront emissions reductions opportunities will be further explored throughout detailed design and construction procurement.

During operation, the proposal is not expected to exacerbate future trends. Rehabilitation of the BOOS is expected to improve the resilience of the wastewater network to climate change by reducing sediment load and reducing the potential for water to infiltrate the BOOS during wet weather.

Mitigation measures

With the implementation of the proposed mitigation measures, cumulative and future trends impacts can be adequately managed, and residual impacts are expected to be minor.

Table 5-13 Environmental mitigation measures — cumulative and future trends

Mitigation measures
Consult with key stakeholders that are constructing infrastructure in the area with a view to coordinate works where practicable.
Check WMC council development application website once staging of works along the BOOS is known. Delivery contractor will coordinate works with ongoing or proposed developments with the potential to cause cumulative impacts.

5.11 General environmental management

Table 5-14 Environmental mitigation measures — general environmental management

Mitigation measures
Sydney Water's Project Manager (after consultation with the environmental and community representatives and affected landowners) can approve temporary ancillary construction facilities (such as compounds and access tracks), without additional environmental assessment or approval if the facilities: • limit proximity to sensitive receivers • do not disrupt property access

Mitigation measures

- have no impact to known items of non-Aboriginal and Aboriginal heritage
- are outside high risk areas for Aboriginal heritage
- use existing cleared areas and existing access tracks
- have no impacts to remnant native vegetation or key habitat features
- have no disturbance to waterways
- do not require additional safeguards beyond those included in the EIA
- do not disturb contaminated land or acid sulfate soils
- will be rehabilitated at the end of construction.

The Delivery Contractor must demonstrate in writing how the proposed ancillary facilities meet these principles. Any facilities that do not meet these principles will require additional environmental impact assessment.

The agreed location of these facilities must be shown on the CEMP site plan and appropriate environmental controls installed.

The Delivery Contractor should consider/must conduct pre-mobilisation and post-demobilisation soil sampling on compound sites to confirm no residual impacts.

Should the proposal or methodology change from the EIA, no further environmental assessment is required provided the change:

- remains within the assessment/study area for the EIA and has no net additional environmental impact or
- is outside the assessment/study area for the EIA but:
    - reduces impacts to biodiversity, heritage or human amenity or
    - avoids engineering (for example, geological, topographical) constraints and
    - after consultation with any potentially affected landowners and relevant agencies.

The Delivery Contractor must demonstrate in writing how the changes meet these requirements, for approval by Sydney Water's Project Manager in consultation with the environmental and community representatives.

Prepare a Construction Environmental Management Plan (CEMP) addressing the requirements of this environmental assessment. The CEMP should specify licence, approval and notification requirements. Prior to the start of work, all project staff and contractors will be inducted in the CEMP.

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

- go/no go areas and boundaries of the work area including locations of lay-down and storage areas for materials and equipment
- 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.

The CEMP will identify appropriate delineation. Delineate approved site boundary before construction.

Mitigation measures

Prepare an Incident Management Plan (IMP) outlining actions and responsibilities for:

- predicted/onset of heavy rain during works
- spills
- unexpected finds (e.g. heritage and contamination)
- other potential incidents relevant to the scope of works.

All site personnel must be inducted into the IMP.

To ensure compliance with legislative requirements for incident management (e.g. *Protection of the Environment Operations Act 1997)*, Follow SWEMS0009 and attach SWEMS0009 to the CEMP.

Complaints to be managed in accordance with Sydney Water's Complaints Procedure and relevant Community Engagement Plan.

Assign single person with accountability for coordinating communication and information flow across contractors and consultants and provide the contact details of this person in the CEMP.

6. Conclusion

Sydney Water has prepared this REF to assess the potential environmental impacts of rehabilitating the Bondi Ocean Outfall Sewer (BOOS).

The main potential construction environmental impacts of the proposal include impacts associated with waste and hazardous materials, non-Aboriginal heritage, noise and vibration, traffic, and social and visual. No operational impacts are anticipated. Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in this 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 ESD. The proposal will not result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment.

Publication Number: SW 199 05/26

References

D4C, 2023. Bondi Ocean Outfall Sewer (BOOS) Rehabilitation Stage 1 Package A - Geotechnical Factual Report, February 2023.

D4C, 2026. Waste classification - Bondi Ocean Outfall Sewer (BOOS) rehabilitation, January 2026.

WMC (Woollahra Municipal Council) (2014) Woollahra Local Environmental Plan 2014 (2015 EPI 20), NSW legislation website, accessed January 2026.

EPA (NSW Environmental Protection Authority) (2017) *NSW Noise Policy for Industry*, EPA website, accessed January 2026.

EPA (NSW Environment Protection Authority) (2020) *Draft Construction Noise Guideline*, EPA website, accessed January 2026.

WSP, 2020. Detailed Site Investigation – 64 Stuttie Road, Double Bay, September 2020.

Appendices

Appendix A – Section 171 checklist

Section 171 checklist	REF finding
Any environmental impact on a community	There will be temporary impacts on the community including from noise, vibration, loss of amenity, and traffic. Potential impacts will be managed in accordance with the mitigation measures listed in Section 5. During operation, no impacts are expected.
Any transformation of a locality	There are minor and localised visual changes during construction associated with construction sites and vegetation impacts. The proposal will not result in the transformation of a locality during operation, as the BOOS is below ground.
Any environmental impact on the ecosystems of the locality	The proposal will result in minor environmental impacts to ecosystems of the locality as tree clearing and trimming is required. These impacts will be offset in accordance with the Sydney Water's Biodiversity Offset Guideline.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	There are temporary and minor reductions in aesthetic and recreational factors during construction. However, there are no permanent changes as the BOOS is below ground. Trees removed will be offset in accordance with the Sydney Water's Biodiversity Offset Guideline.
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	Potential impacts to the heritage items are assessed as minor. Applying the recommended mitigation measures will ensure potential impacts to the heritage values are avoided.
Any impact on the habitat of any protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)	All trees identified for removal are planted exotic species and the impact on the habitat of protected animals is considered negligible. Any unanticipated impacts would be managed in accordance with the mitigation measures listed in Section 5.
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	The proposal will not endanger any species. Any unanticipated impacts would be managed in accordance with the mitigation measures listed in Section 5.
Any long-term effects on the environment	The proposal will have a minor long-term impact on the environment from vegetation removal. But this will be offset in accordance with Sydney Water's Biodiversity Offset Guideline. The proposal will have an overall long-term benefit by providing a reliable wastewater service for the area.

Section 171 checklist	REF finding
Any degradation of the quality of the environment	There will be minor and temporary degradation of the social and aesthetic quality of the environment through visual impacts associated with vegetation removal and the presence of construction compounds. Site footprints have been modified where possible to retain higher quality vegetation.
Any risk to the safety of the environment	The proposal will not increase risk to the safety of the environment. It is not expected to be impacted by, or impact, future trends such as flooding and bushfire.
Any reduction in the range of beneficial uses of the environment	During construction there will be some temporary reduction in the range of beneficial uses of the environment, such as temporary closures of public recreation areas. There will be no reduction of beneficial uses during operation.
Any pollution of the environment	Potential temporary odour and noise emissions will be generated by the proposal during construction. Vehicles and plant will also release some greenhouse gases. Environmental mitigation measures will manage potential impacts and no other pollution is expected. The proposal will have an overall long-term benefit by reducing the potential for pollution during operation.
Any environmental problems associated with the disposal of waste	Waste disposal will be in accordance with the environmental mitigation measures, and no environmental problems 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 will not have any cumulative environmental effect with other existing or likely future activities.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposal will not have any impact on these factors.
Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the EP&A Act, Division 3.1	The BOOS is a strategically important wastewater asset but there are no applicable strategic planning statements or plans. The proposal is part of Sydney Water's South Avoid Fail Program (SAF), that proactively addresses escalating structural, environmental, and service continuity risks.
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 requires a determining authority to take into account the matters a consent authority must consider under Part 6.2 of the BCSEPP for a proposal within a 'regulated catchment'. Sydney Water has considered the requirements of Section 171A as the proposal is within the Sydney Harbour catchment. Impacts to water quality and quantity, aquatic ecology and works on flood liable land would be negligible. The proposal would have a minor impact on recreation and public access and these impacts are discussed in Section 5.

Appendix B – 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?		x
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		x
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		x
Connect to, and use a substantial volume of water from a council owned water supply system?		x
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?	x	
Excavate a road, or a footpath adjacent to a road, for which the council is the roads authority, that is not minor or inconsequential?	x	
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?		x
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?		x
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)?		x
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?		x
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 *National Parks and Wildlife Act 1974* or land acquired under Part 11 of that Act*? If so, consult with DPE (NPWS).*		x
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? *If so, consult with DPE (NPWS).*		x
Will the proposal include a fixed or floating structure in or over navigable waters? *If so, consult TfNSW.*		x
Will the proposal be on land in a mine subsidence district within the meaning of the *Coal Mine Subsidence Compensation Act 2017*? *If so, consult with Subsidence Advisory NSW.*		x
Will the proposal be on land in a Western City operational area specified in *the Western Parkland City Authority Act 2018,* Schedule 2 and have a capital investment value of $30 million or more? *If so, consult the Western Parkland City Authority*.		x
Will the proposal clear native vegetation on land that is not subject land (ie non-certified land)? *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).*		x

Appendix C – Arboricultural Assessment

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Arboricultural Assessment

Version 2

Bondi Ocean Outfall Rehabilitation
Dillon Street Playground, Paddington NSW 2021
Elizabeth Street, Paddington NSW 2021
Birrigna Road, Bellevue Hill NSW 2023
Lough Playing Fields, Double Bay NSW 2028
Trelawney Street, Woollahra NSW 2025

Inspection Dates: 21 August 2025, 5 September 2025 and 24 November 2025

PREPARED FOR:

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Document Information

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Project Name:	**BOOS Rehabilitation**
Reference #:	**E-002438-25**
Client:	**South Avoid Fail**
Site(s):	**Dillon Street Playground, Paddington NSW 2021** **Elizabeth Street, Paddington NSW 2021** **Birrigna Road, Bellevue Hill NSW 2023** **Lough Playing Fields, Double Bay NSW 2028** **Trelawney Street, Woollahra NSW 2025**
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Document Status

Status	Date	Revision type
Version 1 - Draft	15 September 2025	
Versiuon 2 - Draft	16 December 2025	Additional trees added

Review Register

Date	Reviewed By	Approved By
15 September 2025	KH	KH
16 December 2025	KH	KH

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Report Assumptions and Limitations

1. Information provided by the client or third party is assumed to be accurate.
2. All information has been sourced with care and verified to the best of the consultant's knowledge. Any opinions not duly researched are based on the consultant's experience and observations.
3. The consultant is not required to give testimony or attend court unless under a contractual agreement, subject to payment of additional fees.
4. Modifying or removing any key contextual elements will invalidate the report.
5. The report does not guarantee that future problems or deficiencies associated with the site or vegetation will not arise.
6. The report addresses the items outlined in the project brief or examined during site inspection and reflects the condition of these items at the time of inspection.
7. The inspection is limited to ground-based inspection of accessible areas and does not include dissection, excavation, or probing unless specified.
8. The report is an impartial assessment of the tree(s) and its condition based on available evidence and projected outcomes.

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Abbreviations

Table of Abbreviated Terms

Abbreviation	Meaning	Abbreviation	Meaning
AIA	Arboricultural Impact Assessment Report	**mm**	Millimetres
AQF	Australian Qualification Framework	**NDE**	Non-destructive excavation
AS	Australian Standard	**NRZ**	Notional Root Zone
BAM	Biodiversity Assessment Method	**NSW**	New South Wales
BC Act	*Biodiversity Conservation Act 2016*	**PCT**	Plant Community Type
BCSEPP	*State Environmental Planning Policy (Biodiversity and Conservation) 2021*	**PDA**	Preliminary Development Assessment
cm	Centimetre	**PHC**	Plant Health Care
DSH	Diameter at Standard Height	**SEED**	Sharing and Enabling Environmental Data
DCP	Development Control Plan	**SEPP**	State Environment Planning Policies
DRB	Diameter at Root Buttress	**sp.**	Species
EP&A Act	*Environmental Planning and Assessment Act 1979*	**SRZ**	Structural Root Zone
EPBC Act	*Commonwealth of Australia's Environmental Protection & Biodiversity Conservation Act 1999*	**STARS©**	IACA Significance of a Tree, Assessment Rating System
IACA	Institute of Australian Consulting Arboriculturists	**TEC**	Threatened Ecological Communities
ISA	International Society of Arboriculture	**TPP**	Tree Protection Plan
GIS	Geographic Information System	**TPS**	Tree Protection Specification
GNSS	Global Navigation Satellite System	**TPZ**	Tree Protection Zone
LEC	Land and Environment Court of New South Wales	**TRAQ**	Tree Risk Assessment Qualification
LEP	Local Environment Plans	**ULE**	Useful Life Expectancy
m	Metres	**VTA**	Visual Tree Assessment

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Executive Summary

Safe Avoid Fail (SAF) is undertaking critical remediation works on the Bondi Ocean Outfall Sewer (BOOS). The scope of works includes desilting and relining of the sewer, facilitated through the establishment of access shafts, laydown areas, temporary access roads, and ancillary site amenities at five locations between Paddington and Bellevue Hill.

Canopy Consulting was engaged to undertake an arboricultural assessment of trees within the subject sites. A total of 99 trees under 86 tree numbers were assessed. These comprise a mixture of indigenous, native, and exotic species, several of which exhibit high retention value.

Key Arboricultural Findings:

- Three trees (Tree 78, 82 and 85, Dillon Street Playground) will require removal to facilitate the works. Given the species of Tree 78 and its recent translocation history, this tree is considered suitable for transplanting within the reserve.
- Nine trees have been identified requiring canopy modifications to facilitate plant and vehicle access.
- Protection across the five sites can generally be achieved either by fencing around the Tree Protection Zone (TPZ) of individual trees or by establishing fenced enclosures around work zones. Where vehicle or plant movements are proposed within TPZs, ground protection measures such as track mats or mulch layering shall be implemented.

It is recommended that:

- A Project Arborist (AQF Level 5 minimum) will be appointed for the duration of works to oversee the installation and maintenance of tree protection measures, supervise all works within TPZs, and provide ongoing compliance reporting.
- All pruning is to be carried out by a suitably qualified arborist (AQF Level 3 minimum).
- A qualified and experienced contractor shall undertake transplanting.

The proposed works across the five sites can be facilitated with minimal long-term impacts to the existing tree population, provided the recommended pruning, protection, and transplanting measures are implemented.

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1. Introduction

1.1. Background

The BOOS, constructed between 1880 and 1889, is designed to divert sewage from Sydney Harbour to the ocean at North Bondi. The 6.1-kilometre brick-lined tunnel was a major engineering achievement of its time, featuring an oviform cross-section. The sewer reduced harbour pollution and was later supplemented with low-level pumping stations to collect sewage from areas not directly above the tunnel.

As part of ongoing maintenance and environmental management, SAF is undertaking a project to carry out remedial works on the BOOS, primarily focusing on relining and desilting sections of the sewer between Paddington and Bellevue Hill.

These works aim to preserve the structural integrity of the historic sewer while improving its operational efficiency and mitigating environmental impacts.

1.2. Aim

SAF proposes to undertake desilting and relining of the BOOS at five sites between Paddington and Bellevue Hill.

SAF has engaged Canopy Consulting to investigate trees adjacent to the proposed works where they may be adversely affected by the project.

This assessment investigates trees potentially affected by the proposed works and provides:

- Tree identification and assessment within the study areas
- Retention value assessment for affected trees
- Foreseeable project impact evaluation
- Design and construction recommendations to minimise negative impacts to adjacent trees, where appropriate
- Protection recommendations in accordance with *AS 4970-2025 Protection of trees on development sites.*

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1.3. Reviewed Plans and Documents

Table 1: Reviewed Plans and Documents

Title	Author	Dwg. No.	Revision	Date
Site Layout*	D4C	N/A	N/A	N/A
Dillon Park Site Layout	Sydney Water	INDEX507_496	4	15/09/25

Note: Plans provided are not to scale; construction elements are indicative only.

1.4. Project Description

The project area comprises the overall potential area of direct disturbance or impact by the project.

This may be temporary for construction or permanent for operational infrastructure and extend below the ground surface.

The works will involve excavation for shafts or manholes, directional drilling, sewer relining, and the use of heavy plant and machinery, including piling rigs, cranes, and maintenance equipment, across all sites. Temporary site amenities and laydown areas will be established to support operations.

Existing land uses, including playgrounds, car parks and street parking, will be temporarily displaced and reinstated after construction.

Table 2 describes the scope of work for each of the five sites. It summarises the key construction activities, access requirements, and temporary facilities required to support the delivery of the BOOS remediation.

Table 2: Description of Works

Site	Description of Works
Dillon Street Playground	This section of the project will require excavating an 8 m x 7.6 m access shaft to lower the new lining segments to the BOOS. To facilitate these works, site amenities, plant, and laydown areas will be established. Access from the adjacent Dillon Street will also need to be constructed, along with a temporary access road capable of supporting mobile crane operation and movement.
Elizabeth Street	Works will include directional drilling to facilitate a GRP insert, with potential desilting that may require excavating a larger manhole. The site will also require a laydown area and site amenities to accommodate a piling rig.
Birriga Road	Works will require a small shaft within the parking lane to provide access for sewer maintenance machinery. Site amenities and parking will be required to facilitate the works.
Lough Playing Fields	A shaft will be excavated in the north carpark. Works will require site amenities, laydown areas, a temporary car park, plant, crane operation and movement, and temporary access points from Manning Road and Suttie Road.
Trelawney Street	Work will include a new manhole in the parking lane. The site will require an exclusion zone, plant, and site parking.

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1.5. Legislative Context

A Review of Environmental Factors (REF) will be carried out by Sydney Water to assess the potential environmental impacts of the project under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water as both the proponent and determining authority. The *State Environmental Planning Policy (Transport and Infrastructure) 2021* allows the project to be carried out without development consent.

The Commonwealth of Australia's *Environmental Protection & Biodiversity Conservation Act 1999* (EPBC Act) manages nationally significant ecological communities and heritage items. The EPBC Act delegates to the NSW *Biodiversity Conservation Act 2016* (BC Act) for state and local management of ecological and heritage matters. The BC Act, which repealed the NSW *Threatened Species Conservation Act 1995*, may require Species Impact Statement and Biodiversity Banking and Offset Scheme agreements determined by the Biodiversity Assessment Method (BAM)

In NSW, the *Environmental Planning and Assessment Act 1979* (EP&A Act) regulates significant development and infrastructure through Environmental Planning Instruments (EPI), including State Environment Planning Policies (SEPP) for matters of state or regional significance and Local Environmental Plans (LEP) and Development Control Plans (DCP) for land usage guidance for local Councils.

1.6. Planning & Tree Management Controls

Table 3: Applicable Planning & Tree Management Controls

Local Environment Plan	Woollahra Local Environmental Plan 2014 (WLEP)
Development Control Plan	Woollahra Development Control Plan 2015 (WDCP)
Tree Management Controls	Prescribed trees within the Woollahra Municipal Council are protected under Part A Section 4.3 of the WDCP made pursuant to Chapter 2 of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (the BCSEPP). The BDCP generally protects all 'prescribed trees' which are defined as: • Any tree or palm, whether of indigenous, endemic, exotic or introduced species with a diameter spread of branches greater than 3m or with a height greater than 5m, irrespective of the spread of branches, and that is not identified in this chapter as exempt. 1 • Any tree, whether of indigenous, endemic, exotic or introduced species with roots greater than 50mm diameter, but only if root pruning is proposed. • Any tree or palm identified in Council's Significant Tree Register.

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- Any tree or palm identified in Schedule 5 Environmental Heritage of Woollahra LEP, or located on land identified in Schedule 5 including:
  - a tree listed as a heritage item;
  - a tree located on land identified as containing a heritage item; or
  - a tree on land within a heritage conservation area.
- Any bushland as defined in State Environmental Planning Policy 19 – Bushland in Urban Areas.

1.7. Additional Legislative Protections

The following government planning overlays have been reviewed (SEED - NSW Government, 2025). Table 4 indicates the presence of the items on site.

Table 4: Mapping Overlays

NSW OEH	Present on Site	Relevance
Threatened Ecological Communities (TEC) Greater Sydney	☐	Not present on site. No relevance.
State Heritage Register	☐	Not present on site. No relevance
Biodiversity Values	☐	Not present on site. No relevance
DCP/LEP		
Heritage	☑	**Dillon Street Reserve** **Heritage Item**- Scottish Hospital - main hospital building and interiors, grounds, gardens, terracing, 2 Moreton Bay Figs, Norfolk Island Pine, Kauri Pine, Weeping Lilli Pilli, Holm Oak **Heritage Conservation Area** - Paddington **Elizabeth Street** **Heritage Conservation Area** - Paddington **Trelawney Street** **Heritage Item**- Lenana - residential flat building and interiors, iron gateposts and gates. **Heritage Item**- London Plane Trees - approx. 35 trees **Heritage Conservation Area** - Paddington
Terrestrial Biodiversity	☐	Not present on site. No relevance
Environmentally Sensitive Land	☐	Not present on site. No relevance
Other		
10/50 Vegetation Clearing Scheme	☐	Not present on site. No relevance

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1.8. Site Details

Table 5: Site Details

Site Address	Zoning & Local Environment Plan	Site Description
Dillon Street Playground, Paddington NSW 2021	Public Recreation (RE1) under the Woollahra Local Environmental Plan 2014	Dillon Street Playground functions as a children's play and outdoor recreation space. Stephen Street bounds it to the east, Neild Avenue to the west, The Terraces to the south, and residential properties to the north. The site forms the eastern portion of the reserve and includes grassed areas, landscaped garden beds, and sections of Stephen Street. The landscape appears to have been refurbished within the past five years, involving tree removals, construction of raised sandstone garden beds, and associated planting.
Elizabeth Street, Paddington NSW 2021	Medium Density Residential (R3) under the Woollahra Local Environmental Plan 2014	Elizabeth Street is a residential street running in a northeast-southwest alignment through the suburb of Paddington. The site comprises a small section at the northern end, between Harris Street and Sutherland Avenue. It is bounded by residential properties and contains a combination of parallel and 90-degree parking bays, with three street trees present within the streetscape.
Birrigna Road, Bellevue Hill NSW 2023	Medium Density Residential (R3) under the Woollahra Local Environmental Plan 2014	Birriga Street is a busy residential street running in an east-west alignment. The site is located approximately 200 metres from the Old South Road intersection and is bounded by large residential properties and manors. The street is lined with mature trees and vehicles are parked on both sides at 90-degree angles to the kerb.
Lough Playing Fields, Double Bay NSW 2028	Public Recreation (RE1) & Sewerage System (SP2) under the Woollahra Local Environmental Plan 2014	Lough Playing Fields is a large park providing playing fields and recreational space for the surrounding suburb. The site contains a large grassed field and is bordered by a planting of mature trees. It is bounded by Manning Road to the west, Suttie Road to the south, the Double Bay substation to the north, and residential properties to the east. The focus of this assessment is the northern section of the park, located on elevated ground above the playing fields where the works are proposed. The assessment also considers an access location to the southern site and sections of the eastern boundary.
Trelawney Street, Woollahra NSW 2025	Medium Density Residential (R3) under the Woollahra Local Environmental Plan 2014	Trelawney Street is a busy mixed-use road running east-west, connecting Edgecliffe Road with Queen Street. The site is located outside Wolper Jewish Hospital, between Fullerton Street and Edgecliffe Road. Vehicles are parked parallel on both street sides

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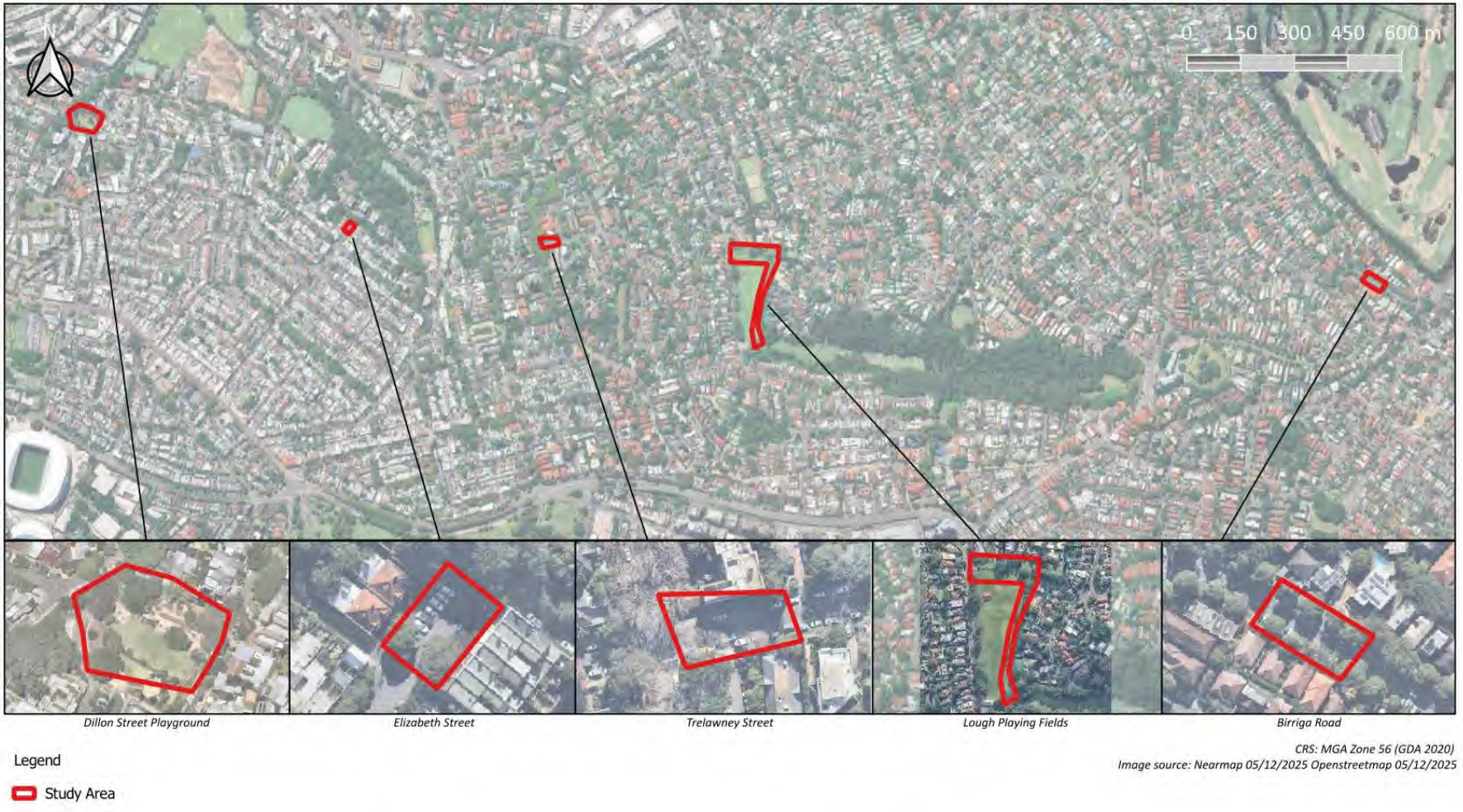


Figure 1: Site Locations Map

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2. Scope

This assessment evaluates the health and condition of trees on the site and neighbouring properties that may be affected by proposed works. It determines tree retention values based on heritage, environmental, and arboricultural principles.

The assessment provides:

- A comprehensive description of each tree's attributes and current condition
- Documentation of all observations pertinent to tree health and stability in a development context
- Assignment of retention values based on established criteria
- Analysis of potential impacts from proposed works on site trees
- Recommendations for remedial works or tree management where appropriate
- Detailed specifications for protection measures to minimise development impacts
- Identify clearance pruning where feasible
- Evaluation of removal and replacement options where retention is not viable.

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3. Method

3.1. Data Collection

To record the above-ground health and condition of each tree, a Visual Tree Assessment (VTA), adapted from (Lonsdale, 2013), was undertaken from ground level on 21 August 2025, 5 September 2025 and 24 November 2025 by Consulting Arborists Mark McHugh and Matthew Brown.

This involved an inspection of

- Tree health and structural integrity
- Site conditions and constraints
- Amenity and heritage value
- Environmental significance
- Habitat characteristics

All diameter measurements were obtained using a diameter tape or forestry callipers. Height and canopy spread values were estimated by experienced arborists. Offset measurements were taken with a calibrated tape measure.

Data collection utilised GIS software linked to a GNSS receiver, providing 1-2cm accuracy under optimal conditions.

3.2. Useful Life Expectancy

The assessment of remaining Useful Life Expectancy (ULE) employs a modified version of the TreeAZ SULE method (Barrell, 2009). Detailed criteria for each category classification are provided in Appendix A.

3.3. Retention Value

Tree significance ratings and retention values were determined using the IACA Significance of a Tree Assessment Rating System (STARS)© (IACA, 2010). This system evaluates landscape significance and estimated Useful Life Expectancy using established assessment criteria and the retention value priority matrix. Complete assessment parameters are detailed in Appendix A.

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3.4. Notional Root Zone, Structural Root Zone and Tree Protection Zone

The Notional Root Zone (NRZ) and Structural Root Zone (SRZ) calculations follow Australian Standard *4970:2025 Protection of Trees on Development Sites* and are expressed in radial measurements in metres.

The NRZ is a primary trigger for arboricultural input on a development site, which is calculated as:

$$\text{NRZ radius} = \text{DSH} \times 12$$

The SRZ represents the area required for tree stability, calculated as:

$$\text{SRZ radius} = (\text{DRB} \times 50)^{0.42} \times 0.64$$

The Tree Protection Zone (TPZ) is then determined based on the NRZ and other considerations (Clause 3.3.2 of AS4970-2025). The TPZ is the specified zone above and below ground set aside for protection during construction.

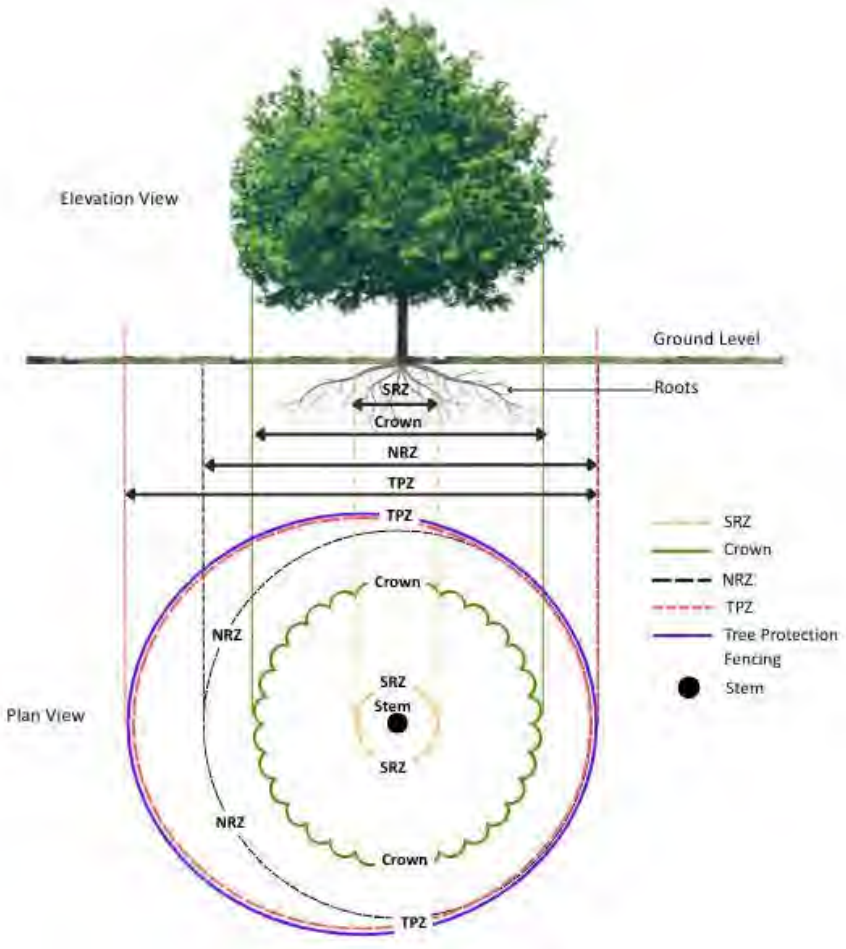


Figure 2: Indicative Notional Root Zone, Crown Spread and Structural Root Zone (Standards Australia, 2025)

Please note that the plans provided by the client are at a preliminary stage. The locations of works within the sites are not to scale; therefore, construction impacts are based on foreseeable

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encroachments rather than precise assessments, which may affect NRZ and SRZ encroachment calculations.

4. Observations

4.1. Site Soils

A range of soil landscapes is present across the five sites, including 'Gymea', 'Newport', 'Deep Creek', and 'Hawkesbury' (eSPADE v2.2, 2025). All these soil profiles share a common origin, being derived from sandstone sedimentary rock. Consequently, in their natural state, a sandy soil profile with generally good drainage would be expected across the sites.

However, all sites are located within heavily developed urban areas, and the existing soils may not represent the natural soil profile. This is particularly evident in the streetscape sites, Elizabeth Street, Birrigna Street, and Trelawney Street, where past construction, paving, and infrastructure works may have altered the soil composition, depth, and structure.

A further observation was made at the two park sites, Lough Playing Fields and Dillon Street Park, where sections of the low-lying grassed areas were completely inundated following heavy rainfall during the assessment. This indicates potential drainage issues and highlights areas susceptible to soil saturation. Consideration of the soil conditions in these low-lying areas is important when evaluating compaction risk and the movement of machinery during works.

4.2. Summary of Tree Observations

Complete tree attributes and observations can be found in Appendix B - Tree Assessment Schedule. The following is a summary of tree quantities across each site. Please note that where trees were similar in size, species, and location, and were of lower significance in the landscape, they were grouped together.

- Dillon Street Playground: 36 trees assessed under 36 tree numbers
- Elizabeth Street: 3 trees assessed under 3 tree numbers
- Birrigna Street: 9 trees assessed under 9 tree numbers
- Lough Playing Fields: 45 trees assessed under 32 tree tags
- Trelawney Street: 5 trees assessed under 5 tree tags

Several observations are of particular note.

Within Dillon Street Playground, Tree 3, a senescent *Quercus ilex*, has a short estimated ULE and is unlikely to tolerate construction impacts. In addition, Trees 16, 79, two *Xanthorrhoea* sp. and Tree 79, a *Brachychiton rupestris* (Queensland Bottle Tree) were located within raised garden beds in the landscaped area of the park. Historical imagery from Google Maps indicates that these trees have

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been translocated to their current location within the last five years. Anecdotally, these species transplant readily, suggesting they are likely to tolerate being moved if required.

At Trelawney Street, Tree 62, located on the periphery of the study area, forms part of a heritage avenue of *Platanus × acerifolia*. Special considerations will be required to protect this tree during any works.

Lough Playing Fields contains several trees classified as environmental weeds under the NSW Department of Primary Industries (DPI). Despite this classification, many are of considerable age and contribute significantly to the park's canopy, and should therefore be considered for retention irrespective of their assigned retention value. Several *Ficus* within the park also exhibit extensive surface roots extending a considerable distance from the root crown. Where access is required over these root systems, appropriate ground protection measures will be necessary to avoid damage.

Photos and a subset of observations can be accessed using this link.

Table 6 lists the species distribution and quantity across the five sites.

Table 6: Tree Species

Total	*Origin*			
Botanical Name	**Exotic**	**Indigenous**	**Native**	**Grand Total**
Acer negundo	2			2
Afrocarpus falcatus	1			1
Agonis flexuosa			1	1
Angophora costata		1		1
Brachychiton acerifolius		2		2
Brachychiton rupestris			1	1
Casuarina cunninghamiana			5	5
Casuarina glauca		2		2
Celtis sinensis	6			6
Cinnamomum camphora	3			3
Citharexylum spinosum	1			1
Cupressus x leylandii	1			1
Cussonia spicata	1			1
Elaeocarpus reticulatus		1		1
Eucalyptus microcorys			4	4
Ficus macrophylla			3	3
Ficus microcarpa var hilli			1	1
Ficus rubiginosa		2		2
Harpephyllum caffrum	1			1
Harpullia pendula			1	1
Jacaranda mimosifolia	5			5

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Total	*Origin*			
Botanical Name	Exotic	Indigenous	Native	Grand Total
Liquidambar styraciflua	1			1
Lophostemon confertus			8	8
Melaleuca styphelioides		2		2
Nerium Oleander	6			6
Phoenix canariensis	1			1
Platanus x acerifolia	3			3
Prunus sp.	2			2
Quercus ilex	1			1
Syncarpia glomulifera		1		1
Syzygium paniculatum			2	2
Syzygium smithii		2		2
Tristaniopsis laurina			1	1
Ulmus parvifolia	8			8
Waterhousea floribunda		1		1
Xanthorrhoea sp.			2	2
Grand Total	**43**	**14**	**29**	**86**

Table 7 summarises the trees' legislated protection status under the WDCP. This assessment considers the size of the tree or exemption due to their species.

Table 7: Tree Legislated Protection Status

DCP Status	Tag/Tree QTY (Tree QTY)	Tree Numbers
Protected	85 (85)	All other trees
Exempt	1 (14)	59
N/A	0 (0)	
Total	**86 (99)**	

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4.3. Retention Value

Determined by using the Retention Value - Priority Matrix of the IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA, 2010). Tree retention values are summarised in Table 10.

Table 8: STARS Retention Value

Retention Value	Tag/Tree QTY (Tree QTY)	Tree Numbers
High - Priority for Retention	29 (29)	2, 4, 6, 8, 9, 10, 12, 13, 16, 20, 22, 30, 31, 47, 50, 55, 57, 58, 62, 68, 69, 70, 71, 74, 75, 76, 77, 78, 79
Medium - Consider for Retention	26 (39)	1, 5, 11, 14, 15, 18, 23, 25, 26, 27, 28, 29, 32, 34, 36, 40, 56, 59, 61, 64, 67, 72, 83, 84, 85, 86
Low - Consider for Removal	30 (30)	3, 7, 17, 19, 21, 24, 33, 35, 37, 38, 41, 42, 43, 44, 45, 46, 48, 49, 51, 52, 53, 54, 60, 63, 65, 66, 73, 80, 81, 82
Priority for Removal	1 (1)	39
Total	**86 (99)**	

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4.4. Tree Locations



Figure 3.1: Dillon Street Playground - Indicative Notional Root Zone and Structural Root Zones

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Figure 3.2: Elizabeth Street - Indicative Notional Root Zone and Structural Root Zones

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Figure 3.3: Birriga Road -Indicative Notional Root Zone and Structural Root Zones

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Figure 3.4: Lough Playing Fields (Part 1): Indicative Notional Root Zone and Structural Root Zones

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Figure 3.5: Lough Playing Fields (Part 2): Indicative Notional Root Zone and Structural Root Zones

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Figure 3.6: Trelawney Street: Indicative Notional Root Zone and Structural Root Zones

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5. Findings

5.1. Impact Assessment Considerations

The NRZ represents a theoretical area around the base of a tree where the majority of roots capable of sustaining the tree are located on a development site. Activities within this zone require careful management, as works such as excavation, ground-level modifications, temporary and permanent infrastructure, trenching or soil profile inversion may compromise the root system or alter essential growing conditions.

The SRZ forms the critical area required for tree stability, encompassing structural woody roots and soil cohesion necessary for anchoring the tree. While some carefully managed activities may occur within this zone, any significant disturbance risks compromising tree stability. Construction methods such as pier and beam foundations or hand-excavated service installations may be permissible when properly implemented.

The TPZ is the designated area for the protection of roots and crown, where these might be damaged by development. The TPZ provides the physical boundary for protection measures, including fencing and access restrictions, and is formulated after the impacts have been assessed in consideration of Clause 3.3.2 of *AS 4970-2025*.

5.2. Encroachments into the Notional Root Zone

NRZ encroachment calculations cannot be accurately assessed at this preliminary stage of the project. However, foreseeable encroachments are described in the following terms, as outlined in *AS 4970-2025 Protection of trees on development sites* guidelines.

Encroachments into the NRZ are categorised into three levels based on the percentage of NRZ area affected:

Minor encroachment (≤10% of NRZ area): Generally considered minor provided it is outside the SRZ and no recent NRZ encroachments have taken place. It is unlikely that there will be a significant impact on tree health, longevity or structure. Tree protection should be implemented during site works, and to avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates that the tree will remain viable.

Moderate encroachment (>10% and ≤20% of NRZ area): Requires the engagement of a project arborist to review the proposed impacts and demonstrate how the tree will remain viable. This may require additional investigations to address the factors listed in Clause 3.3.2 or be achieved through the implementation of suitable design measures and construction controls to mitigate impacts during the development process as part of a Tree Protection Specification (TPS) and Tree Protection Plan (TPP). To avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates that the tree will remain viable.

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Major encroachment (>20% of NRZ area): A project arborist shall be engaged to explore alternative designs with the design team and/or demonstrate that the tree will remain viable. For the assessment of major encroachment, a more detailed investigation is necessary. This may include root or soil investigations, review of historical records related to the tree or site, or research into relevant literature and examples of similar microclimates. To avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates that the tree will remain viable.

These measures are only required if a tree is to be retained and must be considered in the impact assessment.

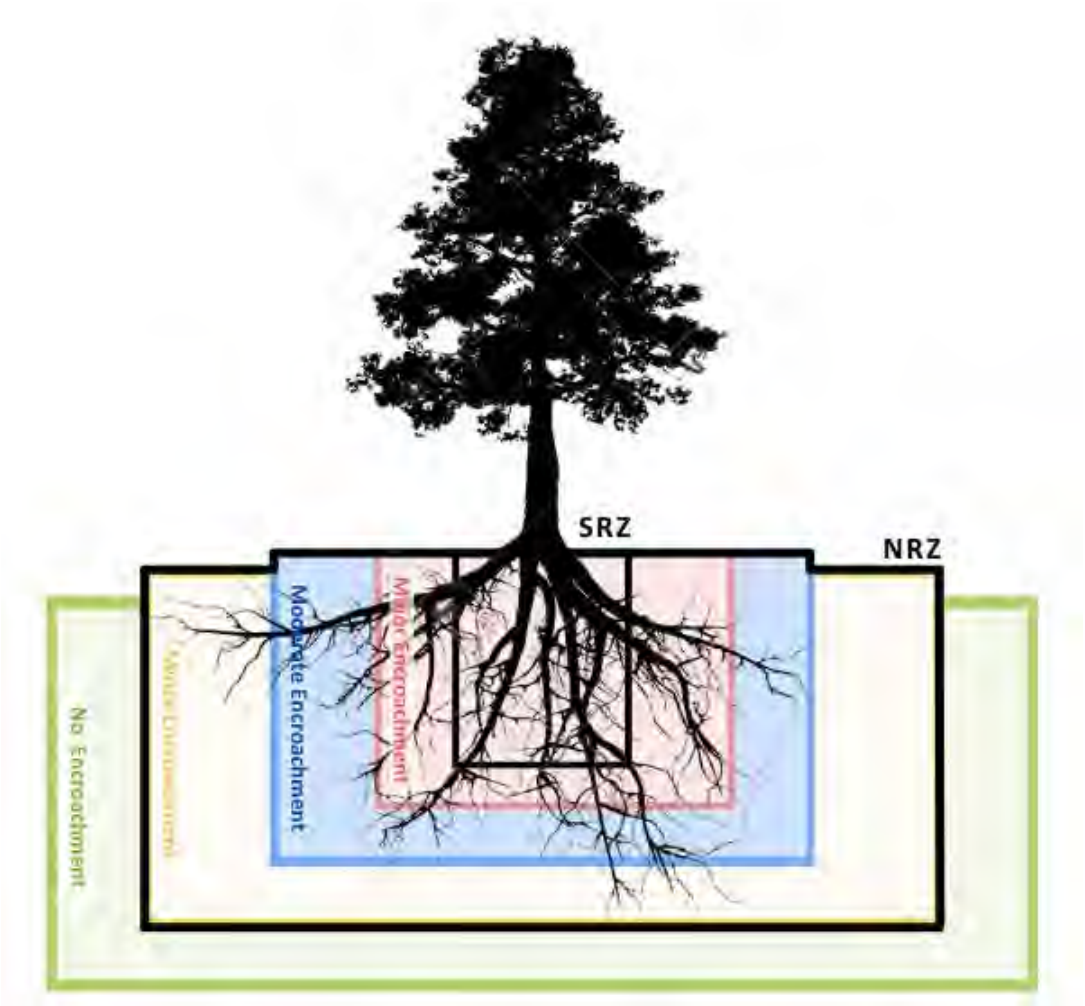


Figure 4: Indicative zones of NRZ and SRZ encroachment.

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5.3. Site 1 - Dillon Street Reserve

Proposed Works and Foreseeable Impacts

The works at Dillon Street Reserve will require an 8 m × 7.6 m access shaft to lower the new lining of the BOOS. To facilitate these works, site amenities, plant, and laydown areas will be established. Access from the adjacent Dillon Street will also need to be created, along with a temporary access road capable of supporting mobile crane operations.

The proposed shaft is situated within the existing landscaped area, which is likely to place it within the NRZ of Trees 82 and 85. Additionally, the proposed temporary road along the southern side of the site will facilitate access with a specified area for crane operations. This will result in considerable machinery movement within this section of the site, which will require sufficient ground protection measures to be implemented to prevent impacts to existing trees.

Additionally, the M8 Manhole is located within the SRZ of Trees 73 and 74. If excavation is required within the area, Non-Destructive Root Exploration (NDRE) must be preformed under the supervision of a minimum AQF Level 5 Arborist to determine the root mass within the area and advise on root pruning if required.

Tree Removals and Transplants

At this stage, it is foreseeable that three trees, Tree 78, 82 and 85, will require removal to facilitate the design. The proposed excavation for the access shaft results in an encroachment on Trees 82 and 85, with the encroachment entering the SRZ of Tree 82. Given the significant asymmetrical crown of these trees and the surrounding topography. It is likely that the structural roots of these trees will be impacted.

Tree 78 results in canopy conflicts with the site shed; due to the size of the tree and species, this tree is recommended to be transplanted.

Tree Protection Recommendations

- The proposed temporary road from Stephen Street to Neild Avenue should be constructed of ground protection mats (track mats), over a mulched area, and consideration should be given to amend the road to a single entry point from Stephen Road to avoid impacts to Trees 70, 71, 74, 75 and 76. Trunk protection will also be required. Not applicable
- Once the shaft location is finalised, a detailed assessment against the NRZ of surrounding trees should be undertaken to determine encroachments and impacts. finalised
- If possible, shifting the shaft footprint to the east by approximately 10m is recommended to reduce impacts and facilitate retention of the trees on site. This design change will necessitate the transplanting of Tree 79; however, it will have minimal impact on other trees in the area due to the existing garden beds. not possible

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5.4. Site 2 - Elizabeth Street

Proposed Works and Foreseeable Impacts

The works at Elizabeth Street will include directional drilling to facilitate a GRP insert, with potential desilting that may require excavating a larger manhole. A laydown area and site amenities will be required to accommodate a piling rig.

The majority of works are proposed to occur within the roadway, where root biomass is expected to be minimal. The entire site is covered by hardstand, providing ample space for laydown areas and material storage without risk of site disturbance.

Pruning Requirements

- Tree 18: Crown uplift over the roadway to facilitate vehicle and machinery movement beneath the canopy.

Tree Removals and Transplants

- No tree removals are expected as part of these works.

Tree Protection Recommendations

Position the excavation footprint so that it remains at least four metres from the base of any trees, ideally outside the dripline, to minimise canopy conflicts.

5.5. Site 3 - Birriga Road

Proposed Works and Foreseeable Impacts

The works at Birriga Road will require a small shaft to be excavated within the parking lane to provide access for sewer maintenance machinery. Site amenities and parking will be required to facilitate the works.

Given the location of the proposed excavation at the edge of the parking lane, impacts to adjacent site trees are expected to be minor.

Pruning Requirements

- No trees have been identified. Site amenities and storage should be located accordingly to avoid the need for any canopy modification.

Tree Removals and Transplants

- No tree removals are anticipated as part of these works.

Tree Protection Recommendations

- Generic tree protection, which includes fencing (either individual trees or around the edge of the works area, is to be maintained in accordance with *AS 4970-2025 Protection of trees on development sites.*

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5.6. Site 4 - Lough Playing Fields

Proposed Works and Foreseeable Impacts

A shaft will be excavated in the northern car park. Works will require site amenities, laydown areas, a temporary car park, plant, crane operation and movement, and temporary access points from Manning Road and Suttie Road.

The proposed shaft is located within the existing car park and is therefore not expected to impact site trees directly. The site shed is proposed east of these works within the NRZ of nearby trees. If the shed is sited above ground, impacts are expected to be minor. Delivery and removal pre- and post-works could be undertaken through the existing car park gate, resulting in only minimal pruning. If a delivery truck is required to access the upper northern section of the site, additional pruning of Trees 32 and 34 will be necessary.

The proposed temporary car park in the north-west corner can accommodate fewer than ten vehicles without impacting adjacent trees. Track mats are preferable to DGB road base to protect the NRZ of Trees 55 and 57.

Movement across the northern perimeter of the site, through the NRZ of Trees 48–52, should be limited to pedestrian traffic only. If vehicle access is unavoidable, ground protection will be required to protect surface roots.

If access from Suttie Road is required, Tree 29 will need a crown uplift over the entry gate. Ground protection, possibly with sand levelling, will be required to safeguard surface roots. Vehicle movement from Suttie Road to the northern section of the site should avoid the NRZ of Trees 58–62 along the eastern boundary.

Pruning Requirements

Four trees have been identified for pruning, dependent on final access arrangements: cancelled

- Tree 29: Crown uplift over the gate if access is required from Suttie Road.
- Tree 32: Crown uplift of the southern canopy if access is required for site shed delivery.
- Tree 34: Reduction of the southern crown if access is required for site shed delivery.
- Tree 36: Reduction of the southern crown to facilitate site shed delivery.

Tree Removals and Transplants

- No tree removals are expected as part of these works.

Tree Protection Recommendations

- Install ground protection (e.g. track mats) where vehicle movement is proposed within tree NRZs.
- Avoid NRZs where possible; restrict movement across the northern perimeter (Trees 48–52) to pedestrian access only.
- Deliver and remove site sheds before and after works to reduce vehicle movements during construction.

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- Where access from Suttie Road is required, provide suitable ground protection to protect the surface roots of Trees adjacent the entrance.

5.7. Site 5 - Trelawney Street

Proposed Works and Foreseeable Impacts

The Trelawney Street works will involve building a new manhole in the parking lane. The site will require an exclusion zone, plant, and site parking.

Works are proposed within the eastbound parking lane and are not expected to impact trees within the study area.

Pruning Requirements

- No trees will require pruning as part of the work.

Tree Removals and Transplants

- No trees will require removal or transplanting as part of the work.

Tree Protection Recommendations

- Trees can be protected through generic tree protection measures, either around each tree individually or by fencing around the entire worksite.

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6. Recommendations

6.1. Project Arborist

An official "Project Arborist" must be commissioned to oversee the tree protection, and any works within the TPZs and complete regular monitoring compliance certification.

The Project Arborist must have a minimum of five (5) years of industry experience in arboriculture, horticulture with relevant demonstrated experience in tree management on construction sites, and Diploma level qualifications in arboriculture – AQF Level 5.

6.2. Tree Removal

When assessing the impacts of the proposed plans, three trees, Tree 78, 82 and 85 at Dillon Street Reserve, has been identified for removal. Given that tree 78 was transplanted to its current location within the last five years, it is considered suitable for relocation to another area of the site.

Transplanting tree 78 is recommended to mitigate canopy loss and maintain site amenity, provided it is carried out by suitably qualified contractors using best-practice methods.

6.3. Generic Tree Protection

Generic tree protection measures are recommended to restrict construction activities within the NRZ, which may adversely affect the health and condition of a tree to be retained as part of the works. In order of precedence, the following is required for trees to be retained.

1. Install TPZ fencing and signage either around each tree or around the designated works zones. Where impractical and subject to Project Arborist approval;
2. Install trunk and ground protection where machine access is required.

Notes:

- All activities within the fenced TPZ are to be supervised by the project arborist.
- TPZ fencing is not to be moved.

6.4. Tree Pruning

Five trees 18, 29, 32, 34, 36 require pruning to facilitate the proposed works and are summarised in Table 15.

It is anticipated that additional minor pruning may be required at the direction of the Project Arborist due to unforeseen project requirements. This additional, unforeseen pruning should be factored into any environmental approval documents that rely on this report. In situations where trees have not been recommended for pruning, the impact on the trees is to be assessed by the Project Arborist and recommendations made to permit pruning or instruct machinery to work around to viably maintain the tree.

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Trees are to be pruned in accordance with *AS 4373-2007 Pruning of amenity tree*s (Standards Australia Limited, 2007).

Trees must be pruned to avoid damage to adjacent or understory vegetation and structures.

A minimum AQF Level 3 Arborist should complete all pruning works or under direct supervision thereof.

Table 9: Pruning schedule

Tree no.	Site	Botanical Name	Pruning Recommendation	Pruning Comments
18	*Elizabeth Street*	*Melaleuca styphelioides*	Crown Uplift	Crown uplift over the roadway to facilitate vehicle and machinery movement beneath the canopy.
29	*Lough Playing Fields*	*Harpephyllum caffrum*	Crown Uplift	Crown uplift over the gate if access is required from Suttie Road.
32	*Lough Playing Fields*	*Ulmus parvifolia*	Crown Uplift	Crown uplift of the southern canopy if access is required for site shed delivery.
34	*Lough Playing Fields*	*Ulmus parvifolia*	Crown Reduction	Reduction of the southern crown if access is required for site shed delivery.
36	*Lough Playing Fields*	*Ulmus parvifolia*	Crown Reduction	Reduction of the southern crown to facilitate site shed delivery.

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8. Appendix A - IACA Significance of a Tree, Assessment Rating System (STARS) ©

Tree Landscape Significance - Assessment Criteria

1. High Significance in landscape	2. Medium Significance in landscape	3. Low Significance in landscape
The tree is in good condition and good vigour; The tree has a form typical for the species; The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age; The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register; The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity; The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values; The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions.	The tree is in fair-good condition and good or low vigour; The tree has form typical or atypical of the species; The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street, The tree provides a fair contribution to the visual character and amenity of the local area, The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*. **Notes** The tree is to have a minimum of three (3) criteria in a category to be classified in that group. The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.	The tree is in fair-poor condition and good or low vigour; The tree has form atypical of the species; The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings, The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area, The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen, The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions, The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms, The tree has a wound or defect that has potential to become structurally unsound. **Environmental Pest / Noxious Weed Species** The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties, The tree is a declared noxious weed by legislation. **Hazardous/Irreversible Decline** The tree is structurally unsound and/or unstable and is considered potentially dangerous, The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

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Estimated Life Expectancy

1. Long	2. Medium	3. Short	4. Remove
Trees that appear to be retainable with an acceptable level of risk for more than 40 years. Structurally sound trees located in positions that can accommodate future growth. Storm damaged or defective trees that could be made suitable for retention in the long term by remedial tree surgery. Trees of special significance for historical, commemorative, or rarity reasons that would warrant extraordinary efforts to secure their long-term retention.	Trees that appear to be retainable with an acceptable level of risk for 15-40 years. Trees that may only live between 15 and 40 more years. Trees that may live for more than 40 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 40 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees that appear to be retainable with an acceptable level of risk for 5-15 years. Trees that may only live between 5 and 15 more years. Trees that may live for more than 15 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 15 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees with a high level of risk that would need removing within the next 5 years. Dead trees. Trees that should be removed within the next 5 years. Dying or suppressed or declining trees through disease or inhospitable conditions. Dangerous trees through instability or recent loss of adjacent trees. Dangerous trees through structural defects, including cavities, decay, included bark, wounds, or poor form. Damaged trees that are considered unsafe to retain. Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. Trees that will become dangerous after removal of trees for other reasons.

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Tree Retention Value – Priority Matrix

Estimated Life Expectancy	Landscape Significance Rating				
	1 (High)	2 (Medium)	3 (Low)	4 (Environmental Pest / Noxious Weed)	5 (Hazardous / Irreversible Decline)
Long (>40)	High - Priority for Retention	High - Priority for Retention	Medium - Consider for Retention	Low - Consider for Removal	Priority for Removal
Medium (15-40)	High - Priority for Retention	Medium - Consider for Retention	Medium - Consider for Retention / Low - Consider for Removal	Low - Consider for Removal	Priority for Removal
Short (5-15)	Low - Consider for Removal	Low - Consider for Removal	Low - Consider for Removal	Priority for Removal	Priority for Removal
Dead Or Hazardous (0-5)	Low - Consider for Removal	Priority for Removal	Priority for Removal	Priority for Removal	Priority for Removal

Legend for Matrix Assessment

High - Priority for Retention	These trees are considered important for retention and should be retained and protected. Design modification or re-location of buildings should be considered to accommodate the setbacks as prescribed by the Australian Standard *AS4970-2025 Protection of trees on development sites*. Tree-sensitive construction must be implemented, e.g. pier and beam, etc if works are to proceed within the Tree Protection Zone
Medium - Consider for Retention	These trees may be retained and protected. These are considered less critical; however, their retention should remain a priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered exhausted.
Low - Consider for Removal	These trees are not important for retention, nor require special works or design modification to be implemented for their retention.
Priority for Removal	These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

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9. Appendix B - Tree Assessment Schedule

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
1	*Jacaranda mimosifolia*	Jacaranda	1	11	400	2.0	12.6	5.9	3	3	Good	Good	Juvenile	Medium (15-40)	Co-dominant stems		Protected	Exotic	2 (Medium)	Medium - Consider for Retention
2	*Ficus macrophylla*	Moreton Bay Fig	1	16	500	2.0	12.6	6.5	4	4	Good	Good	Juvenile	Long (>40)			Protected	Native	2 (Medium)	High - Priority for Retention
3	*Quercus ilex*	Evergreen Oak, Holly Oak, Holm Oak	1	70	1200	8.4	221.7	9.4	6	6	Poor	Poor	Senescent	Short (5-15)	Cavity, Deadwood moderate (3-10cm diameter), Decay, Dieback, Epicormic shoots, Excessively thin crown density, Wound(s)	Very poor health, this tree is unlikely to tolerate even minor construction impacts.	Protected	Exotic	2 (Medium)	Low - Consider for Removal
4	*Syzygium paniculatum*	Brush Cherry	1	47	1300	5.6	99.9	9.7	11	11	Good	Good	Semi-mature	Long (>40)	Asymmetrical crown, Co-dominant stems, Deadwood moderate (3-10cm diameter)	Positioned in a raised gardenbed. Depending on access route, crown reductions will be required to facilitate crane access and operation.	Protected	Native	2 (Medium)	High - Priority for Retention
5	*Harpullia pendula*	Tulipwood	1	50.93	1100	6.1	117.3	9.1	10	10	Good	Fair	Mature	Medium (15-40)	Asymmetrical crown, Co-dominant stems, Epicormic shoots, Included bark	Positioned in a raised gardenbed.	Protected	Native	2 (Medium)	Medium - Consider for Retention
6	*Phoenix canariensis*	Canary Island Date Palm	1	59	1100	7.1	157.5	9.1	5	5	Good	Good	Mature	Long (>40)	Deadwood moderate (3-10cm diameter)	Street tree.	Protected	Exotic	2 (Medium)	High - Priority for Retention
7	*Celtis sinensis*	Chinese Hackberry	1	52.8	1300	6.3	126.1	9.7	10	10	Good	Good	Mature	Medium (15-40)	Deadwood moderate (3-10cm diameter), Environmental/Declared Weed, Poor pruning	Street tree. Bifurcating at ground level. Crown bias over the roadway.	Protected	Exotic	4 (Environmental Pest / Noxious Weed)	Low - Consider for Removal
8	*Casuarina cunninghamiana*	River Sheoak	1	40	1800	4.8	72.4	11.1	7	7	Good	Good	Mature	Long (>40)	Asymmetrical crown, Constrained growing environment, Deadwood moderate (3-10cm diameter)	Street tree.	Protected	Native	2 (Medium)	High - Priority for Retention
9	*Casuarina cunninghamiana*	River Sheoak	1	65	2200	7.8	191.1	12.1	9	9	Good	Good	Mature	Long (>40)	Asymmetrical crown, Constrained growing environment, Deadwood moderate (3-10cm diameter)	Street tree. Will require a crown uplift over the roadway to facilitate site compound installation.	Protected	Native	1 (High)	High - Priority for Retention
10	*Casuarina cunninghamiana*	River Sheoak	1	35	2100	4.2	55.4	11.9	7	7	Good	Good	Mature	Long (>40)	Asymmetrical crown	Street tree.	Protected	Native	2 (Medium)	High - Priority for Retention
11	*Casuarina cunninghamiana*	River Sheoak	1	41	1900	4.9	76.0	11.4	8	8	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Constrained growing environment, Deadwood moderate (3-10cm diameter), Included bark	Street tree. Poorly formed codominant branch junction.	Protected	Native	2 (Medium)	Medium - Consider for Retention
12	*Casuarina glauca*	Swamp Sheoak	1	50	2200	6.0	113.1	12.1	7	7	Good	Good	Mature	Long (>40)	Co-dominant stems		Protected	Indigenous	1 (High)	High - Priority for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
13	*Citharexylum spinosum*	Fiddlewood	1	78.41	1600	9.4	278.1	10.6	22	22	Good	Good	Mature	Medium (15-40)	Co-dominant stems, Crossing/rubbing branches, Epicormic shoots	Crown reduction will be required to facilitate crane access and operation.	Protected	Exotic	1 (High)	High - Priority for Retention
14	*Jacaranda mimosifolia*	Jacaranda	1	61.62	1600	7.4	171.8	10.6	19	19	Good	Fair	Mature	Medium (15-40)	Asymmetrical crown, Co-dominant stems, Deadwood moderate (3-10cm diameter), Epicormic shoots, Included bark, Poor pruning, Wound(s)	May require a crown uplift over the roadway to facilitate site compound installation.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
15	*Syzygium paniculatum*	Brush Cherry	1	28.02	600	3.4	35.5	7.0	5	5	Good	Good	Semi-mature	Medium (15-40)	Co-dominant stems		Protected	Native	2 (Medium)	Medium - Consider for Retention
16	*Xanthorrhoea sp.*	Grass Tree	1	39	200	4.7	68.8	4.4	1	1	Good	Good	Semi-mature	Long (>40)	Co-dominant stems	Potential for transplanting.	Protected	Native	2 (Medium)	High - Priority for Retention
17	*Melaleuca styphelioides*	Prickly-leaved Paperbark	1	56.58	700	6.8	144.8	7.5	9	9	Good	Poor	Mature	Short (5-15)	Co-dominant stems, Constrained growing environment, Epicormic shoots, Included bark, Poor pruning - power line clearance, Wound(s)		Protected	Indigenous	2 (Medium)	Low - Consider for Removal
18	*Melaleuca styphelioides*	Prickly-leaved Paperbark	1	54	800	6.5	131.9	7.9	12	12	Fair	Good	Mature	Medium (15-40)	Asymmetrical crown, Co-dominant stems, Poor pruning - power line clearance		Protected	Indigenous	2 (Medium)	Medium - Consider for Retention
19	*Tristaniopsis laurina*	Water Gum	1	23	500	2.8	23.9	6.5	3	3	Fair	Fair	Semi-mature	Short (5-15)	Co-dominant stems, Epicormic shoots, Poor pruning - power line clearance		Protected	Native	3 (Low)	Low - Consider for Removal
20	*Lophostemon confertus*	Brushbox	1	65	1400	7.8	191.1	10.0	14	14	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Deadwood moderate (3-10cm diameter), Included bark	Crown hanging 2 metres above the parking lane.	Protected	Native	1 (High)	High - Priority for Retention
21	*Prunus sp.*	Cherry	1	18	300	2.2	14.7	5.2	4	4	Good	Poor	Mature	Short (5-15)	Co-dominant stems, Crossing/rubbing branches, Included bark		Protected	Exotic	3 (Low)	Low - Consider for Removal
22	*Lophostemon confertus*	Brushbox	1	38	1300	4.6	65.3	9.7	6	6	Good	Good	Semi-mature	Long (>40)	Deadwood moderate (3-10cm diameter)		Protected	Native	2 (Medium)	High - Priority for Retention
23	*Lophostemon confertus*	Brushbox	1	61	1000	7.3	168.3	8.7	9	9	Good	Fair	Mature	Medium (15-40)	Asymmetrical crown, Cavity, Co-dominant stems, Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Epicormic shoots, Poor pruning - power line clearance, Wound(s)		Protected	Native	2 (Medium)	Medium - Consider for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
24	*Cinnamomum camphora*	Camphor Laurel	1	85.09	1400	10.2	327.5	10.0	18	18	Fair	Good	Mature	Medium (15-40)	Co-dominant stems, Constrained growing environment, Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Dieback	Crown hanging 2.5 metres off the parking lane.	Protected	Exotic	4 (Environmental Pest / Noxious Weed)	Low - Consider for Removal
25	*Lophostemon confertus*	Brushbox	1	91	1300	10.9	374.6	9.7	20	20	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Deadwood moderate (3-10cm diameter), Epicormic shoots, Poor pruning - power line clearance	Historically lopped for powerlines clearance.	Protected	Native	2 (Medium)	Medium - Consider for Retention
26	*Lophostemon confertus*	Brushbox	1	65	1100	7.8	191.1	9.1	13	13	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Epicormic shoots, Poor pruning - power line clearance	Historically lopped for powerlines clearance.	Protected	Native	2 (Medium)	Medium - Consider for Retention
27	*Lophostemon confertus*	Brushbox	1	86	1100	10.3	334.6	9.1	16	16	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Deadwood moderate (3-10cm diameter), Epicormic shoots, Poor pruning - power line clearance		Protected	Native	2 (Medium)	Medium - Consider for Retention
28	*Lophostemon confertus*	Brushbox	1	105	1200	12.6	498.8	9.4	15	15	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Deadwood moderate (3-10cm diameter), Epicormic shoots, Included bark, Poor pruning - power line clearance	Historically lopped for powerlines clearance.	Protected	Native	2 (Medium)	Medium - Consider for Retention
29	*Harpephyllum caffrum*	Kaffir Plum	1	112.93	1600	13.6	576.9	10.6	9	9	Good	Poor	Mature	Medium (15-40)	Asymmetrical crown, Co-dominant stems, Constrained growing environment, Included bark, Over-extended branch(es), Poor pruning, Suppressed	Crown uplift required to 3 metres over the sites proposed entrance.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
30	*Ficus macrophylla*	Moreton Bay Fig	1	115	2000	13.8	598.3	11.6	16	16	Good	Good	Semi-mature	Long (>40)	Co-dominant stems, Deadwood moderate (3-10cm diameter)	Surface roots present on the proposed access pathway. This area may need to be built up with sand and ground protection applied.	Protected	Native	1 (High)	High - Priority for Retention
31	*Ficus macrophylla*	Moreton Bay Fig	1	87	1800	10.4	342.4	11.1	19	19	Good	Good	Semi-mature	Long (>40)	Co-dominant stems, Leaf feeding insect		Protected	Native	1 (High)	High - Priority for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
32	*Ulmus parvifolia*	Chinese Elm	1	43	700	5.2	83.6	7.5	10	10	Good	Fair	Semi-mature	Medium (15-40)	Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Poor pruning, Previous failure(s), Wound(s)	Southern crown may need to be reduced to facilitate vehicle access (if the carpark can not be used.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
33	*Ulmus parvifolia*	Chinese Elm	1	39	500	4.7	68.8	6.5	5	5	Poor	Fair	Semi-mature	Short (5-15)	Climbing vine, Co-dominant stems	Smoothered by a climbing vine.	Protected	Exotic	3 (Low)	Low - Consider for Removal
34	*Ulmus parvifolia*	Chinese Elm	1	69	1100	8.3	215.4	9.1	14	14	Good	Fair	Mature	Medium (15-40)	Asymmetrical crown, Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Poor pruning	Southern crown may need to be reduced to facilitate vehicle access (if the carpark can not be used.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
35	*Ulmus parvifolia*	Chinese Elm	1	44	1000	5.3	87.6	8.7	9	9	Fair	Poor	Mature	Short (5-15)	Cavity, Deadwood major (>10cm diameter), Decay, Previous failure(s), Wound(s)		Protected	Exotic	3 (Low)	Low - Consider for Removal
36	*Ulmus parvifolia*	Chinese Elm	1	43.28	800	5.2	84.7	7.9	16	16	Good	Fair	Mature	Medium (15-40)	Asymmetrical crown, Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Over-extended branch(es), Poor pruning, Wound(s)	Southern crown may need to be reduced to facilitate vehicle access (if the carpark can not be used.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
37	*Ulmus parvifolia*	Chinese Elm	1	28	600	3.4	35.5	7.0	11	11	Fair	Poor	Semi-mature	Short (5-15)	Asymmetrical crown, Decay, Epicormic shoots, Suppressed, Wound(s)		Protected	Exotic	3 (Low)	Low - Consider for Removal
38	*Ulmus parvifolia*	Chinese Elm	1	43.27	900	5.2	84.7	8.3	11	11	Fair	Fair	Semi-mature	Short (5-15)	Co-dominant stems, Crossing/rubbing branches, Deadwood moderate (3-10cm diameter), Decay, Poor pruning, Wound(s)		Protected	Exotic	2 (Medium)	Low - Consider for Removal
39	*Celtis sinensis*	Chinese Hackberry	1	43.33	1300	5.2	84.9	9.7	9	9	Good	Good	Semi-mature	Short (5-15)	Co-dominant stems, Environmental/Declared Weed, Self-sown and inappropriately located		Protected	Exotic	4 (Environmental Pest / Noxious Weed)	Priority for Removal
40	*Ulmus parvifolia*	Chinese Elm	1	17	600	2.0	13.1	7.0	5	5	Good	Good	Juvenile	Medium (15-40)	Asymmetrical crown, Epicormic shoots, Suppressed		Protected	Exotic	3 (Low)	Medium - Consider for Retention
41	*Jacaranda mimosifolia*	Jacaranda	1	17.8	600	2.1	14.3	7.0	6	6	Fair	Fair	Semi-mature	Short (5-15)	Asymmetrical crown, Crossing/rubbing branches, Epicormic shoots, Wound(s)		Protected	Exotic	3 (Low)	Low - Consider for Removal

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
42	*Nerium Oleander*	Oleander	1	29.39	500	3.5	39.1	6.5	5	5	Good	Fair	Mature	Short (5-15)	Co-dominant stems, Poor pruning - power line clearance		Protected	Exotic	3 (Low)	Low - Consider for Removal
43	*Nerium Oleander*	Oleander	1	29.39	300	3.5	39.1	5.2	5	5	Fair	Fair	Mature	Short (5-15)	Co-dominant stems, Poor pruning - power line clearance		Protected	Exotic	3 (Low)	Low - Consider for Removal
44	*Nerium Oleander*	Oleander	1	29.39	200	3.5	39.1	4.4	5	5	Fair	Fair	Mature	Short (5-15)	Co-dominant stems, Poor pruning - power line clearance		Protected	Exotic	3 (Low)	Low - Consider for Removal
45	*Nerium Oleander*	Oleander	1	29.39	200	3.5	39.1	4.4	3	3	Fair	Fair	Mature	Short (5-15)	Co-dominant stems, Poor pruning - power line clearance		Protected	Exotic	3 (Low)	Low - Consider for Removal
46	*Nerium Oleander*	Oleander	1	29.39	300	3.5	39.1	5.2	5	5	Fair	Fair	Mature	Short (5-15)	Co-dominant stems, Poor pruning - power line clearance		Protected	Exotic	3 (Low)	Low - Consider for Removal
47	*Eucalyptus microcorys*	Tallowood	1	53	1300	6.4	127.1	9.7	9	9	Good	Good	Semi-mature	Long (>40)	Deadwood moderate (3-10cm diameter), Epicormic shoots		Protected	Native	1 (High)	High - Priority for Retention
48	*Celtis sinensis*	Chinese Hackberry	1	108.8	1800	13.1	535.5	11.1	20	20	Good	Poor	Mature	Medium (15-40)	Co-dominant stems, Environmental/Declared Weed, Hanger(s), Inappropriate location, Included bark, Partial failure	Codominant from ground level. Low hanging branches that may require branch protection if vehicles traverse below the crown.	Protected	Exotic	4 (Environmental Pest / Noxious Weed)	Low - Consider for Removal
49	*Celtis sinensis*	Chinese Hackberry	1	29	700	3.5	38.0	7.5	6	6	Good	Good	Semi-mature	Medium (15-40)	Co-dominant stems, Crossing/rubbing branches, Environmental/Declared Weed		Protected	Exotic	4 (Environmental Pest / Noxious Weed)	Low - Consider for Removal
50	*Ficus rubiginosa*	Port Jackson Fig	1	150.45	2000	15.0	706.9	11.6	28	28	Good	Poor	Mature	Medium (15-40)	Co-dominant stems, Epicormic shoots, Included bark, Over-extended branch(es), Previous failure(s), Wound(s)		Protected	Indigenous	1 (High)	High - Priority for Retention
51	*Ficus microcarpa var hilli*	Hills Fig	1	162.79	1200	15.0	706.9	9.4	10	10	Good	Poor	Mature	Short (5-15)	Co-dominant stems, Decay, Epicormic shoots, Included bark, Wound(s)	The entire crown has been reduced back to first order branches and is comprised of epicormic growth.	Protected	Native	3 (Low)	Low - Consider for Removal
52	*Syzygium smithii*	Common Lilly Pilly	1	9.8	300	2.0	12.6	5.2	2	2	Fair	Fair	Juvenile	Short (5-15)	Co-dominant stems	Stunted specimen.	Protected	Indigenous	2 (Medium)	Low - Consider for Removal
53	*Syzygium smithii*	Common Lilly Pilly	1	20.95	500	2.5	19.9	6.5	5	5	Good	Fair	Juvenile	Short (5-15)	Co-dominant stems, Included bark	Codominant from ground level.	Protected	Indigenous	2 (Medium)	Low - Consider for Removal
54	*Nerium Oleander*	Oleander	1	29.39	300	3.5	39.1	5.2	5	5	Good	Good	Mature	Short (5-15)	Asymmetrical crown, Co-dominant stems, Suppressed		Protected	Exotic	3 (Low)	Low - Consider for Removal
55	*Afrocarpus falcatus*	Outeniqua, Yellowwood	1	157.63	1700	15.0	706.9	10.9	24	24	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Crossing/rubbing branches, Included bark		Protected	Exotic	1 (High)	High - Priority for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
56	*Jacaranda mimosifolia*	Jacaranda	1	13	700	2.0	12.6	7.5	4	4	Good	Fair	Juvenile	Medium (15-40)	Wound(s)	Trunk wound.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
57	*Lophostemon confertus*	Brushbox	1	75	1900	9.0	254.5	11.4	13	13	Good	Good	Mature	Long (>40)	Co-dominant stems, Deadwood moderate (3-10cm diameter)	Growing in an elevated level to the remained of the site.	Protected	Native	1 (High)	High - Priority for Retention
58	*Jacaranda mimosifolia*	Jacaranda	1	81.54	1700	9.8	300.8	10.9	25	25	Good	Poor	Mature	Medium (15-40)	Co-dominant stems, Epicormic shoots, Included bark	Located in a private property.	Protected	Exotic	1 (High)	High - Priority for Retention
59	*Cupressus x leylandii*	Leyland Cypress	14	13	500	2.0	12.6	6.5	2	2	Good	Good	Juvenile	Medium (15-40)	Suppressed	Additional 13 trees to the south that form a hedge.	Exempt	Exotic	3 (Low)	Medium - Consider for Retention
60	*Acer negundo*	Box Elder	1	41.79	900	5.0	79.0	8.3	14	14	Fair	Fair	Mature	Short (5-15)	Asymmetrical crown, Cavity, Co-dominant stems, Previous failure(s), Suppressed, Wound(s)	Proposed access pathway runs adjacent to this tree. It should be diverted to go around the NRZ.	Protected	Exotic	3 (Low)	Low - Consider for Removal
61	*Acer negundo*	Box Elder	1	71.8	1500	8.6	233.2	10.3	18	18	Fair	Fair	Mature	Medium (15-40)	Asymmetrical crown, Co-dominant stems, Included bark, Wound(s)	Proposed access pathway runs adjacent to this tree. It should be diverted to go around the NRZ.	Protected	Exotic	3 (Low)	Medium - Consider for Retention
62	*Platanus x acerifolia*	London plane	1	120	2300	14.4	651.4	12.4	20	20	Fair	Fair	Mature	Medium (15-40)	Canker(s), Crossing/rubbing branches, Decay, Epicormic shoots	This tree forms part of a heritage avenue planting. Trunk body language suggests internal decay. Neotermes wounding in the upper crown.	Protected	Exotic	1 (High)	High - Priority for Retention
63	*Prunus sp.*	Cherry	1	9.85	200	2.0	12.6	4.4	1	1	Poor	Fair	Semi-mature	Short (5-15)	Deadwood moderate (3-10cm diameter), Dieback, Wound(s)		Protected	Exotic	3 (Low)	Low - Consider for Removal
64	*Agonis flexuosa*	Willow Myrtle	1	68	600	8.2	209.2	7.0	9	9	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Included bark	Buurls abundant on the trunk and main branches.	Protected	Native	2 (Medium)	Medium - Consider for Retention
65	*Platanus x acerifolia*	London plane	1	44	1200	5.3	87.6	9.4	6	6	Fair	Poor	Semi-mature	Short (5-15)	Canker(s), Poor pruning	Significant trunk canker.	Protected	Exotic	2 (Medium)	Low - Consider for Removal
66	*Platanus x acerifolia*	London plane	1	74	1800	8.9	247.7	11.1	17	17	Fair	Poor	Mature	Short (5-15)	Asymmetrical crown, Canker(s), Cavity, Co-dominant stems, Epicormic shoots, Wound(s)	Neotermes damage around pruning wounds and on first order branches. The upper crown has previously been reduced.	Protected	Exotic	2 (Medium)	Low - Consider for Removal
67	*Casuarina glauca*	Swamp Sheoak	1	47	1900	5.6	99.9	11.4	10	10	Good	Poor	Mature	Medium (15-40)	Wound(s), Crossing/rubbing branches, Co-dominant stems, Deadwood moderate (3-10cm diameter), Included bark, Significant fault - bark inclusion(s)	Small wound at base. Significant inclusion at approx 8m	Protected	Indigenous	2 (Medium)	Medium - Consider for Retention
68	*Ficus rubiginosa*	Port Jackson Fig	1	20.83	300	2.5	19.6	5.2	6	6	Good	Good	Juvenile	Long (>40)		Located within 'The Terraces Paddington'	Protected	Indigenous	2 (Medium)	High - Priority for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
69	*Waterhousea floribunda*	Weeping Satinash	1	157.68	2200	15.0	706.9	12.1	20	20	Good	Good	Mature	Long (>40)	Hanger(s), Epicormic shoots, Deadwood major (>10cm diameter), Co-dominant stems	Five trunks originating from ground level. Located within 'The Terraces Paddington'.	Protected	Indigenous	1 (High)	High - Priority for Retention
70	*Eucalyptus microcorys*	Tallowood	1	102.86	2200	12.3	478.6	12.1	12	12	Good	Fair	Mature	Medium (15-40)	Wound(s), Crossing/rubbing branches, Included bark, Co-dominant stems	2x large co dominant leaders growing extremely close together at approx 10m with high probability of contact during wind events. Small wound on Southern side of stem at the base. Reaction growth evident here.	Protected	Native	1 (High)	High - Priority for Retention
71	*Eucalyptus microcorys*	Tallowood	1	84	2200	10.1	319.2	12.1	19	19	Good	Good	Mature	Medium (15-40)	Over-extended branch(es), Included bark, Deadwood moderate (3-10cm diameter)	Low lateral extension over LV power network to NW	Protected	Native	1 (High)	High - Priority for Retention
72	*Elaeocarpus reticulatus*	Blueberry Ash	1	10	500	2.0	12.6	6.5	3	3	Good	Good	Semi-mature	Medium (15-40)			Protected	Indigenous	2 (Medium)	Medium - Consider for Retention
73	*Casuarina cunninghamiana*	River Sheoak	1	14	700	2.0	12.6	7.5	3	3	Fair	Fair	Semi-mature	Short (5-15)	Dieback, Epicormic shoots, Deadwood minor (<3cm diameter), Suppressed, Asymmetrical crown		Protected	Native	3 (Low)	Low - Consider for Removal
74	*Eucalyptus microcorys*	Tallowood	1	94	2000	11.3	399.7	11.6	18	18	Good	Good	Mature	Medium (15-40)	Deadwood moderate (3-10cm diameter), Asymmetrical crown	Assymetrical crown with a northern bias.	Protected	Native	1 (High)	High - Priority for Retention
75	*Brachychiton acerifolius*	Illawarra Flame Tree	1	39	1100	4.7	68.8	9.1	5	5	Good	Good	Semi-mature	Medium (15-40)	Included bark, Crossing/rubbing branches	Branch from Tallowood rubbing in 1x co dominant stem	Protected	Indigenous	1 (High)	High - Priority for Retention
76	*Syncarpia glomulifera*	Turpentine Tree	1	49	1600	5.9	108.6	10.6	8	8	Good	Good	Semi-mature	Long (>40)	Co-dominant stems		Protected	Indigenous	1 (High)	High - Priority for Retention
77	*Angophora costata*	Smooth-barked Apple Myrtle	1	64	2000	7.7	185.3	11.6	17	17	Good	Good	Mature	Long (>40)	Co-dominant stems, Deadwood minor (<3cm diameter), Asymmetrical crown		Protected	Indigenous	1 (High)	High - Priority for Retention
78	*Brachychiton rupestris*	Queensland Bottletree	1	33	300	4.0	49.3	5.2	2	2	Good	Good	Semi-mature	Long (>40)			Protected	Native	2 (Medium)	High - Priority for Retention
79	*Xanthorrhoea sp.*	Grass Tree	1	49	300	5.9	108.6	5.2	3	3	Good	Good	Semi-mature	Long (>40)			Protected	Native	2 (Medium)	High - Priority for Retention

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Tree no.	Botanical Name	Common Name	Trees in group	DSH Total (cm)	DRB (cm)	Radial NRZ (m)	NRZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Vigour	Structural Condition	Age Class	ULE (Yrs.)	Observations	Comments	DCP Status	Origin	STARS Significance Rating	Retention Value
80	*Cinnamomum camphora*	Camphor Laurel	1	158.03	2000	15.0	706.9	11.6	16	16	Poor	Poor	Mature	Short (5-15)	Excessively thin crown density, Climbing vine, Wound(s), Asymmetrical crown, Cavity, Dieback, Epicormic shoots, Nutrient deficiency, Poor pruning	Located on adjacent property. Poor pruning on the southern and eastern canopy. Partial VTA due to access and vine growth. Location, DRB and DSH and approximations. Failed bracing system observed in the northern crown.	Protected	Exotic	3 (Low)	Low - Consider for Removal
81	*Cinnamomum camphora*	Camphor Laurel	1	120.21	1900	14.4	653.7	11.4	16	16	Poor	Fair	Mature	Short (5-15)	Wound(s), Deadwood major (>10cm diameter), Dieback, Epicormic shoots, Cavity, Co-dominant stems	Located on adjacent property. Partial VTA due to access. Location, DRB and DSH and approximations.	Protected	Exotic	3 (Low)	Low - Consider for Removal
82	*Celtis sinensis*	Chinese Hackberry	1	70.21	1700	8.4	223.0	10.9	14	14	Good	Poor	Mature	Short (5-15)	Wound(s), Crossing/rubbing branches, Co-dominant stems, Asymmetrical crown	Significantly assymetrical crown with a western bias.	Protected	Exotic	3 (Low)	Low - Consider for Removal
83	*Brachychiton acerifolius*	Illawarra Flame Tree	1	16	1000	2.0	12.6	8.7	3	3	Good	Good	Semi-mature	Medium (15-40)			Protected	Indigenous	2 (Medium)	Medium - Consider for Retention
84	*Cussonia spicata*	Spiked Cabbage Tree	1	41	1600	4.9	76.0	10.6	9	9	Good	Fair	Mature	Medium (15-40)	Co-dominant stems, Asymmetrical crown		Protected	Exotic	2 (Medium)	Medium - Consider for Retention
85	*Celtis sinensis*	Chinese Hackberry	1	63	1600	7.6	179.6	10.6	17	17	Good	Fair	Mature	Medium (15-40)	Environmental/Declared Weed, Crossing/rubbing branches, Included bark, Co-dominant stems, Asymmetrical crown	Species clarified as a weed, however this specimen is a mature specimen. Significantly assymetrical crown with a western bias.	Protected	Exotic	2 (Medium)	Medium - Consider for Retention
86	*Liquidambar styraciflua*	Sweet Gum	1	60	1800	7.2	162.9	11.1	14	14	Good	Good	Mature	Medium (15-40)	Deadwood moderate (3-10cm diameter), Hanger(s), Previous failure(s)		Protected	Exotic	2 (Medium)	Medium - Consider for Retention

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Appendix D – Aboriginal Heritage Due Diligence

This information has been redacted to protect sensitive Aboriginal heritage information.

Appendix E – Non-Aboriginal Heritage Assessment

EVERICK HERITAGE

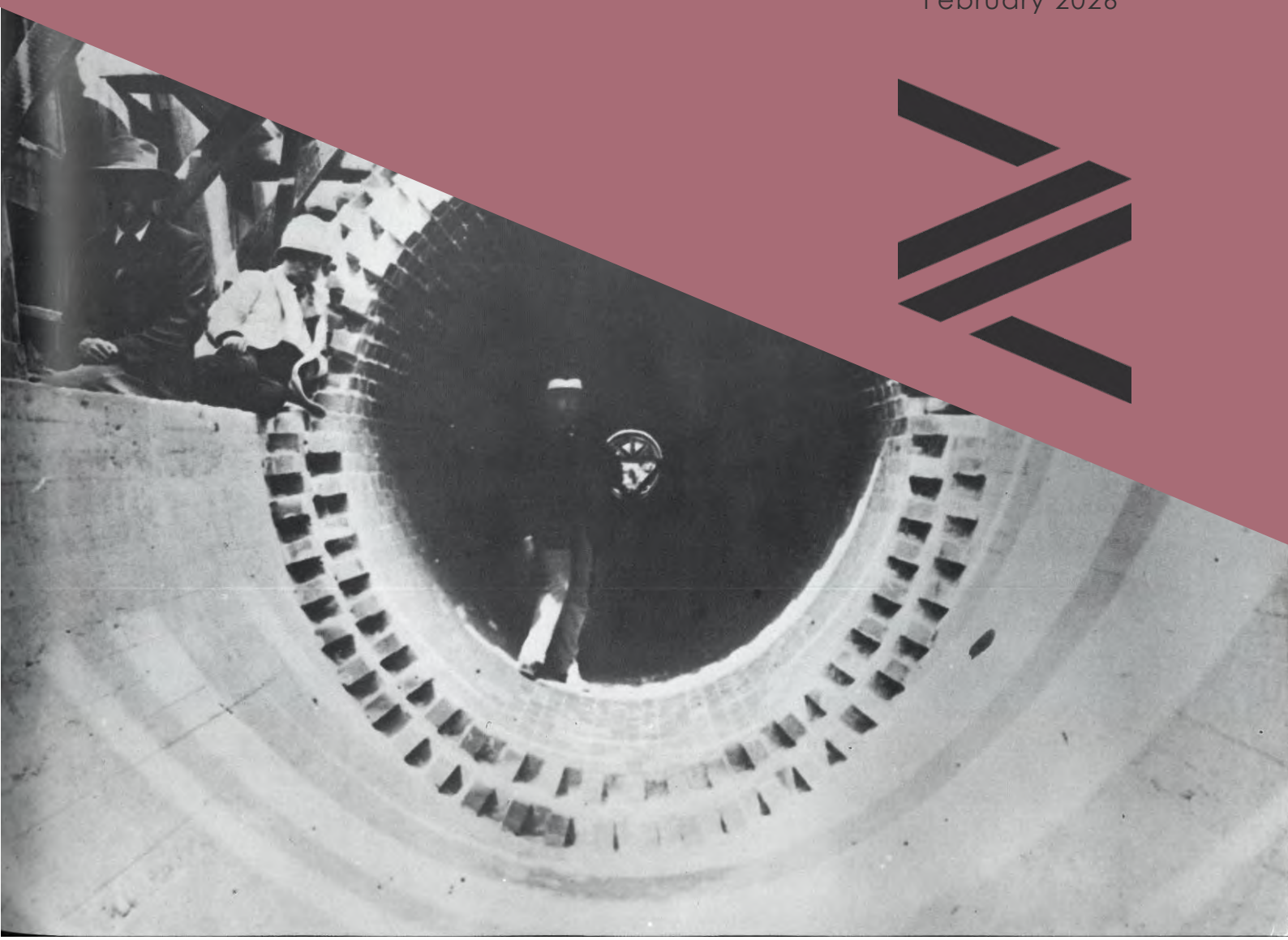
Bondi Ocean Outfall Sewer Rehabilitation Works

Statement of Heritage Impact

Prepared for

Sydney Water

February 2026



Report Reference:

Everick Heritage 2026: Bondi Ocean Outfall Sewer Rehabilitation Works - Statement of Heritage Impact; February 2026; Everick Heritage Pty Ltd; unpublished report prepared for Sydney Water.

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Cover image: 'Construction of the Bondi Sewer'; Sydney Water.

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EVERICK HERITAGE

Statement of Heritage Impact - Summary

Name of Heritage Item:

BOOS (Bondi Ocean Outfall Sewer)

Address and Location:

Sydney City to Ben Buckler, Bondi NSW

Statement of Heritage impact for:

Rehabilitation and Desiltation Works

Prepared by:

Everick Heritage Pty Ltd

Prepared for:

Sydney Water

Date:

13 March 2026

Issue:

Final Draft

Executive Summary

Background

Everick Heritage Pty Ltd has been engaged by Sydney Water to complete a Statement of Heritage Impact for the proposed rehabilitation works to be undertaken to the Bondi Ocean Outfall Sewer (the BOOS). The Bondi Ocean Outfall Sewer is listed on the NSW State Heritage Register as "*BOOS (Bondi Ocean Outfall Sewer)*". The BOOS is also listed in the Sydney Water Heritage and Conservation Register (s170).

The project involves desilting the BOOS from maintenance holes MH5 to MH19 and slip-lining approximately 2.3 km of the BOOS between Boundary Road (MH6) and Lough Park (MH16). The BOOS is located underground and internal access is via a series of maintenance holes located above the sewer, typically located within road reserves. However, these maintenance holes are of inadequate size for the scale of operations required and new penetrations into the sewer are proposed. The proposed new access holes and work sites are located at:

- Gugara Park (Dillon St Reserve), Nield Avenue, Paddington;
- Elizabeth Street (near Sunderland Avenue), Paddington;
- Trelawney Street (near Fullerton Street), Woollahra; and
- Lough Playing Fields, Manning Road, Double Bay.

The Gugara Park (Dillon St Reserve) and Elizabeth Street Work Sites are both located within the '*Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' (C8)*. The Trelawney Street Work Site is located within the '*Woollahra Heritage Conservation Area' (C15)*. The Lough Playing Fields Work Site is not subject to any heritage listing. All, except Lough Playing Fields, are located in the vicinity of local heritage items.

Conclusions

Impacts to the BOOS

This report has assessed the potential impacts to the heritage significance of BOOS resulting from the proposed works. The proposed works to the BOOS, including the desiltation, partial internal lining and creation of new access maintenance holes, would result in Little to No Impact to the heritage significance of the BOOS. The proposed desiltation and partial internal lining works will protect the fabric and maintain the sewer in service. The alterations to the fabric necessary to achieve this outcome are minor in relation to the overall scale of the sewer, affecting 4 metres out of 6.8 kms of sewer.

Impacts at the Four Work Sites

This report has assessed the potential impacts of the proposed works at the four Work Sites upon the heritage significance of any heritage items or Heritage Conservation Areas identified in either the *Sydney Local Environmental Plan 2012* or the Woollahra *Local Environmental Plan 2014*. There are no adverse impacts arising from the proposed works at each of the four Work Sites. The works will not have any impact upon the significant values of the Paddington HCA or the Woollahra HCA, nor are there impacts upon any Heritage Items in the vicinity of the Work Sites.

At the Trelawney Street site, the works do not propose to impact the footpath pavements, however, the proximity of the Street Name Inlays (Items I679 and I673) requires measures to ensure that these elements are not accidentally damaged during the course of the works. The contractor engaged to undertake the works should be informed of this requirement as part of their appointment.

Proposed works at the Elizabeth Street and Trelawney Street Work Sites include the drilling of a 2 metre wide shaft from road level to the BOOS. In both cases, there is a layer of sand overlying the bedrock, which will require extraction as part of the drilling. An Aboriginal Due Diligence Assessment, although not a statutory requirement, would provide evidence of appropriate due consideration of this potential, should any Aboriginal archaeological material be found during the excavations through the sand layers.

Approval Pathway

The proposed works are works that may be carried out without development consent under the provisions of Clause 2.125(6) of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*. In respect of the requirements of the NSW Heritage Act, the proposed works do not comprehensively fall within the scope of the Standard or the State Agency (Sydney Water) Exemptions. Consequently, NSW Heritage Council approval for the proposed works is required.

However, Sydney Water, as a government agency, has delegated authority to approve works to State Heritage Items in particular circumstances. The proposed works to the BOOS fall within the statutory parameters and may be approved by Sydney Water internally in accordance with its delegated authority.

Recommended Management Measures

As no adverse impacts are identified arising from the proposed works, no mitigation actions are identified. It is recommended that:

1. The records of the project works be added to the archival record of the BOOS.

2. All project team members, including contractors, should be informed about the heritage significance of the site as part of the general site induction package. The induction would identify why the BOOS is significant, the contractors' statutory obligations relating to heritage and to unexpected finds and the protection methods to be used during construction to prevent accidental damage during construction works.

3. The Contractor should be required to provide photographic records of the interior of the BOOS before, during and after the conduct of the works. These should be annotated to identify their subjects and added to the archival record of the BOOS.

4. Bricks removed from the BOOS as part of the development of new maintenance hole access shafts should, if their condition is assessed by the SW Heritage Team and deemed to be satisfactory, be saved and recycled for use as replacement bricks in other sections of the BOOS.

5. The risk of encountering Aboriginal archaeological material whilst boring through the sand sheet at the Elizabeth Street and Trelawney Street sites should be considered in determining the need for the preparation of an Archaeological Due Diligence Report for these two sites.

6. In the unlikely event of unexpected archaeological deposits being uncovered during ground disturbance works, it is recommended that the Unexpected Finds Protocols of Sydney Water's Environmental Management System should be followed.

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Glossary of Key Terms

The following definitions apply to the terms used in this report:

Term	Definition
Burra Charter	*The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013*
DA	Development Application
DCP	Development Control Plan
DPE	Department of Planning and Environment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPI	Environmental Planning Instrument
Heritage Act	*Heritage Act 1977* (NSW)
Heritage NSW	Heritage NSW, Environment and Heritage Group, Department of Planning and Environment
ICOMOS	International Council on Monuments and Sites
LEP	Local Environmental Plan
LGA	Local Government Area
s 170	Section 170 Heritage and Conservation Registers
SHI	State Heritage Inventory. An online database containing heritage items and conservation areas on statutory lists in NSW. This includes the State Heritage Register, s 170 registers and local government items
SHR	NSW State Heritage Register. A list of places and items of importance to the people of NSW. Only places of State heritage significance are listed on the State Heritage Register. The State Heritage Register protects these items and their significance
SoHI	Statement of Heritage Impact

1. Introduction

1.1. The Project

Everick Heritage Pty Ltd has been engaged by Sydney Water to complete a Statement of Heritage Impact for the proposed rehabilitation works to be undertaken to the Bondi Ocean Outfall Sewer (the BOOS). The Bondi Ocean Outfall Sewer is listed on the NSW State Heritage Register (SHR) as "*BOOS (Bondi Ocean Outfall Sewer)*". The BOOS is also listed in the Sydney Water Heritage and Conservation Register (s170 Register).

The project involves desilting the BOOS from maintenance holes MH5 to MH19 and slip-lining approximately 2.3 km of the BOOS between Boundary Road (MH6) and Lough Park (MH16). The BOOS is located underground and internal access is via a series of maintenance holes located above the sewer. However, the existing maintenance holes are of inadequate size for the scale of operations required and new penetrations into the sewer are proposed. The proposed new access holes and work sites are located at:

- Gugara Park (Dillon Street Reserve), Nield Avenue, Paddington;
- Elizabeth Street (near Sutherland Avenue), Paddington;
- Trelawney Street (near Fullerton Street), Woollahra; and
- Lough Playing Fields, Manning Road, Double Bay.

The Gugara Park (Dillon St Reserve) and Elizabeth Street sites are both located within the '*Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' (C8)*. The Trelawney Street site is located within the '*Woollahra Heritage Conservation Area' (C15)*. The Lough Playing Fields site is not subject to any heritage listing. All, except Lough Playing Fields, are located in the vicinity of local heritage items. This report has been prepared to assess impacts of proposal on the SHR-listed BOOS and upon any heritage conservation areas and heritage items in the vicinity of the work sites.

1.2. Site Description

The Bondi Ocean Outfall Sewer is an oviform sewer varying from 2.1 m x 1.8 m (height x width) to 2.2 m x 1.9 m (height x width), installed partly in tunnel and partly by cut-and-cover. It is formed from mass-concrete and brickwork and runs for 6.8 kms from the western end of Liverpool Street, adjacent to Hyde Park, in Sydney, to the ocean cliffs at Ben Buckler, on the northern side of Bondi Beach (Figure 1.1). It services a densely-populated catchment of approximately 3,560 hectares, conveying flows from the

Sydney CBD and surrounding suburbs to the Bondi Wastewater Resource Recovery Facility (WRRF), located in a large, excavated cavern beneath Williams Park and the Bondi Golf Club.



Figure 1-1: Aerial image showing the location (underground) of the Bondi Ocean Outfall Sewer. (Source: Spatial Services)

1.3. Heritage Listing/s

The following tables summarise the statutory heritage listings of the *Bondi Ocean Outfall Sewer*.

Table 1-1: Statutory heritage listings of the site

Heritage List	Listed (Y/N)	Item name	Listing number
World Heritage List / buffer zone	N	-	-
National Heritage List	N	-	-
Commonwealth Heritage List	N	-	-
State Heritage Register	Y	*BOOS (Bondi Ocean Outfall Sewer)*	01623
State Agency s170 Heritage and Conservation Registers	Y	*Bondi Ocean Outfall Sewer (BOOS)*	4570662
Local Environmental Planning Instruments	N		-

Due to the nature of the sewer as an underground structure, there are numerous identified heritage items at surface level above the sewer. These are not, however, relevant to the sewer in any respect and their identification is unnecessary for this report. For the four proposed work sites at ground level (identified in

detail in Section 4 of this report), heritage items in their vicinity are addressed in relation to the individual work sites.

1.4. Methodology

This assessment is consistent with the principles and guidelines set forth in the *Australia ICOMOS Charter for Places of Cultural Significance* (the Burra Charter)[1]. The report has been prepared in line with current best practice guidelines identified within the *Guidelines for preparing a statement of heritage impact*.[2]

1.5. Author Identification

This Statement of Heritage Impact has been prepared by Tony Brassil, Principal Heritage Advisor, with technical review provided by Alice Steedman, Principal Heritage Architect.

1.6. Limitations

This report is limited to an assessment of impact on historic heritage and does not include any assessment or evaluation of Aboriginal Heritage as defined in the *National Park and Wildlife Act 1974* (NPW Act).

No visual inspection of the interior of the sewer was undertaken for the preparation of this Statement of Heritage Impact. Condition assessments are contained in the Condition Assessment reports prepared by Metrocorp Technologies Pty Ltd[3] and Kellogg Brown and Root Pty Ltd[4]. All photographs contained in this report remain the intellectual property of their respective owners and are provided with attribution as appropriate.

[1] *Australia ICOMOS*. 2013.
[2] Department of Planning and Environment NSW. 2023b.
[3] Metrocorp; *Bondi Ocean Outfall Sewer (BOOS) FPI Inspection Report, 18/07/2025*; Report for D4C.
[4] Kellog Brown and Root; *Bondi Ocean Outfall Sewer - Sewer Traverse Report Nov 2019*; Report for Sydney Water.

2. History and Significance

2.1. History of the BOOS

2.1.1. General History

The following history of the BOOS is reproduced from the State Heritage Inventory listing sheet:

> *"By 1859 Sydney's sewerage system consisted of five outfall sewers which drained to the Harbour. By the 1870's, the Harbour had become grossly polluted and an alternative means of disposing of the city's sewage was investigated. This led to the construction of the Main Northern Ocean Outfall Sewer and a southern sewer draining to a sewage farm at Botany Bay.*
>
> *The Main Northern Outfall Sewer (BOOS) was the first ocean outfall sewer to be designed and built in Sydney. At the time when Melbourne was getting its first reticulated sewer, Sydney was diverting its existing sewers from Harbour outfalls to ocean outfall. It was a marvel of surveying accuracy for its time which allowed bricking to commence before breakthrough of the tunnel. This system reduced the flow into the Harbour sewers, until the introduction of the electric pumping stations. This system was instrumental in reducing the pollution entering the Harbour.*
>
> *The sewer was lined with brick. It is 2.4m x 2.2m diminishing to 2.1m x 1.8m at the junction chamber at the corner of junction of Oxford and College Streets. It is from this point that the main branches extended in northerly, westerly and south-westerly directions. Two sections of the system have pitched roofs at the junction of Oxford and College Streets and also at Taylor Square. A number of engineers who worked on the system later worked on other notable landmarks, such as T. Keele (President of The Water Board in 1904), L. A. B. Wade (father of dams) and W. C. Bennett (Chief Engineer), who were also both Board Members.*
>
> *It is now known that the large volume expansion chamber near the ocean was tunnelled from the ocean end so that the spoil did not need to be hauled to the surface nor trundled along the tunnel under Blair Street. This meant that the extended tunnel could not drain out seepage water. This was dealt with by digging a side drain from Bondi across to Rose Bay to help dry out the wetland/swamp which is now a golf course. The spoil was dumped at the bottom of the cliff face. The remnants of the ladderway by which miners descended was removed c.1990."*

2.1.2. Repairs and Alterations

Cracks in the original Ben Buckler Sewer Vent Stack were apparent soon after construction and, despite repairs and the addition of iron bands, these were an ongoing problem (practice artillery shoots from the nearby Bondi Gun Battery were considered to be a likely cause). In 1910, the original stack was demolished and a new reinforced concrete stack erected in its place (Figure 2.2).[5]

In 1926, the only significant failure of the BOOS occurred when a section near Stephen Street, Paddington collapsed. Two adjacent terrace houses were severely damaged and were subsequently demolished. Repairs to the sewer were immediately undertaken and the sewer returned to service.

The original ocean outfalls comprised two circular outlets, one facing north-east and the other facing south-east, but both discharged above the low-tide level. In 1930, the north-east outlet was closed and the southeastern outlet altered to discharge 5 metres below low tide level. However, continuing problems and complaints led, in 1936, to the commencement of excavation of a large cavern below Ben Buckler to house a treatment plant. Excavation was interrupted by the war and it wasn't till 1953 that the Treatment Plant began partial operation. In 1991, excavation commenced on an extension of the outfall to 2.2 kms offshore, with this deep-water outfall commencing operation in 1992.

In 1941, the whole sewer was cleaned and the brickwork mortared and render repaired as necessary. Following this, few further works were required until the 2000s, when the section of sewer below Blair Street was repaired and re-rendered during 2008 and 2009 (Figures 2.1, 2.3, 2.4).



Figure 2-1: A typical section of the Bondi Sewer, showing the concrete invert, rendered mid-section and brickwork arch. (Source: KBR[6])

[5] This section is based upon information in the report: Godden Mackay Logan; *Bondi Ocean Outfall Sewer and Ben Buckler Sewer Vent - Conservation Management Strategy*; Report for Sydney Water; June 2011.
[6] KBR; *Bondi Ocean Outfall Sewer; Sewer Traverse Report;* Nov 2019.



Figure 2-2: The Ben Buckler Vent Stack being replaced in 1910 (L) and the current stack (R). (Source: SLNSW (L) and J Bar (R)).



Figure 2-3: Interior of the BOOS, showing no render on the mid-section (L) and the base of a maintenance hole shaft – BMH7 (R). (Source: KBR[7])

2.2. Heritage Significance

The following Statement of Significance for the BOOS is reproduced from the State Heritage Inventory listing sheet:

> *The Main Northern Ocean Outfall, or Bondi Ocean Outfall Sewer (BOOS), was the first ocean outfall sewer of its type to be designed and built in the country. It is one of the most significant*

[7] KBR op cit

engineering structures in Australia. It was a marvel of surveying accuracy for its time. The surveying allowed for the lining of the sewer before the tunnelling was completed.

The BOOS reduced the volume of polluted waters entering the Harbour and improved the health of the city's residents by moving polluted waters off shore. The construction of the BOOS saw other advances in technology related to the removal of sewerage from the sewers, houses and water courses within the city. These included the improving design and construction of pumping stations to move the sewerage from low lying areas, construction and research into the safe removal of noxious gases from the sewers, better ways of treating raw effluent, advances in engineering methods and construction for tunnelling across waterways and many more.

The significance of the Sydney's sewerage systems primarily relates to its role in the growth of Sydney and the expansion of municipal services from the turn of the century to the present. The construction in these systems is evidenced in the sewage pumping stations, vents, pipes, tunnels and other associated works which display in their character, a gradual change in architectural style spanning the Federation, Inter-War and Post War periods. Many of these systems are still in use today with little change to their original fabric. In addition, the development of the major sewerage systems also represented a major advance in the protection of public health of Sydney by reducing the discharge of sewage from inner city areas into Port Jackson.

The system includes the sewers, vent shafts, pumping stations and other associated structures. Many of these features are of aesthetic and cultural significance and have landmark values. Some of these items include nineteen of the first twenty pumping stations, large brick sewer vents at Bondi, Glebe, Hyde Park and Bellevue Hill. It also includes the construction of the cavern which later housed the treatment plant which began partial operation in 1953.

A revised and updated Statement of Significance was prepared for the Conservation Management Strategy Report undertaken by Godden Mackay Logan in 2011[8].

The Main Northern Ocean Outfall, or Bondi Ocean Outfall Sewer (BOOS), was the first ocean outfall sewer of its type to be designed and built in the country.

The BOOS has historical and engineering significance as a rare and representative example of an early sewerage system in Sydney. It also has the potential to demonstrate the evolving public attitudes towards sanitation and the role of government in urban spaces and, as such, there is research value in the documentary sources and in the fabric of the sewer itself. This is enhanced by the degree of integrity and intactness of the form of the sewer and its nineteenth-century fabric.

[8] Godden Mackay Logan, 2011 op cit.

The BOOS was the first completed major sewerage line to cater both the city and suburbs of inner Sydney. Its construction was a key factor in the establishment of the Metropolitan Board of Water Supply and Sewerage. The development of the BOOS reflects the growing public concern with health and sanitation in the mid-nineteenth century. This concern initially led to the construction of the Bennelong sewer system; however, this was quickly outgrown necessitating the construction of the BOOS. The BOOS reduced the volume of polluted waters entering Sydney Harbour and improved the health of the city's residents by moving polluted waters off shore.

The BOOS represents a major development in the surveying technology in Australia. The precise and accurate surveying of the tunnel allowed for the addition of the brick lining to commence before the completion of the tunnel length. The BOOS also reflects the adoption of the oviform sewerage technique which alleviated problems associated with early sewerage technologies.

The construction of the BOOS led to developments in both urban form and governance. The significance of the Sydney's sewerage systems primarily relates to its role in the growth of Sydney and the expansion of municipal services from the turn of the 19th century to the present. The construction of the BOOS necessitated the construction of Blair Street into a wide boulevard terminating at the Ben Buckler Sewer Vent, now a prominent landmark. This cemented the role of government in supplying a high quality of sanitation and urban living for the city dwellers.

The evolution of the BOOS through the nineteenth century, with the addition of low-level pumping stations, the STP and the deepwater outfall, reflect both changing technologies, as well as changing community expectations of the quality government services. It also reflects a changing awareness of the impact of the city on the surrounding marine environment. The Metropolitan Board of Water Supply and Sewerage raised the standards of sewerage infrastructure in line with those community expectations.

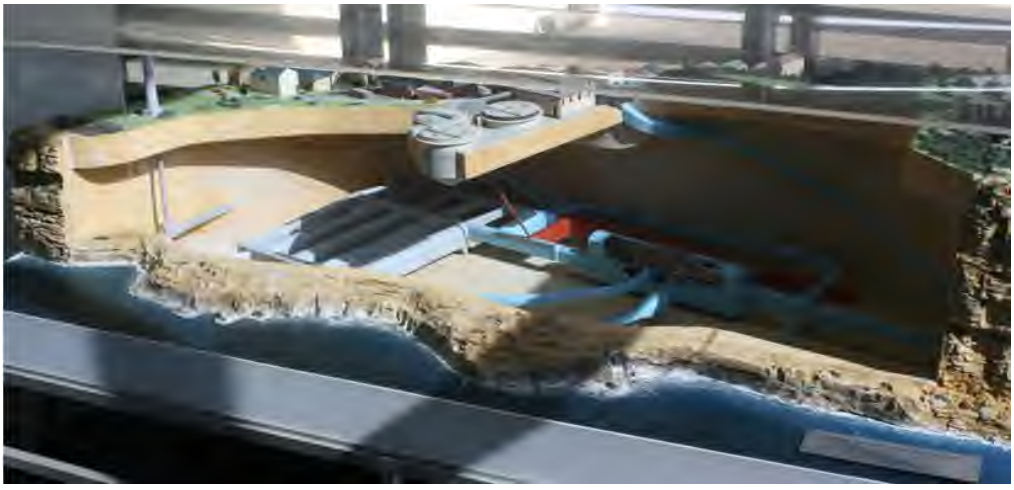


Figure 2-4: Photograph of Sydney Water's model showing the extent of the sewerage treatment facilities underground at Ben Buckler. (Source: Author)

3. Proposed Works

3.1. Project Description

The BOOS is structurally intact but inspections have identified age-related issues, including mortar loss and occasional brick dislodgement. Several sections are approaching the end of their service life and require rehabilitation to prevent deterioration and potential failure. A major failure would have significant public health, safety, environmental harm, licence non-compliance and reputational consequences.

The project involves desilting the BOOS from maintenance holes MH5 to MH19 and slip-lining approximately 2.3 km of the BOOS between Boundary Road (MH6) and Lough Park (MH16) (Figure 3.1).

The BOOS rehabilitation scope includes:

- GRP slip-lining with annular grouting of GRP segments from maintenance holes MH 6 to MH11 and maintenance holes MH12 to Lough Playing Fields shaft.
- CAC lining from maintenance holes MH11 to MH12 and maintenance hole MH14 (Lough Playing Fields shaft) to MH16.
- Installation of a new GRP maintenance hole at Elizabeth Street – approximately 22m deep.
- Installation of a new GRP maintenance hole at Trelawney Street – approximately 63m deep.

For the purposes of this document, GRP relining refers to insertion of an internal liner made of Glass Reinforced Plastic (GRP) with a grout-filled annulus and CAC refers to application of Calcium Aluminate Cement (CAC) by spraying onto the interior surface of the BOOS structure.

Associated works include:

- Raising of maintenance hole MH6 which was buried under the pavement.
- Reinstatement of sewer inlets at MH7, MH8, MH9, MH14 post slip lining of deteriorated oviform sections with segmental GRP installed by jacking.
- Transition works between remediation types and ends of remediation zone.
- GRP interface to existing maintenance holes.

Desilting methodologies which may be utilised include:

- Manually driven mechanical loader
- Self propelled desilting machine

- Winch-driven dragged bucket system.

Access will be via three or four existing maintenance holes, although these are of inadequate size for the scale of operations required and will be supplanted by new holes to be created as part of the works. These new maintenance holes, about 1.8 m diameter, will be drilled from ground level to penetrate the roof of the sewer and the shaft and sewer connection will be reconstructed with new Glass Reinforced Plastic (GRP) maintenance holes at Elizabeth Street and Trelawny street, at 22 m and 63 m deep respectively.

The proposed work sites are located at:

- Dillon Reserve, Nield Avenue, Paddington (Figure 3.2);
- Elizabeth Street (near Sunderland Avenue), Paddington (Figure 3.3);
- Trelawney Street (near Fullerton Street), Woollahra (Figure 3.4); and
- Lough Playing Fields, Manning Road, Double Bay (Figure 3.5).



Figure 3-1: Plan showing the location of the Maintenance Holes and the sections of the BOOS subject to rehabilitation and desiltation. (Source: Sydney Water[9])

[9] Sydney Water; *Request for proposal - BOOS rehabilitation Project Date: 12 December 2025*

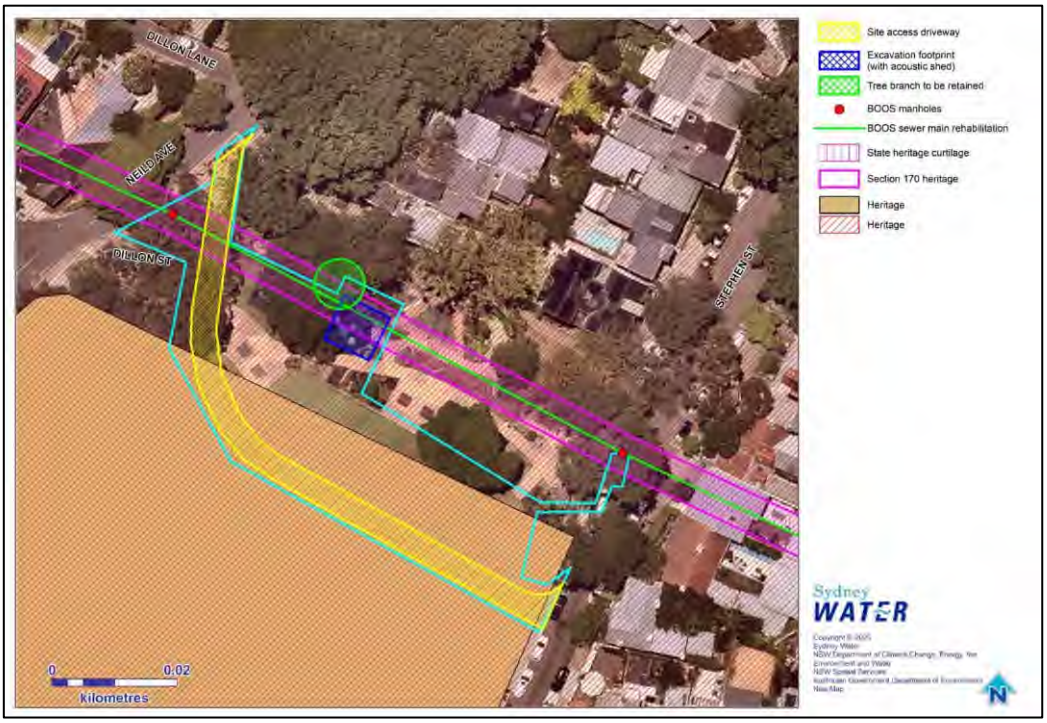


Figure 3-2: The work site at Gugara Park (Dillon St Reserve), between Nield Avenue and Stephen Street, Paddington. (Source: Sydney Water[10])

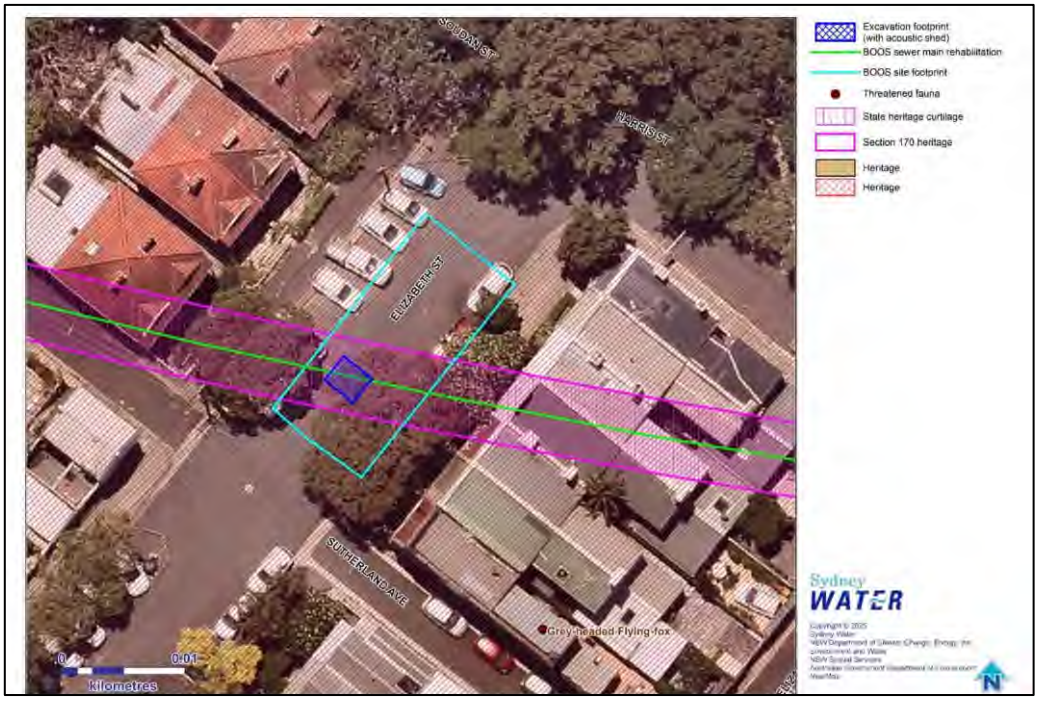


Figure 3-3: The work site at Elizabeth St (near Sunderland Ave), Paddington. (Source: Sydney Water[11])

[10] Sydney Water; *Detailed Design Report BOOS Rehabilitation Rev B*; 06/01/2026
[11] Sydney Water op cit

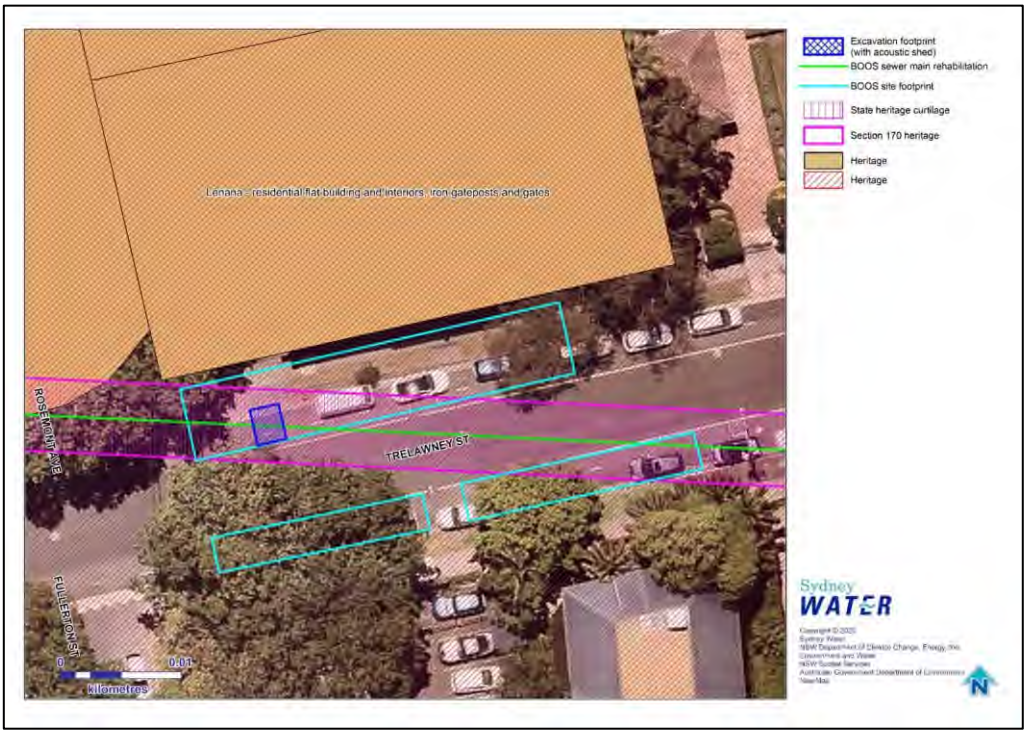


Figure 3-4: The work site at Trelawney Street (near Fullerton St) Woollahra. (Source: Sydney Water[12])

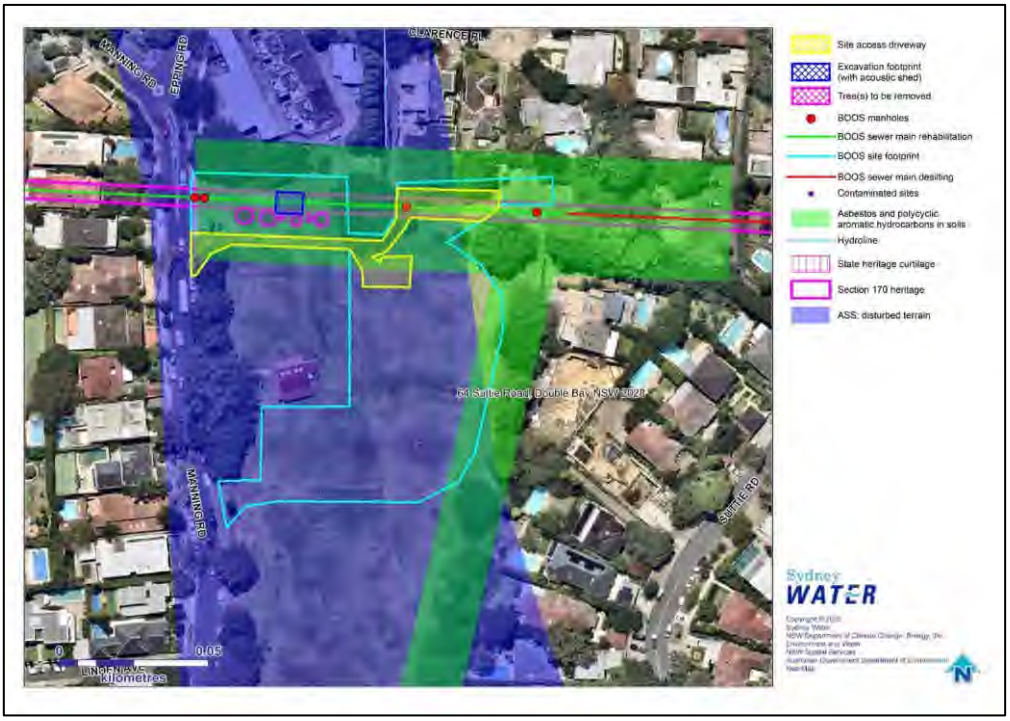


Figure 3-5: The work site at Lough Playing Fields, Manning Rd, Double Bay. (Source: Sydney Water[13])

[12] Sydney Water *Detailed Design* op cit
[13] Sydney Water *Detailed Design* op cit

3.2. Desiltation Methodology

The following description of the methodology for desiltation is based upon Section 2.4 of the *BOOS Rehabilitation - Concept Design Report, Rev B,* provided as part of the Project Brief.

3.2.1. Desilting sites

Desilting will be undertaken to re-establish a clear bore and safe access for survey, GRP jacking and CAC lining, while maintaining service under the Flow Isolation & Flow Management (FIFM) plan. The proposed primary desilting sites for access are via the main shafts/sites at:

- Lough Playing Fields.
- Elizabeth Street (new maintenance hole).
- Gugara Park (Dillon St Reserve).
- Trelawny Street (new maintenance hole – if confirmed). Trelawny Street is available for local lift-out only, due to restricted surface space and shaft width.

These sites have sufficient ground-level space to support invert access, laydown for silt storage, and ventilation systems. Smaller auxiliary sites at MH7 and MH10 can be utilised to support desilting efficiency local to their access points; however, this would be limited to small quantities of material and will require immediate removal at surface due to space and odour constraints. Other maintenance holes along the BOOS line have smaller openings that can be used for workers' access/egress, only to access the worksite.

Operations will occur mainly in low-flow/night windows, using enclosed sheds with gantry cranes, transfer to sealable skip bins and flat-bed haulage, with odour/noise controls in place. Desilting will progress in both directions from each shaft, protecting inlets/overflows and pausing for wet-weather triggers.

Table 2-1: Desilting sites

Description	Site	Comments
Desilting site 1	Gugara Park (Dillon St Reserve) shaft	Dillion Street Reserve Slot Shaft is a major site and enables desilting from MH5 to MH11, including the lowering of desilting equipment. Containment shed provided.
Desilting Site 2	Elizabeth Street (MH-11A) new maintenance hole	Elizabeth Street Shaft enables removal of silt material, with containment shed provided. Facilitates silt removal for the section between 1) midway of Dillon Park and

Description	Site	Comments
		Elizabeth Street shaft; and 2) midway of Lough Playing Field and Elizabeth Street shaft.
Desilting Site 3	Lough Playing Fields shaft	Lough Playing Fields Slot Shaft is a major site and facilitates desilting from Elizabeth Street shaft to MH19, including lowering of equipment. Containment shed provided.
Desilting Site 4	Trelawny Street (MH13-A) new maintenance hole	Trelawny Street Shaft cannot support major desilting works but can assist local removal via sealed bag lift outs directly to trucks, should progress be too limited from Elizabeth or Lough Park Shafts. Equipment will need to be moved in BOOS under the hill section from Elizabeth or Lough Park Shafts in current concept philosophy.

3.2.2. Desilting Methodology

Desilting will be undertaken during periods of low flow, requiring night shift operations. Mechanical cleaning of the invert is proposed, using either (Figure 3.6):

- a customised, manually-driven mechanical loader;
- a purpose-built, self-propelled desilting machine; or
- a winch-driven, dragged-bucket system.

A self-propelled unit is preferred, with the HMS200 compact mini loader identified as a suitable base model. Preliminary discussions with the supplier have confirmed the feasibility of modifying the equipment for use in the oviform BOOS. Modifications would include flotation and angled/side wheels accessories to suit an oviform shape.

Silt collection will involve transferring material into bulker bags loaded onto a remote controlled transport unit within the BOOS. Bags will then be lifted to the surface using winch systems and either a mobile crane or gantry crane, depending on site constraints. Where hardened deposits are encountered, specialist breaking equipment will be deployed to fragment material for subsequent removal.



Figure 3-6: Examples of desilting equipment: Mechanical Loader (top left), Dragged Bucket (top right) and an example of a purpose-built, self-propelled, desilting machine, as used on the NSOOS (bottom). (Source: Sydney Water[14])

All three desilting sites will be fitted with enclosed sheds equipped with gantry cranes to facilitate safe and efficient handling of material (Figure 3.7). Sediment removed from the BOOS will be transferred into sealable skip bins, which will be lifted to the surface using the gantry cranes on monorails. The sealed bins will then be loaded onto flat-bed trucks for transport to an approved disposal facility, ensuring containment of odour and minimising environmental impact during haulage.

[14] Sydney Water; *Concept Design Report BOOS Rehabilitation Rev B*; nd.



Figure 3-7: Desilting works schematic. (Source: Sydney Water[15])

3.3. New Maintenance Holes

New maintenance holes are proposed to be created as part of the works. These are at Elizabeth Street and Trelawney Street.

The new Elizabeth Street shaft (to be named MH11A) will be located within the carriageway of Elizabeth Street. It will be 21 m to the invert of the BOOS and will be lined with a GRP liner. It will be converted to a permanent maintenance hole for future access.

The new Trelawney Street shaft (to be named MH13A) will act as a replacement for the inaccessible MH13 and will be approximately 63 m deep to the invert of the BOOS and lined with a GRP liner. It will be converted to a permanent maintenance hole for future access.

Maintenance holes 11A and 13A will be approximately 1.8m diameter, using a standard DN1800 GRP pipe. Key technical details and maintenance hole specifications include:

- Shaft excavation: 2.0 m internal diameter, constructed using vertical rotary drilling with rock bucket into rock, with a maximum allowable deviation of 1% measured relative to the shaft centreline.

[15] Sydney Water; Concept Design-op cit

• Maintenance hole lining: PN1 GRP pipe (DN1800, 38 mm wall thickness, SN10,000). Individual GRP segments shall be 6 m long and connected using stainless steel or GRP couplers with EPDM seals.

• Structural support: GRP pipe segments shall be self-supporting via six (6) M16 dowels embedded into the rock, with a minimum embedment length of 1200 mm into the rock strata. Dowels shall be arranged in two rows of three dowels per GRP segment, spaced at 120° intervals.

• Access structures: Stainless steel ladders and platforms shall be installed in accordance with the drawings.

• Surface cover: Maintenance holes shall be fitted with Class D concrete infill covers (Mascot or approved equivalent).

At the Gugara Park (Dillon St Reserve) (Figure 3.8) and Lough Playing Fields sites (Figure 3.9), the BOOS lies at relatively shallow depths of approximately 6.5 m (Dillon Street) and 5 m (Lough Playing Fields). In these locations, the BOOS structure has an aqueduct-like configuration but appears not to have been originally designed to function as an above-ground or exposed structure. Access slots are to be cut (around mid-height) in the Dillon Street and Lough Playing Fields aqueduct sections above spring line to facilitate the insertion of the slip-lining.



Figure 3-8: Location of the proposed new entry at the Dillon Street site. (Source: Sydney Water[16])

[16] Sydney Water; *Detailed Design* – op cit

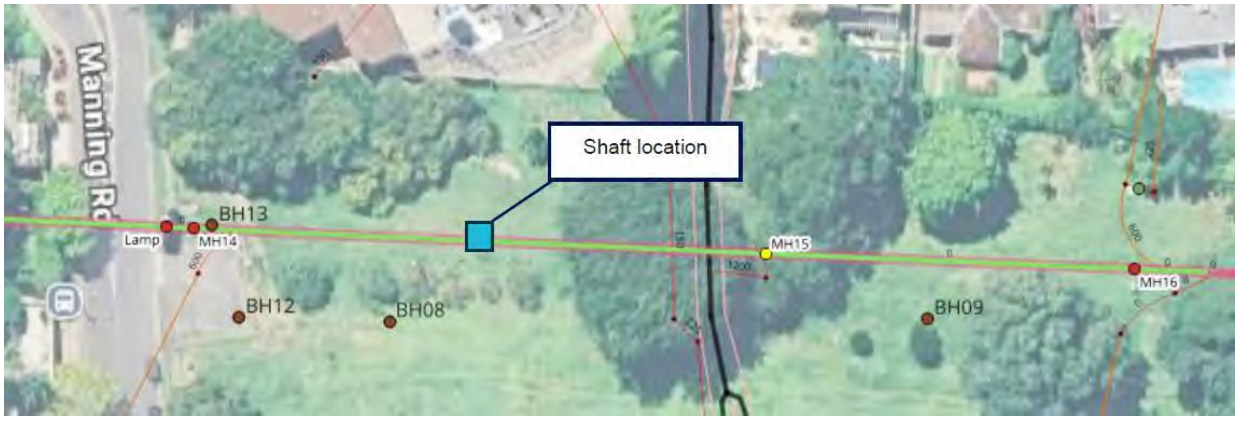


Figure 3-9: Location of the proposed new entry at the Lough Playing Fields site. (Source: Sydney Water[17])

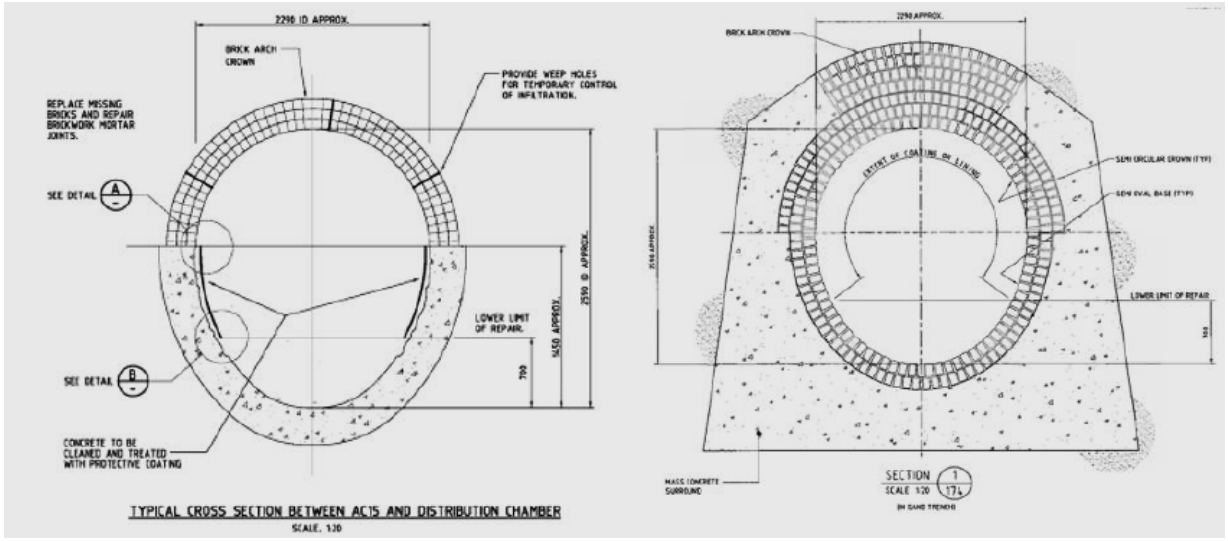


Figure 3-10: Typical cross-sections. The typical arrangement for where the BOOS is in tunnel (L) and as an aqueduct (R). (Source: Sydney Water[18])

3.4. Sewer Break-Ins

3.4.1. Rock Tunnel Break-in

A critical component of the work is gaining controlled access to the BOOS (Figure 3.10) at the four work sites without uncontrolled collapse that could block or restrict the flow or lead to a cascading failure of the existing BOOS liner.

[17] Sydney Water; *Detailed Design* – op cit
[18] KBR / Sydney Water; *Sewer Traverse Report*; Nov 2019.

At the Elizabeth Street and Trelawny Street Shafts, a direct bore connection of 2m diameter to the BOOS is required. This was originally intended to be completed by hand, however, the potential of undetonated explosives from the 1880s tunnel construction introduces personnel and asset risk. This will be mitigated by using the 81T piling rig to directly bore into the shaft (post initial pilot hole bore break-in at smaller scale).

It is proposed to create a custom, heavy-duty, debris collection trolley (Figures 3.11, 3.12) that is rated for potential small detonator blast or drill impact. It will be capable of protecting the invert and walls of the sewer while the crown of the existing BOOS liner is demolished into the catch tray. Steel sets will also be installed onto the brick work 300mm each side of the break-in zone, to protect the existing brick liner crown from cascading failure and limiting the demolition to the shaft area.

3.4.2. Aqueduct Break-in

In comparison to the rock tunnel break-in, the aqueduct break-in can be much more controlled. At these sites, the BOOS will be exposed to spring line, to allow for inspection of the substructure. Using lifting beams and the acoustic shed monorail, 500mm wide sections of the aqueduct can be separated and be removed using a fitted external frame and long chemical anchors installed deep into the aqueduct, so as to provide tension support to the unreinforced concrete.

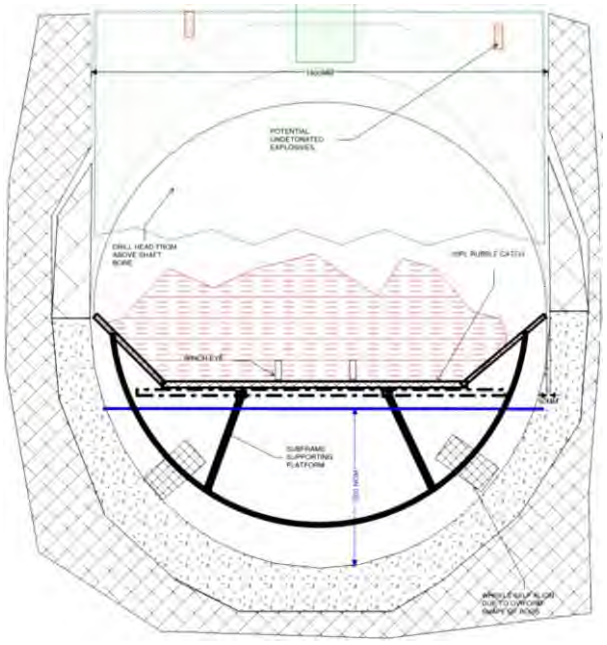


Figure 3-11: Cross Section of Break-In Debris Collection Trolley. (Source: Sydney Water[19])

[19] Sydney Water; *Detailed Design* – op cit

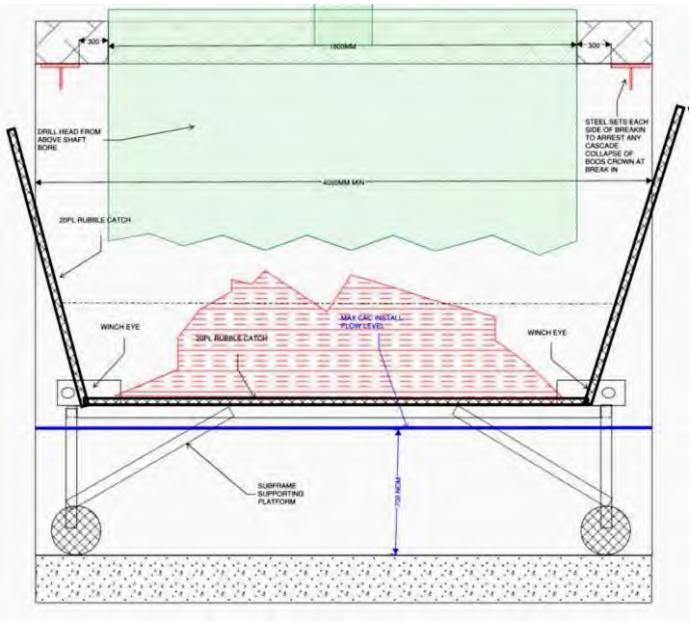


Figure 3-12: Long Section of Break-In Debris Collection Trolley. (Source: Sydney Water[20])

4. Work Sites - Heritage Context

4.1. General

In addition to the State Heritage Register listing of the BOOS, the four proposed works sites are located at ground level and exist within a local heritage landscape. The Gugara Park (Dillon St Reserve) and Elizabeth Street sites are both located within the '*Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' (C8)*. The Trelawney Street site is located within the '*Woollahra Heritage Conservation Area' (C15)*. The Lough Playing Fields site is not subject to any heritage listing.

All, except Lough Playing Fields, are located in the vicinity of local heritage items. The proposed work site at Gugara Park (Dillon St Reserve) is in partially in the curtilage of the locally listed '*Scottish Hospital main hospital building and interiors, grounds*'.

The specific context of each of these sites is examined in more detail in the following sections.

[20] Sydney Water; *Detailed Design* – op cit

4.2. Gugara Park (Dillon Street Reserve), Nield Avenue, Paddington

Gugara Park (formerly known as the "Dillon Street Reserve") is a small local park between Nield Avenue and Stephen Street in Paddington. It was owned by the MWS & DB as a 'Sewer Reserve' in the 1920s (Figure 4.1) and, based upon aerial photography, was a local street (the eastern extension of Dillon Street) until circa 1980, when the street was closed and converted to a park Figure 4.3 to 4.7). At some stage, control of the land was transferred to Woollahra Council, likely in the mid-twentieth century. Circa 2020, the current owners of the former Scottish Hospital, Anglicare, transferred a 1,300 m^2 parcel of land to the council for the expansion of Gugara Park (Figure 4.2). This equates to the area of Lot 20, DP1255181, on the northern side of the original rectangular land parcel (which has no land title and remains, presumably, Crown land).

Gugara Park was, in 2021, landscaped as a children's play area by GJ's Landscape and Civil for Woollahra Council, with play equipment including a tubular slide, a large climbing net, balance beams and timber stepping posts, new footpaths, picnic settings, seating and a drinking fountain and new garden beds established with extensive plantings of shrubs and perennials (Figure 4.8).



Figure 4-1: Street map of Paddington circa 1920, showing the Sewer Reserve between Dillon and Stephen streets. (Source: Robinsons Suburbs of Sydney Street Maps)

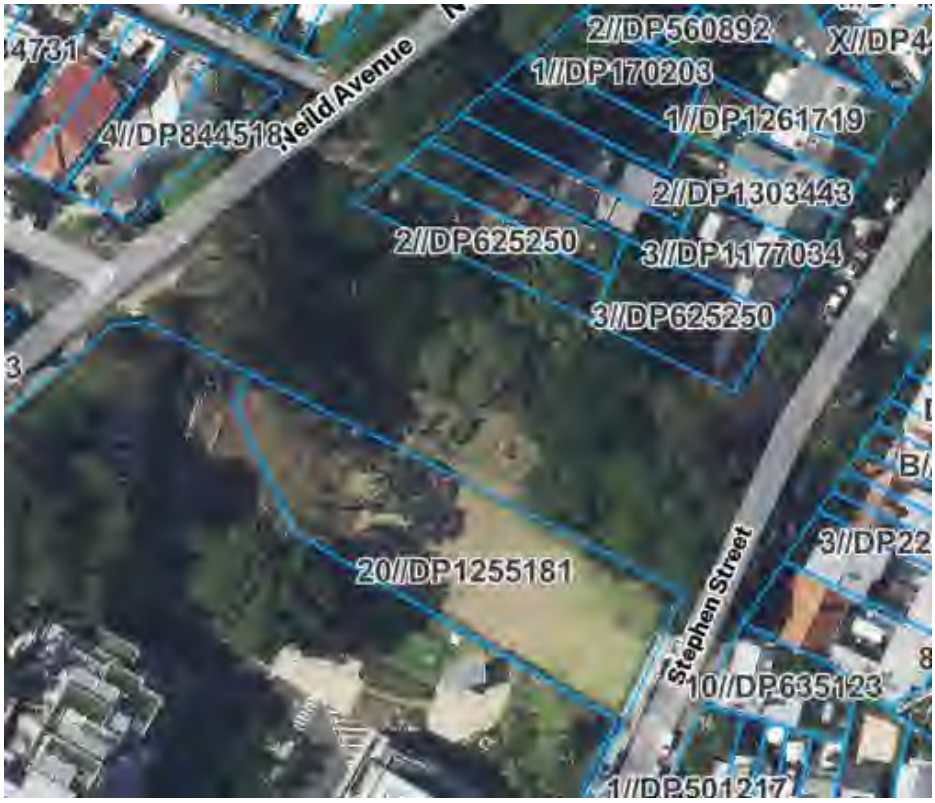


Figure 4-2: Land and Property information map of Paddington, showing the former Sewer Reserve as untitled land between Dillon and Stephen Streets. Lot 20, DP1255181 has been added to Gugara Park. (Source: NSW LPI)



Figure 4-3: 1930 Aerial Photograph showing the Dillon Street Reserve. (Source: NSW Spatial Services)



Figure 4-4: 1943 Aerial Photograph showing the Dillon Street Reserve. (Source: NSW Spatial Services)



Figure 4-5: 1978 Aerial Photograph showing the Dillon Street Reserve. (Source: NSW Spatial Services)



Figure 4-6: 1986 Aerial Photograph showing the Dillon Street Reserve. (Source: NSW Spatial Services)

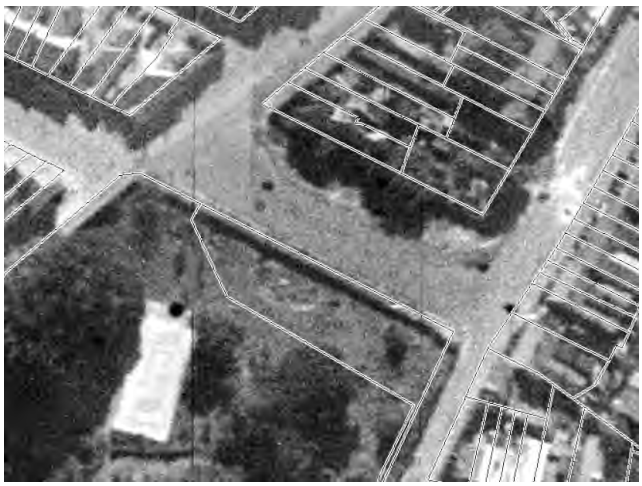


Figure 4-7: 1943 Aerial Photograph showing the Dillon Street Reserve, with the current subdivision boundaries showing Lot 20, DP1255181. (Source: NSW Spatial Services)



Figure 4-8: Landscaping in Gugara Park (the Dillon Street Reserve) - Aerial View in November 2025 (L) (Source: NearMap) and from within the Park. (Source: GJ's Landscape and Civil)

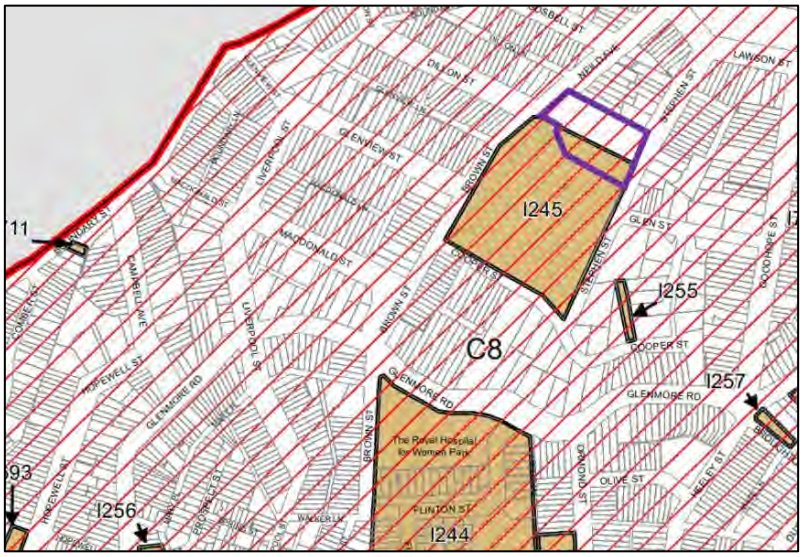


Figure 4-9: Extract of Woollahra LEP Heritage Map HER001, showing heritage listings (shaded brown) and Conservation Area (red hatching) in the vicinity of the Gugara Park (Dillon St Reserve) Work Site. Gugara Park (Dillon St Reserve) is outlined in purple. (Source: Woollahra Council)

The individual Heritage Item I245 is the "*Scottish Hospital main hospital building and interiors, grounds*", listed in Schedule 5 – Heritage Items, of the *Woollahra Local Environmental Plan 2014*. Item I255 (House, interiors and grounds - 8A Cooper Street) is separated by topography and has no visual or geographic relationship to the Gugara Park (Dillon St Reserve). The red cross-hatching shows the extent of the C8 - *Paddington, including parts of Woollahra and Edgecliff Heritage Conservation Area* (Figure 4.9).

The Statement of Significance for the "*Scottish Hospital main hospital building and interiors, grounds*" is:

> *The Scottish Hospital and its site have historic, aesthetic and social significance at a local and State level for a number of reasons.*
>
> *The site represents the subdivision of the early land grants in the suburb, and the early suburbanisation of Paddington. It is representative of the conversion of large houses in Sydney to private hospitals that took place prior to the First World War. The building contains remnants of an early 1840s Victorian residence built by Henry Burton Bradley.*
>
> *The Scottish Hospital is historically significant for its evidence of caring for the sick in New South Wales and its associations with historically significant persons John Edye Manning, Henry Burton Bradley, George Sydney Jones and Sir Alexander MacCormick. It has a long association with the Presbyterian Church in NSW, and its role as a health-care provider. It is representative of small private hospitals that began functioning in Sydney in the early 20th century, and of those private hospitals that operated from converted inner city mansions.*

The Scottish Hospital has local aesthetic significance for its intact Federation Arts & Crafts exterior. The main hospital building has also high historic, aesthetic and social significance for the part it played in the social structure of the Paddington community, and its Arts and Crafts remodelling of the building.

The cultural landscape at The Scottish Hospital site is historically significant at a State level for its strong association with a number of individuals and families important in the development of Sydney's Eastern Suburbs and of private health care in New South Wales. The landscape site has the ability to reflect particular design trends and planting styles for its type of garden over the period of its development.

The Hospital is situated at the top of a well maintained terraced garden which contains many mature trees over one hundred years old. The landscape of The Scottish Hospital site has the ability to reflect particular design trends and planting styles for its type of garden over the period of its development. The original residential building on the site was named the Terraces after the terraced gardens for which the property was renowned. The Terrace gardens remain largely unaltered, main features being mature trees include Port Jackson and Moreton Bay figs, Norfolk Island pine, Blackbean and a variety of palms.

The mixed planting of evergreen and deciduous trees and shrubs, together with the vistas and views have produced a landscape with considerable character, which is now in stark contrast with the garden's more highly developed urban surroundings. Extensions to the hospital were carefully planned to take consideration of the many trees, some of which are over one hundred years old. The garden and trees have high social and historical significance as part of the garden of the original residence.

The landscape at the Scottish Hospital site has the potential to yield information that will contribute to an understanding of NSW's cultural history. The garden has archaeological, educational and interpretative potential as a resource for the study of subjects such as architecture, design, social history, landscape history and horticulture for present and future generations of Australians.

The Statement of Significance for the "*Paddington Heritage Conservation Area*" is:

Paddington is a unique urban area which possesses historical, aesthetic, technical and social significance at a National and State level. An important factor in the significance of Paddington is its exceptional unity, encompassing scale, character, history, architecture and urban form.

The built environment of Paddington is an excellent example of the process of 19th century inner city urbanisation of Sydney which was largely completed by 1890. The predominant Victorian

built form is an excellent representative example of the phenomena of land speculation and a 'boom' building period between 1870 and 1895.

The terraces of Paddington clearly trace the evolution of the imported English Georgian and Regency terrace models into the distinct Australian style evident in the Victorian era terraces.

Paddington retains many significant types of buildings that represent all phases of the suburb's historical development. These building types range from modest, small-scale, single storey timber and masonry cottages, to remnant examples of former gentry mansions, boom style middle-class terrace houses, apartment blocks and contemporary infill development, all of which are set in a varied network of streets, lanes and pedestrian accessways which reflect the phases of subdivision and development.

Paddington has a multitude of important historical and social associations. It is linked with the early transport routes along South Head Road (Oxford Street) and Point Piper Road (Jersey Road), the construction of Victoria Barracks in the 1840s, the gentry estates, prominent figures of the early colony, the speculative building boom between 1870 and 1890, and the development of Australian tennis at the White City site. Its historical and social associations extend to the periods of occupancy by immigrant groups and minority groups including the Chinese market gardeners, the Jewish community around the turn of the century, the European immigrants in the 1950s and an alternative artistic and intellectual population in the 1960s and 1970s. Today Paddington has a high level of social esteem and is regarded as one of Sydney's most desirable inner-city urban areas. The changing sociology of Paddington demonstrates phenomenal variations in status and changes in community attitudes to the 19th century suburb.

Paddington has important associations with the evolution of the conservation movement in Australia, in particular with the actions by the National Trust and the Paddington Society, which ensured its conservation at a time of redevelopment threat in the 1960s. It is significant as the first suburb classified by the National Trust, a community based, non-government organisation committed to promoting and conserving Australia's heritage. Paddington has a unique aesthetic significance due to the superimposition of the built form on a sloping topography which overlooks Sydney Harbour and its foreshores. The coherent and extensive Victorian built form comprising groups of terrace buildings on narrow allotments which step down hills, turn corners or sit in ranks along tree lined streets produces a singularly recognisable image.

Paddington provides vast opportunity for research, education and interpretation through the physical layout of its road network, its subdivision pattern and the varied form of buildings. These buildings provide an excellent record of past technologies and domestic lifestyles through features such as original external and internal building fabric, detailing and room layouts. Terrace houses,

semi-detached dwellings, flat buildings and freestanding houses all show the evolving attitudes towards families and the home from the early 19th to the late 20th century.

4.3. Elizabeth Street (near Sunderland Avenue), Paddington

The Elizabeth Street site is located within the road reserve of Elizabeth Street, just north of the intersection with Sunderland Avenue. The buildings on either side are late nineteenth and early twentieth century residential terrace houses of two-storeys, typically with iron lace balustrades and valences to verandahs and pike and rail fences.

The Elizabeth Street Work Site is located within the '*Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' (C8)* (Figure 4.10). The only individually identified heritage item in the vicinity is the Four-In-Hand Hotel, Item I682. This building is 500 metres south of the work site and is separated by topography and distance. There is little visual or geographic relationship to the proposed work site (Figures 4.11, 4.12).



Figure 4-10: Extract of Woollahra LEP Heritage Map HER003C, showing heritage listings (shaded brown) and Conservation Areas (red hatching) in the vicinity of the Elizabeth Street Work Site (outlined in purple). (Source Woollahra Council)

The Statement of Significance for the "*Paddington Heritage Conservation Area*" is set out in the previous section.



Figure 4-11: Buildings on either side of Elizabeth Street adjacent to the Work Site are late nineteenth century / early twentieth century residential terraces which have changed little since originally constructed. (Source: Streetview)



Figure 4-12: View south (L) and north (R) along Elizabeth Street from the Work Site. (Source: Streetview)

4.4. Trelawney Street (near Fullerton Street), Woollahra

The Trelawney Street site is located within the road reserve of Trelawney Street, just east of the intersection Fullerton Street. Woollahra. Unlike the Elizabeth Street site, the access point is located within a limited part of the road reserve and the carriageway of Trelawney Street will remain open during the works. The Trelawney Street site is located within the '*Woollahra Heritage Conservation Area' (C15)* (Figure 4.13). It is adjacent to a number of individual Heritage Items listed in the Woollahra LEP. These are:

- I601 - 'Lenana': residential flat building and interiors, iron gateposts and gates (Figures 4.14, 4.15).
- I602 - Lyndhurst Gardens: residential flat building and interiors, forecourt (Figure 4.16).
- I605 - London Plane Trees: approx. 35 trees in Rosemont Avenue (within road reserve) (Figure 4.17).
- I616 - Great Tree: house and interiors, street fencing (Figure 4.18).

Items I698, I488 and I494 are separated by topography and distance and have little visual or geographic relationship to the proposed work site.

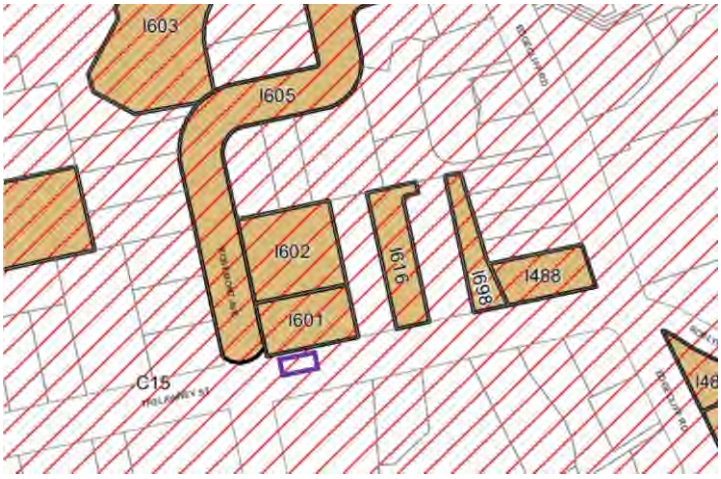


Figure 4-13: Extract of Woollahra LEP Heritage Map HER003D, showing local heritage listings (shaded brown) and Conservation Areas (red hatching) in the vicinity of the Trelawney Street Work Site (outlined in purple). (Source Woollahra Council)



Figure 4-14: View east along Trelawney Street. The Work Site is indicated in yellow. Heritage Item I601, 'Lenana', is at left. (Source: Streetview)

The Statement of Significance for Item I601 – 'Lenana', 1 Rosemont Avenue, is:

> *'Lenana' is highly significant as an exceptional and intact example of the work of the prominent architectural firm of Joseland and Gilling during the Inter War period. This three-storey building is also historically and socially significant through its ability to demonstrate the emergence of the residential flat building in Sydney, and in particular in the Woollahra municipal area in the Inter War period.*

1 Rosemont Avenue is an outstanding and intact example of Gillings use of classical detailing applied to a larger multi-unit housing block.

'Lenana' demonstrates a moderate level of technical significance through the opportunity to study construction techniques in a three-storey Inter War building. The listing of this building by a number of special interest groups indicates a moderate level of social esteem.

There is no Statement of Significance provided in the State Heritage Inventory for Item I602, '*Lyndhurst Gardens*' - 3 Rosemont Avenue. However, it features in the "*Woollahra Interwar Buildings Thematic History*" report[21] and is a high-quality, representative example of an Interwar Flat building.

There is no Statement of Significance provided in the State Heritage Inventory for Item I605 – '*London Plane Trees*', Rosemont Avenue (within road reserve). There are approximately 35 mature street trees on either side of Rosemont Avenue.

There is no Statement of Significance provided in the State Heritage Inventory for Item I616 – '*Great Tree - house, street fencing*' – 7 Trelawney Street. It appears as a substantial early twentieth century residential house, set back from the street, with a random-coursed sandstone masonry front fence. There is a large tree in the front yard.

The Statement of Significance for the "*Woollahra Heritage Conservation Area*" is:

The Woollahra HCA has historical, aesthetic, technical and social significance at the local level.

The surviving built and natural fabric of the Woollahra HCA has significance for its ability to demonstrate the important historical phases of the area's development. These phases include the development of large estates during the mid-19th century, small lot residential development in the mid-19th century, retail development of the mid-19th to early 20th centuries, speculative subdivisions of the late-19th century, Inter-War consolidation and municipal improvements of the 20th century.

In its surviving elements of built fabric, the Woollahra HCA retains the potential to reveal evidence of ways of life, building and land uses which have now changed or disappeared. Such fabric includes:

- *early domestic kitchens and their associated service areas and technology;*
- *former stable buildings;*
- *outbuildings including early external toilets and garages;*

[21] GML Heritage; *Woollahra Interwar Buildings Thematic History*; Report for Woollahra Municipal Council; July 2024.

- *'nightsoil' lanes;*
- *paling fences and gates to rear lanes;*
- *front fences and gateposts to buildings that have been demolished;*
- *bricked-up openings to former doors; and*
- *first floor loading bays to former industrial and storage buildings.*

The Woollahra HCA has high aesthetic significance for its visual complexity derived from:

- *the variety of significant public and private building types;*
- *the variety of significant architectural styles and scales within the range of building types;*
- *the complex and varied subdivision pattern;*
- *the significant intact and remnant landscape; and*
- *the municipal parks and small reserves.*

The Woollahra HCA contains aesthetically contributory items of architectural excellence dating from all the major periods of its development, many designed by the eminent architects of their period.

The area has social significance for its association with the growth of the heritage conservation movement in Sydney during the 1960s. It was an early example of an area which received recognition by the National Trust and the Australian Heritage Commission through the efforts of the local community.



Figure 4-15: *'Lenana'*, 1 Rosemont Avenue (Item I601). (Source: Streetview)



Figure 4-16: *'Lyndhurst Gardens'* - 3 Rosemont Avenue (Item I605). (Source: Streetview)



Figure 4-17: *'London Plane Trees'* - Rosemont Avenue (Item I605). (Source: Streetview)



Figure 4-18: *'Great Tree - house, street fencing'* – 7 Trelawney Street (Item I616). (Source: Google Earth)

In addition, LEP heritage items Woollahra I679 and Double Bay I673 are identified without any location identified by shading. These are both the same item (albeit for the two suburbs) identified as "*Street Name Inlays" – Various Locations*. The Statement of Significance for the Street Name Inlays is:

> *"The 493 street name inlays throughout the footpaths and kerbs of the Municipality have historic and social significance for their construction in the 1930s as part of a civic beautification scheme that is thought to have taken advantage of surplus labour following the Great Depression."*[22]

Review of the Woollahra Council Planning Proposal report[23] identifies five listed Street Name Inlays in the vicinity of the Trelawney Street Work Site (Figure 4.19). These are:

- Trelawney Street Gutter near cnr of Rosemont Avenue;
- Trelawney Street kerb near cnr of Fullerton Street;
- Trelawney Street near cnr of Fullerton Street;
- Trelawney Street near cnr of Rosemont Avenue; and
- Trelawney Street near cnr of Rosemont Avenue.

[22] Woollahra Council Planning Proposal - *Local Heritage Listing - Street Sign Inlays*; February 2016.
[23] Woollahra Council Planning Proposal *op cit*.

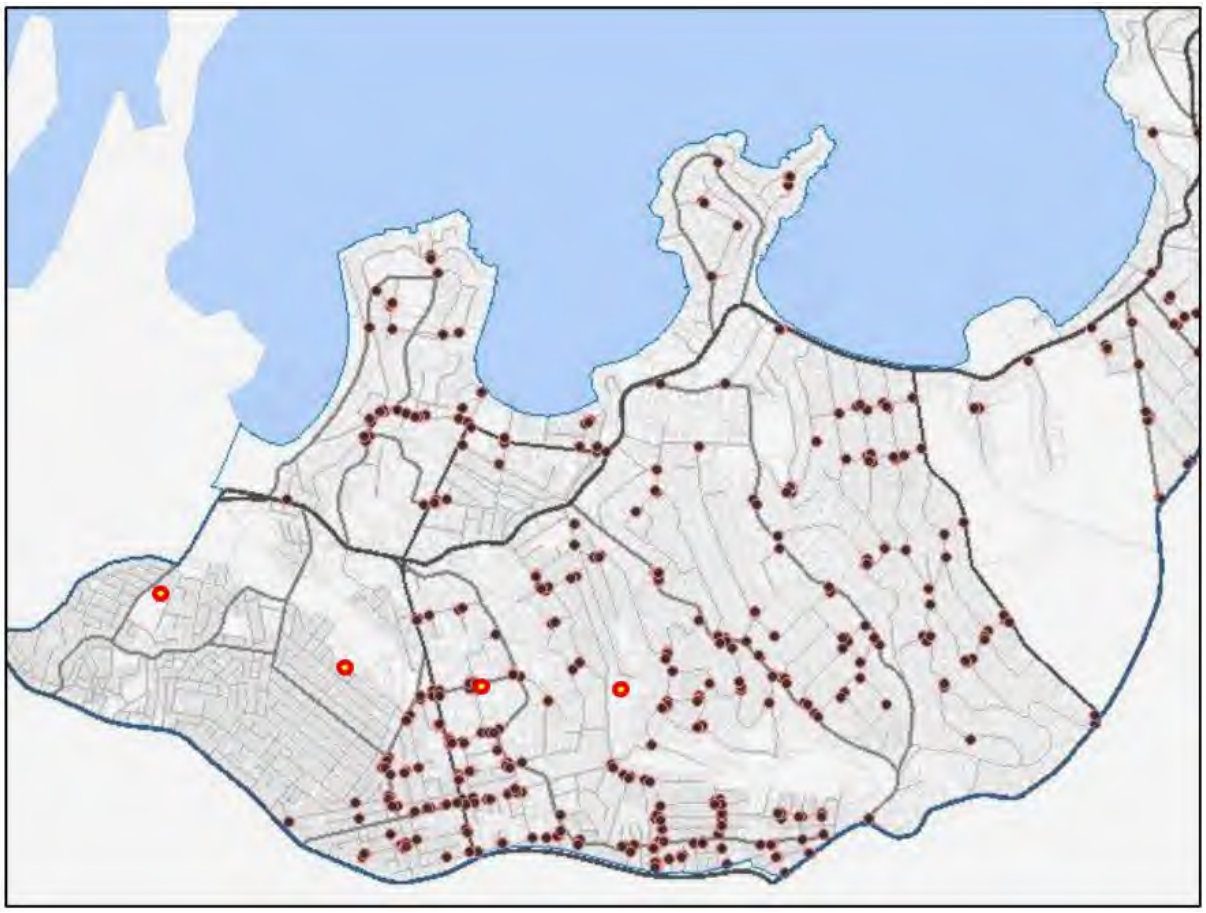


Figure 4-19: Street Name Inlay locations in Woollahra and Double Bay. The locations of the four Work Sites are shown by the red/yellow circles. (Source: Woollahra Council)

4.5. Lough Playing Fields, Manning Road, Double Bay

The Lough Playing Fields was created by the progressive acquisition of land by Woollahra Council between 1927 and 1944. Much of the land had been in use for market gardens and as a dairy, with Double Bay Creek running through the centre. The Bondi Sewer was built as an aqueduct in this section to span over the creek line (which has subsequently been converted to an underground stormwater channel through the Park, reappearing as an open stormwater channel on the northern side of the Sewer).

In 1935, Woollahra Council approached the Water Board to acquire the Board's Sewer Reserve (Figure 4.20) at the northern end of the land. It was approved in May 1938 and transferred in September 1940 (Figure 4.21). After the final land acquisition in 1944, Council undertook some landscaping works but it wasn't until the 1950s that the playing fields were established. Originally referred to as the 'Manning Road Reserve', it was renamed the Lough Playing Fields in 1955 in honour of John C. Lough, long-serving Town Clerk of Woollahra Council.

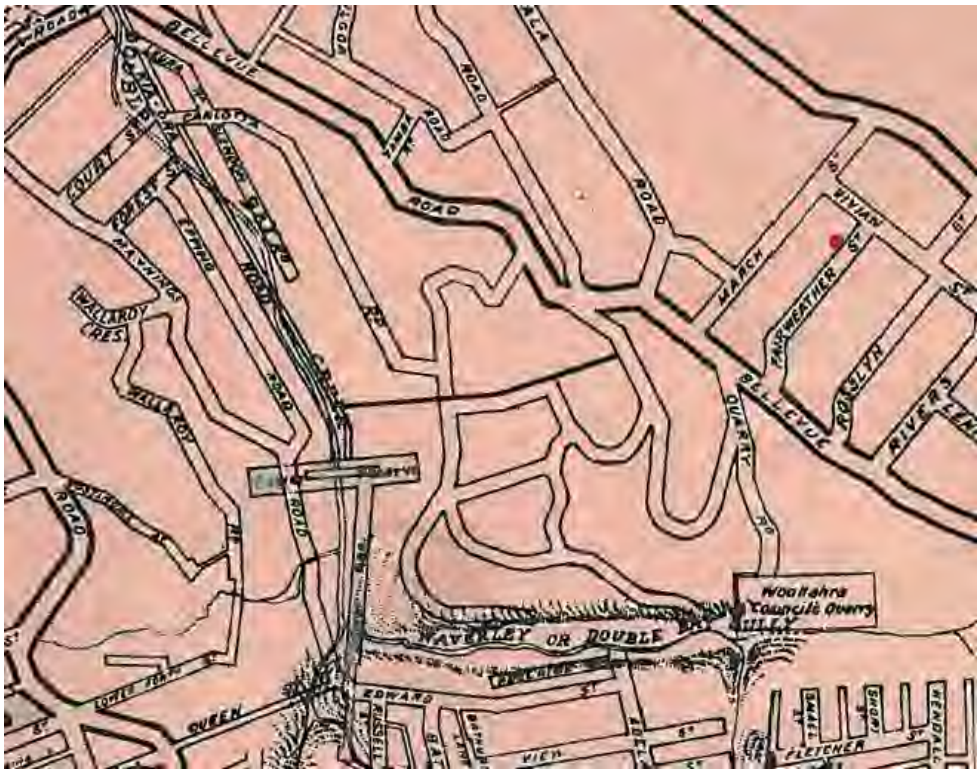


Figure 4-20: Street map of Woollahra circa 1920, showing the Sewer Reserve at Lough Playing Fields. (Source: Robinsons Suburbs of Sydney Street Maps).



Figure 4-21: Lough Playing Fields in 1943. Some crude air-raid shelters have been established in the centre of the park. (Source: SixMaps)



Figure 4-22: Extract of Woollahra LEP Heritage Map HER003D, showing heritage listings (shaded brown) in the vicinity of the Lough Playing Fields Work Site (outlined in purple). (Source Woollahra Council)

The nearest identified heritage item to the works site (Figure 4.22) is Item I45 - *3 Washington Palms, Cliff Date Palm, 4 Canary Island Date Palms - Northland Road, within road reserve*. All other items are separated by topography and distance and have little visual or geographic relationship to the proposed work site (Figures 4.23, 4.24).

There is no Heritage Conservation Area covering this part of Double Bay and there are no identified Street Name Inlays identified in the vicinity of the Work Site.



Figure 4-23: Lough Playing Fields (L) and the access to the former Sewer Reserve (R) at the northern end. (Source: Streetview)



Figure 4-24: Lough Playing Fields – view east from Manning Street across the former Sewer Reserve. (Source: Streetview)

4.6. Significant Tree Register

The Woollahra Significant Tree Register was republished in 2022. This document is a reproduction of the original 1991 Register of Significant Trees produced for Woollahra Council by LandArc Pty Ltd, which has been reformatted to better integrate with Council's current suite of tree management documentation. Aerial photographs have been included for many of the listings, together with updated photographs of listed items, where possible. Where it was clear that significant trees had died or been removed, the listings have been updated accordingly to reflect these obvious changes. There have been no new additions to the Register and Arterra Design Pty Ltd advises that no additional research was undertaken to verify the accuracy or significance attributed to entries within the original 1991 document.

The content of the Significant Tree Register has been checked and, although some identified 'significant trees' are in the vicinity of the four Work Sites (notably within the Scottish Hospital and along the verge of Brown Street, Paddington), none are impacted by the proposed works.

4.7. Aboriginal Archaeological Sensitivity Mapping

Woollahra Council commissioned Coast History and Heritage to undertake a municipality-wide Aboriginal Heritage Study, the results of which were produced in July, 2021. This study, amongst other

things, identified the nature and extent of known Aboriginal sites and places in the Local Government Area and, as one result, produced an Aboriginal Archaeological Sensitivity Map for the area. Review of the Sensitivity Map indicates that there is no Archaeological sensitivity at any of the four Work Sites (see Figure 4.25).



Figure 4-25: Aboriginal Archaeological Sensitivity Map – Woollahra Council 2021. The Work Sites are shown as red/yellow stars. (Source: Coast History and Heritage[24])

[24] Coast History & Heritage; *Woollahra Local Government Area Aboriginal Heritage Study*; Report prepared for Woollahra Municipal Council; July 2021.

5. Heritage Impact Assessment - BOOS

5.1. Approach to Assessment

The following section provides an assessment of heritage impacts caused by the proposed works upon the significance of the BOOS itself, independent of the impacts arising at the above-ground work sites, which are addressed in the following Section 6.0. The assessment is consistent with the *Guidelines for preparing a statement of heritage impact*[25] *and* follows the definitions of 'heritage impact', based on the *Heritage NSW Material Threshold Policy*[26]. These have been modified to apply to matters of local, Commonwealth and National heritage significance, as relevant to the proposed works.

Table 5-1: Scale of impact to heritage significance

Impact	*Definition*
Total Loss of Significance	*Major adverse impacts to the extent where the place would no longer meet the criteria for listing.*
Adverse Impact	*Major (that is, more than minor or moderate) adverse impacts.* *Moderate adverse impacts to the heritage significance of the item.* *Minor adverse impacts to heritage significance of the item.*
Little to No Impact	*An alteration to a significant heritage item that is so minor that it is considered negligible.*
Positive Impact	*Alterations to a significant item that enhance the ability to demonstrate its cultural heritage values.*

5.2. Matters for Consideration

The *Guidelines for preparing a statement of heritage impact*[27] provide a series of matters for consideration when assessing the impact of a proposed work to the heritage values of an item or place. The following sections provide a detailed assessment of matters, as they are relevant to the proposed works.

[25] Department of Planning and Environment NSW. 2023b.
[26] Department of Planning and Environment NSW. 2022.
[27] Department of Planning and Environment NSW. 2023b.

5.2.1. Fabric and Spatial Arrangements

The proposed work to the BOOS has two components – the desiltation of the interior of the sewer from MH5 to MH19 (approximately 4.1 kms) and the internal lining of a 2.3 km section of the BOOS, between MH6 (Boundary Road) and MH16 (Lough Park).

The desiltation work ostensibly has no impact upon the fabric of the BOOS, as it involves the removal of the build-up of silt in the conduit and the return of the conduit to its full capacity. However, in order to access the conduit and remove the silt, alteration to the access facilities (ie maintenance holes) is required. The new access is also required to enable the delivery of the slip-lining into the sewer and to facilitate to removal of accumulated silt.

The slip-lining has two components:

- GRP slip-lining with annular grouting of GRP segments from maintenance holes MH 6 to MH11 and maintenance holes MH12 to Lough Playing Fields shaft.
- CAC (Calcium Aluminate Cement) sprayed onto the interior surfaces) lining from maintenance holes MH11 to MH12 and maintenance hole MH14 (Lough Playing Fields shaft) to MH16.

In both approaches, there will be no substantive adverse effect upon the existing fabric of the BOOS, as both approaches install an inner lining to the existing conduit. The GRP slip-lining is an inner tube to carry the effluent flow and will preserve the existing fabric from further degradation by wear and chemical attack. The insertion of grout between the new lining and the existing conduit walls is necessary to stabilise the lining within the conduit, to stabilise the conduit walls and to prevent the GRP lining from floating. Grout is a simple material which will aid in the exclusion of groundwater seepage. Although its future removal is not envisaged at this time, the difference between the grout material and the fabric of the BOOS (brick and concrete) is sufficient to permit the relatively easy separation between these surfaces, if required in the future.

Calcium Aluminate Cement is a special cement which is noted for its high abrasion resistance and for its resistance to biogenic sulphide corrosion, the latter being particularly relevant for applications involving the presence of sewage. For this reason, one of its particular uses is for rehabilitation of existing sewers and it is typically applied as a sprayed (wet or dry) mortar coating. The application of a sprayed mortar coating onto the interior of the BOOS is consistent with the range of cements which have been used in the past on the interior of the sewer to minimise wear and chemical degradation, with the exception that, in this case, it is proposed to use a specific type of cement mortar which should prove to be superior in its ability to protect the existing and significant fabric of the BOOS. The application of this lining will overlie the original brickwork of the BOOS but, as this fabric is never seen by members of the public, there is little overt impact on significance as a result. The proposed lining affects approximately one third

of the length of the BOOS and the other two thirds will remain as is. A good example of the original construction of the BOOS exists in relatively good condition within the excavation at Ben Buckler, where the sewer outlet has been diverted into the Treatment Plant and the original section to the vent shaft and cliff-face outlet abandoned.

In considering the heritage significance of the BOOS and the degree of interference proposed by this project, it is relevant that the BOOS was built over 130 years ago and it has operated continuously since that time. The content of any sewer produces an aggressive chemical environment and the fabric of the BOOS is currently displaying the long-term effects of the progressive degradation of the internal brick and concrete fabric of the sewer, as set out in the Inspection[28] and Condition[29] Reports. Without some level of protection, the fabric of the BOOS will continue to degrade until it inevitably requires replacement. The application of the CAC lining and the insertion of a GRP slip-liner are actions which are intended to preserve the fabric and to prolong the operational functionality of the BOOS, consistent with its heritage significance.

The most significant actions proposed are the creation of two, new, drilled maintenance hole shafts at Elizabeth Street and at Trelawney Street and the creation of access slots in the aqueduct sections of the BOOS at Gugara Park (Dillon St Reserve) and Lough Playing Fields. In both cases, there is alteration to the fabric of the BOOS.

Each of the drilled maintenance holes will remove a 2.0 m circular section of brickwork from the crown of the sewer. In both cases, the new maintenance holes will remain in place after the completion of the works as permanent access points. The access slots will be cut into the upper half of the aqueduct sections of the sewer and the crown of the sewer lifted away for the duration of the works. The upper section of the sewer will be replaced at the end of the works and the openings made good.

In terms of the total length of the sewer at 6.8 kms, these new openings, temporary and permanent, represent an alteration to a tiny percentage (0.1 %) of the overall fabric and are works necessary to rehabilitate and conserve the sewer. The new maintenance holes will be distinguished from all others by their GRP, rather than brick, lining of the shaft but this difference will only ever be apparent to maintenance workers. The works to the aqueduct sections will be reburied at the end of the works and the permanent evidence of the works will not be apparent.

Overall, the adverse impact of the proposed works upon the fabric and spatial arrangements is minor, as it affects only a small proportion of the fabric, will not be apparent to anyone except maintenance

[28] Metrocorp Technologies; *Analysis of Pipeline - Bondi Ocean Outfall Sewer (BOOS) FPI Inspection Report*; Report for D4C; 18/06/2025.
[29] Kellogg Brown & Root Pty Ltd; *Bondi Ocean Outfall Sewer - Sewer Traverse Report, Nov 2019*; Report for Sydney Water; 18 February 2020.

workers and represents a minor alteration to the fabric to facilitate its maintenance and repair and to conserve the sewer in operating condition for the next several decades. The impact upon the heritage significance of the Sewer is negligible, while preserving its fabric for the foreseeable future.

5.2.2. Setting, Views and Vistas

The proposed works will have little to no impact upon the setting, views and vistas associated with the BOOS. The BOOS is completely underground, with only maintenance hole covers visible at street level and there are no significant views or vistas that could be impacted by the works.

5.2.3. Landscape

The proposed works will have little to no impact on any significant landscape elements located in or within the vicinity of the BOOS. The sewer does not include any notable plantings or trees.

5.2.4. Use

The proposed works do not involve a change of use. The proposed works are formulated to protect the fabric of the BOOS while allowing it to continue in its current use.

5.2.5. Demolition

The proposed works do not involve any demolition of significant fabric or elements of the BOOS. The removal of brickwork for the new maintenance holes is addressed in 5.2.1 above.

5.2.6. Curtilage

The proposed works do not include any change of curtilage.

5.2.7. Movable Heritage

There are no items of movable heritage located in or within the vicinity of the BOOS.

5.2.8. Aboriginal Cultural Heritage

This Statement of Heritage Impact does not provide an assessment of Aboriginal Cultural Heritage relevant to the BOOS.

5.2.9. Historical Archaeology

The BOOS is an underground conduit formed by tunnelling or by cut-and cover trenching. There is no potential for significant historical archaeological material to be associated with the BOOS in either situation.

The proposed works do not involve any substantial ground disturbing works, apart from the temporary removal and replacement of existing fill over the aqueduct sections of the BOOS at Dillon Street and Lough Playing Fields. The proposed works are unlikely, therefore, to impact upon any potential historical archaeological materials. The potential for substantial ground disturbance in relation to the two new manhole sites is addressed in the following section.

5.2.10. Natural Heritage

There are no known items of Natural Heritage in or within the vicinity of the BOOS that could be impacted by the proposed works. No discoveries of fossil material were reported during the excavation of the BOOS.

5.2.11. Cumulative Impacts

The proposed works are a component of an in-progress evolution of the sewer to enable its continuing operation. Built during the 1880s using the materials available at the time, the sewer has performed admirably for over 130 years with only minor repairs and upgrades. However, the environment in the sewer is aggressive towards materials and recent condition inspections have determined that, without serious investment in further internal protection, the materials will soon degrade beyond saving and the long-term security of the sewer is not assured. Consequently, the works are formulated to maintain and protect the original fabric of the sewer for the long-term, by insertion of a lining or addition of a coating.

The proposed works cover the majority of the central section of the sewer and, although not envisaged at this stage, it is conceivable that, in the future, these works may need to extend to the sections of the sewer that are not covered by this work program However, even if this occurs, works of this nature will, firstly, protect the original fabric and, second, serve to keep the sewer in operation. Taken all together, it

is considered that the cumulative impacts arising from the proposed development will have a neutral or positive impact upon the heritage significance of the BOOS.

5.2.12. Conservation Management Plan

The current Conservation Management Plan for the BOOS is the: *Bondi Ocean Outfall Sewer and Ben Buckler Sewer Vent Conservation Management Strategy;* Report for Sydney Water; June 2011 by Godden Mackay Logan (the CMS). Conservation Policies are set out in the CMS and have been considered in the development of the project and the assessment of its potential heritage impacts.

In the table below, the relevant policies from the CMS are identified and the compliance, or otherwise, of the proposed works in relation to the policy is discussed.

Policy	Response
7.6.2 Retention of Significance *Policy* *Maintenance or works that would adversely impact on significant areas, elements or fabric or other aspects of significance of the place should only be permitted where:* *the work makes possible the recovery of aspects of greater significance;* *the work helps ensure the integrity and viability of the place;* *there is no feasible alternative (eg to meet safety and/or legal requirements);* *the area, element, fabric or other aspect of significance is adequately recorded and, where appropriate, interpreted; and* *full assessment of alternative options has been undertaken to minimise adverse impacts.*	The Proposed works: • will help ensure the integrity and viability of the BOOS by arresting further degradation of the original materials and thereby ensuring the ongoing viability of the sewer. • do not have a feasible alternative and are necessary to meet ongoing service obligations. • will affect internal fabric of the BOOS that is well documented and, in any case, will be enabled to remain in place as a result of these works. • have been formulated through an extensive design development phase which has considered alternative options, most of which involve a greater adverse impact.
7.6.3 Significant Fabric *Policy* *Proposed works should assess impacts on significant fabric, curtilage and setting of the BOOS or Ben Buckler Sewer Vent. They should then proceed, based on the principle of doing as much as necessary but as little as possible.*	The Proposed works: Have been assessed in terms of their impacts on fabric, curtilage and setting. Meet the objectives of the *"as much as necessary but as little as possible"* principle.
7.6.4 Maintenance *Policy*	The Proposed works: Are formulated to secure the interior fabric against further deterioration and to ensure the

Policy	Response
Appropriate maintenance works should be carried out regularly and as a matter of priority on significant components of the BOOS, both to secure particular fabric against further deterioration and ensure the intactness/integrity of the place is conserved.	intactness/integrity of the sewer for the long-term.
7.6.5 Major Works *Policy* *Major works should be undertaken as necessary to ensure the ongoing viability of the BOOS and Ben Buckler Sewer Vent. However, those planning and designing works should be mindful of the significance of the items and their fabric, and mitigate any adverse impacts where possible.*	The Proposed works: Have been formulated in the context of the objective of the conservation of the heritage significance of the sewer. No replacement of fabric is proposed and, while a small amount of fabric will be removed, this is a tiny proportion of the total and represents a small sacrifice for the overall benefit arising from the desiltation and internal lining works.
7.6.13 Environmental Benefits *Policy* *Undertake necessary maintenance and repair works on the BOOS and Ben Buckler Sewer Vent to alleviate the need for replacement, thereby mitigating negative externalities caused by the construction of a new sewerage system.*	The Proposed works: Are maintenance and repair works on the BOOS which will stabilise the significant fabric and enable the sewer to remain in use for its designed purpose for the foreseeable future.

5.2.13. Other Heritage Items in the Vicinity

There are no other heritage items in the vicinity of the BOOS underground. The impact on the heritage significance of heritage items in the vicinity of the work sites at ground level are addressed in the following section.

5.2.14. Commonwealth/National Heritage Significance

There are no items of Commonwealth or National Heritage Significance in or within the vicinity of the BOOS underground.

5.2.15. World Heritage Significance

There are no items of World Heritage Significance in or within the vicinity of the BOOS underground.

5.2.16. Interpretation

The proposed works do not affect any items of heritage significance that could be supported by interpretation.

5.3. Summary of Assessed Impacts

In consideration the matters assessed above, the proposed works would result in Little to No Impact to the heritage significance of the BOOS. The proposed works will protect the fabric and maintain the sewer in service and the alterations to the fabric necessary to achieve this outcome are minor in relation to the overall scale of the sewer.

6. Heritage Impact Assessment – Work Sites

6.1. Approach to Assessment

The following section provides an assessment of heritage impacts caused by the proposed works upon the heritage significance of the four Work Sites, consistent with the *Guidelines for preparing a statement of heritage impact*[30]. The assessment follows the definitions of 'heritage impact', based on the *Heritage NSW Material Threshold Policy*[31] (see Table 5.1).

The proposed work to the BOOS includes the creation of two, new, drilled maintenance hole shafts at Elizabeth Street and at Trelawney Street and the creation of access slots in the aqueduct sections of the BOOS at Dillon Street and Lough Playing Fields. This section considers the local heritage environment at each of the four Work Sites and assesses the impact of the proposed works upon the heritage significance of the local environmental context in each case.

The local environmental context in each case is:

- The Gugara Park (Dillon St Reserve) Work Site and the Elizabeth Street Work Site are both located within the '*Paddington, including parts of Woollahra and Edgecliff, Heritage Conservation Area' (C8)*.
- The Trelawney Street site is located within the '*Woollahra Heritage Conservation Area' (C15)*.
- The Gugara Park (Dillon St Reserve) Work Site is partially within the curtilage of the locally listed '*Scottish Hospital main hospital building and interiors, grounds*'.
- The Lough Playing Fields site is not subject to any heritage listing.
- All, except Lough Playing Fields, are located in the vicinity of local heritage items.

6.2. Matters for Consideration

The *Guidelines for preparing a statement of heritage impact*[32] provide a series of matters for consideration when assessing the impact of a proposed work to the heritage values of an item or place. The following sections provide a detailed assessment of matters, as they are relevant to the proposed works.

[30] Department of Planning and Environment NSW. 2023b.
[31] Department of Planning and Environment NSW. 2022.
[32] Department of Planning and Environment NSW. 2023b.

6.2.1. Fabric and Spatial Arrangements

Paddington Heritage Conservation Area (C8)

In relation to the *Paddington (including parts of Woollahra and Edgecliff) Heritage Conservation Area* (C8), the Gugara Park (Dillon St Reserve) Work Site and the Elizabeth Street Work Site both fall within its boundaries. The Paddington Heritage Conservation Area (HCA) is significant historically and aesthetically for its exceptional unity of scale, character, history, architecture and urban form. Paddington retains many significant types of buildings, ranging from modest, small-scale, single storey timber and masonry cottages to former gentry mansions.

The Gugara Park (Dillon St Reserve) Work Site will occupy an area of open space for the duration of the works but will not affect any standing buildings and will not leave any permanent structures after completion. The temporary occupation of this space will not affect the buildings or landscape in its vicinity and will not have any substantive impact upon the significant heritage values of the Paddington HCA. There are no impacts on any significant fabric or upon the spatial arrangements of the urban context.

Similarly, the Elizabeth Street Work Site will occupy a part of the road reserve of Elizabeth Street but will not have any impact upon the buildings or landscape in its vicinity. The temporary occupation of the roadway will not have any substantive impact upon the significant heritage values of the Paddington HCA.

Woollahra Heritage Conservation Area (C15)

The Trelawney Street site is located within the Woollahra HCA. The Woollahra Heritage Conservation Area is significant for its historical and aesthetic values, expressed in the architectural qualities of its building stock, the arrangement of streets and buildings within the varied topography and the spatial qualities of its settlement and subdivision.

The Trelawney Street Work Site will occupy a part of the road reserve of Trelawney Street but will not have any impact upon the buildings or landscape in its vicinity. The temporary occupation of the roadway will not have any substantive impact upon the significant heritage values of the Woollahra HCA.

The (former) Scottish Hospital

The Gugara Park (Dillon St Reserve) Work Site is partially within the curtilage of the locally listed '*Scottish Hospital main hospital building and interiors, grounds*'. The (former) Scottish Hospital is significant for its Arts and Crafts architecture, its history of use as a residence and a hospital and for its terraced garden and mature tree plantings. The part of the curtilage that is affected by the proposed works is contained entirely with Lot 20, DP1255181 and is proposed as a driveway and parking area (see Figure 3.2) for

the Work Site. Ownership of Lot 20, DP1255181 was, circa 2020, transferred to Woollahra Council for addition to the Gugara Park (Dillon St Reserve) and it no longer forms part of the Scottish Hospital grounds.

Reference to the historical aerial photographs (Figures 4.3 to 4.7) identifies that this area of land on the northern fringe of the (former) Scottish Hospital grounds contained no plantings or landscaping and appears to have been open flat ground for the duration of the twentieth century. It does not have any features that are relevant to the nature of the heritage significance of the (former) Scottish Hospital. The one large tree visible in the photographs from the mid-twentieth century is no longer standing. Consequently, the use of this area as part of the Work Site will have no impact upon the fabric or the spatial arrangements of the (former) Scottish Hospital and there will be no long-term permanent change to the land arising from the works.

Summary

Overall, the proposed works at the Work Sites will have little to no impact upon the fabric and spatial arrangements of the Paddington HCA and the Woollahra HCA, as they are located at small, discrete sites and the works do not require any changes to the buildings or landscapes in their vicinity. All the works are temporary in their effect above ground and will leave no or minimal visual traces at the completion of the works.

There is no adverse impact upon the fabric and spatial arrangements of the (former) Scottish Hospital arising from the proposed Dillon Street Reserve Work Site.

6.2.2. Setting, Views and Vistas

The proposed works will have temporary impacts upon the significant settings, views and vistas associated with the Paddington HCA and the Woollahra HCA, as the Work Sites will occupy road reservations or public reserves for the duration of the works. However, the works are temporary in their effect above ground and will leave no, or minimal (maintenance hole covers visible at street level), visual traces at the completion of the works. The removal of vegetation at the Dillon St Reserve will be a short-to medium term alteration to local views but, noting that the Reserve had no vegetation until the 1980s, this is not a significant alteration to any significant view. Woollahra Council may, or may not, opt to replace the vegetation in accordance with their vision for the future use of Gugara Park.

6.2.3. Landscape

The proposed works will have little to no impact on any significant landscape elements located in or within the vicinity of the four Work Sites. The works in Gugara Park (Dillon St Reserve) and in the Lough Playing Fields will affect local vegetation and trees that have grown within the boundaries of the former sewer reserves. However, none of these are notable or old examples and, where they have grown up in proximity to the sewer, may require removal in any case to prevent root growth impacts to the sewer.

Overall, the works will have Little-to-No impact upon any significant landscape elements of the Paddington HCA and the Woollahra HCA and will have no impact upon the significant landscape elements at the (former) Scottish Hospital.

6.2.4. Use

The proposed works do not involve any permanent changes of use, although there will be temporary cessations of the current uses during the works. The road reservations and the public open space areas will be returned to their current uses at the completion of the works.

6.2.5. Demolition

The proposed works do not involve any demolition of significant fabric or elements of the Paddington HCA, the Woollahra HCA or the (former) Scottish Hospital.

6.2.6. Curtilage

The proposed works do not include any changes of curtilage. Owing to the transfer of ownership of Lot 20 DP1255181 and considering that this allotment has never contained landscape elements or plantings of significance, the listed curtilage of the (former) Scottish Hospital should be amended by Woollahra Council in due course. However, this is only of passing relevance to the proposed works and is not a factor or objective of the works.

6.2.7. Movable Heritage

There are no items of movable heritage located in or within the vicinity of the four Work Sites.

6.2.8. Aboriginal Cultural Heritage

This Statement of Heritage Impact does not provide an assessment of Aboriginal Cultural Heritage.

The Aboriginal Heritage Information Management System (AHIMS) is a digital database that stores information about Aboriginal cultural heritage across New South Wales, including recorded sites, archaeological reports and cultural heritage assessment reports. A basic search of the AHIMS database indicates that there are no recorded Aboriginal sites in the vicinity of any of the four Work Sites (Figure 6.1).



Despite the vicinity being identified in the Woollahra Council Aboriginal Sensitivity Map as having "No Potential" (Section 4.6), there remains some potential for the discovery of evidence of prior Aboriginal occupation, as the sites at Elizabeth Street and Trelawney Street involve excavation through the layer of sand over the underlying bedrock (see Figure 6.2). An Aboriginal Due Diligence Assessment, although not a statutory requirement, would provide evidence of appropriate due process should any Aboriginal archaeological material be found during the excavations through the sand layers.

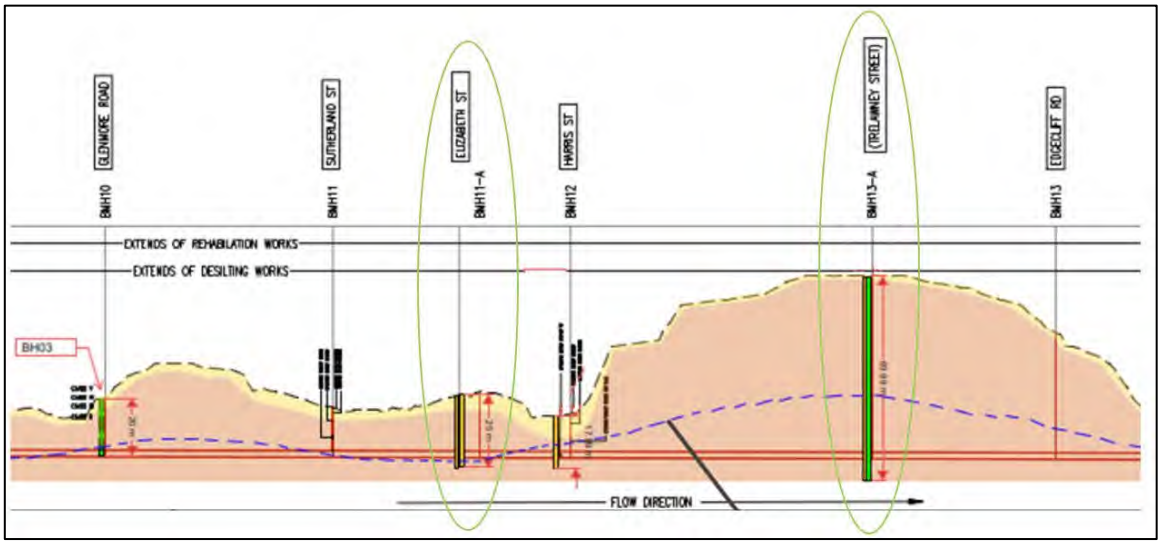


Figure 6-2: An edited extract of a Groundwater Profile plan for the BOOS, amended to illustrate the sand layer (yellow) over bedrock (peach-pink) at the Elizabeth Street and Trelawney Street Work Sites (circled in green). (Source: Sydney Water[33])

6.2.9. Historical Archaeology

The proposed works do not involve any substantial ground disturbing works that are likely to impact upon any historical archaeological material of Local or State significance. The temporary removal and replacement of earth over the aqueduct sections of the BOOS at Dillon Street and Lough Playing Fields involves the disturbance of pre-existing fill, dating from the construction of the BOOS in the 1880s. The Gugara Park (Dillon St Reserve) fill is likely to have been re-disturbed to a significant degree during the repairs to the aqueduct section in the 1920s. No excavation is proposed within the curtilage of the Scottish Hospital.

At the Elizabeth Street and Trelawney Street locations, both sites are within the roadways, which are original roadways dating from the subdivision of lands in the nineteenth century. The creation of new maintenance hole shafts at these locations is likely to disturb evidence of earlier road surfaces but this material is unlikely to hold any values of heritage significance. The proposed works are unlikely, therefore, to impact upon any potential historical archaeological materials of significance.

6.2.10. Natural Heritage

There are no known items of Natural Heritage in or within the vicinity of the four Work Sites that could be impacted by the proposed works.

[33] Sydney Water; Detailed Design; op cit.

6.2.11. Cumulative Impacts

At each of the four Work Sites, there will be temporary impacts arising from the establishment, operation and ultimate removal of site sheds and equipment but, with little long-term evidence remaining of the Work Sites in each case, the ultimate impact will be negligible.

6.2.12. Conservation Management Plan

There is no Conservation Management Plan for the Paddington HCA or the Woollahra HCA, however, the *Woollahra Development Control Plan 2015* (DCP) contains provisions to protect the significant character of each HCA.

Part C1 of the DCP contains controls for the Paddington HCA in relation to:

- Building types;
- General controls for all development;
- Specific policies for building and site elements; and
- The public domain.

Of these, the controls for the Public Domain are potentially relevant to the proposed Work Sites.

Section *C1.6.1 Kerbs and Gutters* requires the conservation and use of sandstone and concrete Kerbs and Gutters. No Kerbs and Gutters are proposed to be impacted by the proposed works at the Gugara Park (Dillon St Reserve) or Elizabeth Street Work Sites.

Section *C1.6.2 Views and Vistas* identifies and protects significant views and vistas within the HCA. No significant views and vistas (See Figure 6.3 below) are identified in relation to the proposed Work Sites at the Gugara Park (Dillon St Reserve) or Elizabeth Street sites.

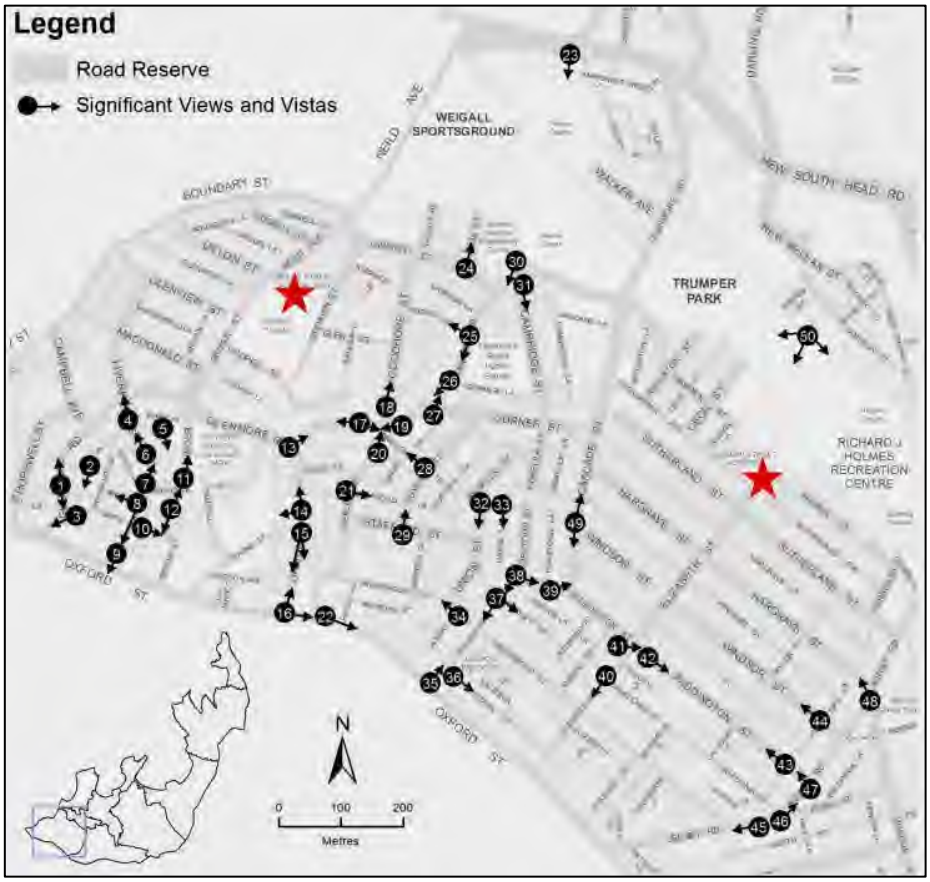


Figure 6-3: MAP 2 Chapter C1, Woollahra DCP, showing significant views and vistas within the Paddington Heritage Conservation Area. The two Work Sites are indicated by the red stars. (Source: Woollahra Council)

The Woollahra HCA, addressed in Part C2 of the DCP, also contains controls in relation to:

- Building types;
- General controls for all development; and
- The public domain.

Of these, the controls for the Public Domain are potentially relevant to the proposed Work Site at Trelawney Street.

Section C2.6.1 *Landscape elements* provides controls in relation to landscape elements such as steps, ramps, walls and railings. No steps, ramps, walls and railings are proposed to be impacted by the proposed works at the Trelawney Street Work Site.

Section C2.6.2 *Kerbs and Gutters* requires the conservation and use of sandstone and concrete kerbs and gutters. No kerbs and gutters are impacted by the proposed works at the Trelawney Street Work Site.

Section *C1.6.2 Views and Vistas* identifies and protects significant views and vistas within the HCA. No specific significant views and vistas within the HCA are identified in the DCP. The Control provided for significant views and vistas within the HCA states:

> *"C1 Street tree planting and new development in the public domain should respect existing view corridors. Both should be designed and located to minimise the impact on and, where possible, improve existing vistas."*

The proposed Work Site at Trelawney Street is a temporary occupation of the road reserve to undertake works to the BOOS below ground. No new plantings or developments are proposed at the Work Site.

6.2.13. Other Heritage Items in the Vicinity

There are heritage items listed in Schedule 5 – Heritage Items, of the *Woollahra Local Environmental Plan 2014* in the vicinity of the four Work Sites, identified in Section 4.0 of this report. Each of these are addressed below.

Gugara Park (Dillon St Reserve)

The Work Site at Gugara Park (Dillon St Reserve) is located in the vicinity of (Figure 6.4):

- Item I245 - "Scottish Hospital main hospital building and interiors, grounds"; and
- Item I255 – "House, interiors and grounds 8A Cooper Street".

The (former) Scottish Hospital is adjacent to the Gugara Park (Dillon St Reserve) to the south and is significant for its history, architecture and landscape. There will be no permanent structures demolished or created by the proposed works and there will be no impact upon the history or architecture of the adjacent site. Examination of the historical aerial photographs (Figures 4.3 to 4.7) indicates that the terraced gardens and trees did not extend as far north as the Gugara Park (Dillon St Reserve) and no works within the Work Site will have any impact upon any significant plants or the historical landscape.

The House at 8 Cooper Street (Item I255) is separated by topography and the multi-storey apartment building at 40 Stephen Street and has no visual or associational relationship to the Gugara Park (Dillon St Reserve).



Figure 6-4: The (former) Scottish Hospital (L) and the House at 8 Cooper Street (R). (Source: Streetview)

Elizabeth Street

The only identified heritage item in the vicinity of the Elizabeth Street Work Site is the Four-In-Hand Hotel, Item I682, located 500 metres south of the Work Site (Figure 6.5). It is separated by topography and distance; it is upslope and obscured by street trees in views to and from the Work Site. There is little visual or geographic relationship to the proposed Work Site and the Work Site will have no impact upon the heritage significance of the Four-In-Hand Hotel.



Figure 6-5: The Four-In-Hand Hotel (L) and a representative example of a Street Name Inlay at Trelawney Street (R). (Source: Streetview (L); Woollahra Council (R))

Trelawney Street

The Trelawney Street Work Site is in the vicinity of a number of individual Heritage Items listed in the Woollahra LEP. These are (see Figure 4.13):

- I601 – 'Lenana'— residential flat building and interiors, iron gateposts and gates
- I602 - Lyndhurst Gardens — residential flat building and interiors, forecourt
- I605 - London Plane Trees — approx. 35 trees in Rosemont Avenue (within road reserve)
- I616 - Great Tree — house and interiors, street fencing

The proposed Work Site is located directly outside the garage block of the residential apartment building known as 'Lenana' (Item I601). This building's primary entry is off Rosemont Avenue and, while the Work Site located within the road reserve of Trelawney Street may be a temporary inconvenience to access into the garages, it will have no impact upon the significance of the building.

Item I602 – 'Lyndhurst Gardens' and Item I605 – 'London Plane Trees' are both located in the adjacent Rosemont Street and are unaffected by the proposed Work Site. Item I616 – 'Great Tree (House and Interiors)' is further east from the Work Site, is set well back from the street alignment and is visually separated by the downslope of Trelawney Street. As with Item I601, the Work Site may be a temporary inconvenience but will have no impact upon the significance of this building.

The corner of Trelawney Street with Rosemont Avenue on the north and Fullerton Street on the south is listed as having five Street Name Inlays (Item I679) (Figure 6.5). These appear to be located on each corner, generally inset into the pedestrian footpath. There is no aspect of the proposed works that involves disturbance to the footpaths or kerbing of Trelawney Street, however, in view of the proximity of these items, measures to ensure the protection of these Street Name Inlays should be implemented at this Work Site. These may include parking restrictions, controls on work vehicle placement and movement and general avoidance of the locations of the Inlays.

Lough Playing Fields

There are no heritage items located in the vicinity of the Lough Playing Fields Work Site that might be affected by the proposed works. The closest item (I45) is the group of trees (three Washington Palms, one Cliff Date Palm and four Canary Island Date Palms) planted in Northland Road at the corner of Suttie Road, which are over 100 metres away and separated by a row of house allotments (Figure 6.6). There is no aspect of the proposed works that would affect these trees.



Figure 6-6: The seven trees in Northland Road listed as Heritage Item I45 (L) and the view from the Work Site towards Northland Road, demonstrating no visual connection. (Source: Streetview)

6.2.14. Commonwealth/National Heritage Significance

There are no items of Commonwealth or National Heritage Significance in or within the vicinity of the four Work Sites.

6.2.15. World Heritage Significance

There are no items of World Heritage Significance in or within the vicinity of the four Work Sites.

6.2.16. Interpretation

The proposed works at the four Work Sites do not affect any items of heritage significance that could be supported by interpretation.

6.3. Summary of Assessed Impacts

Overall, at each of the four Work Sites, there are no adverse impacts arising from the proposed works. The Work Sites will not have any impact upon the significant values of the Paddington HCA or the Woollahra HCA, nor are there impacts upon any Heritage Items in the vicinity of the Work Sites.

At the Trelawney Street site, the proposed works at this site do not propose to impact the footpath pavements, however, the proximity of these Street Name Inlays requires measures to ensure that these elements are not accidentally damaged during the course of the works.

Proposed works at the Elizabeth Street and Trelawney Street Work Sites include the drilling of a 2 metre wide shaft from road level to the BOOS. In both cases, there is a layer of sand overlying the bedrock, which will require extraction prior to the drilling. An Aboriginal Due Diligence Assessment, although not a statutory requirement, would provide evidence of appropriate due process should any Aboriginal archaeological material be found during the excavations through the sand layers.

7. Statutory Context

Heritage items, and their conservation and management, exist within a framework of relevant Commonwealth, State, and Local government legislation. Additionally, non-statutory registers, conservation policies and community attitudes and expectations can also have an impact on the management, use and development of heritage items. The proposed works to the BOOS need to satisfy the requirements of this legislation in order to proceed. The following section assesses the relevant legislation and identifies the required approval pathway for the project.

Review of the previous sections identifies that there are no items of World, National or Commonwealth heritage significance located in the vicinity of the four work sites. Consequently, Commonwealth heritage legislation, specifically, the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) is not relevant to this project and is not addressed.

7.1. *Heritage Act 1977* (NSW)

7.1.1. State Heritage Register

The *Heritage Act 1977* is the primary heritage management legislation in NSW. The Heritage Act, inter alia, establishes the NSW Heritage Council and the State Heritage Register (SHR). Heritage places, buildings, works, relics, movable objects, precincts and archaeological sites which are of state-level heritage significance in NSW are listed on the SHR. The BOOS is listed on the SHR.

Listing on the SHR controls activities such as alteration, damage, demolition and development. When a place is listed on the SHR, the approval of the Heritage Council of NSW is required for any major work, including the following:

- Demolishing the building or work;
- Carrying out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct; and / or
- Altering the building, work, relic or movable object.

An application for approval under section (s) 60 of the Heritage Act must be made to the Heritage Council in order to carry out such activities.

7.1.2. Standard Exemptions

Approval under (s) 60 may not be required if works are undertaken in accordance with the *Standard Exemptions for Works Requiring Heritage Council Approval* (published by the NSW Heritage Council on 7 November 2025). Works undertaken in accordance with the gazetted standard exemptions do not require official notification to Heritage NSW, although sufficient record keeping and justification for their use may be required. The Standard Exemptions are:

General Conditions

1. Maintenance and Cleaning
2. Repairs to non-significant fabric
3. Repair and replacement of significant fabric
4. Alterations to non-significant fabric
5. Alteration to interiors of non-significant buildings
6. Repair or replacement of existing non-significant utility and services infrastructure
7. Non-significant telecommunications facilities and water, wastewater and stormwater infrastructure
8. Fire safety, suppression and detection and security systems
9. Excavation
10. Painting
11. Restoration of significant fabric
12. Strata subdivision of buildings
13. Temporary events and structures
14. Vegetation, invasive species management and bush regeneration
15. Burial sites and cemeteries
16. Signage
17. Filming
18. Temporary relocation of moveable objects
19. Compliance with minimum standards and orders
20. Site safety and security
21. Emergency situations and lifesaving
22. Additional or temporary change of use
23. Energy saving and sustainable technologies
24. Accessibility measures
25. Aboriginal cultural practices
26. Agricultural operations
27. Bushfire management

Of these, Exemptions 1, 3 and 9 may be applicable to the proposed works. These are analysed in more detail below.

Exemption 1: Maintenance and Cleaning

The following are the descriptions and standards set out for the application of Exemption 1:

Description of activity

a. The maintenance of an item to retain its condition or operation.

b. Application of protection coatings such as limewash, polish, oils and waxes to an item.

c. Cleaning to remove surface deposits, organic growths or graffiti from an item.

Relevant standards

d. The specified activities must be carried out in accordance with the general conditions.

e. The specified activities must not alter, damage, or remove significant fabric.

f. New materials or finishes may only be introduced to non-significant fabric where this does not impact the significance of the item, uses a colour sympathetic to the item, does not detract from the item and does not reduce the ability to appreciate the item.

g. Protective coatings may only be applied to surfaces which have previously had these coatings. Existing finishes such as oils and waxes for timber must continue to be used rather than modern alternative protective coatings.

h. Surface patina important to the item's heritage significance must be preserved during maintenance and cleaning.

i. Cleaning of significant fabric with water must only use low-pressure water and neutral detergents appropriate to the surface being cleaned. Water pressure must not exceed 500 kPa (72 psi) or other pressure suitable to the fabric or surface in accordance with written advice prepared by a suitably qualified and experienced heritage professional.

Analysis:

The proposed works to the BOOS include desiltation of the interior of the sewer. This work represents cleaning which, of itself, will not alter, damage or remove significant fabric. In isolation from the other works, desiltation could qualify as Maintenance and Cleaning under Exemption 1.

The application of CAC lining to the Sewer does not qualify as an 'application of protective coatings', as these areas of the BOOS have not previously had this coating applied (Standard G).

Exemption 3: Repair and replacement of significant fabric

The following are the descriptions and standards set out for the application of Exemption 3:

Description of activity

a. Minor repair (such as refixing and patching) of damaged or deteriorated significant fabric of an item that is beyond further maintenance.

b. Replacement of missing, damaged or deteriorated significant fabric of an item that is beyond repair.

c. Works directly associated with minor repair and replacement of significant fabric of an item.

Relevant standards

d. The specified activities must be carried out in accordance with the general conditions.

e. Repairs must be based on the principle of doing as little as possible and only as much as is necessary to retain and protect the item. Therefore, replacement must only occur as a last resort where a part of an item has decayed beyond further maintenance.

f. Any new fabric must be sympathetic to the appearance, composition, detailing, size, position and finish of existing fabric.

g. Repair must maximise protection and retention of significant fabric and conserve existing detailing.

h. Any new materials used for repair must not exacerbate the decay of surrounding significant fabric due to chemical incompatibility, obscure existing significant fabric or limit access to existing significant fabric for future maintenance.

i. The specified activities are to be consistent with an assessment and the advice of a qualified and experienced heritage professional.

Analysis

The proposed slip lining and CAC lining represents the conservation of existing deteriorated fabric that is beyond further maintenance by the insertion of protective materials to the inside of the BOOS. In the absence of any aesthetic considerations (noting that the brickwork will be retained intact), the materials proposed (GRP conduit and CAC lining) are sympathetic to the functional context and therefore meet the requirements of Standard F.

These repair solutions will obscure existing fabric (Standard H), however, this occurs in an underground conduit with no practical access. The repair solutions will limit access to significant fabric for future maintenance, however, this is an intentional outcome, as the original fabric is beyond further maintenance. There are few, if any, alternative approaches that would not involve replacement of the deteriorated fabric. The preferred repair solution will preserve the original fabric behind the inserted inner lining. The majority of the interior of the BOOS will remain in its present condition.

In general, this Exemption has possible application but only through a liberal interpretation of the requirements and standards.

Exemption 9: Excavation

Description of activity

a. Excavation or disturbance of land that is:

i. *for the purpose of locating and/or exposing underground utility services infrastructure which occurs within an existing service trench.*
ii. *to carry out inspections or emergency maintenance or repair on underground utility services.*
iii. *to maintain, repair, or replace underground utility services to buildings.*
iv. *to maintain or repair the foundations of an existing building.*
v. *to expose survey marks.*
vi. *associated with feral animal/insect eradication.*
vii. *for other activities exempt by these exemptions.*

b. Removing contaminated soils.

c. Excavation for the purposes of geotechnical testing, contamination testing, survey and exploration including:

i. *bore holes up to 100mm in width.*
ii. *hydraulic and soil testing up to 100mm in width.*

Relevant standards

d. The specified activities must be carried out in accordance with the general conditions.

e. The specified activities must not involve ground disturbance or excavation which may expose, move, damage or destroy known or relics, ruins and/or Aboriginal objects.

f. The specified activities must not involve alteration to, damage to, or the removal of, significant fabric.

g. Excavation must not compromise the structural integrity of any significant item or significant part of an item.

h. The specified activities must be made good, for example filled in and restored to original ground level.

Analysis

Excavation forms a component of the proposed works and complies with Criterion A(ii), excavation for the purpose of "*repair on underground utility services*". Excavation of two forms is proposed as part of the works.

Excavation and exposure of the sewer at Gugara Park (Dillon St Reserve) and at Lough Playing Fields involves the removal of the overlying soils to access the top of the sewer. These soils were placed over the sewer following its construction in cut-and-cover trenches and represents 'replaced fill' with little, if any, potential to hold artefacts of local or state significance. These excavations are consistent with Standards d, e, f, g and h.

Excavations at Elizabeth Street and Trelawney Street, however, involve the breaking of new ground to drill a vertical shaft from ground level down to the sewer. Whilst the majority of the excavation / drilling will be through sandstone bedrock, the overlying soil / sand will need to be removed. At both sites, the location is within an original road reserve and, as best is known, has only ever had the road surface constructed. Depending upon the thickness of the sand layer, it is likely that some of this layer will have remained undisturbed by the construction of the road surface and, therefore, may contain evidence of prior indigenous occupation in the vicinity.

It may be argued that, in each case, the excavations occur outside of the curtilage of the BOOS and are therefore not subject to the Heritage Act requirements. This argument fails on two levels; the works are in association with and for the purpose of undertaking works to the SHR Listed item and therefore fall within the approval requirements; and, second, the operation of the *National Parks and Wildlife Act 1974 (NSW)*, which prevents disturbance or harm to Aboriginal objects or places without proper assessment and approvals. An Aboriginal Due Diligence assessment would be required to determine the likelihood of Aboriginal objects being found in this location and the appropriate approach to management of this likelihood.

Consequently, these two excavations do not meet the requirements of Standard E.

Application of Standard Exemptions

Standard Exemptions 1 and 3 apply to some elements of the works overall and Standard Exemption 9 applies to some of the excavation works. However, elements of the works do not comply with the Standard Exemptions.

7.1.3. State Agency (Sydney Water) Exemptions

In addition to the Standard Exemptions, the Heritage Act allows for specific State Government Agencies to have specific Exemptions relating to the requirements of their specialist activities. State Agency Exemptions for Sydney Water were published in the *NSW Government Gazette No. 636 of 10 December, 2021*. These Exemptions are:

- Exemption 1: Urgent Maintenance And Repair.
- Exemption 2: Temporary Activities/Works.
- Exemption 3: Security and/or Safety Signage.
- Exemption 4: Excavation.

Exemptions 1 and 2 relate to a) 'urgent' and b) 'temporary works' and Exemption 3 relates to safety and security. None of these apply to the proposed works. One of the Exemptions, Exemption 4, is relevant to the proposed works:

Sydney Water Exemption 4: Excavation

Specified activities/works:

(k) Excavation or disturbance of land for the purpose of:

i creating temporary stockpiles; and/or

ii exposing, inspecting, testing, replacing, installing, maintaining and/or repairing SWC infrastructure and assets (including dams and fences) and/or survey markers.

Relevant standards:

(l) Excavation or disturbance of land is only permissible within existing trenches, or within an area of previous disturbance.

(m) Excavation or disturbance of land is not permitted in areas assessed as having archaeological significance.

(n) Excavation or disturbance of land must not compromise the structural integrity of any structure listed on the SHR or subject to an IHO, including significant landscape elements, as identified in a SHR listing, statement of significance, CMP and/or CMS.

Application of State Agency Exemptions

The proposed works at Gugara Park (Dillon St Reserve) and Lough Playing Fields are consistent with the Specified Activity 'k(ii)' and Relevant Standards for this Exemption. However, the works at Elizabeth Street and Trelawney Street are potentially passing through previously undisturbed ground and are therefore excluded.

7.1.4. Site-specific Exemptions

In some cases, the Heritage Council of NSW has approved Site-specific Exemptions for particular places as part of an approved management regime. There are no Site-specific Exemptions that are relevant to the proposed works to the BOOS.

7.1.5. Archaeological Relics

Part 6 Division 9 of the Heritage Act protects archaeological 'relics' from being 'exposed, moved, damaged or destroyed' by the disturbance or excavation of land. This protection extends to the situation where a person has 'reasonable cause to suspect' that archaeological remains may be affected by the

disturbance or excavation of the land. It applies to all land in NSW that is not included in the SHR. Separate approval for excavation of land within the curtilage of a place listed on the SHR must be undertaken in accordance with a permit under Section (s) 60, or a gazetted Exemption under s 57(2) of the Heritage Act. A 'relic' is defined by the Heritage Act as:

a) *any deposit, object of material evidence which relates to the settlement of the area that comprises NSW, not being Aboriginal settlement*

b) *and has local or state significance.*

Application

As discussed above, the proposed works at Gugara Park (Dillon St Reserve) and Lough Playing Fields will disturb ground that has been previously disturbed for the construction of the sewer and both sites have no potential for the retention of relics of state or local significance. The works at Elizabeth Street and Trelawney Street will break ground previously disturbed for road construction and, based upon the known history of the roads in this vicinity, there is no likelihood of other, non-road-related material being present below the road construction material. Consequently, the historical archaeological potential of the works areas is Nil.

7.1.6. State Government Agency Section 170 Registers

Under section 170 (s170) of the Heritage Act, heritage items owned or managed by State Government agencies must be listed in an agency Heritage and Conservation Register. Section 170A(2) requires that:

> *(2) Each government instrumentality is responsible for ensuring that the items entered on its register under section 170 and items and land to which a listing on the State Heritage Register applies that are under its care, control or management are maintained with due diligence in accordance with State Owned Heritage Management Principles approved by the Minister on the advice of the Heritage Council and notified by the Minister to government instrumentalities from time to time.*

Application

The BOOS is included in the Sydney Water Heritage and Conservation Register. The proposed works are, therefore, required to comply with the statutory requirements of the Heritage Act and to respond to the State-Owned Heritage Management Principles. No other items listed in the Sydney Water Heritage and Conservation Register are affected by the proposed works.

7.2. Environmental Planning and Assessment Act 1979 (NSW)

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) requires that environmental impacts are considered in land-use planning, including impacts on Aboriginal and non-Aboriginal heritage. The EP&A Act requires councils to consider environmental effects when assessing new developments. Heritage is one of the matters for consideration. Sites of environmental heritage (including historic heritage sites and sometimes Aboriginal heritage sites) are protected by gazetted LEPs and Development Control Plans (DCP) which specify the constraints on development in the vicinity of these sites. Proposed activities and development are considered under different parts of the EP&A Act, including:

- Major projects (State Significant Development under Part 4.1 and State Significant Infrastructure under 5.1) require approval of the Minister for Planning
- Minor or routine development requiring local council consent are usually undertaken under Part 4 activities which, in limited circumstance may require the Minister's consent.
- Part 5 activities which do not require development consent. These are often infrastructure projects approved by local councils or the State agency undertaking the project.

Under Section 5.5 of the EP&A Act, a determining authority has the duty to fully consider the environmental impact (including historical or Aboriginal heritage) of an activity and is required to 'take into account the fullest extent possible all matters affecting, or likely to affect the environment' arising from the proposal. This is facilitated through the current assessment which has the purpose of identifying, assessing and determining the significance of potential heritage impacts, as well as mitigating actions and responsibilities that can be taken to minimise the potential impacts.

7.2.1. State Environmental Planning Policy (Transport and Infrastructure) 2021

The *State Environmental Planning Policy (Transport and Infrastructure) 2021* (the Transport and Infrastructure SEPP) aims to facilitate the effective delivery of transport and infrastructure across NSW. The Transport and Infrastructure SEPP outlines the planning rules for development by Infrastructure agencies. Division 18 of the SEPP deals with Sewerage Systems and Clause 2.125(6) states:

> *(6) Development for the purpose of sewage reticulation systems may be carried out without consent on any land in the prescribed circumstances.*

For the purposes of this particular example, the 'prescribed circumstances' are that the development is carried out by or on behalf of a public authority.

Clause 2.11 of the SEPP requires consultation with local councils: *"if the development—*

(a) is likely to affect the heritage significance of a local heritage item, or of a heritage conservation area, that is not also a State heritage item, in a way that is more than minor or inconsequential, and

(b) is development that this Chapter provides may be carried out without consent."

The BOOS is a 'State Heritage item' for the purposes of this Clause.

Application

Under these provisions, Sydney Water may undertake the proposed works without development consent and, as the proposed works will be undertaken upon a State heritage item and any impacts upon significance are *'minor or inconsequential'*, consultation with Woollahra Council in accordance with Clause 2.11 is not required for the works to the BOOS.

The four Work Sites fall within Heritage Conservation Areas or are in the vicinity of local heritage items, as set out in Section 4 of this report. These works may fall within the requirements of Clause 2.11. The assessment of heritage impacts carried out in Section 6 of this report has determined that, at each of the four work sites, the impact upon any Heritage Conservation Area or upon any local heritage items in the vicinity of the works is *'minor or inconsequential'*. Consultation with Woollahra Council in accordance with Clause 2.11 is not required for the works at the four work sites.

The Transport and Infrastructure SEPP provisions do not override the requirements of the Heritage Act in relation to development affecting an item listed on the NSW State Heritage Register. Unless the works qualify under one of the Standard, Agency-specific or Site-specific Exemptions, an application for approval under Section 60 of the Heritage Act is still required.

In Section 5 above, analysis of the works has identified that the proposed works would result in Little to No Impact to the heritage significance of the BOOS. The proposed works will protect the fabric and maintain the sewer in service and the alterations to the fabric necessary to achieve this outcome are minor in relation to the overall scale of the sewer.

An environmental assessment of the impact of the proposed works is still required for the non-Heritage Act aspects of the proposed works, in accordance with the requirements of Part 5 of the EP&A Act. This Statement of Heritage Impact satisfies the requirements for environmental self-assessment under Part 5 of the EP&A Act.

7.3. Local Legislation

Every local government area in New South Wales is required to prepare a planning instrument which governs how local governments assess development applications, amongst other things, in terms of their impact to local heritage.

7.3.1. Sydney Local Environmental Plan 2012

Section 5.10 of the *Sydney Local Environmental Plan 2012* pertains to heritage conservation. Section 5.10 sets out when consent from the local council is required:

a. *demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance)—*
    i. *a heritage item,*
    ii. *an Aboriginal object,*
    iii. *a building, work, relic or tree within a heritage conservation area,*
b. *altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,*
c. *disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,*
d. *disturbing or excavating an Aboriginal place of heritage significance,*
e. *erecting a building on land—*
    i. *on which a heritage item is located or that is within a heritage conservation area, or*
    ii. *on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,*
f. *subdividing land—*
    i. *on which a heritage item is located or that is within a heritage conservation area, or*
    ii. *on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.*

Application

Under the provisions of the Transport and Infrastructure SEPP, Sydney Water may carry out the work without development consent. The assessment of heritage impacts carried out in Section 6 of this report has determined that, at each of the four work sites, there will be no, or minimal, impact upon any Heritage Conservation Area or upon any local heritage items in the vicinity of the works. No consultation with Sydney Council is required in relation to the requirements of Clause 2.11 of the SEPP.

7.3.2. Woollahra Local Environmental Plan 2014

Section 5.10 of the *Woollahra Local Environmental Plan 2012* pertains to heritage conservation. Section 5.10 sets out when consent from the local council is required:

a. *demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance)—*

i. *a heritage item,*

ii. *an Aboriginal object,*

iii. *a building, work, relic or tree within a heritage conservation area,*

b. *altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,*

c. *disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,*

d. *disturbing or excavating an Aboriginal place of heritage significance,*

e. *erecting a building on land—*

i. *on which a heritage item is located or that is within a heritage conservation area, or*

ii. *on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,*

f. *subdividing land—*

i. *on which a heritage item is located or that is within a heritage conservation area, or*

ii. *on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.*

Application

Under the provisions of the Transport and Infrastructure SEPP, Sydney Water may carry out the work without development consent. The assessment of heritage impacts carried out in Section 6 of this report has determined that, at each of the four work sites, there will be no, or minimal, impact upon any Heritage Conservation Area or upon any local heritage items in the vicinity of the works. No consultation with Woollahra Council is required in relation to the requirements of Clause 2.11 of the SEPP.

7.4. National Parks and Wildlife Act 1974 (NSW)

The Aboriginal Heritage Information Management System (AHIMS) register is a list of recorded Aboriginal heritage sites within NSW and is maintained by the NSW Office of Environment and Heritage (OEH) (formerly Department of Environment, Climate Change and Water). All Aboriginal sites, whether recorded on AHIMS or not, are protected under the *National Parks and Wildlife Act 1974* (NSW), with Part 6 of the Act establishing offences of harm and Section 86 stating that it is an offence to knowingly harm or desecrate an Aboriginal object or Aboriginal place. Aboriginal places are protected under Section 84 of the Act.

No known Aboriginal sites registered on the AHIMS are located in the vicinity of the four Work Sites (see Figure 6.1). Two work sites involve excavation through the layer of sand over the underlying bedrock and there is some undefined potential for the discovery of evidence of prior Aboriginal occupation within this

sand layer. An Aboriginal Due Diligence Assessment, although not a statutory requirement, would provide evidence of appropriate due consideration of this potential, should any Aboriginal archaeological material be found during the excavations through the sand layers.

7.5. Approval Pathway

The proposed works are works that may be carried out without development consent under the provisions of Clause 2.125(6) of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*. An internal determination under Part 5 of the EP & A Act will be required.

In respect of the requirements of the NSW Heritage Act, the proposed works do not comprehensively fall within the scope of the Standard or the State Agency (Sydney Water) Exemptions. Consequently, NSW Heritage Council approval for the proposed works is required.

However, Sydney Water, as a government agency, has delegated authority to approve works to State Heritage Items in particular circumstances. These circumstances are set out in the *Government Gazette Notice Number 636–Planning and Heritage, Friday, 10 December 2021*. The relevant section states:

> *1. The delegate may approve an application for property owned, leased, managed or controlled by SWC provided:*
>
> *a) the application is accompanied by a Statement of Heritage Impact in accordance with the guideline Statements of Heritage Impact 2002 (as amended from time to time)*
>
> *b) the application will not materially affect the State heritage significance of the SHR item in accordance with the Material Threshold Policy 2020 (as amended from time to time)*
>
> *c) the application is consistent with a CMP endorsed by the Heritage Council or its delegate: section 38A*
>
> *d) the application would not affect an* (sic) *historic shipwreck*
>
> *e) the application would not affect an item of significance to Aboriginal people as identified on the State Heritage Inventory: section 21(1)(e)*
>
> *f) the application would not impact state significant archaeology*
>
> *g) the 'matters of consideration' in section 62 are taken into consideration when determining an application for approval.*

In Section 5 above, analysis of the works has identified that the proposed works would result in Little to No Impact to the heritage significance of the BOOS. The proposed works will protect the fabric and maintain the sewer in service and the alterations to the fabric necessary to achieve this outcome are minor in relation to the overall scale of the sewer. Consequently, the proposed works to the BOOS may be determined by Sydney Water in accordance with its delegated authority under the Heritage Act 1977.

8. Conclusions and Recommendations

8.1. Conclusions

Impacts to the BOOS

This report has assessed the potential impacts to the heritage significance of BOOS resulting from the proposed works for the desiltation and partial internal lining of the BOOS.

The proposed works to the BOOS, including the desiltation, partial internal lining and creation of new access maintenance holes, would result in Little to No Impact to the heritage significance of the BOOS. The proposed works will protect the fabric and maintain the sewer in service and the alterations to the fabric necessary to achieve this outcome are minor in relation to the overall scale of the sewer.

Impacts at the four Work Sites

This report has assessed the potential impacts of the proposed works at the four Work Sites upon the heritage significance of any heritage items or Heritage Conservation Areas identified in either the *Sydney Local Environmental Plan 2012* or the Woollahra *Local Environmental Plan 2014*.

There are no adverse impacts arising from the proposed works at each of the four Work Sites. The Work Sites will not have any impact upon the significant values of the Paddington HCA or the Woollahra HCA, nor are there impacts upon any Heritage Items in the vicinity of the Work Sites.

At the Trelawney Street site, the proposed works at this site do not propose to impact the footpath pavements, however, the proximity of these Street Name Inlays requires measures to ensure that these elements are not accidentally damaged during the course of the works.

Proposed works at the Elizabeth Street and Trelawney Street Work Sites include the drilling of a 2 metre wide shaft from road level to the BOOS. In both cases, there is a layer of sand overlying the bedrock, which will require extraction as part of the drilling. An Aboriginal Due Diligence Assessment, although not a statutory requirement, would provide evidence of appropriate due consideration of this potential, should any Aboriginal archaeological material be found during the excavations through the sand layers.

Approval Pathway

The proposed works are works that may be carried out without development consent under the provisions of Clause 2.125(6) of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*. In respect of the requirements of the NSW Heritage Act, the proposed works do not comprehensively fall

within the scope of the Standard or the State Agency (Sydney Water) Exemptions. Consequently, NSW Heritage Council approval for the proposed works is required.

However, Sydney Water, as a government agency, has delegated authority to approve works to State Heritage Items in particular circumstances. The proposed works to the BOOS fall within the statutory parameters and may be approved by Sydney Water internally in accordance with its delegated authority.

8.2. Recommended Management Measures

As no adverse impacts are identified arising from the proposed works, no mitigation actions are identified. It is recommended that:

1. The records of the project works be added to the archival record of the BOOS.

2. All project team members, including contractors, should be informed about the heritage significance of the site as part of the general site induction package. The induction would identify why the BOOS is significant, the contractors' statutory obligations relating to heritage and to unexpected finds and the protection methods to be used during construction to prevent accidental damage during construction works.

3. The Contractor should be required to provide photographic records of the interior of the BOOS before, during and after the conduct of the works. These should be annotated to identify their subjects and added to the archival record of the BOOS.

4. Bricks removed from the BOOS as part of the development of new maintenance hole access shafts should, if their condition is assessed by the SW Heritage Team and deemed to be satisfactory, be saved and recycled for use as replacement bricks in other sections of the BOOS.

5. The risk of encountering Aboriginal archaeological material whilst boring through the sand sheet at the Elizabeth Street and Trelawney Street sites should be considered in determining the need for the preparation of an Archaeological Due Diligence Report for these two sites.

6. In the unlikely event of unexpected archaeological deposits being uncovered during ground disturbance works, it is recommended that the Unexpected Finds Protocols of Sydney Water's Environmental Management System should be followed.

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APPENDIX A

Construction Drawings:

APPENDIX A PART 1 - BOOS Stage 1B Concept Design Drawings Rev 2 - Permanent Works

APPENDIX A PART 2 -BOOS Stage 1B Rehabilitation Concept Design Drawings Rev 2 - Temporary Works

Appendix F – Construction Noise and Vibration Impact Assessment

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Bondi Ocean Outfall Sewer (BOOS) Rehabilitation

Detailed Design – Construction Noise and Vibration Impact Assessment

Delivering 4 Customers (D4C)

Level 3, 261/265 Chalmers Street
Redfern, NSW 2016

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.033188.00001

Client Reference No.: R02

12 December 2025

Revision: v1.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
v1.0	12 December 2025	Joseph Spagnol	Mark Irish	Mark Irish

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Delivering 4 Customers (D4C) (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Delivering 4 Customers (D4C) to prepare a Construction Noise and Vibration Impact Assessment (CNVIA) for construction works associated with the Bondi Ocean Outfall Sewer (BOOS) Rehabilitation project (the project).

This CNVIA addresses the potential noise and vibration impacts associated with the shaft construction and associated works at four locations:

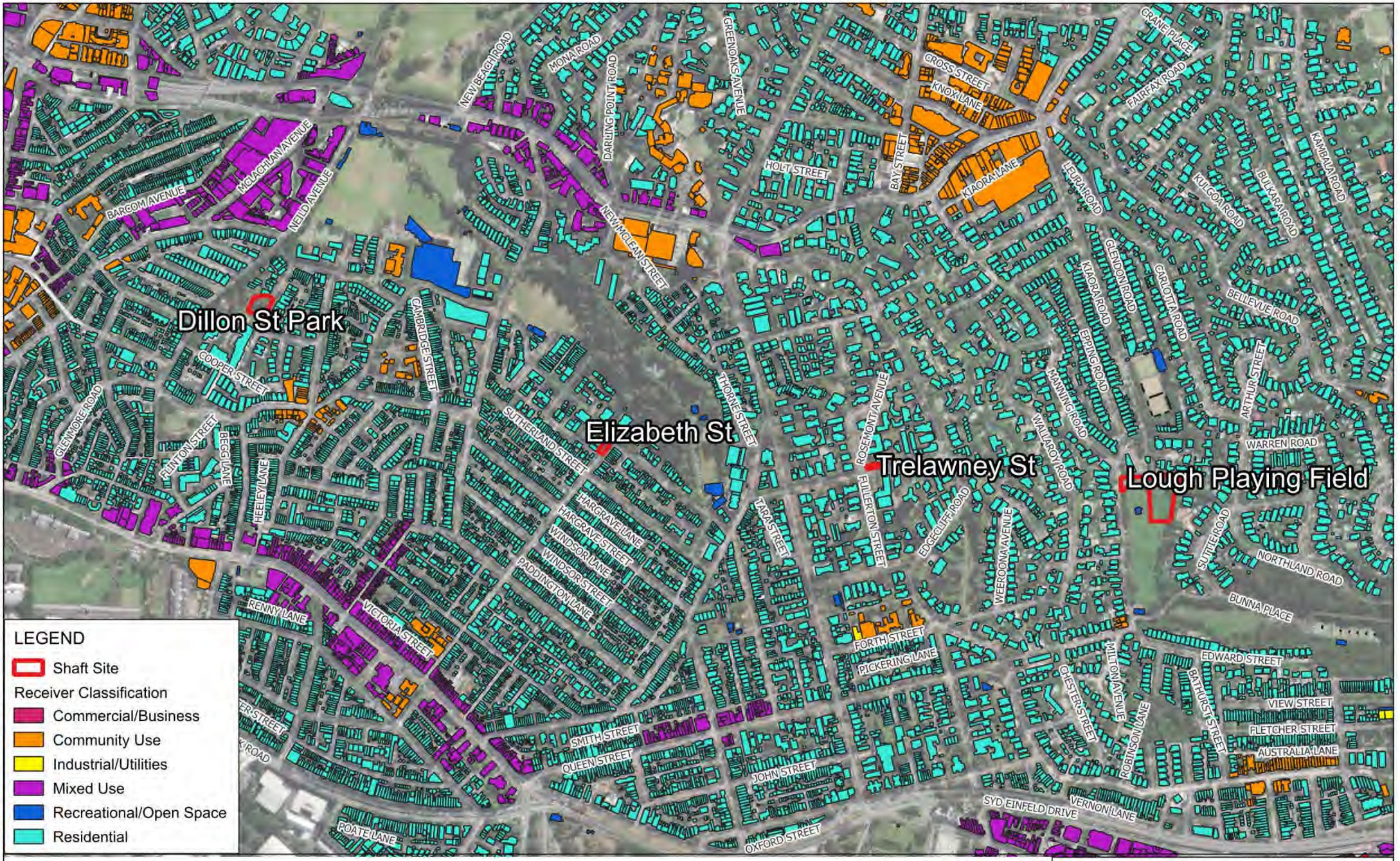
- Dillon Street Park Site (Neild Ave, Paddington)
- Lough Playing Field Site (104 Manning Rd, Double Bay)
- Elizabeth Street Site (103 Elizabeth St, Paddington)
- Trelawney Street Site (1 Rosemont Ave, Woollahra)

Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in **Appendix A**.

SLR is suitably qualified to produce this CNVIA and SLR staff are members of the Australian Acoustical Society (AAS). SLR is also a member firm of the Association of Australasian Acoustical Consultants (AAAC).

1.1 Nearest Sensitive Receivers

The project location, work areas and surrounding receivers are shown in **Figure 1.** The receivers in the figure are categorised based on land use, e.g., residential, community use, recreational/open space. In general, each shaft site is surrounded predominantly by low-density and medium-density suburban residential receivers, with various other sensitive receiver types such as commercial, childcare, medical receivers. The locations of these other types of receivers have not been identified.



H:\Projects-SLR\610-SrvSYD\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 QGIS\BOOS Rehabilitation.qgz

SLR

Data Source:
ESRI World Imagery

DISCLAIMER: All information within this document maybe based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose .

Scale: 1:10,000
Coordinate System: GDA2020 / MGA zone 56

0 250 500 m

Drawn Date: 10-Sep-2025 | Project Number: 610.033188

BOOS Rehabilitation Shaft Sites Receiver Classifications

FIGURE 1

2.0 Existing Noise Environment

Unattended noise monitoring was not conducted to establish the existing background noise levels. Guidance from the NSW EPA *Noise Policy for Industry* (NPfI) was instead taken to assign Rating Background Noise Levels (RBLs) based on the residential receiver amenity noise categories outlined in the NPfI. **Table 1** replicates the information provided in the NPfI.

Table 1 Residential Receiver Amenity

Receiver Category	Typical Planning Land Use Zoning	Typical Existing Background Noise Levels (RBL)	Description
Rural	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime <40 dBA Evening <35 dBA Night <30 dBA	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime <45 dBA Evening <40 dBA Night <35dBA	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime >45 dBA Evening >40 dBA Night >35 dBA	Urban – an area with an acoustical environment that: • Is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • Has through-traffic with characteristically heavy and continuous traffic flows during peak periods • Is near commercial districts or industrial districts • Has any combination of the above.

Amenity categories for the surrounding receivers have been selected based on land zoning, relevant descriptions from **Table 1** and the descriptions provided in the NPfI. The summary of this assessment is provided in **Table 2**. The RBLs in **Table 2** are supported by the

recommended RBLs in the Transport for NSW Construction Noise and Vibration Guideline (CNVG). The assumed RBLs should be confirmed by background noise monitoring.

Table 2 Residential Receiver Amenity Category Assessment

Location	Selected Amenity Classification	Assumed Background Noise Levels RBL (dBA)			Discussion
		Day	Eve	Night	
All Sites	Suburban residential	40	35	30	All sites, excluding Dillon Street Park Site, are surrounded by large areas zoned as R2 and R3 with small, scattered pockets of RE1 (Public Recreation) zoned land. Dillon Street Park is immediately surrounded by R2 zoning although the site is within 200 m from R1 and MU (Mixed Used) zoning. In general, the 'suburban residential' amenity classification from **Table 1** based on zoning, alone. These receivers are expected to experience little traffic noise for many periods of the day from local roads and are greater than 300 m from nearby state roads (e.g., New South Head Road and Oxford Street). Minimal traffic noise nearby the site areas has the potential to result in background noise levels lower than the maximums specified for "suburban residential" classification as such, the maximum RBLs for each period have been reduced by 5 dB for conservatism.

3.0 Assessment Criteria

3.1 Interim Construction Noise Guideline

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 3** and the project specific residential NMLs are summarised in **Table 4**.

Table 3: ICNG NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL[1] + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details
	Highly Noise Affected 75 dBA	• The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: ○ Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences ○ If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times
Outside Standard Construction Hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW Industrial Noise Policy (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

Table 4: Residential Noise Management Levels (dBA)

Receiver Type	NML ($L_{Aeq(15minute)}$ – dBA)			
	Standard Construction Hours[1] (RBL+10dB)	Out of Hours[2] (RBL+5dB)		
	Daytime[1]	Daytime	Evening	Night-time
Residential	50	45	40	35

Note 1: Standard construction hours are defined as: Monday to Friday 7:00am to 6:00pm and Saturdays from 8:00am to 1:00pm, excluding public holidays.

Note 2: Evening out of hours periods are defined as Monday to Saturday 6:00pm to 10:00pm, and Saturday 1:00pm to 10:00pm. Night-time out of hours periods are defined as Monday to Saturday 10:00pm to 7:00am. Daytime out of hours periods are defined as Saturday 7:00am to 8:00am, and Sunday and public holidays 8:00am to 6:00pm

'Other Sensitive' Land Uses and Commercial Receivers

The ICNG NMLs for 'other sensitive' non-residential land uses are shown in **Table 5**. These have been adopted from the ICNG and other relevant guidelines where applicable.

Table 5 NMLs for 'Other Sensitive' Receivers

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (dB) (Applied when the property is in use)	
	Internal	External
ICNG 'Other Sensitive' Receivers		
Classrooms at schools and other educational institutions	45	55[1]
Hospital wards and operating theatres	45	65[2]
Places of worship	45	55[1]
Active recreation areas (characterised by sporting activities and activities which generate noise)	-	65
Passive recreation areas (characterised by contemplative activities that generate little noise)	-	60
Commercial	-	70
Industrial	-	75
Additional Non-ICNG 'Other Sensitive' Receivers		
Hotel – daytime & evening[3]	50	70[2]
Childcare Centres[4]	35	45[1]

Note 1: It is assumed that these receivers have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level.

Note 2: It is assumed that these receivers have fixed/closed windows which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

Note 3: Adopted from AS2107.

Note 4: Adopted from Association of Australian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment for sleeping areas.

Highly Noise Affected

In addition to the NMLs presented above, the ICNG highly noise affected level (>75 dBA) represents the point above which there may be strong community reaction to noise and is applicable to all residential receivers during approved project hours as outlined in the ICNG.

3.2 Construction Vibration Criteria

3.2.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort impacts are shown in **Table 6**.

Table 6 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods and is dependent on the level of vibration as well as the duration.

3.2.2 Structural and Cosmetic Damage Vibration

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings. The levels of vibration required to cause cosmetic damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration. Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints.

British Standard BS 7385 Part 2 (BS 7385-2) recommends vibration limits for transient vibration judged to give a minimal risk of vibration induced damage to affected buildings. The limits for residential and industrial buildings are shown in **Table 7**.

Table 7 BS 7385-2 Transient Vibration Values for Minimal Risk of Damage

Group	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values should be reduced by up to 50%.

BS 7385-2 sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where the minimal risk for a named effect is usually taken as a 95% probability of no effect.

It is noteworthy that extra to the guide values in **Table 7**, the standard states that:

> *Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.*

3.2.3 Sydney Water Assets

Table 8 replicates vibration limits for Sydney Water assets listed in the *Specialist Engineering Assessment* (SEA) document.

Table 8 Threshold Vibration Limits

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

The document further notes that the thresholds above are

> *… 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.*

3.2.4 APA Gas Assets

Vibration limits provided in APA document *Guidelines for Works Near Existing Gas Assets* (400-STD-AM-0001 revision 2, dated 18 Aug 2023) are as follows:

- For cast iron mains: 5 mm/s maximum Peak Particle Velocity (PPV) measured on the pipe.
- For steel pipe with a coal tar enamel (CTE) coating or with poor coating health: 10 mm/s maximum PPV measured on the pipe.
- For non-coal tar enamel pipe coatings an other pipe materials (i.e. steel, PE, PVC or Nylon): 20 mm/s maximum PPV measured on the pipe.

The guideline document also states that:

> *Cast iron mains are particularly susceptible to damage by vibration. The PPV limit may not prevent leaks from cast iron and may require additional gas leakage survey activities during works…*

and additionally states that

> *… vibration monitoring adopt an alarm at 80% of the acceptable PPV value and when the alarm is activated, the work must stop and be re-assessed. Short incursions up to 100% are acceptable, for sustained periods of vibration longer than 5 minutes, works must be stopped.*

3.2.5 Other Assets

Australian Coal Association Research Program (ACARP) project No C14057 *Effect of Blasting on Infrastructure* (hereafter referred to as “ACARP”). ACARP provides recommended “safe” vibration limits without more detailed analysis for transient vibration, which are reproduced in **Table 9**.

Table 9 ACARP Recommended 'Safe' Vibration Limits for transient vibration

Item	Recommended PPV Limit
Public Roads	100 mm/s
Power lines – Timber poles[1]	100 mm/s
Power lines – Concrete poles[1]	100 mm/s
Power lines – Steel towers[1]	100 mm/s
Electrical substations – Buckholz Switches	10 mm/s to 25 mm/s
Buried Communications Cables and Pipelines	100 mm/s

Note 1: It is assumed that the power lines are suspended from poles (above ground services)

Elsewhere in ACARP, concrete culverts were also found to have a 'safe' vibration limit of 100 mm/s.

ACARP applies only to the effects of blasting and does not provide any commentary on the effects of continuous vibration. It is recommended that a 50% reduction to the transient limits laid out above should be applied, consistent with the recommendations for continuous vibrations described in BS 7385-2 and German Standard DIN 4150 Part 3.

If available, asset owner vibration thresholds should be used instead of the suggested thresholds in this section.

3.2.6 Minimum Working Distances for Vibration Intensive Works

Minimum working distances for typical vibration intensive construction equipment are provided in the Transport for NSW *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 10**. The minimum working distances are for both cosmetic damage (from BS 7385) and human comfort (from the NSW EPA Vibration Guideline). They are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

Table 10 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Working Distance	
		Cosmetic Damage	Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	20 m
	<200 kN (4–6 tonne)	12 m	40 m
	<300 kN (7–13 tonne)	15 m	100 m
	>300 kN (13–18 tonne)	20 m	100 m
	>300 kN (>18 tonne)	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	7 m

Plant Item	Rating/Description	Minimum Working Distance	
		Cosmetic Damage	Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	73 m
Vibratory Pile Driver[1]	Low Energy (nominally 2 kJ/cycle)	8 m	30 m
Vibratory Pile Driver[1]	Medium Energy (nominally 10 kJ/cycle)	18 m	100 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	N/A
Piling Rig – Bored[1]	≥ 800 mm and ≤ 2500 mm	4 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	2 m

Note 1: Vibration minimum working distances for these plant items are not from the CNVG and based on other empirical data.

4.0 Assessment Methodology

The potential construction noise levels from the project have been predicted to the surrounding receivers using the ISO 9613-2 algorithm in SoundPLAN. The noise model includes ground topography, ground type, buildings and representative worst-case noise sources from the project.

4.1 Work Scenarios

The noisiest work scenarios for each shaft site have been assessed to determine the likely worst-case impacts from the works at each location. These scenarios are shown in **Table 11** together with a high-level description of each works activity.

Table 11: Construction Scenario Descriptions

Ref.	Equipment	Description	Equipment List[1]
W.001a	Dillon Street Park - CFA Piling & Shaft Excavation	• Pile installation via CFA method • Delivery of concrete and injection of concrete • Shaft excavation using excavator	• CFA piling rig • Tipper truck • Concrete truck • Concrete pump • 20T excavator
W.001b	Dillon Street Park - Site Establishment & General Operation	• Site establishment (laydown and compaction) • General operation includes movement of vehicles, generators and water carts	• 2T vibratory roller • Flatbed truck • Light vehicles • Generator • Water cart • Skid steer • Franna • Telehandler • Electric hand tools
O.001a	Dillon Street Park – Operational – Day Only	• Installation of pipe via jacking, and grouting, including supply of grout • Concrete saw cuts • Critical crane lift • Ventilation/OCU operation	• Pipe jack • Franna • Concrete truck • Grout pump • Concrete saw • Ventilation fan • Monorail Crane • 60T Crane
O.001b	Dillon Street Park – Operational	• Installation of pipe via jacking, and grouting • Ventllation/OCU operation	• Pipe jack • Franna • Concrete truck • Grout pump • Ventilation fan • Monorail Crane
W.002a	Lough Playing Fields - CFA Piling & Shaft Excavation	• Pile installation via CFA method • Delivery of concrete and injection of concrete • Shaft excavation using excavator	• CFA piling rig • Tipper truck • Concrete truck • Concrete pump • 20T excavator)

Ref.	Equipment	Description	Equipment List[1]
W.002b	Lough Playing Fields - Site Establishment & General Operation	• Site establishment (laydown and compaction) • General operation includes movement of vehicles, generators and water carts	• 20T vibratory roller • Flatbed truck • Light vehicles • Generator • Water cart • Skid steer • Franna • Telehandler • Electric hand tools
O.002a	Lough Playing Fields – Operational – Day Only	• Installation of pipe via jacking, and grouting, including supply of grout • Concrete saw cuts • Critical crane lift • Ventillation/OCU operation	• Pipe jack • Franna • Concrete truck • Grout pump • Concrete saw • Ventilation fan • Monorail Crane • 60T Crane
O.002b	Lough Playing Fields – Operational	• Installation of pipe via jacking, and grouting • Ventillation/OCU operation	• Pipe jack • Franna • Concrete truck • Grout pump • Ventilation fan • Monorail Crane
W.003a	Elizabeth Street - Boring, Shaft Excavation & General Operation	• Excavation of shaft using excavator • Shaft boring • General operation includes movement of vehicles, generators and water carts	• Large bored piling rig SANY SR305R (105T) • Flatbed truck • Light vehicles • Generator • Water cart • Skid steer • Franna • Telehandler • Electric hand tools
O.003a	Elizabeth Street - Operational	• Delivery of CAC and lining • Ventillation/OCU operation	• Concrete truck • Concrete pump • Ventilation fan
W.004a	Trelawney Street - Boring, Shaft Excavation & General Operation	• Excavation of shaft using excavator • Shaft boring • General operation includes movement of vehicles, generators and water carts	• Large bored piling rig SANY SR305R (105T) • Flatbed truck • Light vehicles • Generator • Water cart • Skid steer • Franna • Telehandler • Electric hand tools

Ref.	Equipment	Description	Equipment List[1]
O.004a	Trelawney Street - Operational	• Delivery of grout and lining • Ventilation/OCU operation	• Concrete truck • Grout pump • Ventilation fan

Note 1: Equipment underlined corresponds to plant that would operate in an acoustic shed.

Note 2: Work scenarios O.001a-O.004a and O.001b-O.002b will commence after shaft construction.

Details of the items of plant that would be used during each scenario, together with corresponding sound power levels are detailed in **Appendix B**.

4.2 Hours of Construction

Construction activities for the proposal are assumed to only be undertaken during the following hours:

- 7:00 am to 6:00 pm, Mondays to Fridays
- 8:00 am to 1:00 pm on Saturdays
- At no time on Sundays or Public Holidays.

A summary of construction work periods, schedule required for each scenario are provided in **Table 12**.

Table 12 Scenarios and Periods of Work

ID	Scenario	Hours of Work			
		Standard Construction Hours	Out-of-Hours Work		
			Day OOH[1]	Evening[2]	Night[3]
W.001a	Dillon Street Park - CFA Piling & Shaft Excavation	✓	-	-	-
W.001b	Dillon Street Park - Site Establishment & General Operation	✓	-	-	-
O.001a	Dillon Street Park – Operational – Day Only	✓			
O.001b	Dillon Street Park – Operational	✓	✓	✓	✓
W.002a	Lough Playing Fields - CFA Piling & Shaft Excavation	✓	-	-	-
W.002b	Lough Playing Fields - Site Establishment & General Operation	✓	-	-	-
O.002a	Lough Playing Fields – Operational – Day Only	✓			
O.002b	Lough Playing Fields – Operational	✓	✓	✓	✓
W.003a	Elizabeth Street - Boring, Shaft Excavation & General Operation	✓	-	-	-
O.003a	Elizabeth Street - Operational	✓	✓	✓	✓
W.004a	Trelawney Street - Boring, Shaft Excavation & General Operation	✓	-	-	-
O.004a	Trelawney Street - Operational	✓	✓	✓	✓

Note 1: Daytime out of hours is 8 am to 6 pm on Sunday and public holidays.

Note 2: Evening is 6 pm to 10 pm Monday – Sunday (including public holidays).

Note 3: Night is 10 pm to 7 am Monday – Saturday and 10pm to 8am Sunday (including public holidays).

5.0 Assessment of Impacts

5.1 Construction Noise

The assessments in this section use 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

The noise contour maps for the W.001a-W.004a and O.001b, O.002b, O.003a and O.004a at the worst-case receivers are shown in **Appendix C**. The noise contours are presented at 1.5m above ground height, which is representative of typical ground floor receivers. In built up environments, noise levels may be greater at higher floors of receiver buildings which are set back from the work area. The impacts from W.001b-W.004b are typically similar to or less than W.001a-W.004a.

Based on the subjective classifications detailed in **Table 13**, **Table 14** summarises the predicted noise impacts of the assessed construction scenarios on the worst-case affected receiver at a height of 1.5 m. The typical and worst-case predicted construction noise impacts are provided in the table; worst-case impacts occur when equipment in operating at the closest point of a work area to the receiver.

The predictions are representative of the highest noise levels that could potentially be experienced at the surrounding receivers when the works are at the closest point to the receiver. For most construction activities, it is expected that the construction noise levels would frequently be lower than those predicted, as the noise levels presented are based on all items of equipment in each scenario being used concurrently and occurring at the nearest point of the site to each receiver.

Table 13 Exceedance Bands and Impact Colouring

Subjective Classification	Exceedance of NML		Impact Colouring
	Daytime	Out of Hours	
Noticeable	No exceedance	0 to 5 dBA	
Low impact	1 to 10 dBA	6 to 15 dBA	
Moderate impact	11 to 20 dBA	16 to 25 dBA	
High impact	> 20 dBA	>25 dBA	
Highly Noise Affected	>75 dBA	-	

Table 14 Construction Noise Predictions at the Most-Affected Sensitive Receivers

Site Location	Receiver Address	Receiver Type	NML (dBA)	Period	Construction Scenario ID[1]	Predicted Construction Noise Impact $L_{Aeq(15minute)}$ (dBA)	
						Typical	Worst-case
Dillon St Park	36 Stephen St, Paddington	Residential	50	Day	W.001a - CFA Piling & Shaft Excavation	74	87
	36 Stephen St, Paddington		50	Day	W.001b - Site Establishment & General Operation	74	87
	17 Neild Av, Paddington		50	Day	O.001a - Operational – Day (all activities)	81	85
	17 Neild Av, Paddington		35	Night	O.001b – Operational- Night (shed activities only)	69	73
	36 Stephen St, Paddington		35	Night	O.001b – Operational – Night (all activities)	72	78
Lough Playing Fields	81 Manning Rd, Woollahra	Residential	50	Day	W.002a - CFA Piling & Shaft Excavation	71	84
			50	Day	W.002b - Site Establishment & General Operation	73	84
			50	Day	O.002a - Operational – Day (all activities)	75	79
			35	Night	O.002b – Operational- Night (shed activities only)	63	66
			35	Night	O.002b – Operational – Night (all activities)	65	73
Elizabeth Street	105 Elizabeth St, Paddington	Residential	50	Day	W.003a - Boring, Shaft Excavation & General Operation	85	91
			35	Night	O.003a – Operational (shed activities only)	76	80
			35	Night	O.003a – Operational (all activities)	82	87
Trelawney Street	2/1 Rosemont Av, Woollahra	Residential	50	Day	W.004a - Boring, Shaft Excavation & General Operation	89	106
			35	Night	O.004a – Operational (shed activities only)	80	90
			35	Night	O.004a – Operational (all activities)	99	100

Note 1: Noise results for "shed activities only" correspond to construction plant/equipment intended to be operated in an acoustic shed (underlined in **Table 11**). The results presented do not include mitigation effects from an acoustic shed.

For each work scenario, the approximate extent (in metres) for each subjective classification is visualised via the noise contour maps in **Appendix C**. For other sensitive receiver types, lesser impacts are expected, except for childcare centres (external NML of 45 dBA when in use). Construction mitigation measures are discussed in **Section 6.0** and are based on these subjective classifications.

5.2 Construction Vibration

5.2.1 Building Cosmetic Damage and Human Comfort

The major potential sources of vibration from the proposed construction activities would likely be vibratory rollers or sheet piling rigs for Dillon Street Park and Lough Playing Fields sites.

A vibration screening assessment for building cosmetic damage and human comfort for the following activities have been conducted:

- W.001a Dillon St Park – CFA/bored piling (≤ 800 mm diameter; **Figure 2**)
- W.001b Dillon St Park – 2T vibratory roller (**Figure 3**)
- W.002a Lough Playing Fields – CFA/bored piling (≤ 800 mm diameter; **Figure 4)**
- W.002b Lough Playing Fields – 2T vibratory roller (**Figure 5**)
- W.003a Elizabeth Street – Bored piling (800-2500 mm diameter; **Figure 6**)
- W.004a Trelawney Street – Bored piling (800-2500 mm diameter; **Figure 7**)

The minimum working distance buffer areas shown in the figures have been determined from **Table 10**. Buildings within the minimum working distances for cosmetic damage have been highlighted. Structures that fall within the minimum working distance may be at risk of cosmetic damage. Human occupants within buildings that fall within the human comfort minimum working distance may have an increased likelihood of complaints, depending on their proximity and duration of the works to the occupants.

It is expected that vibration impacts from bored piling for Elizabeth Street and Trelawney Street shaft sites will be minimal, unless unusually very competent/hard ground is encountered. Relocation of the bored shaft locations within 4 m of any structures would necessitate vibration monitoring of the activity to confirm vibration levels are below relevant vibration thresholds.

Figure 2 Dillon Street Park – CFA/Bored Piling Vibration



Figure 3 Dillon Street Park – 2T Vibratory Roller Vibration



Figure 4 Lough Playing Fields – CFA/Bored Piling Vibration



Figure 5 Lough Playing Fields – 2T Vibratory Roller Vibration



Figure 6 Elizabeth Street – Bored Piling



Figure 7 Trelawney Street – Bored Piling



No buildings or heritage items have been identified to be at risk of cosmetic damage when the 2T vibratory roller is in use.

Less vibration intensive plant should be considered where buildings or assets are encountered within the minimum working distances, for example, using a vibration plate compactor instead of a vibratory roller. The vibration impacts of a vibration plate compactor are expected to be less than the 2T vibratory roller.

The nearest buildings to Dillon Street Park and Lough Playing Fields shaft sites are within the human comfort minimum working distances. Occupants of these buildings may be able to perceive vibration impacts at times when 2T vibratory roller are in use nearby. Where impacts are perceptible, they would likely only be apparent for relatively short durations when vibration intensive equipment is in use nearby.

5.2.2 Vibration Impacts on Other Assets

Table 15 presents the minimum working distances from vibration-intensive plant identified in this CNVIA. The minimum working distance provided should be thought of as the slant distance from buried assets to a vibration source (e.g., toe of sheet pile or vibratory roller drum). Any assets within the minimum working distances in **Table 15** may be at risk of vibration-induced damage.

Table 15 Approximate Minimum Working Distances from Assets

Asset	Guideline	Vibration Limit (mm/s)	Minimum Working Distance from 2T Vibratory Roller
Optic Fibre	ACARP	50 mm/s	2 m
SWD	ACARP	50 mm/s	2 m
SWD	Sydney Water – masonry	3 mm/s	9 m
Gas	APA – cast iron	5 mm/s	7 m
Gas	APA - steel with CTE) or poor coating health	10 mm/s	5 m
Gas	APA - non-CTE or other pipe materials	20 mm/s	3 m
Electrical	Overhead power line poles	50 mm/s	2 m
Substation	Buckholz Switches	5 mm/s	7 m

The vibration thresholds selected in **Table 15** may not apply to the assets nearby the BOOS Rehabilitation project sites and therefore the minimum working distances provided may not be applicable. If available, asset owner vibration thresholds should be used instead of the suggested thresholds.

Special consideration may be required for the aqueduct under Lough Playing Field, depending on the material construction of the aqueduct (stormwater drain).

Feasible and reasonable construction vibration mitigation measures should be applied where vibration intensive works are required within the minimum working distances. Construction mitigation and management measures are discussed further in **Section 6.0**.

6.0 Mitigation and Management Measures

The ICNG acknowledges that due to the nature of construction works it is inevitable that there will be impacts where construction is near to sensitive receivers.

Predicted construction noise during all working scenarios assessed are expected to exceed the 'Highly Noise Affected' Level for the nearest sensitive receivers and will exceed the NML for a significant number of receivers surrounding the site.

Notwithstanding, all appropriate feasible and reasonable mitigation measures would be applied to the work to minimise the potential impacts, as far as practicable.

It is recommended that the mitigation and management measures detailed in **Table 16** are adopted where feasible and practicable to minimise impacts at the surrounding receivers.

Table 16: Environmental Management Controls for Construction Noise and Vibration

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Project Planning			
Use quieter and less vibration emitting construction methods where feasible and reasonable.	Project Manager	Ongoing	Best practice
Works are proposed be completed during standard daytime construction hours outlined in **Section 4.1.**			
Truck routes to site would be limited to major roads.			
Truck deliveries (e.g. concrete) would be limited to standard construction hours when feasible.			
Site Layout			
Compounds and worksites would be designed to promote one-way traffic and minimise the need for vehicle reversing.	Project Manager	Ongoing	Best practice
Where practicable, work compounds, parking areas, and equipment and material stockpiles should be positioned away from noise-sensitive locations and take advantage of existing screening from local topography.			
Documentation of how site layout has been considered to reduce noise impacts would be provided to the Contractor's Project Manager. This should occur any time there are significant changes to the site layout.			
Equipment that is noisy should be started away from sensitive receivers.			
Training			
Training should be provided to all personnel on noise and vibration requirements for the project. Inductions and toolbox talks to be used to inform personnel of the location and sensitivity of surrounding receivers.	Project Manager	Ongoing	Best practice
Doors/openings of acoustic sheds should be faced away from nearby sensitive receivers	Project Manager	Design stage	

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Plant and Equipment Source Mitigation			
All plant and equipment should be maintained in a proper and efficient condition, operated in a proper and efficient manner, and feature standard noise amelioration measures where applicable.	Project Manager	Ongoing	Best practice
Where practicable, tonal motion / reversing alarms (beepers) should be replaced with non-tonal alarms (squawkers) on all equipment in use (subject to occupational health and safety requirements).			
Equipment should be oriented so that noise emissions are directed away from any sensitive areas, where possible.			
Noise generating equipment should be regularly checked and effectively maintained, including checking of hatches/enclosures regularly to ensure that seals are in good condition and doors close properly against seals.			
Noise monitoring spot checks of equipment should be completed to ensure individual items are operating as expected.			
Dropping materials from a height should be avoided.			
Loading and unloading should be carried out away from noise sensitive areas, where practicable.			
Trucks should not queue outside residential properties. Truck drivers should avoid compression braking as far as practicable.			
Truck movements should be kept to a minimum, i.e. trucks are fully loaded on each trip.			
Screening			
The layout of the site should take advantage of existing screening from local topography, where possible. Site huts, maintenance sheds and/or containers should be positioned between noisy equipment and the affected receivers.	Project Manager	Ongoing	Best practice
Implementation of temporary noise barriers for highly intensive noise activities, such as saw cutting or sheet piling.			
Install purpose-built screening or enclosures around long-term fixed plant that has the potential to impact nearby receivers			
Complaints Management			
Where complaints are received, work practices should be reviewed and feasible and reasonable practices implemented to minimise any further impacts.	Communications and Community Liaison Representative or Project Manager	Ongoing	Best practice

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Monitoring			
Noise monitoring should be conducted (as appropriate) when noise/vibration intensive works are being undertaken near some of the most-affected sensitive receivers	Environmental Coordinator or Project Manager	Ongoing	Best practice
It is recommended that attended vibration monitoring is undertaken at the closest affected receiver and/or asset point during operation of vibration intensive equipment to determine the impacts and relative risk of vibration-impacts in accordance with the vibration levels identified in **Section 5.2**.			
Noise and/or vibration monitoring should be conducted (as appropriate) in response to any complaints received to verify that levels are not substantially above the predicted levels.			
Vibration			
If vibration generating works are required within the minimum working distances to buildings or assets (refer to **Section 3.2** and **5.25.2.2**) and considered likely to exceed the criteria: • Different construction methods with lower source vibration levels will be investigated and implemented, where feasible, e.g., vibration plate instead of vibratory roller • Attended vibration measurements should be undertaken at the start of the works to determine actual vibration levels at the item. Vibration intensive works should cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Environmental Coordinator or Project Manager	Ongoing	Best practice
Where works are required within the cosmetic damage minimum working distances building condition surveys and public infrastructure dilapidation surveys to ensure no cosmetic damage has occurred.			
Due to the complex nature of human comfort, vibration monitoring is recommended in response to complaints, and if levels exceed the human comfort thresholds specified in **Section 3.2.1** respite offers (RO) should be implemented. Respite periods of 1 hour after every 3 hours of high noise/vibration generating work are also required.			
Vibration from the mobilisation of large construction plant (e.g. large bored piling rig or crane) is to be minimised using feasible and reasonable methods, e.g., speed reductions and smoothing of access paths			

6.1 Additional Mitigation and Management Measures

Where the 'mitigated' construction noise levels are expected to remain above the NMLs, it is recommended that the Additional Mitigation Measures Matrix (AMMM) adapted from the CNVG are implemented. The approach, guided by the AMMM, is primarily aimed at pro-active engagement with affected sensitive receptors rather than additional noise reducing mitigation.

The additional mitigation measures listed in **Table 17**, **Table 18** and **Table 19** are based on the guidance from the CNVG.

Table 17 Additional Mitigation Measures

Mitigation/Management Measure	Description	Abbreviation
Periodic notification	Periodic notifications provide an overview of current and upcoming work across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Content and length are determined on a project-by-project basis. Most projects distribute notifications monthly. Each notification is graphically designed within a branded template.	PN
Verification monitoring	Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging (i.e., for vibration provided there is an immediate feedback mechanism such as SMS capabilities) or operator attended surveys (i.e., for specific periods of construction noise). Verification should be undertaken by suitably qualified, trained and experienced personnel using appropriate equipment and methodology, with reference to AS1055. Refer to EPA's guideline 'Approved methods for the measurement and analysis of environmental noise in NSW' for additional guidance on personnel, methodology and equipment requirements. The purpose of monitoring is to confirm that: • Construction noise and vibration from the project are consistent with the predictions in the noise assessment. • Mitigation and management of construction noise and vibration is appropriate for receivers affected by the work. Where noise monitoring finds the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required.	V
Specific notification	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives.	SN
Alternative construction methodology	Where the vibration assessment identifies that the proposed construction method has a high risk of causing structural damage to buildings near the work, the proponent needs to consider alternative construction options to achieve compliance with the building cosmetic damage thresholds. For example, replace large rock breaker with smaller rock breakers or rock saws.	AC
Respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise pre-purchased movie tickets, bowling activities, meal vouchers or similar offers designed to provide residents with a short break from impact of construction activity outside of their home. This measure is determined on a case-by-case basis and may not be applicable to all Transport projects.	RO
Duration Reduction	Where Respite Periods (see management measure above) are counterproductive to reducing noise and vibration	DR

Mitigation/Management Measure	Description	Abbreviation
	impacts to the community, it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis and may not be applicable to all Transport projects. Impacted receivers must be consulted and evidence of community support for the Duration Reduction.	
Alternative Accommodation	Alternative accommodation options may be provided for residents living near construction activities likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.	AA
Respite Period	OOHW during evening and night periods will be restricted so receivers are impacted for no more than three consecutive evenings and no more than two consecutive nights in the same NCA in any one week, except where there is Duration Reduction. A minimum respite period of four evenings/five nights shall be implemented between periods of consecutive evening and/or night work. Strong justification must be provided where it is not reasonable and feasible to implement these period restrictions.	RP

Table 18 Airborne Noise – Additional Mitigation Measures Matrix

Time Period		Receiver perception	Exceedance of NML (dBA)	Additional management measures
Standard Hours	Monday-Friday 7 am-6pm Saturday 8am-1pm	Noticeable	No exceedance	-
		Low impact	1-10	-
		Moderate impact	11-20	PN
		High impact	>20	PN
		Highly Noise Affected	-	PN, V, SN
OOHW Period 1	Monday-Friday 6pm-10pm Saturday 7am-8am or 1pm-10pm Sunday/Public Holidays 8am-6pm	Noticeable	≤ 5	-
		Low impact	6 to 15	PN, RP[1], DR[1]
		Moderate impact	16 to 25	PN, V, SN, RO, RP[1], DR[1]
		High impact	>25	PN, V, SN, RO, RP[1], DR[1]
OOHW Period 2	Monday-Saturday 12am-7am 10pm-12am Sunday/Public Holidays 12am-8am 6pm-12am	Noticeable	≤ 5	PN
		Low impact	6 to 15	PN, V, SN, RO[2], RP, DR
		Moderate impact	16 to 25	PN, V, SN, RO[2], RP, DR
		High impact	>25	PN, V, SN, RO[2], RP, DR, AA

Note 1: Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only (i.e. Saturday 7am-8am & 1pm-6pm, Sundays / Public Holidays 8am-6pm)

Note 2: Respite offers during OOHW Period 2 are only applicable for evening periods on Sundays and Public Holidays 6pm-10pm, and may not be required if a respite offer has already been made for the immediately preceding OOHW Period 1.

Table 19 Vibration – Additional Mitigation Measures Matrix

Time Period		Receiver Perception	Above criterion	Additional management measures
Standard Hours	Monday-Friday 7 am-6pm Saturday 8am-1pm	Human annoyance	Within human comfort screening area	PN, V, RO
		Building damage	Within cosmetic damage screening area	V, AC

6.1.1 Receivers Eligible for Additional Mitigation Measures – Noise

Residential receivers that would be eligible for additional mitigation measures detailed in **Table 18** can be determined by the results in **Section 5.1** (also refer to worst-case noise contour maps in **Appendix C**).

Sensitive receivers closest to all shaft sites are eligible for alternative accommodation during OOHW Period 2 works, unless sufficient noise mitigation is achieved.

6.1.2 Receivers Eligible for Additional Mitigation Measures - Vibration

No buildings have been identified as being at risk of cosmetic damage. If alternative construction methodology is required that generates higher vibration levels (e.g., higher output vibratory rollers), vibration monitoring should confirm that vibration levels are likely to exceed the nominated cosmetic damage thresholds (refer to **Section 3.2**).

D4C has informed SLR that no vibration-intensive activities will occur during out of hours periods.

6.2 Acoustic Shed Reductions

Table 14 includes the worst-case predicted $L_{Aeq(15\ minute)}$ noise level at the most affected sensitive receiver for activities assumed to occur during out of hours (i.e., O.001b at Dillon St Park, O.002b at Lough Playing Fields, O.003a at Elizabeth St and O.004a Trelawney St sites). The table also includes the worst-case predicted $L_{Aeq(15\ minute)}$ noise level for activities assumed to occur in an acoustic shed (refer to plant underlined in **Table 11**).

Table 20 provides the acoustic shed reduction required to comply with night-time NML (35 dBA) or 'noticeable impact' noise levels (assumed 5 dB above NML, i.e., 40 dBA) based on the assumed background noise levels detailed in **Section 2.0** and the worst-case predicted noise level from **Table 14**.

Table 20 Acoustic Shed Reductions

Location	$L_{Aeq(15\ minute)}$ at Most Affected Sensitive Receiver due to Shed Activities dBA	Required acoustic shed reduction for night-time NML compliance dBA	Required reduction for 'Noticeable' impact during night-time (assumed 5 dB above night-time NML) dBA	Residual impacts likely?
Dillon St Park	73	38	33	Yes

Location	$L_{Aeq(15\ minute)}$ at Most Affected Sensitive Receiver due to Shed Activities dBA	Required acoustic shed reduction for night-time NML compliance dBA	Required reduction for 'Noticeable' impact during night-time (assumed 5 dB above night-time NML) dBA	Residual impacts likely?
Lough Playing Fields	66	31	26	No
Elizabeth Street	80	45	40	Yes
Trelawney Street	90	55	50	Yes

Some plant and equipment are assumed to not operate in the shed for O.001b (Dillon St Park site) and O.002b (Lough Playing Field site). Noise levels for these plant and equipment could be mitigated and managed based on **Section 6.0**, e.g., limiting truck deliveries to standard construction hours, where feasible.

Acoustic shed reductions greater than 30 dB are not considered practically achievable and therefore the closest sensitive receivers at Dillon St Park, Elizabeth Street and Trelawney Street would likely experience residual noise impacts.

7.0 Cumulative Impacts

Cumulative construction noise impacts can occur where multiple work activities are being completed near to a particular receiver at the same time. There is potential for cumulative construction impacts from multiple construction activities being completed in adjacent shaft sites of the project (e.g., Lough Playing Field and Trelawney Street sites).

Since the construction scenarios required for various stages of the project would generally require similar items of equipment, concurrent construction work being completed near to a particular area could theoretically increase the worst-case noise levels in this report by around 3 dB (ie a logarithmic adding of two sources of noise at the same level).

8.0 Summary and Recommendations

The noise and vibration impacts of construction at four shaft sites (Dillon Street Park, Lough Playing Fields, Elizabeth Street and Trewlawney Street) are discussed in this CNVIA.

A detailed vibration assessment for buried assets is still required, however minimum working distances to various buried assets are discussed in **Section 5.2.2**. Vibration due to mobilisation of large piling rigs and cranes has not been assessed. All reasonable and feasible methods to minimise vibration should be undertaken, e.g., speed reductions and smoothing of access roads/surfaces nearby buried assets and buildings.

The noise assessment, including the acoustic shed reduction assessment, presented in this CNVIA are based on assumed background noise levels (typical suburban RBLs) which consider the surrounding land zoning of each site and the expected traffic noise. These assumptions are to be confirmed via unattended noise logging at each site prior to acoustic shed construction. A summary of the noise assessment at each site is as follows:

Dillon Street Park:

- Worst-case noise assessment predicts that nearest sensitive receivers are expected to be 'Highly Noise Affected' (>75 dBA) during all daytime construction activities. Specific notification required for these receivers.
- Worst-case noise assessment of in-shed only activities predicted a noise level of 73 dBA at the nearest sensitive receiver.
    - A 33 dBA reduction is required from the acoustic shed to ensure 'Low Impact' at the nearest sensitive receiver during the night-time (35 dBA NML assumed) when in-shed activities are conducted. Acoustic shed reductions greater than 30 dB are not considered practically achievable and therefore the closest sensitive receivers would likely experience residual noise impacts.
- No vibration impacts predicted to nearby buildings when 2T vibratory roller or CFA piling rig is used.

Lough Playing Fields:

- Worst-case noise assessment predicts that nearest sensitive receivers are expected to be 'Highly Noise Affected' (>75 dBA) during all daytime construction activities. Specific notification required for these receivers.
- Worst-case noise assessment of shed only activities predicted a noise level of 66 dBA at the nearest sensitive receiver.
    - A 26 dBA reduction is required from the acoustic shed to ensure 'Low Impact' at the nearest sensitive receiver during the night-time (35 dBA NML assumed) when in-shed activities are conducted. This noise reduction is deemed practically achievable.
- No vibration impacts predicted to nearby buildings when 2T vibratory roller or CFA piling rig is used.
- Vibration plate compactor to be considered in areas around stormwater drain.

Elizabeth Street:

- Worst-case noise assessment predicts that nearest sensitive receivers are expected to be 'Highly Noise Affected' (>75 dBA) during all daytime construction activities. Specific notification required for these receivers.

- Worst-case noise assessment of shed only activities predicted a noise level of 80 dBA at the nearest sensitive receiver.
    - A 40 dBA reduction is required from the acoustic shed to ensure 'Low Impact' at the nearest sensitive receiver during the night-time (35 dBA NML assumed) when in-shed activities are conducted.. Acoustic shed reductions greater than 30 dB are not considered practically achievable and therefore the closest sensitive receivers would likely experience significant residual noise impacts.
- No vibration impacts predicted to nearby buildings when bored piling rig is used

Trelawney Street:

- Worst-case noise assessment predicts that nearest sensitive receivers are expected to be 'Highly Noise Affected' (>75 dBA) during all daytime construction activities. Specific notification required for these receivers.
- Worst-case noise assessment of shed only activities predicted a noise level of 90 dBA at the nearest sensitive receiver.
    - A 50 dBA reduction is required from the acoustic shed to ensure 'Low Impact' at the nearest sensitive receiver during the night-time (35 dBA NML assumed) when in-shed activities are conducted.. Acoustic shed reductions greater than 30 dB are not considered practically achievable and therefore the closest sensitive receivers would likely experience significant residual noise impacts.
- No vibration impacts predicted to nearby buildings when bored piling rig is used.

Appendix A Acoustic Terminology

Bondi Ocean Outfall Sewer (BOOS) Rehabilitation

Detailed Design – Construction Noise and Vibration Impact Assessment

Delivering 4 Customers (D4C)

SLR Project No.: 610.033188.00001

12 December 2025

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

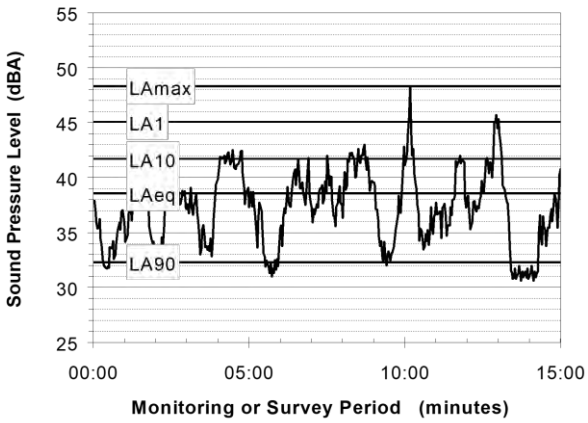
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

L_{Amax} The A-weighted maximum sound pressure level of an event measured with a sound level meter.

5. Frequency Analysis

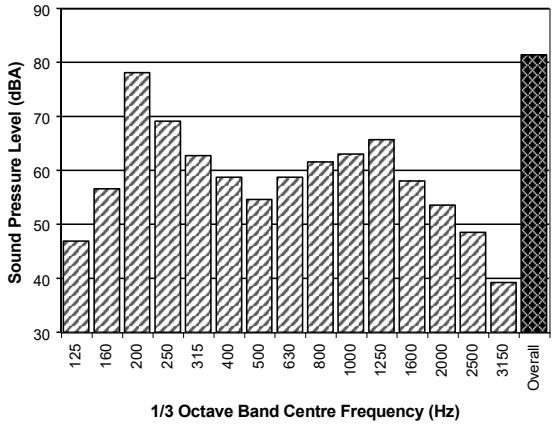
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

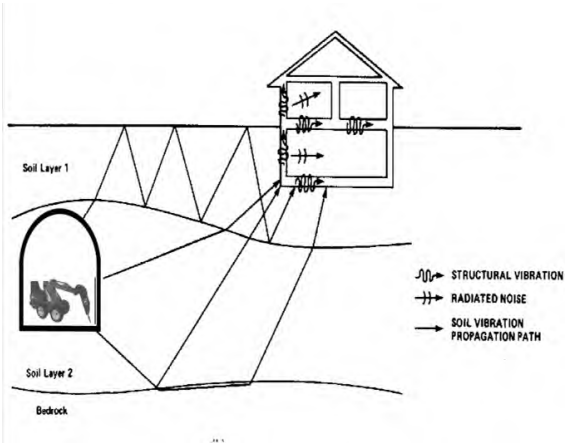
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B Work Scenarios Noise Levels

Bondi Ocean Outfall Sewer (BOOS) Rehabilitation

Detailed Design – Construction Noise and Vibration Impact Assessment

Delivering 4 Customers (D4C)

SLR Project No.: 610.033188.00001

12 December 2025

Equipment		Total Lw (dBA)	Centrifugal fan	Concrete agitator truck	Concrete pump truck	Crane - Truck mounted (20-60 tonne)	Crane Franna (20 tonne)	Excavator - Tracked (20 tonne)	Gantry crane	Generator	Hand tools (electric)	Light Vehicle	Loader - skidsteer (1/2 tonne)	Piling Rig - Bored	Pipe jack	Pressure grout pump	Roller – Vibratory[1]	Saw – Concrete[1]	Telescopic Handler	Truck - Dump	Truck - Medium Rigid (20 tonne)	Ventilation fan[3]
Sound Power Level (Lw)[2]			90	109	108	108	98	105	102	92	102	95	107	112	82	104	109	118	99	110	103	93
Estimated utilisation (%)			100	100	100	30	30	50	25	100	75	25	50	100	25	100	100	25	50	25	25	100
ID	**Construction Scenario**																					
W.001a	Dillon Street Park - CFA Piling & Shaft Excavation	**115**	1	1			1						1						1			
W.001b	Dillon Street Park - Site Establishment & General Operation	**115**				1			1	1	2	1				1		1		1		1
O.001a	Dillon Street Park – Operational – Day Only	**118**	1		1	1		1						1	1		1				1	
O.001b	Dillon Street Park – Operational	**111**	1	1			1						1						1			
W.002a	Lough Playing Fields - CFA Piling & Shaft Excavation	**115**				1			1	1	2	1				1		1		1		1
W.002b	Lough Playing Fields - Site Establishment & General Operation	**115**	1		1	1		1						1	1		1				1	
O.002a	Lough Playing Fields – Operational – Day Only	**118**				1			1	1	2	1	1					1		1		1
O.002b	Lough Playing Fields – Operational	**111**	1												1						1	

Equipment		Total Lw (dBA)	Centrifugal fan	Concrete agitator truck	Concrete pump truck	Crane - Truck mounted (20-60 tonne)	Crane Franna (20 tonne)	Excavator - Tracked (20 tonne)	Gantry crane	Generator	Hand tools (electric)	Light Vehicle	Loader - skidsteer (1/2 tonne)	Piling Rig - Bored	Pipe jack	Pressure grout pump	Roller – Vibratory[1]	Saw – Concrete[1]	Telescopic Handler	Truck - Dump	Truck - Medium Rigid (20 tonne)	Ventilation fan[3]
W.003a	Elizabeth Street - Boring, Shaft Excavation & General Operation	**114**				1			1	1	2	1	1					1		1		1
O.003a	Elizabeth Street - Operational	**110**	1												1						1	
W.004a	Trelawney Street - Boring, Shaft Excavation & General Operation	**114**	1	1			1						1						1			
O.004a	Trelawney Street - Operational	**110**				1			1	1	2	1				1		1		1		1

Note 1: Equipment classed as ‘annoying’ in the ICNG and requires a 5 dB correction.

Note 2: Sound power level data is taken from the DEFRA Noise Database, AS2436 and TfNSW Construction Noise and Vibration Guideline.

Note 3: Ventilation fan sound pressure level of 85 dBA at 1 m provided to SLR by D4C.

Appendix C Construction Noise Contour Maps

Bondi Ocean Outfall Sewer (BOOS) Rehabilitation

Detailed Design – Construction Noise and Vibration Impact Assessment

Delivering 4 Customers (D4C)

SLR Project No.: 610.033188.00001

12 December 2025



SLR

Data Source:
ESRI World Imagery

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W.001a (Day) - Dillon St Park
CFA Piling & Shaft Excavation

FIGURE C.2

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 DGIS\BOOS Rehabilitation.qgz



Scale: 1:4,500
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

SLR

Data Source:
ESRI World Imagery

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W.002a (Day) - Lough Playing Fields
CFA Piling & Shaft Excavation

FIGURE C.3

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 QGIS\BOOS Rehabilitation.qgz



Scale: 1:3,200
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

SLR

Data Source:
ESRI World Imagery

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W.003a (Day) - Elizabeth Street Boring, Shaft Excavation & General Operation

FIGURE C.4

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 GIS\BOOS Rehabilitation.qgz



Scale: 1:3,200
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

H:\Projects-SLR\610-SYD\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 QGIS\BOOS Rehabilitation.qgz

SLR

Data Source:
ESRI World Imagery

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W.004a (Day) - Trelawney Street Boring, Shaft Excavation & General Operation

FIGURE C.5



Scale: 1:5,000
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

SLR

Data Source:
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O.001b (Night) - Dillon St Park Operational

FIGURE C.6

H:\Projects-SLR\610-Srv\SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 GIS\BOOS Rehabilitation.qgz



Data Source:
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O.002b (Night) - Lough Playing Fields Operational

FIGURE C.7

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 GIS\BOOS Rehabilitation.qgz



Scale: 1:6,000
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

SLR

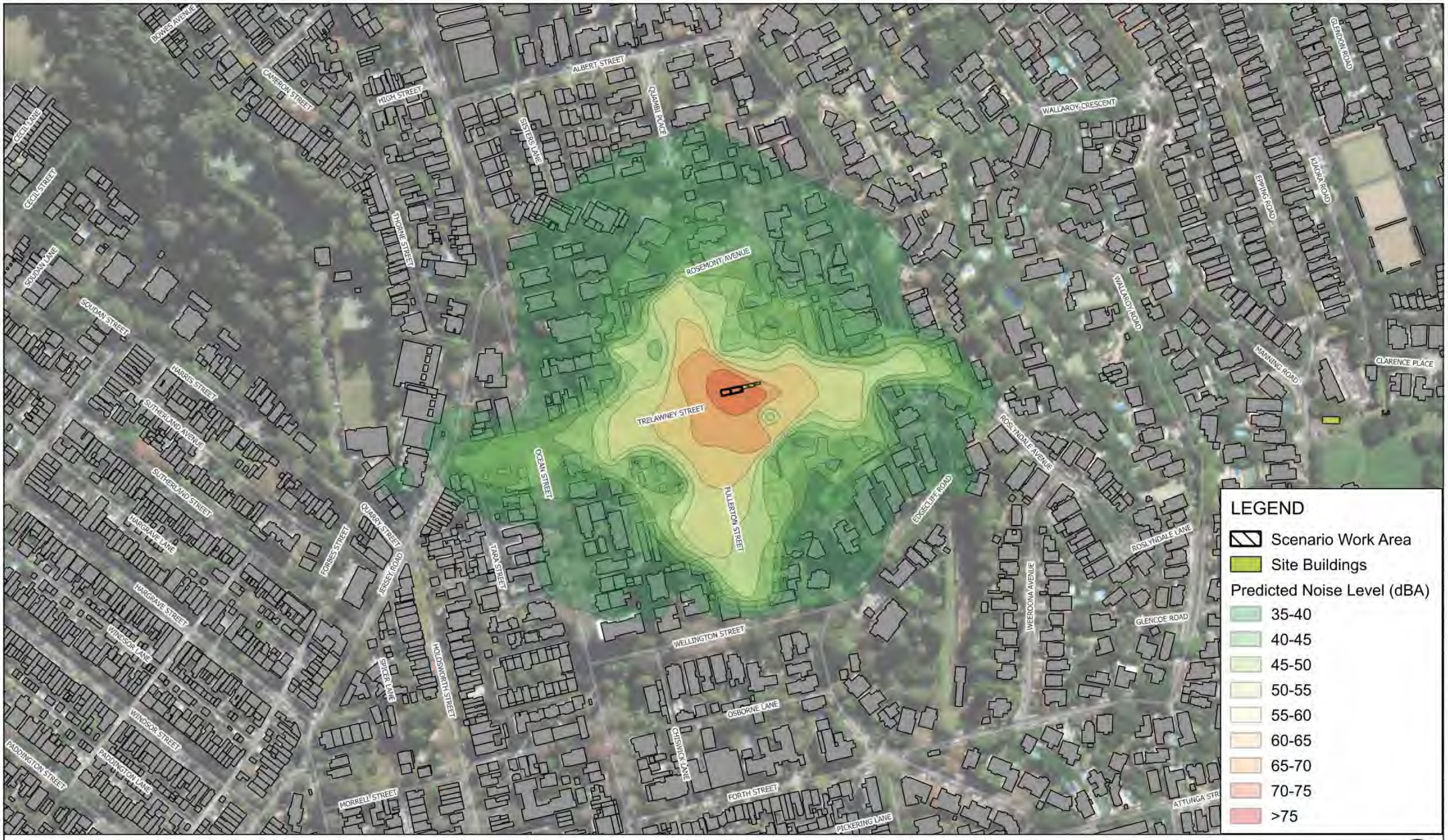
Data Source:
ESRI World Imagery

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O.003a (Night) - Elizabeth Street Operational

FIGURE C.8

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 GIS\BOOS Rehabilitation.qgz



Scale: 1:4,500
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 11-Dec-2025
Project Number: 610.033188

SLR

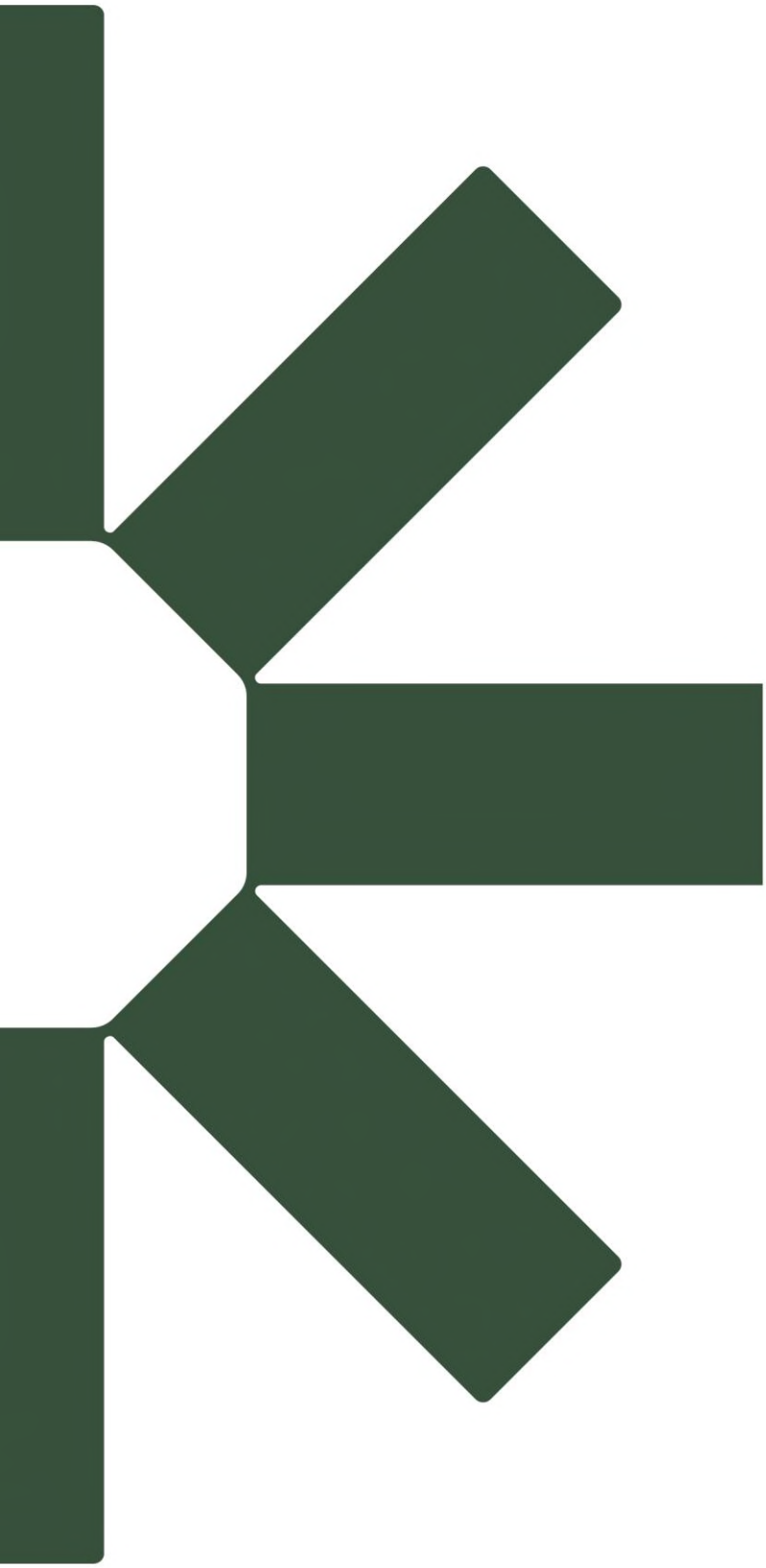
Data Source:
ESRI World Imagery

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O.004a (Night) - Trelawney Street Operational

FIGURE C.9

H:\Projects-SLR\610-SYD\610.033188.00001 BOOS Rehabilitation NV\06 SLR Data\05 Modelling\00 GIS\BOOS Rehabilitation.qgz



Making Sustainability Happen