SEPP (Resilience and Hazards) 2021
Considerations of Impact to Coastal Wetland
53A Warriewood Rd, Warriewood NSW 2102

Prepared by Ecological Consultants Australia Pty Ltd TA Kingfisher Urban Ecology and Wetlands

April 2025

About this document

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Statement of Authorship

This study and report were undertaken by Ecological Consultants Australia for the client. The author of the report is Elaway Dalby-Ball with qualifications BSc majoring in Ecology and Botany with over 25 years' experience in this field.

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

Document Control Sheet	
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Signed: Elaway (Geraldene) Dalby-Ball – Director of Ecological Consultants Australia Pty Ltd

Summary

Ecological Consultants Australia (ECA), trading as Kingfisher Urban Ecology & Wetlands, has been commissioned by Sekisui House to assess the potential impacts of the proposed subdivision on the SEPP 14 Wetland in the vicinity of 53A Warriewood Road, Warriewood, within the Northern Beaches Local Government Area (LGA).

This includes addressing (a) and (b) of Section 2.8 of the SEPP (Resilience and Hazards) 2021, with a particular focus on the possible impacts on the SEPP 14 Wetland.

Section 2.8 of the Resilience and Hazards SEPP 2021 states that development consent must not be granted to development on land identified as 'proximity areas for coastal wetlands' or 'proximity area for littoral rainforest' on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact the items outlined in Table 2.3.

Extract from Table 2.3 (SEPP [Resilience and Hazards] 2021)

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland or littoral rainforest.

The proposal did not trigger BOS entry requirements. An ecological report and a Vegetation Management Plan (VMP) have been prepared by ECA (between August 2022 andMarch 2025).

Methods

- On-ground survey took place in 2022, 2023, December 2024, and March 2025.
- Groundwater studies were undertaken by Crozier Geotechnical Consultants in April 2024 (report submitted with DA).
- Mapping has been accessed from relevant State Government portals.
- Flora and fauna observations were recorded onsite using binoculars and physical examination. Notes, photos, and samples of flora species were taken to assess the ecological health and value of the site.
- BioNet searches were performed for flora, fauna, and endangered populations to identify if there were previous records of threatened species within a 10 km radius around the site (these are relevant in terms of impacts on the wetland, as flora/fauna impacts are addressed directly in the separate Flora and Fauna Assessment and VMP).

Results

The proposed works are wholly outside the Coastal Wetland (SEPP Resilience and Hazards), and partly within the 50m buffer area of the wetland.

Geotechnical studies note the identification of a freestanding groundwater table encountered broadly 2.50-3m below existing ground levels at the rear of the site, with minor seepage at the geological interfaces. A review of proposed excavation depth indicates that excavation is unlikely to intertest the water table and will have negligible impact on surface seepage (see extract below).

surface movement in adjoining areas. Backfilled retaining walls within the site, away from site boundaries or existing structures, that may deflect can utilise active earth pressure coefficients (Ka).

4.2.4. Drainage and Hydrogeology		
Groundwater Table or Seepage identified in Investigation		Yes – freestanding groundwater table encountered broadly 2.50m-3.00m below existing ground levels within the rear of site with minor seepage also observed at geological interfaces
Excavation likely to intersect	Water Table	No – Pending excavation depth
	Seepage	Negligible
Site Location and Topography		On the southern side of the road within gentle south west dipping topography
Impact of development on local hydrogeology		Negligible, provided the recommendations of this report are implemented
Onsite Stormwater Disposal		Not possible
Remarks: Trenches, as well as all new building gutters, down pipes and stormwater intercept trenches should be connected to a stormwater system designed by a Hydraulic Engineer.		

Potential Acid Sulphate Soils (PASS) have been detected, and a detailed PASS Management Plan is required if more than 1000 tonnes are disturbed. Monitoring and effective management will ensure no impact on the Coastal Wetland (see extracts below).

The laboratory test results indicate that potential Acid Sulfate soils (PASS) are present within the site with any disturbance of natural soils in excess of 1000 tonnes triggering the requirement of a detailed ASS management plan.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/04/2024	2	03/04/2024	03/04/2024		03/04/2024	[NT]
Date analysed	-			04/04/2024	2	04/04/2024	04/04/2024		04/04/2024	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	2	4.4	4.4	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	2	0.05	0.05	0	[NT]	[NT]
TAA pH 6.5	moles H$^+$/t	5	Inorg-068	<5	2	32	33	3	94	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	2	0.04	0.04	0	98	[NT]
a-Chromium Reducible Sulfur	moles H$^+$/t	3	Inorg-068	<3	2	25	25	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	2	0.012	0.012	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	2	<0.005	<0.005	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	2	0.018	0.017	6	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	2	[NT]	[NT]		100	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	2	[NT]	[NT]		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	2	0.11	0.11	0	[NT]	[NT]
a-Net Acidity	moles H$^+$/t	5	Inorg-068	<5	2	66	66	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	2	5	5	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H$^+$/t	5	Inorg-068	<5	2	66	66	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	2	5.0	5.0	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	2	0.11	0.11	0	[NT]	[NT]

Water management has been designed to maintain groundwater levels and recharge it with treated, clear stormwater at the same rate as it was predevelopment (see report by Enspire, March 2025, and extracts later in this report). A key structure for returning water is the On-Site Detention (OSD) system and the on-site vegetated swale. The OSD retains water with a slow, constant release to the swale, allowing water to infiltrate into groundwater if the soil is dry enough.

Dewatering of the Coastal Wetland will not occur as a result of the development. Excavation is only planned for the 30m closest to the creek, and the depth of excavation is mostly 0.1m, with some areas reaching 0.5m. The southern corner is lower, as it serves as the point of exit for swale to the creek (see plan later in this report).

Conclusions and Recommendations

- Based on the proposed works being outside the Coastal Wetland, but partly within the 50m wetland buffer area, there is no direct impact.
- Possible indirect impacts have been considered, including:
    - Changes to hydrology (e.g., flow area, rate, velocity, inundation intervals, and duration).
    - Weed incursion/expansion, including an assessment of nutrients post-development.
    - Increase bushfire risk – none identified.
    - Increased predation pressure on native species in/near the wetland – effective companion animal management is required, as most companion animals tend to avoid areas with open water at the surface.
    - Increased disturbance to native species in/near wetland due to inappropriate access/management.

- Increased use of chemicals in the possible management of mosquitoes, should their numbers become excessive.

The proposal, if approved, would increase development in the vicinity of the wetland. However, it does not require any direct impact on the wetland, including the creation of Asset Protection Zones (APZs). With proper water management and the OSD and swale for water infiltration to the ground, water volume and quality are expected to be the same as or better than predevelopment conditions.

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1 Introduction

Ecological Consultants Australia (ECA), trading as Kingfisher Urban Ecology & Wetlands, has been commissioned by Sekisui House to assess the potential impacts of the proposed subdivision on the SEPP 14 Wetland in the vicinity of 53A Warriewood Road, Warriewood, within the Northern Beaches Local Government Area (LGA).

This includes addressing (a) and (b) of Section 2.8 of the SEPP (Resilience and Hazards) 2021, with a particular focus on the possible impacts on the SEPP 14 Wetland.

1.1 Site Description

The Subject Site (the "site") encompasses the area of direct and likely indirect impacts and is defined as the entire property (see Figure 1.1). The study area includes the site along withany additional land surveyed during the site assessment.

The site is within Garimaigal Homelands, in what is now known as the Warriewood Valley. The site is located directly adjoins Narrbeen Creek (Figure 1.2).

Table 1.1 Site administrative information.

Category	Details
Title Reference (Lot/DP)	2/DP1115877
Area (ha)	9,251m^2
Address	53A Warriewood Rd, Warriewood, NSW 2102
LGA	Northern Beaches Council
Land Zoning	R3 – Medium Density Residential

Figure 1.1. Subject property.

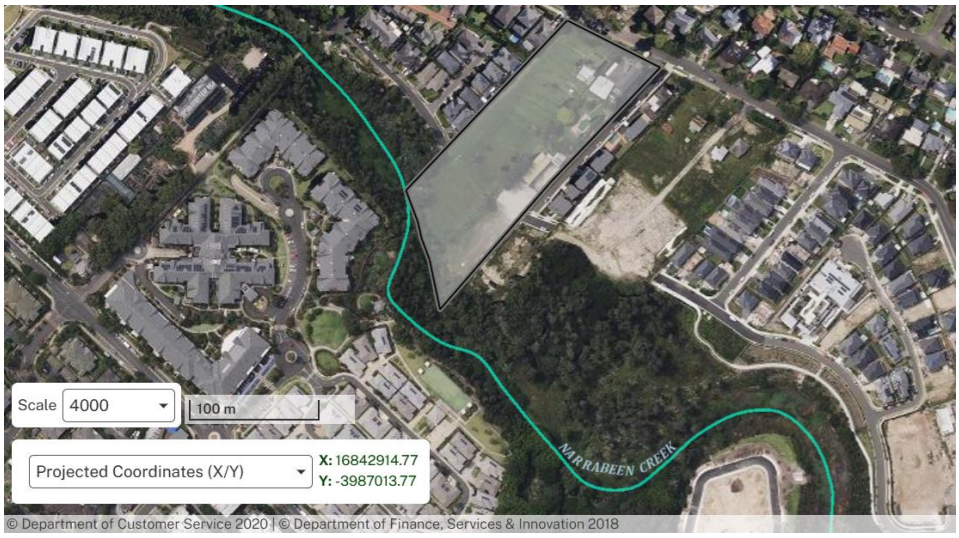

Figure 1.2. Narrabeen Creek.

A part of the site falls within the ”Proximity Area for Coastal Wetlands”, as defined by mapping under the SEPP (Resilience and Hazards) 2021, as shown in Figure 1.3. Potential impacts on this area are addressed in this report.

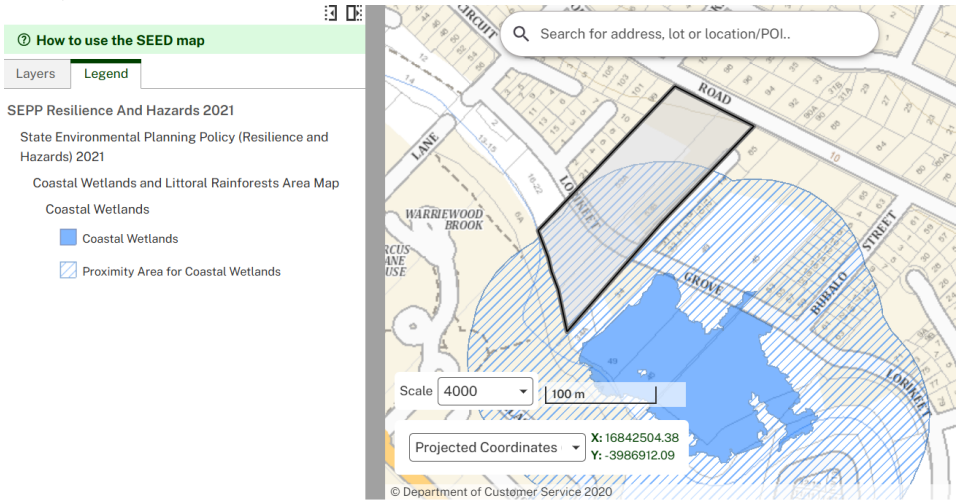

Figure 1.3. Coastal Wetlands and Littoral Rainforests Area Map.

1.2 Proposed development

The proposed development seeks approval to subdivide the existing lot into 28 residential lots, as shown in Figures 1.4 to 1.6.

Refer to DA package for further information.

ECA prepared the Flora and Fauna report and Vegetation Management Plan (VMP) for the subject property. The report assesses the impacts of development on the vegetation within the site. The VMP includes management actions to mitigate and reduce the impacts of development including revegetation works and long-term monitoring.

Figure 1.4. Proposed Site Plan.

The proposal incorporates a 50-metre-wide multi-use corridor adjacent to Narrabeen Creek, consisting of an inner 25-metre fully vegetated riparian corridor and an outer 25-metre zone featuring mixed-use native species landscaping and access pathways. The creek line restoration is addressed in the site's VMP, while the outer 25-metre zone is covered in the Landscape Plan, as illustrated in Figure 1.5.

Figure 1.5. Landscape Plan.

Several iterations of stormwater management designshave been considered, including designs for wetlands and rain gardens. However, due to site constraints, these options were not feasible. The environmental impact remains low, as no wetland will be lost, and other open water bodies exist in the vicinity.

The proposed vegetated swale and headwalls have been designed to enhance habitat for frogs and small reptiles. The swale, which will carry water to the creek, will be fully vegetated with locally native species, mostly sedges and rushes.

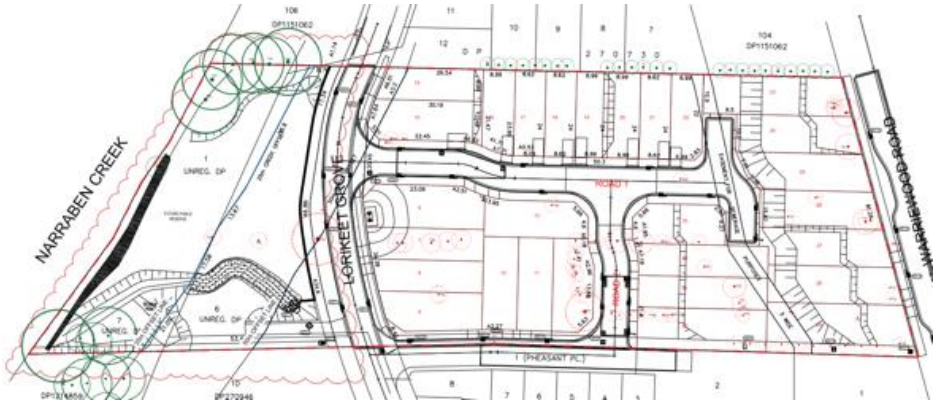

Figure 1.6. Proposed vegetated swale, with existing native trees represented by green circles.

Flooding, Ground Water and Levels:

An existing retaining wall along the creek embankment will be removed, and levels will be lowered, to allow for additional flood storage within the inner and outer creek line corridor.

The creek embankment is proposed to be reinstated with a 1 in 3 batter and rock armouring, as outlined in the WVLMDG (see drawing number from Engineering documents), and shown in the revised engineering plans. Due to the lowering of levels within both the inner and outer creek line corridors, some loss of native vegetation is expected. All proposed vegetation within the inner and outer creek line corridors will adhere to Council's specifications.

Commented [BT1]: What is this?

Revised Civil Engineering Plans are provided in the DA package reflect amendments to the creek line embankment works. Specifically, it is proposed to reinstate the creek line embankment and install rock armouring along a significant portion of the creek within the site. Further details will be provided as part of the Subdivision Works Certificate. No retaining walls are proposed along the creek.

The Engineering team have collaborated with the ecologist in an effort to retain native trees on the bank. Multiple design iterations were tested to avoid impacts, but none met the flood storage requirements without tree removal. Minimising impact has been prioritised within the 25m zone. Seed has been collected, with more Planned, and this local seed is will be used to propagate trees for replanting in this area. Seed collection and planting are part of the mitigation measures.

For the creekline bank, it has not been possible to avoid impacts and remove the existing vertical wall while achieving the necessary level drop. The "Avoid, Minimise, Mitigate" process is in included in the Flora and Fauna Report. Recommendations are detailed in the VMP, which is the tool to ensure the return of diverse and abundant native species.

Earthworks Volume:

The expected cut volume is 1600-1800m^3 for the downstream Lot 1, with the majority of the cut occurring for the formation of the swale and outlet (1-1.5m). The remaining cut areas are minor, with the ground level being lowered by approximately 200mm (0-0.5m).

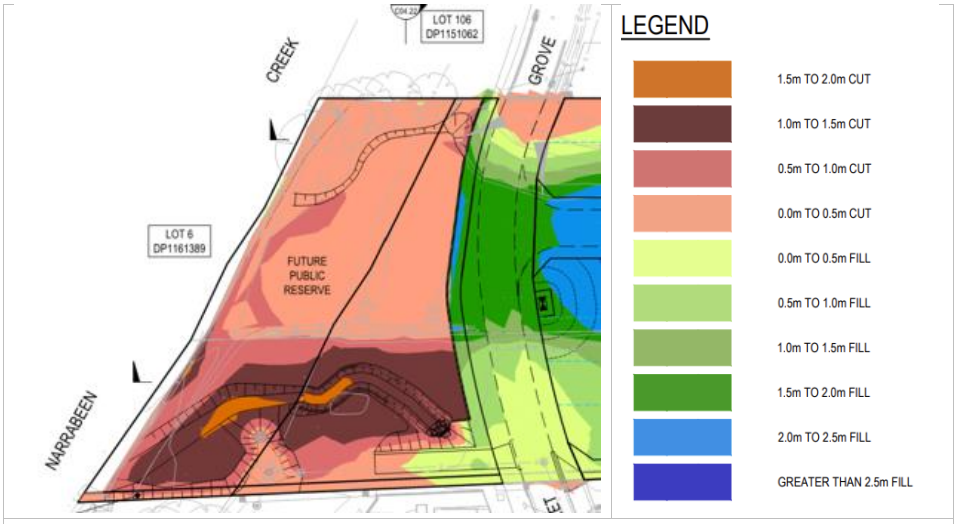

Figure 1.7. Proposed cut and fill within the riparian corridor.

Flood modelling for the 1% and 20% events, pre-works, is shown in Figure 1.8.

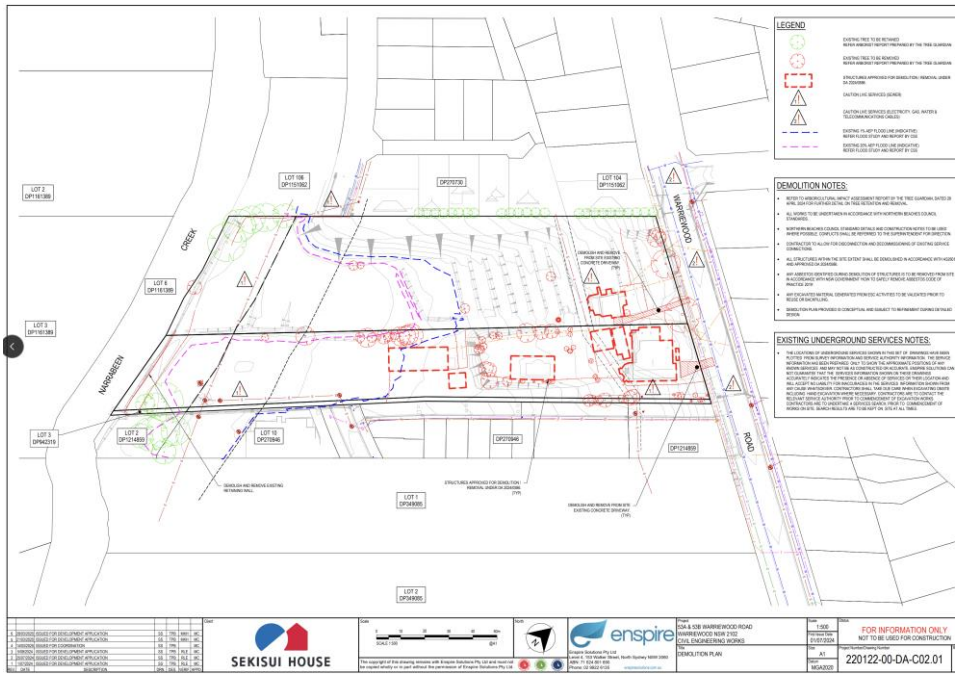

Figure 1.8. Riparian area showing flood levels pre-works (1% and 20%).

6.4 Flooding

A site-specific Flood Study assessment has been undertaken by CSS for the site and its surroundings. The peak water surface levels and flood extents for various storm events has been assessed for the site and results are reflected in the flood study. A summary of the results is outlined below.

Table 2 - Flood Levels (CSS)

Design Event (ARI)	Peak Flood level (m AHD) Pre-Development	Peak Flood Level (m AHD) Post-Development
1 in 2-year[1]	4.35	4.29
1 in 5-year[1]	4.44	4.38
1 in 20-year[1]	4.54	4.49
1 in 100-year[1]	4.71	4.66
Probable Maximum Flood (PMF)[1]	5.55	5.53

Inclusive of 30% Climate Change Impacts

Creek bed levels will be retained (as indicated on page 4 of the Civil Engineering Works DA).

> Narrabeen Creek levels vary between RL 1.63 at the base to RL 3.89 taken at the top of bank. It is intended to retain existing levels within the creek bed. A select number of trees are also to be retained. Reference shall be made to **Appendix A** for the Detail Survey.

The pre- and post-development flows are similar for all tested events (1%, 5%, and 20%). As indicated in the extract below, there is no predicted increased in scouring due to changes in flow velocity.

6.7.2 Stormwater Quantity Results

A pre- to post-development flow assessment was undertaken for the site. The calculated Permissible Site Discharge (PSD) considers the subject site only and does not cater for any external catchments. All flows generated external and upstream of the site will not be conveyed via the pit and pipe network within the subdivision, but rather the trunk drainage and existing overland flow paths around the site.

The pre- to post-development flow assessment results are outlined below in **Table 4**. Results were taken at the lowest point of the site being Narrabeen Creek.

Table 4 – Pre-Post Flow Assessment

Storm Event	Pre-Development Flow (m^3/s)	Post-Development Flow (m^3/s)	Compliant
20% AEP	0.509	0.506	Yes
5% AEP	0.717	0.641	Yes
1% AEP	0.921	0.809	Yes

From the above, Enspire confirm with the provision of the OSD systems, post development flows are less than or equal to pre-development flows at the site discharge point.

Retaining Walls:

Retaining walls will not impact the flow of groundwater through or under the site, as shown in the extract below (indicating red and purple areas for retaining walls) The On-site Detention (OSD) system will hold and retain water before it enters the vegetated swale and rock outlet, allowing for increased water infiltration. This provide more opportunity for the soil to dry, creating space for water to infiltrate, as shown in the extract below.

An overview of the retaining wall locations is presented in **Figure 11**.

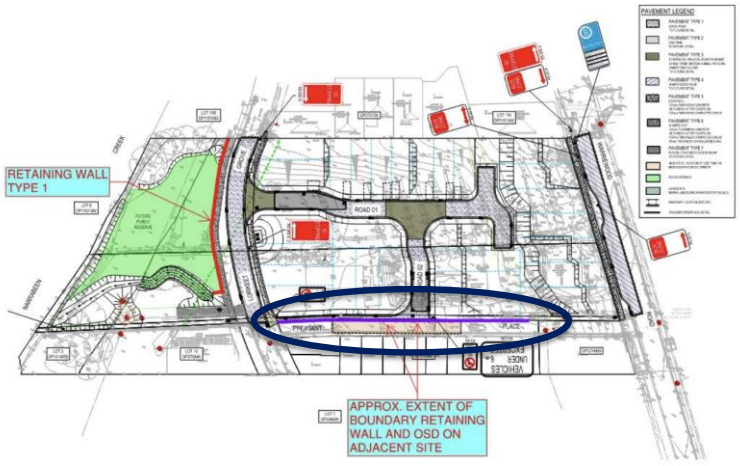

Figure 11 - Retaining Walls

Water Quality:

From a water quality perspective, the site is expected to have no adverse impact on the Coastal Wetland, as the reduction targets for gross pollutants, nutrients, and suspended solids are being met within the required performance levels. While elevated nutrients could increase weed growth, it is noted that weed growth in the wetalnds is already high, and small increases will not result in significant changes, such as anoxic conditions or worsened weed proliferation. The extract below provides further details.

6.8.3 MUSIC Model Results

The MUSIC model was run to estimate the annual pollutant loads generated by the proposed development, as well as the resultant pollutant loads discharging from the site after flows pass through the proposed treatment train.

Table 5 summarises the average annual pollutant loads and reductions.

Table 5 - Water Quality Targets

Pollutant	Performance Target	Performance Result	Compliant
Gross Pollutants	90% reduction in the post development mean annual load (for pollutants greater than 5mm in diameter)	100	Yes
Total Phosphorus	65% reduction in the post development mean annual load	65	Yes
Total Nitrogen	45% reduction in the post development mean annual load	49.2	Yes
Total Suspended Solids	85% reduction in the post development mean annual load	90	Yes

1.3 Information sources

The following sources of information were used for this assessment:

BioNet, previous studies and the author's knowledge of the local area, were used to determine the possible occurrence of threatened species, ecological communities, and their habitats present on the subject site. BioNet records assessed a 10km radius around the subject site and include records from 1993 to the present day.

Records from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (BioNet) Office of Environment and Heritage (OEH).
- Biodiversity Values Map and Threshold Tool https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap
- Nearmap, SIX Maps. Various maps in SEED (GDE and PCTs).
- NSW Threatened Species Information (DPIE).
- PlantNET (The Royal Botanic Gardens and Domain Trust, 2014).
- Historical Imagery Viewer. https://www.spatial.nsw.gov.au/products_and_services/aerial_and_historical_imagery

Plans, drawing and reports specific to the proposed development:

- Flora and Fauna Assessment (Kingfisher March 2025)
- Vegetation Management Plan (Kingfisher, March 2025)
- Engineering Plan (Enspire, 2025)
- Geotechnical Report (Croziers, 2024)

1.4 Legislative context and statutory requirements

1.4.1 NSW Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000* institutes and sets out a system for environmental planning and assessment in NSW and includes Part 4 which deals with development applications on private land and state significant development. This proposal falls under a Part 4 development and requires development consent and associated environmental assessment.

1.4.2 NSW Biodiversity Conservation Act 2016 and associated documents

The *Biodiversity Conservation Act 2016* (BC Act) is the key legislation that enables the conservation of biodiversity within the state of New South Wales. The BC Act facilitates the assessment and on-going protection of flora and fauna, including threatened species and ecological communities. The BC Act outlines assessment and offsetting requirements for activities with the potential to impact threatened species and ecological communities in NSW, and the clearing of native vegetation.

A Flora and Fauna report has been prepared for the proposed development.

1.4.3 State Environmental Planning Policy (Resilience and Hazards) 2021

A part of the site falls within the 'Proximity Area for Coastal Wetlands', as defined by mapping under the SEPP (Resilience and Hazards) 2021, as shown in Figure 1.9. Potential impacts on this area are addressed in this report.

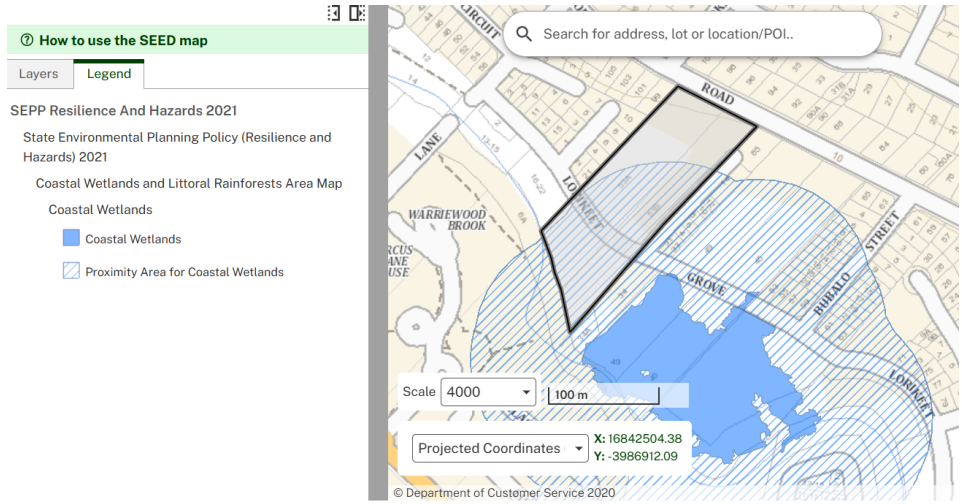

Figure 1.9. Coastal Wetlands and Littoral Rainforests Area Map.

Section 2.8 of the State Environmental Planning Policy (Resilience and Hazards) 2021 states that "development consent must not be granted to development on land identified as 'proximity areas for coastal wetlands' or 'proximity area for littoral rainforest' on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on the items outlined in Table 2.3"

Extract from Table 2.3:

> *"(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or*
>
> *(b) the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland or littoral rainforest."*

Commented [BT2]: SEPP 14 has been repealed and is not relevant to the proposed development. The link you have provided is for the repealed SEPP historical version 2007-2008. The current SEPP is the State Environmental Planning Policy (Resilience and Hazards) 2021.

1.4.4 Water Management Act 2000

1.4.5 The subject property directly adjoins Narrabeen creek, and the proposed works are within 40 metres of the top of the bank. As a result, the Water Management Act 2000 is triggered as integrated development. However, this report does not focus on the waterway itself.

Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is applicable if it was considered that an impact on a 'Matter of National Environmental Significance (MNES)' were likely, thus providing a trigger for referral of the proposal to the Department of Environment and Heritage.

Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and

- nuclear actions.

The Commonwealth Government has published the *Environmental Protection and Biodiversity Conservation Act 1999: Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment, 2013) to assist in determining whether an action is likely to have a significant impact on a MNES. The proposal is not expected to significantly impact any MNES.

1.4.6 Pittwater Local Environmental Plan (LEP) 2014 and Pittwater 21 Development Control Plan (DCP)

The Pittwater Local Environmental Plan 2014 and Pittwater 21 Development Control Plan applies to 53A Warriewood Road, Warriewood NSW. To aim of the relevant controls is to conserve, enhance and manage corridors to facilitate species movement, dispersal and interchange of genetic material – this has been covered in the Flora and Fauna report.

2 Landscape features and site context

2.1 Landscape features

Landscape features identified within the site and surrounds are shown on Figures 2.1, 2.2, and 2.3. A discussion of relevant landscape features is provided in Table 2.1.

Table 2.1. Landscape features.

Landscape feature	Description
IBRA bioregion	Sydney Basin
IBRA subregion	Pittwater
Rivers, streams, estuaries and wetlands	The site directly adjoins Narrabeen Creek on its southern boundary, with the creek being a first-order watercourse that forms the southern boundary.
Habitat connectivity	The site has a medium wildlife corridor value for arboreal and highly mobile fauna. The site borders residential properties to the east, which feature a tall tree canopy and patchy mid- and ground cover. The surrounding residential properties maintain an intact native canopy, which connects the tree canopy on the site to areas of native vegetation in the locality.
Karst, caves, crevices, cliffs, rocks and other geological features of significance	No karst, caves, crevices, cliffs, rocks, or other geological features of significance occur on the site.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been identified on the site.
Soil landscape	A review of eSPADE v2.2 indicates that the site is underlain by the Warriewood soil landscape. This landscape comprises Holocene silty to peaty quartz sand and medium to fine marine sand with podzols. The soils in this group are deep (>150 cm), well sorted, sandy Humus Podzols and dark, mottled Siliceous Sands, overlying buried Acid Peats in depressions, deep (>200 cm) Podzols, and pale Siliceous Sands on sandy rises.

Commented [BT3]: This is not relevant to this assessment.

Commented [BT4]: Consistency throughout. The subject property has been identified as the "site" earlier in the report.

3 Native vegetation, plant community types, and threatened ecological communities

3.1 Plant community types

A review of the NSW State Vegetation Type Map indicates that no Plant Community Type (PCT) occurs within the site boundary, as shown in Figure 3.1.

A small area of PCT 4006, the Northern Paperbark-Swamp Mahogany Saw-sedge Forest, is located to the west of the site, while a larger area of PCT 4028, the Estuarine Swamp Oak Twig-rush Forest, lies to the east. The eastern vegetation connects to the mapped Coastal Wetland (SEPP Resilience and Hazards) 2021. Both PCTs are part of the Endangered Ecological Community (EEC) Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

Figure 3.1. Mapped PCTs either side of the site.

Mapping of Groundwater Dependent Ecosystems (GDE) indicates that the surrounding PCTs are classified as GDE with a medium category. See the extract for PCT 4006 in Figure 3.2. This classification is expected to apply to the site once it is replanted. The current lack of mapping of GDE on the site is due to the absence of sufficient native species to quality it as a vegetation community.

GDE HEVAE

Add to Saved Results | Pulse | Zoom

Metadata

PCT ID	4006.00
PCT Name	Northern Paperbark-Swamp Mahogany Saw-sedge Forest
DIVERSITY VALUE	0.50
DIVERSITY CATEGORY	Medium
DISTINCTIVENESS VALUE	0.90
DISTINCTIVENESS CATEGORY	Very High
NATURALNESS VALUE	0.20
NATURALNESS CATEGORY	Very Low
VITALHABITAT VALUE	0.00
VITALHABITAT CATEGORY	Very Low
GDE HEVAE VALUE	0.40
GDE HEVAE CATEGORY	Medium
WSP Priority	
Catchment	Sydney Metro
SHAPE_Length	155.00
SHAPE_Area	636.32

Figure 3.2. Groundwater Dependent Ecosystems (GDE) mapping near the site. The colour code represents a medium classification.

3.2 Site photos

Plate 1. The site closest to the creek is shown in the foreground, with the neighbouring property featuring exotic species including Arundo and Coral Trees. Swamp Mahogany is visible at the rear.

Plate 2. The neighbouring property features Coral Trees, Large-leaf Privet, vine weeds, and She Oaks among other species.

Plate 3. Coral Trees are present along the creek edge, with Large-leaf Privet also observed.

Plate 4. Ground cover consists of exotic species, including Alligator Weed.

Plate 5. Turf area located on the raised part of the site, dominated by exotic species.

Plate 6. From the central area of the mapped Coastal Wetland, native canopy species include Cabbage Trees, Palms, Swamp Oaks, and native ground covers such as *Persicaria*, *Carex appressa*, *Gahnia*, along with the climbing weed Morning Glory.

Plate 7. Dense sedge areas are present in the Coastal Wetland, with free (open) water visible at the surface during the Nov 2024 and March 2025 inspections. Note that there was prolonged rainfall prior to the March 2025 inspection.

Plate 8. A high-flow bypass for extreme events runs around the Coastal Wetland.

Plate 9. View from halfway up the property, looking away from the creek.

Plate 10. The central area of the Coastal Wetland has an infestation of *Ludwigia peruviana* (weed).

4 Coastal Wetland Impact Assessment

4.1 Biophysical, Hydrological and Ecological Integrity

Section 2.8 of the State Environmental Planning Policy (Resilience and Hazards) 2021 states that "development consent must not be granted to development on land identified as 'proximity areas for coastal wetlands' or 'proximity area for littoral rainforest' on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on the items outlined in Table 2.3"

Extract from Table 2.3:

> *"(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or*
>
> *(b) the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland or littoral rainforest."*

Considerations for Impacts on the Biophysical, Hydrological, and Ecological Integrity of the Adjacent Coastal Wetland

The biophysical and hydrological integrity of the wetland will remain intact. However, several indirect impact have been considered in relation to the proposed development.

4.1.1 Weed growth and invasion

Weeds are present both on-site and in the surrounding catchment area, and must be properly managed to prevent further spread. Many of these weed species are already in the wetland and upstream, so a catchment-wide effort is necessary to address this issue.

To manage weeds in the direct works zone, herbicides will be used to control Ludwigia before any disturbance. Soil is to be considered contaminated with weed seeds, and ongoing maintenance will be required to prevent further weed spread. Continuous management of the site, both during and post-works, is critical, as weeds tend to colonize and pioneer in cleared areas.

4.1.2 Introduction of pathogens

The introduction of pathogens into the site and surrounding bushland may occur through machinery, tools, equipment, and worker clothing (e.g., boots). Diseases to watch out for include *Phytophthora* (Root Rot) and Myrtle Rust (*Puccinia psidii*). Bushland Hygiene Protocols for Phytophthora are outlined in Appendix IV of this report.

4.1.3 Soil disturbance and erosion

The removal of vegetation and trees, although primarily outside of the wetland buffer zone can lead to soil disturbance. The soil in the area appears to be sodic, which increases the risk of erosion. Additionally, soil compaction may occur due to machinery use. To mitigate these impacts, it is recommended that soil compaction be avoided in non-built areas, particularly in areas where trees are being retained. The replacement of woody debris and a covering of organic matter over the cleared site will help prevent erosion. Detailed recommendations are provided in the Engineering Reports.

4.1.4 Threatened species

Amphibian surveys occurred at various times – mid-afternoon, morning, and evening, as well as before, during, and after rain. Three species of common frogs were observed. Common Eastern Froglet *Crinia signifera* and Stripped Marsh Frog *Lymnodynastes peronii* and Dainty Tree Frog, *Litoria gracilenta,* were heard. Opportunistic observations were also made during vegetation surveys. Habitat features were thoroughly investigated, and no threatened amphibian species were identified during the surveys. Four days were allocated to the surveys. Further details can be found in the Flora and Fauna report.

Commented [BT6]: What species were observed?

Commented [BT7]: Not relevant to this report unless threatened species were identified as relevant to the site in the Flora and Fauna report? Only include a summary of threatened species identified within the site relevant to the coastal wetland. If there isn't any then state this with reference to the FF.

4.2 Quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland

4.2.1 Water Quality

Water quality modelling outcomes indicate that gross pollutants, nutrients, and other potential contaminants will be kept within acceptable levels. The stormwater management system is designed to ensure that these factors will not negatively impact the coastal wetland.

4.2.2 Surface and Groundwater Flows

The quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland are expected to remain unchanged post-development.

4.2.3 Groundwater

The stormwater management design includes a vegetated swale that focuses on returning clean water to the groundwater source. This design reduces the likelihood of dewatering issues. The proposed swale has the capacity to capture and briefly hold water, which will attenuate the increased peak runoff from the development. The storage and slow release of water through the swale will help maintain the hydrological conditions similar to the pre-development state.

Excavation within the riparian area is not expected to result in dewatering of the coastal wetland. Groundwater levels were found to be 2-3 meters below the surface, and the proposed excavation is above this level. As such, there should be no adverse impact on the wetland's groundwater source.

Further details of this analysis are provided in the report by Enspire 2025, which includes ground bore data. It is noted that this investigation is ongoing, as water levels can change over decades and longer.

4.3 Management tasks to assist the ongoing health of the Coastal Wetland

4.3.1 Delineation of work areas

Throughout the development, impacts to the site and retained vegetation should be minimised by clearly delineating work areas. Access to the site should be restricted to the development footprint, with an exclusion zone established around the vegetation outside these areas.

4.3.2 Erosion control and soil management

Efforts should be made to prevent soil compaction during construction, particularly in non-built areas and where trees are being retained. This can be achieved by limiting machinery access and using equipment designed to minimise compaction.

Replace woody debris and cover cleared areas with organic mulch or ground cover to prevent erosion. Erosion control measures should be maintained throughout the construction phase and into the post-construction phase.

Implement sediment control barriers, such as sediment fences, around construction zones and any disturbed areas to prevent runoff from carrying sediments into the wetland.

4.3.3 Weed management

Prior to construction, aggressive weeds, such as Ludwigia and Arundo, should be manually or chemically removed from the site and surrounding riparian zones. Herbicide application should be carried out with care to avoid non-target species.

Post-construction, regular monitoring should be conducted to detect and control the spread of weeds. This may involve the continued application of herbicide, hand removal, or targeted re-vegetation with native species.

A broader catchment-based effort will be necessary to manage weeds in the surrounding area and prevent their spread to the wetland and other nearby natural habitats.

4.3.4 Water quality testing

Regular water quality monitoring should be conducted at key points in the creek and wetland to track nutrient levels, suspended solids, and potential contaminants.

4.3.5 Fencing and tree protection

Refer to the Preliminary Arboricultural Impact Assessment and Tree Protection Plan. Tree protection measures will be implemented in accordance with the recommendations outlined in the Arboricultural Impact Assessment.

4.3.6 Training and awareness

Provide training for works and contractors on pathogen identification, hygiene practices, and protocols for preventing their introduction into sensitive areas.

4.3.7 Groundwater monitoring

Continue monitoring groundwater levels and surfacer water flow patterns to detect any potential changes that could affect the wetland's hydrology. Data should be used to inform adaptive management practices if necessary.

To fully understand and monitor potential changes in groundwater levels over time, it is recommended that a piezometer be installed in the riparian area. This monitoring device will allow for the collection of groundwater data to track changes in water levels within the riparian zone throughout the development and beyond.

4.3.8 Pathogen management

Bushland Hygiene Protocols outlined in Appendix III must be followed. The site is considered to be an area that may promote the spread of *Phytophthora* due to its moist soil and proximity to the creek. Equipment should be cleaned before entering the site and after moving between different areas of the site or the catchment.

5 Conclusion

The proposed works align with the objectives outlined in the Resilience and Hazards SEPP 2021.

Below is a summary of the actual and potential direct and indirect impacts:

- There is no direct impact on groundwater; however, changes to soil levels within the creek line corridor could potentially impact groundwater holding, storage, and flow. The proposed reshaping of the riparian zone to meet legislation requirements is unlikely to significantly alter groundwater conditions, and available data indicates that excavation will not affect the wetland.
- The development will convert porous areas (grass) into non-porous roads and dwellings, affecting stormwater infiltration. Post-development, stormwater will run off from these non-porous surfaces and be directed to stormwater devices. Modelling shows that the overall volume of stormwater will remain similar, with a slight reduction. Opportunities for water infiltration will be incorporated through the vegetated swale and rock-lined swale in the riparian corridor, as well as through on-site stormwater detention systems.

In conclusion, the development is expected to have minimal impact on the adjacent coastal wetland and will be carefully managed through ongoing mitigation measures and monitoring.

To ensure the long-term success of the project, ongoing site management will be essential, particularly for sediment control, weed management, groundwater recharge, and maintaining required water quality standards.

A Landscape Management Plan will outline the importance of the adjacent wetland and detail the restriction of pesticides and fertilisers within the C2 zone and near waterways, especially on surfaces that may direct water towards the C2 zone.

Key mitigation measures include, but are not limited to, the delineation of work areas, vegetation clearing control measures, establishment of fencing and tree protection, implementation of erosion and sediment control, and proactive weed management.

6 Author

With over 25 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Geraldene was a key contributor to the recent set of Guidelines commissioned by Southeast Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

Elaway Dalby-Ball
DIRECTOR

SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works.
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring.
- Engaging others in the area of environmental care and connection.
- Technical Advisor – environmental design, guidelines and policies.
- Sound knowledge and practical application of experimental design and statistics.
- Project management and supervision.
- Grant writing and grant assessment.
- Budget estimates and tender selection.
- Expert witness in the Land and Environment Court.

CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-*present*
- **Director and Ecologist**, Dragonfly Environmental. 1998-*present*
- **Manager** Natural Resources and Education, Pittwater Council 2002-2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Science with 1st Class Honors**, Sydney University.
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member** Ecological Consultants Association of NSW.