Review of Environmental Factors Addendum

Calderwood 3A2 Wastewater and Water Servicing

Determination

This Review of Environmental Factors Addendum (REFA) assesses potential environmental impacts of the Calderwood 3A2 Wastewater and Water Servicing project. The REFA was prepared under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority.

The Sydney Water Project Manager is accountable for ensuring the proposal is carried out as described in this REFA and the approved REF. Additional environmental impact assessment may be required if the scope of work or work methods described in this REFA change significantly following determination.

Certification

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

Prepared by:	Reviewed and endorsed by:	Endorsed by:
[redacted]	[redacted]	[redacted]
Catherine Timbrell Environmental Scientist, Sydney Water Date: 11/06/2026	Sarah Mitchell Senior Environment Scientist Sydney Water Date: 11/06/2026	Tom Seymour Senior Project Manager Sydney Water Date: 12/6/2026

Decision Statement

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

Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in this REF, the proposal is unlikely to 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]	**Jill Berwick** **A/Senior Manager, Environment and Heritage Services** **Sydney Water** **Date: 24/06/26**

1 Proposal description

1.1 Proposal details

Table 1-1 describes the proposal change and Figure 1-1 shows the proposal location.

Table 1-1 Proposal need, objectives and justification for proposal change

Aspect	Relevance to proposal
Approved REF	• Review of Environmental Factors Calderwood 3A2 Wastewater Servicing, November 2024 (Approved REF) • Review of Environmental Factors Addendum Calderwood 3A2 Wastewater Servicing, February 2025 (REFA 2025).
Proposal need and objectives	Sydney Water provides water and wastewater related infrastructure in the Illawarra region and has been progressively delivering services as development occurs within the Calderwood Precinct. Sydney Water proposes to install about 3.5 km of DN450 watermain along sections of Calderwood Road, Tongarra Road (Illawarra Highway), and Church Street. The key driver for the proposal is to provide infrastructure to service the Governments planned development of Calderwood within the West Lake Illawarra Growth Area up to 2048. This proposal is required to meet Sydney Water's commitment to service continuing growth in Calderwood as stated in the Growth Servicing Plan (2025-2030). The proposal objectives are to: • provide the timely delivery of water services to Calderwood 3A2 • support the orderly roll out of land release and infrastructure • meet Sydney Waters statutory and regulatory obligations. The secondary objectives are to provide services that: • protect public health • protect catchment and river health • provide affordable and efficient water services • provide resource and energy efficient water services.
Proposal change description	The proposal change includes the installation of about 3.5 km of DN450 watermain, and associated civil works, to service the Calderwood Precinct. The proposal change involves: • open trenching within the road corridor • horizontal directional drilling (HDD) for about 140 m under Macquarie Rivulet • excavation of launch and receival pits for the HDD which may also require shoring • stringing pipes along the construction corridor • installation of associated thrust blocks, fittings, isolating valves, air valves, and scour valves

Aspect	Relevance to proposal
	• coordination and execution of all required connections and tie-ins to existing water infrastructure • restoration of impacted area to pre-existing or better condition in accordance with Transport for NSW and council requirements • pressure testing, flushing, disinfection, and commissioning of the new watermain to Sydney Water and relevant regulatory standards. Laydown areas and a construction compound are proposed. HDD requires excavation of launch and receival pits which may also require shoring.
Justification for proposal change	The proposal supports the delivery of drinking water to about 2,163 lots in the Calderwood Precinct. The watermain alignment forms part of the preferred servicing strategy for water supply from Albion Park and Mt Terry supply zones. The concept design for the proposal was completed in 2022 and was placed on hold to align with the future road upgrade of Calderwood Road by Stockland, and Tripoli Road by Shellharbour City Council which is scheduled to commence in 2026.
Location and land ownership	The proposal is in the Shellharbour City local government area (LGA) and will be within the road corridor of: • Calderwood Road, Calderwood • Tongarra Road (Illawarra Highway), Albion Park (classified state road) • Church Street, Albion Park.
Site establishment	Site establishment would involve • establishing erosion and sediment controls • stripping and stockpiling of topsoil for reuse during restoration • removal of vegetation to be cleared • establishing no-go areas [redacted]
Ancillary facilities (compounds)	A construction compound will be required to house site sheds, construction amenities, and material laydown. The compound will be located at Lot 13, 14 and 15 DP 26688 on Tongarra Road, Albion Park and is shown in Figure 1-1.
Materials and equipment	The materials and equipment to be used during construction in addition to that listed in the Approved REF will be confirmed by the Delivery Contractor. Additional materials and equipment is likely to include: • bitumen and road base • concrete and dewatering pumps • concrete vibrator • dosing pod • imported clean fill • horizontal directional drill • light tower • PE welder • positrack • rigid truck • slasher • street sweeper • tool truck • trench compactor

Aspect	Relevance to proposal
Work hours	Most of the work and deliveries will be scheduled during standard daytime hours: • 7 am to 6 pm, Monday to Friday • 8 am to 1 pm, Saturdays. The proposal will require work outside these hours for the installation of the watermain along Tongarra Road to minimise traffic disruptions. Potential impacts associated with out-of-hours work are assessed in Section 4 of this report.
Proposal timing	Construction of the proposal change is expected to start mid-2026 and take about 18 months.
Operational requirements	Sydney Water will maintain operational assets which may involve excavation for access. Maintenance activities will be undertaken in line with Sydney Water's existing maintenance procedures.

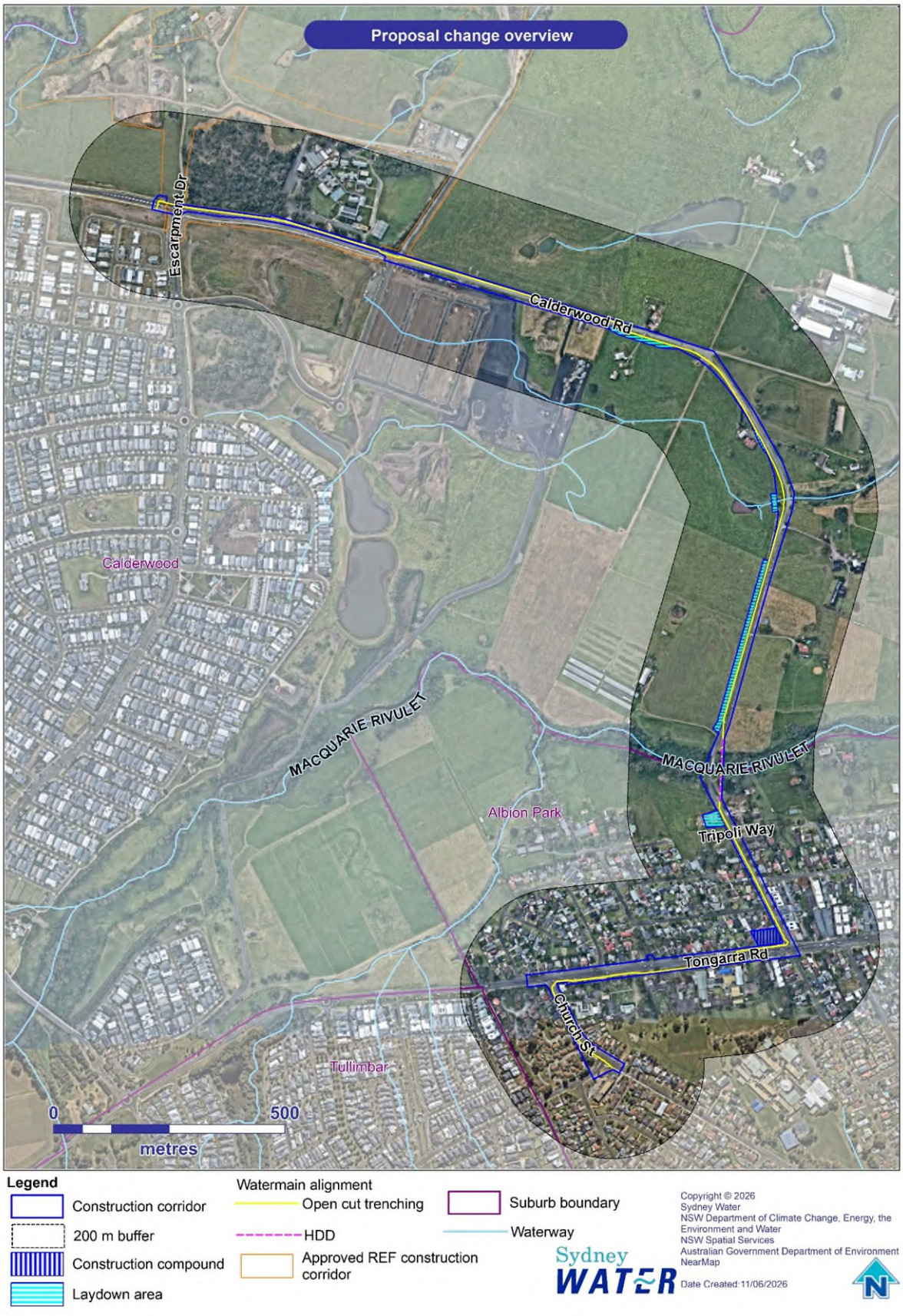


Figure 1-1 Proposal change overview

1.2 Assessment area and changes to the scope of work

The construction corridor for the proposal comprises all areas directly impacted by the proposal. It includes the proposed watermain alignment, laydown areas, and the construction compound.

The study area encompasses the broader environment surrounding the proposal area including adjacent residential areas, public open space, waterways, vegetation, and heritage features, where indirect impacts may occur.

The proposal shown in this REFA is indicative and based on the latest concept design at the time of REFA preparation. The final proposal may change based on detailed design and/ or 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.

2 Consultation

2.1 Community and stakeholder consultation

The proposal change will result in additional impacts to:

- Shellharbour City Council
- developers
- property owners and adjacent residential receivers impacted by the proposal change.

A summary of recent consultation performed for the proposal is detailed in Table 2-1. Consultation with all key stakeholders will be ongoing throughout construction.

Table 2-1 Consultation summary

Stakeholder	Consultation type
Shellharbour City Council	Monthly meetings have been undertaken to discuss: • impacts to Council owned roads • timing of works • traffic management.
Developers	Weekly meetings have been undertaken to discuss: • review of watermain design (alignment to follow future road corridor being delivered by the developer) • traffic management • use of developer permits and approvals (e.g. AHIPs) • construction timeframes • coordination of consultation with private property owners.
Impacted property owners	Individual consultation has been undertaken with impacted private property owners including letter box drops and doorknocking. Adjacent property owners will be notified of the proposal change in accordance with the approved REF.

2.2 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 (specified in the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP). Consultation was undertaken with Shellharbour City Council on 5th May 2026 in accordance with the TISEPP section 2.10(1)(e) and 2.10(1)(f) as works will impact council related infrastructure and services. Impacts related to these TISEPP sections include:

- temporary partial lane closures of council owned roads (Calderwood Road, Church Street)

- excavating within the current road verge and road corridor of these roads.

No response has been received from Shellharbour City Council to date. Sydney Water will continue to consult with Shellharbour City Council. Any future response about the work in the roads and lane closures will be managed in line with the Community and Stakeholder Engagement Plan.

3 Legislative requirements

Additional legislative requirements above those already assessed in the approved REF are detailed in Table 3-1 and Table 3-2.

Table 3-1 Environmental planning instruments relevant to the proposal change

Environmental Planning Instrument	Relevance to proposal
Shellharbour City Local Environmental Plan 2013 (Shellharbour City LEP)	The proposal will be located within the Shellharbour City LGA. The proposal is located on land zoned RU1 Primary Production, RU6 Transition, R2 Low Density Residential, E1 Local Centre, SP2 Infrastructure, and RE1 Public Recreation under the Shellharbour City LEP. Land zoning is shown in Figure 3-1.
State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)	Clause 2.159(1) of the TISEPP permits development by or on behalf of a public authority for water reticulation systems without consent on any land. As the proposal is for a watermain, which is a water reticulation system, and Sydney Water is a public authority, the proposal is permissible without consent.
State Environmental Planning Policy (Precincts – Regional) 2021 (Precincts – Regional SEPP)	The proposal is partially located within the Calderwood State significant precinct as prescribed in Appendix 5 of the Precincts – Regional SEPP. The proposal intersects a small area of land zoned as B4 Mixed Use under this SEPP. Land zoning and the Calderwood State significant precinct boundary is shown in Figure 3-1. Clause 12 of Appendix 5 identifies the permissibility of land uses within the B4 land zoning. Water reticulation systems are not specifically identified, meaning that the works would be permissible with consent under Clause 12(3). However, clause 31 (1) of Appendix 5 (State significant precinct – Calderwood site) states that the Appendix does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development that is permitted to be carried out with or without development consent or that is exempt development under TISEPP, Chapter 2. Accordingly, the proposal remains permissible without consent under the TISEPP Chapter 2 clause 2.159(1).

Table 3-2 Consideration of key environmental legislation

Legislation	Relevance to proposal
Water Management Act 2000	All dewatering activities require an approval under Section 91B of the *Water Management Act 2000*. Section 60A of the Act states that it is an offense to take water without a licence. Dewatering of groundwater from excavations is expected during construction. Sydney Water will acquire a Water Supply Works Approval (WSWA) for the proposal.

Legislation	Relevance to proposal
	A WSWA application was submitted to NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 20 May 2026 to extract up to 14 megalitres (ML) of groundwater. Impacts to groundwater are further discussed in Section 4.1.2.

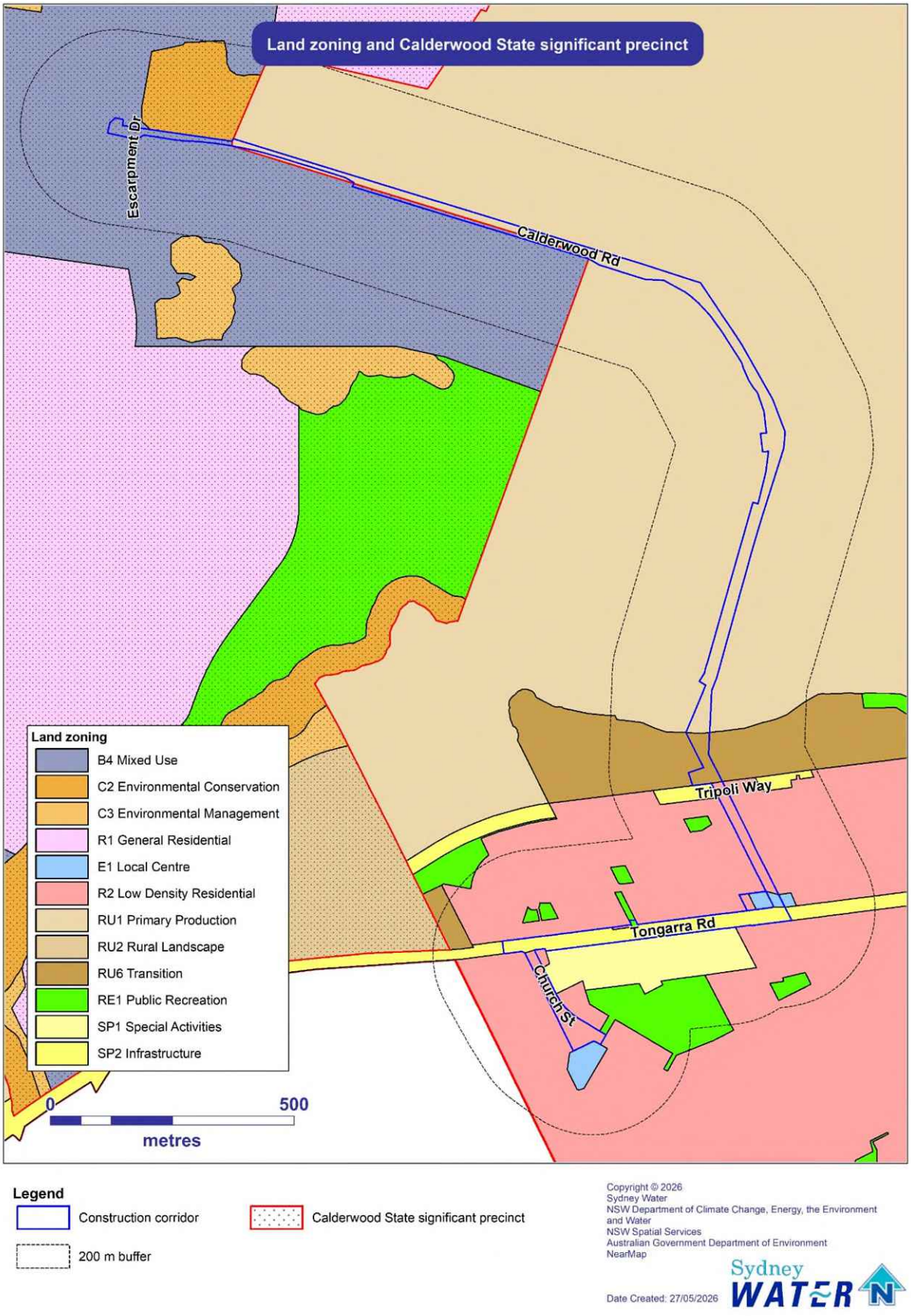


Figure 3-1 Land zoning and Calderwood State significant precinct

4 Environmental assessment

The environmental impacts checklist (SWEMS0019.01) was considered for the proposal change. Table 4-1 details the aspects assessed in the approved REF and if additional environmental assessment was required due to the proposal change.

Table 4-1 Environmental aspects that require additional environmental assessment

Environmental aspect	construction impact	operational impact	specialist assessment	Relevant document
Topography, geology and soils	✓	-		Section 4.1.1
Water and drainage	✓			Section 4.1.2
Flora and fauna	✓	-	-	Section 4.1.3
Heritage – Aboriginal	-	-	✓	Section 4.1.4, Appendix C
Heritage – Non - aboriginal	✓	-	-	Section 4.1.5
Noise and vibration	✓	-	✓	Section 4.1.6, Appendix D
Air quality and energy	-	-	-	Approved REF
Waste and hazardous material	-	-	-	Approved REF
Traffic and access	✓	-	-	Section 4.1.7
Social and visual	-	-	-	Approved REF
Cumulative and future trends	✓	-	-	Section 4.1.8

4.1 Environmental aspects, impacts and safeguards

4.1.1 Topography, geology and soils

Existing environment and potential impacts

The proposal area is characterised by Fairy Meadow (SWfa) and Albion Park (ERap) soils.

About 1 km of the construction corridor along Calderwood Road is located within an area mapped as acid sulfate soils with a low probability of occurrence, as shown in Figure 4-2. Despite the low likelihood, there remains potential that excavated material may require treatment. If not adequately managed, construction activities could expose acid sulfate soils, resulting in the formation of sulphuric acid. This may adversely affect water quality and lead to broader environmental impacts.

The proposed construction compound is located in an area identified as being affected by potential soil contamination, as listed on the NSW EPA Register of Notified Sites. This listing relates to the former service station at 1 Calderwood Road (refer Figure 4-1 and Figure 4-2). The site is not currently subject to regulation under the *Contaminated Land Management Act 1997* and is fenced and vacant as shown in Figure 4-1.

Potential impacts associated with contamination include the disturbance and mobilisation of contaminated soils encountered during construction which could pose risks to human health and the environment. The compound site has been designed to avoid ground disturbance. A layer of geofabric and dense graded base (DGB) will be placed down prior to site establishment within the identified contaminated area.

Open cut trenching will be carried out in the road verge adjacent to the contaminated area, as shown in Figure 4-2. Soil sampling was undertaken in May 2026 in the road verge immediately east and south of the contaminated site. The results indicated that the soil can be classified as General Solid Waste in line with the *NSW EPA (2014) Waste Classification Guidelines, Part 1: Classifying Waste*. These soils are considered suitable to be returned to the place of excavation.

Figure 4-1 Former service station at 1 Calderwood Road (source: Nearmap, 2026)





Figure 4-2 Soils

Mitigation measures

Potential impacts can be adequately managed by the application of mitigation measures from the approved REF and with the implementation of the mitigation measures below.

Table 4-2 Environmental mitigation measures – topography, geology and soils

Mitigation measures
No ground disturbance within the former service station site. Geofabric and a layer of dense graded base (DGB) will be placed prior to works occurring.
A pre- and post-construction land condition assessment of the former service station site (1 Calderwood Road) will be undertaken to identify and manage any potential impacts resulting from construction activities.

4.1.2 Water and drainage

Existing environment and potential impacts

Waterways

The proposal alignment intercepts two waterways, an unnamed tributary on Calderwood Road and Macquarie Rivulet (Figure 4-3). Macquarie Rivulet is a 5th order Strahler stream and mapped Key Fish Habitat (KFH). This section of the proposal will be underbored to avoid impacts to the waterway.

The unnamed tributary is an ephemeral, 2nd order Strahler stream which has been partially modified and is a tributary of Macquarie Rivulet. The proposal change includes open cut trenching this tributary. Temporary instream structures may be required to protect the work area within the waterway. These structures include coffer dams and shoring boxes. A bypass to divert water flow may also be required.

Open cut trenching of the tributary has the potential to cause increased scouring and erosion. This can lead to sedimentation impacting water quality and aquatic fauna, if not appropriately managed. The temporary instream structures have the potential to impact the hydrologic and geomorphic function of a waterway affecting flows, bed and bank stability.

Groundwater

Geotechnical information on groundwater levels indicate that the proposal will intercept groundwater and that dewatering will be required. An Inflow and Drawdown Assessment has been prepared by the delivery contractors for the proposal which found that the total inflow volume required for dewatering activities is 14 ML. The maximum groundwater drawdown distance from excavations is 70 m.

Groundwater dependent ecosystems (GDE's) can be impacted by dewatering. Extensive, ongoing, and prolonged dewatering could deplete water dependant systems affecting the ecosystem integrity and reduce habitat. It can also cause the surrounding ground to lose structural integrity resulting in ground settlement.

There are two GDE's mapped within the construction corridor, being the South Coast Floodplain Grassy Swamp Forest and the Coastal Creekflat Layered Grass-Sedge Swamp Forest. These GDE's are not defined as High

Priority under the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 and have low-medium ecological value (HEVAE).

The Inflow and Drawdown Assessment (D4C, 2026) (Appendix E) indicates that impacts to GDE are unlikely, however the proposal change has potential to impact GDE if not properly managed. Groundwater monitoring at sensitive GDE locations is recommended during construction in line with the approved REF. Details will be included in the Dewatering Management Plan.

The extraction of groundwater can only occur with approvals (WSWA) as per section 91B of the *Water Management Act 2000*. Sydney Water lodged an application for a WSWA on 20 May 2026 with DCCEW. Dewatering activities will be carried out in accordance with the Dewatering Management Plan and WSWA. No groundwater extraction is anticipated during open cut trenching adjacent to the former service station. Should groundwater be encountered, which is considered unlikely, groundwater will be collected and disposed of as liquid waste.

Mitigation measures

Potential impacts can be adequately managed by the application of mitigation measures from the approved REF with the implementation of the mitigation measures below.

Table 4-3 Environmental mitigation measures – water and drainage

Mitigation measures
In the unlikely event that groundwater is encountered adjacent to the former service station, the groundwater will be collected and disposed of as liquid waste.

4.1.3 Flora and fauna

Existing environment

Vegetation communities

A review of the State Vegetation Type Map (SVTM) identified the following 4 plant community types (PCTs) with associated Threatened Ecological Communities (TECs) within or directly adjacent to the construction corridor (refer Figure 4-3):

- PCT 3330: South Coast Lowland Woollybutt Grassy Forest (has associated TEC)
- PCT 3077: Illawarra Complex Dry Rainforest (has associated TEC)
- PCT 3078: Illawarra Lowland Wet Vine Forest (has associated TEC)
- PCT 3056: Central Eastern Ranges Riparian Dry Rainforest (has associated TEC)

The proposal will not be carried out in a declared area of outstanding biodiversity value.

Threatened flora and fauna

A review of BioNet Atlas show recent sightings (within 200 m of the proposal) of the Grey-headed flying fox (*Pteropus poliocephalus*) (vulnerable under the BC Act) and the Southern Greater Glider (*Petauroides volans*) (endangered under the BC Act). There is also a 2025 record of the koala (*Phascolarctos cinereus*) (endangered under the BC Act) within 1 km of the proposal. There are no current flora records within 200 m of the proposal. Threatened flora and fauna records are shown in Figure 4-3.

Aquatic and riparian habitats

As detailed in Section 4.1.2, the proposal crosses two waterways. No threatened freshwater fish species are mapped by the NSW DPI Fisheries Spatial Portal (DPI 2026) to occur within the waterways within the construction corridor.

GDEs are mapped in the construction corridor and are discussed in Section 4.1.2.

4.1.3.1 Potential impacts

During construction, we will clear mostly exotic vegetation and some native vegetation, including the removal of about 6 shrubs/ trees around the unnamed tributary (shown in Figure 4-4).

A portion of this impacted vegetation is mapped in the SVTM as PCT 3077 Illawarra Complex Dry Rainforest with associated TECs. There is also a medium value GDE associated with the South Coast Floodplain Grassy Swamp Forest. The vegetation is dominated by weeds and has a low ecological value. A species impact statement is not required for the works.

All vegetation removal will be offset in accordance with the Approved REF.



Figure 4-3 Ecology

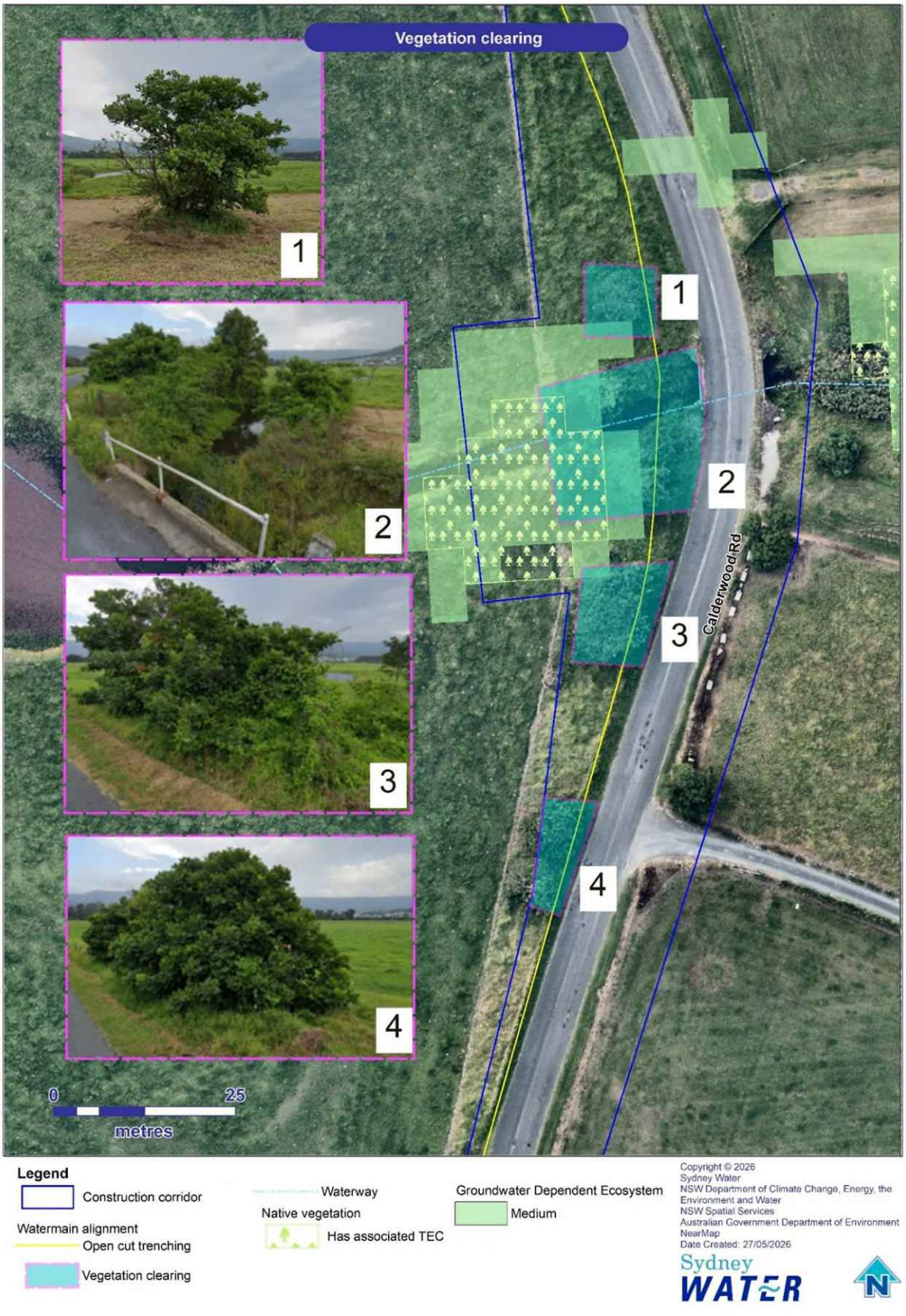


Figure 4-4 Vegetation clearing

4.1.3.2 Mitigation measures

Potential impacts can be adequately managed by the application of mitigation measures from the approved REF and with the implementation of the mitigation measures below. Residual impacts to flora and fauna are expected to be low and any vegetation removal, including removal of the 6 shrubs/ trees around the unnamed tributary, will be offset in accordance with the approved REF.

Table 4-4 Environmental mitigation measures – flora and fauna

Mitigation measures
No clearing of native vegetation is permitted within Macquarie Rivulet.

4.1.4 Aboriginal heritage

This REFA is supported by an Aboriginal heritage due diligence assessment (AHDD) prepared by Kelleher Nightingale Consulting Pty Ltd (KNC) and is provided in Appendix C. The AHDD was prepared in accordance with the *Heritage NSW Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (OEH, 2010).

Existing environment

Desktop assessment

The proposal is located within landform features (within 200 m of waterways) which are likely associated with Aboriginal occupation/ activity.

The Aboriginal Heritage Information Management System (AHIMS) contains information and records of registered Aboriginal archaeological sites and declared Aboriginal places in NSW. An AHIMS search was conducted on 17 April 2026 by KNC ([redacted]), which found the following records within the search area:

- [redacted]
- [redacted]

[redacted] Desktop assessment did not identify any Aboriginal heritage items or Aboriginal archaeological sites within the construction corridor.

Aboriginal Heritage Impact Permits

The construction corridor intersects land that has been previously assessed for Aboriginal cultural heritage values [redacted].

[redacted]

[redacted]

Site inspection

The construction corridor was visually inspected on 23 April 2025 by KNC. The visual inspection identified that most of the construction corridor has been disturbed by existing roads and associated infrastructure.

[redacted]

Potential impacts

[redacted]

In line with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (OEH, 2010), KNC have concluded that the proposal can proceed with caution.

Aboriginal heritage information must not be made publicly available or be published in any form or by any means by Sydney Water or our contractors / joint ventures, unless where approval has been sought from the AHIMS Registrar and provided in writing to Sydney Water.
Sydney Water has removed this information out of respect for Aboriginal cultural heritage and the Aboriginal community

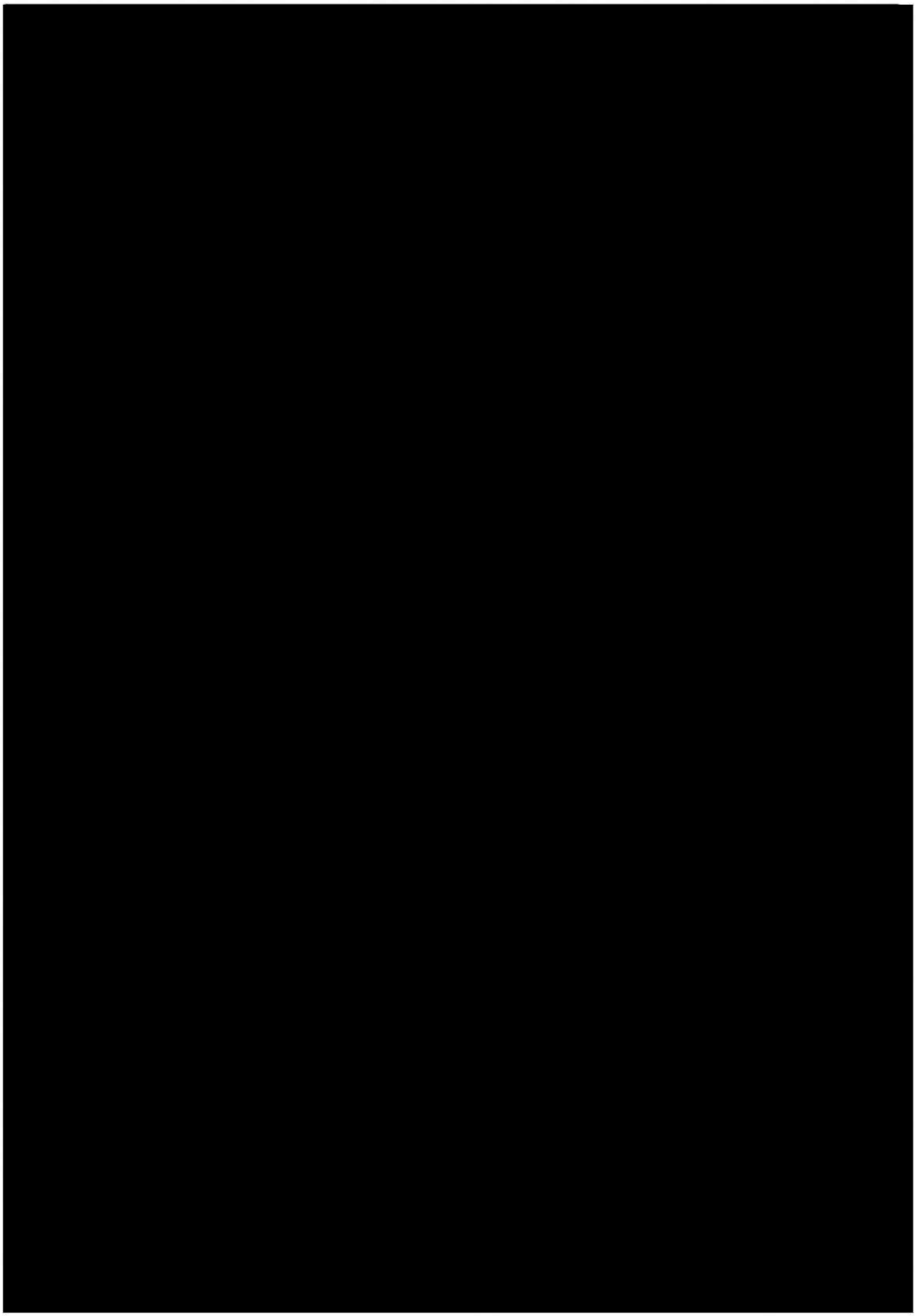


Figure 4-5 Aboriginal heritage

4.1.4.1 Mitigation measures

Potential impacts can be adequately managed with the application of mitigation measures from the approved REF and with the implementation of the mitigation measures below.

Table 4-6 Environmental mitigation measures – Aboriginal heritage

Mitigation measures
[redacted]

4.1.5 Non-Aboriginal Heritage

Existing environment and potential impacts

The proposal is located within the curtilage of 3 local heritage items listed under the Shellharbour LEP 2013, as shown on Figure 4-7:

- Tulkeroo & Albion Park Butter Factory (former) (Item I001), 23 Calderwood Road
- St Andrew's Presbyterian Church and tree (Item I012), 250 Tongarra Road
- Anglican and Roman Catholic cemeteries (Item I014), 247–253 Tongarra Road.

The proposal will occur within the road verge and along the edge of the curtilage of Items I012 and I014.

The Presbyterian Church is of local heritage significance as a substantially intact Federation Gothic-style church, constructed in face brickwork and dating from the mid-19th century.

The construction corridor also extends beyond the road verge to use a laydown area within Item I001. The former Tulkeroo & Albion Park Butter Factory is of local heritage significance, the buildings represent early cooperative practices among local dairy farmers and the development of perishable goods manufacturing in the Illawarra region. Figure 4-6 demonstrates that this area proposed as a laydown area has been highly disturbed by recent construction activities. No additional disturbance is proposed within the curtilage of Item I001 and impact to the heritage value of this site not expected.

The proposal is also located directly adjacent to the curtilage of All Saints Anglican Church and tree (Item I015), 253 Tongarra Road. The Anglican Church is of local significance as a 19th century Yellow Rock sandstone building designed in the Gothic Revivalist style. The Anglican Church and most of its headstones and monuments remain intact.

The proposal will not directly impact the heritage values of these items. Potential indirect impacts from vibration may occur during construction which is discussed in Section 4.1.6.

Figure 4-6 Area of disturbance within the former Tulkeroo & Albion Park Butter Factory (Source: Nearmaps, 2026)

October 2024	April 2025	May 2026



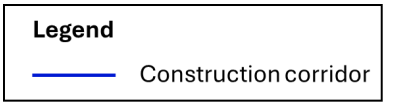




Figure 4-7 Local heritage

Mitigation measures

Potential impacts can be adequately managed with the application of mitigation measures from the approved REF and with the implementation of the mitigation measures detailed in Section 4.1.6.

4.1.6 Noise and vibration

This REFA is supported by a noise and vibration impact assessment (NVIA) prepared by GHD Pty Ltd (GHD) and is provided in Appendix D.

The NVIA assesses the potential construction noise and vibration impacts from the proposal change in line with the following guidelines:

- Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Noise Policy for Industry (NPfI) (NSW EPA, 2017)
- Assessing Vibration: a technical guideline (NSW EPA, 2017)
- NSW Road Noise Policy (RNP) (DECCW, 2011).

Existing environment

The study area includes 3,667 sensitive receivers within Calderwood and Albion Park.

For the purposes of the NVIA, the study area was divided into the following 4 noise catchment areas (NCAs) that share similar acoustic environments and baseline background noise levels:

- NCA01: residential development to the south-west of the study area along Church Street and surrounding streets south of Tongarra Road.
- NCA02: residential development to the south-east of the study area surrounding Tongarra Road (Illawarra Highway).
- NCA03: semi-rural area to the north-east of the study area and surrounding Calderwood Road. This NCA includes the Macquarie Rivulet HDD crossing and creek crossing work areas.
- NCA04: residential development to the north-west of the study area in the Calderwood Valley estate (Bushranger Parade and surrounding streets).

Background noise monitoring was undertaken by GHD at 4 locations representative of each NCA over a period of 2 weeks in March 2026. The location and results of the noise monitoring are summarised in Table 4-7 below.

Table 4-7 Background noise monitoring results

NCA (location)	Background noise descriptors[1] $L_{A90(Period)}$, dBA			Ambient noise descriptors[1] $L_{Aeq(period)}$, dBA		
	Day	Evening	Night	Day	Evening	Night
NCA01 (2D Church Street, Albion Park)	45	43	42	65	62	58
NCA02	49	41	36	62	60	58

NCA (location)	Background noise descriptors[1] $L_{A90(Period)}$, dBA			Ambient noise descriptors[1] $L_{Aeq(period)}$, dBA		
(226 Tongarra Road, Albion Park)						
NCA03 (74 Calderwood Road, Calderwood)	37	39	36	51	63	46
NCA04 (34 Bushranger Parade, Calderwood)	39	41	37	52	59	46
1. The time periods are defined as follows: Day: 7:00am to 6:00pm Evening: 6:00pm to 10:00pm Night: 10:00pm to 7:00am						

Assessment criteria

Section 3 of the NVIA (refer Appendix D) provides a detailed description of the following assessment criteria which informed its findings and recommendations:

- Construction noise management levels
- Sleep disturbance screening criteria
- Construction traffic noise criteria
- Construction vibration criteria (human comfort, cosmetic damage, and ground-borne noise).

Construction noise management levels at sensitive receivers are provided in Table 4-8 below. The noise perception categories are also provided in Table 4-9.

Table 4-8 Construction noise management levels

Receiver type	Noise management levels, $L_{Aeq,15\ min}$ dBA				
	Standard recommended hours		Outside recommended hours		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential (NCA01)	55	75	50	48	47
Residential (NCA02)	59	75	54	46	41
Residential (NCA03)	47	75	42	42[2]	41
Residential (NCA04)	49	75	44	42[2]	42
Educational facilities	55 (external) – when in use[1]				
Active recreation areas	65 (external) – when in use				

Passive recreation areas	60 (external) – when in use
Places of worship	55 (external) – when in use[1]
Commercial	70 (external) – when in use
Industrial	75 (external) – when in use

Note 1: Based on 10 dB attenuation through an open window to achieve an internal level of 45 dBA
Note 2: The NPfI recommends that the evening level be set at no greater than the level for day and that the night level be set at no greater than the level for day or evening.

Table 4-9 Construction noise perception categories

Noise perception category	Noise level range above NML Standard hours	Outside standard hours – day, evening and night
Moderately intrusive	10 dBA to 20 dBA above NML	15 dBA to 25 dBA above NML
Highly intrusive	More than 20 dBA above NML	More than 25 dBA above NML

Potential impacts

Construction noise scenarios

Based on the construction methodology, 15 construction noise scenarios have been developed by GHD to capture expected impacts during works as shown in Table 4-10. Scenario activity sound power levels have been determined based on the loudest equipment item expected to be operational during the activity.

Most of the construction work will be carried out during standard construction hours. Out-of-hours works will be required for connections and tie-ins (CS09), intersection works along Tongarra Road (CS11), HDD pipe installation (CS14), and activities supported by the construction compound (CS15).

The overall construction program is anticipated to be 18 months in duration. HDD activities are expected to take 3 months, with the out-of-hours string pulling activity to require 1 day of works. Other out-of-hours works such as for intersection works and tie ins are anticipated to be similarly short in duration.

Table 4-10 Construction noise scenarios

Phase	Activity	Scenario ID	Loudest equipment item	Modelled area	Activity SWL dBA	Construction hours
Excavation and pipelaying	Excavation	CS01	Vacuum truck	Modelled across	109	Standard

Phase	Activity	Scenario ID	Loudest equipment item	Modelled area	Activity SWL dBA	Construction hours
	Backfilling works	CS02	Compactor	alignment area. Limited to road surface areas in built up areas	107	Standard
	Pipe installation	CS03	Concrete agitator truck		109	Standard
Creek crossing excavation	Damming of creek	CS04	Dosing pod	Creek crossing area	109	Standard
	Excavation	CS05	Vacuum truck		109	Standard
	Backfilling works	CS06	Compactor		107	Standard
	Installation of formwork and reinforcement	CS07	Hand tools (electric)		102	Standard
	Pipe installation	CS08	Concrete agitator truck		109	Standard
Connections/tie ins	Excavation, Backfilling and Pipe installation	CS09	Vacuum truck	Both ends of the alignment	109	Out-of-hours night
Excavation and pipelaying Tongarra road	Excavation, Backfilling and Pipe installation	CS10	Vacuum truck	Alignment area at Tongarra Road, limited to road surface areas	109	Out-of-hours day
Excavation and pipelaying Tongarra road intersections	Excavation, Backfilling and Pipe installation	CS11	Vacuum truck	Alignment area within the intersections at Tongarra Road and Calderwood Road and at Church Street	109	Out-of-hours night
Macquarie Rivulet HDD	Excavation	CS12	Excavator	Entry and exit pits	105	Standard

Phase	Activity	Scenario ID	Loudest equipment item	Modelled area	Activity SWL dBA	Construction hours
	Drilling	CS13	HDD drill rig	Entry pit	115	Standard
	Pipe installation (string pull)	CS14	Vacuum truck	Exit pit	109	Standard hours, Out-of-hours night
Construction compound	Construction compound	CS15	Vacuum truck	Construction compound	107	Standard, Out-of-hours Day Evening and Night

Noise impacts during standard hours

Exceedances of noise management levels are predicted at receivers in all four NCAs for all scenarios. Highly noise affected levels are predicted at receivers near the works. For the pipeline, construction noise management level exceedances are predicted for standard daytime hours, with most exceedances being less than 10dB.

The noisiest activities are excavation and pipelaying (CS01 and CS03) (Table 4-11). Noise contours for CS01 are shown in Figure 4-8. Some properties are predicted to be highly noise affected however, this is only expected to be for a short period of time (a few days) as the works progressively move along the pipeline alignment.

Table 4-11 Pipeline construction noise impacts – standard hours

NCA	LAeq NML dB(A)	Maximum LAeq noise level dB(A)	Number of properties where noise levels are expected to exceed the NML			Number of properties which are highly noise affected
			1-10 dB(A) exceedance	11-20 dB(A) exceedance	> 20 dB(A) exceedance	
NCA01	55	85	68	22	24	28
NCA02	59	90	57	30	15	38
NCA03	47	80	10	4	4	2
NCA04	49	62	18	1	0	0

Noise impacts during out-of-hours (night)

During the out-of-hours night period, the highest precited noise level is 80 dBA during the excavation and pipelaying of Tongarra Road (CS11) (Table 4-12). There are 175 receivers predicted to exceed the noise

management level, of which 6 are highly noise affected. The most impacted NCA is NCA02 with 117 exceedances during CS11. Out-of-hours works are required at intersections for worker safety and may take up to several weeks. Mitigation measures were identified in the approved REF to provide respite and manage sleep disturbance. The noise contour for CS11 is shown in Figure 4-10.

Table 4-12 Pipeline construction noise impacts – out of hours night

NCA	LAeq NML dB(A)	Maximum LAeq noise level dB(A)	Number of properties where noise levels are expected to exceed the NML			Number of properties which are highly noise affected
			1-10 dB(A) exceedance	11-20 dB(A) exceedance	> 20 dB(A) exceedance	
NCA01	47	80	32	10	5	5
NCA02	41	76	60	25	9	1
NCA03	41	42	1	0	0	0
NCA04	42	30	0	0	0	0

Sleep disturbance

The number of residential receivers predicted to exceed the sleep disturbance screening criteria for each scenario has been assessed. The sleep disturbance criteria for NCA01is L_{AFMax} 57 dBA and L_{AFMax} 52 for the remaining NCA's. The worst-case scenario for sleep disturbance is CS11 at the Tongarra Road intersections with a total of 130 residential receivers predicted to exceed the screening criteria.

Construction traffic

The predicted increase in road traffic noise levels due to construction traffic generation has been assessed. No exceedances of the 2 dB relative increase criteria are expected as a result of construction traffic.

Construction vibration

Safe working distances have been determined for vibration-intensive equipment. The worst-case vibration-intensive equipment has been assessed as an 18 tonne (t) vibratory roller. 296 receivers are located within the human comfort safe working buffer distances (refer to Section 3.3 of the NVIA) and could be impacted.

A total of 70 receivers are located within the 25 m safe working distance for damage to standard structures for a 18 t vibratory roller. The buffers for construction vibration are shown in Figure 4-9.

A list of sensitive receivers within 25 m of the construction activities is provided in Appendix D of the NVIA. These receivers should be informed of the nature of the works, expected vibration levels, duration of works and a method of contacting Sydney Water to raise complaints.

Local heritage

The German standard *DIN4150-3:2016 vibration in buildings: Effects on structures* to assess (DIN4150) has been used by GHD to assess vibration impacts on heritage items. Based on DIN4150, a guideline velocity value of 3 mm/s has been conservatively adopted.

To identify heritage items with the potential to exceed this guideline value, a heritage survey distance of 3 times the standard structure damage buffer has been utilised (75 m).

Four local heritage items are within 75 m of the construction corridor and have the potential to be impacted by construction vibration while using vibration-intensive plant as listed in Table 4-13 below.

Table 4-13 Distance to local heritage items

Local heritage item	Distance of local heritage item/ structure to:	
	Construction corridor	Watermain alignment
Tulkeroo and Albion Park Butter Factory	16 m	28 m
All Saints Anglican Church and Tree	33 m to church 3.5 m to cemetery	38 m to church 11 m to cemetery
St Andrew's Presbyterian Church and tree	3 m	27 m
Anglican and Roman Catholic cemeteries	45 m to cemetery	52 m to cemetery

With the implementation of the mitigation measures below, vibration impacts to these local heritage items can be adequately managed, and there will be no residual impacts.

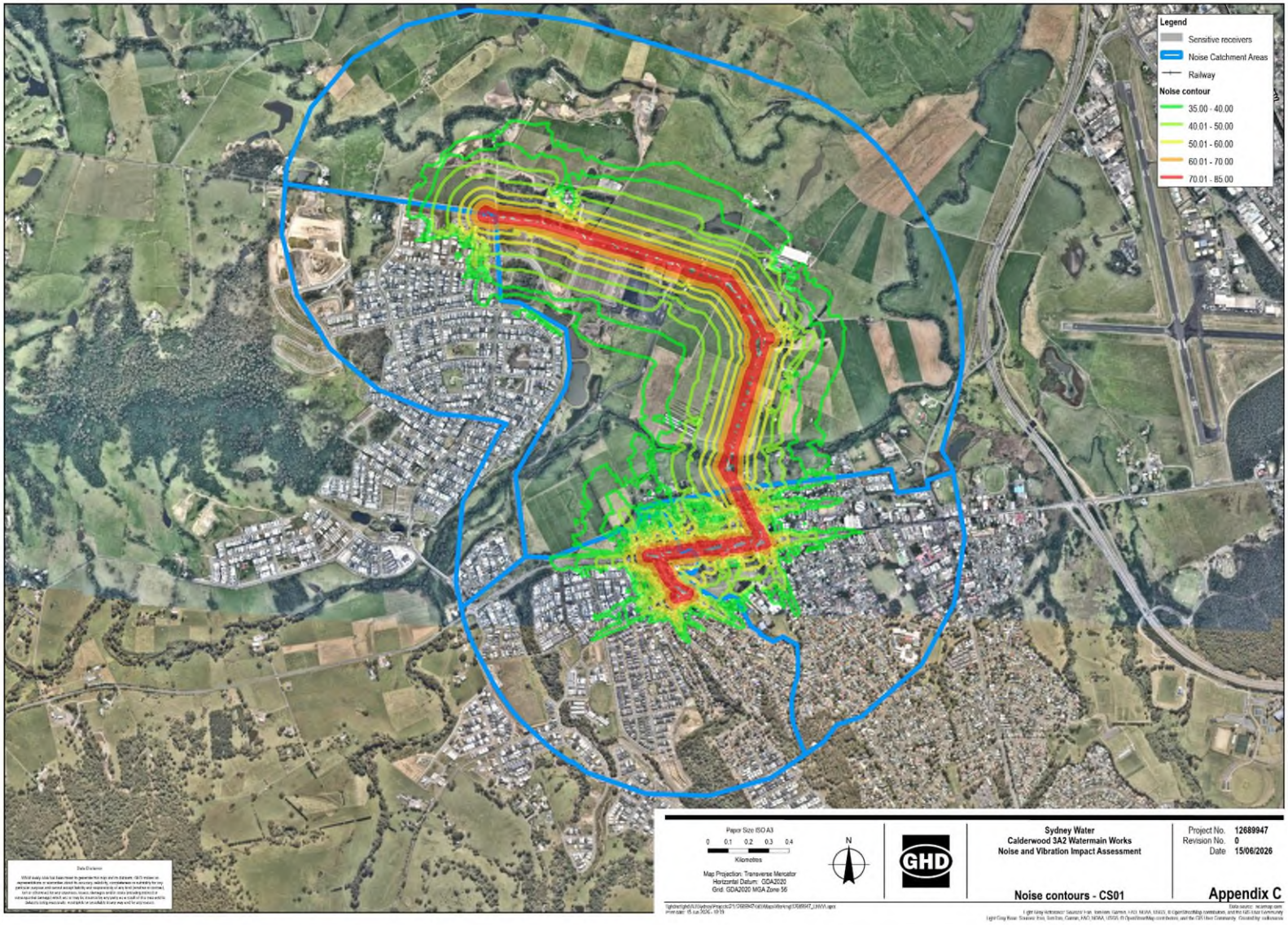


Figure 4-8 Noise contour CS01: excavation, standard hours

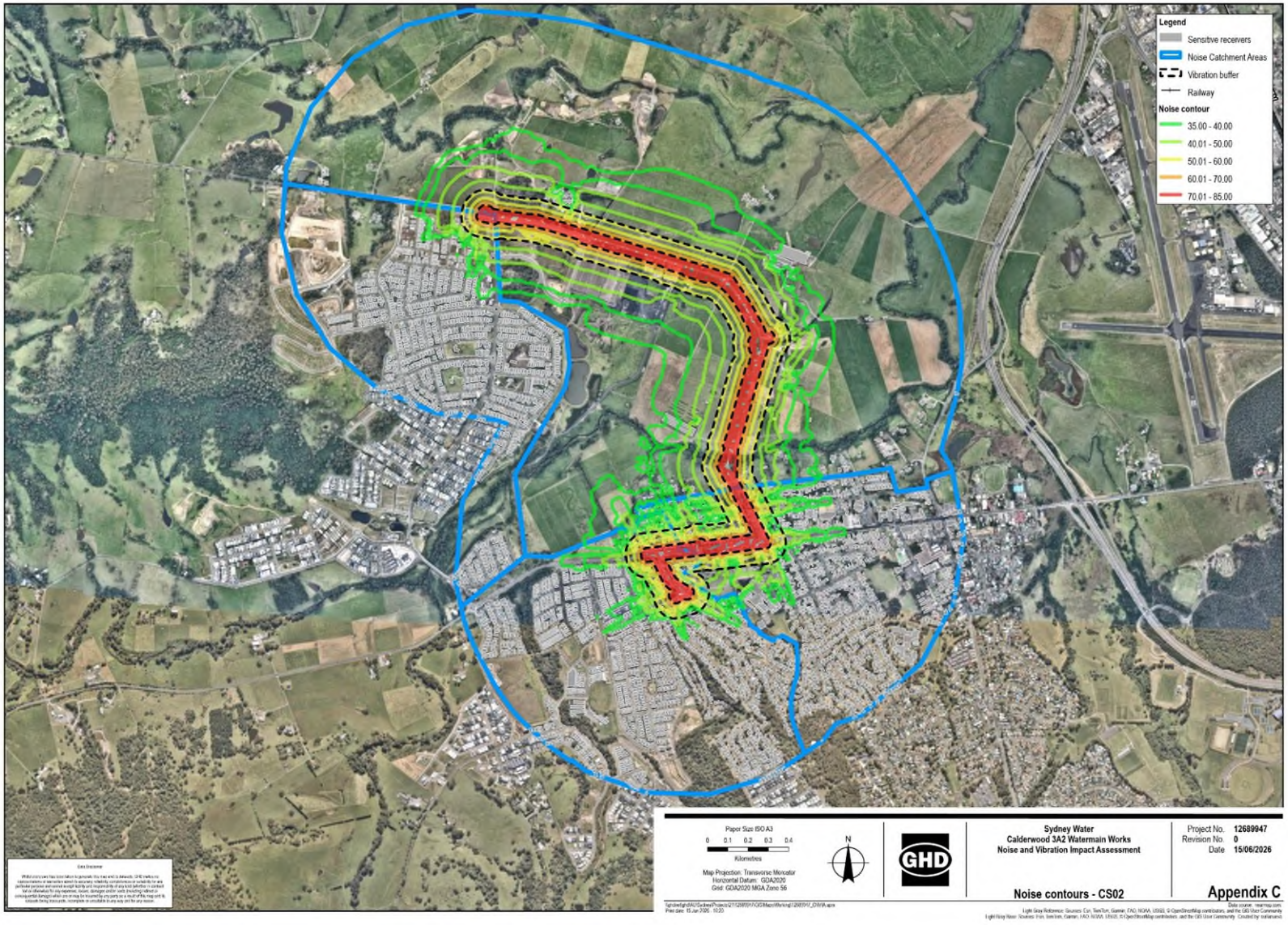


Figure 4-9 Noise contour CS02: Excavation and pipelaying (backfiling works), standard hours



Figure 4-10 Noise contour CS11: Excavation and pipelaying Tongarra road intersections, out-of-hours night

4.1.6.1 Mitigation measures

Potential impacts can be adequately managed by the application of mitigation measures from the approved REF and with the implementation of the mitigation measures below.

Table 4-14 Environmental mitigation measures – noise and vibration

Mitigation measures
Out-of-hours evening activities likely to generate the highest levels of noise would be scheduled to occur at the beginning of the shift (prior to 10 pm, during the 6 pm to 10 pm evening period) to minimise the potential for sleep disturbance.
Where vibration cannot be further mitigated to comply (such as by choosing smaller sized equipment, as detailed in the approved REF), undertake dilapidation surveys for heritage items within the heritage safe work distances. Where structurally sound, apply BS 7385 safe work distances. If structurally unsound apply the DIN 4150 heritage safe working distances. Where heritage structures identified within the safe work distances (following dilapidation surveys and implementing all relevant mitigation measures) are identified, trial vibration monitoring with alarms should be undertaken.

4.1.7 Traffic and access

Existing environment

The proposal would be constructed within the road verges of Calderwood Road, Tongarra Road (Illawarra Highway), and Church Street.

A description of the roads within the construction corridor is provided in Table 4-15. The assumed traffic volumes for these roads are presented in Table 4-16 and are based on the *Tripoli Way Upgrade Noise Impact Assessment* (Cardno, 2021).

Table 4-15 Roads within construction corridor

Road	Lanes	Speed limit	Pedestrian facilities/ active transport/ public transport within construction corridor
Calderwood Road	One lane each way	50 km/h and school zones	No
Tongarra Road (Illawarra Highway)	One lane each way	50 km/h and school zones	Formalised footpath along southern road verge and a section of the northern road verge. There is a bus stop outside All Saints Anglican Church and St Paul's Catholic Primary School. Three bus services are run between 5:46 am and 9:39 pm: • route 75: Shellharbour via Calderwood • route 76: Shellharbour Village via Albion Park • route 77: Shellharbour via Albion Park

Road	Lanes	Speed limit	Pedestrian facilities/ active transport/ public transport within construction corridor
Church Street	One lane each way	50 km/h	Formalised footpath along localised section of the western road verge. There is a bus stop at Church Street opposite Sophia Street for bus routes 76 and 77.

Table 4-16 Existing traffic volumes along transport route (Cardno, 2021 cited in GHD, 2026)

Street	Day 1-hour		Night 1-hour		15-hour day period volume		9-hour night period volume	
	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Calderwood Road	436	37	71	4	6541	553	642	40
Tongarra Road	940	32	206	10	14102	481	1857	88
Escarpment Drive	436	37	71	4	6541	553	642	40

Potential impacts – Construction

Transport route

Construction access to the site would be via Escarpment Drive and Tongarra Road as shown in Figure 4-11. A Heavy Vehicle Permit from the National Heavy Vehicle Regulator (NHVR) would be required for access to Calderwood Road due to an existing 5-tonne load limit. Access via Escarpment Drive is the preferred construction route, as it avoids this restricted route including the bridge crossing over Macquarie Rivulet.

Traffic movements

A range of vehicles would be required to construct the proposal, and this would temporarily increase the number of traffic movements along the road network. Heavy vehicles would be required for the delivery of plant, equipment and materials. During construction planning, the delivery contractor would confirm the number of vehicle movements likely to be required. Vehicles movements would depend on whether work would occur concurrently at multiple work sites.

The following volumes have been assumed during the day and night periods during peak construction:

- Day: 15 heavy vehicles and 12 light vehicles
- Night: 5 heavy vehicles and 4 light vehicles

The on-site workforce is estimated to be about 12 personnel during off-peak construction periods, increasing to up to 30 personnel during peak construction. Where practicable, construction staff would carpool to minimise traffic volumes.

Partial road closures

The proposal would require partial road closures along Calderwood Road, Tongarra Road and Church Street. Works on Tongarra Road would be scheduled during evening and night periods, where feasible, to minimise impacts on traffic. As Tongarra Road is a State road, a Road Occupancy Licence (ROL) would be obtained from TfNSW prior to the commencement of works. Sydney Water will consult with Shellharbour City Council as required by the TISEPP and as described in Section 2.

Sensitive receivers

Construction traffic will have a temporary impact on nearby residents and other sensitive receivers. Partial road closures may impact local schools during pick up/ drop off times and reduce parking availability. Nearby schools with the potential to be impacted by construction are listed in Table 4-17. The Traffic Management Plan will include management measures to minimise traffic impacts on sensitive receivers.

Table 4-17 Nearby schools and potential impact

School	Address	Distance to proposal	School hours
Calderwood Christian School	234 Calderwood Road, Calderwood	Adjacent	Supervision begins at 8:10am and ends at 3:10pm, Monday to Friday
St Paul's Catholic Primary School	247-251 Tongarra Road, Albion Park	Adjacent	Supervision begins at 8:30am and ends 3:15pm Monday to Friday
St Joseph's Catholic High School	16 Macquarie St, Albion Park	350 m south east	Supervision begins at 8:10am and ends 2:40pm, Monday to Friday
Albion Park Public School	Corner of Hamilton Road and Tongarra Road, Albion Park	570 m east	Supervision begins at 8:50am and ends 3:15pm, Monday to Friday
Albion Park Preschool	253 Tongarra Road, Albion Park	Adjacent	Operational hours are 8:00am to 4:00pm, Monday to Friday



Figure 4-11 Transport route

4.1.7.1.1 Mitigation measures

Potential impacts can be adequately managed by the application of mitigation measures from the approved REF and with the implementation of the mitigation measures below. Residual traffic and access impacts are expected to be minor.

Table 4-18 Environmental mitigation measures – traffic and access

Mitigation measures
The delivery contractor will obtain relevant traffic permits, including a Traffic Guidance Schemes for lane closures to be provided to Shellharbour City Council and a Road Occupancy Licence (ROL) from TfNSW. These would be identified in the Traffic Management Plan for the project.
The use of alternative routes is recommended to avoid the restricted route (5-tonne limit on Calderwood Road). If the heavy equipment being brought in requires vehicles other than General Access Vehicles (e.g. oversize/over mass), an application will be required through the National Heavy Vehicle Regulator portal.
Where practicable, construction staff would carpool to site to minimise traffic volumes.

4.1.8 Cumulative and future trends

Potential environmental impacts

The proposal is in an area that is subject to ongoing development which will continue until the completion of the Calderwood Precinct.

Stockland Corporation Limited (Stockland) is planning an upgrade of Calderwood Road. This upgrade includes road widening and reconstruction along the length of the road, upgrades to service infrastructure, and the construction of a new bridge.

Sydney Water has consulted with Stockland during the development of this REFA. The watermain installation associated with this REFA will be undertaken prior to the commencement of the Calderwood Road upgrade works.

Further development is expected in the areas surrounding the proposal, though start dates for these areas is currently unknown, it is expected that the proposal will be completed before these are underway.

There is the potential for cumulative impacts associated with works within the development area, however cumulative impacts are likely to be negligible given the small scale of the proposal change relative to the broader precinct development and its timeline.

A search of Shellharbour City Council's website found the developments/ development applications presented in Table 4-19 which may result in cumulative noise and vibration and traffic and access impacts.

Table 4-19 Nearby developments

DA	Lodgement date (Status)	Description	Address	Applicant
DA0345/2026	14/05/2026 (Current - external referrals required)	Torrens Title Subdivision To Create 208 Residential Lots, One Public Park Lot (Local Park 18), 3 Residue Lots (Including Future School Site, Homestead Lot And Part of Johnston's Spur, Provision Of Utility Infrastructure, Road And Stormwater Drainage, Bulk Earthworks And Landscaping (Stage 7C)	379 Calderwood Road Calderwood	Orion Consulting Engineers Pty Ltd
DA0203/2026	18/03/2026 (Current - internal referrals required)	Embellishment And Civil Works For The Calderwood Urban Development Project (CUDP) 'Sportsground S1' and 7 Lot Torrens Title Subdivision	179 Calderwood Road, Calderwood	SRCP (Calderwood) Pty Ltd
DA0773/2025	13/11/2025 (Current – in progress)	Landscape embellishment of Calderwood Road and associated works including stormwater infrastructure, pedestrian paths, fencing, retaining walls and acoustic walls	258 Calderwood Road, Calderwood	Private
DA0296/2024	16/10/2024 (Approved)	Torrens title subdivision to create 263 residential lots, internal network including local roadways, street lighting, pedestrian walkways and cycle ways, road reserve landscaping, services and stormwater drainage infrastructure, grading for final residential lot levels, landscape shaping, boundary interfaces and roadway level, provision of utility infrastructure and landscaping and associated works (Town Centre East)	179 Calderwood Road, Calderwood	Lendlease Communities (Calderwood) Pty Ltd

4.1.8.1 Mitigation measures

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

Table 4-20 Environmental mitigation measures – cumulative and future trends

Mitigation measures
Liaise with Calderwood precinct developer and other relevant developers within Calderwood to reduce the construction impact due to concurrent work schedules, timing of work, access to site etc.

5 Conclusion

Sydney Water has prepared this REFA to assess the potential environmental impacts of the Calderwood 3A2 Wastewater and Water Servicing. The proposal is required to ensure there is infrastructure to service the planned development of Calderwood within the West Lake Illawarra Growth Area up to 2048.

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

The REFA is consistent with the Approved REF in alignment with the principles of ESD. The proposal change will not result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment.

SW 214 06/26

Appendices

Appendix A – Section 171 checklist

There are no requirements in addition to those considered in the approved REF.

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

TISEPP section	Yes	No
Section 2.15 Consultation with public authorities other than councils		
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 – Aboriginal Heritage

Aboriginal heritage information must not be made publicly available or be published in any form or by any means by Sydney Water or our contractors / joint ventures, unless written approval has been provided to Sydney Water from DPE's AHIMS Registrar .

For publicly displayed REFs, all Aboriginal heritage information that identifies individual sites must be removed.

Appendix D – Noise and vibration

Appendix E – Inflow and Drawdown Assessment