

Review of Environmental Factors Addendum

Phase 2 compliance upgrades – Castle Hill Water Resource Recovery Facility

1 Determination

This Review of Environmental Factors Addendum (REFA) assesses potential environmental impacts of the proposed changes to the compliance upgrade works at Castle Hill Water Resource Recovery Facility (WRRF; the proposal) as approved under the original Review of Environmental Factors (Sydney Water, 2021) and REFA (Sydney Water, 2023; the existing approvals). This 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 to ensure the proposal is carried out as described in this REFA and the existing approvals. Additional environmental impact assessment may be required if the scope of work or work methods described in this REFA change significantly following determination.

Decision Statement

During construction, the main potential environmental impacts of the proposal include impacts on biodiversity and visual amenity. Traffic generated during construction is anticipated to be less than proposed under the existing approvals. Minor local and ongoing impacts associated with visual amenity are anticipated during operation of the proposal. 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. Accordingly, a Species Impact Statement (SIS) 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 REFA and the existing approvals, the proposed work is unlikely to have a significant impact on the environment. Accordingly, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.







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 Regulations (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 and the information it contains is neither false nor misleading.

Prepared by:	Reviewed by:	Reviewed by:	Endorsed by:	Approved by:
Jacob Vickers	Lynne Sheridan	Sarah Mitchell	Yousef Abdel	Murray Johnson
REFA author Element Environment Pty Ltd Date: 14 May 2024	Executive Director Element Environment Pty Ltd Date: 14 May 2024	Senior Environmental Scientist, Sydney Water Date: 14/05/2024	Senior Project Manager Sydney Water Date:14 May 2024	Environment and heritage manager Sydney Water Date 16/05/2024







2 Proposal Summary

Aspect	Detailed description	
Proposal location	190 Wrights Road, Castle Hill, 2154, Hills Shire local government area (LGA; Figure 1) (Legally known as Lot 1, DP 553269 and Lot 21 DP 557319)	
Existing approvals	 Review of Environmental Factors North West Treatment Hub Castle Hill and Rouse Hill Water Recycling Plants Compliance Upgrade (August, 2021) 	
	 Review of Environmental Factors Addendum Northwest Hub Phase 2 Program – Castle Hill 2024 Compliance Project (May, 2023) 	
Approved scope	The proposal was originally approved under an REF (Sydney Water, 2021), which includes upgrades to the Castle Hill WRRF and Rouse Hill WRRF to ensure continued compliance with environmental regulatory frameworks as the region develops. Specifically, the upgrades at Castle Hill WRRF include:	
	 Installing inlet works (including screening and grit removal). 	
	• Replacing existing infrastructure such as the primary sedimentation tank cover.	
	• Upgrading existing systems such as the reclaimed wastewater system.	
	 Installing new infrastructure such as pumps, tanks, dosing systems, storage, pipelines, facilities, and an additional discharge main (~125 m) to Cattai Creek. 	
	Demolishing redundant infrastructure.	
	Additional scope items were approved for the proposal under a REFA (Sydney Water, 2023), which included the following modifications to the approved Castle Hill WRRF proposal:	
	Dewatering and infilling decommissioned lagoon.	
	Installing a high voltage (HV) power cable.	
	Changing the location of a HV switch room.	
	Figure 2 shows the extent of approved project area that was assessed under the existing approvals (the approved project).	
Proposal change	Sydney Water identified several modifications to the approved project that require assessment and approval under Division 5.1 of the EP&A Act. These modifications are limited to the Castle Hill WRRF and include the following (see Figure 3) :	
	 Demolition of two electrical transformers and construction of a new maintenance shed and two car parking spaces in its place. 	
	 Establishment of a three-metre electrical easement and a temporary construction access road along the western boundary of the site. 	





Detailed description

Aspect

- Relocation of the approved wastewater discharge main and headwall.
- Relocation of first flush system and new overflow discharge outlet in Cattai Creek.
- Construction of a bypass pipeline in the north-eastern section of the plant.
- Extension of approved project area to provide space for installing Ultra Filtration pipes on the western boundary.
- Raising the design height of two pipe bridges

Construction is anticipated to commence in the second quarter of 2024 with works prioritising the construction of the wastewater discharge main pipeline and the temporary construction access road. All other construction works are anticipated to commence in the second or third quarter of 2024.

Demolition of electrical transformers

Two redundant electrical transformers and associated power poles and overhead cables, along with the concrete paving foundation will be dismantled and disposed of off-site.

Following the removal of demolition waste the site will be prepared for the construction of a new maintenance shed and two new car parks. The shed will be constructed with Colourbond cladding or precast concrete via tilt-up construction. The two new car parks will be established adjacent to the new maintenance shed on the eastern side of the internal road.

The location of these works is outside the boundary of the approved project, but does not include any additional impacts to vegetation.

Electrical easement and temporary construction access

The existing project requires an electrical easement on the western site boundary, however this was omitted from the scope of the existing approvals. Works associated with the electrical easement are almost exclusively within the boundary of the approved project, with the exception of a small parcel of land.

Establishment of the easement will involve the removal of vegetation, trenching, and installation of electrical cables. The easement will remain cleared to ensure access can be maintained.

A temporary construction access road will be required on the western boundary to provide separate site access for construction traffic during construction of the new western internal road approved under the existing proposal. A range of services will be installed alongside the western internal road, including dual high voltage incoming conduits and pit system, stormwater, recycled water pipeline and a load shedding pipe. The temporary construction access road will separate operational and construction traffic to allow operational traffic to continue to





Aspect

Detailed description

enter, exit and circulate the site unhindered whilst maintaining safe working environments for both operational and construction vehicles.

Construction of the temporary access road will include the removal of vegetation and the importation, placement and compaction of stable material such as gravel or road base. The temporary access road will be removed upon completion of construction, and all disturbed areas associated with the temporary access road will be rehabilitated to its original condition or better.

The western boundary of the approved project will be extended to accommodate both the electrical easement and the temporary construction access road.

Relocation of wastewater discharge main

The existing approvals include an additional ~125 metre (m) wastewater discharge main north of the northern site boundary with a headwall in Cattai Creek, which will require the removal of up to 0.157 ha of Sydney sandstone hinterland dry sclerophyll forest (PCT 1255 – now decommissioned, see Section 5).

The proposed changes include the shortening and relocation of this wastewater discharge main from the northern boundary to the western boundary, where it will extend approximately 20 m from the approved project boundary. The new alignment will be advanced via micro tunnelling and an approximately 20 m wide clearance corridor will be required to provide access to the creek for the installation of the wastewater discharge structure and scour protection.

The relocation of the headwall to an upstream location within the waterway will have equivalent impacts on water quality to that of the approved project. The relocation and shortening of the wastewater discharge main will reduce impacts to vegetation, visual amenity of the nearby walking track and noise impacts to residential receivers.

Relocation of first flush system and new stormwater outfall

The approved project design includes a first flush detention system adjacent to the UF flocculant tank, however Sydney Water identified engineering constraints that required the relocation of the first proposed flush detention system.

The proposed changes include relocating the first flush detention system from the UF flocculant tank to near the anoxic tank at the western boundary where the new internal access road is being constructed, installing a new overflow pipe and headwall within Cattai Creek.

The new first flush pit will have a capacity of 60,000 litres and service a catchment area of 9,955 m2. Captured water will be pumped back into the WRRF treatment process. If the first flush system overflows during heavy rain events, excess stormwater will be discharged directly to Cattai Creek via the proposed stormwater overflow discharge pipe. The overflow pipe will be micro tunnelled to Cattai Creek where a new headwall and scour protection will be installed, which may require rock hammering.







Installation of the bypass pipework will involve excavation of a three-metre trench along the north-eastern boundary of the approved project, laying of the 900 mm diameter nominal (DN) bypass pipeline, backfilling and compaction. The boundary of the approved project follows the centreline of the proposed pipeline, which does not allow sufficient space for an adequate construction corridor associated with the deep excavation. As such, additional space is required to ensure the excavation and associated erosion and sediment controls will be wholly within the approved boundary of the proposal. The area is within the treatment plant boundary. The pipeline and concrete manhole will be constructed via a 30-tonne excavator fitted with a rock hammer and a tipper. The excavation will require shoring whilst the pipe is being laid. Nightworks will be required to activate the new pipeline. Ultra filtration pipes The proposal footprint will be expanded to the west of the existing filter block in the north-western portion of the site to lay additional pipes for Ultra Filtration (UF). These pipes include UF pipework (DN500) that feeds the flocculant tank, UF feed pipe to UF strainers (DN500), chemical dosage pipe (DN100) and associated pits, and stormwater return to the foul water tank from the UF area (DN450). Raising design height of pipe bridge Sydney Water have identified an access constraint with the current design of two on-site pipe bridges. The current design height of 5 metres is insufficient to allow passage for operational vehicles, and as such will be raised to 7 metres. These works are within the existing approved boundary. Justification for proposal Some aspects of the proposal are required to include scoped work activities that change were omitted in the existing approvals, such as the removal of electrical transformers and the construction of the maintenance shed, carparking spaces and the electrical easement. The proposed temporary construction access is required to allow separation between construction and operational vehicles, reducing constraints and improving efficiencies and safety during entry, exit and internal circulation of vehicles. The wastewater discharge main will be shortened and relocated to a more efficient and optimised alignment, reducing the travel distance of wastewater, the quantity of piping, earthworks, noise impacts and impacts to native vegetation. The position of the proposed first flush system in the approved project is in the northern portion of the site as it was anticipated that it could utilise the stormwater outfall pipeline associated with the existing northern first flush system near the entrance to the site. However due to engineering constraints

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this is no longer feasible and the new first flush system has been relocated further to the south on the western boundary where it can connect to a new stormwater outfall pipe that discharges directly to Cattai Creek.

Additional area is required in the north-east of the site to accommodate the bypass pipeline as the approved project allowed insufficient space to complete the works. Similarly, additional space is required along the north-western boundary to allow space for laying additional pipes associated with Ultra Filtration as the existing approvals did not account for the number of services required behind the filter block.

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Figure 1 **Regional context**





Figure 2 Local context







Figure 3 Additional impacts



Figure 4 Platypus habitat assessment (Photo Points) and dusk survey effort (Survey Points) within the subject site Castle Hill Resource Recovery Facility REVIEW OF ENVIRONMENTAL FACTORS ADDENDUM





Source: Ecoplanning, 2024



3 Consultation



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 (as specified in the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

The proposal includes works within Key Fish Habitat (KFH) (see Section 5) and as such Sydney Water consulted with DPI Fisheries under Section 199 of the *Fisheries Management Act 1994* (FM Act). DPI Fisheries was consulted regarding the detailed design of the headwalls and discharge points for both the new stormwater overflow outfall and wastewater discharge. DPI Fisheries responded on 19 February 2024 with no objection to the proposal and recommended a number of mitigation measures to be implemented during construction. The mitigation measures recommended by DPI Fisheries have been included in the water and drainage aspect of Section 5.

No formal consultation was required under the TISEPP. Further detail is provided in Appendix B.

4 Legislative considerations

There are additional legislative requirements above those already assessed in the existing approvals.

Legislation	Additional considerations
Protection of the Environment Operations (POEO) Act 1997	The site operates under environment protection licence (EPL) 1725 issued by the NSW Environment Protection Authority (EPA), which allows the site to carry out sewage treatment. The EPL permits one wastewater discharge point to waters, 500 m downstream of the junction of Castle Hill Creek and Cattai Creek. Sydney Water will apply for a licence variation to include an additional discharge point to accommodate the proposed additional wastewater discharge main associated with the proposal.





5 Additional environmental impacts and mitigation measures

The table below lists the additional environmental impacts that could result from the proposed change compared to the approved REF and any recommended additional mitigation measures. **Figure 5** illustrates the project boundary approved under the existing approvals, whilst **Figure 6** illustrates the proposed changes to the existing project boundary. All other environmental impacts and mitigation measures identified in the existing approvals remain the same and will be incorporated into the contractor's CEMP.

Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
Topography, geology and soils	Earthworks will be required to excavate trenches for the laying of the Ultra Filtration and bypass pipelines. The new wastewater discharge main and stormwater outfall from the first flush system will be advanced via micro tunnelling. Trenches will be shored as necessary to secure excavations during work. Excavation of the first flush detention pit in the new location is not expected to generate any additional impacts when compared to the approved project. All trenches will be backfilled with excavated soil deemed suitable for reuse and/or imported excavated natural material. Once backfilled, the surface will be compacted and stabilised. Excess spoil will be tested for re-use if suitable or classified in accordance with the <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA,2014) and disposed of off-site at an appropriately licensed waste facility. All spoil will be managed in accordance with the existing approvals.	 The following additional mitigation measures must be implemented to ensure that the proposal does not result in any sedimentation and/or pollution of waterways during micro tunnelling: A drilling management plan will be prepared and approved by Sydney Water prior to the commencement of works. The drilling management plan must be implemented during all micro tunnelling works. All drilling waste will be disposed of appropriately and in accordance with the drilling management plan. Micro tunnelling will be carried out using a dry drilling technique, and as such no drilling fluids will be generated by the works and the potential for frac out events will be eliminated.
Water and drainage	Cattai Creek flows in a northerly direction parallel to the western boundary of the site. The creek is part of the Hawkesbury-Nepean	 Any groundwater or rainfall which accumulates in an excavation requiring dewatering would be tested in order to determine whether it



Aspect Additional impacts		Additional mitigation measures
catchment and confle Castle Hill Creek flow where it confluences A groundwater inves Water, 2018) which i ground level. Excava pipeline, UF pipeline reach a depth of 3.75 excavations may end infiltration is observe in accordance with th existing approvals ar Council mapping ind water flows west tow system in the northet that discharges to Ca The proposed first flu outfall that will dischar discharge through th generated during hea area. A burst rain eva across the 9,955 m of system discharges s into Cattai Creek.	uences with the Hawkesbury River at Cattai. ws along the southern boundary of the site with Cattai Creek. tigation was carried out in 2018 (Sydney intercepted groundwater at 3.75 m below ations associated with laying the bypass and first flush system are not expected to 5 m, however it is possible that the counter groundwater. If groundwater d in the excavation, it will require dewatering ne mitigation measures provided in the nd this REFA. icates that the site is not flood prone. Surface yards Cattai Creek. The existing first flush rn portion of the site has a stormwater outfall attai Creek. ush system includes a stormwater overflow arge directly into Cattai Creek. Stormwater is outfall will be limited to excess stormwater avy bursts of rainfall that within the catchment ent of approximately 7 mm will be required catchment before the 60,000 L first flush tormwater via the stormwater overflow outfall	 ai. is of an acceptable quality to be released back into the environ Where groundwater or excavation water is suspected or confirm contain contaminants, or its discharge may result in a potential b of Section 120 of the POEO Act (e.g. the water is highly turbic water would be either: pumped back into the WRRF treatment process, or disposed off-site to a licensed waste management facility DPI Fisheries recommended the following mitigation measures will be implemented during construction of the proposal: Erosion and sediment mitigation devices are to be erected manner consistent with current Best Management Practic Managing Urban Stormwater: Soils and Construction Edition Landcom, 2004) to prevent entry of sediment in waterway prior to any earthworks being undertaken. The to be maintained in good working order for the duration works and subsequently until the site has been stabilise the risk of erosion and sediment movement from the siminal. There is to be no complete blockage of fish passage durin works. Environmental protection measures or (if requested are to be erected so that fish passage for the duration works are to be erected so that fish passage for the site once the site has been stabilised are risk of sediment movement is minimal.



Aspect	Additio
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Additional impacts

The additional discharge point is not expected to result in an increased volume of stormwater entering the waterway during heavy rainfall events as stormwater currently flows overland into the waterway. Further, the proposed additional first flush system will improve the overall water quality of stormwater discharge from the site, as the initial stormwater discharge generated in its catchment will be captured and pumped back into the WRRF treatment process, minimising the potential for pollutants to enter the receiving waterways.

The shortened wastewater discharge main outfall will be relocated further upstream and is not expected to have any additional impact on the water quality of Cattai Creek.

The works will involve micro tunnelling within the waterway and will require a permit under Section 199 of the *Fisheries Management Act 1994*. As discussed in Section 3, the consultation process will address any water quality implications associated with the works.

There is potential for stormwater to accumulate in excavations associated with the works. Following rain events, accumulated water will be tested to determine if it is suitable for processing within the WRRF. If suitable, stormwater will be pumped from excavations and processed in the facility, if not then water will be collected and disposed of by an appropriately licensed liquid waste contractor.

Additional mitigation measures

away from the waterway and to be contained by appropriate erosion and sediment control devices.

- On completion of the works all disturbed soil is to be levelled, smoothed and sown with a mixture of sterile/native grass seeds to encourage rapid revegetation and planted out with native endemic riparian vegetation.
- Machinery is not to enter or work from the waterway unless in accordance with the proposed works.
- \circ Only clean rock (no fines) is to be used during these works.
- Prior to use at the site and/or entry into the waterway, machinery is to be appropriately cleaned degreased and serviced. Spill kits are to be available on site at all times during the works.
- \circ $\;$ Works are to be undertaken during low flows in the waterway.
- If rain or increased flows in Cattai Creek cause the water level in the creek to rise and potentially inundate the works, additional erosion and sediment controls (such as silt curtains or a cofferdam) must be installed to prevent turbid plumes escaping into the waterway.
- Surface flows must be diverted around the work site to prevent sediment migration to the creek.
- A copy of the Construction and Environment Management Plan (CEMP), Vegetation Management Plan (VMP), including any provisions relating to trenching, dewatering activities is to be submitted to DPI Fisheries for comment prior to the commencement of works.



Environmental impa	cts table	
Aspect	Additional impacts	Additional mitigation measures
		 Should any dewatering be required, then: pumps used in waterways are to be screened with mesh of no greater than 6mm in diameter, daily checks of the sediment levels in the dewatering sediment dams are to be conducted to ensure adequate storage capacity, dewatering operations must ensure retention of spoil for a long enough period to allow mobilised sediments to settle out, a visual inspection of the waterway is to be conducted at all times during dewatering operations to ensure that no visible plumes are generated within the waterway from dewatering operations; Procedures to ensure adherence to water quality guidelines are to be detailed in the CEMP. DPI Fisheries (1800 043 536) and the Environment Protection Authority (EPA) (131 555) are to be notified immediately if any fish kills occur in the vicinity of the works. In this situation, all works other than emergency response procedures are to cease until the issue is rectified and approval is given by DPI Fisheries and/or the EPA for the works to proceed.
Flora and fauna	The site has been severely disturbed by construction of the existing WRRF, and is surrounded by native vegetation.	 All works near Cattai Creek must preserve bank stability and vegetation within 5 m of the bank. This includes staging vegetation removal and replacement, and ensuring all practicable and feasible



Environmental impacts table			
Aspect	Additional impacts	Additional mitigation measures	
	 Vegetation in this area has been assessed by East Coast Ecology (ECE) (Appendix C), which determined the presence of non-native vegetation and two plant community types (PCTs), namely: PCT 3038: Sydney Coastal Coachwood Gallery Rainforest, and PCT 3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest. Neither of the PCTs identified on-site are listed as threatened under the <i>Biodiversity Conservation Act 2016</i> (BC Act) or the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). A revised list of PCTs has been adopted for the eastern NSW coastal and tableland regions, which came into effect on 23 February 2023, decommissioning the PCTs referred to in the existing approvals. The assessment included database searches which found 20 species of threatened flora have potential to occur within 5 km of the site. No threatened flora was identified during the assessment nor were any historical sightings of threatened flora recorded within the site. One hollow bearing tree has been recorded within the site (a stag with one medium hollow and three small hollows), and one has been recorded within close proximity of the site. 	 erosion controls are in place. All sediment generated from micro tunnelling must be captured prior to entering the waterway. Prior to works, the applicant should commission the services of a qualified and experienced Ecologist (minimum 3 years' experience). The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to implement the mitigation measures in the accordance with the approved project and this addendum. Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline (SWEMS0019.13). These works will require revegetating at least 0.088 ha of native vegetation and the provision of at least eight nest boxes or salvaged replacement hollows. Map and report native vegetation clearing greater than 0.01 ha in extent (and any associated rehabilitation) to the Sydney Water Environmental Representative. Track vegetation clearing as per SWEMS0015.26 Contractor Native Vegetation Clearing and Rehabilitation template. 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. 	



Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
	 Two priority weeds, <i>Lantana camara</i> (West Indian lantana) and <i>Senecio madagascariensis</i> (Fireweed) were identified within the site. A database search found 41 threatened species occur, or have potential to occur within 5 km of the site. No threatened fauna was identified within the site during the assessment, however results from the Atlas of NSW Wildlife indicate that three historical sightings of threatened fauna have occurred within the site, including: <i>Lathamus discolor</i> (Swift parrot) <i>Pycnoptilus floccosus</i> (Pilotbird) <i>Miniopterus orianae oceanensis</i> (Large bent-wing bat). Based on available habitat and historical records, two species of threatened fauna were found to have potential to occur within the site that could be impacted by the works: <i>Pommehhelix duralensis</i> (Dural land snail), and <i>Pseudophryne australis</i> (Red-crowned toadlet). ECE carried out a test of significance under the BC Act and determined that the works are unlikely to significantly impact these threatened fauna species. There are no EPBC Matters or Matters of National Significance which will be potentially impacted by the proposed works. This has 	 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 will only recommence once the impact on the species has been assessed and appropriate control measures implemented. Trees that are to be retained must be protected in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites and the Program Delivery Guidance Standard 9.3 Biodiversity Management (ENV-GS-003). Do not damage tree roots unless absolutely necessary, and engage a qualified arborist where roots >50mm are impacted within the Tree Protection Zone. If any damage occurs to vegetation outside of the proposed additional disturbance area (see Figure 3), notify the Sydney Water Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.



Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
	 been confirmed through a search of the EPBC Protected Matters Search Tool. Vegetation removal will be required to accommodate the works. The worst-case scenario is summarised in Section 5.1 and illustrated in Figure 7. The existing project involves the removal of up to 0.638 ha of native vegetation, 0.21 ha of managed grassland as well as impacts to urban native / exotic planted trees including the removal of 23 trees and 0.096 ha. The proposed changes will result in the additional impacts to 0.044 ha of native vegetation, resulting in a total cumulative impact of 0.988 ha (see Section 5.1). Whilst no threatened flora or fauna species were identified during the site inspection, there remains potential for threatened species to exist within the proposal boundary. Further, the removal of regetation has the potential to injure and/or displace native fauna that may be present at the time of clearing. The Grey-headed flyingfox (<i>Pteropus poliocephalus</i>) was found to have a high likelihood of occurrence proposal footprint, however they are a highly mobile species and are considered unlikely to be impacted by the works. One hollow-bearing tree has been identified for removal within the alignment of the wastewater discharge main. The tree is a stag (dead tree) and contains one medium sized hollow and three small hollows. The removal of this habitat has potential to impact upon 	 If necessary, adjust methodology (eg avoid area, hand excavate, implement exclusion fencing) to protect sensitive areas where possible (such as mature trees, known threatened species, populations or ecological communities). Allocate all storage, stockpile, and laydown sites away from any vegetation that is planned to be retained. Avoid importing any soil from outside the site in order to avoid the potential of incurring indirect impacts on biodiversity values as this can introduce weeds and pathogens to the site. If materials are required to be imported for landscaping works, they are to be sterilised according to industry standards prior to importation to site. No priority or environmental weeds, pathogens or other biosecurity issues (e.g. fire ants) are to be imported on to the site prior to or during construction works. The contractor must prepare a vegetation rehabilitation plan for the works, including all works within the creek bank. The plan must meet the requirements of the Sydney Water Biodiversity Offset Guide. Induct workers on platypus awareness, stop work if platypus sighted and contact Environment Representative for advice (for works on discharge structure).
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AspectAdditional impactsAdditional mitigation measuresany fauna inhabiting the hollows, however the potential impact can be minimized with the implementation of the recommended safeguards.File proposed works will not result in significant impacts upon
any fauna inhabiting the hollows, however the potential impact can be minimized with the implementation of the recommended safeguards. The proposed works will not result in significant impacts upon
The proposed works will not result in significant impacts upon
endangered or threatened ecological communities, populations or species protected under the <i>Environment Protection & Biodiversity</i> <i>Conservation Act 1999</i> , BC Act or <i>Fisheries Management Act 1994</i> , nor potential habitat of threatened fauna, and a Species Impact Statement (SIS) is not required.
A population of platypuses have been identified in Cattai Creek via eDNA testing which is indicative of platypus presence in the waterway. Cattai Creek is a long waterway and eDNA testing does not indicate the specific area in which the platypus may reside. However, works close to a burrow have the potential to disrupt their behaviours, and/or cause them to move away. As such, a Platypus assessment was undertaken by Ecoplanning in May 2024 that included:
a site-specific literature and database review
 a targeted field survey a habitat assessment.
The platypus survey memorandum in attached in Appendix C.
The results of the desktop assessment found six records in the past 20 years within 5 km of the study area, all within Cattai Creek (12



Environmental impacts table			
Aspect	Additional impacts	Additional mitigation measures	
	April 2004-present). Of these records, one is an observation from a 2019-21 Community Wildlife Survey with an accuracy of 10 m, and the other five records are from eDNA testing in Cattai Creek. These records are identified in BioNet as having an accuracy of 1 km.		
	The literature review included a summary of six studies exploring platypus in urbanised and disturbed environments. It found that the Platypus is adaptable and resilience when faced with human- induced alterations to their habitats. Concluding that, if present, it is plausible to anticipate the Platypus would have a degree of tolerance to the approved project.		
	A targeted survey was undertaken in April 2024 by Ecoplanning ecologists to determine if platypuses are present in the vicinity of the proposed works. Two ecologists undertook a habitat survey and spotlighted for about five person hours. As platypus are usually active at dawn and dusk, often using this time to feed, the spotlighting was undertaken at dusk. Five survey points were observed for 30 minutes each (shown in Figure 4). The points were selected based on suitability of the habitat for the species and proximity to the proposed works. The habitat assessment of Cattai Creek found sparse native vegetation and declining riparian condition. The majority of the embankment within the subject site consisted of rock, which does not constitute platypus habitat. The survey did not detect any platypus or obtain conclusive evidence of their babitation along the length of Cattai Creek within the subject		
	site.		



Aspect	Additional impacts	Additional mitigation measures
	The assessment concluded that the proposal site:	
	 has no evidence of platypus or platypus habitation (i.e., platypus or their burrows) 	
	 has limited potential habitat for the platypus 	
	 is located in areas where habitat is generally not suitable for platypus (i.e. rock embankment). 	
	Provided that the safeguards detailed in the existing approvals and this REF Addendum are implemented prior to, during and after construction, the potential for the works to result in adverse impacts on flora and fauna will be minimal.	
	Offsets	
	Offsets are not required under the BC Act, however Sydney Water's <i>Biodiversity Offset Guide</i> (BOG) states that if a proposal has a residual biodiversity impact, all areas of native vegetation cleared or damaged during the proposal must be offset to deliver a maintained or enhanced biodiversity outcome. This can be achieved through:	
	 Restoring the impacted site through native vegetation, and/or 	
	 Restoring adjacent land to the impacted site, and /or at an alternative offset site by undertaking native revegetation, and/or 	



Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
	• Purchasing voluntary offset credits under the NSW Government's Biodiversity Offset Scheme (BOS).	
	The proposed changes will result in additional impacts to up to 0.044 ha of native vegetation, which is classified as a moderate impact under the BOG. Moderate impacts require an offset multiplier of 2, which means twice the area being cleared must be offset. These works will require revegetating at least 0.088 ha of native vegetation.	
	Additionally, the removal of each tree hollow must be replaced with two nest boxes or salvaged hollows. As the proposal may result in the removal of a tree that bears four hollows, the proposal must offset this habitat loss with at least eight nest boxes or salvaged hollows.	
	Actual impacts will be quantified before clearing offsets will be provided based on verified impacts. The location of offsets will be determined during detailed design and in consultation with council.	
Heritage		

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Environmental impacts table Additional impacts Additional mitigation measures Aspect

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Environmental impacts table

Aspect

Additional impacts



Noise and vibration Microtunnelling and rock hammering will be used to construct the wastewater discharge main pipeline and headwall. Hydraulic hammering was assessed in the existing approvals however microtunnelling was not. The noise profile of micro tunnelling works is consistent with the noise profile of the 'ditchwitch' and vacuum truck which have been assessed. Given that rock hammering and activities with a similar noise profile to microtunneling have been assessed, noise generated from the proposal is not expected to generate any additional impacts.

The wastewater and stormwater pipelines will be advanced via microtunnelling and the headwalls and outlet will be constructed using a 13-tonne excavator with a hydraulic hammer. The closest residential receivers to the wastewater discharge headwall are approximately 60 m to the west, which achieves the minimum working distance of 23 m, as per the existing approvals.

No additional noise impacts are expected from the new stormwater outfall in Cattai Creek as this outlet will only discharge during a rain

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Additional mitigation measures

N/A

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Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
	event, in which the additional flow within Cattai Creek will overwhelm any additional noise generated from the increased flow of the stormwater outfall.	
	All work activities and the types of equipment and plant associated with the proposed changes are consistent with those previously assessed in the existing approvals, and as such no additional noise and vibration impacts are anticipated.	
Air and energy	The site is in a heavily vegetated reserve with a residential area of Castle Hill to the east and a residential area of Kellyville to the west. At its closest point, the site is approximately 50 m from residential receivers to the west and 75 m from residential receivers to the east. The site is adjacent to a recreational walking track which encircles the site.	N/A
	Earthworks associated with the excavations of trenches and construction of the temporary access track and easement may generate some minor and temporary local dust emissions, however these emissions will be effectively mitigated with the safeguards recommended in the existing approvals.	
	Air quality impacts from earthworks associated with the construction of the new first flush detention system are considered to be consistent with the REF given that the new location is approximately 45 m further from residential receivers and dust generation during minor excavations will be temporary and localised.	



Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
Waste and hazardous materials	The proposed works will generate organic green waste during the removal of vegetation. Where feasible, vegetation will be mulched on-site and retained on-site for use as erosion and sediment controls.	N/A
	Additional waste will be generated during demolition works, including concrete, transformers, cabling and asphalt. All waste streams are consistent with the existing approvals and will be re- used and/or recycled where feasible, and managed in accordance with the Abergeldie Waste and Resource Recovery Management Plan (revision 3).	
Traffic and access	Overall, the proposed changes will not result in any additional traffic impacts as the number of truck movements is expected to decrease due to the shortened wastewater discharge main, which will require less structures, pipes and other construction materials such as pipe bedding.	N/A
	Heavy vehicle generation associated with the demolition of the transformers will be minimal and limited to the removal of waste material and the construction of the new maintenance shed and car parks.	
	Construction of the temporary access road will generate additional heavy vehicle movements through clearing and importation, placement and compaction of gravel or similar material. Heavy vehicle movements generated through the proposed changes are	



Environmental impacts table		
Aspect	Additional impacts	Additional mitigation measures
	not expected to exceed the expected traffic generation assessed under the existing approvals.	
	Once built, the temporary construction road will significantly reduce vehicle constraints, allowing the separation of operational and construction traffic and improving internal traffic circulation during construction.	
	There will be no material change to light vehicle movements.	
	There will be no changes to operational site access.	
Social and visual	Access to the walking track within the surrounding bushland will be restricted during construction of the proposal. The walking tracks are used by the community and as such diversions will be in place during the construction period to restrict public access from the walking track adjacent to the western boundary of the site.	 The closure of the walking track and erection of signage is to be implemented as per the Pedestrian/Walking Track Plan (Abergeldie, 2023).
	The western walking track is expected to be closed for a duration of 2-3 weeks whilst the temporary access road is constructed and a duration of 2 to 3 months while the pipes associated with the wastewater discharge main and stormwater outfall are being laid across the western boundary of the site.	
	Abergeldie Complex Infrastructure Pty Ltd (Abergeldie) has prepared a Pedestrian/Walking Track Plan (Abergeldie, 2023) that will be implemented during restriction of the public walking tracks.	
	Walkers attempting to access this area will be diverted over the pedestrian foot bridge and vehicle bridge, and will occasionally be	

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Aspect	Additional impacts	Additional mitigation measures
	required to use an alternative access route as described in the Pedestrian/Walking Track Plan. Appropriate signage will be implemented in consultation with council and maintained whilst the walking track is restricted to provide clear communication of diversions and alternative access paths to the community.	
	The walking track to the south of the vehicle bridge will not be restricted during construction.	
	As soon as practicable following the completion of construction works, all disturbed areas associated with the temporary access road, new stormwater outfall pipeline, UF pipeline, wastewater discharge main and the existing walking track will be rehabilitated to its original condition or better.	
Cumulative and future trends	The proposed changes are consistent in nature with the existing approved project, and are not considered to result in any cumulative changes that have not been assessed in this addendum or the existing approvals.	N/A



5.1 Summary of PCTs and proposed impacts

5.1 Summary of PCTs and proposed impacts	
Area	PCTs and area of impact
Wastewater discharge main and UF pipeline	PCT 3038 - 0.003 ha – good condition PCT 3619 - 0.055 ha – moderate condition One hollow-bearing tree
Overflow pipeline	Exotic vegetation – 0.032 ha PCT 3619 - 0.004 ha – moderate condition
Stormwater discharge, temporary construction access road and 3 m electrical easement	PCT 3619 - 0.139 ha – moderate condition
Maintenance shed and car park	No clearing required.
Re-location of	PCT 1255 (decommissioned)
existing discharge main alignment	Based on the new alignment of the discharge main, 0.157 ha of vegetation will be retained from the extent of vegetation subject to removal under the existing approvals.
Total	PCT 3038 - 0.003 ha - good condition
	PCT 3619 - 0.198 ha - moderate condition
	The proposed changes will result in the removal of up to 0.201 ha of native vegetation, however, due to the proposed re-location of the wastewater discharge outlet, 0.157 ha of PCT 1255 (decommissioned) that was subject to removal under the existing approvals will be retained.
	Whilst not directly comparable, the decommissioned PCT 1255 is classified within the same Offset Trading Class as PCT 3619 as they share similar characteristics such as both having a vegetation class of Sydney Hinterland Dry Sclerophyll Forests, a threat status of low and are less than 50% cleared. As such, PCT 1255 (decommissioned) and PCT 3619 are considered like-for-like in regards to offset obligations.
	Considering the above, the proposed changes will result in additional impacts to up to 0.044 ha of native vegetation.
Cumulative	Impacts to vegetation under the existing approvals include:
impacts	Approved REF (August 2021):
	0.01 ha (low condition) Red Bloodwood – scribbly gum heathy woodland on sandstone plateau of the Sydney Basin Bioregion (PCT 1083 – decommissioned).







Area PCTs and area of impact

0.08 ha (low condition) Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion (PCT 1181 – decommissioned).

0.08 ha (poor condition) plus 0.18 ha (fair to good condition) PCT 1255 (decommissioned).

23 urban native / exotic planted trees.

Approved REFA (May 2023):

0.133 ha (fair condition) plus 0.155 ha (poor condition) PCT 1255 (Decommissioned).

0.096 ha of urban native / exotic planted trees.

0.21 ha of managed grassland

Total vegetation impacts under existing approvals: 0.944 ha

Proposed cumulative total of vegetation impacts:

- 0.01 ha (low condition) PCT 1083
- 0.08 ha (low condition) PCT 1181
- 0.096 ha of planted trees plus 23 urban native / exotic planted trees
- 0.21 ha of managed grassland
- 0.078 ha (poor condition) PCT 1255 (accounting for reduction of 0.157 hectares due to new wastewater discharge alignment)
- 0.313 ha (fair to good condition) PCT 1255
- 0.003 ha (good condition) PCT 3038
- 0.198 ha (moderate condition) PCT 3619

Total proposed cumulative vegetation impacts: 0.988 ha



Figure 5 Approved project boundaries and proposed additional impacts





Figure 6 Addendum REF boundary





Figure 7 Field-validated vegetation communities









6 Conclusion

This REFA outlines potential environmental impacts associated with several modifications to the approved project, which comprise:

- Demolition of two electrical transformers and construction of a new maintenance shed and two car parking spaces in its place.
- Establishment of a three-metre electrical easement and a temporary construction access road along the western boundary of the site.
- Relocation of the approved wastewater discharge main and headwall.
- Relocation of first flush system and new overflow discharge outlet in Cattai Creek.
- Construction of a bypass pipeline in the north-eastern section of the plant.
- Extension of approved project area to provide space for installing Ultra Filtration pipes on the western boundary.
- Raising the design height of two pipe bridges.

The environmental impacts of the proposal were not previously considered as part of the approved project under the existing approvals. Any additional environmental impacts as a result of the proposed changes are considered minor and potential impacts can be mitigated through implementation of the proposed measures outlined in this REFA and the existing approvals. The proposal is not likely to significantly impact on the environment.







7 References

Abergeldie (2023). North West Treatment Hub Compliance Project Castle Hill Water Recycling Plant, Pedestrian/Walking Track Plan. (August 2023).

Sydney Water (2018). *Review of Environmental Factors Rouse Hill and Castle Hill Water Recycling Plant. Growth Amplification Project* (November, 2018).

Sydney Water (2021). *Review of Environmental Factors North West Treatment Hub Castle Hill and Rouse Hill Water Recycling Plants Compliance Upgrade* (August, 2021).

Sydney Water (2023). *Review of Environmental Factors Addendum Northwest Hub Phase 2 Program – Castle Hill 2024 Compliance Project* (May, 2023).

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Appendix A – Section 171 checklist

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

Section 171 checklist	REF addendum finding
Any environmental impact on a community	There is potential for additional temporary visual and access impacts, which will be limited to construction occurring in the vicinity of the public walking track, including the enclosure of the walking track. However, these impacts will be minor and temporary in nature and will be minimised with adequate signage and the implementation of the walking track management plan (Abergeldie, 2023) and mitigation measures outlined in this AREF and existing approvals.
Any environmental impact on the ecosystems of the locality	There will be some additional vegetation clearing associated with the proposal, however this will not impact upon any local ecosystems. Revegetation will be undertaken in accordance with Sydney Water's biodiversity offset guide and the vegetation rehabilitation plan. The proposal will lead to environmental improvements by ensuring a reliable wastewater service to collect and treat wastewater, minimising any impacts on the ecosystem.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	There is potential for additional impacts to the aesthetic and recreational values of the area due to construction works being visible from the public walking track and the restriction of public access from the walking track during works. These impacts will be minor and temporary in nature and will be minimised with adequate signage and the implementation of the walking track management plan (Abergeldie, 2023) and mitigation measures outlined in this AREF and existing approvals.
Any impact on the habitat of any protected animals (within the meaning of the <i>Biodiversity Conservation Act 2016</i>)	The proposed changes will not impact upon any threatened species of flora, fauna or threatened ecological communities or their habitats. One hollow-bearing tree will be removed during the works, however the removal has been assessed to be not significant. All residual impacts associated with vegetation removal will be offset as per Sydney Water's Biodiversity Offset Guide.
Any reduction in the range of beneficial uses of the environment	The restriction of public access from the walking track will cause a temporary reduction in the range of beneficial uses for the area. However, these impacts will be minor and temporary in nature and will be minimised with adequate signage and the implementation of the walking track management plan (Abergeldie, 2023) and mitigation measures outlined in this AREF and existing approvals.
Any pollution of the environment	Sydney Water will apply for a variation of their EPL to permit the additional wastewater discharge point in Cattai Creek and comply with the conditions imposed by NSW EPA to ensure there will be no pollution of the environment under Section 120 of the POEO Act. Further, Sydney Water has consulted with DPI Fisheries and received no objection. All mitigation measures recommended by DPI Fisheries

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Section 171 checklist	REF addendum finding
	have been included in this REFA for implementation during construction of the proposal.
Any cumulative environmental effect with other existing or likely future activities	The proposed changes are consistent in nature with the existing approved project, and are not considered to result in any cumulative changes that have not been assessed in this addendum or the existing approvals.





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?		х
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		х
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		х
Connect to, and use of a substantial volume of water from a council owned water supply system?		х
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?		х
Excavate a road or a footpath adjacent to, a road for which the council is the roads authority that is not minor or inconsequential?		х
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?		Х
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?		х
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)?		х
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		
Will the proposal be on land adjacent to land reserved under the National Parks and Wildlife Act 1974 or to land acquired under Part 11 of that Act? If so, consult with DPIE (NPWS).		х
Will the proposal be on land in Zone E1 National Parks and Nature Reserves or on a land use zone that is equivalent to that zone? <i>If so, consult with DPIE (NPWS)</i>		х
Will the proposal include a fixed or floating structure in or over navigable waters? If so, consult <i>TfNSW</i>		х
Will the proposal be on land in a mine subsidence district within the meaning of the <i>Coal Mine Subsidence Compensation Act 2017</i> ? If so, consult with Subsidence Advisory NSW.		х
Will the proposal be on land in a Western City operational area specified in <i>the Western Parkland City Authority Act 2018,</i> Schedule 2 and have a capital investment value of \$30 million or more? <i>If so, consult the Western Parkland City Authority.</i>		X
Will the proposal clear native vegetation on land that is not subject land (ie non-certified land)? If so, notify DPIE 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).		х







Appendix C – Specialist studies

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Flora and Fauna Assessment - Addendum 2

Castle Hill Water Resource Recovery Facility

Prepared by: Alex Graham (BAAS19040) Final Report: November 2023





Document Control

Internal Project ID: CHWRRF1

Project Title: Flora and Fauna Assessment - Addendum 2 - Castle Hill Water Resource Recovery Facility

Project Manager: Alex Graham *BSc (Biology), Grad Dip. (Bushfire Protection)* Principal Ecologist & Accredited Assessor BAAS19040

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	Sydney Water	
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East Coast Ecology Pty Ltd (ABN: 66 652 418 623)

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GLOSSARY

Abbreviation	Definition
amsl	Above mean sea level
BAM	Biodiversity Assessment Method 2020
BC Act	Biodiversity Conservation Act 2016 (NSW)
BDAR	Biodiversity Development Assessment Report
BOM	Bureau of Meteorology
DBH	Diameter at Breast Height
DPE	Department of Planning and Environment (formerly DPIE)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (now DPE)
ECE	East Coast Ecology
EP&A Act	Environmental Planning & Assessment Act 1979 (NSW)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FFA	Flora and Fauna Assessment
FM Act	Fisheries Management Act 1994
ha	Hectares
KFH	Key Fish Habitat
km	Kilometres
LGA	Local Government Area
Locality	The same meaning when describing a local population of a species or local occurrence of an ecological community.
m	metres
mm	millimetres
MNES	Matters of National Environmental Significance
NSW	New South Wales
РСТ	Plant Community Type
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
Subject Land	The land depicted in Figure 1.
TEC	Threatened Ecological Community

i.	Details a	nd Experience	of Author/s and	Contributors
----	-----------	---------------	-----------------	--------------

Name	BAM Assessor Accreditation no.	Position/ Role	Tasks Performed	Relevant Qualifications
Alex Graham	BAAS19040	Principal Ecologist	Report preparation, figure preparation, vegetation mapping, document review, fauna habitat surveys.	BSc, Grad. Dip. Bushfire Protection
Jack Tatler	BAAS21006	Principal Ecologist	Document review.	BSc (Zoology & Entomology), Hons (Zoology), PhD (Ecology)

ii. Conflict of Interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature:

Date: 27 October 2023

BAM Assessor Accreditation no.: BAAS19040

1. INTRODUCTION

1.1 The Proposed Activity

Sydney Water, c/- Abergeldie Complex Infrastructure proposes to upgrade the operational capacity of the Castle Hill Water Resource Recovery Facility (WRRF) and remove redundant infrastructure. The activity aims to increase the overall efficiency of the facility to accommodate the needs of a growing population in the locality.

Key features of the proposed activity would include:

- Demolition of existing transformers and construction of a new maintenance storage shed and two carpark spaces
- Constructions of an Electrical Easement (3m wide)
- Temporary construction access road
- Relocation and shortening of the additional effluent discharge main from northern to western boundary
- New first flush location/stormwater overflow to creek, including vegetation removal and potential headwall in creek
- Additional area within the north-east section of the plant for construction of bypass pipeline including vegetation removal
- Additional area along north western boundary for space for laying additional pipes for the Ultra Filtration on the western boundary, west of the existing filter block, and
- Electrical Earthing Routes.

To facilitate the proposed activity, removal of native vegetation will be required.

East Coast Ecology Pty Ltd (ECE) was commissioned by Abergeldie Complex Infrastructure c/- Element Environment to prepare a Flora and Fauna Assessment (FFA) Addendum, for the works associated with the proposed activity.

1.1.1 The Subject Land

The area assessed within this report is referred to as the 'Subject Land' and has been defined in consultation with representatives from Element Environment, Abergeldie Complex Infrastructure and Sydney Water. The Subject Land comprises four distinct areas located on the periphery of the existing Castle Hill WRRF. The location of the proposed activity is depicted in **Figure 1**.



Figure 1. The location of the Subject Land.

1.2 Scope of Assessment

The overarching objective of this assessment was to evaluate the ecological values that occur within the Subject Land and identify how the proposed activity satisfies the relevant planning framework. This report discerns the likelihood of occurrence of any threatened entities (i.e. ecological communities and species) listed under the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The full scope of the assessment included:

- Background research to determine the likelihood for NSW and/ or Commonwealth threatened biota to occur within the Subject Land during any point of their lifecycle
- Assess any potential impacts to species and/ or communities listed under the BC Act and EPBC Act
- Establishing the likelihood of occurrence of migratory species and threatened ecological communities (TEC) as listed under the BC Act and/ or the EPBC Act
- Identifying and mapping the distribution of vegetation communities within the Subject Land
- Recording presence and the extent of any known or potential fauna habitat features such as nests, dreys, caves, crevices, culverts, pools, soaks, flowering trees, fruiting trees or hollow-bearing trees and provide recommendations for on-going management of these habitat features and any fauna present
- Determining potential ecological impacts or risks that may result due to the proposed works, and
- Recommendation of any controls or additional actions to be taken to protect or improve environmental outcomes of the activity.

The areas within this FFA have been defined using the detailed design and are provided in **Appendix A**.

1.3 Legislative Context

1.3.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The Commonwealth EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places which are considered Matters of National Environmental Significance (MNES). Under the EPBC Act, approval is required for actions that have, will have, or are likely to have a significant impact on MNES.

Several EPBC listed threatened species have potential to utilise the Subject Land. The proposed activity will not result in a 'significant impact' on any MNES and a referral to the Australian Government Minister for the Environment is not required.

1.3.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) establishes the system of environmental planning and assessment in NSW. The proposed activity is being assessed under Division 5.1 of the EP&A Act via a Review of Environment Factors (REF). This report provides input into the REF and environmental impact assessment process by providing assessment specific to matters of biodiversity.

An REF has been prepared to satisfy Sydney Water's duties under s.5.5 of the EP&A Act to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.5.5 in making decisions on the likely significance of any environmental impacts. This FFA (addendum #2) forms part of the REF addendum (Element Environment, 2023) being

prepared for the Castle Hill WRRF project and assesses the biodiversity impacts of the proposed activity to meet the requirements of the EP&A Act.

1.3.3 Biodiversity Conservation Act 2016

The BC Act (NSW) seeks to conserve biological diversity and promote ecologically sustainable development, to prevent extinction and promote recovery of threatened species, populations and ecological communities and to protect areas of outstanding biodiversity value.

Several BC Act listed threatened species have the potential to occur within, or utilise, the Subject Land. The BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using the test listed in Section 7.3 of the BC Act. Where a significant impact is likely to occur, a Species Impact Statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM) (DPE, 2020a). The proposed activity will not result in a 'significant impact' on any threatened entities and therefore the Biodiversity Offset Scheme is not triggered (**Appendix C**). As such, an SIS or a BDAR is not required. The Subject Land is not located within any Areas of Outstanding Biodiversity Value.

1.3.4 Biosecurity Act 2015

The *Biosecurity Act 2015* (NSW) provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by an activity as a matter of biosecurity. As defined in Part 3, section 23 of this Act, any non-conformance by an individual is defined as guilty of an offence.

Two priority weeds, *Lantana camara* and *Senecio madagascariensis*, were identified within the Subject Land. Suitable mitigation measures (**Section 7.2**) have been provided to appropriately manage weeds within the impact areas in accordance with the *Biosecurity Act 2015*.

1.3.5 Water Management Act 2000

The main objective of the *Water Management Act 2000* (NSW) (WM Act) is to manage NSW water in a sustainable and integrated manner that will benefit today's generations without compromising future generations' ability to meet their needs. Section 91E of the Act establishes an approval regime for controlled activities within waterfront land. However, clause 41 of the Water Management (General) Regulation 2018 provides an exemption for public authorities in relation to all controlled activities on waterfront land. Therefore, approval under the WM Act is not required.

1.3.6 State Environmental Planning Policy (Resilience and Hazards) 2021

The State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) commenced on the 1st of March 2022 and replaces the following former SEPPs:

- State Environmental Planning Policy (Coastal Management) 2018
- State Environmental Planning Policy 33 Hazardous and Offensive Development, and
- State Environmental Planning Policy 55 Remediation of Land.

The Subject Land is not located within the 'Coastal Zone' therefore this SEPP does not apply.

1.3.7 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Section 2.7(1) of this SEPP states that an authority to clear vegetation under this policy is not required if it is a clearing authorised under s60(O) of the *Local Land Services Act 2013*. Section 60(O) provides an exemption for clearing under Part 5 of the EP&A Act and therefore consent is not required under the SEPP (Biodiversity and Conservation).

1.3.8 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (NSW) (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations including conserving fish stocks and key fish habitats and promoting ecologically sustainable development. The closest Key Fish Habitat (KFH) occurs within the Subject Land, within Cattai Creek (**Figure 2**). DPI Fisheries should be consulted to determine what permits are required (e.g. a permit under Section 200 of the FM Act) prior to commencing the activity.





2. METHODOLOGY

2.1 Background Research

A thorough literature review of local information relevant to the Subject Land was undertaken. Searches using NSW Wildlife Atlas (BioNet) (DPE, 2023a) and the Commonwealth Protected Matters Search Tool (PMST) (DCCEEW, 2023) were conducted to identify all current threatened flora and fauna, as well as migratory fauna records, within a 5km radius of the Subject Land. These data were used to assist in establishing the presence or likelihood of any ecological values as occurring on or adjacent to the Subject Land and helped inform our ecologists on what to look for during the site assessment.

Soil landscape and geological mapping, as well as existing vegetation mapping, were examined to assist in determining whether any threatened flora or ecological communities could be present. The following technical resources were comprised in the preparation of this report:

- State and Commonwealth datasets:
 - ^o EPBC Protected Matters Search Tool (DCCEEW, 2023)
 - NSW BioNet. The website of the Atlas of NSW Wildlife (DPE, 2023a)
 - NSW BioNet. Threatened Biodiversity Data Collection (DPE, 2023b)
 - NSW BioNet. Vegetation Classification System (DPE, 2023c)
 - NSW Government Spatial Services: Search and Discovery Historical, Aerial and Satellite Imagery (Spatial Services, 2023a)
 - NSW Government Spatial Services: Six Maps Clip & Ship (Spatial Services, 2023b)
 - BAM Important Habitat Maps
 - Key Fish Habitat Maps Sydney Metro (DPI, 2023b)
- Vegetation and soil mapping:
 - The NSW State Vegetation Type Map (DPE, 2023d)
 - 。 eSPADE v2.2.0 (DPIE, 2023)
- NSW State guidelines:
 - Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPE, 2020b)
 - Threatened Species Survey and Assessment: Guidelines for developments and activities.
 Working Draft (DEC, 2004b)

Species from both the BioNet and PMST online searches were combined to produce a list of threatened species, populations and communities that are likely occur within the Subject Land (**Appendix A**).

2.2 Permits and Licences

The biodiversity assessment was conducted under the terms of ECE's Scientific Licence issued by the NSW Department of Planning and Environment (SL102667). Fauna survey was conducted under approval RVF22/2367 from the NSW Animal Care and Ethics Committee.

2.3 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity Methods

2.3.1 Existing Information

A review of the State Vegetation Type Map (DPE, 2023d) was used to assist in the identification of Plant Community Types (PCTs) within and surrounding the Subject Land. The PCT of 'best-fit' was determined based on the floristic descriptions within the Vegetation Classification System database (DPE, 2023c).

2.3.2 Mapping Native Vegetation Extent

The extent of native vegetation within the Subject Land was determined through a field assessment with the aid of a GPS-enabled tablet.

2.4 Threatened Flora Survey Methods

2.4.1 Review of Existing Information

Threatened flora with potential to occur within the Subject Land and immediate surrounds were identified following review of BioNet and the PMST. Soil mapping (DPIE, 2023) and topography (Google Earth) were also used to provide further context on habitat constraints for threatened flora.

2.4.2 Field Surveys

To determine whether any threatened flora or their habitats were present, a survey was undertaken using parallel field traverses in accordance with the 'Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method' (DPE, 2020b).

2.5 Threatened Fauna Survey Methods

2.5.1 Review of Existing Information

Threatened fauna with potential to occur within the Subject Land and immediate surrounds were identified following review of BioNet and the PMST. Soil mapping (DPIE, 2023) and topography (Google Earth) were also used to provide further context on habitat constraints for threatened fauna.

2.5.2 Habitat Constraints

A field survey was undertaken to identify any habitat constraints (e.g. waterbodies, rocky areas, tree hollows), including microhabitat, present within the Subject Land and immediate surrounds. Potential habitat constraints within the broader area (500m buffer) were assessed using Google Earth, historical aerial imagery (Spatial Services, 2023a), soil landscape mapping (DPIE, 2023) and recent vegetation mapping (DPE, 2023d).

2.5.3 Field Surveys

No targeted surveys for fauna were undertaken. To determine whether any threatened fauna species were present, targeted habitat surveys were undertaken using parallel field traverses.

2.6 Weather Conditions

Surveys were undertaken on 19th October 2023 within and immediately surrounding the Subject Land. Weather conditions taken from the nearest weather station (Parramatta North (Masons Drive) (station 066124)) in the lead up and during the field survey are outlined in **Table 1**.

	Date	Day	Temperatu	Rainfall	
Timing/activities			Min	Мах	(mm)
Lead up to the survey	12/10/2023	Thursday	14.4	32.7	0
	13/10/2023	Friday	13.0	24.7	0.2
	14/10/2023	Saturday	13.2	28.0	0
	15/10/2023	Sunday	14.6	25.7	0
	16/10/2023	Monday	14.4	25.0	0
	17/10/2023	Tuesday	11.5	18.7	0.8
	18/10/2023	Wednesday	13.0	21.5	2.8
Site Assessment &	10/10/2022	Thursday	13.1	23.1	0.2
Habitat Survey	19/10/2023				0.2

Table 1. Weather conditions taken from the nearest weather stations (Station number 066124) in the lead up and during the field survey (BOM, 2023).

Dark border indicates survey date.

2.7 Limitations

Not all flora and fauna species could be directly surveyed for during the site assessment. These species include nocturnal fauna and cryptic flora with flowering times outside of the survey period. The presence of nocturnal and cryptic species was assessed based on habitat constraints and historical records.

East Coast Ecology was not engaged to undertake an aquatic impact assessment (e.g. AUSRIVAS).

3. SITE CONTEXT

3.1 Landscape Features

3.1.1 IBRA Bioregion and subregion

The Subject Land is situated within The Hills Shire Local Government Area (LGA) and lies within the Yengo Interim Biogeographic Regionalisation for Australia (IBRA) Subregion, within the Sydney Basin IBRA Bioregion (**Figure 3**).

3.1.2 Rivers, streams, estuaries and wetlands

Cattai Creek, a third-order watercourse, bifurcates the Subject land. The Subject Land therefore lies within its associated riparian buffer zone.

3.1.3 Topography, Geology and Soils

The elevation within the Subject Land broadly grades from approximately 70m above sea level (asl) in the eastern extent to approximately 60m asl in the western extent (bed of Cattai Creek). The Subject Land is mapped as occurring on the Hawkesbury soil landscape, characterised by rugged, rolling to very steep hills on Hawkesbury Sandstone (Chapman and Murphy, 1989).

3.1.4 Karst, Caves, Crevices, Cliffs, Rocks or Other of Geological Features of Significance

The Subject Land did not contain areas of geological significance (karsts, caves, cliffs and crevices). The Subject Land, or surrounding area (500m buffer), was not mapped as occurring on acid sulfate soils nor mapped as having risk/ probability of exhibiting occurrence of acid sulfate soils.

3.1.5 Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value occur on the Subject Land or surrounding area.

3.1.6 NSW (Mitchell) Landscapes

Mitchell Landscapes (Mitchell, 2002) groups ecosystems into meso-ecosystems representing larger natural entities based on topography and geology. The naming of ecosystems and meso-ecosystems was standardised so that each name provided location information and a meaningful descriptive landscape term. The Subject Land occurs within the 'Blaxlands Ridge' Mitchell Landscape Ecosystem.

3.1.6.1 Blaxlands Ridge

Undulating dissected ridges with dendritic drainage network on horizontal Triassic quartz sandstone and shale, a few linear cappings of shale comparable to the Bilpin Ridges landscape, general elevation 190 to 250m, local relief 50m. Moderate amounts of rock outcrop, thin sand accumulations in joint crevices, red and yellow texture-contrast soils on wider benches underlain by shale. Woodland and forest of Grey Ironbark (*Eucalyptus paniculata*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Mountain Grey Gum (*Eucalyptus cypellocarpa*) and Turpentine (*Syncarpia glomulifera*) with diverse shrubs and Kangaroo Grass (*Themeda triandra*).



Figure 3. The location of Subject Land within the broader context.

East Coast Ecology – Flora and Fauna Assessment Castle Hill Water Resource Recovery Facility

4. **RESULTS: NATIVE VEGETATION**

4.1 Plant Community Types

4.1.1 Historically Mapped Vegetation

The State Vegetation Type Map (DPE, 2023d) indicated the presence of six Plant Community Type (PCT) in proximity to the Subject Land:

- PCT 3321: Cumberland Shale-Sandstone Ironbark Forest
 - ^o BC Act: Shale Sandstone Transition Forest in the Sydney Basin Bioregion (CEEC)
 - EPBC Act: Shale Sandstone Transition Forest of the Sydney Basin Bioregion (CEEC)
- PCT 3593: Sydney Coastal Sandstone Bloodwood Shrub Forest
- PCT 3617: Sydney Hinterland Peppermint-Apple Forest
- PCT 3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest
- PCT 4025: Cumberland Red Gum Riverflat Forest
 - BC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)
 - EPBC Act: River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC)
- PCT 4058: Sydney Hinterland Red Gum Riverflat Forest
 - BC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)
 - EPBC Act: River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC)



Figure 4. State Vegetation Type Mapping (predicted vegetation) surrounding the Subject Land.

4.1.2 Field-validated Vegetation

Site assessment by ECE determined the presence of two PCTs:

- PCT 3038: Sydney Coastal Coachwood Gallery Rainforest , and
- PCT 3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest.

All non-native vegetation has been assigned to a novel community type:

• Exotic Vegetation.

The Plant Community Types (PCT) used in the Review of Environmental Factors (Sydney Water, 2021) have since been decommissioned. The revised PCTs in eastern NSW coastal and tableland bioregions came into effect on 23rd February 2023 and are adopted within this report.

Vegetation within the Subject Land has been assessed as aligning with the BioNet Vegetation Classification PCT identified within **Table 2**. A detailed description of the PCT is provided in the following subsections. The vegetation within the Subject Land is detailed in **Table 3** and displayed in **Figure 5**.

Table 2. PCT identified within the Subject Land.

PCT ID	PCT Scientific Name	Area within the Subject Land (ha)
3038	Sydney Coastal Coachwood Gallery Rainforest	0.08
3619	Sydney Hinterland Enriched Sandstone Bloodwood Forest	0.46
	Total Area	0.54



Figure 5. Field-validated vegetation communities.



Table 3. Description of vegetation within the Subject Land, that will be impacted by the activity.

Vegetation Formation	Rainforests	
Extent within Subject Land (approximate)	0.08ha	
Description of the Vegetation within the Subject Land		

PCT 3038: Sydney Coastal Coachwood Gallery Rainforest adjoined Cattai Creek. These areas were generally in good condition, and were reflected by *Tristaniopsis laurina, Ceratopetalum apetalum, Ceratopetalum gummiferum* and *Callicoma serratifolia. Lomandra longifolia* and a variety of native fern species dominated the understorey.

PCT 3038: Sydney Coastal Coachwood Gallery Rainforest

Description of PCT 3038 in BioNet

Very tall to extremely tall, sclerophyll open forest with dense rainforest sub-canopy, or tall to very tall dense rainforest. This PCT occurs along streams on creek flats and alluvial flats, and sometimes on sheltered lower slopes, in north-east metropolitan Sydney, between Ku-ring-gai Creek and the Parramatta River. Rarely it occurs on fairly steep slopes, however in those sites it is associated with small drainage lines fed by water seepage. The sclerophyll overstorey, which is only sometimes present and locally abundant, is of variable composition and occasionally includes Syncarpia glomulifera and *Eucalyptus pilularis*, rarely with *Angophora costata* and *Eucalyptus piperita*. The rainforest canopy almost always includes Ceratopetalum apetalum with a high cover, very frequently Callicoma serratifolia and Pittosporum undulatum with lower cover, occasionally Acmena smithii and Elaeocarpus reticulatus, and commonly Tristaniopsis laurina, sometimes with a high cover. The vine Gynochthodes jasminoides is very frequently present. There is a sparse to mid-dense ground cover which very frequently includes Lomandra longifolia and Calochlaena dubia, commonly with Oplismenus imbecillis. This PCT occurs in mild, moderately wet locations receiving 1060-1250 mm mean annual rainfall, at low elevations of less than 90 metres asl. It occurs in narrow strips along creeks on Hawkesbury sandstone, especially along Lane Cove River and Middle Creek and their tributaries. It is usually highly disturbed due to nearby urban development, has a relatively low native species richness and very high component of exotic species. In shale-enriched sites it may grade into wet sclerophyll PCT 3176, and on adjacent rocky slopes it may grade into sandstone dry sclerophyll communities such as PCTs 3586 and 3593.

Groundwater Dependent Ecosystems (GDE)	Assessment of the potential for the Subject Land to support groundwater dependent ecosystems was carried out using the Commonwealth's Bureau of Meteorology Groundwater Dependent Ecosystems Atlas (BOM, 2023a). This PCT has a medium probability of being associated with a GDE.
BC Act 2016 Status	Not listed
EPBC Act 1999 Status	Not listed

PCT3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest



Vegetation Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Extent within Subject Land (approximate)	0.46ha

Description of the Vegetation within the Subject Land

The vegetation within the Subject Land was generally in moderate condition, with localised patches of environmental weeds mostly adjoining the Castle Hill WRRF. Within the Subject Land, the vegetation was dominated by *Eucalyptus globoidea* with scattered *E. punctata* and *E. sclerophylla*. The sub-canopy was co-dominated by *Syncarpia glomulifera* and *Pittosporum undulatum*. Evidence of an ecotone with PCT 3038: Sydney Coastal Coachwood Gallery Rainforest was apparent adjoining gullies and riparian areas, reflected by an increase in *Tristaniopsis laurina*, *Ceratopetalum apetalum*, *Ceratopetalum gummiferum* and *Callicoma serratifolia*. Small landslips have devegetated the ground and mid-stratum throughout parts of the Subject Land resulting in exposed rock and bare earth. Due to the presence of overhanging native canopy, they have been included within this vegetation type. Where landslips had occurred, the colonising species were dominated by environmental weeds.

PCT3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest

Description of PCT 3619 in BioNet

A tall, rarely very tall, shrubby sclerophyll open forest or woodland, found on exposed, slightly enriched Hawkesbury or Mittagong sandstone ridges on the margins of the Cumberland plain, western and southwestern Sydney. It describes the assemblage found on the highest sandstone-influenced soils amongst the suite of PCTs found near or within the broad interface between sandstone and shale substrates on the lower elevation sandstone plateaus of the Sydney hinterland. The tree canopy very frequently includes a higher cover of *Corymbia gummifera* together with one or more species of stringybark eucalypts, of which Eucalyptus oblonga and Eucalyptus globoidea are most frequent. These may be occasionally accompanied or replaced by Eucalyptus punctata, Angophora costata or species of scribbly gum or mahogany eucalypts, of which Eucalyptus sclerophylla and Eucalyptus resinifera are most frequent respectively. A mid-dense shrub layer very frequently includes *Leptospermum trinervium*, Banksia spinulosa, Acacia linifolia and Persoonia levis. Other common shrubs include Isopogon anemonifolius and Lambertia formosa. The ground layer is a mid-dense cover characterised by the very frequent occurrence of grasses Entolasia stricta and Austrostipa pubescens and graminoids Cyathochaeta diandra, Lomandra obligua and Lomandra multiflora subsp. multiflora. This PCT is common on the margins of shale-enriched soils that are often cleared of native vegetation cover. It grades into PCT 3616 with increasing shale influence and where species that prefer richer soils, including grasses Themeda triandra and Aristida vagans, and eucalypts such as Eucalyptus punctata are both more frequent and abundant, while the frequency, cover and diversity of heath shrubs including Banksia spinulosa, Persoonia levis and Lambertia ormosa, declines. This PCT occurs within a broad elevation range of 80-580 metres asl mainly with a mean annual rainfall of 810-1050 mm, rarely higher. It has an extensive distribution from western Menai and Panania in the Georges River catchment, south-west along the margins of Campbelltown and Wedderburn into the upper Nepean catchment, onto the Burragorang Plateau and into the lower Blue Mountains and Hawkesbury River catchment. A disjunct northern outlier occurs in northern Baulkham Hills local government area.

Groundwater Dependent Ecosystems (GDE)	Assessment of the potential for the Subject Land to support groundwater dependent ecosystems was carried out using the Commonwealth's Bureau of Meteorology Groundwater Dependent Ecosystems Atlas (BOM, 2023a). This PCT has a medium probability of being associated with a GDE.
BC Act 2016 Status	Not listed
EPBC Act 1999 Status	Not listed

4.2 Wildlife Connectivity Corridors

The Subject Land occurs within the vegetated riparian zone of Cattai Creek, which provides areas of contiguous habitat that support movement of threatened species across the broader landscape.

4.3 Threatened Ecological Communities

No threatened ecological communities (TEC) were identified within the Subject Land.

5. **RESULTS: THREATENED SPECIES**

5.1 Threatened Flora

Database searches revealed 20 threatened flora have potential to occur within a ~5km radius of the Subject Land (**Table 4**). No threatened flora species were identified within the Subject Land however, this does not rule out the potential for threatened species to still exist within the Subject Land, particularly threatened orchids, grasses and herbs.

Based on habitat constraints, no threatened flora species were considered likely to occur within the Subject Land, particularly given the existing disturbed state (understorey dominated by weeds). Further assessment is provided in **Appendix B** of this report.

Scientific Name	Common Name	BC Act	EPBC Act	Records within 5km
Acacia bynoeana	Bynoe's Wattle	E	V	12
Acacia pubescens	Downy Wattle	V	V	17
Callistemon linearifolius	Netted Bottle Brush	V	-	1
Darwinia biflora		V	V	638
Epacris purpurascens var. purpurascens		V	-	197
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	5
Eucalyptus scoparia	Wallangarra White Gum	E	V	1
Eucalyptus sp. Cattai		E	CE	482
Hibbertia puberula		Е	-	1
Hibbertia spanantha	Julian's Hibbertia	E	CE	1
Hibbertia superans		E	-	553
Leucopogon fletcheri subsp. fletcheri		E	-	25
Macadamia integrifolia	Macadamia Nut	-	V	8
Melaleuca deanei	Deane's Paperbark	V	V	1
Persoonia hirsuta	Hairy Geebung	E	E	21
Persoonia mollis subsp. maxima		E	E	1
Pimelea curviflora var. curviflora		V	V	36
Pomaderris brunnea	Brown Pomaderris	E	V	1
Syzygium paniculatum	Magenta Lilly Pilly	E	V	14
Tetratheca glandulosa		V	-	20

Table 4. Threatened flora with potential to occur within the Subject Land.

V – Vulnerable; E – Endangered; EP – Endangered Population; CE – Critically Endangered; X – Extinct

5.2 Threatened Fauna

Database searches revealed 41 threatened fauna occur, or have potential to occur, within a ~5km radius of the Subject Land (**Table 5**). No threatened fauna species were identified within the Subject Land however, this does not rule out the potential for threatened species to still exist within the Subject Land, particularly given no targeted surveys were undertaken.

Two (2) threatened fauna had the potential to occur within the Subject Land, based on habitat constraints and/ or historical records, that could be impacted by the proposed activity:

- 。 Pommerhelix duralensis (Dural Land Snail), and
- Pseudophryne australis (Red-crowned Toadlet).

All habitat areas of native vegetation within the Subject Land are potential habitat for these species. Based on the minor nature of the impacts, no threatened fauna species were considered likely to be significantly impacted by the proposed activity (**Appendix C**).

Based on habitat constraints (**Appendix B**), no other threatened fauna were considered likely to occur, or potential impacts were considered negligible and no further assessment was required.

Details of the threatened fauna habitat recorded within the Subject Land are included in Table 6.

Scientific Name	Common Name	BC Act	EPBC Act	Records within 5km
Anthochaera phrygia	Regent Honeyeater	E	CE	2
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	17
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E	E	1
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	7
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	12
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	2
Chthonicola sagittata	Speckled Warbler	V	-	3
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	3
Daphoenositta chrysoptera	Varied Sittella	V	-	5
Dasyurus maculatus	Spotted-tailed Quoll	V	E	3
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	23
Glossopsitta pusilla	Little Lorikeet	V	-	14

Table 5. Threatened fauna with potential to occur within the Subject Land.

Scientific Name	Common Name	BC Act	EPBC Act	Records within 5km
Hirundapus caudacutus	White-throated Needletail	-	V	14
Ixobrychus flavicollis	Black Bittern	V	-	3
Lathamus discolor	Swift Parrot	E	CE	10
Litoria aurea	Green and Golden Bell Frog	E	V	1
Lophoictinia isura	Square-tailed Kite	V	-	6
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	1
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	12
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	37
Miniopterus australis	Little Bent-winged Bat	V	-	18
Miniopterus orianae oceanensis	Large Bent-winged Bat		-	84
Myotis macropus	Southern Myotis	V	-	22
Neophema pulchella	Turquoise Parrot	V	-	1
Ninox connivens	Barking Owl	V	-	6
Ninox strenua	Powerful Owl	V	-	247
Pandion cristatus	Eastern Osprey	V	-	1
Petroica boodang	Scarlet Robin	V	-	1
Petroica phoenicea	Flame Robin	V	-	2
Petroica rodinogaster	Pink Robin	V	-	1
Phascolarctos cinereus	Koala	E	E	6
Polytelis swainsonii	Superb Parrot	V	V	1
Pommerhelix duralensis	Dural Land Snail	E	E	96
Pseudophryne australis	Red-crowned Toadlet	V	-	18
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	246
Pycnoptilus floccosus	Pilotbird	-	V	1
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	19
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	30
Tyto novaehollandiae	Masked Owl	V	-	3
Tyto tenebricosa	Sooty Owl	V	-	1

Scientific Name	Common Name	BC Act	EPBC Act	Records within 5km
Vespadelus troughtoni	Eastern Cave Bat	V	-	1

V – Vulnerable; E – Endangered; EP – Endangered Population; CE – Critically Endangered.

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Habitat component	Subject Land
Coarse woody debris	Present throughout.
Rock outcrops and bush rock	Present throughout.
Caves, crevices and overhangs	Absent.
Culverts, bridges, mine shafts, or abandoned structures	Absent.
Nectar/lerp-bearing Trees	Present throughout – <i>Eucalyptus</i> spp.
Nectar-bearing shrubs	Present throughout – <i>Acacia</i> spp.
Large stick nests	Absent.
Sap and gum sources	Present throughout – <i>Eucalyptus</i> spp.
She-oak fruit	Present throughout – Allocasuarina spp.
Seed-bearing trees and shrubs	Present throughout – Eucalyptus spp., Allocasuarina spp.
Soft-fruit-bearing trees/shrubs	Present throughout – Pittosporum spp.
Dense shrubbery and leaf litter	Present.
Tree hollows	Present – one stag with 1 medium and 3 small hollows (Figure 5)
Decorticating bark	Absent.
Wetlands, soaks, and streams	Cattai Creek bifurcates the Subject Land.
Open water bodies	Absent.
Estuarine, beach, mudflats, and rocky foreshores	Absent.

5.3 Migratory Species

Database searches revealed seven migratory terrestrial species, or their habitat, are known to occur within the Subject Land (**Table 7**). These species do not breed in Australia.

Table 7. Migratory terrestrial species with potential to occur in the Subject Land.

Species	EPBC Act Status
Cuculus optatus (Oriental Cuckoo)	Migratory, CAMBA, JAMBA, ROKAMBA
Hirundapus caudacutus (White-throated Needletail)	Vulnerable, Migratory, CAMBA, JAMBA, ROKAMBA
Monarcha melanopsis (Black-faced Monarch)	Migratory, Bonn
Monarcha trivirgatus (Spectacled Monarch)	Migratory, Bonn
<i>Motacilla flava</i> (Yellow Wagtail)	Migratory, CAMBA, JAMBA, ROKAMBA
<i>Myiagra cyanoleuca</i> (Satin Flycatcher)	Migratory, Bonn
Rhipidura rufifrons (Rufous Fantail)	Migratory, Bonn

CAMBA = China-Australia Migratory Bird Agreement, JAMBA = Japan-Australia Migratory Bird Agreement, ROKAMBA = Republic of Korea-Australia Migratory Bird Agreement and Bonn = Convention on the Conservation of Migratory Species of Wild Animals.


Figure 6. Threatened species records within proximity to the Subject Land.

6. IMPACT SUMMARY

6.1 Direct Impacts

6.1.1 Impacts to Plant Community Types

The primary direct ecological impact of the proposed activity is clearing of native vegetation. The proposed activity will result in the removal of 0.54ha of native vegetation, including:

- 0.08ha of PCT3038: Sydney Coastal Coachwood Gallery Rainforest
- 0.46ha of PCT3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest

Vegetation within the Subject Land is generally in poor condition due to weed encroachment. Remnant vegetation is scarce within the Subject Land, mostly cleared prior to 1978 (Spatial Services, 2023a).

6.1.2 Impacts to Protected Fauna

All vegetation proposed for removal provides minor foraging habitat for a suite of protected fauna species. Sensitive and/ or specialist fauna habitats (e.g. hollow-bearing trees) were present within the Subject Land. Based on the design, it is anticipated that one hollow-bearing tree (stag) with 1-medium hollow, and 3-small hollows will require removal.

Within the context of the surrounding landscape, these habitat types are largely unsuitable for threatened fauna owing to the proximity of the ongoing operational impacts created by the surrounding proximal development.

DNA testing has confirmed that at least one extant Platypus population remains within Cattai Creek (THSC, 2023). No Platypus burrows were observed within the Subject Land during surveys, however it is possible that the burrows were not visible due to the water level at the time of surveys. It is also possible that burrowing may have occurred within the Subject Land since the surveys were conducted. Measures are provided in **Section 7.2** to manage Platypus within the Subject Land should they be identified during future surveys.

6.1.3 Impacts to Threatened Species and Communities

No TECs were identified within the Subject Land. A likelihood of occurrence table for threatened flora and fauna species within the Subject Land is presented in **Appendix B**.

Two (2) threatened fauna had the potential to occur within the Subject Land, based on habitat constraints and/ or historical records, that could be impacted by the proposed activity:

- 。 Pommerhelix duralensis (Dural Land Snail), and
- Pseudophryne australis (Red-crowned Toadlet).

All habitat areas of native vegetation within the Subject Land are potential habitat for these species. Based on the minor nature of the impacts, no threatened fauna species were considered likely to be significantly impacted by the proposed activity (**Appendix C**).

Based on habitat constraints (**Appendix B**), no other threatened fauna were considered likely to occur, or potential impacts were considered negligible and no further assessment was required.

The result of a Test of Significance (5-Part Test) under the BC Act was that the proposed activity will not result in a 'significant impact' on any threatened entities and therefore the Biodiversity Offset Scheme is not triggered (**Appendix C**). As such, an SIS or a BDAR is not required. The proposed activity will not result in a 'significant impact' on any MNES and a referral to the Australian Government Minister for the Environment is not required.

6.2 Indirect Impacts - edge effects, erosion, sedimentation, hydrology

Vegetation within the Subject Land was already subject to edge effects where it interacts with adjacent urban areas and degraded urban waterways. The clearing of small areas of vegetation may create new areas impacted by edge effects. Vegetation removal and ground disturbance has the potential to create erosion and sedimentation impacts to nearby aquatic environments (i.e. Cattai Creek). Erosion and sediment controls should be installed to minimise contamination of the waterway, which is classified as Key Fish Habitat.

7. AVOIDANCE, MINIMISATION & MITIGATION

7.1 Avoidance and Minimisation

When assessing the biodiversity impacts of a proposed activity there are three key considerations. These three approaches are listed in a descending order of best biodiversity outcomes:

- Avoid: measures taken by a proponent such as careful site selection, or actions taken through the design, planning, construction and operational phases of the development to completely prevent impacts on biodiversity values, or certain areas of biodiversity
- Minimise: a process applied throughout the development planning and design life cycle that seeks to reduce the residual impacts of development on biodiversity values
- Compensate: measures in a proposed activity to compensate for the biodiversity values lost. This can be achieved through offsets (financial or not).

Given the nature of the proposed activity, opportunities to change the project design in favour of vegetation retention are fairly limited and defined by engineering requirements. Laydown and storage areas will be positioned outside of native vegetation to avoid any additional impacts to native vegetation beyond the unavoidable impacts associated with the proposed activity.

Non-statutory offsets will be required for veg clearing in accordance with Sydney Water's Biodiversity Offset Guide. For non-TECs, 2:1 ratio will be used for offsets.

7.2 Impact Mitigation and Minimisation Recommendations

This section of the report details recommended efforts to avoid and minimise impacts on biodiversity values associated with the proposed activity. Measures to be implemented before, during, and post construction are detailed in **Table 8**.

Table 8. Measures to be implemented before, during, and after construction to avoid and minimise the impacts of the proposed activity.

Action	Outcome	Timing	Responsibility
Tree Protections	Australian Standard 4970 (2009) Protection of Trees on Development Sites (AS 4970:2009) outlines that a Tree Protection Zone (TPZ) is the principal means of protecting trees on construction sites. It is an area isolated from construction disturbance so that the tree remains viable. Ideally, works should be avoided within the TPZ. A Minor Encroachment is less than 10% of the TPZ and is outside the structural root zone (SRZ). A Minor Encroachment is considered acceptable by AS 4970:2009 when it is compensated for elsewhere and contiguous within the TPZ. A Major Encroachment is greater than 10% of the TPZ or inside the SRZ. Major Encroachments generally require root investigations undertaken by non-destructive methods or the use of tree sensitive construction methods. Temporary tree protection fencing should be installed prior to the commencement of works.	Prior to Construction	Abergeldie Arborist
Assigning a Project Ecologist for Vegetation Clearing	 Prior to works, the applicant should commission the services of a qualified and experienced Ecologist (minimum 3 years' experience). The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to implement the following measures in accordance with best-practice, publicly available guidelines: Pre-clearing surveys will be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011) Undertake a targeted survey for Platypus burrows within proximity to the Subject Land, and determine measures to be taken if Platypuses or their burrows are identified Vegetation and Habitat removal should be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and 	Prior to Construction	Abergeldie Ecologist
	 managing biodiversity on RTA projects (RTA, 2011) Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011) 		

Action	Outcome	Timing	Responsibility
	 Habitat will be replaced or re-instated in accordance with Guide 5: Re-use of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011) 		
	The unexpected species find procedure is to be followed under Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011) if threatened flora and fauna, not assessed in the biodiversity assessment, are identified in the Subject Land.		
Edge Effects on Adjacent Native Vegetation and Habitat	Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011).	During Construction	Abergeldie
Erosion and Sedimentation	Appropriate erosion and sediment control should be erected and maintained at all times during construction in order to avoid the potential of incurring indirect impacts on biodiversity values. Erosion and sediment controls would be established in accordance with an erosion and sedimentation plan to be produced for the proposed works. As a minimum, such measures should comply with the relevant industry guidelines such as 'the Blue Book' (Landcom, 2004).	During Construction	Abergeldie
Clearing of Vegetation	All habitat trees should be felled using a 'slow drop' technique. This involves knocking the trees to encourage any in situ fauna to vacate (e.g. using an excavator bucket) before slowly pushing the trees to the ground. Logs and log piles should be relocated outside of impact areas to minimise any loss of habitat.	During Construction	Abergeldie
Storage and Stockpiling (Soil and Materials)	Allocate all storage, stockpile, and laydown sites away from any vegetation that is planned to be retained. Avoid importing any soil from outside the site in order to avoid the potential of incurring indirect impacts on biodiversity values as this can introduce weeds and pathogens to the site. If materials are required to be imported for landscaping works, they are to be sterilised according to industry standards prior to importation to site.	During Construction	Abergeldie

Action	Outcome	Timing	Responsibility
No Weeds imported on to the Subject Land	No priority or environmental weeds, pathogens or other biosecurity issues (e.g. fireants) are to be imported on to the site prior to or during construction works.	During Construction	Abergeldie

8. CONCLUSION

The proposed activity will impact approximately 0.54ha of native vegetation, including:

- 0.08ha of PCT3038: Sydney Coastal Coachwood Gallery Rainforest
- 0.46ha of PCT3619: Sydney Hinterland Enriched Sandstone Bloodwood Forest

DNA testing has confirmed that at least one extant Platypus population remains within Cattai Creek (THSC, 2023). No Platypus burrows were observed within the Subject Land during surveys, however it is possible that the burrows were not visible due to the water level at the time of surveys. It is also possible that burrowing may have occurred within the Subject Land since the surveys were conducted. Measures are provided in **Section 7.2** to manage Platypus within the Subject Land should they be identified during future surveys.

No threatened flora or fauna species were identified within the Subject Land however, this does not rule out the potential for threatened species to still exist within the Subject Land, particularly cryptic species. Two (2) threatened fauna had the potential to occur within the Subject Land, based on habitat constraints and/ or historical records, that could be impacted by the proposed activity:

- Pommerhelix duralensis (Dural Land Snail), and
- Pseudophryne australis (Red-crowned Toadlet).

Based on habitat constraints (**Appendix B**), and/ or the minor nature of the impacts, no threatened fauna species were considered likely to occur and/ or be significantly impacted by the proposed activity (**Appendix C**).

This assessment demonstrates that the relevant provisions of the *Environmental Planning and Assessment Act 1979, Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999* have been satisfied. If the appropriate recommendations in this report are followed, the proposed activity will have a non-significant impact to protected biodiversity and is unlikely to significantly impact any threatened ecological community or species

9. **REFERENCES**

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10. APPENDICES

Appendix A. Project Design Drawings (Element Environment, 2023).

Appendix B. Assessment of likely occurrence of threatened species within the Subject Land.

Appendix C. 5-Part Tests (Tests of Significance).

Appendix A. Project Design Drawings (Element Environment, 2023).



Caste HE WRP ADDENDUM REVIEW OF ENVIRONMENTAL FACTORS



East Coast Ecology – Flora and Fauna Assessment Castle Hill Water Resource Recovery Facility

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
Acacia bynoeana	Ε	V	Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morisset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.	12	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.
Acacia pubescens	V	V	Concentrated around the Bankstown- Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Grows in open woodland and forest, in a variety of plant communities, including Cooks River-Castlereagh Ironbark forest, Shale-Gravel Transition forest and Cumberland Plain woodland.	17	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.
Callistemon linearifolius	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.

Appendix B. Assessment of likely occurrence of threatened species within the Subject Land. Survey undertaken in October 2023.

Scientific name	Status		Distribution and habitat	Number	r Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
			the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.			
Darwinia biflora	V	V	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. The vegetation structure is usually woodland, open forest or scrub-heath.	638	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Epacris purpurascens var. purpurascens	V	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	197	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Eucalyptus nicholii	V	V	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire.	5	Unlikely. This natural distribution of this species does not overlap with the Subject Land. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
Eucalyptus scoparia	E	V	In NSW it is known from only three locations near Tenterfield. Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops, typically at high altitudes. At lower elevations can occur in less rocky soils in damp situations.	1	Unlikely. This natural distribution of this species does not overlap with the Subject Land. No further assessment is required.	
Eucalyptus sp. Cattai	CE	CE	Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops. Associated soils are laterised clays overlying sandstone. There are no known populations occur in conservation reserves.	482	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Hibbertia puberula	E	-	Occurs on sandy soil often associated with sandstone. Flowering time is October to November.	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Hibbertia spanantha	CE	CE	Grows in forest with canopy species including Eucalyptus pilularis, E. resinifera, Corymbia gummifera and Angophora costata on light clay soils ssess ng on a shale sandstone soil transition on Sydney's north shore. The understorey is open with species of Poaceae,	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
			Orchidaceae, Fabaceae and Liliaceae. Flowers October and November.			
Hibbertia superans	E	-	Flowering time is July to December. The species occurs on sandstone ridgetops often near the shale-sandstone boundary. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides.	553	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Leucopogon fletcheri subsp. fletcheri	E	-	Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	25	Low. Although the survey did not take place within the recognised survey period, no species from this genus were identified, therefore this species was considered absent from the Subject Land. No further assessment is required.	
Macadamia integrifolia	-	V	Macadamia Nut occurs from Mt Bauple, near Gympie, to Currumbin Valley in the Gold Coast hinterland, south-east Queensland. The species was known to occur in north-east New South Wales; was described from 1850-60 specimens collected from Camden Haven, and there are specimens also from Lismore. This species grows in remnant rainforest, including complex mixed notophyll forest, and prefers partially open areas such as rainforest edges.	8	Unlikely. This natural distribution of this species does not overlap with the Subject Land. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
Melaleuca deanei	V	V	Grows in wet heath on sandstone in coastal districts from Berowra to Nowra.	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Persoonia hirsuta	Ε	Ε	Distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. A large area of occurrence, but occurs in small populations, increasing the species's fragmentation in the landscape. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Probably killed by fire (as other Persoonia spp. are) but will regenerate from seed.	21	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Persoonia mollis subsp. maxima	Ε	Ε	Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. Flowers are likely to be pollinated predominantly by native bees. Self- pollination is usually unsuccessful.	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	

Scientific name	Status BC EPBC Act Act		Distribution and habitat	Number	Likelihood of occurrence	
				of records (BioNet)		
Pimelea curviflora var. curviflora	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley- lateritic soils over sandstone and shale- sandstone transition soils on ridgetops and upper slopes amongst woodlands.	36	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Pomaderris brunnea	Ε	V	The species is expected to live for 10 – 20 years, while the minimum time to produce seed is estimated to be 4 – 6 years. Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area. It also occurs at Walcha on the New England Tableland and in far eastern Gippsland in Victoria.	1	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Syzygium paniculatum	Ε	V	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities	14	Low. Although the survey did not take place within the recognised survey period, no species from this genus were identified, therefore this species was absent from the Subject Land. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
Tetratheca glandulosa	V	-	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey-sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands-open woodlands, and open forest.	20	Low. A targeted survey was undertaken during the recognised survey period and this species was absent from the Subject Land. No further assessment is required.	
Anthochaera phrygia	CE	CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra- Barraba region. In NSW the distribution is very patchy and mainly confined to the two main	2	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
			breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.			
Artamus cyanopterus cyanopterus	V	-	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region. The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris (Higgins and Peter 2002). Birds are also often observed in farm land, usually at the edges of	17	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
			forest or woodland or in roadside remnants or wind breaks with dead timber.			
Callocephalon fimbriatum	V	E	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	1	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. No further assessment is required.	
Callocephalon fimbriatum – endangered population	V	EP	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	7	As above.	
Calyptorhynchus lathami lathami	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a	12	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.		not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. No further assessment is required.
Chalinolobus dwyeri	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	2	Low. This highly mobile species may be an occasional visitor, but habitat constraints required for this species are absent within the Subject Land. No further assessment is required.
Chthonicola sagittata	V	-	The Speckled Warbler lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	3	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
Climacteris picumnus victoriae	V	-	Found in eucalypt woodlands (including box- gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough- barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	3	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Daphoenositta chrysoptera	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	5	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
					No further assessment is required.
Dasyurus maculatus	V	E	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	3	Low. Suitable habitat for the species is absent from the Subject Land, given the disturbed nature of the site. No further assessment is required.
Falsistrellus tasmaniensis	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor. This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites.	23	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Glossopsitta pusilla	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt	14	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.		life cycle periods such as winter flowering resources) on habitats in the Subject Land. No further ssessent is required.
Hirundapus caudacutus	-	V	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges.	14	Moderate. This highly mobile species may forage aerially above the Subject Land, but is unlikely to rely on any habitats within the Subject Land. No further assessment is required.
Ixobrychus flavicollis	V	-	Usually found on coastal plains below 200 m. Often found along timbered watercourses, in wetlands with fringing trees and shrub vegetation. The sites where they occur are characterized by dense waterside vegetation.	3	Unlikely. Suitable habitat for the species is absent from the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Lathamus discolor	E	-	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects . The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in	10	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			Tasmania and also nomadic, moving about in response to changing food availability.		No further ssessent is required.
Litoria aurea	Ε	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	1	Unlikely. Suitable habitat for the species is absent from the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Lophoictinia isura	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata or E. smithii. Individuals appear to occupy large hunting ranges of more than 100km2. They require large living trees for breeding, particularly near water with surrounding woodland -forest close by for foraging habitat. Nest sites are generally	6	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding) on habitats in the Subject Land. No further assessment is required.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			located along or near watercourses, in a tree fork or on large horizontal limbs.		
Melithreptus gularis gularis	V	-	Eucalypt woodlands within an approximate annual rainfall range of 400-700mm	1	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Meridolum corneovirens	E	-	Primarily inhabits Cumberland Plain woodland (an EEC). This community is a grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	12	Unlikely. Suitable habitat for the species is absent from the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Micronomus norfolkensis	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	37	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence	
	BC Act	EPBC Act		of records (BioNet)		
					No further ssessent is required.	
<i>Miniopterus</i> australis	V	-	Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.	18	Low. This highly mobile species may be an occasional visitor, but habitat constraints required for this species are absent within the Subject Land. No further assessment is required.	
Miniopterus orianae oceanensis	V	-	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	84	Low. This highly mobile species may be an occasional visitor, but habitat constraints required for this species are absent within the Subject Land. No further assessment is required.	
Myotis macropus	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 – 15 close to water in caves, mine shafts, hollow-bearing	22	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the	

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			trees, storm water channels, buildings, under bridges and in dense foliage.		species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land. No further ssessent is required.
Neophema pulchella	V	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	1	Unlikely. Suitable habitat for the species is absent from the Subject Land. No further assessment is required.
Ninox connivens	V	-	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.	6	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding) on habitats in the Subject Land. No hollows suitable for breeding were identified within the Subject Land. No further assessment is required.
Ninox strenua	V	-	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed	247	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm.		species is not dependent (i.e., for breeding) on habitats in the Subject Land. No hollows suitable for breeding were identified within the Subject Land. No further assessment is required.
Pandion cristatus	V	-	Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south- eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	1	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Petroica boodang	V	-	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it	1	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.		not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. This species has not been recorded within the locality in the last 10-years. No further assessment is required.
Petroica phoenicea	V	-	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes eucalyptus forests and woodland, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January.	2	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land. No further ssessent is required.
Petroica rodinogaster	V	-	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south- eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and	1	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land. No further ssessent is required.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			tall, open eucalypt forest, particularly in densely vegetated gullies.		
Phascolarctos cinereus	V	E	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall.	6	Unlikely. Suitable habitat for the species is absent from the Subject Land due to the nearby urban interface, and relatively fragmented nature of the habitat. No further assessment is required.
Polytelis swainsonii	V	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. Inhabits box-gum, box-cypress-pine and boree woodlands and river red gum forest.	1	Unlikely. Suitable habitat for the species is absent from the Subject Land. No further assessment is required.
Pommerhelix duralensis	E	Ε	Endemic to NSW and confined to northwest fringes of the Cumberland Plain. Distribution extends as far north as St. Albans; southwest to Mulgoa, and southeast to Parramatta. Occurs in low densities in Hawkesbury Sandstone Vegetation and Shale/Sandstone Transition Forest. Found under rocks, logs, bark and in leaf litter. Has a strong preference	96	Moderate. Suitable habitat for this species occurs within the Subject Land, and this species has been recorded within proximity to the Subject Land in the last 10-years. Further assessment is required (Appendix C) .

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			for shale-influenced transitional landscapes and has not been confirmed outside such habitats.		
Pseudophryne australis	V	-	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breads	18	Moderate. Suitable habitat for this species occurs within the Subject Land, and this species has been recorded within proximity to the Subject Land in the last 10-years.
			within small ephemeral creeks that feed into larger semi-perennial streams. After rain these creeks are characterised by a series of shallow pools lined by dense grasses, ferns and low shrubs and usually contain leaf litter for shelter. Eggs are terrestrial and laid under litter, vegetation or rocks where the tadpoles inside will reach a relatively late stage of development before waiting for flooding waters before hatching will occur.		Further assessment is required (Appendix C).
Pteropus poliocephalus	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	246	High. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the Subject Land. No further assessment is required.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
<i>Pycnoptilus</i> floccosus	-	V	Pilotbirds are endemic to south-east Australia. Upland Pilotbirds occur above 600 m in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria (Higgins & Peter 2002; Loyn et al. 2021). Lowland Pilotbirds occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to Dandenong near Melbourne (Higgins & Peter 2002; Loyn et al. 2021). Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth (Higgins & Peter 2002).	1	Unlikely. Suitable habitat for the species is absent from the Subject Land. No further assessment is required.
Saccolaimus flaviventris	V	-	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	19	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land. No further assessment is required.
Scoteanax rueppellii	V	-	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at	30	Moderate. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			low altitudes below 500 m. In dense environments they utilise natural and human- made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.		species is not dependent (i.e., for breeding or important life cycle periods) on habitats in the Subject Land. No further assessment is required.
Tyto novaehollandiae	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet.	3	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding) on habitats in the Subject Land. No hollows suitable for breeding were identified within the Subject Land. No further assessment is required
Tyto tenebricosa	V	-	Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often	1	Low. This highly mobile species may be an occasional visitor, but habitat similar to the Subject Land is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding) on habitats in the Subject Land. No hollows suitable for breeding were identified within the Subject Land.

Scientific name	Status		Distribution and habitat	Number	Likelihood of occurrence
	BC Act	EPBC Act		of records (BioNet)	
			located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter.		No further assessment is required
Vespadelus troughtoni	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	1	Low. This highly mobile species may be an occasional visitor, but habitat constraints required for this species are absent within the Subject Land. No further assessment is required.
Appendix C. 5-Part Tests (Tests of Significance).

<i>Biodiversity Conservation Act 2016 –</i> Test of Significance (5-part Test)						
Pseudophryne australis, Pommerhelix duralensis						
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	The proposed action is not likely to cycle of this species such that a viab is likely to be placed at risk of extinct Although not ideal habitat given pro- potential direct impacts will occur of habitat in leaf litter or under bush ro- nature of the vegetation (severely w proximity of the Castle Hill WRRF, it Subject Land would be used for bre- were to occur. It is not expected that be likely to be placed at risk of extin- remaining immediately adjacent to large areas of potential habitat in the targeted surveys prior to construction reduce the potential direct impact to It is possible that these species will a associated with downstream sedim- can be controlled through standard likely to have an adverse effect on the that a viable local population of the risk of extinction.	have an adverse effect on the life ole local population of the species action. Desimity to the Castle Hill WRRF, on all slopes where sheltering back occurs. Given the degraded weed infested), and the close is unlikely that any part of the eding by these species, if they at a viable local population would action given suitable habitat the Subject Land and the very be broader locality. In addition, on, and translocation, will further o these species. suffer from indirect impacts entation, although these impacts mitigation measures and are not he life cycle of the species such especies is likely to be placed at				
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	Not Applicable.				

Biodiversity Conservation Act 2016 - Test of Significance (5-part Test)

Pseudophryne australis, Pommerhelix duralensis						
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	Not Applicable.				
	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	Approximately 0.54ha of potential habitat for this species will be impacted as a result of the activity. Areas potentially containing these species, that immediately adjoin the Subject Land, will be retained.				
(c) in relation to the habitat of a threatened species or ecological community:	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	Minor fragmentation will occur as a result of the activity. Connectivity will continue to provide potential habitat following construction, with large areas of potential habitat occurring in the broader locality.				
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The habitat to be directly impacted (non-breeding), is unlikely to be of high importance to this species given its current or historical use (regen and weed infested). Higher-quality habitat will continue to persist in the broader locality.				
(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The activity proposed is not likely to have an adverse effect on any declared area of critical habitat, directly or indirectly.					

Biodiversity Conservation Act 2016 – Test of Significance (5-part Test)

Pseudophryne australis, Pommerhelix duralensis						
(e) whether the proposed	The following Key Threatening Processes (KTPs) are documented to impact upon the survival of the ecological community:					
is part of a key threatening process or is likely to	Clearing of native vegetationRemoval of bush rock					
increase the impact of a key threatening process.	Suitable habitat will remain adjacent to the Subject Land and in the broader locality.					

Conclusion

There will be no significant impact on these species therefore the proposed action should not warrant the preparation of a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR).



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30 April 2024

Re: Platypus Survey, 'Castle Hill Water Recycling Plant' 179z Wright Road, (Lot 2 // DP 541048) Castle Hill, NSW

Dear Justin,

This letter report describes the methodology and summarises the findings of a literature review and field survey undertaken to determine presence of the Platypus (*Ornithorhynchus anatinus*) at 179z Wright Road (Lot 2 // DP 541048), Castle Hill, NSW (herein referred to as the 'subject site'). The survey did not detect any Platypus or obtain conclusive evidence of their habitation along the length of Cattai Creek within the subject site.

Background

Sydney Water has approved relocation of a wastewater discharge main and headwall associated with the Castle Hill Water Resource Recovery Facility (WRRF), as well as the relocation of first flush system and new overflow discharge outlet in Cattai Creek (**Figure 1**). The Review of Environmental Factors (REF) (Sydney Water, 2021) and REF Addendum (REFA) (Sydney Water, 2023) for the proposed works noted that eDNA testing identified the presence of Platypus in Cattai Creek (THSC 2023). Cattai Creek is a long waterway and eDNA testing does not indicate the specific area in which the Platypus may reside. The REFA recommended that Sydney Water should commission a qualified and experienced Ecologist to 'undertake a targeted survey for Platypus burrows within proximity to the subject land and determine measures to be taken if Platypuses or their burrows are identified' prior to REF Addendum 2 approvals.

It is noted that the Platypus is not listed as threatened under the NSW *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and no survey guidelines exist for this species.

Desktop Assessment

A site-specific literature and database review was undertaken for the subject site prior to the field survey and the preparation of this report, which included the following sources:

• BioNet Atlas (DPE 2023)

- NSW Hydrography (DFSI 2016)
- SIX Maps (DCS 2023)
- State Vegetation Type Map (DPE 2022)
- Review of Environmental Factors Addendum Phase 2 compliance upgrades Castle Hill Water Resource Recovery Facility (Sydney Water, 2023)
- Flora and Fauna Assessment Addendum 2 Castle Hill Water Resource Recovery Facility (East Coast Ecology, 2023)
- Prime real estate for the platypus (*Ornithorhynchus anatinus*): Habitat requirements in a peri-urban environment (Brunt et al 2018)
- Distribution and characteristics of the platypus (*Ornithorhynchus anatinus*) in the Murrumbidgee catchment (Connolly et al 2015)
- Understanding and managing the interactive impacts of growth in urban land use and climate change on freshwater biota: A case study using the platypus (*Ornithorhynchus anatinus*) (Coleman 2021).
- Use of stream and river habitats by the platypus, *Ornithorhynchus anatinus*, in an urban fringe environment (Serena 1998).

The results of the desktop assessment found six records in the past 20 years within 5 km of the study area, all within Cattai Creek (12 April 2004-present) (DPE 2023). Of these records, one is an observation from a 2019-21 Community Wildlife Survey with an accuracy of 10 m, and the other five records are from eDNA testing in Cattai Creek (THSC 2023). These records are identified in the BioNet as having an accuracy of 1,000 m.

Literature Review

Platypus have been subject to numerous studies exploring their resilience and adaptability in the face of urbanisation and environmental disturbances. The proposed residential subdivision, while potentially not significantly altering the area's character, warrants consideration regarding potential impacts on the Platypus and the implementation of mitigation measures during construction to ensure their protection.

A study by Serena et al (1998) explores Platypus behaviour in the Melbourne metropolitan area, focusing on their adaptation to urban and disturbed environments. Platypus were found to establish burrows near roads with substantial traffic, indicating their willingness to inhabit areas impacted by human activities. Despite encountering bridges and roads, Platypus preferred navigating along water channels rather than crossing over roadways, displaying an ability to adapt to man-made structures within their habitat.

Their habitat preferences showcase adaptability, with Platypus selecting burrow sites based on factors like bank height, vegetation cover, and structural elements along both urban creeks and more natural river systems. This adaptability suggests their resilience in diverse environments affected by human presence. Moreover, the observed movement patterns under one-lane and two-lane bridges highlight their capability to utilise waterways intersected by roads and bridges, showcasing their adaptability to urbanized settings. Threats to this species have been attributed to poor land management practices associated with stream bank erosion, loss of riparian vegetation and channel sedimentation (Grant and Smith 2010). Overall, the study provides evidence supporting the idea that Platypus exhibit tolerance to urban and disturbed environments, as they demonstrated the ability to thrive and establish homes near human infrastructure while displaying adaptability in their movement patterns and habitat selection.

Brunt et al (2018) investigates habitat requirements for the Platypus in a peri-urban environment. They note sightings in both urban and peri-urban landscapes, mostly in lower urban reaches, showing they persist in these human-altered spaces. Platypuses were found in disturbed catchments in Melbourne, Brisbane, and NSW, indicating their ability to adapt to habitat changes caused by humans. Despite increased disturbances, Platypus seem to persist, showcasing resilience in altered environments. The article stresses the importance of ongoing monitoring since there might be a limit to their tolerance to disturbance. While they currently adapt to some extent, safeguarding their habitats remains crucial for their continued existence in such environments.

Bino et al (2019) highlight challenges faced by the Platypus in urbanised and disturbed areas. They highlight various studies which demonstrate vulnerability to altered flow regimes in urban streams, constraining their distribution despite their adaptability.

A study by Connolly et al (2015) revealed a widespread presence of Platypus within the Murrumbidgee catchment, encompassing areas influenced by agricultural, forestry, and urban development. Overall, the study suggests a certain level of tolerance and adaptability to human disturbances and supports the species' ability to persist in diverse environments, navigate altered landscapes, and exhibit sightings despite challenges implies a degree of resilience and adaptiveness to anthropogenic impacts within their habitats.

Coleman et al (2021) offers insights into the habitat preferences and responses of Platypus to environmental factors, shedding light on their adaptability to certain urbanized landscapes despite challenges posed by urban expansion and climate change. The models generated suggest that while the Platypus does exhibit preferences for specific environmental conditions, they also indicate a level of resilience and adaptation within altered habitats.

The studies reviewed offer a comprehensive understanding of the adaptability and tolerance of Platypus to urban and disturbed environments, portraying this species as resilient in the face of human-induced alterations to their habitats. Given the Platypus's demonstrated adaptability and resilience, it is plausible to anticipate a degree of tolerance to the approved project.

Survey Overview

Survey took place at dusk on Tuesday 23 April 2024 with two ecologists spotlighting for approximately five person hours which included a habitat survey prior to dusk. Following the habitat assessment, areas that were identified as containing the most suitable habitat for the species were observed for 30 minutes each. Five survey points were chosen across the subject site as shown in **Figure 2**, which took into consideration available habitat and proximity to the proposed works. The Platypus is usually active at dawn and dusk, often using this time to feed (QG 2016). The survey did not detect any Platypus or obtain conclusive evidence of their habitation along the length of Cattai Creek within the subject site.

Photographs were taken to correspond with GPS points and show the condition of the creek (**Figure 3** to **Figure 9**). Additionally, GPS tracks were recorded to demonstrate the extent of

survey (**Figure 2**). Some common bird species (Willie Wagtail, Dusky Moorhen, and Eurasian Coot), an Eastern Water Dragon, and unidentified fish and turtles were observed.

Survey Limitations

The steepness of the terrain and the prevalence of dense weed patches made access to the entire reach of Cattai Creek within the subject site difficult, however access in the vicinity of the approved infrastructure was generally unimpeded. Ecologists traversed the banks of Cattai Creek within the subject site during the survey to access areas impeded by terrain and weeds (**Figure 2**).

Habitat Assessment

Platypus make their home in and near freshwater creeks, slow-moving rivers, and lakes. They build a simple burrow in a river bank, just above water level and often among vegetation (QG 2016). They are known to forage between submerged roots and branches and dig their burrows between tree roots (Grant and Fanning 2007).

Assessment of the length of Cattai Creek within the subject site revealed a declining riparian condition as the survey progressed from north to south, towards the approved infrastructure locations. Increased erosion, weed invasion, sedimentation, and instances of rubbish dumping were observed in this area (**Figure 6**). The native vegetation became sparser, and the flow of water contracted, indicating a deteriorating riparian habitat. The majority of the embankment within the subject site consisted of rock, which does not constitute Platypus habitat (**Figure 3**, **Figure 8**). No Platypus individuals or confirmed Platypus burrows were observed during the survey.

Conclusion:

The Platypus is a common species, known to persist in urban and peri-urban landscapes and be tolerant of disturbance. Observation and eDNA records over the past 20 years indicate Platypus inhabit Cattai Creek. However, field investigation of the subject site in April 2024 found no evidence of Platypus habitation (i.e., Platypus or their burrows) and there was only limited potential habitat for the Platypus. Presence of Platypus utilising the subject site can therefore not be substantiated.

Proposed impacts to the watercourse will be limited to the relocation of the approved wastewater discharge main and headwall and relocation of first flush system and new overflow discharge outlet in Cattai Creek. Additional mitigation measures are provided in the REFA (Sydney Water, 2023) and FFA prepared by East Coast Ecology (2023). The proposed works are located in areas where habitat is generally not suitable for Platypus (i.e. rock embankment; **Figure 3**, **Figure 8**).

The REFA (Sydney Water, 2023) outline the proposed works which include mitigation measures pre, during and post construction such as erosion and sediment mitigation, creekbank stabilisation and restoration of the riparian vegetation. Additionally, there is to be no complete blockage of fish passage during the works. Environmental protection measures or (if required) are to be erected so that fish and other vertebrate passage is maintained in the waterway.

Yours sincerely,

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Figure 1: Subject site showing proposed infrastructure footprint (yellow polygon) and Platypus records in the locality within Cattai Creek (DPE 2023).



Figure 2: Habitat assessment (Photo Points) and dusk survey effort (Survey Points) within the subject site.



Figure 3: Survey Point 5. Limited Platypus habitat present with majority of the embankment comprised of sandstone rock.



Figure 4: Survey Point 4. Signs of embankment deterioration with weed density becoming more prevalent.



Figure 5: Survey Point 3. Weed density and erosion becoming more prevalent.



Figure 6: Survey Point 2. Highly disturbed portion of the creek with high weed density, high amounts of litter and rocky embankment that does not constitute Platypus habitat,



Figure 7: Survey Point 1. Southern most extent of the subject site looking north. Improvements to bank stability, weed cover and some Platypus habitat present.



Figure 8: Photo Point 2. Sandstone rock embankment not constituting suitable habitat for Platypus.



Figure 9: Photo Point 4. Sandstone rock embankment not constituting suitable habitat for Platypus.

Noise Assessment

Water Treatment Plant Outlet Pipe 190 Wrights Road Castle Hill, NSW



Prepared for: Abergeldie Complex Infrastructure Pty Ltd October 2023 MAC231931-01RP1V1

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Noise Assessment

Water Treatment Plant Outlet Pipe

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Abergeldie Complex Infrastructure Pty Ltd (Abergeldie) to prepare a Noise Assessment (NA) to quantify emissions from the proposed additional outlet pipeline located at the western boundary of the Castle Hill Water Treatment Plant (CHWTP), Castle Hill, NSW.

The NA has quantified potential operational and sleep disturbance noise emissions from the operation and recommends reasonable and feasible noise controls where required.

This assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- NSW Environment Protection Authority (EPA), Approved Methods for the measurement and analysis of environmental noise in NSW, 2022;
- International Organisation for Standardisation (ISO) 9613-1:1993 (ISO9613:1) Acoustics -Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere;
- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) Acoustics -Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation;
- Standards Australia AS 1055:2018 Acoustics Description and measurement of environmental noise - General Procedures;
- Standards Australia AS/NZS 2107:2016 (AS2107) Acoustics Recommended Design Sound Levels and Reverberation Times for Building Interiors; and
- ISO/TR 17534-3 Acoustics Software for the calculation of sound outdoors Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1.

A glossary of terms, definitions and abbreviations used in this report is provided in Appendix A.



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2 Project Description

2.1 Project Background

The additional outlet pipe was originally assessed and approved in 2021 as part of the Sydney Water Review of Environmental Factors (REF), with the proposed location adjacent to the existing pipe outlet associated with the CHWTP. During detailed design of the project, the proposed additional outlet is proposed to be located approximately 100m to the south of the original outlet location.

2.1.1 Receiver Review

A review of residential receivers in proximity to the project has been completed. The surrounding locality is predominantly suburban residential dwellings with an area for public recreation in which the outlets are located (Cameo Place Reserve). **Figure 1** provides a locality plan showing the position of these receivers in relation to the existing and additional proposed pipe outlet associated with the CHWTP.





3 Noise Policy and Guidelines

3.1 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

- Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
- 2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
- 3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.



- 4. Consider residual noise impacts that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
- 5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
- 6. Monitor and report environmental noise levels from the development.

3.1.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.1.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. The measured RBLs relevant to the project are contained in **Section 4**.

3.1.3 Project Intrusiveness Noise Level (PINL)

The PINL (LAeq(15min)) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.



Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is note that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a Project Intrusiveness Noise Level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the Project Amenity Noise Level is to moderate against background noise creep.

3.1.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended Amenity Noise Levels specified in Table 2.2 (of the NPI). The NPI defines two categories of Amenity Noise Levels:

- Amenity Noise Levels (ANL) are determined considering all current and future industrial noise within a receiver area; and
- Project Amenity Noise Level (PANL) is the recommended level for a receiver area, specifically focusing the project being assessed.



Additionally, Section 2.4 of the NPI states: "to ensure that industrial noise levels (existing plus new) remain within the recommended Amenity Noise Levels for an area, a PANL applies for each new source of industrial noise as follows":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the Project Amenity Noise Level. In such cases the Project Amenity Noise Level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to ANLs (ie areas where existing traffic noise levels are 10dB greater than the recommended ANL)



Table 1 Amenity Noise Levels						
Possiver Type	Noise Amonity Area	Time of day	Recommended Amenity Noise Level			
	Noise Amenity Area	Time of day	dB LAeq(period)			
		Day	50			
	Rural	Evening	45			
		Night	40			
		Day	55			
Residential	Suburban	Evening	45			
		Night	40			
		Day	60			
	Urban	Evening	50			
		Night	45			
Hotels, motels, caretakers'			5dB above the recommended Amenity			
quarters, holiday	See column 4	See column 4	Noise Level for a residence for the			
accommodation, permanent			relevant noise amenity area and time			
resident caravan parks.			of day			
School Classroom	A11	Noisiest 1-hour	35 (internal)			
		period when in use	45 (external)			
Hospital ward						
- internal	All	Noisiest 1-hour	35			
- external	All	Noisiest 1-hour	50			
Place of worship	All	When in use	40			
- internal						
Passive Recreation	All	When in use	50			
Active Recreation	All	When in use	55			
Commercial premises	All	When in use	65			
Industrial	All	When in use	70			

The recommended Amenity Noise Levels as per Table 2.2 of the NPI are reproduced in Table 1.

Notes: The recommended Amenity Noise Levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



3.1.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the nighttime period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- LAeq(15min) 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- LAmax 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.



4 Existing Environment

4.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at one location representative of the ambient environment surrounding the project site. The selected monitoring location is shown in **Figure 1** and is considered representative of surrounding residential receivers as per Fact Sheet B1.1 of the NPI.

The unattended noise survey was conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The measurements were carried out using one Svantek 977 noise analyser from Wednesday 13 September 2023 to Friday 22 September 2023. All acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

The results of long-term unattended noise monitoring are provided in **Table 2**. The noise monitoring charts for the background monitoring assessment are provided in **Appendix B**. Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI.

Table 2 Background Noise Monitoring Summary – L1						
	Measured Background Noise Level			Measured dB LAeq(period) ^{2,3}		
Date	(LA90) dB ABL ^{1,2,3}					
	Day	Evening	Night	Day	Evening	Night
L1 – RBL / Leq Overall	37	38	38	45	51	42

Note 1: Rating background level (ABL) - the single-figure background level representing each assessment period day, evening and night as per NPI Fact Sheet A.

Note 2: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology weather station Gosford AWS, NSW (33.4351°S 151.3614°E 7m AMSL).

Note 3: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



4.2 Attended Noise Monitoring

To supplement the unattended noise assessment and to quantify the changes in ambient noise in the community surrounding the operation, one 15 minute attended measurement was completed.

The attended noise survey was conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

All acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

The attended noise monitoring was conducted using one Svantek 971 noise analyser at the site (see **Figure 1**) on Wednesday 13 September 2023 to quantify ambient background noise levels.

The attended measurement was completed during calm and clear meteorological conditions and confirmed that ambient traffic and commercial noise dominated the surrounding environment. The results of the short-term noise measurement and observations are summarised in **Table 3**.

Table 3 Operator-Attended Noise Survey Results							
Noise Descriptor (dBA re 20 µPa)			Mataaralagu	Description and CDL dDA			
LAmax	LAeq	LA90	Weteorology	Description and SFL, UDA			
			WD: NW	Aircraft 39-62			
62	39	39	WS: 0.3m/s	Birds 39-62			
			23°C	CHWTP 38-40			
	-Attended I Noise De LAmax 62	-Attended Noise Survey Noise Descriptor (dBA LAmax LAeq 62 39	Attended Noise Survey Results Noise Descriptor (dBA re 20 μPa) LAmax LAeq 62 39 39	Attended Noise Survey Results Noise Descriptor (dBA re 20 μPa) Meteorology LAmax LAeq LA90 62 39 39 WD: NW 62 39 39 WS: 0.3m/s 23°C 23°C 23°C			



Attended Monitoring identified the CHWTP as a dominant continuous source in the noise environment, which is also apparent in the measured unattended logging L90 data (see **Table 2**). The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is note that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a project intrusiveness noise level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the Project Amenity Noise Level is to moderate against background noise creep.


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5 Assessment Criteria

5.1 Project Noise Trigger Levels (Operational Noise)

5.1.1 Intrusiveness Noise Levels

The PINL are presented in **Table 4** and have been determined based on the RBL +5dBA and only apply to residential receivers.

Table 4 Project Intrusiveness Noise Levels					
Location	Receiver Type	Period ¹	Measured RBL	Adopted RBL	PINL
			dB LA90	dB LA90	dB LAeq(15min)
L1	Suburban Residential	Day	37	38	43
		Evening	38	38	43
		Night	38	38	43

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.1.2 Amenity Noise Levels and Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 5**.

Table 5 Amenity Noise Levels and Project Amenity Noise Levels					
Receiver Type	Noise Amenity Area	Assessment Period ¹	NPI Recommended ANL dB LAeq(period)	ANL dB LAeq(period) ²	PANL dB LAeq(15min) ³
		Day	55	50	53
Residential	Suburban	Evening	45	40	43
		Night	40	35	38

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Project Amenity Noise Level equals the Amenity Noise Level -5dB as there is other industry in the area.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.



5.1.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 6** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 6 Project Noise Trigger Levels					
Receiver	Noise Amenity	Assessment	PINL	PANL	PNTL
Туре	Area	Period ¹	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)
		Day	43	53	43
Residential	Suburban	Evening	43	43	43
		Night	43	38	38

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



6 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2024) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE¹. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

6.1 Assessment Scenarios

The modelled assessment scenario assumed the operation of both the existing outlet and the proposed outlet operating in conjunction over a 15-minute period.

¹ Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981



6.2 Sound Power Levels

Table 7 presents the Sound Power Level for each noise source modelled in this assessment. It is noted that Sound Power Levels were sourced from in-field measurements of the existing outlet. The measurement obtained from the water outlet, which was consistently running at a steady flow rate, provides a representative sample of typical outlet water flows.

Table 7 Acoustically Significant Sources - Sound Power Levels dBA (re 10 ⁻¹² Watts)					
Item and number modelled	Individual Sound Power	Modelled Sound Power			
per 15 minutes	Level	Level dB LAeq(15min)	Source Height		
Operation					
Outlet Pipe (x2) 88		91	0.25		

Note 1: Height above the relative ground or building below source.

6.2.1 Annoying Characteristics

Fact Sheet C of the NPI provides guidelines for applying 'modifying factors' adjustments to account for annoying noise characteristics such as low frequency, tonality, intermittent noise, irregular or noise of short duration. An assessment of annoying characteristics has been undertaken for the project. It is noted that due to the nature of the operations, intermittent noise is unlikely to be a feature of the site and has not been considered further.

The analysis of low frequency noise found that modelled noise levels from all sources was below the screening test of C-A weighted noise levels greater or equal to 15dB at the nearest receivers. The results of the assessment indicated that Z weighted noise levels remained below the relevant thresholds for all octave bands for each receiver location. Hence, no correction for low frequency noise is applied.

An assessment of tonality was undertaken to identify dominant tones associated with the project. The tonal noise correction applies when the level of an octave band exceeds the level of the adjacent band on either side by at least 5dB. The results of the tonality assessment demonstrates that the operations do not result in dominant tones. Hence, no correction for tonality is applied.



7 Noise Assessment Results

This assessment has quantified operational noise levels at the nearest receivers.

7.1 Operational Noise Assessment

Noise predictions from both outlets have been quantified at surrounding residential receivers to the project site and noise contour plots are presented in **Figure 2**. Noise contour mapping indicates that the receiver noise levels will be below the PNTLs for all periods at all residential receivers surrounding the project.





8 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment (NA) to quantify emissions from the proposed additional outlet pipeline located at the western boundary of the Castle Hill Water Treatment Plant located at Castle Hill, NSW.

The results of the Noise Assessment demonstrate that noise emissions from the proposed outlet and existing outlet operating simultaneously would satisfy the relevant PNTLs at all assessed receivers.



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Appendix A – Glossary of Terms



A number of technical terms have been used in this report and are explained in Table A1.

Table A1 Glossary of	of Acoustical Terms
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being
	twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background
	level for each assessment period (day, evening and night). It is the tenth percentile of the
	measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all
	sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the
	human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under
	investigation, when extraneous noise is removed. This is usually represented by the LA90
	descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing
	noise, the most common being the 'A-weighted' scale. This attempts to closely approximate
	the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second
	equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound.
	For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure
	representing the background level for each assessment period over the whole monitoring
	period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level	This is a measure of the total power radiated by a source in the form of sound and is given by
(Lw or SWL)	10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{12} watts.
Sound pressure level	the level of sound pressure; as measured at a distance by a standard sound level meter.
(Lp or SPL)	This differs from Lw in that it is the sound level at a receiver position as opposed to the sound
	'intensity' of the source.



 Table A2 provides a list of common noise sources and their typical sound level.

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA







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Appendix B – Noise Monitoring Charts





Connelly Way, Kellyville - Wednesday 13 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Thursday 14 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Friday 15 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Saturday 16 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Sunday 17 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Monday 18 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Tuesday 19 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Wednesday 20 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Thursday 21 September 2023



Wind Speed m/s (10m AGL)



Connelly Way, Kellyville - Friday 22 September 2023



Wind Speed m/s (10m AGL)

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