Review of Environmental Factors

for

Proposed Boat Launching Facility

Lot 7308 DP 1144810
Havilland Street
Conjola Park

PROPONENT: SHOALHAVEN CITY COUNCIL

REF PREPARED BY: PETER DALMAZZO

VERSION: REVISION 1 - 21 NOVEMBER 2020

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ATTACHMENTS

1 INTRODUCTION

1.1 Background

Peter Dalmazzo was commissioned by MI Engineers to prepare this review of environmental factors for a proposed new public boat launching ramp and associated facilities in Havilland Street Conjola Park. MI Engineers was the successful tenderer to Shoalhaven City Council for investigation and design of the facility, including preparation of a review of environmental factors for the project. Design was funded from the NSW Better Boating Program. This report includes an assessment of potential environmental impacts and information on legislative requirements, licences and/or permits that may need to be considered for the further development of the project. This revision of the report assesses amended plans dated March 2020.

1.2 Location and Land Tenure

The location of the site is shown in Figures 1, 2 and 3. The site of the proposed boat launching ramp is on the southwestern shore of Conjola Lake, on Lot 7308 DP 1144810 and the adjacent bed of the lake, to the east of Conjola Park. Conjola Park is a residential village located in the City of Shoalhaven on the south coast of NSW, approximately 220 kilometres south of Sydney. Lot 7308 and the adjacent bed of the lake are Crown land. Lot 7308 is Crown Reserve R97 for Public Recreation & Public Purposes with Shoalhaven City Council the appointed Crown land manager.

Figure 1. Location of Conjola Park in the region.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

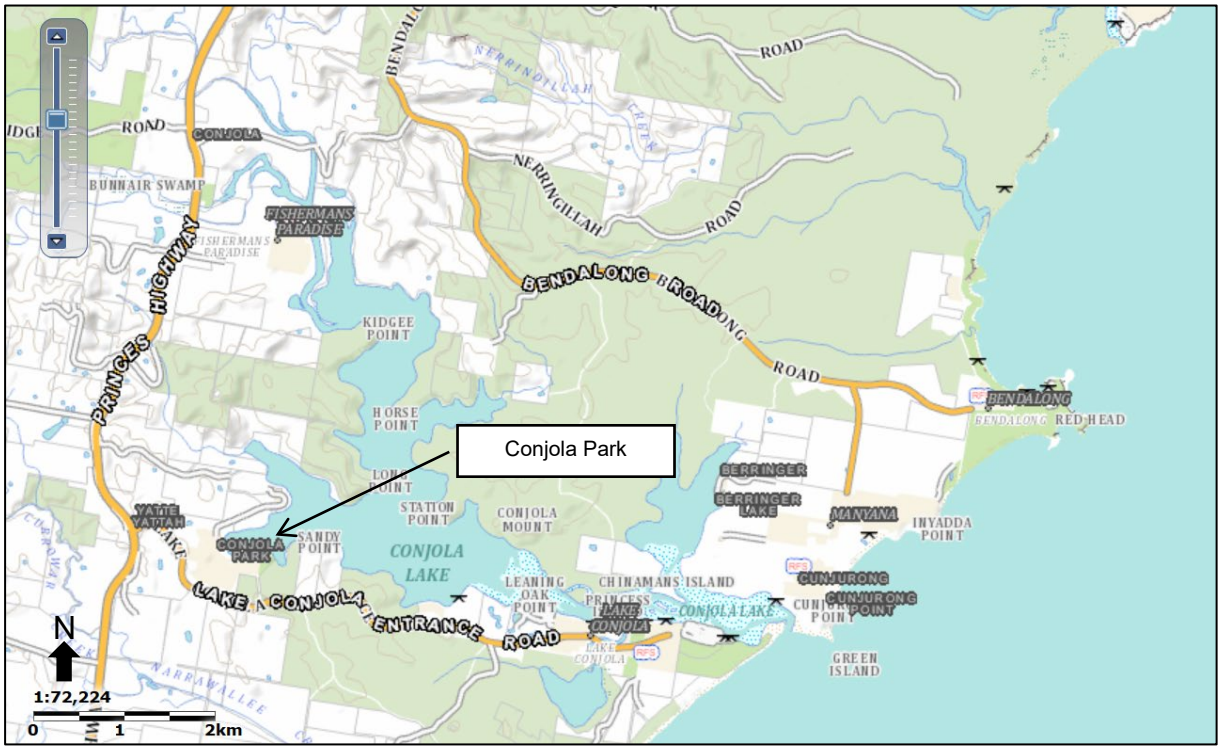

Figure 2. Location of Conjola Park.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

Figure 3. Location of the subject land, Lot 7308 DP 1144810.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

2 DESCRIPTION & JUSTIFICATION OF PROPOSED ACTIVITY

The intent of this facility is to be the main boat launching area for the western part of the lake. The lake is popular with water skiing, fishing and passive boating. Lake Conjola is the only major waterway in the Shoalhaven that is not provided with a reasonable boat launching facility within public ownership and the need for a new boat launching ramp at Conjola Lake was identified more than 20 years ago. The need for a new facility has been identified in the following strategic planning documents:

- SCC Lake Conjola Estuary Management Plan (1998)
- NSW Maritime Boating Plan of Management (2005)
- SCC – Waterways Infrastructure Management Plan (2008).

The project was placed on hold due to the discovery of the noxious aquatic weed *Caulerpa taxifolia* that was prolific in Lake Conjola. The presence of the weed is now no longer a “show stopper” but it would be expected that boat washing facilities will be required.

In 2016, Shoalhaven City Council engaged MI Engineers to investigate options for the site and design the following facilities:

- Boat launching ramp(s)
- Provision of pontoon/walkway(s)
- Car parking arrangement
- Internal road and access layout
- Services (water and power)
- Provision for toilets
- Landscaping.

After a number of design iterations, the resultant general layout for the proposed facility is shown in Figures 4 and 5 and detailed plans are in Attachment 1. The layout is the result of working to create a usable facility whilst taking other significant constraints into account, including:

- site topography
- retention of important fauna habitat especially hollow bearing trees
- minimising noise impacts for local residents
- the need for a buffer to the adjacent national park.

This revision of the review of environmental factors assesses amended plans dated March 2020. The main differences between the 2020 plans and the 2016 design are:

- construction would be staged (stage 1 is shown in Figure 5)
- entry to the facility off Havilland Street relocated resulting in shorter internal roadway
- parking areas gravel i.e. 100mm sub base only
- reduced pipe drainage.

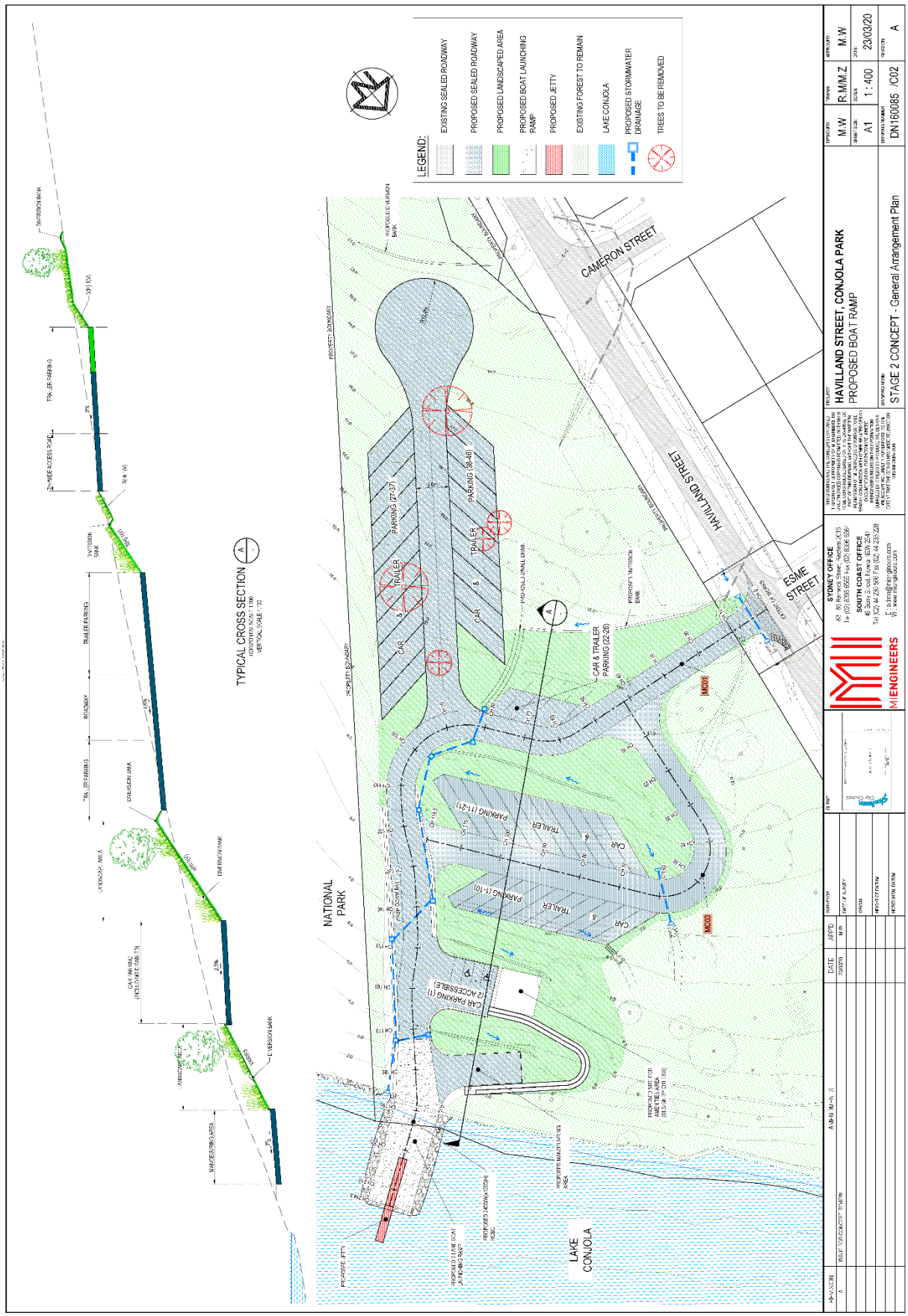

Figure 4. General layout of the complete proposed facility.

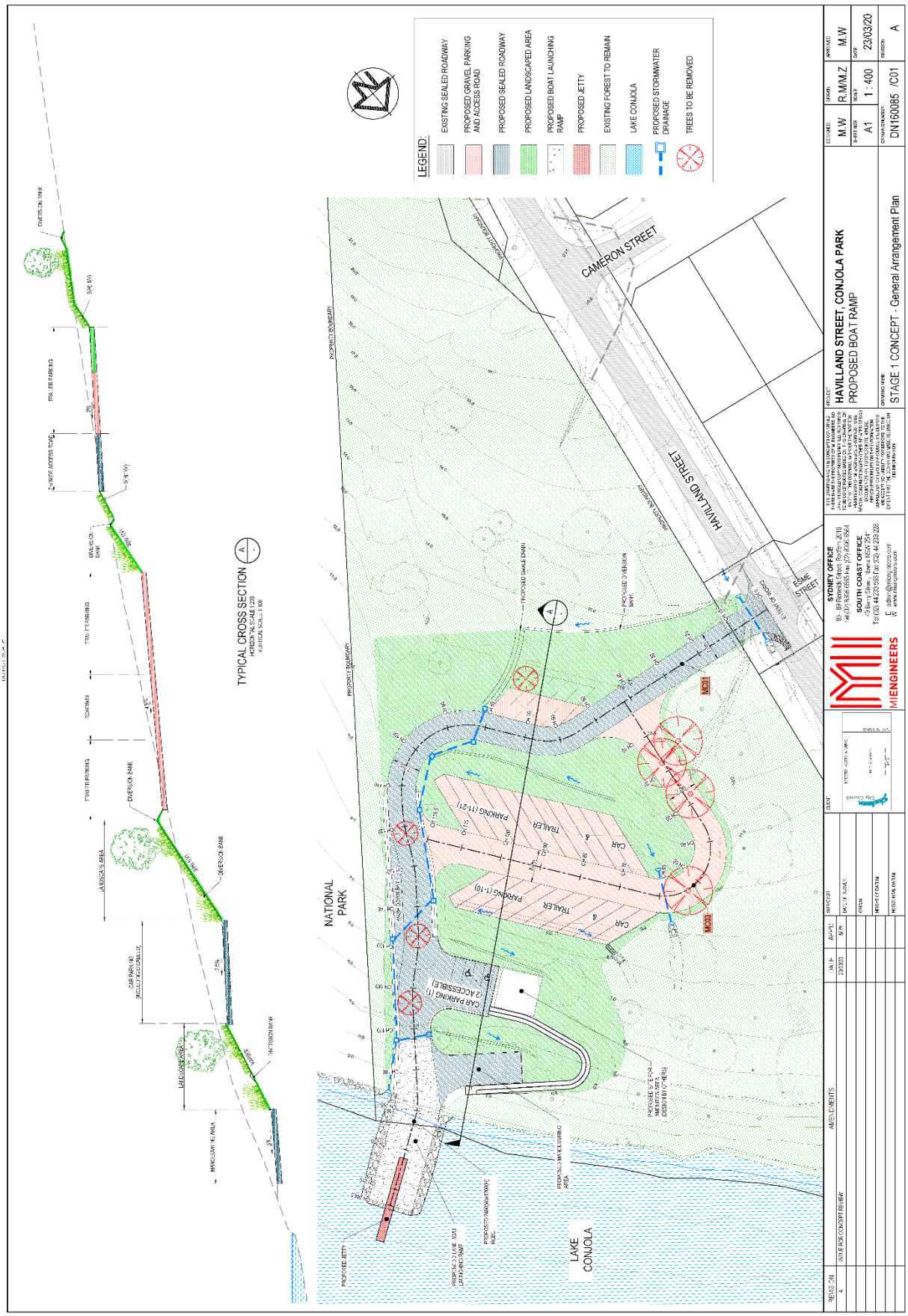

Figure 5. General layout of stage 1 of the proposed facility.

3 LEGISLATION AND PERMIT REQUIREMENTS

3.1 NSW Environmental Planning & Assessment Act 1979 & Regulation 2000

Section 5.5 in Part 5 of the Environmental Planning and Assessment Act requires that Council must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. Section 5.7 requires that an assessment must also be made of whether the proposed activity is likely to have a significant effect on the environment and therefore whether or not an environmental impact statement is required. These assessments are included in Section 7 of this review of environmental factors.

3.2 State Environmental Planning Policy (Infrastructure) 2007

Part 3 Division 13 of SEPP (Infrastructure) deals with port, wharf or boating facilities. 'Facilities' includes:

- launching facilities for any vessel
- facilities for the embarkation or disembarkation of passengers onto or from any vessels
- sea walls
- roads, fencing, lighting or car parks.

Clause 68(4) of the SEPP provides that development for the purpose of wharf or boating facilities may be carried out by or on behalf of a public authority without development consent on any land. Clause 68(5) allows Council to carry out construction works including dredging and land reclamation if it is required for the construction of facilities and also allows Council to operate the facility once it is built.

Part 2 Division 1 clause 16 requires that Council must give written notice of the intention to carry out the development to the following specified authorities and take into consideration any response to the notice that is received from those authorities within 21 days after the notice is given:

- Office of Environment and Heritage (because the development would be adjacent to land reserved under the National Parks and Wildlife Act 1974)
- Roads and Maritime (because the development would comprise a fixed or floating structure in or over navigable waters).

3.3 State Environmental Planning Policy (Coastal Management) 2018

The aim of this Policy is to promote an integrated and co-ordinated approach to land use planning in the coastal zone. The proposed activity would not be carried out on land identified as "coastal wetlands" or "littoral rainforest" or as "proximity area" on the Coastal Wetlands and Littoral Rainforests Area Map (Figure 6). The nearest mapped wetland is in Narrawallee Inlet approximately 1.5 kilometres south of the proposed facility and the nearest mapped wetland in Conjola Lake is approximately 2.7 kilometres north of the proposed facility. The nearest mapped littoral rainforest is approximately 4.6 kilometres east of the proposed facility. Therefore development consent is not required by clause10. The provisions of clauses 11, 12, 13 and 14 in relation to proximity areas, coastal vulnerability area, coastal environment area and coastal use area do not apply because development consent is not required.

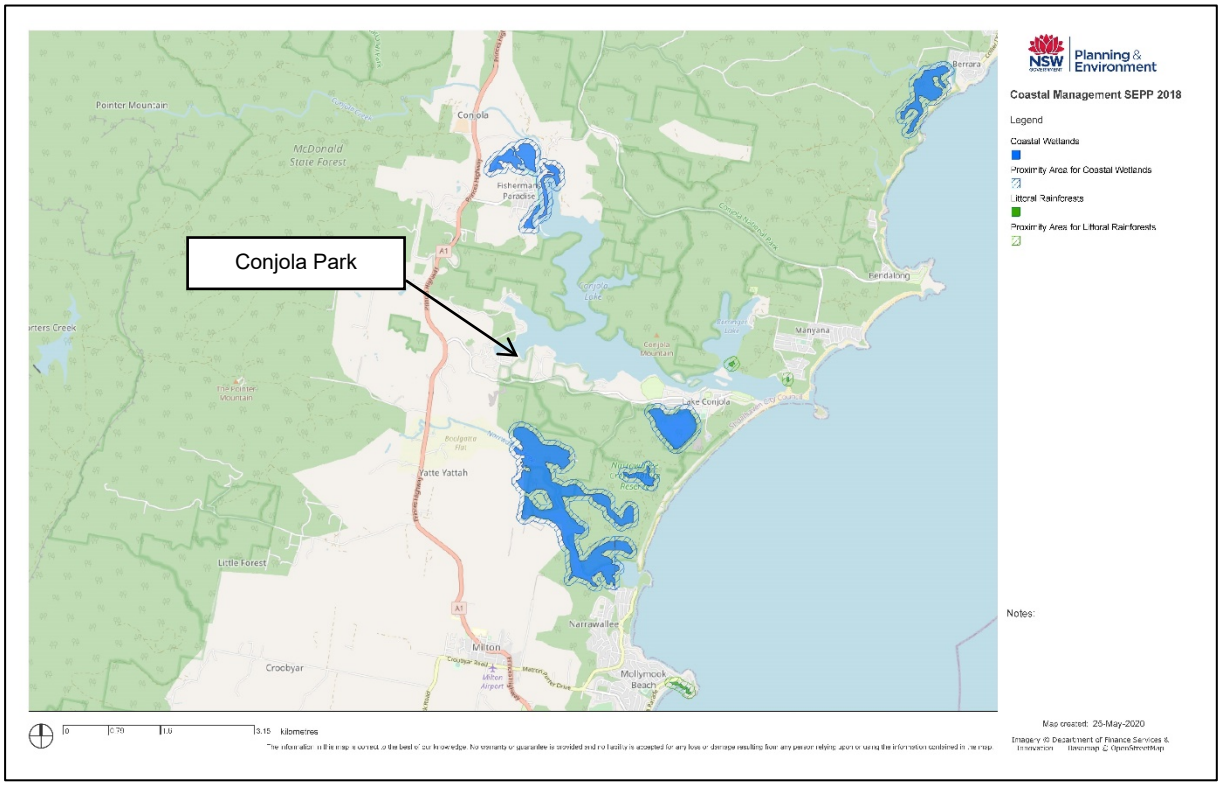

Figure 6. SEPP (Coastal Management) Coastal Wetlands and Littoral Rainforests Area Map.
Source: NSW Department of Planning and Environment

3.4 Shoalhaven Local Environmental Plan 2014

The land is zoned by the Shoalhaven LEP 2014 as W1 Natural Waterways and RE1 Public Recreation (Figure 7).

Objectives of the W1 zone are:

- To protect the ecological and scenic values of natural waterways.
- To prevent development that would have an adverse effect on the natural values of waterways in this zone.
- To provide for sustainable fishing industries and recreational fishing.

Boat launching ramps (including associated car parking facilities) and jetties are permissible in the zone with consent (but see comment below that development consent is not required due to provisions of SEPP (Infrastructure)).

Objectives of the RE1 zone are:

- To enable land to be used for public open space or recreational purposes.
- To provide a range of recreational settings and activities and compatible land uses.
- To protect and enhance the natural environment for recreational purposes.

Car parks, recreation areas, roads and water recreation structures are permissible in the zone with consent (but see comment below that development consent is not required due to provisions of SEPP (Infrastructure)).

Clause 5.12(1) of the LEP provides that the local environmental plan does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007. The provisions of SEPP (Infrastructure) mean that this proposal can be carried out by Council without development consent (see Section 3.2 above).

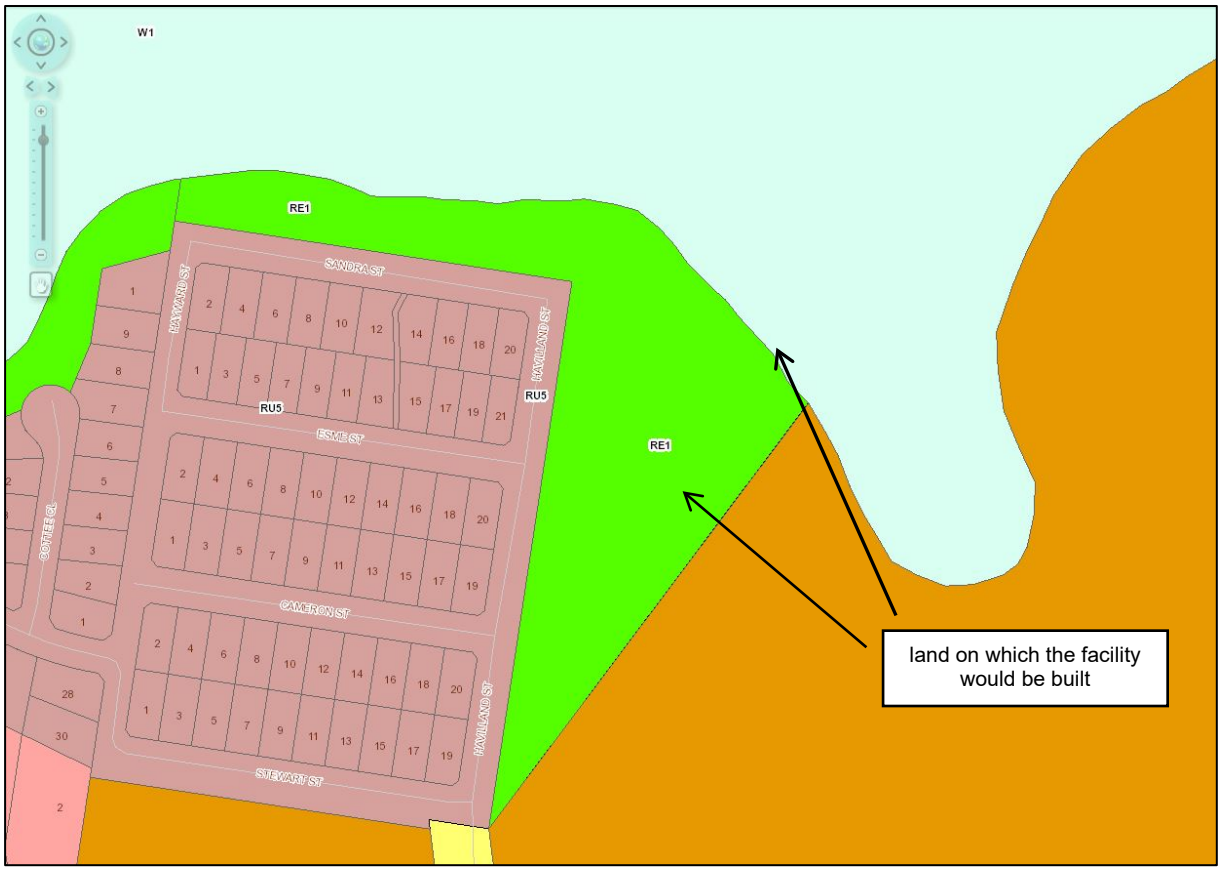

Figure 7. Land use zoning in Shoalhaven LEP 2014.
Source: Shoalhaven City Council Maps Online

3.5 NSW Protection of the Environment Operations Act 1997

Section 142A makes pollution of land an offence. The Act defines pollution of land as

> *placing in or on, or otherwise introducing into or onto, the land (whether through an act or omission) any matter, whether solid, liquid or gaseous:*
>
> *(a) that causes or is likely to cause degradation of the land, resulting in actual or potential harm to the health or safety of human beings, animals or other terrestrial life or ecosystems, or actual or potential loss or property damage, that is not trivial, or*
> *(b) that is of a prescribed nature, description or class or that does not comply with any standard prescribed in respect of that matter.*

If fill is to be placed at the site, a defence to prosecution for pollution of land includes the use of 'virgin excavated natural material' which is defined in the Act as

natural material (such as clay, gravel, sand, soil or rock fines):

(c) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities, and
(d) that does not contain any sulfidic ores or soils or any other waste,

and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.

A defence to prosecution for pollution of land at the subject site or by disposal of waste from the subject site would include:

- the use of 'virgin excavated natural material' as fill
- compliance with a relevant resource recovery order and exemption under Part 9 of the Protection of the Environment Operations (Waste) Regulation 2014
- compliance with a licence granted under the Protection of the Environment Operations Act 1997 or a specific exemption.

Relevant resource recovery orders and exemptions include those for:

- excavated public road material (2014)
- reclaimed asphalt pavement (2014)
- excavated natural material (2014).

3.6 NSW Biodiversity Conservation Act 2016

This Act lists threatened species and ecological communities, areas of outstanding biodiversity value and key threatening processes. If a significant impact on threatened species is likely, a determining authority may elect either to obtain a biodiversity development assessment report in connection with environmental impact assessment or a species impact statement must be completed and concurrence of the Environment Agency Head obtained. Biodiversity conservation matters are dealt with in Section 7 of this report.

3.7 NSW National Parks and Wildlife Act 1974

The National Parks and Wildlife Act protects all Aboriginal objects and Aboriginal places in NSW. It is an offence to dig up or damage any Aboriginal object or place without the permission of the NPWS. Aboriginal heritage matters, including a preliminary assessment under the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales, are dealt with in Section 7 of this report.

Land to the east of the site is reserved as part of Conjola National Park under the National Parks and Wildlife Act so the guidelines for development adjoining NPWS land have been considered during the design and assessment of the proposed facility.

3.8 NSW Crown Land Management Act 2016

The proposed facility would be over Crown land. As Crown land manager for public reserve R97, Shoalhaven City Council is authorised by section 3.21 of the Crown Land Management Act to classify and manage the land as if it were public land within the meaning of the Local Government Act 1993. Council build the facility without further approval as the works would be consistent with reserve's purpose of Public Recreation

& Public Purposes. An exception to this is any part of the facility beyond the reserve (such as the boat ramp) for which a licence may be required.

3.9 NSW Fisheries Management Act 1994

The Fisheries Management Act lists threatened species of fish and marine vegetation, populations or ecological communities that need to be considered under the Environmental Planning and Assessment Act. Section 200 of the Act requires Council to apply for a permit to carry out dredging or reclamation, unless the work is authorised under the Crown Lands Act or by another relevant public authority. Any works resulting in harm or impact to any marine vegetation (mangroves, seagrass, saltmarsh or seaweeds) require approval under section 205 of the Act. Any blockages or obstructions to fish passage, whether temporary or permanent will require an approval under sections 218-220 of the Act. Any use of explosives in waterways will require an approval under clauses 112-113 of the Fisheries Management (General) Regulation 2002. Fisheries matters are dealt with in Section 7 of this report.

3.10 NSW Marine Safety Act 1998

It is an offence under section 16 of this Act to create, without lawful authority (such as under the Crown Land Management Act), an obstruction to navigation by any structure.

3.11 NSW Water Management Act 2000 and Regulation 2018

Under clause 41 of the Water Management (General) Regulation 2018, activities carried out by public authorities on waterfront land are exempt from the need for a Controlled Activity Approval. Therefore, so long as the works are carried out by or on behalf of Council and that Council maintains responsibility for the carrying out of the works, a controlled activity approval from the NSW Department of Planning, Industry & Environment is not required.

3.12 NSW Aboriginal Land Rights Act 1983

The Aboriginal Land Rights Act recognises the rights of Aboriginal people in New South Wales and provides a vehicle for the expression of self-determination and self-governance. The Act provides that the New South Wales Aboriginal Land Council and Local Aboriginal Land Councils may make claim(s) to claimable Crown land(s). Aboriginal Land Claims are dealt with in Section 7 of this report.

3.13 Australian Native Title Act 1993

The Native Title Act recognises and protects native title. It provides that native title cannot be extinguished contrary to the Act. The Act covers acts affecting native title and determining whether native title exists and compensation for acts affecting native title. For past acts and future acts, this Act deals with (a) their validity, (b) their effect on native title, (c) compensation for the acts. Native title is dealt with in Section 7 of this report.

3.14 Australian Environment Protection & Biodiversity Conservation Act 1999

The EPBC Act is Australian legislation that protects matters of national environmental significance. It acts in parallel with the NSW legislation and requires separate assessments of significance should listed species or processes be potentially impacted by the works. Under Part 9 of the EPBC Act an action that could have a significant impact on a matter of national environmental significance may only be taken with approval of the Australian Government Minister for the Environment. EPBC Act matters are dealt with in Section 7.3 of this report.

4 CONSULTATION

Recent consultation is reported here but it should be noted that there has been consultation with various groups at various times in the past.

As required by State Environmental Planning Policy (Infrastructure), Council gave written notice to the following specified authorities in September 2016 of the intention to carry out the development:

- Office of Environment and Heritage (because the development would be adjacent to land reserved under the National Parks and Wildlife Act 1974)
- Roads and Maritime (because the development would comprise a fixed or floating structure in or over navigable waters).

Council's representatives also met on site with an officer of the National Parks & Wildlife service in October 2016.

A preliminary design was sent to Department of Primary Industries – Fisheries and comment invited in January 2017.

In 2016, letters were sent to all ratepayers in Conjola, Conjola Park and Fishermans Paradise (south side of the lake) requesting comment and the proposal was advertised on Council's web site. A public meeting was held at the Lake Conjola Community Hall on 16 November 2016 and was attended by approximately 22 people. Additional consultation with the local community was undertaken in 2020 in view of the modified design and a draft of this review of environmental factors was exhibited on Council's web site.

Responses from agencies and comments from the public are in Attachment 2.

Issues raised by agency representatives and by members of the public have been addressed in appropriate sections of this review of environmental factors.

The following NSW Government agencies should be provided an opportunity to review and provide comment on the revised design of the proposed facility and the review of environmental factors, prior to determination:

- Department of Primary Industries - Fisheries
- Department of Primary Industries - Lands
- NSW National Parks and Wildlife Service
- Roads and Maritime Services - Maritime Division.

5 THE ENVIRONMENT

The following description of the site is based on its character as assessed in 2016, updated where necessary to take into account the impacts of a significant bushfire that burnt through the site on 31 December 2019. Air photos of the site pre and post-fire are shown in Figures 8 and 9. As shown in Figure 10, effects on canopy and understorey vegetation on the site have been mostly attributed to GEEBAM Burnt Area Class 5-Very High. The character of the site can be seen in Figures 11 to 19.

Figure 8. Pre-fire air photo of the site.
Air photo taken 14 September 2019 © nearmap www.nearmap.com.au

Figure 9. Post-fire air photo of the site.
Air photo taken 31 January 2020 © nearmap www.nearmap.com.au

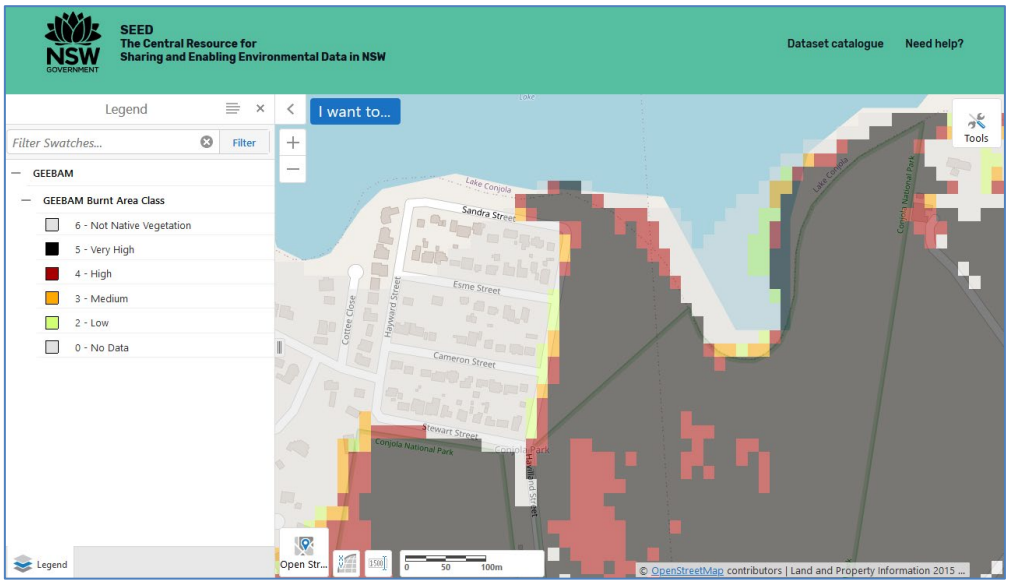

Figure 10. Google Earth Engine Burnt Area Map (GEEBAM).
Source: © State Government of NSW and Department of Planning, Industry and Environment 2020

5.1 Physical Character

The site is located on the southern foreshore of the western part of Lake Conjola. Bathymetry and topography of the site are shown in Figure 4.

The shoreline had an erosion scarp generally less than half a metre in height above a very narrow sandy intertidal beach. The bed of the lake dropped away from the shore at a fairly even and shallow grade down to several metres depth. The subtidal substrate at the site was generally muddy sand. In very shallow water there was a thin layer of black, oozy, organic-rich material on top of the sand, less so in deeper water. In some shallow areas there was a layer of leaf litter and twigs from the trees on the adjacent land. There were also a few submerged branches and fallen tree trunks at or near the site. At the western end of the site there was an outcropping ledge of sandstone extending from the water's edge into the lake. The sandstone was broken up in places.

The land above the lake sloped to the north and slightly east and therefore had a generally north-facing aspect, with natural elevations varying from 30 m ASL within the southern portion of the site to sea level adjacent to Lake Conjola. No significant drainage lines were present, however, to the east of the subject site, in the Conjola National Park, there was a gully. The site covered an area of around 2.5 hectares and was entirely vegetated, though disturbed in places by a variety of unsealed vehicle and walking tracks. Urban refuse and green garden waste had been dumped at various points along the western edge of the vegetation near Havilland Street.

Geotechnical investigations of the site (Network Geotechnics Pty Ltd, 2016; Attachment 3) revealed that on higher ground, where roads and car parking areas would be built, the soil was variously sandy clay, silty clay or sandy silt. Adjacent to the lake, where it is proposed to construct the boat ramp and manoeuvring areas, the subsurface conditions are summarised in Table 1.

Table 1. Summary of subsurface profile encountered in borehole adjacent to lake.

Layer	Soil Description	Depth to Base of Layer (m)
Topsoil	Silty SAND with roots, dark brown	0.5
Residual	Silty CLAY and Sandy CLAY, pale brown becoming mottled orange brown	4.1
Rock (probable)	Recovered as sandy GRAVEL, grey. (Probable low strength rock)	>7.5

5.2 Terrestrial Flora

A terrestrial flora assessment is in Attachment 4 and the following description is drawn from that. More than 80 species of native plants were identified. The site has been mapped by Tozer *et al*. (2010) as Southern Turpentine Forest, a type of wet sclerophyll forest (WSFp95). Tree species observed included Red Bloodwood *Corymbia gummifera*, Bangalay *Eucalyptus botryoides*, White Stringybark *Eucalyptus globoidea*, Blackbutt *Eucalyptus pilularis*, Sydney Peppermint *Eucalyptus piperita* and Turpentine *Syncarpia glomulifera*. Trees were between 25 m and 30 m in height with a fairly continuous canopy cover. A number of trees were killed by the December 2019 bushfire but many were showing signs of regeneration by epicormic growth in March 2020 (Figure 15).

A medium to sparse density middle storey layer of native shrubs that reach a height of 12 m was present. The understorey was of sparse density and composed of native shrubs and saplings that were to 2 m in height, the density of this also being dependent upon past disturbances. Throughout the subject site the understorey varied from open (southern portions) to closed (northern). Species included Lance Beard-heath *Leucopogon lanceolatus*, Gorse Bitter Pea *Daviesia ulicifolia*, Golden Glory Pea *Gompholobium latifolium*, Tantoon *Leptospermum polygalifolium*, Hairpin Banksia *Banksia spinulosa*, Native Holly *Lomatia ilicifolia*, Smooth Geebung *Persoonia levis*, Hopbush *Dodonaea triquetra*, Sweet Wattle *Acacia suaveolens*, Prickly Moses *Acacia ulicifolia*, Rough-fruit Pittosporum *Pittosporum revolutum* and Sweet Pittosporum *Pittosporum undulatum*.

The groundcover comprised of grasses, herbs and forbs to 0.5 m in height. Adjacent to Havilland Street, exotic grasses and weeds were present. Leaf litter, ground debris and fallen timber was common throughout the subject site. Ground layer plants and climbers included Bracken Fern *Pteridium esculentum*, Small-leaf Glycine *Glycine microphylla*, Dusky Coral Pea *Kennedia rubicunda*, Prickly Shaggy Pea *Podolobium ilicifolium*, Wattle Mat-rush *Lomandra filiformis*, Wombat Berry *Eustrephus latifolius*, Bonnet Orchid *Cryptostylis erecta*, Blue Flax-lily *Dianella caerulea*, Wiry Panic *Entolasia stricta* and Basket Grass *Oplismenus aemulus*.

Most of the understorey was removed by the bushfire in December 2019. There was some regeneration apparent in March 2020, from seeds and, for some species, from underground lignotubers.

To the east of the subject site, in the Conjola National Park, there was a gully with vegetation typical of a wetter environment that included eucalypt forest with more mesic midstorey plants including Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii*, and Grey Myrtle *Backhousia myrtifolia*.

5.3 Terrestrial Fauna

A terrestrial fauna assessment is in Attachment 5 and the following description is drawn from that. By the completion of the field investigation 12 native mammals, 47 native birds and one frog had been recorded within, adjacent to or flying over, the subject site. In addition, one introduced species was detected. The following species were recorded:

- the Short-beaked Echidna (*Tachyglossus aculeatus*) was observed
- the Brown Antechinus (*Antechinus stuartii*) was identified through use of the hairtube traps
- the Long-nosed Bandicoot (*Perameles nasuta*) and Sugar Glider (*Petaurus breviceps*) were both heard calling prior to conducting the playback session on 14 July 2016
- the Common Brushtail Possum (*Trichosurus vulpecula*) was both spotlit and detected through use of the infrared camera
- the Swamp Wallaby (*Wallabia bicolor*) was also detected through use of the infrared camera, indicative scats of this animals also being observed
- the Feathertail Glider (*Acrobates pygmaeus*) was spotlit
- the Eastern Grey Kangaroo (*Macropus giganteus*) was observed within the locality

- various microchiropteran bats were identified through the analysis of echolocation calls recorded
- a Sooty Owl responded, and was subsequently observed, during a call playback session conducted
- various other birds were observed within, adjacent to, or flying over the proposal area, or identified from their distinctive calls
- the Common Eastern Froglet (*Crinia signifera*) was heard emanating from Conjola Lake and associated vegetation. This winter calling amphibian was the only frog detected during the course of the field investigations.

Of those native species recorded, two are listed as vulnerable under the TSC Act:

- Sooty Owl
- Little Lorikeet (*Glossopsitta pusilla*)

Based on the results of the field investigations, the observations of the habitat present, the winter timing of the study and as they have been previously recorded in the study region, it is considered appropriate to adopt the precautionary principle and assume the presence of the following species:

- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Eastern Falsistrelle
- Large-footed Myotis
- Greater Broad-nosed Bat
- East-coast Freetail Bat.

Within the subject site, 38 trees were noted to contain one or more hollows (hollow diameter ranging from 10 cm to 40 cm) during the terrestrial fauna assessment in 2016. These were mostly in the western and northern parts of the site and are important habitat resources for hollow-dependant species of animals. The site was searched again for hollow-bearing trees in March 2020 to assess the impact of the December 2019 bushfire on these habitat components. Some previously identified hollow bearing trees had fallen, some had burnt completely, some had been felled for safety reasons and some remained standing. Of the 38 hollow-bearing trees that were mapped in 2016, eleven were not found in 2020.

5.4 Aquatic Ecology

An aquatic ecological assessment is in Attachment 6 and the following description is drawn from that.

Riparian and aquatic habitats and organisms are shown in Figures 12 and 16 to 19. The habitats and vegetation types present at the site were:

- the water column
- unvegetated soft substrates (sand/mud)
- rocky reef
- seagrass
- submerged timber (fallen tree branches and trunks)
- riparian vegetation.

Terrestrial forest extended close to the lake but in places there was a narrow riparian band of Sheoaks *Casuarina glauca*, rushes and sedges, including Bare Twigrush *Baumea juncea* and Sea Rush *Juncus kraussii*, growing at the water's edge.

Seagrasses were present at the site. In shallow areas (mostly less than 0.5 metres deep) within 5 metres of the shore and mostly closer than that, there were patches of Paddleweed *Halophila australis*, some sparse patches of Eelgrass *Zostera muelleri* and some areas of mixed Paddleweed and Eelgrass. There were a few scattered macroalgae plants (red and brown), including *Cystoseira trinodis*, growing attached to hard objects (rock and timber).

Although *Caulerpa taxifolia* had colonised extensive areas of the lake by the year 2000, the Department of Primary Industries web site indicates that between 2011 and 2014, the density of *Caulerpa* populations was observed to be significantly reduced in most southern NSW estuaries as a result of natural fluctuations in salinity and temperature. At the time of the current inspection, *Caulerpa taxifolia* was not observed and habitat at the site that would have previously been occupied by *Caulerpa* was occupied by seagrass or bare sand/mud. It is possible that small *Caulerpa* beds may remain in other parts of Lake Conjola.

In terms of aquatic fauna, there was some bioturbation of the subtidal sediments with holes approximately 10 millimetres in diameter, probably burrows of crustaceans rather than worms. Australian Mud Whelk *Batillaria australis* was numerous, grazing on organic material and algae on the sand and particularly on hard surfaces such as submerged tree branches and rock outcrops. In very shallow water close to and all along the shore there were many thousands of juvenile prawns present. Pleated Sea Squirt *Styela plicata* (an ascidian considered an introduced species in Australian waters) was attached to some fallen tree branches. Free-floating egg masses of Leaden Sand Snail *Conuber sordidum* were present. In the intertidal area there were empty cases of sessile barnacles Balanomorpha and tube worms Serpulida attached to timber. It is possible that the animals that made these shells and tubes had persisted when the lake water was in a saline state for an extended period but had died when the lake water was in a relatively fresh state. No recolonization was apparent.

A few fish were observed including Yellowfin Bream *Acanthopagrus australis* (mostly amongst the submerged timber) and Dusky Flathead *Platycephalus fuscus* on the unvegetated sediments.

Figure 11. Aerial photograph of the site. (source: SCC)

Figure 12. The site viewed from the water. (source: SCC)

Figure 13. The site viewed across Havilland Street from Esme Street. (source: SCC)

Figure 14. Native vegetation on the site. (source: SCC)

Figure 15. Character of the site in March 2020 showing regeneration following bushfire December 2019.

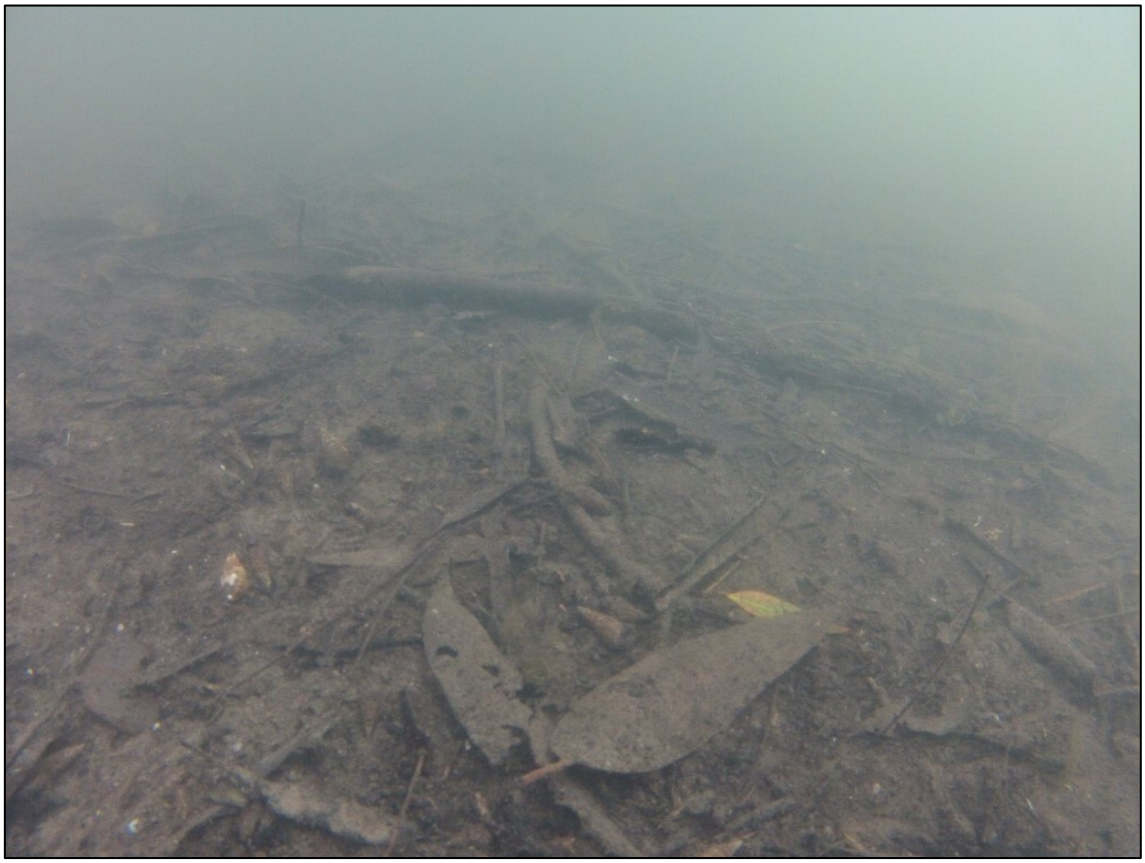

Figure 16. Partially decomposed twigs and leaves close to shore on lake bed.

Figure 17. Patch of Paddleweed *Halophila ovalis*.

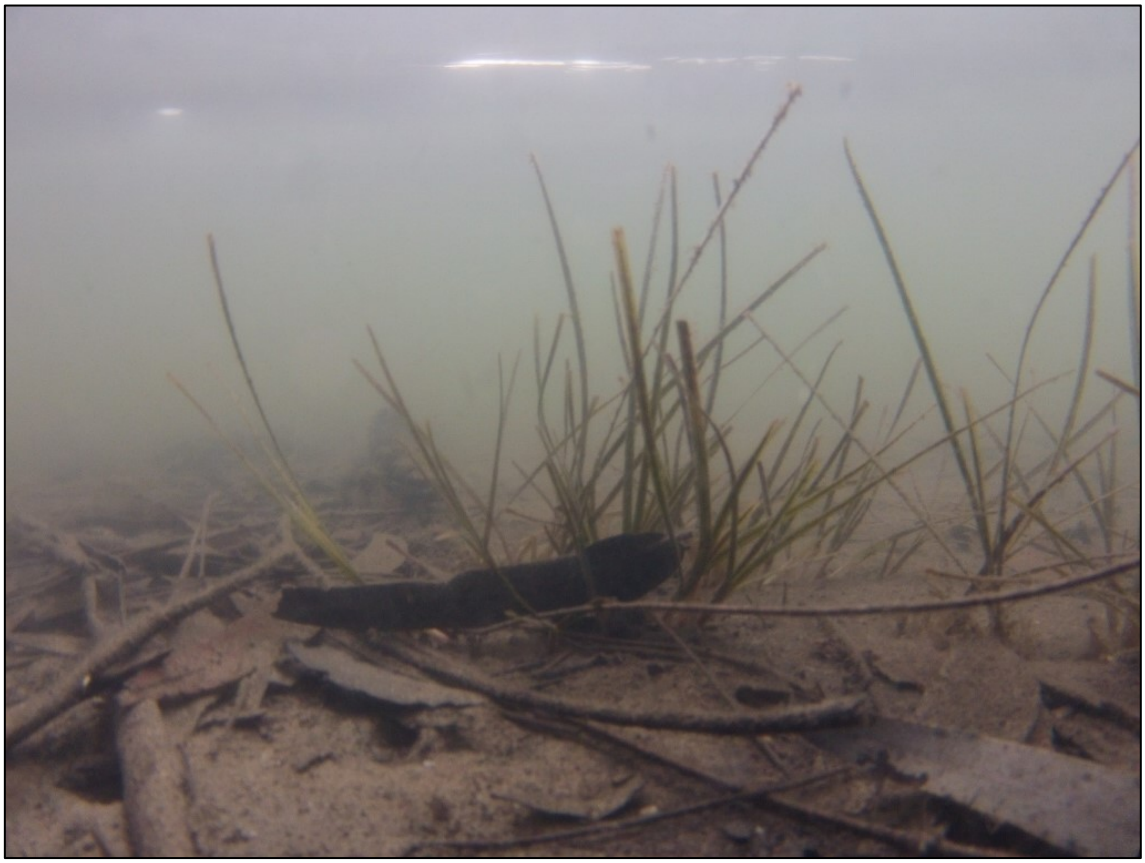

Figure 18. Patch of Eelgrass *Zostera muelleri*.

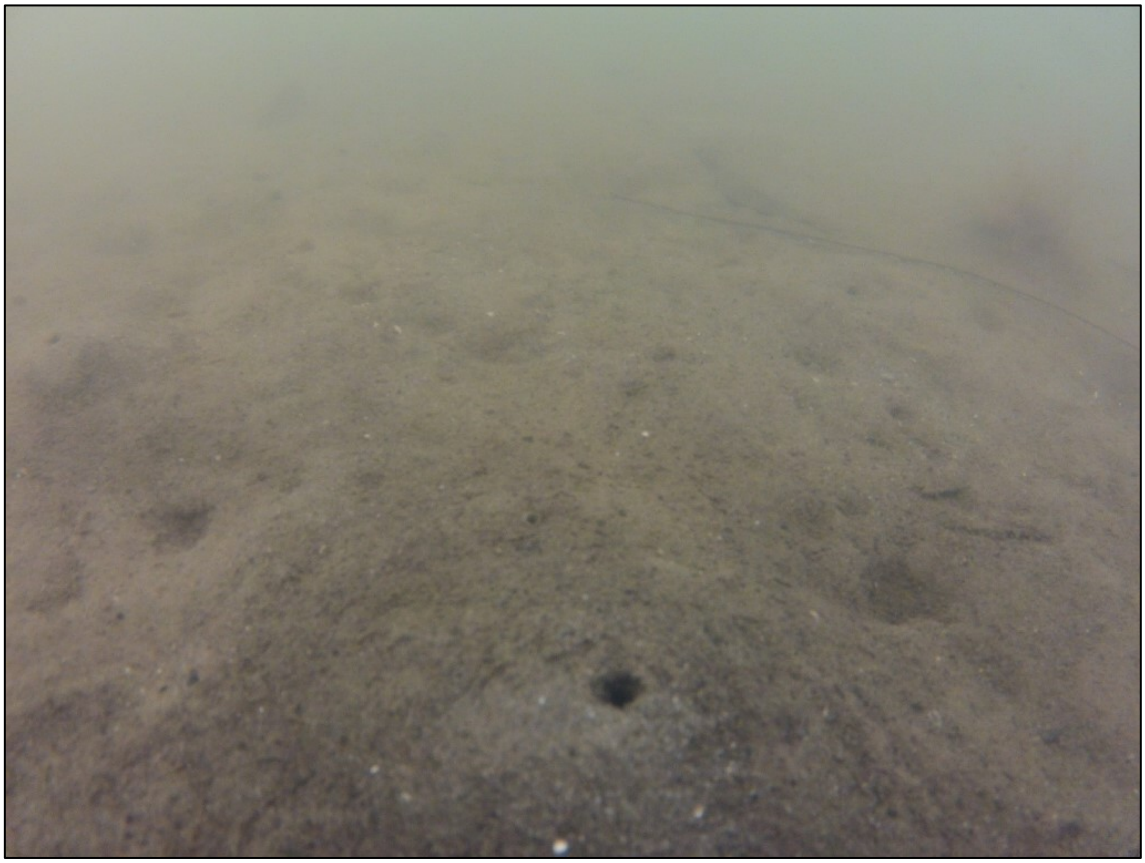

Figure 19. Unvegetated sand offshore from seagrass, with invertebrate burrows.

6 POTENTIAL ENVIRONMENTAL IMPACTS

There are a number of potential permanent/ongoing impacts and construction impacts from the proposal that could affect the human environment, aquatic, intertidal or terrestrial plants or animals or their habitats, as well as affecting the adjacent national park.

Permanent/ongoing impacts are those that result in long term changes to the environment and could include:

- increased traffic entering Havilland Street and associated noise and safety issues
- noise associated with launching and retrieval
- increased noise, erosion and other impacts from increased boating
- removal or modification of habitat by:
    - clearing of vegetation
    - changes to substrate composition and orientation
    - shading
- effects on wildlife and vegetation from increased human activity
- increased littering and other pollution.

Construction activities have the potential to cause shorter term impacts on the environment than those potential permanent/ongoing impacts described above. These could involve physical impacts directly on people, plants and animals or effects on their habitats through:

- death or disturbance of plants or animals
- temporary impacts on water quality and consequent impacts on ecology.

The potential impacts listed above are described in more detail below and are considered by applying statutory assessment criteria in Section 7. Environmental safeguards to mitigate or offset impacts are provided in Section 8.

7 ASSESSMENT OF ENVIRONMENTAL IMPACTS

7.1 Biodiversity Conservation Act 2016

Section 7.2 of the Biodiversity Conservation Act states that development is likely to significantly affect threatened species if:

> *(a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3*

An updated test of significance is in Attachment 7 to this review of environmental factors. It is concluded that the proposed activity is not likely to significantly affect threatened species or ecological communities, or their habitats.

> *(b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values*

This subsection of the Act does not apply to development that is an activity subject to environmental impact assessment under Part 5 of the Environmental Planning and Assessment Act 1979. Nevertheless, the following is noted: no area included on the Biodiversity Values Map (Figure 20) would be affected by the proposed activity.

> *(c) it is carried out in a declared area of outstanding biodiversity value*

The subject site is not in a declared area of outstanding biodiversity value listed in the Register of Declared Areas of Outstanding Biodiversity Value.

Based on the above criteria, the biodiversity offsets scheme does not apply and the determining authority does not need to consider obtaining a biodiversity development assessment report or to retire biodiversity credits to offset the residual impact on biodiversity values.

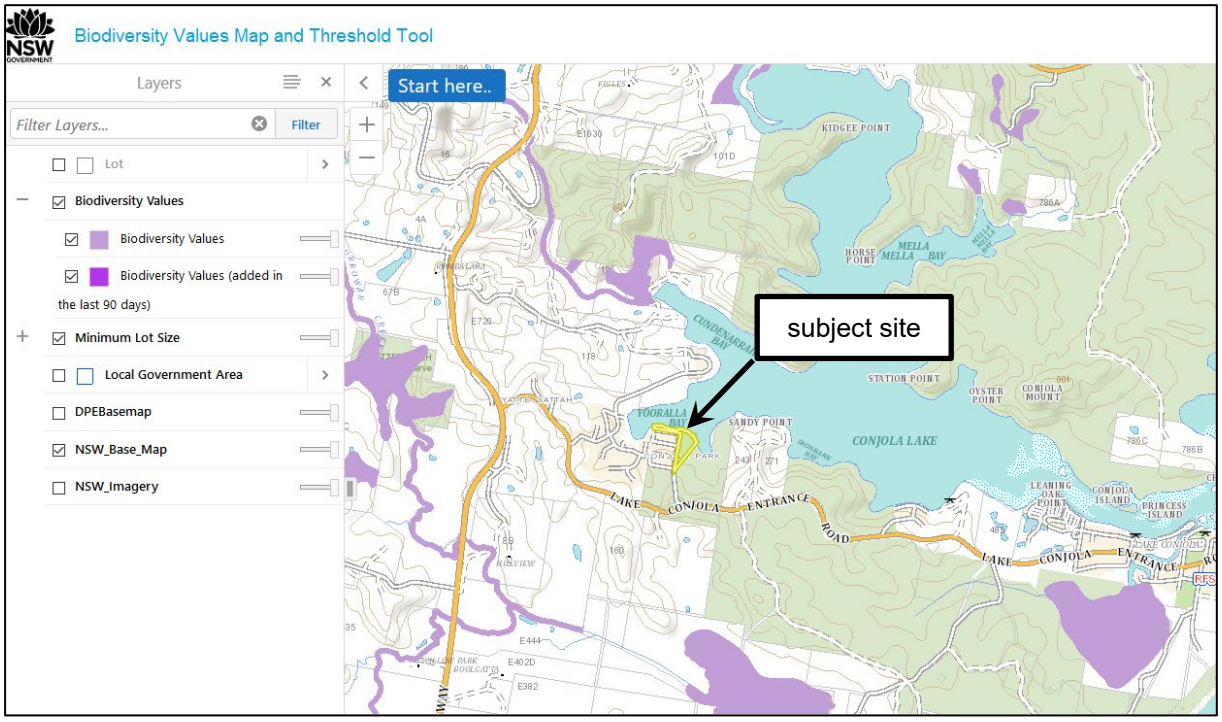

Figure 20. Biodiversity Values Map, generated 9 June 2020.
Source: © State of New South Wales and Office of Environment and Heritage [2020]
Biodiversity Values Map and Threshold Tool

7.2 NSW Environmental Planning and Assessment Act

Subsection 5.5(3) of the Environmental Planning and Assessment Act requires that determining authorities consider the effect of an activity on any wilderness area (within the meaning of the Wilderness Act 1987) in the locality in which the activity is intended to be carried on. The site is not in or near a wilderness area and would not affect a wilderness area.

Clause 228(2) of the Environmental Planning and Assessment Regulation 2000 lists the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment under Part 5 of the Environmental Planning and Assessment Act. The following assessment deals with each of the listed factors in relation to the proposed works.

7.2.a Any environmental impact on a community

The community most likely to be affected would be residents and visitors of Conjola Park and Lake Conjola more broadly, including people that would use the boat launching ramp and people that would not. There would be positive impacts for the boating community. Completion of the proposed works would greatly improve access to the waterway of Conjola Lake.

7.2.a.1 *Traffic and Launching Impacts*

Vehicular access to the boat ramp facility will be via Havilland Street to an entry road directly opposite Esme Street. It is proposed that signage be installed on Lake Conjola Access Road to direct traffic to the boat ramp and signage placed on the exit from the boat ramp to direct traffic back to Lake Conjola and the Princes Highway via Lake Conjola Access Road. This will minimise the use of the village roads and therefore, the majority of the properties in the village would not be directly affected by increased traffic. A draft Traffic Impact Study (Shoalhaven City Council, 2020) considered the project's effects on the surrounding road network particularly the intersection of Lake Conjola Entrance Road and Havilland Street and reviewed the proposed parking and access arrangements. It was concluded that the development would slightly increase traffic on Havilland Street and Lake Conjola Entrance Road, however it was considered minor and within the capacities of the local road network. The parking facilities provided were considered adequate for a single lane boat ramp but short of the recommended guidelines and standards for a two-lane ramp, indicating the full capacity of the ramp would be limited by parking availability, which is consistent with most boat ramps in the Shoalhaven. However, it was expected that the operation of the boat ramp would be acceptable given the demand for a facility by the community. The performance and impacts would be monitored closely and further improvements made, when further grant funding becomes available, if and when it is deemed necessary.

There would be noise impacts associated with launching and retrieval of vessels at the new facility. The actual launching ramp and manoeuvring area has been positioned as far as possible from the residential area. It would be tucked over the hill approximately 150 metres from the nearest house. The car parking areas would generally be below Havilland Street and separated from it by a buffer of native vegetation.

7.2.a.2 *Boating Impacts*

Current boating restrictions go some way to restricting water skiing to the main Conjola Lake basin where the foreshores are in general steep and rocky. Increased boating and

subsequent noise impacts in the vicinity of Conjola Park and elsewhere on the lake are potential consequences of the provision of the facility. The Boating Plan of Management (NSW Maritime Authority, 2005; Attachment 8) considers this in some detail and concludes that a new facility is appropriate. NSW Roads and Maritime Services has completed a signage upgrade within Lake Conjola – this will assist with concerns around vessels speed, antisocial behaviour and wash issues. Signage shall be maintained for the 'Low Noise Area' adjacent to Conjola Park village as set out in the boating plan of management. Speed restriction shall be put in place in vicinity of boat ramp.

Roads and Maritime Services acknowledge that residents see the increase of waterway users will have an impact on local waterways and as such Roads and Maritime Services will keep abreast of local impacts, congestion concerns and watercraft interactions. Staffing levels will be adjusted accordingly as required.

7.2.a.3 *Construction Impacts*
During construction there may be some short term inconvenience as trucks and other machinery enter and leave the site and operate on the site. Negative impacts include short term traffic control, access restrictions and noise for the duration of the construction works. It is expected that the construction would take approximately five months. The works would be constructed in an order and manner that would cause minimum inconvenience and impact to residents and the general public that may be affected by the works. An environmental management plan is to be prepared that will address noise, dust and other issues. Construction work shall not be done outside the hours of 7 am and 6 pm Mondays to Fridays or 8 am to 3 pm Saturdays. The traffic impact study considered construction traffic impacts should be dealt with by way of construction traffic management plan to mitigate impacts of heavy vehicles on the local road networks and incorporate environmental controls, including noise restrictions, with the aim of keeping residential streets safe, clean and convenient to use.

With implementation of appropriate environmental safeguards it is concluded that impacts on the community would not be significant.

7.2.b Any transformation of a locality
The proposal would transform an area of waterway into a boat launching facility with jetty and an area of bushland into roads car parking areas and other facilities. The overall land form of the locality would remain as a north facing hillside and the retention of a wide buffer of native vegetation on the western part of the land means that the facility should not be highly visible from the village of Conjola Park. It is considered that the transformation of the locality would not be a significant impact the environment.

7.2.c Any environmental impact on the ecosystems of the locality
Permanent impacts on ecosystems would result from direct loss of organisms and habitat, from changes to substrate composition and orientation, from shading and from changes to hydrology and nutrients.

7.2.c.1 *Terrestrial Ecosystems*
The National Parks and Wildlife Service advised that the subject site is high conservation value land but was left out of the gazetted Conjola National Park to allow for the future provision of boating facilities. The site is mapped in the biodiversity layers of the Shoalhaven Local Environmental Plan 2016 (Figure 21). No documentation was available to justify the land's inclusion on the map but based on the flora and fauna

assessments undertaken for this review of environmental factors (Attachments 4 & 5), it is concluded that the conservation value of the land lies in the density of hollow-bearing trees present, presence of threatened species and their habitat.

Less than one hectare of native vegetation would be removed overall (Approximately 0.63 ha in stage 1 and 0.24 ha in stage 2). The facility was redesigned a number of times to minimise the removal of hollow-bearing and other trees. Some of the site's value as a habitat corridor would be retained, although the facility would create some separation of tree canopy and understorey vegetation.

Some mobile amphibians, reptiles, birds or mammals could be killed or injured during construction of the facility, such as those that seek shelter under logs, bark, tussocks or in tree hollows. Environmental safeguards to mitigate direct impacts on animals have been proposed in Section 8 of this report, including the following. A suitably qualified and NSW National Parks & Wildlife Service licensed wildlife handler should reinspect the vegetation just prior to its removal to ensure there are no new nests, drays, burrows or other shelter present. The wildlife handler should also be on site during removal of the hollow limbs or on-ground logs to rescue fauna, if required.

Invasion of natural ecosystems by various exotic species, including escaped garden plants, can be a key threatening process. Such invasion is recognised globally as a significant threat to biodiversity. Invasive exotic plants can impact on ecosystem structure and function, reducing native species richness, altering hydrological or fire regimes, changing soil nutrient status and modifying habitat. It is apparent that some garden waste has been/is being dumped in the bushland on the site. Environmental safeguards to mitigate impacts through weed invasion have been proposed in Section 8 of this report.

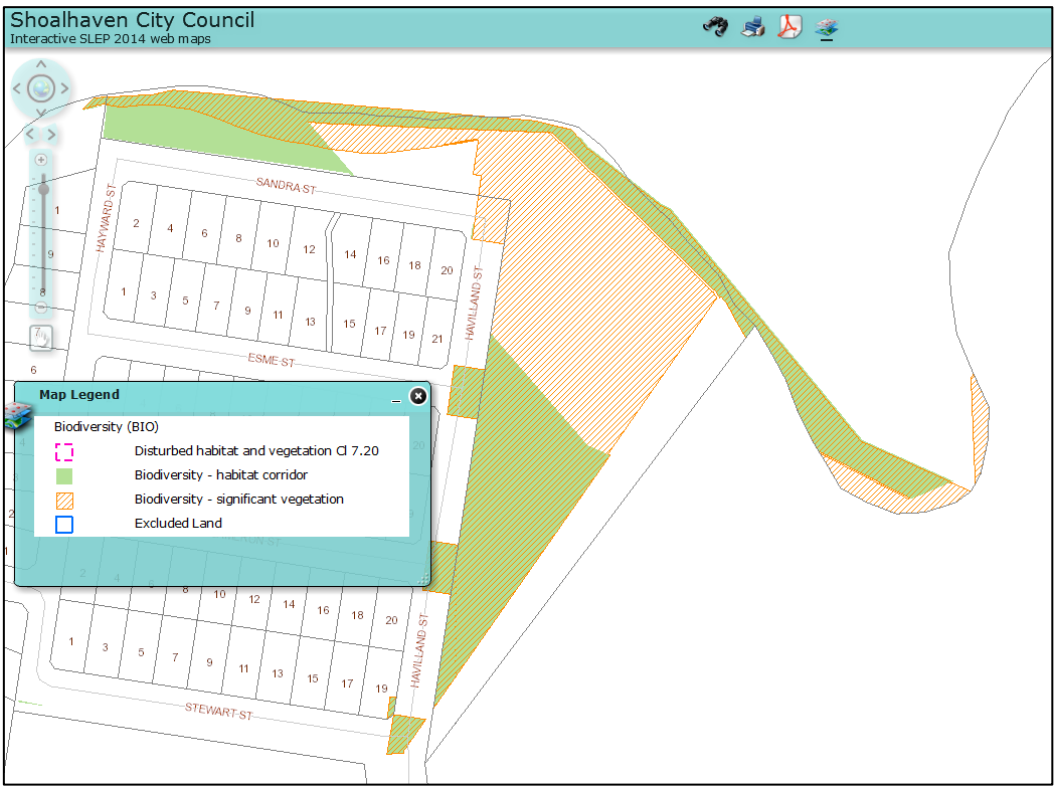

Figure 21. Biodiversity mapping from Shoalhaven Local Environmental Plan 2016.
Source: Shoalhaven City Council Maps Online

7.2.c.2 *Aquatic Ecosystems*
An aquatic ecological assessment is included as Attachment 6.

The facilities would affect relatively small areas of aquatic habitat. Assuming a ramp size of 11 metres width and 17 metres length, approximately 190 square metres of concrete ramp would replace sandy mud and seagrass habitats. The areas of habitat affected by the ramp would be relatively small compared to the total amount of these habitat types in the vicinity of the proposal. Nevertheless, a permit under the Fisheries Management Act would be required.

A small amount of benthic habitat would be permanently replaced by the piles for the jetty. There would be no aquatic vegetation under that part of the jetty that would extend beyond the boat ramp so there would be no need for it to be constructed of mesh to allow greater light transmission.

New habitat for sessile plants and animals would be created by parts of the hard surfaces of the supporting piles.

It is unlikely that many mobile birds, fish and invertebrates would be killed or injured by the construction activity, but they may be disturbed from their normal activities. Birds, fish and large mobile invertebrates living at the site may be disturbed by the movement of machinery and people and from noise during the construction activities. Some would seek shelter, some would flee and some would be attracted as food organisms are disturbed. The effects would be localised to within a few tens of metres of the work site and would be intermittent and short term as the work is carried out. Those organisms that flee or seek shelter may return to the area when construction or other human activity is not occurring.

Some sessile, benthic fauna may be killed during the installation of the ramp or the driving of jetty piles. The number of organisms potentially affected would not be large.

Advisory material shall be provided on the actions that waterway users should take to prevent reintroduction or further spread of *Caulerpa taxifolia* to unaffected areas.

The current boat ramp situated in the western part of Conjola Park does not provide adequate parking and is currently degraded and discharging sediment into the Lake. As an offset for the construction of the new ramp and associated infrastructure DPI - Fisheries would require the removal of the current ramp and rehabilitation of this site.

7.2.c.3 *Conjola National Park Ecosystems*
The construction of the access road and carpark will disrupt existing impacts on the park in the form of trails motor bikes and other damaging activities. To deter riders from simply going over the eastern edge of the road and into the park, a dense, 5 metre wide vegetated buffer will be provided. The battered bank in this buffer zone shall be densely planted with native species selected from Table 1 of the attached flora report (Attachment 4), preferably grown from locally collected seed. Closely planted Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii*, and/or Grey Myrtle *Backhousia myrtifolia* would provide a manageable and dense barrier planting. Consideration had been given to installing a fence here but it is likely to be vandalised and it would be difficult to “complete” the barrier at the top and bottom ends.

Although the National Parks and Wildlife Service would prefer a wider buffer to the National Park boundary, this was outweighed by the following considerations:

- topography, in particular slope of foreshore area on the western part of the site is much steeper making construction of a functional manoeuvring and launching area difficult
- the desire to maximise distance from residential areas to reduce visual and noise impacts
- the presence of an Aboriginal artefact on the foreshore to north west of proposed ramp location
- retention of most of hollow-bearing trees, especially on the north western part of site.

Space shall be available for NPWS to provide visitor interpretative signage at the ramp to help curb behaviour that could impact on the Conjola National Park.

Drainage will generally be directed away from the Park. Any drainage will not be concentrated i.e. remain as sheet flow.

Overall, the ecological impacts of the proposed facility would be relatively small and localised. The impacts on the ecosystem of the locality would not be significant.

The impacts of the proposed activities on threatened species are considered in the assessment at Section 7.2.g below.

7.2.d Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality

It is expected that the new facility would not impact on aesthetic value of the site to any great extent for the following reasons. The actual launching ramp and manoeuvring area has been positioned as far as possible from the residential area. It would be tucked over the hill approximately 150 metres from the nearest house. The car parking areas are generally below Havilland Street and separated from it by a buffer of native vegetation. The facility should not be very visible from the village. Most of the facility would be separated from the lake by a wide buffer of native vegetation but the boat ramp itself would be visible from part of the lake. The people most likely to see the facility from the lake are users of the facility.

Some recreational value of the locality, such as strolling through the forest, would be reduced but its value for active recreation in the form of boating would be enhanced.

The aesthetic, recreational, scientific or other environmental quality or value would not be altered to any significant extent by the proposed works.

7.2.e Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations

7.2.e.1 *Items of Environmental Heritage*

No items of environmental heritage listed in schedule 5 of Shoalhaven Local Environmental Plan 2016 are present at or near the subject site. The proposal would not affect any environmental heritage items.

7.2.e.2 *Native Title*

A search of the National Native Title Tribunal databases in June 2020 indicated that native title had not been determined to exist over the subject land but there was one active native title claim in the area under the Native Title Act 1993 (Attachment 9 - NC2017/003 by South Coast People). As a general rule, the reservation or dedication of land for a public purpose does not extinguish all native title rights and interests in the land, but might have the effect of extinguishing some rights. The proposed activity can be authorised as a future act under Section 24KA (facilities for services to the public) of the Native Title Act. Notification and request for comment was sent to the Aboriginal and Torres Strait Islander Representative Body for NSW (NTSCORP) on 20/8/2020. No comments were received and Shoalhaven City Council's Native Title Manager would consider this future act to be valid under Subdivision K (Facilities for Services to the Public).

7.2.e.3 *Aboriginal Land Rights*

Advice from the Aboriginal Land Claim Assessment Team - Crown Lands - Department of Planning, Industry and Environment on 30 June 2020 (Attachment 9) indicated that Lot 7308 DP 1144810 is subject of two Aboriginal Land Claims lodged under the NSW Aboriginal Land Rights Act 1987 by New South Wales Aboriginal Land Council: ALC42454 lodged on 15 December 2016 and ALC42493 lodged on 19 December 2016. Council is appointed Crown Land Manager for the reserve and has authority to carry out works on the land. The proposed activity can proceed as:

- the reserve has been identified prior to the land claims as needed for an essential public purpose (boat ramp facility) in the SCC Lake Conjola Estuary Management Plan (1998), NSW Maritime Boating Plan of Management (2005) and SCC's Waterways Infrastructure Management Plan (2008). The land on which the proposed activities are to be undertaken is therefore unlikely to be claimable land under the Act's definition.
- there is nothing in the Act that precludes the activity taking place in the Reserve.

Despite this, the land claims remain and will eventually be subject to assessment. Depending on the outcome of the land claim, compensation or negotiation with the claimants may be required.

7.2.e.4 *Aboriginal Objects*

The National Parks and Wildlife Act protects all Aboriginal objects and Aboriginal places in NSW. It is an offence to do any of the following things without the permission of the NPWS (penalties can apply):

- disturb or move an Aboriginal object
- excavate land for the purpose of discovering an Aboriginal object
- knowingly destroy, damage or deface an Aboriginal object or Aboriginal place
- knowingly cause or permit the destruction, damage or defacement of, an Aboriginal object or Aboriginal place.

A preliminary assessment of potential impacts on Aboriginal objects under the NSW Government's Due Diligence Code of Practice is set out below.

Preliminary Assessment under Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales

Step 1. Will the activity disturb the ground surface?

Yes.

Step 2a. Search the AHIMS database and use any other sources of information of which you are already aware

The results of an extensive search of the AHIMS database are attached to this report (Attachment 9). No Aboriginal places have been declared at or near the location. One Aboriginal site was recorded within 200 metres of the subject site during studies for the Conjola sewerage system (site ID 58-1-0962).

Step 2b. Activities in areas where landscape features indicate the presence of Aboriginal objects

Even if an AHIMS search indicates no *known* Aboriginal objects at a site, it is necessary to consider whether Aboriginal objects are *likely* to be in the area having regard to landscape features. Aboriginal objects are often associated with particular landscape features as a result of Aboriginal people's use of those features in their everyday lives and for traditional cultural activities. Examples of such landscape features are rock shelters, sand dunes, waterways, waterholes and wetlands. The code indicates that the following generic list of landscape features should be considered:

Landscape Feature	Assessment for Lot 7308
1. within 200m of waters	the site is within 200 metres of Conjola Lake
2. located within a sand dune system	the site is not located within a sand dune system
3. located on a ridge top, ridge line or headland	the site is not located on a ridge top, ridge line or headland
4. located within 200m below or above a cliff face	no cliff faces were observed within 200 metres of the site
5. within 20m of or in a cave, rock shelter, or a cave mouth	no caves or rock shelters were observed within 20 metres of the site

Based on the assessment in the above table, the proximity of the subject site to the Conjola Lake landscape feature indicated that Aboriginal objects could have been present there.

The code provides that if the proposal is on such landscape *and is not on disturbed land*, then the assessment must continue to step 3. Disturbed land or land already disturbed by previous activity is defined in the code as follows:

> *Land is disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable. Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks and walking tracks), clearing vegetation, construction of buildings and the erection of other structures, construction or installation of utilities and other*

similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure) and construction of earthworks.

Although some of the site had been disturbed by construction of fire trails and other tracks, native vegetation on the site was largely intact. Progression to step 3 was therefore considered warranted.

Step 3. Can you avoid harm to the object or disturbance of the landscape feature?

Construction of the proposed facility would result in significant disturbance of the landscape close to Conjola Lake. Disturbance to the ground in the landscape features where Aboriginal objects might occur would be difficult to avoid.

Preliminary Aboriginal Heritage Conclusion

Given that

1. Aboriginal objects are known to be present within 200 metres of the site
2. landscape features are present that indicate the potential for existence of Aboriginal objects at the site and
3. there are constraints to varying the location or nature of the project,

it was recommended that an archaeologist be commissioned to undertake the following additional steps in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales:

Step 4: Desktop assessment and visual inspection

Step 5. Further investigations and impact assessment.

Undertaking an archaeological assessment would establish whether or not the proposal would result in impacts to Aboriginal objects and would determine the need, or otherwise, for an Aboriginal Heritage Impact Permit.

It was also recommended that Council consult with interested parties in accordance with the NSW Government's Aboriginal Cultural Heritage Consultation Requirements for Proponents (NSW Department of Environment, Climate Change and Water, 2010a).

If it is concluded that the activity can proceed without applying for an Aboriginal heritage impact permit, workers involved in site works should nevertheless be informed of the possible presence of Aboriginal objects at the site. They should be instructed to cease work and inform the "superintendent" if any material such as bone or other artefact is uncovered during excavation works. The superintendent should inform the DPIE Archaeologist.

Detailed Assessment under Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales

A detailed due diligence assessment (Feary, 2017) conducted in August 2016 and updated in March 2017 is included in Attachment 9. It involved field inspection and a

comprehensive review of relevant previous archaeological investigations, particularly those associated with the Conjola REMS. During initial field inspection a single stone flake was identified and indicated the subject area had some potential for containing further Aboriginal objects. It was concluded that the single Aboriginal stone artefact is likely to be in the natural buffer zone and not impacted by the activity. Further archaeological investigation (Feary, 2016) was conducted in October 2016 (included in Attachment 9) by way of observation and recording during machine auguring to obtain critical geotechnical data, but this did not identify any Aboriginal objects.

Subsequent to preparation of the above report, a tree that may have been scarred by some Aboriginal activity, was found by Peter Dalmazzo on the far southern part of the site, east of the village between Cameron and Windemere Streets. The tree had broken off through the middle of an area that appeared to have had bark removed, with callus around the edge. Sue Feary inspected the tree in March 2017 and advised that the tree was a dead and fallen over Blackbutt *Eucalyptus pilularis* probably around 100 to 200 years old. The scar was a well-defined oval, which had been broken in two by the tree falling over. It was impossible to determine whether the scar had been made by a stone or steel axe. There were cuts across the scar suggestive of a steel axe but this could have been done much later. In March 2017 Feary also identified an additional a single stone flake though it was not in the area to be affected by the proposed development. Feary concluded that the scarred tree and the additional artefact would not be impacted by the proposed development.

Feary concluded that because of poor ground visibility it was not possible to be confident that the area has been comprehensively assessed for stone artefacts and that harm may occur to unrecorded artefacts from levelling the ground and construction of the car park, access roads and other facilities across the subject area, above the flood level. Given the medium potential for additional artefacts additional survey of the site for Aboriginal objects was undertaken by Council's Environmental Operations Officer in July 2020, taking advantage of the improved visibility created by the December 2019 bushfire. Council's Environmental Operations Officer found 3 object sites (5 artefacts). Visibility was generally quite good - at least 60% but better closer to the foreshore. The sites would be outside the proposed development site. Site cards were lodged with Heritage NSW (AHIMS sites 58-1-1099 and 58-1-1101). Council's Environmental Operations Officer also advised that the scarred tree was destroyed in the bushfire in December 2019. The site card for the scarred tree should be updated to reflect that it was destroyed by the bushfire and no longer exists at the site.

Overall, it is considered unlikely that there would be any significant effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.

7.2.f Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)

All native mammals, birds, reptiles and amphibians in the area are protected under the National Parks and Wildlife Act. The area of habitat affected by the proposed construction (less than one hectare) would be relatively small compared to the total amount of habitat in the vicinity of the proposal (for example, more than 1000 hectares in adjacent parts of Conjola National and Narrawallee Creek Nature Reserve). It is concluded that the potential impacts would not be significant for the proposed activity.

7.2.g Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air

Section 221ZV of the NSW Fisheries Management Act 1994 sets out the matters that are to be taken into account for the purposes of determining whether a proposed activity is likely to significantly affect threatened fish species, populations or ecological communities, or their habitats. Section 7.3 of the NSW Biodiversity Conservation Act 2016 sets out the test for determining whether a proposed activity is likely to significantly affect other threatened species or ecological communities, or their habitats. Assessments under the above provisions are included in Attachments 4, 5, 6 and 7. Provided the proposed environmental safeguards are employed, it is concluded that there is not likely to be a significant effect on aquatic or terrestrial threatened species, populations or ecological communities, or their habitats from the proposed activity and therefore a species impact statement is not required.

7.2.h Any long-term effects on the environment

Construction impacts would be short term and temporary (approximately five months). The new facilities would have an expected life of several decades and could be removed and the area rehabilitated if that was considered necessary in the future. There would be no significant long term effects on the environment.

7.2.i Any degradation of the quality of the environment

Provision of the facility would affect the 'natural' quality of the environment in the area. The vegetated buffers mean that at least in appearance the current overall quality of the site would be retained - that of a bushland site. There would be no significant degradation of the quality of the environment.

7.2.j Any risk to the safety of the environment

During construction, there is a danger that people could be injured by working machinery if they get too close. The risks would be reduced by traffic control and by defining a no go area for public with use of hazard fencing, navigation markers, restricted area signs, etc. as appropriate, which would be removed when the construction is completed.. All workers should be inducted in occupational health and safety requirements for the work site.

Ongoing, the proposed facility is likely to make the launch and retrieval of vessels safer because it would be a modern facility in relatively deep and calm water.

The site is mapped as bushfire prone in the Shoalhaven Local Environmental Plan 2016 (Figure 22). The facility should be evacuated and closed if a bushfire threatens the area. The proposal would not increase risks to safety associated with bushfires.

The boat ramp and associated manoeuvring area are on flood prone land. The ramp crest would be at 1.1 m AHD and the jetty level would be at 1.1 m and 0.9 m. The lake opening level is 1.0 m AHD and it could sit just under that level for some time (weeks or months) if the lake is closed to the sea and there is no rain. The lake level can get higher during floods and storm surges but drops fairly quickly after the storm passes if entrance is open. It is not considered that the ramp would increase flood risk.

There would be no significant increase in the risk to the safety of the environment.

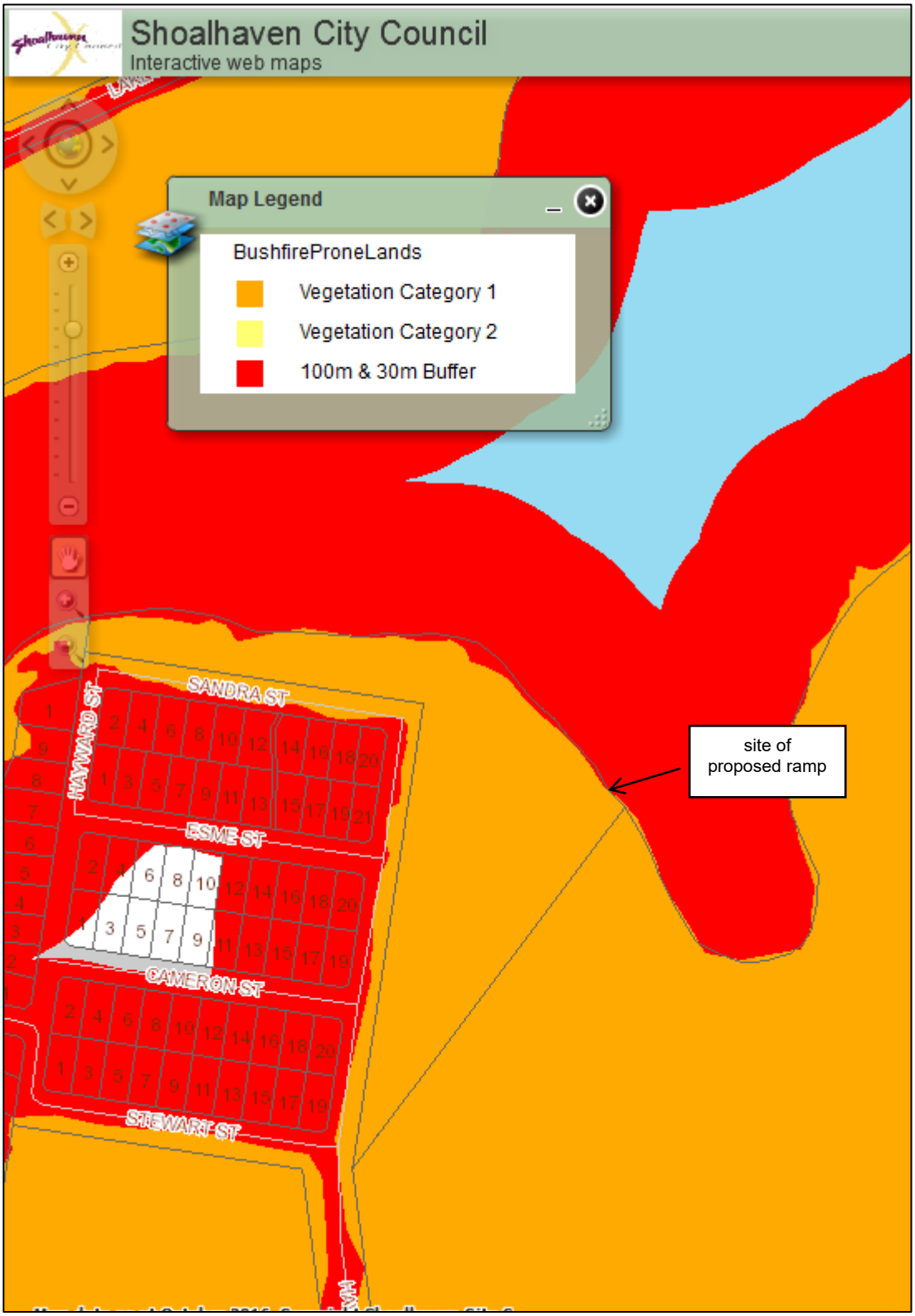

Figure 22. Bushfire prone land, Shoalhaven Local Environmental Plan 2016.
Source: Shoalhaven City Council Maps Online

7.2.k Any reduction in the range of beneficial uses of the environment

Beneficial uses of the environment such as supply of water and food, availability of flowering plants for honey production (most trees would be retained), absorption and storage of carbon dioxide and production of oxygen would not be greatly affected. Although the area appears to have been logged in the past it is unlikely that it would

again be logged. There would be no significant reduction in the range of beneficial uses of the environment.

7.2.l Any pollution of the environment

Pollution of the environment (noise, vibration, dust and diesel fumes) may be experienced for several weeks while construction equipment operates to carry out the works. The nearest residence is approximately 150 metres from the boat ramp and 50 metres from the edge of car parking bays. Hours of operation of machinery shall be restricted to 7am to 6pm Mondays to Fridays and 8am to 3pm Saturdays.

To avoid pollution from machinery, refuelling should be done off site, however if refuelling on site is required, due care should be taken to avoid spilling fuel, and a tray should be used to catch any accidentally spilt fuel.

Waste material should be contained within the construction site or site compound during the activity and then be removed to an authorised waste disposal facility. No material should be placed in any location or in any manner that would allow it to escape from the site.

During construction over the lake, appropriate measures will need to be put in place to catch debris and prevent it from entering the waterway.

To prevent contaminated material being placed on the site, if fill material is imported for construction of the ramp extension it needs to be either ‘virgin excavated natural material’ or comply with a relevant Resource Recovery Order and Exemption. Otherwise, an environment protection licence would be required under the Protection of the Environment Operations Act.

Acid sulfate soils (ASS) have the potential to pollute waterways with acidic runoff and toxic metals. The bed of the lake at the site is mapped as Class 1 in the acid sulfate soils layer of the Shoalhaven Local Environmental Plan 2016 (Figure 23). To prevent oxidation of potential acid sulfate soil and possible degradation of the environment, no bed sediment material is to be removed from the waterway unless a preliminary assessment has been undertaken to determine whether potential acid sulfate soils are present and, if necessary, an acid sulfate soils management plan in accordance with the ASS Assessment Guidelines (Ahern et al., 1998) prepared.

The environmental safeguards required for this proposal (listed in Section 8 of this review of environmental factors) include measures to protect the waterway from pollution. The environmental safeguards include managing machinery access and maintenance, waste, erosion and sediment control.

There is potential for some short term increase in turbidity and consequent sedimentation of the lake while the works are being built. The sediments would settle or disperse quickly and may coat some plants and animals. The sediment layer is likely to be very thin and most benthic plants and animals would be expected to soon be cleared of or grow through the sediment. A silt curtain will be deployed to contain the spread of turbid water. During operation of the facility there is some scope for fuel or oil to be spilled by boat owners but this is likely to be a rare event and involve only small quantities.

Overall, the proposal would lead to no significant pollution of the environment.

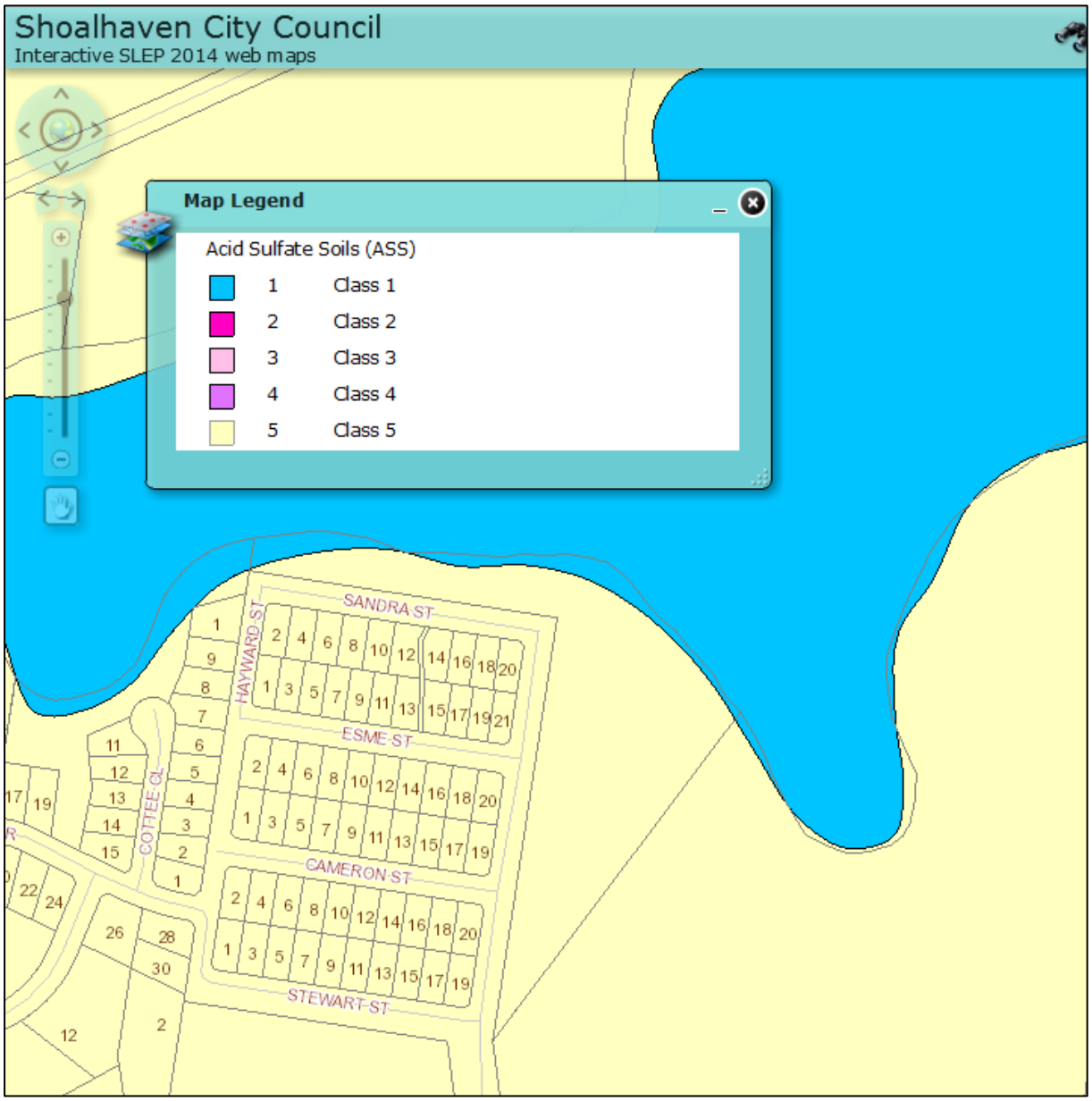

Figure 23. LEP acid sulfate soils map.
Source: Shoalhaven City Council Maps Online

7.2.m Any environmental problems associated with the disposal of waste

There may be a need to dispose of small amounts of construction waste. Construction waste shall be contained within the site during the activity and then be removed to an authorised waste disposal facility.

Vegetation material may be left on site as mulch or as habitat where it would not be considered a fire hazard or, if removed from the site, shall be recycled either through Council's green waste facility or by local mulching or composting. No material is to be burned on site.

There would be no significant problems associated with disposal of waste.

7.2.n Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply

Some fuel would be used to run machinery and equipment and an amount of concrete, steel, timber and other materials would be used, but the amounts would be small and the proposal would not significantly increase demands on these resources such that they become in short supply.

7.2.o Any cumulative environmental effect with other existing or likely future activities

Cumulative impacts relate to combined effects of different activities. No other major public upgrades to boating facilities are foreshadowed in any strategic planning documents. There would be no significant cumulative impacts from the proposal.

7.2.p Any impact on coastal processes and coastal hazards, including those under projected climate change conditions

Coastal hazards include beach erosion, shoreline recession, coastal entrance instability, vegetation degradation and sand drift, coastal inundation, slope and cliff instability and stormwater erosion (NSW Government, 1990) and include impacts of sea level rise.

The proposal would not be adversely affected by the behaviour of the sea, though the lower part of the facility might be inundated occasionally due to storm surge. There was little erosion, sand drift or other instability apparent at the site. The structure would be able to withstand floods. Existing public beach, foreshore or waterfront access and amenity would be maintained or improved.

The boat ramp would be built on piles or would have culverts that would provide for longshore movement of water, sediment plant propagules and animals.

Under the circumstances of rising sea level, the facilities would maintain their function and achieve their intended design performance for a design life of several decades.

The proposed activity would not have any significant effect on coastal hazards or any coastal processes on any beach or dune or the bed, bank, shoreline, foreshore, margin or flood plain in the coastal zone.

7.3 Australian Environment Protection and Biodiversity Conservation Act

7.3.a Protected Matters

Actions that are likely to have a significant impact on a matter of national environmental significance, or are being undertaken on or would have an effect on Commonwealth land, are known as protected matters and may require approval under the EPBC Act. The EPBC Act identifies nine matters of national environmental significance:

- world heritage properties;
- national heritage places
- Ramsar wetlands of international importance;
- listed threatened species and ecological communities;
- listed migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The Australian Department of Environment's online Protected Matters Search Tool was interrogated on 19 June 2020 for the site using a one kilometre buffer. The report is summarised below and the full report is in Attachment 10.

Matters of National Environmental Significance

World Heritage Properties: None
National Heritage Places: None
Wetlands of International Importance: None
Great Barrier Reef Marine Park: None
Commonwealth Marine Areas: None
Listed Threatened Ecological Communities: 2
Listed Threatened Species: 58
Listed Migratory Species: 38

Other Matters Protected by the EPBC Act

Commonwealth Land: None
Commonwealth Heritage Places: None
Listed Marine Species: 46 (relevant to Commonwealth areas only)
Whales and Other Cetaceans: None
Critical Habitats: None
Commonwealth Reserves: None

The proposal is not a nuclear action nor is the action a coal seam gas development and large coal mining development. The proposal is not being undertaken on Commonwealth land nor would it have an effect on Commonwealth land.

The protected matters report (Attachment 10) included a number of listed threatened species and migratory species that have a range of distribution that includes the area of the proposed works. Assessments of the likelihood of there being significant impacts and therefore whether the matter should be referred to the Australian Government

Minister for the Environment are included in Attachments 4, 5, 6 and 7. The Department of the Environment, Water, Heritage and the Arts' Significant Impact Guidelines (Australia Government, 2013) provide the assessment criteria for threatened and migratory species.

The proposed actions are not likely to have a significant impact on a matter of national environmental significance, nor are the actions being undertaken on or having an effect on Commonwealth land. The proposed action therefore does not need to be referred to the Australian Minister for the Environment.

8 ENVIRONMENTAL SAFEGUARDS

Approvals and Consultation

1. The following NSW Government agencies should be provided an opportunity to review and provide comment on the revised design of the proposed facility and the review of environmental factors, prior to determination:

    - Department of Primary Industries - Fisheries
    - Department of Planning, Industry and Environment - Crown Lands
    - NSW National Parks and Wildlife Service
    - Roads and Maritime Services - Maritime Division.

2. A Crown land licence shall be obtained for the boat ramp and associated structures on the bed of Lake Conjola.

3. The AHIMS site card for the scarred tree should be updated to reflect that it was destroyed by the bushfire and no longer exists at the site.

4. Application shall be made for s205 permit under the Fisheries Management Act for destruction or disturbance of marine vegetation (seagrass and macroalgae).

5. If the work is not authorised under the Crown Lands Act, application shall be made for s200 permit under the Fisheries Management Act for carrying out dredging or reclamation work.

6. If there is to be any use of explosives in the waterway an approval under clauses 112-113 of the Fisheries Management (General) Regulation 2002 shall be obtained.

Design & Operation

7. Operation of the facility, including traffic and parking, shall be monitored for performance and impacts; improvements shall be made, when further grant funding becomes available, if and when it is deemed necessary.

8. Signage shall be installed on Lake Conjola Access Road to direct traffic to the boat ramp and signage placed on the exit from the boat ramp to direct traffic back to Lake Conjola and the Princes Highway via Lake Conjola Access Road.

9. The launching ramp and manoeuvring area shall be positioned as far as possible from the residential area.

10. Signage shall be maintained for the ‘Low Noise Area’ adjacent to Conjola Park village as set out in the boating plan of management.

11. Speed restriction shall be put in place in vicinity of boat ramp.

12. Roads & Maritime Services shall keep abreast of local impacts, congestion concerns and watercraft interactions and staffing levels will be adjusted accordingly as required.

13. The boat ramp shall be built on widely spaced piles or culverts should be included under the ramp to minimise restriction on movement of water, sediment, plants and animals.

14. As an offset for the construction of the new ramp and associated infrastructure the current ramp situated in the west of the village shall be removed and the site rehabilitated.

15. Any lighting of the facility shall be directed downward, away from tree canopies and away from the national park.

16. Provide a wide buffer of natural vegetation to Havilland Street and to the lake in north west to maximise retention of hollow-bearing trees and to provide a visual and acoustic screen.

17. As an offset for loss of some tree hollows, prior to the trees being cleared habitat boxes shall be erected or the hollow-bearing limbs themselves collected and relocated as 'habitat-boxes'.

18. Provide a 5 metre wide vegetated buffer between eastern edge of road and national park. The battered bank in this buffer zone shall be densely planted with native species selected from Table 1 of the attached flora report (Attachment 4), preferably grown from locally collected seed. Closely planted Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii*, and/or Grey Myrtle *Backhousia myrtifolia* would provide a manageable and dense barrier planting.

19. Any landscaped areas on the site should similarly use local native plants from Table 1 of the attached flora report (Attachment 4). A cover crop of sterile grasses or other non-invasive plants could be used as an interim stabiliser until local plants are available.

20. When landscaping the site, the following plants shall not be used:

    a. Plant species listed as weeds by NSW Department of Primary Industries (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles)

    b. Plant species listed as part of key threatening processes, including: (http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm)

        - Invasion of native plant communities by exotic perennial grasses
        - Invasion and establishment of exotic vines and scramblers
        - Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
        - Invasion and establishment of Scotch broom (*Cytisus scoparius*)
        - Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*
        - Invasion, establishment and spread of *Lantana camara*
        - Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

21. Advisory material shall be provided to encourage people to bring their waste back after spending a day on the water and Council shall provide bins.

22. Advisory material shall be provided on the actions that waterway users should take to prevent reintroduction or further spread of *Caulerpa taxifolia* to unaffected areas.

23. Space shall be available for NPWS to provide visitor interpretative signage at the ramp to help curb behaviour that could impact on the Conjola National Park.

24. The facility shall be evacuated and closed if a bushfire threatens the area.

Construction

25. Construction work shall not be done outside the hours of 7 am and 6 pm Mondays to Fridays or 8 am to 3 pm Saturdays.

26. All workers shall be inducted in occupational health and safety requirements for the work site.

27. When construction work is underway, the risks to members of the public shall be reduced by traffic control, navigation markers and by defining a no go area for public with hazard fencing and restricted area signs as appropriate. The safety fencing and signage shall be monitored daily by the contractor and immediately repaired or replaced if necessary and shall be removed when construction is completed. Vessels used during construction shall display all necessary navigational indicators.

28. Workers shall be informed of the possible presence of Aboriginal objects at the site and that it is an offence under the National Parks and Wildlife Act to dig up or disturb Aboriginal objects. Should any Aboriginal object (being Aboriginal artefacts, shell middens, bones and/or burials) be discovered during works, then work shall cease and the superintendent shall contact Heritage NSW on 02 9873 8500 as soon as possible.

29. Workers shall be informed that it is an offence under the Biodiversity Conservation Act to harm threatened species, other than as set out in this review of environmental factors or a licence from the Department of Planning, Industry and Environment. To reduce the potential for impacts, all workers shall be made aware that they are potentially working in the habitat of threatened species.

30. Workers shall be informed that they are working close to the boundary of the Conjola National Park and that it is an offence under the National Parks and Wildlife Act to damage the park. No equipment shall enter the national park.

31. Prior to commencement of excavation or construction, boundaries of the development area shall be marked with temporary barrier fencing. Machinery shall only access the work site via clearly defined routes. Machinery and workers shall not enter areas of native vegetation outside the development area. The fencing shall be monitored daily by the site supervisor and immediately repaired or replaced if necessary and shall be removed when construction is completed.

32. No native vegetation outside of the development area (for road and other infrastructure) will be removed. As far as possible, machinery shall operate only within the footprint of the proposed development. Trees to be cleared shall be felled into the development area carefully so as not to damage trees to be retained in or beyond the development area.

33. Vegetation material may be left on site as mulch where it would not be considered a fire hazard or, if removed from the site, shall be recycled either through Council's green waste facility or by local mulching or composting. No material shall be burned on site.

34. To provide additional potential habitat for ground-dwelling fauna such as reptiles and small mammals, any dead wood on the ground in the development area shall be relocated to areas of vegetation to be retained where they would not be considered a fire hazard.

35. A suitably qualified ecologist/wildlife handler should inspect the vegetation just prior to its removal to ensure there are no new nests, drays, burrows or other shelter present.

36. All reasonable care shall be exercised when clearing trees and other vegetation to avoid injury to native fauna which may be roosting or sheltering in the vegetation foliage.

37. Suitably qualified and NSW National Parks & Wildlife Service licensed wildlife handlers (e.g. Wildlife Rescue South Cost ph:0418 427 214) shall be on site to rescue fauna if necessary during the removal of hollow-bearing trees or on-ground logs. The following procedures shall be followed to minimise harm to any fauna:

    - An elevated work platform shall be utilised to inspect each hollow for residing fauna. Each hollow shall be inspected visually with the aid of torch and/or inspection camera if available.
    - In consultation with the wildlife handler, the contractor shall prepare a plan specified to the circumstance of the tree and hollow. Generally:
        - if the full hollow cannot be fully searched and confirmed not to contain any fauna, the hollow section can be removed up to the solid section of the limb
        - if the full hollow could not be fully inspected (e.g. a bend in the limb preventing visual inspection) the visible section of the hollow can be cut to allow further inspection of the hollow. Repeat this process until the whole limb or hollow section is searched. It is important to note that when the hollow limb is cut, it is only to be cut where it can be determined that there is no chance an animal could be residing in that section. Stuffing of the limb just past the cut point may be considered to prevent fauna movement during chainsaw cutting operations.
        - If fauna are found to be residing in the hollow, a management strategy shall be prepared by the wildlife carer in collaboration with the tree removal contractor. This would be dependent on the species present. Generally:
        - tree frogs or small reptiles can be caught and relocated immediately outside the development area into a suitable shelter site (such as hollow log or tussock)

    - nocturnal possums and gliders can be removed from their hollows and placed into cloth pouches and taken into care until suitable release into a nest box or similar.
- A record shall be kept of any animals removed from the tree (i.e. species and numbers)

38. In cases where a native animal is injured, it shall be transferred with appropriate care as soon as possible to the care of a wildlife rescue service or veterinarian.

39. A soil and water management plan shall be prepared in accordance with the Blue Book (Landcom 2004). Soil, erosion and sediment controls shall be installed and maintained in accordance with the plan to prevent the entry of sediment into the waterway. Disturbed ground surfaces shall be stabilised as soon as possible using appropriate methods as specified in the plan. Erosion and sediment controls shall be maintained in good working order for the duration of the works and subsequently until the site has been stabilised and the risk of erosion is minimal.

40. A construction environmental management plan shall be prepared by the construction company that addresses compliance with this review of environmental factors and conditions of NSW Government approvals. The plan shall also address ways in which pollution by noise, dust, waste, fuel and oil will be avoided. This shall include protocols for equipment maintenance, storage of fuel and other chemicals and materials, management of waste and refuelling procedures.

41. A construction traffic management plan shall be prepared and implemented during construction to mitigate impacts of heavy vehicles on the local road networks and shall incorporate environmental controls, including noise restrictions, with the aim of keeping residential streets safe, clean and convenient to use.

42. To avoid pollution from machinery, refuelling shall generally be done off site, however if refuelling on site is required, due care shall be taken to avoid spilling fuel and a tray shall be used to catch any accidentally spilt fuel. Spill kits are to be available on site at all times during works.

43. No major equipment maintenance works shall be undertaken on-site.

44. Prior to use at the site, machinery is to be cleaned, degreased and serviced. If the machinery has previously been used in a waterway where the noxious macroalga *Caulerpa taxifolia* is present, the contractor shall:

    a) inspect anchors, ropes and chains for pieces of *Caulerpa*
    b) inspect diving equipment such as wetsuits, bags and other gear before and after use
    c) inspect trailers, propellers and engine intakes
    d) inspect construction equipment and materials
    e) use dedicated 'wash-down' facilities where available, ensuring that vessel and equipment is thoroughly free of all matter before leaving the area
    f) collect any fragments of *Caulerpa* that may have been picked up, seal the pieces in a plastic bag and dispose of them in a bin where they cannot re-enter the waterway.

45. Workers shall be informed that harming marine vegetation is an offence under the Fisheries Management Act, other than in compliance with a permit granted by Department of Primary Industries - Fisheries.

46. All contractors shall comply with conditions of any permit granted by Department of Primary Industries – Fisheries which might include use of a floating boom and turbidity curtain in line with the following requirements:
    - The curtain shall be installed prior to the commencement of the activity.
    - A minimum of one curtain shall be installed to form a perimeter around the work site.
    - The turbidity curtain shall comprise a fixed or floating boom with a weighted curtain of geotextile fabric.
    - The turbidity curtain shall be affixed so that there are no breaches or gaps between the curtain and shoreline interface.
    - The curtain shall be appropriately managed throughout the duration of the works. The primary curtain shall continually be monitored for visible signs of fuel spills or turbidity plumes, the perimeter of the curtain shall be inspected prior to undertaking any works each day and following a major rainfall or stormwater event.
    - In the event that the turbidity curtain is damaged and/or breached and pollution of the surrounding waters is imminent, all work shall immediately cease. Works shall not recommence until turbidity in the vicinity of the dredging area has returned to baseline conditions, the curtain has been repaired or replaced and the cause of the damage/breach is established and preventative measures implemented.
    - Prior to the removal of the turbidity curtain and boom, the sediment contained within the curtain shall be allowed to settle to further minimise the dispersion of suspended sediments.

47. Any pieces of woody debris more than thirty centimetres in diameter that are located at the site of the proposed boat ramp and jetty or within ten metres either side should be lifted and immediately relocated to an area of similar depth in the bay to the east of the proposed facility.

48. To prevent oxidation of potential acid sulfate soil and possible degradation of the waterway, no bed sediment material shall be removed from the waterway unless a preliminary assessment has been undertaken to determine whether potential acid sulfate soils are present and, if necessary, an acid sulfate soils management plan has been prepared in accordance with the ASS Assessment Guidelines (Ahern et al., 1998).

49. A visual inspection of the waterway for dead or distressed fish is to be undertaken twice daily during the works. Observations of dead or distressed fish are to be immediately reported to the Fishers Watch hotline on 1800 043 536. In such cases all works are to cease until the issue is rectified and approval is given to proceed.

50. During construction appropriate measures shall be put in place to catch debris and prevent it from entering the waterway.

51. If treated timber is to be used:

a. Pigment Emulsified Creosote (PEC), which is virtually free of surface bleeding, shall be used in preference to ordinary creosote. Treatment will be in accordance with AS/NZS2843.

b. After the final PEC treatment the product shall be held for a minimum of six weeks to allow the emulsion to "break" which then provides the final surface condition.

c. The supplier shall be made aware that pieces with visibly oily surfaces will not be accepted.

d. The product shall be inspected visually to ensure that there are no excessive residual materials or preservative deposits. If the material does not appear clean and dry or has developed areas of “bleeding” it shall be rejected.

e. Construction debris shall be prevented from entering the waterway.

f. Construction debris, including off cuts and sawdust shall be collected and disposed of to an approved waste disposal site. This may be achieved by setting up a single cutting station and/or by use of tarpaulins to catch sawdust and drillings.

52. When treating cut surfaces of timber with preservative or paint the following precautions apply:

a. The use of field treatment preservatives is best limited through prefabrication of the wooden structures, which reduces the need for field cutting and drilling.

b. If field treatment with preservatives is necessary they shall be applied sparingly and with care to avoid spillage.

c. Whenever possible, the field treatment shall be applied to the member before it is placed in a structure over water. Excess preservative shall be wiped from the wood.

d. If the preservative must be applied to wood above water, a tray, bucket, pan or other collection device shall be used to contain spills and drips.

e. Field treatments shall not be applied in the rain to wood that is above water.

f. Materials treated with field preservatives shall not be placed directly into water unless the treated surface is dry and free of excess preservative.

53. Physical disturbance to the bed and banks of the waterway shall be minimised and restricted to only what is required for installation of the structures. If possible, machinery should not enter the waterway unless on a floating barge. Barges or other work vessels should not anchor in a way that would damage seagrasses or foreshore vegetation. If it is necessary for equipment to work from the estuary bed then it should do so from within the footprint of the ramp/jetty, commencing offshore and proceeding landward.

54. Waste material (for example packaging, strapping, off-cuts, excess concrete) shall be contained within the land-based site during construction and then be removed to an authorised waste disposal facility or an appropriate storage area for reuse elsewhere. No material shall be placed in any location or in any manner that would allow it to enter the waterway or escape from the site into adjoining bushland or residential areas. Stockpiles of debris and construction materials shall be stored at least 10 metres outside the top of the lake banks or the national park boundary. General refuse shall be disposed of to a covered container stored at the site. This container, when full, shall be transported to Council's authorised waste disposal centre. No waste shall be burnt or buried on-site or disposed of in the waterway or bushland.

55. To prevent contaminated material being placed on the site, if material is imported for fill, it shall be either virgin excavated natural material as defined in the Protection of the Environment Operations Act or be excavated natural material that has been tested in accordance with the 'excavated natural material exemption 2014'. Otherwise, an environment protection licence would be required under the Act.

9 CONCLUSIONS

Provided the environmental safeguards listed in Section 8 of this report are employed, the proposed boat launching facility at Conjola Park:

- is not likely to have a significant effect on the environment and therefore an environmental impact statement is not required

- is not likely to have a significant effect on threatened species and therefore a biodiversity development assessment report or a species impact statement is not required and there is no requirement to retire biodiversity credits to offset the residual impact on biodiversity values

- is not likely to have a significant impact on a matter of national environmental significance; the action would not be undertaken on or have an effect on Commonwealth land; the proposed action therefore does not need to be referred to the Australian Minister for the Environment.

10 REFERENCES

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11 DETERMINATION

I, Paul Keech, Director Assets and Works of Shoalhaven City Council, hereby determine that the proposed boat launching facility at Conjola Park, as described in this REF, can proceed.

(i) I have determined that it is unlikely that there will be any significant environmental impact as a result of the proposed work. An environmental impact statement is not required.

(ii) The proposed activity is not likely to have a significant effect on threatened species and therefore a biodiversity development assessment report or a species impact statement is not required and there is no requirement to retire biodiversity credits to offset the residual impact on biodiversity values.

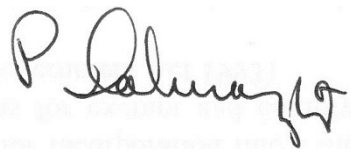
(iii) The proposed action is not likely to have a significant impact on a matter of national environmental significance, nor would the action be undertaken on or have an effect on Commonwealth land. The proposed action therefore does not need to be referred to the Australian Minister for the Environment.

(iv) The environmental safeguards proposed in this review of environmental factors are to be implemented.

....

Paul Keech Date
Director Assets and Works
Shoalhaven City Council

REF prepared by:

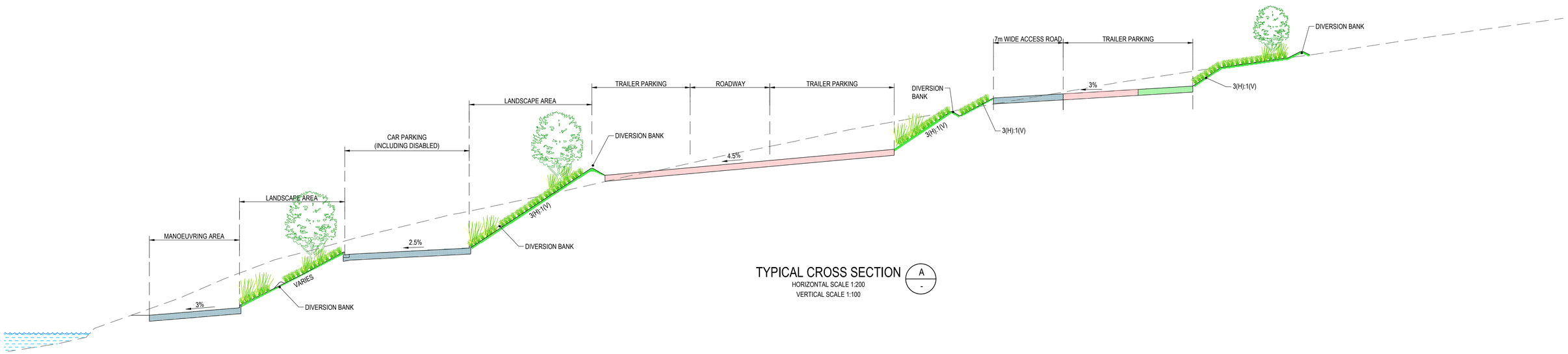


Peter Dalmazzo Date: 7/7/2020

ATTACHMENTS

1. PLANS FOR THE FACILITY
2. CONSULTATION
3. GEOTECHNICALINVESTIGATION
4. TERRESTRIAL FLORA ASSESSMENT
5. TERRESTRIAL FAUNA ASSESSMENT
6. AQUATIC & RIPARIAN FLORA AND FAUNA ASSESSMENT
7. BIODIVERSITY CONSERVATION ACT TEST OF SIGNIFICANCE
8. BOATING PLAN OF MANAGEMENT
9. ABORIGINAL HERITAGE DOCUMENTATION
10. ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT PROTECTED MATTERS REPORT

DO NOT SCALE



TYPICAL CROSS SECTION A

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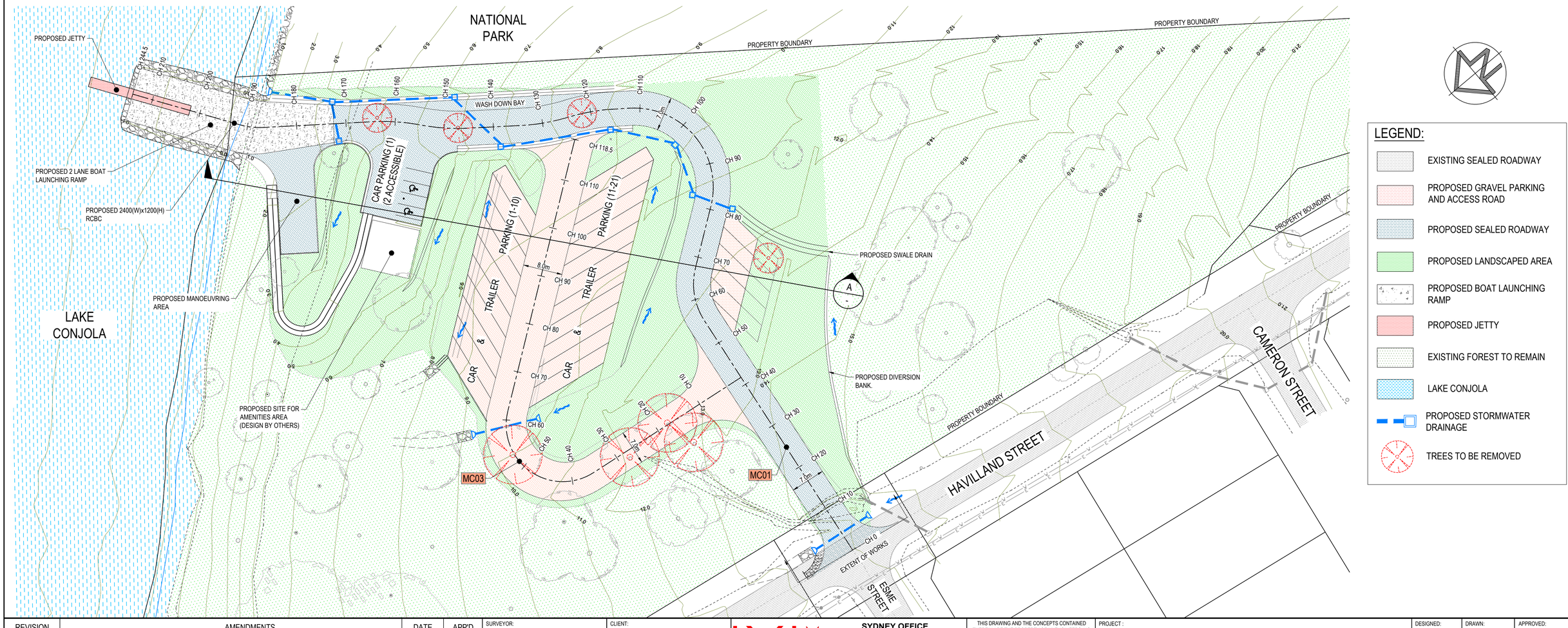
VERTICAL SCALE 1:100



LEGEND:

- EXISTING SEALED ROADWAY
- PROPOSED GRAVEL PARKING AND ACCESS ROAD
- PROPOSED SEALED ROADWAY
- PROPOSED LANDSCAPED AREA
- PROPOSED BOAT LAUNCHING RAMP
- PROPOSED JETTY
- EXISTING FOREST TO REMAIN
- LAKE CONJOLA
- PROPOSED STORMWATER DRAINAGE
- TREES TO BE REMOVED

REVISION	AMENDMENTS	DATE	APP'D
A	ISSUE FOR CONCEPT REVIEW	23/03/20	M.W

SURVEYOR:
DATE OF SURVEY:
ORIGIN:
HEIGHT OF DATUM:
HORIZONTAL DATUM:

CLIENT: Canterbury City Council — DIRECTOR ASSETS & WORKS — Ben Stewart — DATE — PLAN REFERENCE

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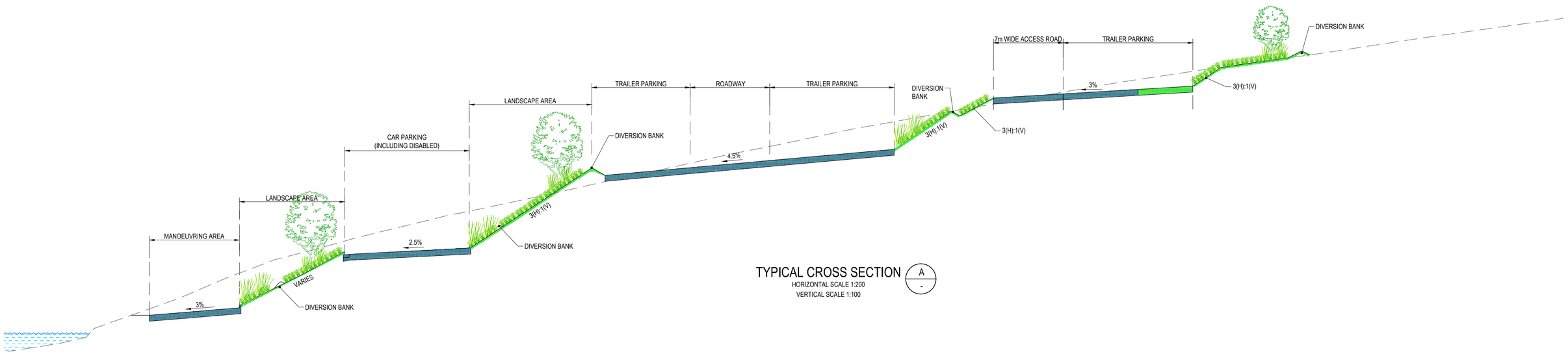
PROJECT :
HAVILLAND STREET, CONJOLA PARK
PROPOSED BOAT RAMP

DRAWING NAME:
STAGE 1 CONCEPT - General Arrangement Plan

DESIGNED:	DRAWN:	APPROVED:
M.W	R.M/M.Z	M.W
SHEET SIZE:	SCALE:	DATE:
A1	1 : 400	23/03/20

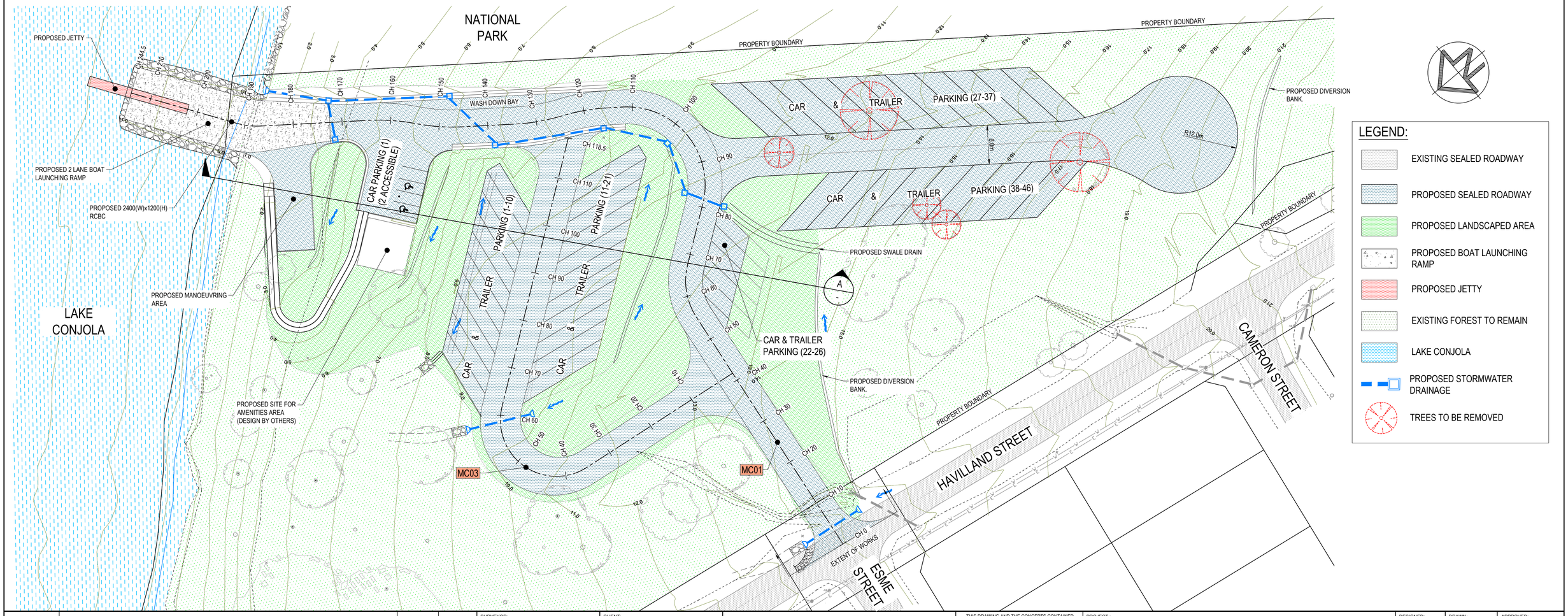
DRAWING NUMBER: DN160085 /C01
REVISION: A

DO NOT SCALE



TYPICAL CROSS SECTION A

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:100



LEGEND:

- EXISTING SEALED ROADWAY
- PROPOSED SEALED ROADWAY
- PROPOSED LANDSCAPED AREA
- PROPOSED BOAT LAUNCHING RAMP
- PROPOSED JETTY
- EXISTING FOREST TO REMAIN
- LAKE CONJOLA
- PROPOSED STORMWATER DRAINAGE
- TREES TO BE REMOVED

REVISION	AMENDMENTS	DATE	APP'D
A	ISSUE FOR CONCEPT REVIEW	23/03/20	M.W

SURVEYOR:
DATE OF SURVEY:
ORIGIN:
HEIGHT OF DATUM:
HORIZONTAL DATUM:

CLIENT: Goulburn City Council — DIRECTOR ASSETS & WORKS — Ben Stewart — DATE — PLAN REFERENCE

MIENGINEERS

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83 - 89 Renwick Street, Redfern 2016
Tel (02) 8396 6565 Fax (02) 8396 6564

SOUTH COAST OFFICE
49 Berry Street, Nowra NSW 2541
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E : admin@miengineers.com
W : www.miengineers.com

PROJECT :
HAVILLAND STREET, CONJOLA PARK
PROPOSED BOAT RAMP

DRAWING NAME:
STAGE 2 CONCEPT - General Arrangement Plan

DESIGNED:	DRAWN:	APPROVED:
M.W	R.M/M.Z	M.W
SHEET SIZE:	SCALE:	DATE:
A1	1 : 400	23/03/20
DRAWING NUMBER:		REVISION:
DN160085 /C02		A

SA17.14 Community Engagement - Proposed Boat Launching Ramp at Havilland St Lake Conjola and Aney Street Conjola - Pontoon at Fishermans Paradise

HPERM Ref: D17/164

Group: Assets & Works Group
Section: Asset Management

Attachments:
1. Plans - Proposed Boat Launching Facility & Car Park - Havilland Street Conjola Park
2. Site plan - Proposed Boat Ramp Pontoon - Fishermans Paradise
3. Plans - Proposed Concrete Boat Launching Ramp - Aney Street Lake Conjola
4. Submission Comments (councillors information folder)

Purpose / Summary

This report provides the feedback and results of community consultation for Councils consideration in relation to proposed waterway infrastructure improvements at Lake Conjola including:

- The investigation and design of a proposed new boat launching facility and carpark at Havilland Street, Conjola Park.
- A small floating pontoon at Fishermans Paradise.
- Concreting of the existing primitive gravel launching ramp at Aney Street, Conjola.

Recommendation (Item to be determined under delegated authority)

That Council:

1. Note the community feedback on the Boating projects
2. Proceed to a detailed design and finalisation of a Review of Environmental Factors for a new boat launching ramp and carpark at Havilland Street Lake Conjola with consideration of the impacts of traffic
3. Include the option for staging of the construction of the Havilland Street car and trailer parking component, through the detailed design, to reduce the initial project cost
4. Consider Havilland Street project construction funding against other boating infrastructure priorities, prior to submission of the next round of the NSW Department of Transport's Better Boating Program (scheduled mid 2017).
5. Council undertakes construction of the Fishermans Paradise pontoon and Aney Street boat launching ramp with current funding allocated from the State Government

Options

1. As recommended

2. Review the Lake Conjola Boating Infrastructure Strategy and consider alternative lower capital cost options for improving public boat launching and associated carparking facilities.

Background

Lake Conjola is the only major waterway in the Shoalhaven that is not provided with a reasonable boat launching facility within public ownership. The need for a new facility has been identified in the following strategic planning documents:

- SCC Lake Conjola Estuary Management Plan (1998)
- NSW Maritime Boating Plan of Management (2005)
- SCC – Waterways Infrastructure Management Plan (2008)

Community Engagement

Letters were sent to all ratepayers in Conjola, Conjola Park and Fishermans Paradise (south side of the lake) requesting comment. A public meeting was held at the Lake Conjola Community Hall on 16 November 2016 and was attended by approximately 22 people.

Generally the focus of the discussion related to the new boat launching ramps at Havilland Street, Conjola Park, this was seen as a major project and a plan is provided as Attachment 1.

There was limited feedback on the proposed works at Fishermans Paradise to construct a pontoon (see Attachment 2) and Aney Street boat launching ramp improvement (see Attachment 3).

A copy of written submissions received is provided in the Councillors Information Folder. No submissions were received for the proposed concrete boat launching ramp at Aney Street Lake Conjola. Issues identified as part of the community consultation are summarised below with a focus on Havilland Street new launching ramp:

Issue	Council Comment
Detailed design issues • Buffer distance to residential properties • Antisocial behaviour /hoon factor/need for speed humps/ surveillance cameras/gate at entrance • Lighting impacts on residential properties • Vehicle impact on Stewart Street/suggest roundabout at Stewart Street • Car trailer overflow impacts during peak periods • Safety benefit of pontoon on the side rather than the middle • Need for gross pollution traps • Include paddle craft access • Inclusion of table and chairs picnic facilities	These issues will be considered as part of the detailed design and Review of Environmental Factors (REF) noting that: • The buffer distance beween the project and houses in Havilland Street is considered to be relatively generous compared to other boating facilities. Unfortunately the buffer distance cannot be increased due to site contraints • Antisocial behaviour is a risk and can be reviewed and managed as is done with other public facilities • Construction cost of a roundabout cannot be justified - 40/car/trailer spaces are proposed and this is considered to be a relatively low trafffic demand. This can be considered further in the detailed design. Paddle craft access will be included • Picnic and amenities can be provided as funds permit
Strategic Issues • Too far to travel from East Conjola. Local boat ramps should be upgraded instead • Completion time too far away • Project needed now	The majority of people that attended the public meeting were in favour of the project. No submissions were received opposing the project but concerns raised related to traffic and parking. Generally people thought that the delivery of this project is well overdue. Upgrading of alternative local ramps could be considered as a lower cost alternative but car and trailer parking is contrained at other sites.
RMS Issues • Lake capacity to take extra boats? • Speed of boats • Erosion impacts	Will require ongoing monitoring by Roads and Maritime Services. 4 knot speed zones will be introduced to reduce speed near the launching facility

Financial/Funding Issues	
Need for paid parking to fund proposal	The relative large capital cost of the project was acknowleged by residents and therefore the option of introducing paid parking was suggested to help fund the project. This suggestion has merit but would need to be considered as part of a city wide strategic review and consultaton process and not just limited to this projectCouncil may consider submitting this as a key project under the next round of the Better boating program.

Financial Implications

$200,000 is budgeted in the 2016/17 Delivery Program that includes $180,000 of funding from the NSW Department of Transports, Better Boating Program that will fund:

- Completion of detailed design for Havilland Street and environmental studies
- Construction of the Fishermans Paradise pontoon
- Concrete ramp upgrade to Aney Street

The construction cost of Havilland Street is estimated to cost approximately $2 million but the detailed design will provide an opportunity gain a more accurate estimate, this exludes the cost of the provision of a public amenity. The ability of staging and reducing the capital cost of the project is limited to providing a reduced number of car and trailer spaces down to 20 instead of 40 at the first stage, this may reduce the project cost by up to $600,000 as it reduces the site works considerably. However concerns have been raised by adjoining residents about the impact on surrounding streets.

Whilst the Havilland Street project is eligible for Better Boating grant fundng and based on feedback is required now, it is a relatively high cost project and is unlikely to be fully funded by a grant. A council contribution is not identified in Council's current Delivery Program and will need to be considered and reported to council, if the project is a priority in the future submission under Better Boating.

Office of Environment & Heritage

NSW GOVERNMENT

Date: 16 September 2016
Your reference: 51901E
Our reference: DOC16/468970
Contact: Calvin Houlison
4224 4179

Michael Strachan
Project Manager Asset Management
Shoalhaven City Council
PO Box 42
NOWRA NSW 2541
E-mail: michael.strachan@shoalhaven.nsw.gov.au

Dear Mr Strachan

RE: Proposed New Boat Launching Facility, Havilland Street, Conjola Park (Lot 7308 DP 114810)

Thank you for consulting us with regard to the abovementioned proposal as required by Clause 16(1) of State Environmental Planning Policy (SEPP)(Infrastructure) 2007. This response reflects the views of both the National Parks & Wildlife Service (NPWS) branch of OEH and the broader OEH. In response, we provide the following comments for your consideration.

REF Assessment Requirements

The REF should undertake an assessment against the relevant provisions of the Infrastructure SEPP, namely permissibility of the proposal and environmental impacts associated with its construction and operation. We understand that Council proposes to construct the facility as development permitted without consent in accordance with Clause 68(4) of the Infrastructure SEPP relating to wharf and boating facilities. We request the opportunity to review and provide comment on the finalised design of the proposed facility and REF, including detailed plans, prior to approval.

NPWS Management Issues

The subject site is high conservation value and was left out of the gazetted Conjola National Park to allow for the future provision of boating facilities. As the development is adjacent to Conjola National Park, the guidelines for development adjoining NPWS land should be followed and discussed with Ulladulla NPWS officers (see Attachment B).

The environmental assessment should clearly delineate between the National Park and boat launching facility site boundary and identify mitigation measures to minimise impacts on the adjacent park and foreshore lands. Management of increased visitor access to the National Park associated with the proposal should also be addressed.

We recommend that the proposal include closure of unauthorised bush tracks in the area and provision of a vegetated buffer next to the park and foreshore. Site management issues, in particular stormwater, boat wash down and weeds, should also be considered in the REF. The adjacent park is a Strategic Fire Advantage Zone (SFAZ) and Council may need to factor this into planning for the proposed facility.

Environmental Impacts

The REF should also address impacts of development both during and after construction on Conjola National Park, water quality impacts on Lake Conjola and impacts on marine ecology. Terrestrial ecology

will also need to be addressed within the REF. The proposal will impact upon native vegetation and there are a number of NSW Wildlife Atlas records for threatened species in the vicinity of the subject site.

A flora & fauna assessment should be undertaken in support of the REF, including assessments of significance under Section 5A of the Environmental Planning & Assessment Act 1979, in order to confirm whether the proposal would have a significant impact upon threatened species, populations or ecological communities, or their habitats. Habitat trees and native vegetation on site should be retained wherever possible.

Aboriginal Cultural Heritage

An Aboriginal cultural heritage assessment that includes the full construction footprint must be conducted. Aboriginal objects are protected under the National Parks and Wildlife Act 1974. Aboriginal objects including culturally modified trees and stone artefact scatters have previously been found close to the proposed construction area, and the broader Lake Conjola area is of high Aboriginal cultural significance.

Exercising due diligence is the first stage in conducting an Aboriginal cultural heritage assessment in NSW. OEH has developed a due diligence procedure to help people consider their legislative obligations in relation to Aboriginal cultural heritage. This is set out in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010).

Given the landscape and cultural context of the proposed works area, we recommend engaging a qualified archaeologist to conduct a full cultural heritage assessment. This should include a full archaeological survey. Archaeological test excavation may also be required. The archaeological survey and any subsequent test excavations must comply with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Before test excavation occurs, consultation with the Aboriginal community must be conducted in accordance with clause 80C of the *National Parks and Wildlife Regulation 2009*, as explained in the *Aboriginal cultural heritage consultation Requirements for Proponents 2010* (DECCW 2010).

Proponents need to make all reasonable efforts to determine whether their proposed activities will harm Aboriginal objects, or harm landscape features that are likely to contain Aboriginal objects. In the event that Aboriginal object(s) are identified within the construction footprint, appropriate conservation and/or mitigation measures must be determined. An Aboriginal Heritage Impact Permit (AHIP) pursuant to Section 90 of the National Parks and Wildlife Act may be required if harm to Aboriginal objects cannot be avoided.

The relevant OEH guidance material for Aboriginal cultural heritage is provided at Attachment B.

Please contact Libby Shields, A/ Ulladulla Area Manager (NPWS) on 4454 9500 or via e-mail at libby.shields@environment.nsw.gov.au should you wish to discuss further.

Yours sincerely

CALVIN HOULISON
Senior Conservation Planning Officer

cc: Libby Shields, A/ Ulladulla Area Manager, NPWS

Attachment A – OEH Guidelines for Aboriginal Cultural Heritage
Attachment B – Guidelines for Development Adjacent to NPWS-owned land

Peter Dalmazzo

From: Michael Strachan <Michael.Strachan@shoalhaven.nsw.gov.au>
Sent: Tuesday, 31 January 2017 4:50 PM
To: 'Mal Windley'
Cc: Peter Dalmazzo
Subject: FW: Lake Conjola Proposed boat ramp - Havilland Street

Response from DPI

FYI

Michael Strachan
Project Manager
Shoalhaven City Council

02 44293276 | 0412780797
strachan@shoalhaven.nsw.gov.au
www.shoalhaven.nsw.gov.au

From: Jillian Reynolds [mailto:jillian.reynolds@dpi.nsw.gov.au]
Sent: Wednesday, 25 January 2017 9:41 AM
To: Michael Strachan <Michael.Strachan@shoalhaven.nsw.gov.au>
Cc: Allan Lugg - Dept of Fisheries <Allan.Lugg@dpi.nsw.gov.au>; Glenn Staples <glenn.staples@dpi.nsw.gov.au>
Subject: Re: Lake Conjola Proposed boat ramp - Havilland Street

Dear Michael,

Thank you for the opportunity to provide feedback on the initial proposal of the boat ramp at Havilland Street, Lake Conjola. Following an inspection of the site we can advised that construction of infrastructure at this site would create minimal impact on the aquatic habitat of the Lake and offer in principle support for the project.
The current ramp situated to the west of the proposal site does not provide adequate parking and is currently degraded and discharging sediment into the Lake. As an offset for the construction of the new ramp and associated infrastructure we would require the removal of the current ramp and restoration of this site.

Regards,

Jillian

Jillian Reynolds | Fisheries Manager
NSW Department of Primary Industries | Aquatic Ecosystems
4 Woollamia Road | PO Box 97 | Huskisson NSW 2540
T: 02 4428 3406 | M: 0429 918 575 | F: 02 4441 8961 | E: jillian.reynolds@dpi.nsw.gov.au
W: www.dpi.nsw.gov.au/fisheries

Conserve, Share, Provide

On 3 January 2017 at 14:20, Michael Strachan <Michael.Strachan@shoalhaven.nsw.gov.au> wrote:

Dear Sir/Madam

I am writing to consult with you regarding Council's proposal for a new boat launching facility and associated infrastructure, including a car parking area, at Lot 7308 DP 1144810 Havilland Street Conjola Park and the adjacent part of the Lake Conjola waterway.

Council, through contractors, is currently undertaking necessary environmental and engineering studies and preparing a design for the proposed facility. An aquatic habitat survey of the site is attached and more detailed assessment of impacts will be undertaken. It would be valuable to have your comments at this stage of the project and your early response would be greatly appreciated.

A public meeting held in December 2016. The project has strong local community support however construction and timing of the project will be dependent on the availability of grant funding.

Please contact me if you need to discuss.

Regards

Michael Strachan
Project Manager
Shoalhaven City Council

02 44293276 | 0412780797
strachan@shoalhaven.nsw.gov.au
www.shoalhaven.nsw.gov.au

From: Peter Dalmazzo [mailto:peter@peterdalmazzo.com.au]
Sent: Tuesday, 3 January 2017 12:08 PM
To: 'Mal Windley' <mal.windley@miengineers.com>; Michael Strachan <Michael.Strachan@shoalhaven.nsw.gov.au>
Subject: HPRM: new conjola boat ramp - consultation with Fisheries

Mal and Michael

As far as I am aware there has been no recent consultation with DPI (Fisheries) for this project (maybe there was many years ago).

I've drafted a letter (attached) that I think should come from Council. Also attached is my aquatic habitat survey report to go with the letter. Fisheries will probably also want another opportunity to comment once design and REF are available.

Regards,

Peter Dalmazzo

peter@peterdalmazzo.com.au

02 4448 6164

0466 930 775

This message may contain both confidential and privileged information intended only for the addressee named above.
If you have received this email in error, please notify the sender immediately then destroy the original message.

Peter Dalmazzo

From: Bruce Thompson <Bruce.Thompson@environment.nsw.gov.au>
Sent: Tuesday, 12 July 2016 9:44 AM
To: Peter Dalmazzo
Subject: RE: Lake Conjola - conservation or biobanking agreements on proposed work site?

Hi Peter

Our database doesn't show any conservation agreements in the vicinity of Lot 7308 DP 1144810.

Regards

Bruce

From: Peter Dalmazzo [mailto:peter@peterdalmazzo.com.au]
Sent: Tuesday, 12 July 2016 2:13 AM
To: OEH ROGHD BioBanking Mailbox <biobanking@environment.nsw.gov.au>; Bruce Thompson <Bruce.Thompson@environment.nsw.gov.au>
Subject: Lake Conjola - conservation or biobanking agreements on proposed work site?

Dear Bruce and Biobanking Mailbox

I am collating information on behalf of Shoalhaven City Council for environmental assessment of a proposed new boat launching facility at Lot 7308 DP 1144810 Havilland Street West Lake Conjola and the adjacent part of the Lake Conjola waterway. Council is required by s111(2) of the EP&A Act to consider the effect of an activity on any conservation agreement entered into under the National Parks and Wildlife Act 1974 or any joint management agreement or biobanking agreement entered into under the Threatened Species Conservation Act 1995.

Maps showing the location of the proposed facility are attached.

Can you please tell me whether there are any conservation, joint management or biobanking agreements on land near this proposal?

Thanks for your assistance.

Regards,

Peter Dalmazzo
peter@peterdalmazzo.com.au
+47 988 59 734 (until 30 August 2016)

Peter Dalmazzo

From: Alana Burley <Alana.Burley@environment.nsw.gov.au> on behalf of OEH ROGHD BioBanking Mailbox <biobanking@environment.nsw.gov.au>
Sent: Tuesday, 12 July 2016 11:22 AM
To: Peter Dalmazzo; Bruce Thompson
Subject: RE: Lake Conjola - conservation or biobanking agreements on proposed work site?

Hi Peter,

There is a biobanking agreement approximately 5 km south east of the proposed work site.

Cheers
Alana

Biobanking Team
Ecosystem Assessment
Regional Operations Group
Office of Environment and Heritage
PO Box A290 Sydney South NSW 1232
E: biobanking@environment.nsw.gov.au
W: www.environment.nsw.gov.au

From: Peter Dalmazzo [mailto:peter@peterdalmazzo.com.au]
Sent: Tuesday, 12 July 2016 2:13 AM
To: OEH ROGHD BioBanking Mailbox <biobanking@environment.nsw.gov.au>; Bruce Thompson <Bruce.Thompson@environment.nsw.gov.au>
Subject: Lake Conjola - conservation or biobanking agreements on proposed work site?

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Maps showing the location of the proposed facility are attached.

Can you please tell me whether there are any conservation, joint management or biobanking agreements on land near this proposal?

Thanks for your assistance.

Regards,

Peter Dalmazzo
peter@peterdalmazzo.com.au
+47 988 59 734 (until 30 August 2016)

Network Geotechnics

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W: www.netgeo.com.au
ABN: 35 069 211 561

W07/4230-A MRW

17 October 2016

MI Engineers Pty Ltd

Attention: Mal Windley

By Email: mal.windley@miengineers.com

Dear Mal,

Re: Fisherman's Paradise & Havilland Street, Conjola Park: Proposed Wharfs/Jettys and Car Parking

1.0 Introduction

This report presents the results of a geotechnical investigation carried out by Network Geotechnics (NG) Pty. Ltd. at two locations, Fisherman's Paradise & Havilland Street, Conjola Park.

Proposed development is understood to comprise a new wharf/jetty at Fisherman's Paradise and a new car park and wharf/jetty at Havilland Street, Conjola Park.

The investigations were commissioned by Mal Windley. The scope of works carried out was based on our Proposal (Ref: W07/4230Q36 dated 9 September 2016).

2.0 Fieldwork and Laboratory Testing

Fieldwork was carried out on 22 and 23 September 2016 and comprised a number of boreholes drilled using NG's Skid Steer Dingo drilling rig. One borehole was drilled at Fisherman's Paradise to a depth of 7.0m. Four boreholes were drilled at Havilland Street, to depths ranging from 1.0m to 7.0m. Dynamic cone penetrometer (DCP) test's were undertaken down the boreholes at selected depths.

The fieldwork was supervised by a Geotechnical Engineer from NG, who set out the borehole locations, nominated sampling and testing and prepared the engineering logs of the subsurface profiles encountered.

Three samples were obtained from Havilland Street for laboratory testing comprising four day soaked CBR (California Bearing Ratio) tests.

3.0 Fisherman's Paradise

The geological map of the area (Shoalhaven, 1:100,000) indicates the site to be underlain by Holocene Backswamp (Qhas) deposits comprising organic mud, peat, silt and clay underlain by Floodplain (Qhap) deposits comprising silt, fluvial sand and clay and/or Alluvial Channel deposits comprising fluvial sand, gravel, silt and clay.

The site is located adjacent to Conjola Lake, where it is proposed to construct a new wharf/jetty.

Subsurface conditions encountered in the Borehole (BH5) are summarised in Table 1 below. Reference should be made to the attached borehole log for detailed subsurface conditions.

Table 1: Summary of subsurface profile encountered in BH5 (Fisherman's Paradise)

Layer	Soil Description	Depth to the Base of Layer (m)	Cohesion Cu (kPa)	Friction Angle phi (degrees)	Bulk Unit Weight (kN/m3)
FILL	Sand with fine to coarse gravel, dark brown, loose	1.7	IGNORE	IGNORE	18
ALLUVIAL	Clayey SAND with some gravel, mottled orange brown, medium dense	>7.5	0	30	19

Groundwater was encountered at a depth of 1.5m in BH5. However, the depth to groundwater may vary over time due to variations in environmental factors.

4.0 Havilland Street, Conjola Park

The geological map of the area (Shoalhaven, 1:100,000) indicates the site to be underlain by Permian sedimentary and minor volcanic rocks. The site is located adjacent to Conjola Lake, where it is proposed to construct a new car parking area and a wharf/jetty.

Boreholes BH1 to BH3 were undertaken to shallow depths in the area of proposed car parking to obtain samples for CBR testing and to undertake DCP tests to estimate the in-situ CBR. The results are summarised in Table 2 below.

Table 2: Summary of Boreholes BH1 to BH3 (Havilland Street, Conjola Park)

Borehole	Depth From	Depth To	Strata	DCP Blows	Penetration (mm)	DCP Index (mm/blow)	CBR (%) Correlation
BH1	0	0.7	Sandy CLAY				
	0.7	0.85		1	150	150	1.1
	0.85	1		3	150	50	3.7
	1.15	1.3		7	150	21	9.6
	1.3	1.45		11	150	14	15.2
	1.45	1.6		15	150	10	22.2
BH2	0	0.6	Silty CLAY				
	0.6	0.75		5	150	30	6.5
	0.75	0.9		8	150	19	10.8
	0.9	1.05		10	150	15	14.1
	1.05	1.2		10	150	15	14.1
	1.2	1.35		21	150	7	33

Borehole	Depth From	Depth To	Strata	DCP Blows	Penetration (mm)	DCP Index (mm/blow)	CBR (%) Correlation
BH3	0	0.6	Sandy SILT				
	0.6	0.75		3	150	50	3.7
	0.75	0.9		7	150	21	9.6
	0.9	1.05		10	150	15	14.1
	1.05	1.2		10	150	15	14.1
	1.2	1.35		150	150	7	33

Borehole 4 was undertaken adjacent to the lake, where it is proposed to construct a new jetty/wharf. Subsurface conditions encountered in the borehole are summarised in Table 3 below. Reference should be made to the attached borehole log for detailed subsurface conditions

Table 3: Summary of subsurface profile encountered in BH4 (Havilland Street, Conjola Park)

Layer	Soil Description	Depth to the Base of Layer (m)	Cohesion Cu (kPa)	Friction Angle phi (degrees)	Bulk Unit Weight (kN/m3)
TOPSOIL	Silty SAND with roots, dark brown	0.5	IGNORE	IGNORE	18
RESIDUAL	Silty CLAY and Sandy CLAY, pale brown becoming mottled orange brown	4.1	100	0	19
ROCK (Probable)	Recovered as sandy GRAVEL, grey. (Probable low strength rock)	>7.5	150	0	20

Groundwater was encountered at a depth of 1.5m in BH4. However, the depth to groundwater may vary over time due to variations in environmental factors.

5.0 Pavement Design (Havilland Street, Conjola Park)

Laboratory four day soaked CBR results are attached. The results gave CBR values in the range 8 to 14% for samples taken from shallow depths up to 0.5m from Boreholes BH1 to BH3. It is understood that a cut of about 1m will be undertaken to form the car parking area. Correlation of DCP results to CBR, shown in Table 2, give CBRs of approximately 9 to 14% at this depth. Based on the above a design CBR value of 10% is recommended.

The client has indicated ESAs of between 1 x 10^5 and 1 x 10^6 for the proposed car park. Based on this and the recommended CBR, a pavement thickness of 300mm is recommended, comprising 100mm base and 200mm subbase.

6.0 Pier Design

It is understood that piers are required to support the new wharfs/jettys at both Fisherman's Paradise and Havilland Street, Conjola Park. It is also understood that driven timber and/or concrete piles are envisaged.

The investigation was limited to a 7.5m deep land based auger drilled borehole at each wharf/jetty location. How subsurface conditions may vary beneath the length of the over water construction is not known. In view of this, timber piles easily able to be spliced may be preferred.

Driven piles in such situations are normally designed for the structural capacity of the pile shaft when driven to a refusal set and bearing on rock or dense/hard soils. For treated hardwood poles, allowable loads of 100-300 are normally achievable for piles of 200 to 300mm diameter.

Lateral capacity for the wharf/jetty is normally achieved by driving pairs of slightly offset piles at intervals along the structure with the pairs being cross braced and the braced pairs being connected and tied into the deck superstructure.

Piers should be designed based on AS 2159-2009 'Piling – Design and Installation'. Account should also be taken of lateral loading on the piles (for example Broms 1965, Design of Laterally Loaded Piles).

The design ultimate geotechnical strength ($R_{d.ug}$) of a pile in compression can be approximated using the following relationship:

$$R_{d.ug} = f_{m.s} A_s + f_b A_b$$

Where: $f_{m.s}$ = average shaft friction for condition of full mobilisation (compression)
f_b = ultimate base pressure (compression)
A_s = shaft surface area of pile in contact with soil
A_b = base area of pile

The design ultimate geotechnical strength ($R_{d.ug}$) of a pile in tension (ie. uplift) can be approximated using the following relationship:

$$R_{d.ug} = f_{m.st} A_s + W$$

Where: $f_{m.st}$ = average shaft friction for condition of full mobilisation (tension) = 0.8 $f_{m.s}$
A_s = shaft surface area of pile in contact with soil
W = weight of pile

The design geotechnical strength ($R_{d.g}$) is calculated as the design ultimate geotechnical strength ($R_{d.ug}$) multiplied by a geotechnical strength reduction factor (ϕ_g).

$$R_{d.g} = R_{d.ug}\ \phi_g$$

The geotechnical strength reduction factor is dependent on a risk assessment and any associated load testing of the installed piles. An average risk rating (ARR) of between 3.0 and 3.5 has been assessed indicating a moderate overall risk category. The pile system for the proposed structure(s) has been considered as a low redundancy system, hence, a geotechnical strength reduction factor (ϕ_g) of 0.48 is considered appropriate.

It should be noted that a nominal length of 1.5 times the pile diameter (D) below the soil surface is normally ignored in the estimation of design ultimate geotechnical strength due to a potential gap (between pile and soil) that may occur within this depth due to cyclic loading and other factors.

Shaft friction (f_s) is calculated using the following equation(s) specific to the type of ground encountered:

$f_s = K_s \sigma_v' \tan \delta$ (for cohesionless soil)
$f_s = C_u \alpha$ (for cohesive soil)
$f_s = 0.4 \sqrt{UCS}$ (for rock)

Where: K_S = horizontal pressure coefficient
σ_v' = effective vertical stress
δ = pile to soil friction angle
C_u = undrained shear strength
α = adhesion factor
UCS = unconfined compressive strength

End bearing (f_b) is calculated using the following equation(s) specific to the type of ground encountered:

$f_b = N_q \sigma_v'$ (for cohesionless soil)
$f_b = N_c C_u$ (for cohesive soil)
$f_b = 4.8 \sqrt{UCS}$ (for rock)

Where: N_q & N_c = bearing capacity factors

Estimates of soil parameters at both Fisherman's Paradise and Havilland Street, Conjola Park are presented in Tables 1 and 3 respectively.

It is anticipated that driven piles will be driven to a set, to form the piers. The depth of penetration will be a function of the soils/rock encountered, the tensile strength of the pile and the driving force employed. The installation of test piles should be considered.

Refusal should be expected in fresh rock. Contractors should be made aware of ground conditions to ensure the appropriate equipment is available so that required embedment depths can be achieved. Further advice regarding pile design and suitability of equipment should be sought from a specialist piling contractor.

7.0 Limitations

This report has been prepared for MI Engineers in accordance with NG's proposal dated 9 September 2016 (ref: W07/4230Q36) under NG's Terms of Engagement.

The report is provided for the exclusive use of MI Engineers for the specific development and purpose as described in the report. The report may not contain sufficient information for developments or purposes other than that described in the report or for parties other than MI Engineers.

The information in this report is considered accurate at the date of issue with regard to the site conditions at the time of investigation. The conclusions drawn in the report are based on interpolation between investigation locations. Conditions can vary between investigation locations that cannot be explicitly defined or inferred by investigation.

The report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by NG, as the report has been written as advice and opinion rather than instructions for construction.

The report must be read in conjunction with the attached Information Sheets and any other explanatory notes and should be kept in its entirety without separation of individual pages or sections. NG cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing the report NG has necessarily relied upon information provided by the client and/or their agents.

We trust these comments are sufficient to meet your present requirements. Please do not hesitate to contact the undersigned should you have any queries.

For and on behalf of
Network Geotechnics Pty Ltd

Report prepared by:

Martin Williams
Principal Geotechnical Engineer

Reviewed by:

Richard King
Principal Geotechnical Engineer

Encl Information Sheets (4 Sheets)
Approximate Borehole Location (Havilland Street) (1 Sheet)
Borehole Logs (2 Sheets)
Laboratory Test Results (1 Sheet)

General Notes About This Report

INTRODUCTION

These notes have been prepared by Network Geotechnics Pty Ltd (NG) to help our Clients interpret and understand the limitations of this report. Not all sections below are necessarily relevant to all reports.

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in NG's proposal under NG's Terms of Engagement, or as otherwise agreed with the Client. The scope of work may have been limited by a range of factors including time, budget, access and/or site constraints.

RELIANCE ON INFORMATION PROVIDED

In preparing the report NG has necessarily relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and plans. NG has not verified the accuracy or completeness of the data except as stated in this report.

GEOTECHNICAL AND ENVIRONMENTAL REPORTING

Geotechnical and environmental reporting relies on the interpretation of factual information based on judgment and opinion and is far less exact than other engineering or design disciplines.

Geotechnical and environmental reports are for a specific purpose, development and site as described in the report and may not contain sufficient information for other purposes, developments or sites (including adjacent sites) other than that described in the report.

SUBSURFACE CONDITIONS

Subsurface conditions can change with time and can vary between test locations. For example, the actual interface between the materials may be far more gradual or abrupt than indicated and contaminant presence may be affected by spatial and temporal patterns.

Therefore, actual conditions in areas not sampled may differ from those predicted since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions and thus the continuing adequacy of a geotechnical report. NG should be kept informed of any such events and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

GROUNDWATER

Groundwater levels indicated on borehole and test pit logs are recorded at specific times. Depending on ground permeability, measured levels may or may not reflect actual levels if measured over a longer time period. Also, groundwater levels and seepage inflows may fluctuate with seasonal and environmental variations and construction activities.

INTERPRETATION OF DATA

Data obtained from nominated discrete locations, subsequent laboratory testing and empirical or external sources are interpreted by trained professionals in order to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions in accordance with any relevant industry standards, guidelines or procedures.

SOIL AND ROCK DESCRIPTIONS

Soil and rock descriptions are based on AS 1726 – 1993, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer to the accompanying soil and rock terms sheet for further information.

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FURTHER ADVICE

NG would be pleased to further discuss how any of the above issues could affect a specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of designs and construction techniques;
- Contract documentation and specification;
- Construction control testing (earthworks, pavement materials, concrete);
- Construction advice (foundation assessments, excavation support).

Abbreviations, Notes & Symbols

SUBSURFACE INVESTIGATION

METHOD

Borehole Logs		Excavation Logs	
AS#	Auger screwing (#-bit)	BH	Backhoe/excavator bucket
AD#	Auger drilling (#-bit)	NE	Natural exposure
B	Blank bit	HE	Hand excavation
V	V-bit	X	Existing excavation
T	TC-bit		
HA	Hand auger	**Cored Borehole Logs**	
R	Roller/tricone	NMLC	NMLC core drilling
W	Washbore	NQ/HQ	Wireline core drilling
AH	Air hammer		
AT	Air track		
LB	Light bore push tube		
MC	Macro core push tube		
DT	Dual core push tube		

SUPPORT

Borehole Logs		Excavation Logs	
C	Casing	S	Shoring
M	Mud	B	Benched

SAMPLING

B	Bulk sample
D	Disturbed sample
U#	Thin-walled tube sample (#mm diameter)
ES	Environmental sample
EW	Environmental water sample

FIELD TESTING

PP	Pocket penetrometer (kPa)
DCP	Dynamic cone penetrometer
PSP	Perth sand penetrometer
SPT	Standard penetration test
PBT	Plate bearing test
s_U	Vane shear strength peak/residual (kPa) and vane size (mm)
N*	SPT (blows per 300mm)
Nc	SPT with solid cone
R	Refusal

**denotes sample taken*

BOUNDARIES

———	Known
— — — -	Probable
.....	Possible

SOIL

MOISTURE CONDITION

D	Dry
M	Moist
W	Wet
Wp	Plastic Limit
Wl	Liquid Limit
MC	Moisture Content

CONSISTENCY		DENSITY INDEX	
VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

USCS SYMBOLS

GW	Well graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sand, sand-silt mixtures
SC	Clayey sand, sand-clay mixtures
ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts of high plasticity
CH	Inorganic clays of high plasticity
OH	Organic clays of medium to high plasticity
PT	Peat muck and other highly organic soils

ROCK

WEATHERING		STRENGTH	
RS	Residual Soil	EL	Extremely Low
XW	Extremely Weathered	VL	Very Low
HW	Highly Weathered	L	Low
MW	Moderately Weathered	M	Medium
DW*	Distinctly Weathered	H	High
SW	Slightly Weathered	VH	Very High
FR	Fresh	EH	Extremely High

**covers both HW & MW*

ROCK QUALITY DESIGNATION (%)

$$= \frac{\text{sum of intact core pieces} > 100\text{mm}}{\text{total length of section being evaluated}} \times 100$$

CORE RECOVERY (%)

$$= \frac{\text{core recovered}}{\text{core lIft}} \times 100$$

NATURAL FRACTURES

Type

JT	Joint
BP	Bedding plane
SM	Seam
FZ	Fractured zone
SZ	Shear zone
VN	Vein

Infill or Coating

Cn	Clean
St	Stained
Vn	Veneer
Co	Coating
Cl	Clay
Ca	Calcite
Fe	Iron oxide
Mi	Micaceous
Qz	Quartz

Shape

pl	Planar
cu	Curved
un	Undulose
st	Stepped
ir	Irregular

Roughness

pol	Polished
slk	Slickensided
smo	Smooth
rou	Rough

Soil & Rock Terms

SOIL

MOISTURE CONDITION

Term	Description
Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through the hand.
Moist	Feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist, but with free water forming on hands when handled.

For cohesive soils, moisture content may also be described in relation to plastic limit (W_P) or liquid limit (W_L). [>> much greater than, > greater than, < less than, << much less than].

CONSISTENCY

Term	c_u (kPa)	Term	c_u (kPa)
Very Soft	< 12	Very Stiff	100 - 200
Soft	12 - 25	Hard	> 200
Firm	25 - 50	Friable	-
Stiff	50 - 100		

DENSITY INDEX

Term	I_D (%)	Term	I_D (%)
Very Loose	< 15	Dense	65 – 85
Loose	15 – 35	Very Dense	> 85
Medium Dense	35 – 65		

PARTICLE SIZE

Name	Subdivision	Size (mm)
Boulders		> 200
Cobbles		63 - 200
Gravel	coarse	20 - 63
	medium	6 - 20
	fine	2.36 - 6
Sand	coarse	0.6 - 2.36
	medium	0.2 - 0.6
	fine	0.075 - 0.2
Silt & Clay		< 0.075

MINOR COMPONENTS

Term	Proportion by Mass coarse grained	fine grained
Trace	≤ 5%	≤ 15%
Some	5 - 2%	15 - 30%

SOIL ZONING

Layers	Continuous exposures
Lenses	Discontinuous layers of lenticular shape
Pockets	Irregular inclusions of different material

SOIL CEMENTING

Weakly	Easily broken up by hand
Moderately	Effort is required to break up the soil by hand

SOIL STRUCTURE

Massive	Coherent, with any partings both vertically and horizontally spaced at greater than 100mm
Weak	Peds indistinct and barely observable on pit face. When disturbed approx. 30% consist of peds smaller than 100mm
Strong	Peds are quite distinct in undisturbed soil. When disturbed >60% consists of peds smaller than 100mm

ROCK

SEDIMENTARY ROCK TYPE DEFINITIONS

Rock Type	Definition (more than 50% of rock consists of….)
Conglomerate	… gravel sized (> 2mm) fragments
Sandstone	… sand sized (0.06 to 2mm) grains
Siltstone	… silt sized (<0.06mm) particles, rock is not laminated
Claystone	… clay, rock is not laminated
Shale	… silt or clay sized particles, rock is laminated

STRENGTH

Term	Is50 (MPa)	Term	Is50 (MPa)
Extremely Low	< 0.03	High	1 – 3
Very Low	0.03 – 0.1	Very High	3 – 10
Low	0.1 – 0.3	Extremely High	> 10
Medium	0.3 – 1		

WEATHERING

Term	Description
Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident
Extremely Weathered	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water. Fabric of original rock is still visible
Highly Weathered	Rock strength usually highly changed by weathering; rock may be highly discoloured
Moderately Weathered	Rock strength usually moderately changed by weathering; rock may be moderately discoloured
Distinctly Weathered	See 'Highly Weathered' or 'Moderately Weathered'
Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength from fresh rock
Fresh	Rock shows no signs of decomposition or staining

NATURAL FRACTURES

Type	Description
Joint	A discontinuity or crack across which the rock has little or no tensile strength. May be open or closed
Bedding plane	Arrangement in layers of mineral grains of similar sizes or composition
Seam	Seam with deposited soil (infill), extremely weathered insitu rock (XW), or disoriented usually angular fragments of the host rock (crushed)
Shear zone	Zone with roughly parallel planar boundaries, of rock material intersected by closely spaced (generally < 50mm) joints and /or microscopic fracture (cleavage) planes
Vein	Intrusion of any shape dissimilar to the adjoining rock mass. Usually igneous

Shape	Description
Planar	Consistent orientation
Curved	Gradual change in orientation
Undulose	Wavy surface
Stepped	One or more well defined steps
Irregular	Many sharp changes in orientation

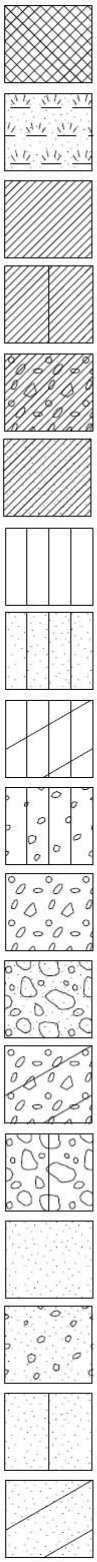
Infill or Coating	Description
Clean	No visible coating or discolouring
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	Visible coating ≤ 1mm thick. Ticker soil material described as seam

Roughness	Description
Polished	Shiny smooth surface
Slickensided	Grooved or striated surface, usually polished
Smooth	Smooth to touch. Few or no surface irregularities
Rough	Many small surface irregularities (amplitude generally < 1mm). Feels like fine to coarse sandpaper

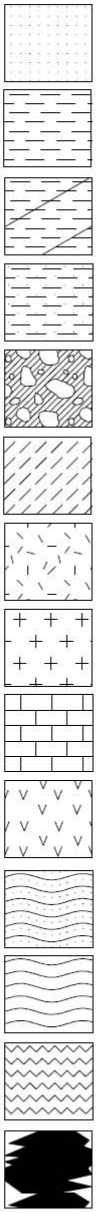
Note: soil and rock descriptions are generally in accordance with AS1726-1993 Geotechnical Site Investigations

Graphic Symbols Index

Soil



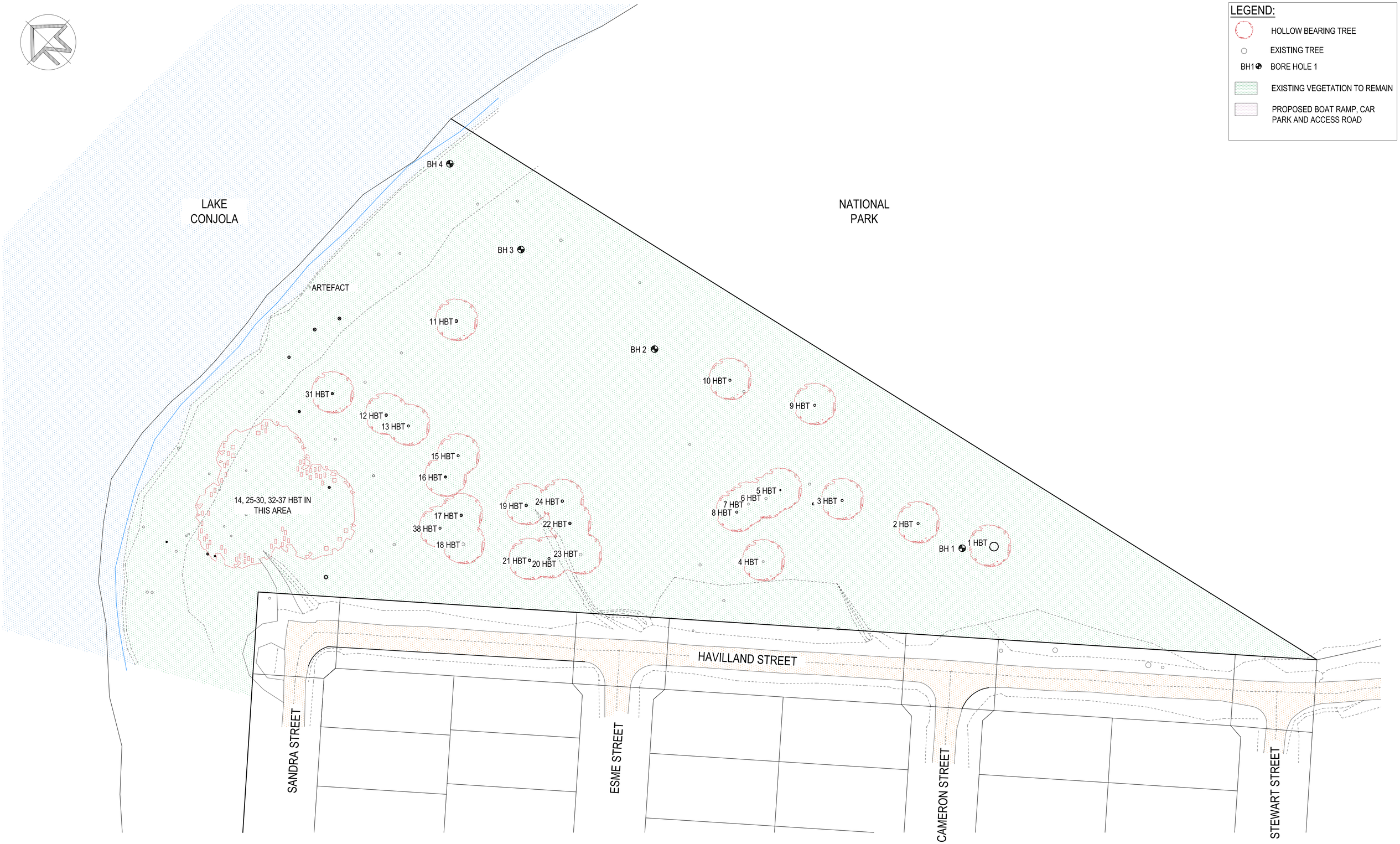
Rock



Other

Water Measurements

DO NOT SCALE



REVISION	AMENDMENTS	DATE	APP'D
A	ISSUE FOR REVIEW	XX/XX/16	M.W

SURVEYOR:

DATE OF SURVEY:

ORIGIN:

HEIGHT OF DATUM:

HORIZONTAL DATUM:

CLIENT:

MIENGINEERS

SYDNEY OFFICE
83 - 89 Renwick Street, Redfern 2016
Tel (02) 8396 6565 Fax (02) 8396 6564

SOUTH COAST OFFICE
49 Berry Street, Nowra NSW 2541
Tel (02) 44 230 566 Fax (02) 44 233 228

E : info@miengineers.com
W : www.miengineers.com

PROJECT :
HAVILLAND STREET, CONJOLA PARK
BOATRAMP

DRAWING NAME:
SITE PLAN

DESIGNED:	DRAWN:	APPROVED:
M.W	E.F	
SHEET SIZE:	SCALE:	DATE:
A1	2 : 1	06/10/16
DRAWING NUMBER:		REVISION:
DN160085/01		A

BOREHOLE LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
Unit 12 7/15 Gundah Road Mt Kuring Gai
NSW 2080
02 84380300
02 84380310

Job No:	W07/4230
Hole No:	**BH4**
Sheet:	PAGE 1 / 1
Started:	22/09/16
Finished:	22/09/16
Logged:	MW
Checked:	MW
RL Surface:	
Datum:	-

Client: MI Engineers

Project: Proposed New Jetty

Location: Havilland Street, Conjola Park
GPS

Equipment Type: Skid Steer Dingo

Borehole Diameter: Inclination: Bearing:

method	water	samples, tests etc	DCP Blows per 150 mm	depth (m)	graphic log	USCS symbol	Material Description	Moisture condition	Consistency/ relative density	comments / notes, structure, and additional observations
ADT	▼		1 5 9				Silty SAND, dark brown, with roots	D	S	TOPSOIL
		D	11 11	1.0		CL	Silty CLAY, pale brown	<Wp	St-Vst	RESIDUAL
			12 14 18 19 28	2.0						
			30			CL	Sandy CLAY, fine to medium gravel, mottled orange-brown and grey			
			25	3.0						
				4.0			Recovered as Sandy GRAVEL, grey		-	PROBABLE ROCK (low strength)
				5.0						
				6.0						
				7.0						

BH4 Terminated at 7.5 m

Refer To Explanation Sheets For Description Of Terms And Symbols Used.

BOREHOLE LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
Unit 12 7/15 Gundah Road Mt Kuring Gai
NSW 2080
02 84380300
02 84380310

Job No:	W07/4230
Hole No:	**BH5**
Sheet:	PAGE 1 / 1
Started:	23/09/16
Finished:	23/09/16
Logged:	MW
Checked:	MW
RL Surface:	
Datum:	-

Client: MI Engineers

Project: Proposed New Jetty

Location: Fishermans Paradise
GPS

Equipment Type: Skid Steer Dingo

Borehole Diameter: Inclination: Bearing:

method	water	samples, tests etc	DCP Blows per 150 mm	depth (m)	graphic log	USCS symbol	Material Description	Moisture condition	Consistency/ relative density	comments / notes, structure, and additional observations
ADT	▼	D	3 6 4	1.0		SP	SAND, with fine to coarse gravel, dark brown/grey	W	L	FILL
			4 2 4 5 7							
			7	2.0		SC	Clayey SAND, with some gravel, mottled orange-brown		MD-D	ALLUVIAL
			7 8 6 16 24							
				3.0						
			9 18 13							
		D	18							
			14							
				4.0						
			11 19 23 27 30							
				5.0						
				6.0						
				7.0						

BH5 Terminated at 7.5 m

Refer To Explanation Sheets For Description Of Terms And Symbols Used.

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Network Geotechnics
Geotechnical Engineering, Consulting & Testing Services

CALIFORNIA BEARING RATIO (CBR) TEST REPORT

Client :	MI Engineers	**Job Number:**	W07/4230
Project:	Fishermans Paradise Boat Ramp	**Report Number:**	1
location:	Havilland St Lake Conjola	**Report Date:**	5/10/2016
GTR:		**Tested By:**	Patrick Baldacchino

TEST IDENTIFICATION — ***Sampling Method :AS1289.1.2.1 (Clause 6.5.3 - Power Auger Drilling)***

Lab Number	W58481	W58482	W58483
Sample Date	22/09/2016	22/09/2016	22/09/2016
Borehole No:	BH1	BH2	BH3
Depth:	0.2-0.5m	0.2-0.5m	0.2-0.5m
Sample Description	(GC) Gravelly Sandy CLAY fine to medium sand fine to medium gravel	(CI) Gravelly Sandy Silty CLAY medium plastic fine to medium gravel brown	(GM) Gravelly Sandy SILT fine to medium gravel fine to medium sand

LABORATORY DATA

		AS1289.5.1.1	*AS1289.2.1.1*	
Field Moisture Content	(%)	13.0	17.3	13.4
Maximum Dry Density	(t/m^3)	1.81	1.77	1.81
Optimum Moisture Content	(%)	15.5	16.1	15.7

TEST RESULTS

		AS1289.6.1.1	*AS1289.2.1.1*	
Date Tested		4/10/2016	4/10/2016	4/10/2016
Days Soaked		4	4	4
Surcharge Weight		9 kg	9 kg	9 kg
Before Soaking				
Dry Density	(t/m^3)	1.82	1.75	1.81
Density Ratio	(%)	101 Standard	99 Standard	100 Standard
Moisture Content	(%)	15.6	16.4	15.5
Moisture Ratio	(%)	101	102	99
After Soaking				
Dry Density	(t/m^3)	1.82	1.74	1.81
Density Ratio	(%)	101 Standard	98 Standard	100 Standard
Swell	(%)	0.0	0.7	0.0
Moisture Content				
After Soaking	(%)	16.4	18.8	16.5
Top 30mm	(%)	16.0	20.1	17.2
Full Depth After Test	(%)	15.8	18.1	16.5
CBR Value	(%)	**8 @ 5.0mm**	**12 @ 2.5mm**	**14 @ 5.0mm**
Percentage of oversize	(%)	0.0 Excluded	0.0 Excluded	0.0 Excluded

Note : -

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025.

Wollongong Laboratory 1318

Approved Signatory:

Jason Danswan

Terrestrial Flora Assessment

for

Proposed Public Boat Launching Facility

Lot 7308 DP 1144810
Havilland Street
Conjola Park

PROPONENT: SHOALHAVEN CITY COUNCIL

PREPARED BY: PETER DALMAZZO

DATE: 10 APRIL 2017

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P J Dalmazzo & A M Glynn ABN 70 885 498 355

Contents

ATTACHMENTS

1 INTRODUCTION

1.1 Background

Peter Dalmazzo was commissioned by MI Engineers to prepare this terrestrial flora assessment for a proposed new public boat launching ramp and associated facilities at Havilland Street, Conjola Park. MI Engineers was the successful tenderer to Shoalhaven City Council for investigation and design of the facility, including preparation of a review of environmental factors for the project. This report deals with the terrestrial flora issues at the site of the proposed facility. Terrestrial fauna, aquatic and riparian ecological issues are dealt with in separate reports.

1.2 Location and Land Tenure

The location of the site is shown in Figures 1, 2 and 3. Conjola Lake is an intermittently closed and open coastal lake located in the City of Shoalhaven on the south coast of NSW, approximately 220 kilometres south of Sydney. The site of the proposed boat launching ramp is on the southwestern shore of Conjola Lake, on Lot 7308 DP 1144810 and the adjacent bed of the lake, to the east of Conjola Park village.

1.3 Description of Proposal

The intent of this facility is to be the main boat launching area for the western part of the lake. The lake is popular with water skiing, fishing and passive boating. Lake Conjola is the only major waterway in the Shoalhaven that is not provided with a reasonable boat launching facility within public ownership and the need for a new boat launching ramp at Conjola Lake was identified more than 15 years ago. After a number of design iterations, the resultant general layout for the proposed facility is shown in Figure 4 and detailed plans are attached to the review of environmental factors for the project. The facility would include a dual lane launching ramp with a central jetty, access road, car and trailer parking areas and an amenities building.

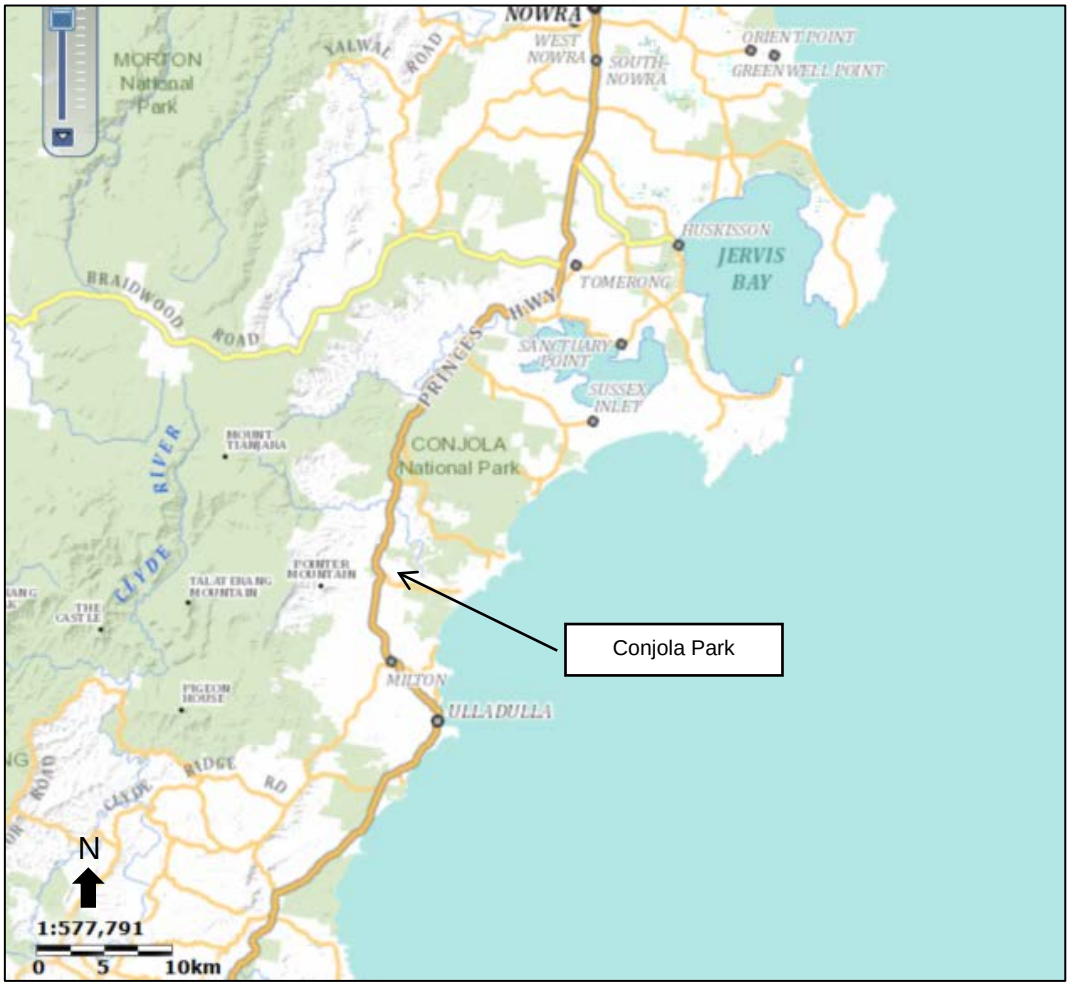

Figure 1. Location of Conjola Park.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

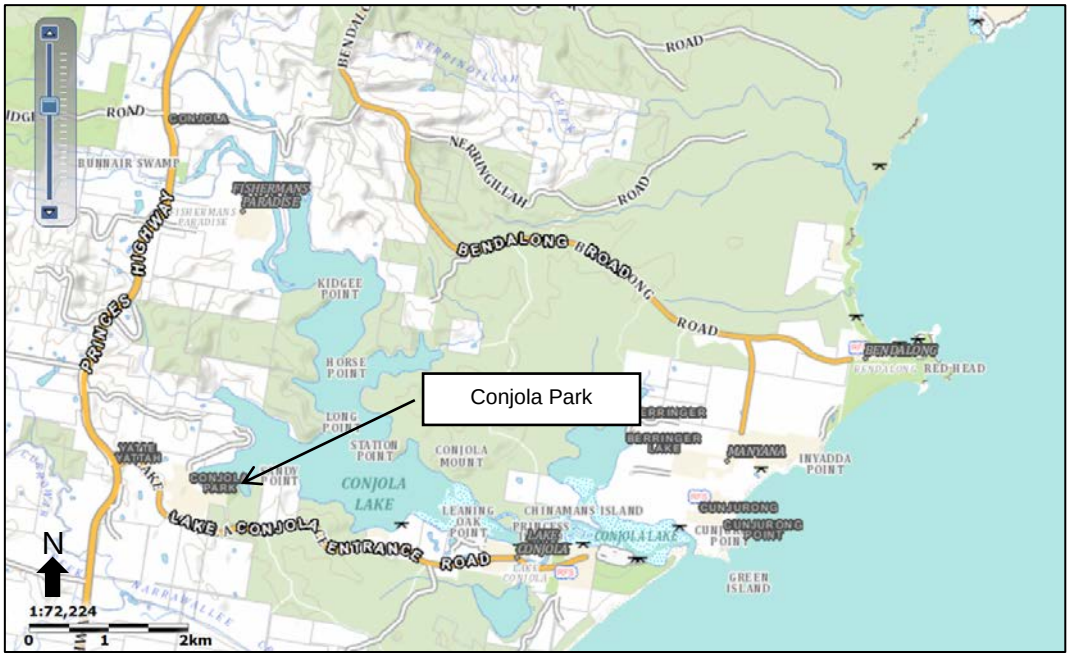

Figure 2. Location of Conjola Park.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

Figure 3. Location of Lot 7308 DP 1144810.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

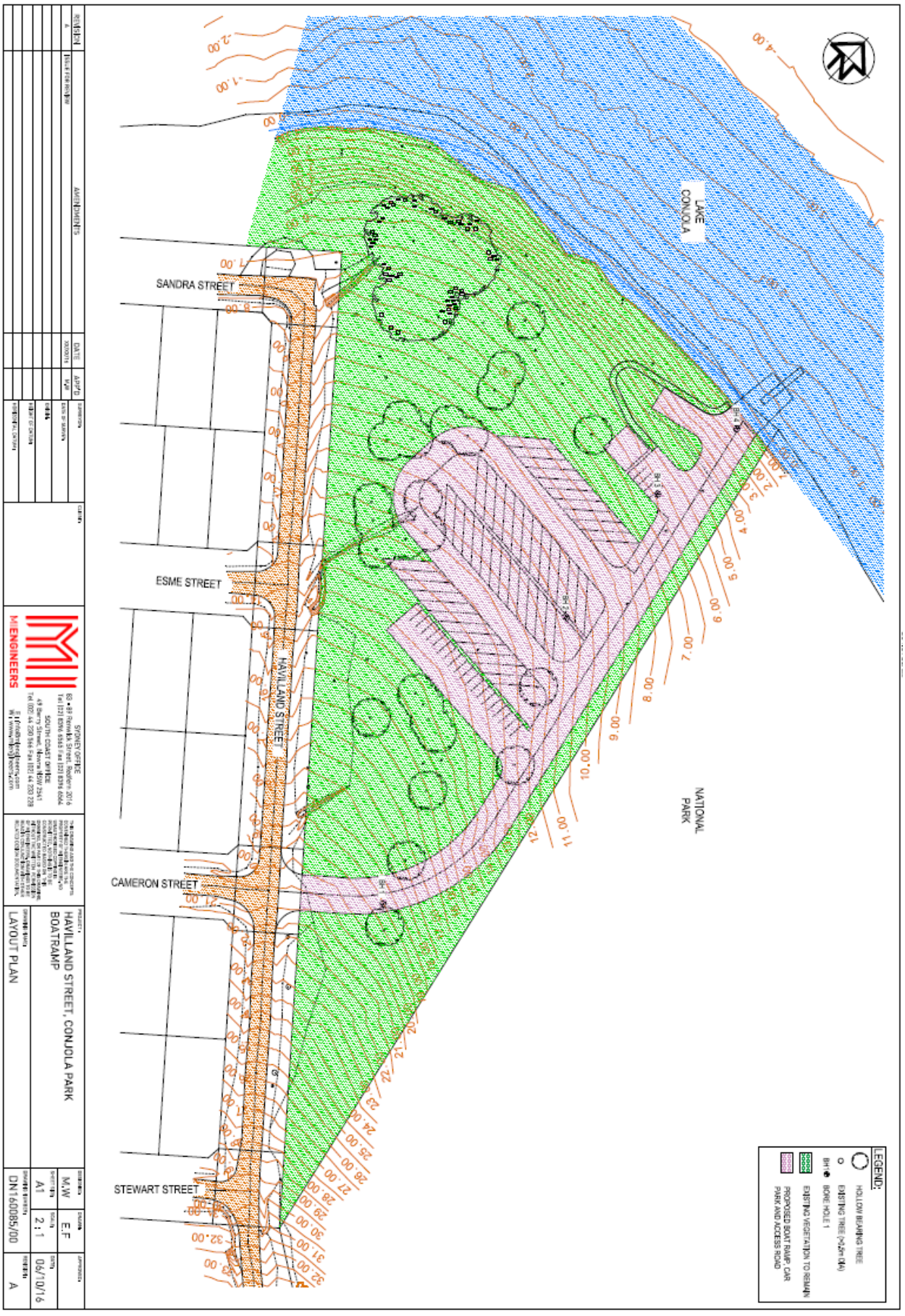

Figure 4. General layout of the proposed facility. The study area comprised the areas shaded green and pink.

2 METHODS

Relevant existing information was collated and reviewed, including previous studies, maps and air photographs. Using the Office of Environment and Heritage's BioNet website logged in as a licensed user, the Atlas of NSW Wildlife was interrogated in July 2016 and updated in March 2017 for records of threatened plant species that have been observed within an area eighteen kilometres by eighteen kilometres around the site. An Environment Protection and Biodiversity Conservation Act protected matters report was generated on 11 July 2016 using the Australian Government's internet search tool with a ten kilometre buffer.

Mapping and site assessment were carried out using a combination of on ground survey and air photo interpretation. Initial assessment of habitats and vegetation communities was made by interpreting recent air photographs available on the Internet at NSW Land and Property Management Authority's Spatial Information eXchange (SIX) Viewer (http://maps.six.nsw.gov.au/). Measurements were made using the measurement tools on the above web site and measured on site. Ground-truthing of photograph interpretation was carried out during the following field observations.

The study area included that part of Lot 7308 east and north of Havilland Street (see Figure 4). The site was inspected on Friday 16 September 2016 from 12:00 midday to 14:45 pm AEST. The weather was fine and partly cloudy, with mild to warm air temperature and a light wind initially from the west but soon turning east-north-easterly. Weather observations from the Nowra and Ulladulla weather stations are in Attachment 1.

The site was traversed on foot and records were made of the nature of the vegetation and habitats present at the site and of plant species that were observed. A plant species list was compiled during random meander on the site (Cropper, 1993). For plants that could not be positively identified in the field, samples were taken for later identification. Plant nomenclature generally conforms to the NSW Flora Online compiled by the National Herbarium of New South Wales ("PlantNET" http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

To establish whether or not vegetation types on the site should be classed as endangered ecological communities, their characteristics (plant species, soil, landform) were compared with descriptions in relevant determinations of the NSW threatened species scientific committee.

During initial field survey it was noted that there was potential habitat at the site for the threatened Leafless Tongue Orchid *Cryptostylis hunteriana*. This species is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) which were present at the site and are thought to have the same pollinator species as *Cryptostylis hunteriana*. Therefore targeted survey for this species was carried during the flowering period in January. The survey methods employed during the site investigation were based on the NSW Office of Environment and Heritage's 2016 "*NSW Guide to Surveying Threatened Plants"* and the Commonwealth of Australia's 2013 draft "*Survey Guidelines for Australia's Threatened Orchids - Guidelines for Detecting Orchids Listed As 'Threatened' Under the Environment Protection and Biodiversity Conservation Act 1999*".

Targeted survey for the Leafless Tongue Orchid *Cryptostylis hunteriana* was undertaken on the subject site on Monday 9 January 2017 between 13:15 pm and 16:05 pm AEDT. The orchid survey was undertaken during the species known flowering period and flowering was verified at two known local populations: on the same day as the site survey, flowering *Cryptostylis hunteriana* (Figure 5) were observed at Heritage Estates, Worrowing Heights approximately 28 kilometres from the subject site and at Turpentine Road, Tomerong approximately 26 kilometres from the subject site. Based on the maturity of the flower spikes at these sites and their proximity to the subject site, it was considered that, if *Cryptostylis hunteriana* was present at the subject site, it would be flowering and visible at the time of survey. The density of vegetation on the subject site was such that visibility was good. The weather at the time of inspection was slightly overcast, humid and very warm with light wind and conditions were considerd good for orchid visibility. The survey was conducted along parallel line transects approximately 10 metres apart, orientated approximately east-west, parallel to the lake shoreline. Searches were conducted on foot and were focused five metres either side of each transect walked. The whole site from the lake edge to 20 metres south of Cameron Street was searched using this method and, additionally, by walking on both sides of internal tracks and from Havilland Street looking into the site.

Figure 5. *Cryptostylis hunteriana* flowers at Heritage Estates, Worrowing Heights (left) and at Turpentine Road, Tomerong (right), 9 January 2017.

3 DESCRIPTION OF THE VEGETATION

The site is located on the southern foreshore of the western part of Lake Conjola. Topography of the site is shown in Figure 4. The land beside the lake slopes to the north and slightly east and therefore has a generally north facing aspect, with natural elevations varying from 30 m ASL within the southern portion of the site to sea level adjacent to Lake Conjola. No significant drainage lines were present on the subject site, however, to the east in the Conjola National Park there was a gully. A number of artificial drains had been cut into the site from Havilland Street. On the higher ground, where roads and car parking areas would be built, the soil was variously sandy clay, silty clay or sandy silt. The site was mostly vegetated, though disturbed in places by a variety of unsealed vehicle and walking tracks. Urban refuse and green garden waste had been dumped at various points along the western edge of the vegetation.

The terrestrial vegetation at the site was open eucalypt forest. The character of the vegetation can be seen in Figures 6 to 12. A list of all plant species observed at the site is included in Table 1. A total of 72 plants were identified including 11 non-native species and 61 native species.

Tree species observed included Red Bloodwood *Corymbia gummifera*, Bangalay *Eucalyptus botryoides*, White Stringybark *Eucalyptus globoidea*, Blackbutt *Eucalyptus pilularis*, Sydney Peppermint *Eucalyptus piperita* and Turpentine *Syncarpia glomulifera*. Trees were between 25 m and 30 m in height with a fairly continuous canopy cover. A medium to sparse density middle storey layer of native trees and shrubs that reached a height of 12 m was present in places.

The understorey was generally of sparse density and composed of native shrubs and saplings that were to 2 m in height, the density of this also being dependent upon past disturbances. Throughout the subject site the understorey varied from open (southern portions) to closed (northern). Species included Lance Beard-heath *Leucopogon lanceolatus*, Gorse Bitter Pea *Daviesia ulicifolia*, Golden Glory Pea *Gompholobium latifolium*, Tantoon *Leptospermum polygalifolium*, Hairpin Banksia *Banksia spinulosa*, Native Holly *Lomatia ilicifolia*, Smooth Geebung *Persoonia levis*, Hopbush *Dodonaea triquetra*, Sweet Wattle *Acacia suaveolens*, Prickly Moses *Acacia ulicifolia*, Rough-fruit Pittosporum *Pittosporum revolutum* and Sweet Pittosporum *Pittosporum undulatum*.

The ground cover vegetation was generally sparse and in some areas there was no ground cover vegetation. Here the soil was either covered with a layer of leaf litter or was bare. The ground cover comprised of grasses, herbs and forbs to 0.5 m in height. Adjacent to Havilland Street, exotic grasses and weeds were present. Leaf litter, ground debris and fallen timber was common throughout the subject site. Ground layer plants and climbers included Bracken Fern *Pteridium esculentum*, Small-leaf Glycine *Glycine microphylla*, Dusky Coral Pea *Kennedia rubicunda*, Prickly Shaggy Pea *Podolobium ilicifolium*, Wattle Mat-rush *Lomandra filiformis*, Wombat Berry *Eustrephus latifolius*, Blue Flax-lily *Dianella caerulea*, Wiry Panic *Entolasia stricta* and Basket Grass *Oplismenus aemulus*. Many flowering orchid plants (Cow Orchid *Cryptostylis subulata* and Bonnet Orchid *Cryptostylis erecta*) were present.

To the east of the subject site, in the Conjola National Park, there was a gully with vegetation typical of a wetter environment that included eucalypt forest with more mesic midstorey plants including Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii* and Grey Myrtle *Backhousia myrtifolia*.

Despite targeted surveys, no *Cryptostylis hunteriana* or other threatened plant species were observed at the site.

The vegetation at the site is not considered to be part of an endangered ecological community.

The native vegetation at the site has been mapped as Blackbutt Forest by Mills for Shoalhaven City Council (Figure 13) and as Southern Turpentine Forest, a type of wet sclerophyll forest (WSF p95), in the NSW Native Vegetation Mapping Program (updated by Tozer *et al*. 2010) (Figure 14).

The vegetation type on the site is generally common and widespread in the region. According to Tozer *et al*. (2010) it is widespread east of the Morton plateau on coastal lowlands near Conjola and Wandandian and large areas occur in Morton and Conjola National Parks and adjacent state forests. Tozer *et al*. (2010) summarised the status of the vegetation type for southeast NSW as:

Area Extant (ha): 62400
Estimated % remaining: >85%
Area in conservation reserves (ha): 38300
Estimated % of pre-clearing area in conservation reserves: 45-65%

The National Parks and Wildlife Service advised that the subject site is high conservation value land but was left out of the gazetted Conjola National Park to allow for the future provision of boating facilities. Parts of the site are mapped as habitat corridor and parts as significant vegetation in the Shoalhaven Local Environmental Plan 2014 (Figure 15). No documentation was available to justify the land's inclusion on the map but based on the current study, the vegetation at the site does not form part of an endangered ecological community. Other potentially significant features of the land as habitat for fauna, such as hollow-bearing trees and corridor value, are considered in a separate terrestrial fauna report.

Table 1. Plant species observed in the study area on 16 September 2016 and 9 January 2017.
* denotes introduced species, [eTSC] endangered species TSC Act

Family	Scientific Name	Common Name
Anthericaceae	*Chlorophytum comosum* *	Spider Plant *
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Asparagaceae	*Asparagus aethiopicus* *	Asparagus 'Fern' *
Asteraceae	*Chrysanthemoides monilifera* *	Bitou Bush *
Asteraceae	*Conyza sp* *	Fleabane *
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Cyperaceae	*Baumea juncea*	Bare Twigrush
Cyperaceae	*Lepidosperma urophorum*	Sword-sedge
Davalliaceae	*Nephrolepis cordifolia* *	Fishbone Fern *
Dennstaedtiaceae	*Pteridium esculentum*	Bracken Fern
Ericaceae - Epacridoideae	*Leucopogon lanceolatus*	Lance Beard-heath
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Fabaceae - Caesalpinioideae	*Senna pendula var. glabrata* *	Cassia *
Fabaceae - Faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae - Faboideae	*Glycine microphylla*	Small-leaf glycine
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea
Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea
Fabaceae - Faboideae	*Podolobium ilicifolium*	Prickly Shaggy Pea
Fabaceae - Faboideae	*Podolobium scandens*	Netted Shaggy Pea
Fabaceae - Mimosoideae	*Acacia longifolia subsp. longifolia*	Sydney Golden Wattle
Fabaceae - Mimosoideae	*Acacia mearnsii*	Black Wattle
Fabaceae - Mimosoideae	*Acacia obtusifolia*	Blunt Leaf Wattle
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle
Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia
Iridaceae	*Gladiolus sp.* *	Gladiolus *
Iridaceae	*Patersonia sericea*	Silky Purple-flag
Juncaceae	*Juncus kraussii*	Sea Rush
Lauraceae	*Cassytha pubescens*	Common Devil's Twine
Liliacae	*Lilium formosanum* *	Formosan Lily *
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush
Lomandraceae	*Lomandra multiflora subsp multiflora*	Many-flowered Mat-rush
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Menispermaceae	*Stephania japonica*	Snake Vine
Myrtaceae	*Acmena smithii*	Lilly Pilly
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Eucalyptus botryoides*	Bangalay
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus pilularis*	Blackbutt
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint
Myrtaceae	*Leptospermum polygalifolium*	Tantoon

Myrtaceae	*Syncarpia glomulifera*	Turpentine
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid
Orchidaceae	*Cymbidium suave*	Snake Orchid
Orchidaceae	*Dipodium punctatum*	Hyacinth Orchid
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Pittosporaceae	*Pittosporum revolutum*	Rough-fruit Pittosporum
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago lanceolata* *	Plantain *
Poaceae	*Cynodon dactylon*	Couch
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Imperata cylindrica*	Blady Grass
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Stenotaphrum secundatum* *	Buffalo Grass *
Poaceae	*Themeda australis*	Kangaroo Grass
Proteaceae	*Banksia spinulosa*	Hairpin Banksia
Proteaceae	*Lambertia formosa*	Mountain Devil
Proteaceae	*Lomatia ilicifolia*	Native Holly
Proteaceae	*Persoonia levis*	Smooth Geebung
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Ranunculaceae	*Clematis aristata*	Old Man's Beard
Rutaceae	*Zieria pilosa*	Hairy Zieria
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart
Sapindaceae	*Dodonaea triquetra*	Hopbush
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower
Vitaceae	*Cissus hypoglauca*	Water Vine
Zingiberaceae	*Hedychium gardnerianum* *	Ginger Lily *

Figure 6. Vegetation at proposed location of boat ramp, viewed from the water.

Figure 7. Moderately open forest canopy.

Figure 8. Area of forest with moderately dense shrub layer.

Figure 9. Area of forest with relatively open understorey, affected by hazard reduction burn.

Figure 10. There are tracks and other disturbed areas in the forest.

Figure 11. Track along foreshore area.

Figure 12. Sparse groundcover with grasses and orchids (*Cryptostylis* spp.)

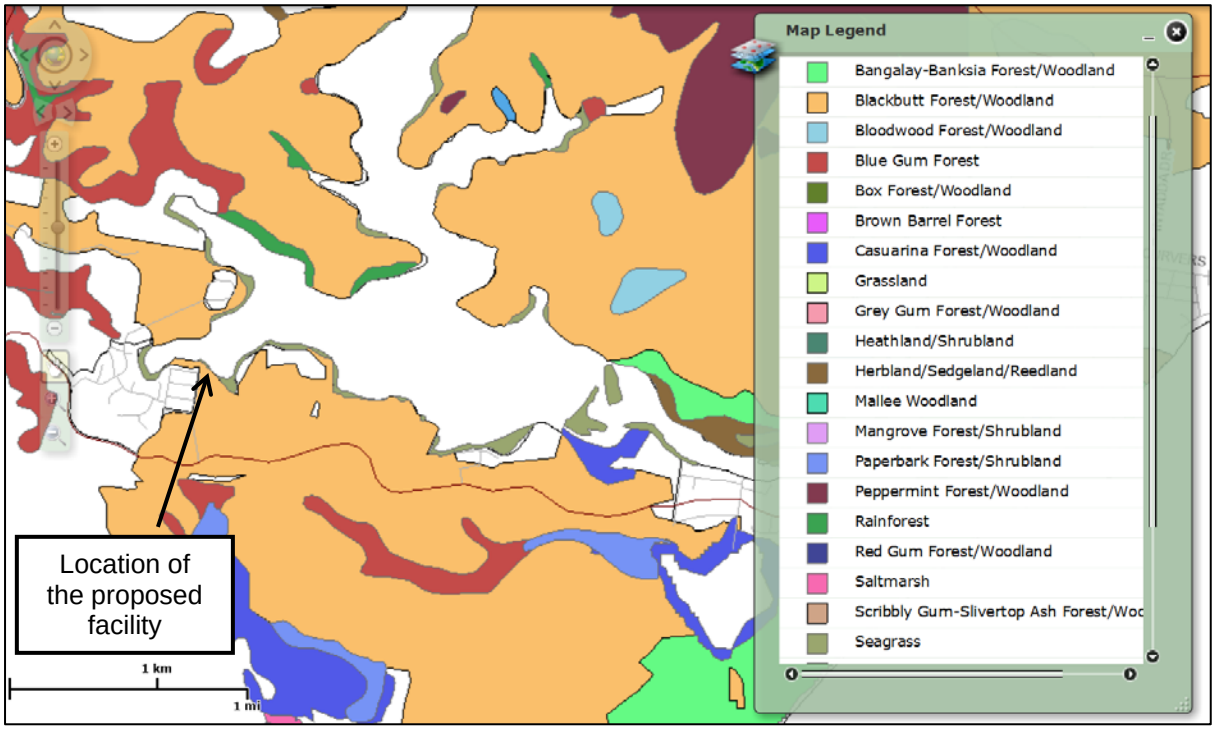

Figure 13. Vegetation mapping by Mills for Shoalhaven City Council.
Source: Shoalhaven City Council's state of the environment maps online.

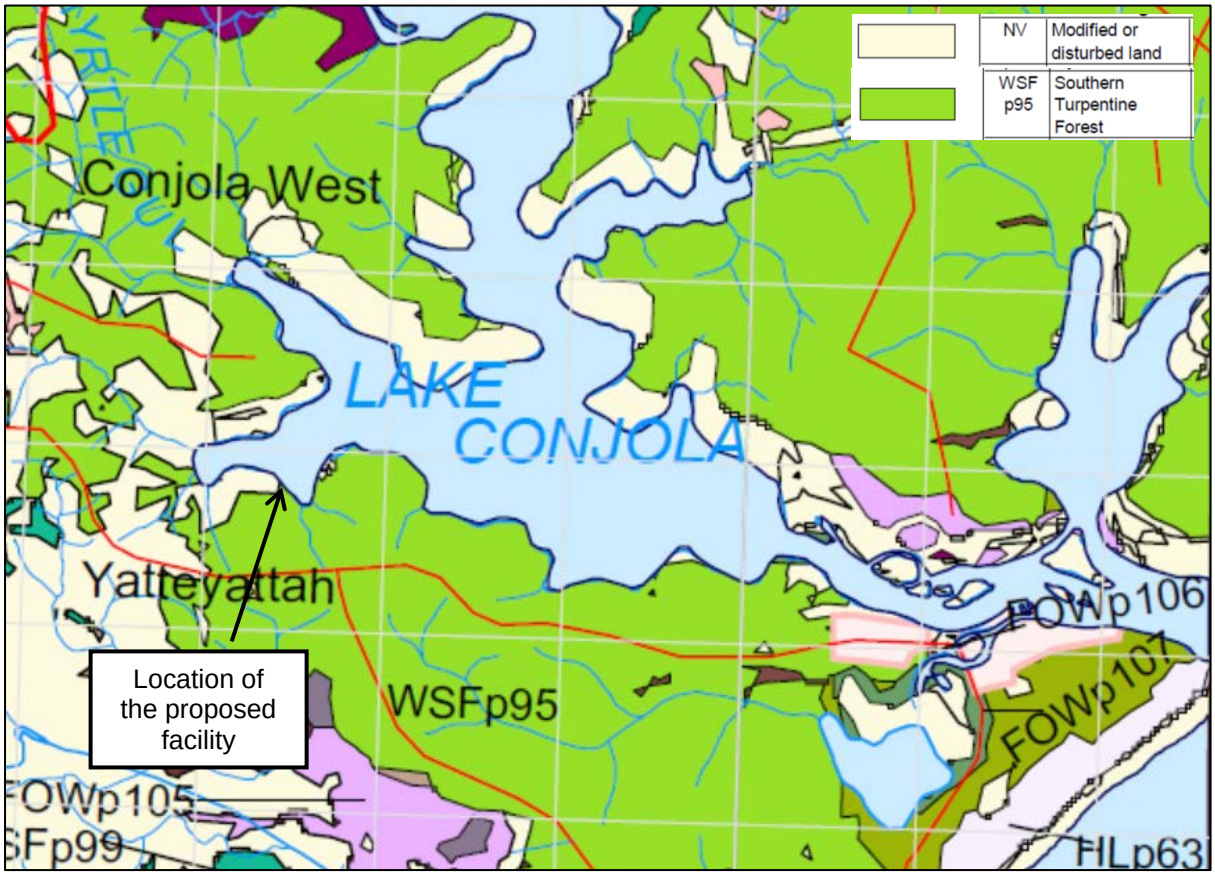

Figure 14. Vegetation mapping by Tozer *et al*. (2010)

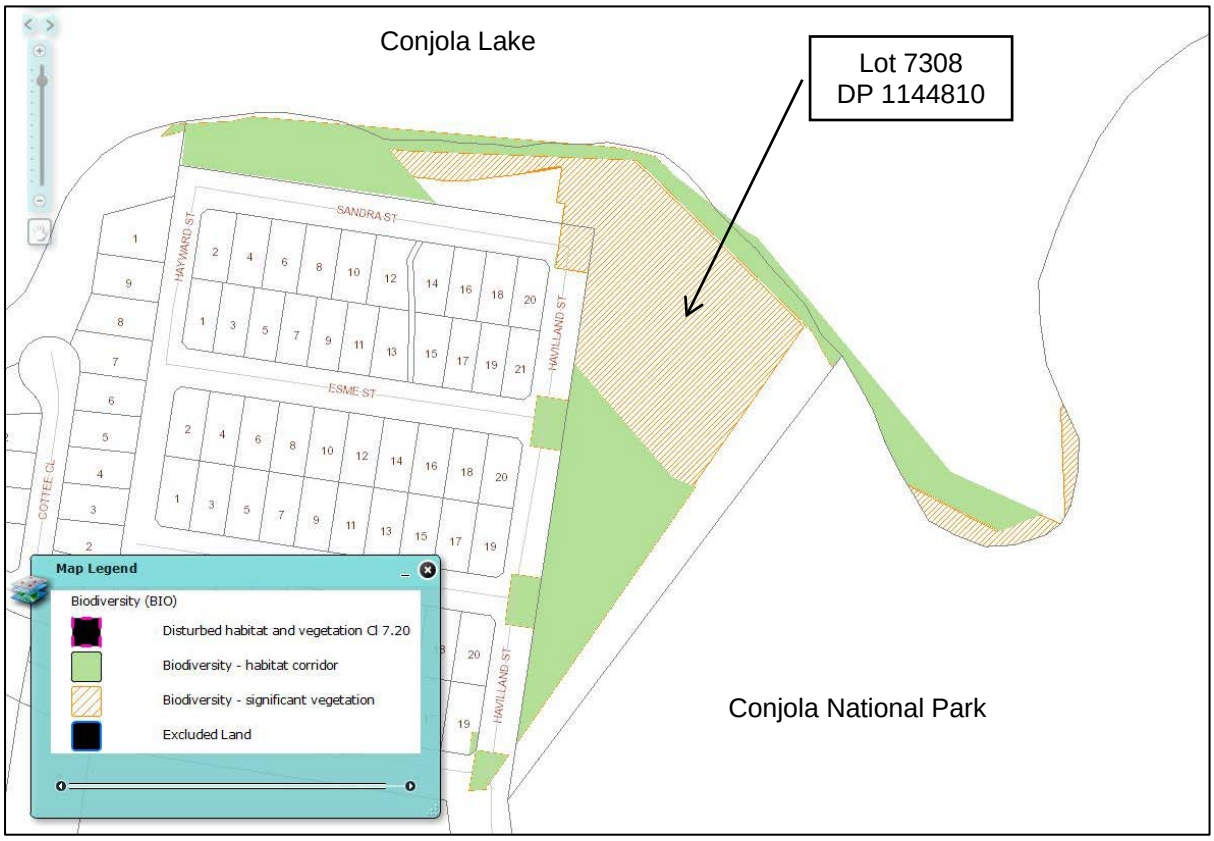

Figure 15. Biodiversity map from Shoalhaven Local Environmental Plan 2014
Source: Shoalhaven City Council's LEP maps online.

4 POTENTIAL FLORA AND FAUNA IMPACTS

There are a number of potential permanent/ongoing impacts and construction impacts from the proposal that could affect the terrestrial vegetation, as well as affecting the adjacent national park.

Permanent/ongoing impacts are those that result in long term changes to the environment and could include:

- removal or modification of habitat by:
    - clearing of vegetation
    - changes to substrate composition and orientation
- effects on vegetation, such as trampling and weed invasion, from increased human activity
- increased littering and other pollution.

Construction activities have the potential to cause shorter term impacts on the environment than those potential permanent/ongoing impacts described above. These could involve physical impacts directly on people, plants and animals or effects on their habitats through:

- death or disturbance of plants
- temporary impacts on water quality and consequent impacts on ecology.

The potential impacts listed above are described in more detail below and are considered by applying statutory assessment criteria in Sections 5 and 6. Environmental safeguards to mitigate or offset impacts are provided in Section 7.

4.1 Removal and Modification of Vegetation

The proposal would result in removal of 0.9 hectares of understorey, ground cover and trees. Some other overhanging trees are also likely to be modified.

4.2 Erosion, Sedimentation and Uncontained Debris

There is potential for indirect effects on terrestrial vegetation during construction from soil erosion and consequent sedimentation, uncontained debris, fuel and oil. To help manage these potential impacts, physical disturbance to the area should be minimised. As far as possible, large debris and fines should be contained during construction and stabilised immediately. Stockpiles of soil should not be stored in areas that may be impacted by stormwater flows if there is rainfall during construction.

Fuel and oil from construction machinery can have toxic effects on plants. An environmental management plan should be prepared that addresses ways in which pollution of the site by fuel and oil will be avoided. This should include protocols for equipment maintenance, storage of fuel and other chemicals and materials, and refuelling procedures.

Drainage will generally be directed away from the national park. Any drainage will not be concentrated i.e. remain as sheet flow.

4.3 Increased Human Activity

Increased human activity can affect native fauna by, for example, disturbance through noise and lighting. At the time of this study, there was evidence of some human use of the area for example for walking, trail bike riding, camping and dumping of garden refuse. The nature of human impacts is likely to change due to the presence of more people more of the time. The impact from increased human activity would be mitigated because the proposed development is adjacent to existing developments and is contained to a small area relative to the area of surrounding bushland and open agricultural land.

4.4 Weed Invasion

The Threatened Species Scientific Committee has found that invasion of natural ecosystems by various exotic species, including escaped garden plants, can be a key threatening process. Such invasion is recognised globally as a significant threat to biodiversity. Invasive exotic plants can impact on ecosystem structure and function, reducing native species richness, altering hydrological or fire regimes, changing soil nutrient status and modifying habitat.

There are a number of weeds present on the site, some have established through the dumping of garden waste. Environmental safeguards to mitigate impacts through weed invasion have been proposed in Section 7 of this report.

4.5 Impacts on Conjola National Park Ecosystems

The construction of the access road and carpark will disrupt existing impacts on the park in the form of trails motor bikes and other damaging activities. To deter riders from simply going over the eastern edge of the road and into the park, a dense, 5 metre wide vegetated buffer will be provided. The battered bank in this buffer zone shall be densely planted with native species selected from Table 1 of this flora report, preferably grown from locally collected seed. Closely planted Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii*, and/or Grey Myrtle *Backhousia myrtifolia* would provide a manageable and dense barrier planting. Consideration had been given to installing a fence here but it is likely to be vandalised and it would be difficult to “complete” the barrier at the top and bottom ends.

5 ASSESSMENT OF SIGNIFICANCE FOR THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS

5.1 Introduction

Section 111 of the Environmental Planning and Assessment Act 1979 requires that an assessment must be made of whether the proposed activity is likely to have a significant effect on threatened species, populations or ecological communities (as listed in schedules to the Threatened Species Conservation Act or Fisheries Management Act), or their habitats, and therefore whether or not a species impact statement and the concurrences of the Director-General of the Office of Environment and Heritage or the Department of Primary Industries are required. Section 5A of the Environmental Planning and Assessment Act provides the factors to be taken into account in deciding whether there is likely to be a significant effect and these factors are considered below.

The following assessment of significance for the proposed new public boat launching facility at Conjola Park has been carried out using the assessment guidelines approved by the Minister for the Environment under section 94A of the Threatened Species Conservation Act 1995 (NSW Department of Environment and Climate Change, 2007).

5.2 Threatened Species

(a) in the case of a threatened species, whether the action proposed 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 results of the Atlas of NSW Wildlife search for terrestrial plants are attached to this report (Attachment 2). Listed in Table 2 are the threatened plant species that were recorded in the Atlas of NSW Wildlife as having been observed within an eighteen kilometres by eighteen kilometres area around the site, as well as those that the EPBC Act protected matters search tool predicts could occur there. Comments on each species' potential to occur at the subject site are included in the table. Information on habitats and life history in the table is mostly from the NSW Office of Environment and Heritage threatened species website and the Australian Department of Environment threatened species website.

Table 2. Threatened species recorded within 18 x 18km of the site or which EPBC Act protected matters search tool predicts could occur within 10km of the site.

TSC Act Status: V - Vulnerable, E1 - Endangered, E4A - Critically Endangered
EPBC Act Status: V - Vulnerable, E - Endangered, CE - Critically Endangered
Species in **bold** have potential to occur at the site and are assessed in detail below.

Species	TSC Act	EPBC Act	Habitat Preferences and Potential to Occur at the Site
Narrow-leafed Wilsonia *Wilsonia backhousei*	V		See separate "Aquatic and Riparian Flora and Fauna Assessment."
Biconvex Paperbark *Melaleuca biconvexa*	V	V	Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Not observed at the site. No suitable habitat at the site.

Species	TSC Act	EPBC Act	Habitat Preferences and Potential to Occur at the Site
Leafless Tongue Orchid *Cryptostylis hunteriana*	V	V	Grows in swamp-heath on sandy soils and heathy woodland. Not observed at the site during targeted survey. Unlikely to occur at the site.
Greenhood Orchid *Pterostylis ventricosa*	E4A		Predominantly in more open areas of tall coastal eucalypt forest. The two largest populations, one at St Georges Basin and one at Sussex Inlet, are located on estates of private land. Two smaller populations, comprising a total of less than 10% of the known plants, are within Conjola National Park. More open areas that this species often favours, such as along powerline easements and on road verges where the tree overstorey has been removed or thinned, were largely absent from the proposed development area. Unlikely to occur at the site.
Illawarra Greenhood *Pterostylis gibbosa*	E1	E	Grows in an open forest of Spotted Gum, Forest Red Gum and Grey Ironbark near South Nowra. Prefers grassy open forest on poorly drained soils. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.
Thick Lip Spider Orchid *Caladenia tessellata*	E1	V	Found in grassy dry sclerophyll woodland. Not observed at the site. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.
Bauer's Midge Orchid *Genoplesium baueri*	E1	E	Occurs in open or clear areas in dry sclerophyll forest or moss gardens over sandstone. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.
East Lynne Midge Orchid *Genoplesium vernale*	V	V	Grows in 'poorer' dry sclerophyll woodland and forest on the south coast of New South Wales between Mogo and just north of Ulladulla. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.
Tangled Bedstraw *Galium australe*	E1		In NSW, Tangled Bedstraw has been recorded in Turpentine forest and coastal Acacia shrubland. Not observed at the site during vegetation surveys. Unlikely to occur at the site.
Budawangs Cliff-heath *Budawangia gnidioides*	V	V	Grows in moist cliff-line niches, in skeletal soil in sandstone crevices or on sandy ledges often beneath cliffs or overhangs, on the margins of open forest and heathland. Not recorded within 18 x 18 km area around site. Not observed at the site. No suitable habitat at the site.
Woronora Beard-heath *Leucopogon exolasius*	V	V	Found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone. Not recorded within 18 x 18 km area around site. Not observed at the site. No suitable habitat at the site.
Budawangs Bush-pea *Pultenaea baeuerlenii*	V	V	Appears to prefer swampy heathland on sandstone. Not recorded within 18 x 18 km area around site. Not observed at the site. No suitable habitat at the site.
Magenta Lilly Pilly *Syzygium paniculatum*	E1	V	Restricted mainly to remnant stands of littoral (coastal) rainforest. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.
Austral Toadflax *Thesium australe*	V	V	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Not recorded within 18 x 18 km area around site. Not observed at the site. Unlikely to occur at the site.

Overall, the proposed action would not be likely to have an adverse effect on the life cycle of any threatened terrestrial plant species such that a viable local population of the species is likely to be placed at risk of extinction.

5.3 Threatened Populations

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Endangered populations are listed in Part 2 of Schedule 1 of the Threatened Species Conservation Act 1995. No endangered populations would be affected by the proposed action.

5.4 Endangered Ecological Communities

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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

(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

Endangered ecological communities are listed in Part 3 of Schedule 1 of the Threatened Species Conservation Act. Critically endangered ecological communities are listed under Part 2 of Schedule 1A of the Act. The endangered Swamp Oak Forest and Coastal Saltmarsh communities are considered in a separate "Aquatic and Riparian Flora and Fauna Assessment." Otherwise, the terrestrial vegetation at the subject site was not part of an endangered or critically endangered ecological community. The proposed action is not likely to adversely affect the extent nor substantially and adversely modify the composition of an endangered ecological community such that a local occurrence is likely to be place at risk of extinction.

5.5 Habitat

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed area of terrestrial flora habitat (0.9 hectares) that would be removed for the proposal is small compared to the amount of unaffected habitat nearby. As can be seen in Figures 13 and 14 there are large areas of similar vegetation in the area that would be unaffected by the proposal.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

The site is mapped as part of a habitat corridor in the Shoalhaven Local Environmental Plan 2014 (Figure 15). However, as can be seen in Figure 3, the stand of vegetation at subject site is isolated from other significant areas of native vegetation to the west by existing urban development and to the north by the lake. A

corridor of intact native vegetation would remain to the east and south of the site in the national park. The proposed removal of vegetation from the site would not cause an area of terrestrial flora habitat to become fragmented or isolated from other areas of habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The habitat that would be affected is not considered likely to be critical to any life cycle stages or reproductive success, and hence long term survival, of any threatened terrestrial flora species, population or ecological communities.

5.6 Critical Habitat

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No areas of land listed as critical habitat in the Register of Critical Habitat kept by the Director General DECC would be affected by the proposed action.

5.7 Recovery and Threat Abatement

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Office of Environment and Heritage has prepared Priorities Action Statements to promote the recovery of threatened species and the abatement of key threatening processes in New South Wales. The Priorities Action Statements identify a number of broad strategies to help threatened plants and animals recover in New South Wales. Each of these strategies has more specific priority actions within it. The actions cover such things as:

- surveys to clarify the distribution of a species
- weed and pest management programs
- guidelines for threatened species issues in development assessments
- research into factors influencing the survival of threatened species
- community education programs to raise awareness of a species or threat in a particular area.

The proposed actions are not inconsistent with these recovery and threat abatement strategies and actions in that:

- the amount of native vegetation that could potentially be cleared or modified (approximately 0.9 hectares) is relatively minor
- the configuration of the facility has been designed to retain as much vegetation as possible
- this study assesses potential environmental impacts of the proposal.

5.8 Key Threatening Processes

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes are the things that threaten, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Of the thirty eight key threatening processes listed under the Threatened Species Conservation Act and eight listed under the Fisheries Management Act the following could conceivably be relevant to the proposal and require consideration.

Human-caused climate change. A small amount of fossil fuel would be burnt to operate machinery and the trees are a temporary carbon sink. However, as part of the 'forest carbon cycle', the carbon stored in the trees would ultimately have been released when the trees or their leaves and limbs died and decayed. The proposed actions would not significantly contribute to climate change.

Clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity. Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification, of the structure, composition and ecological function of the stand or stands. The 0.9 hectares of vegetation that would be removed forms a small part on the edge of a large stand of native vegetation (Figures 13 and 14). This is not considered to be a sufficient proportion to result in the loss or long term modification of the structure, composition and ecological function of the stand. The removal or modification of 0.9 hectares of vegetation is not considered likely to threaten the survival or evolutionary development of plant species, populations or ecological communities.

Invasion by weed species is recognised globally as a significant threat to biodiversity. The following key threatening processes that have the potential to operate or were observed to be operating at the site:

- Invasion of native plant communities by exotic perennial grasses
- Invasion and establishment of exotic vines and scramblers
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
- Invasion and establishment of Scotch broom (*Cytisus scoparius*)
- Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*
- Invasion, establishment and spread of *Lantana camara*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

There was evidence of escaped garden plants from dumped garden waste and one bitou bush pant was observed at the site. Environmental safeguards are included in Section 7 of this report to mitigate potential impacts.

Overall, provided the environmental safeguards proposed in Section 7 are employed, the proposed action is not likely to be part of a key threatening process nor is it likely to result in the operation of, or increase the impact of, a key threatening process to the extent that it could threaten the survival or evolutionary development of any threatened terrestrial plant species, populations or ecological communities.

5.9 Conclusion for Assessment of Significance for Threatened Species, Populations or Ecological Communities, or their Habitats

Provided the environmental safeguards for impact mitigation set out in Section 7 are applied, there is not likely to be a significant effect on threatened plant species, populations or ecological communities, or their habitats from the proposed action and therefore a species impact statement is not required.

6 AUSTRALIAN ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT

6.1 Protected Matters

Actions that are likely to have a significant impact on a matter of national environmental significance, or are being undertaken on or would have an effect on Commonwealth land, are known as protected matters and may require approval under the EPBC Act. The EPBC Act identifies nine matters of national environmental significance:

- world heritage properties
- national heritage places
- Ramsar wetlands of international importance
- listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The Australian Department of Environment's online Protected Matters Search Tool was interrogated on 11 July 2016 for the area within a 10 kilometre radius of the site. The report is summarised below and the full report is attached to the review of environmental factors for this proposal.

Matters of National Environmental Significance

World Heritage Properties: None
National Heritage Places: None
Wetlands of International Importance: None
Great Barrier Reef Marine Park: None
Commonwealth Marine Areas: None
Listed Threatened Ecological Communities: 4
Listed Threatened Species: 68
Listed Migratory Species: 45

Other Matters Protected by the EPBC Act

Commonwealth Land: None
Commonwealth Heritage Places: None
Listed Marine Species: 69 (relevant to Commonwealth areas only)
Whales and Other Cetaceans: 12
Critical Habitats: None
Commonwealth Reserves: None

The proposal is not a nuclear action nor is the action a coal seam gas development and large coal mining development. The proposal is not being undertaken on Commonwealth land nor would it have an effect on Commonwealth land.

The protected matters report included a threatened ecological community, a number of listed threatened species and migratory species that have a range of distribution that includes the area of the proposed works. An assessment of the likelihood of there being a significant impact and therefore whether the matter should be referred to the Australian Government Minister for the Environment is set out below. The following assessments consider criteria from the Department of the Environment, Water, Heritage and the Arts' Significant Impact Guidelines (Australia Government, 2013).

6.2 Threatened Ecological Community

The threatened ecological community Subtropical and Temperate Coastal Saltmarsh occurs at the site. It is dealt with in a separate "Aquatic and Riparian Flora and Fauna Assessment."

None of the terrestrial ecological communities listed in the protected matters report are present at the site.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- *reduce the extent of an ecological community*

The proposed actions would not be likely to reduce the extent of an ecological community.

- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

The proposed actions would not be likely to fragment or increase fragmentation of an ecological community.

- *adversely affect habitat critical to the survival of an ecological community*

The proposed actions would not be likely to adversely affect habitat critical to the survival of an ecological community.

- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

The proposed actions would not be likely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival.

- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

The proposed actions would not be likely to cause a substantial change in the species composition of an occurrence of an ecological community.

- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community including, but not limited to:*

- *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
- *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or*

The proposed actions would not be likely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community.

- *interfere with the recovery of an ecological community.*

The proposed actions would not be likely to interfere with the recovery of an ecological community.

6.3 Threatened Species

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

As described in sections 4 and 5 of this report, the proposed works are unlikely to affect habitat for the terrestrial plant species listed in the protected matters report and is not likely to lead to a long term decrease in populations. Based on consideration of the above criteria, it is not expected that there will be significant effects on nationally threatened species.

6.4 Migratory Species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

There are no terrestrial plants listed in the migratory species section of the protected matters report. Based on consideration of the above criteria, it is not expected that there will be significant effects on migratory species.

6.5 EPBC Act Conclusion

Provided the proposed environmental safeguards are employed, the proposed actions are not likely to have a significant impact on a matter of national environmental significance, nor are the actions being undertaken on or having an effect on Commonwealth land. The proposed actions therefore do not need to be referred to the Australian Minister for the Environment.

7 ENVIRONMENTAL SAFEGUARDS AND IMPACT MITIGATION

The following environmental safeguards are recommended to mitigate the impacts of the proposal on native terrestrial vegetation.

1. Provide a 5 metre wide vegetated buffer between eastern edge of road and national park. The battered bank in this buffer zone shall be densely planted with native species selected from Table 1 of this flora report, preferably grown from locally collected seed. Closely planted Scentless Rosewood *Synoum glandulosum*, Lilly Pilly *Acmena smithii*, and/or Grey Myrtle *Backhousia myrtifolia* would provide a manageable and dense barrier planting.

2. Any landscaped areas on the site should similarly use local native plants from Table 1 of this flora report. A cover crop of sterile grasses or other non-invasive plants could be used as an interim stabiliser until local plants are available.

3. When landscaping the site, the following plants shall not be used:

    a. Plant species listed as weeds by NSW Department of Primary Industries (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles)

    b. Plant species listed as part of key threatening processes, including: (http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm)

        - Invasion of native plant communities by exotic perennial grasses
        - Invasion and establishment of exotic vines and scramblers
        - Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
        - Invasion and establishment of Scotch broom (*Cytisus scoparius*)
        - Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*
        - Invasion, establishment and spread of *Lantana camara*
        - Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

4. Workers shall be informed that they are working close to the boundary of the Conjola National Park and of possible offences under the National Parks and Wildlife Act. No equipment shall enter the national park.

5. Workers shall be informed of their obligations and possible offences under the National Parks and Wildlife Act with respect to threatened species. To reduce the potential for impacts, all workers shall be made aware that they are potentially working in the habitat of threatened species.

6. Prior to commencement of excavation or construction, boundaries of the development area shall be marked with temporary barrier fencing. Machinery shall only access the work site via clearly defined routes. Machinery and workers shall not enter areas of native vegetation outside the development area. The fencing shall be monitored daily by the site supervisor and immediately repaired or replaced if necessary and shall be removed when construction is completed.

7. No native vegetation outside of the development area (for road and other infrastructure) will be removed. As far as possible, machinery shall operate only within the footprint of the proposed structures. Trees to be cleared shall be felled into the development area carefully so as not to damage trees to be retained in or beyond the development area.

8. Vegetation material may be left on site as mulch where it would not be considered a fire hazard or, if removed from the site, shall be recycled either through Council's green waste facility or by local mulching or composting. No dead wood is to be removed from the site or burned on site.

9. An environmental management plan shall be prepared by the construction company that addresses, amongst other things, ways in which pollution by noise, dust, waste, fuel and oil will be avoided. This shall include protocols for equipment maintenance, storage of fuel and other chemicals and materials, management of waste and refuelling procedures.

10. Waste material (for example packaging, strapping, off-cuts, excess concrete) shall be contained within the land-based site during construction and then be removed to an authorised waste disposal facility or an appropriate storage area for reuse elsewhere. No material shall be placed in any location or in any manner that would allow it to enter the waterway or escape from the site into adjoining bushland or residential areas. Stockpiles of debris and construction materials shall be stored at least 10 metres outside the top of the lake banks or the national park boundary. General refuse shall be disposed of to a covered container stored at the site. This container, when full, shall be transported to Council's authorised waste disposal centre. No waste shall be burnt or buried on-site or disposed of in the waterway or bushland.

11. Advisory material shall be provided to encourage people to bring their waste back after spending a day on the water and Council shall provide bins.

8 CONCLUSIONS

The area of the proposed public boat launching facility at Lot 7308 DP 1144810 Havilland Street Conjola Park supports a stand of native forest that is part of a larger stand extending beyond the property boundaries. The plant community on the site is generally common and widespread in the region. The stand is not an endangered ecological community.

A number of environmental safeguards are proposed to mitigate the impacts of the proposal.

It is concluded that the removal of approximately 0.9 hectares of forest would not result in a significant environmental impact.

Provided the environmental safeguards for impact mitigation are applied, there is not likely to be a significant effect on threatened plant species, populations or ecological communities, or their habitats from the proposed action and therefore a species impact statement is not required.

9 REFERENCES

Australian Department of Environment threatened species website http://www.environment.gov.au/biodiversity/threatened

Cropper, S.C., 1993. Management of Endangered Plants. CSIRO Publications, East Melbourne.

NSW Department of Environment and Climate Change, 2007. Threatened species assessment guidelines. The assessment of significance.

NSW Office of Environment and Heritage threatened species website http://www.threatenedspecies.environment.nsw.gov.au

Tozer, M. G., Turner,K., Keith, D.A., Tindal, D., Pennay, C., Simpson, C., MacKenzie, B., Beuker, P. and Cox, S., 2010. Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* (2010) 11(3): 359–406.

ATTACHMENTS

1. WEATHER CONDITIONS AT THE TIME OF FIELD SURVEY
2. ATLAS OF NSW WILDLIFE SEARCH RESULTS

Latest Weather Observations for Ulladulla

IDN60801

Issued at 7:04 pm EST Friday 16 September 2016 (issued every 30 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 069138 **Name:** ULLADULLA AWS **Lat:** -35.36 **Lon:** 150.48 **Height:** 35.7 m

Data from the previous 72 hours. | See also: Recent months at Ulladulla

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
16/07:00pm	15.2	14.9	10.0	71	2.7	ENE	2	7	1	4	1018.2	1018.2	0.0
16/06:30pm	15.2	14.5	10.2	72	2.6	ENE	4	7	2	4	1017.6	1017.6	0.0
16/06:00pm	15.2	14.2	10.2	72	2.6	ENE	6	9	3	5	1017.0	1017.0	0.0
16/05:30pm	15.5	14.4	10.5	72	2.6	ENE	7	13	4	7	1016.4	1016.4	0.0
16/05:00pm	15.8	14.9	10.6	71	2.8	NE	6	13	3	7	1016.0	1016.0	0.0
16/04:30pm	16.1	15.0	10.6	70	2.9	NE	7	13	4	7	1015.5	1015.5	0.0
16/04:00pm	16.1	14.5	10.2	68	3.1	NE	9	13	5	7	1015.3	1015.3	0.0
16/03:30pm	16.5	15.0	10.4	67	3.2	NE	9	17	5	9	1015.2	1015.2	0.0
16/03:00pm	16.5	15.2	10.1	66	3.4	NE	7	13	4	7	1015.3	1015.3	0.0
16/02:30pm	16.6	14.6	10.2	66	3.4	E	11	17	6	9	1015.1	1015.1	0.0
16/02:00pm	16.9	15.1	11.0	68	3.2	E	11	20	6	11	1015.0	1015.0	0.0
16/01:30pm	17.2	15.4	9.4	60	4.1	E	9	20	5	11	1015.1	1015.1	0.0
16/01:00pm	17.8	15.7	6.0	46	5.8	ENE	6	13	3	7	1015.1	1015.1	0.0
16/12:30pm	17.5	14.6	6.7	49	5.4	SSE	11	15	6	8	1015.0	1015.0	0.0
16/12:00pm	17.7	14.4	6.3	47	5.6	SSE	13	17	7	9	1015.1	1015.1	0.0
16/11:30am	19.4	17.2	7.8	47	6.0	SW	9	22	5	12	1015.5	1015.5	0.0
16/11:00am	18.1	16.2	6.6	47	5.7	SSW	6	11	3	6	1015.6	1015.6	0.0
16/10:30am	19.1	16.2	6.6	44	6.3	SW	11	20	6	11	1015.6	1015.6	0.0
16/10:00am	18.0	14.9	7.4	50	5.3	WSW	13	20	7	11	1015.9	1015.9	0.0
16/09:30am	15.8	13.5	7.6	58	4.1	WSW	9	13	5	7	1015.9	1015.9	0.0
16/09:00am	15.2	12.8	7.0	58	4.0	WSW	9	19	5	10	1015.9	1015.9	0.0
16/08:30am	15.2	12.3	6.5	56	4.2	W	11	20	6	11	1015.6	1015.6	0.0
16/08:00am	14.9	13.1	7.0	59	3.9	SW	6	13	3	7	1015.4	1015.4	0.0
16/07:30am	14.3	12.2	6.6	60	3.7	WSW	7	13	4	7	1015.1	1015.1	0.0
16/07:00am	13.9	12.0	6.5	61	3.6	WSW	6	9	3	5	1014.5	1014.5	0.0
16/06:30am	13.3	11.3	6.4	63	3.3	SW	6	11	3	6	1013.8	1013.8	0.0
16/06:00am	13.2	11.0	6.1	62	3.4	SW	7	13	4	7	1013.5	1013.5	0.0
16/05:30am	13.6	10.2	6.0	60	3.6	WSW	13	22	7	12	1013.1	1013.1	0.0
16/05:00am	13.4	10.7	5.8	60	3.6	WSW	9	19	5	10	1013.0	1013.0	0.0
16/04:30am	13.4	10.7	5.6	59	3.7	WSW	9	19	5	10	1012.6	1012.6	0.0
16/04:00am	12.2	9.9	5.8	65	3.0	WSW	7	19	4	10	1012.0	1012.0	0.0
16/03:30am	11.7	9.4	4.9	63	3.1	SW	6	9	3	5	1012.1	1012.1	0.0
16/03:00am	11.4	9.0	4.4	62	3.2	SW	6	9	3	5	1012.2	1012.2	0.0
16/02:30am	11.7	10.1	4.4	61	3.3	SW	2	6	1	3	1011.9	1011.9	0.0
16/02:00am	11.8	10.3	4.8	62	3.2	SW	2	7	1	4	1011.8	1011.8	0.0
16/01:30am	12.1	10.2	4.8	61	3.3	SW	4	6	2	3	1012.0	1012.0	0.0
16/01:00am	12.1	10.5	4.6	60	3.4	WSW	2	6	1	3	1012.2	1012.2	0.0
16/12:30am	13.4	11.4	4.6	55	4.1	WSW	4	9	2	5	1012.1	1012.1	0.0
16/12:00am	12.5	10.8	4.2	57	3.8	S	2	6	1	3	1012.1	1012.1	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/11:30pm	14.0	11.5	3.8	50	4.6	SW	6	15	3	8	1011.8	1011.8	0.0
15/11:00pm	14.5	11.1	3.9	49	4.9	W	11	26	6	14	1011.4	1011.4	0.0
15/10:30pm	14.8	10.2	3.6	47	5.1	WNW	17	30	9	16	1011.2	1011.2	0.0
15/10:00pm	14.6	11.1	3.7	48	5.0	W	11	26	6	14	1011.3	1011.3	0.0
15/09:30pm	14.5	11.7	3.3	47	5.1	WSW	7	20	4	11	1011.4	1011.4	0.0
15/09:00pm	14.9	10.9	3.1	45	5.3	WSW	13	32	7	17	1011.4	1011.4	0.0
15/08:30pm	15.1	12.0	3.6	46	5.3	W	9	32	5	17	1011.4	1011.4	0.0
15/08:00pm	15.1	12.4	3.9	47	5.2	WNW	7	13	4	7	1011.0	1011.0	0.0
15/07:30pm	15.4	12.7	3.9	46	5.3	SW	7	17	4	9	1010.5	1010.5	0.0
15/07:00pm	15.7	11.7	4.7	48	5.2	W	15	28	8	15	1010.0	1010.0	0.0
15/06:30pm	15.7	11.2	5.9	52	4.7	WNW	19	35	10	19	1009.3	1009.3	0.0
15/06:00pm	15.8	11.7	6.3	53	4.6	WNW	17	32	9	17	1009.0	1009.0	0.0
15/05:30pm	16.2	11.5	6.1	51	4.9	WNW	20	35	11	19	1008.6	1008.6	0.0
15/05:00pm	16.6	14.3	5.9	49	5.2	SW	7	15	4	8	1008.5	1008.5	0.0
15/04:30pm	17.1	12.8	5.4	46	5.6	WNW	17	39	9	21	1007.4	1007.4	0.0
15/04:00pm	18.3	15.5	5.2	42	6.4	WSW	9	17	5	9	1007.5	1007.5	0.0
15/03:30pm	18.3	14.0	5.2	42	6.3	NW	17	32	9	17	1006.7	1006.6	0.0
15/03:00pm	18.7	13.9	5.5	42	6.5	WNW	20	44	11	24	1005.9	1005.8	0.0
15/02:30pm	18.9	15.5	6.1	43	6.3	WNW	13	26	7	14	1006.6	1006.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/02:00pm	18.8	14.2	5.6	42	6.5	WNW	19	33	10	18	1006.3	1006.2	0.0
15/01:30pm	19.0	14.2	5.8	42	6.5	NW	20	35	11	19	1006.7	1006.6	0.0
15/01:00pm	18.4	13.6	4.9	41	6.5	WNW	19	39	10	21	1007.0	1006.9	0.0
15/12:30pm	18.3	13.7	5.8	44	6.1	WNW	19	35	10	19	1007.1	1007.0	0.0
15/12:00pm	19.4	14.8	5.8	41	6.7	WNW	19	35	10	19	1007.1	1007.0	0.0
15/11:30am	18.5	13.3	5.7	43	6.3	WNW	22	39	12	21	1006.4	1006.3	0.0
15/11:00am	18.4	12.4	5.3	42	6.4	NW	26	44	14	24	1006.3	1006.2	0.0
15/10:30am	18.1	12.7	4.7	41	6.4	NW	22	43	12	23	1006.2	1006.1	0.0
15/10:00am	18.3	13.3	3.8	38	6.8	WNW	19	33	10	18	1006.7	1006.6	0.0
15/09:30am	17.6	11.9	2.8	37	6.8	NW	22	37	12	20	1006.3	1006.2	0.0
15/09:00am	17.2	12.3	2.0	36	6.9	WNW	17	32	9	17	1006.6	1006.5	1.4
15/08:30am	16.0	10.6	1.3	37	6.4	NW	19	35	10	19	1006.8	1006.7	1.4
15/08:00am	15.7	10.0	0.3	35	6.6	NW	20	35	11	19	1006.3	1006.2	1.4
15/07:30am	15.0	9.3	0.4	37	6.2	WNW	20	41	11	22	1006.6	1006.5	1.4
15/07:00am	14.5	9.1	1.1	40	5.8	WNW	19	35	10	19	1006.7	1006.6	1.4
15/06:30am	14.0	7.7	1.3	42	5.5	NW	24	41	13	22	1006.6	1006.5	1.4
15/06:00am	13.3	7.8	1.9	46	5.0	WNW	20	35	11	19	1005.9	1005.8	1.4
15/05:30am	13.9	8.4	1.9	44	5.2	NW	20	39	11	21	1006.5	1006.4	1.4
15/05:00am	13.7	8.5	2.3	46	5.0	WNW	19	32	10	17	1006.6	1006.5	1.4
15/04:30am	13.7	10.3	2.0	45	5.1	NW	9	22	5	12	1006.0	1005.9	1.4
15/04:00am	14.0	9.8	1.6	43	5.4	WNW	13	33	7	18	1005.6	1005.5	1.4
15/03:30am	13.9	9.0	2.2	45	5.1	WNW	17	32	9	17	1005.8	1005.7	1.4
15/03:00am	14.3	8.2	2.9	46	5.1	NW	24	48	13	26	1006.2	1006.1	1.4
15/02:51am	14.5	7.6	2.4	44	5.4	WNW	28	48	15	26	1006.4	1006.3	1.4
15/02:30am	14.5	9.1	2.7	45	5.3	NW	20	32	11	17	1007.0	1006.9	1.4
15/02:00am	14.2	9.6	3.9	50	4.7	NW	17	28	9	15	1007.5	1007.5	1.4
15/01:30am	13.5	10.3	4.9	56	4.0	WNW	11	24	6	13	1007.9	1007.9	1.4
15/01:00am	12.3	10.6	6.1	66	2.9	NW	4	9	2	5	1008.3	1008.3	1.4
15/12:30am	13.4	12.1	5.8	60	3.6	WNW	2	7	1	4	1008.3	1008.3	1.4
15/12:00am	12.1	10.9	6.6	69	2.6	W	2	6	1	3	1008.1	1008.1	1.4

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/11:30pm	11.5	10.6	6.0	69	2.6	CALM	0	0	0	0	1008.2	1008.2	1.4
14/11:00pm	12.0	11.1	6.1	67	2.8	CALM	0	0	0	0	1008.2	1008.2	1.4
14/10:30pm	12.6	10.9	5.8	63	3.2	W	4	7	2	4	1008.6	1008.6	1.4
14/10:00pm	14.4	12.3	6.0	57	4.0	W	6	11	3	6	1009.0	1009.0	1.4
14/09:30pm	14.6	12.5	5.9	56	4.2	W	6	13	3	7	1008.9	1008.9	1.4
14/09:00pm	14.5	13.6	7.8	64	3.3	NW	2	6	1	3	1009.0	1009.0	1.4
14/08:30pm	15.0	12.9	6.6	57	4.1	WNW	7	15	4	8	1008.5	1008.5	1.4
14/08:00pm	15.7	12.3	7.5	58	4.1	NW	15	22	8	12	1008.2	1008.2	1.4
14/07:30pm	15.6	12.3	8.1	61	3.8	NW	15	24	8	13	1008.2	1008.2	1.4
14/07:00pm	15.3	13.7	10.3	72	2.6	WNW	9	26	5	14	1007.9	1007.9	1.4
14/06:30pm	15.6	15.4	13.1	85	1.4	WNW	6	11	3	6	1007.7	1007.7	1.4
14/06:00pm	16.8	17.8	14.4	86	1.4	WNW	2	11	1	6	1007.2	1007.1	1.4
14/05:30pm	17.7	18.1	15.3	86	1.4	W	7	17	4	9	1007.0	1006.9	1.2
14/05:00pm	18.5	19.2	15.7	84	1.7	NW	6	9	3	5	1007.0	1006.9	0.0
14/04:30pm	18.6	19.7	15.7	83	1.7	NW	4	7	2	4	1007.1	1007.0	0.0
14/04:00pm	18.4	19.2	15.8	85	1.5	NNW	6	13	3	7	1007.2	1007.1	0.0
14/03:30pm	18.6	18.7	15.5	82	1.8	NNE	9	17	5	9	1006.7	1006.6	0.0
14/03:00pm	18.5	17.8	15.4	82	1.8	NNE	13	20	7	11	1006.7	1006.6	0.0
14/02:30pm	19.2	18.4	16.2	83	1.8	NNE	15	24	8	13	1006.9	1006.8	0.0
14/02:00pm	19.1	18.3	16.0	82	1.9	NNE	15	20	8	11	1007.3	1007.3	0.0
14/01:30pm	19.6	19.9	16.1	80	2.1	NE	9	19	5	10	1007.6	1007.6	0.0
14/01:00pm	19.3	17.7	15.0	76	2.5	NNE	17	26	9	14	1008.1	1008.1	0.0
14/12:30pm	19.1	18.5	15.6	80	2.1	NNE	13	20	7	11	1008.8	1008.8	0.0
14/12:00pm	18.6	18.2	15.3	81	1.9	NNE	11	17	6	9	1009.4	1009.4	0.0
14/11:30am	18.1	17.8	15.5	85	1.5	NNE	11	17	6	9	1010.1	1010.1	0.0
14/11:00am	17.6	16.8	15.0	85	1.5	NNE	13	19	7	10	1010.4	1010.4	0.0
14/10:30am	17.4	16.9	14.9	85	1.4	NNE	11	15	6	8	1010.8	1010.8	0.0
14/10:00am	17.0	17.3	15.0	88	1.2	NW	7	11	4	6	1012.0	1012.0	0.0
14/09:30am	17.2	17.7	15.0	87	1.3	NW	6	9	3	5	1012.6	1012.6	0.0
14/09:00am	16.0	16.8	15.8	99	0.1	NW	6	9	3	5	1013.5	1013.5	0.2
14/08:30am	15.8	17.2	15.5	98	0.2	W	2	6	1	3	1013.3	1013.3	0.2
14/08:00am	15.5	16.9	15.5	100	0.0	W	2	4	1	2	1013.8	1013.8	0.2
14/07:30am	14.6	15.3	14.6	100	0.0	W	4	9	2	5	1014.2	1014.2	0.2
14/07:00am	14.1	14.1	14.1	100	0.0	S	7	17	4	9	1014.1	1014.1	0.0
14/06:30am	14.1	15.0	14.1	100	0.0	SSE	2	4	1	2	1013.3	1013.3	0.0
14/06:00am	14.2	14.8	14.2	100	0.0	SSE	4	6	2	3	1013.8	1013.8	0.0
14/05:30am	14.0	14.5	14.0	100	0.0	SSE	4	4	2	2	1013.7	1013.7	0.0
14/05:00am	14.1	14.9	13.8	98	0.2	SSE	2	4	1	2	1013.5	1013.5	0.0
14/04:30am	14.2	15.1	13.9	98	0.2	SSE	2	6	1	3	1014.1	1014.1	0.0
14/04:00am	14.5	14.7	14.3	99	0.1	SSE	6	6	3	3	1014.1	1014.1	0.0
14/03:30am	13.9	14.8	13.0	94	0.5	CALM	0	4	0	2	1013.6	1013.6	0.0
14/03:00am	14.3	15.3	13.2	93	0.6	CALM	0	0	0	0	1014.3	1014.3	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/02:30am	14.3	15.1	12.5	89	1.0	CALM	0	0	0	0	1014.9	1014.9	0.0
14/02:00am	14.5	15.3	12.5	88	1.1	CALM	0	0	0	0	1015.6	1015.6	0.0
14/01:30am	14.5	15.0	12.7	89	1.0	SSE	2	4	1	2	1015.9	1015.9	0.0
14/01:00am	14.2	14.6	12.6	90	0.9	SSE	2	6	1	3	1016.4	1016.4	0.0
14/12:30am	14.0	14.4	12.4	90	0.9	SSE	2	4	1	2	1016.1	1016.1	0.0
14/12:00am	14.5	14.5	12.4	87	1.1	S	4	7	2	4	1016.5	1016.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
13/11:30pm	14.6	15.4	12.6	88	1.1	CALM	0	0	0	0	1017.6	1017.6	0.0
13/11:00pm	14.6	15.4	12.6	88	1.1	CALM	0	2	0	1	1017.6	1017.6	0.0
13/10:30pm	14.6	14.3	12.6	88	1.1	S	6	7	3	4	1017.8	1017.8	0.0
13/10:00pm	14.5	14.6	12.7	89	1.0	SSE	4	6	2	3	1018.3	1018.3	0.0
13/09:30pm	14.1	14.1	12.5	90	0.9	SSE	4	6	2	3	1018.0	1018.0	0.0
13/09:00pm	14.2	14.3	12.6	90	0.9	SSE	4	7	2	4	1018.2	1018.2	0.0
13/08:30pm	14.4	14.5	12.8	90	0.9	SSE	4	6	2	3	1018.5	1018.5	0.0
13/08:00pm	14.4	14.4	12.4	88	1.1	SSE	4	4	2	2	1018.6	1018.6	0.0
13/07:30pm	14.5	14.6	12.7	89	1.0	SSE	4	6	2	3	1018.7	1018.7	0.0

This page was created at **05:21 on Saturday 17 September 2016 (AEDT)**

Latest Weather Observations for Nowra

IDN60801

Issued at 7:04 pm EST Friday 16 September 2016 (issued every 30 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 068072 **Name:** NOWRA RAN AIR STATION AWS **Lat:** -34.95 **Lon:** 150.54 **Height:** 109.0 m

Data from the previous 72 hours. | See also: Recent months at Nowra

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
16/07:00pm	15.1	10.5	3.6	46	5.3	WNW	17	20	9	11	1017.9	1017.8	0.0
16/06:30pm	14.7	11.2	3.5	47	5.1	WNW	11	15	6	8	1017.2	1017.1	0.0
16/06:00pm	16.2	10.5	2.6	40	6.2	W	22	32	12	17	1016.7	1016.6	0.0
16/05:30pm	17.1	11.4	2.7	38	6.6	W	22	32	12	17	1016.0	1015.9	0.0
16/05:00pm	18.2	12.4	2.5	35	7.2	W	22	33	12	18	1015.7	1015.6	0.0
16/04:30pm	18.6	11.6	2.0	33	7.6	W	28	39	15	21	1015.4	1015.3	0.0
16/04:00pm	18.7	13.2	2.1	33	7.6	W	20	33	11	18	1015.3	1015.2	0.0
16/03:30pm	18.4	12.2	1.9	33	7.5	W	24	35	13	19	1015.3	1015.2	0.0
16/03:00pm	19.4	12.5	2.3	32	7.9	W	28	37	15	20	1015.2	1015.1	0.0
16/02:30pm	19.5	12.7	3.2	34	7.7	W	28	39	15	21	1015.3	1015.2	0.0
16/02:00pm	18.4	12.4	3.1	36	7.1	W	24	33	13	18	1015.0	1014.9	0.0
16/01:30pm	18.9	12.2	3.5	36	7.3	WSW	28	39	15	21	1015.1	1015.0	0.0
16/01:00pm	18.8	13.6	3.4	36	7.2	W	20	33	11	18	1015.0	1014.9	0.0
16/12:30pm	19.3	14.9	4.6	38	7.1	WSW	17	28	9	15	1015.1	1015.0	0.0
16/12:00pm	17.6	12.9	5.2	44	6.0	WSW	19	28	10	15	1015.3	1015.2	0.0
16/11:30am	18.8	13.6	5.3	41	6.6	W	22	33	12	18	1015.5	1015.4	0.0
16/11:00am	18.5	12.4	4.7	40	6.6	W	26	37	14	20	1015.7	1015.6	0.0
16/10:30am	18.6	14.1	7.1	47	5.8	WSW	20	28	11	15	1015.7	1015.6	0.0
16/10:00am	17.4	13.3	7.7	53	4.9	WNW	19	28	10	15	1015.9	1015.8	0.0
16/09:30am	16.6	12.2	7.5	55	4.6	W	20	26	11	14	1016.1	1016.0	0.0
16/09:00am	15.4	11.3	6.4	55	4.4	WNW	17	28	9	15	1016.0	1015.9	0.0
16/08:30am	14.6	12.6	6.9	60	3.8	WSW	7	9	4	5	1015.9	1015.8	0.0
16/08:00am	14.0	11.9	6.8	62	3.5	W	7	13	4	7	1015.7	1015.6	0.0
16/07:30am	13.6	12.8	6.5	62	3.4	CALM	0	0	0	0	1015.4	1015.3	0.0
16/07:00am	13.5	11.4	6.8	64	3.2	WSW	7	9	4	5	1014.8	1014.7	0.0
16/06:30am	13.0	10.4	6.1	63	3.3	NNW	9	13	5	7	1014.2	1014.1	0.0
16/06:00am	12.9	9.9	5.8	62	3.4	NW	11	20	6	11	1013.7	1013.6	0.0
16/05:30am	13.3	8.6	5.9	61	3.5	WNW	20	26	11	14	1013.1	1013.0	0.0
16/05:00am	13.1	8.4	6.2	63	3.3	NW	20	26	11	14	1012.9	1012.8	0.0
16/04:30am	13.1	8.5	6.5	64	3.2	WNW	20	28	11	15	1012.4	1012.4	0.0
16/04:00am	13.0	8.4	6.4	64	3.2	NW	20	28	11	15	1012.6	1012.6	0.0
16/03:30am	12.9	8.3	6.3	64	3.2	NW	20	28	11	15	1012.4	1012.4	0.0
16/03:00am	12.8	7.8	6.4	65	3.1	WNW	22	30	12	16	1012.0	1012.0	0.0
16/02:30am	12.7	7.3	6.5	66	3.0	NW	24	35	13	19	1012.2	1012.2	0.0
16/02:00am	12.6	7.9	6.2	65	3.0	WNW	20	30	11	16	1012.3	1012.3	0.0
16/01:30am	12.8	7.4	6.2	64	3.1	NW	24	32	13	17	1012.5	1012.5	0.0
16/01:00am	13.0	7.9	6.1	63	3.3	WNW	22	30	12	16	1012.4	1012.4	0.0
16/12:30am	13.3	7.4	5.9	61	3.5	WNW	26	35	14	19	1012.5	1012.5	0.0
16/12:00am	13.3	7.0	5.7	60	3.6	WNW	28	35	15	19	1012.9	1012.8	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/11:48pm	13.3	7.0	5.7	60	3.6	WNW	28	46	15	25	1012.6	1012.6	0.0
15/11:30pm	13.4	7.1	5.6	59	3.7	WNW	28	39	15	21	1012.5	1012.5	0.0
15/11:00pm	13.6	7.3	5.5	58	3.8	WNW	28	43	15	23	1012.6	1012.6	0.0
15/10:30pm	13.6	7.5	5.0	56	4.0	NW	26	33	14	18	1012.4	1012.4	0.0
15/10:00pm	13.8	8.0	4.4	53	4.3	WNW	24	32	13	17	1012.5	1012.5	0.0
15/09:30pm	14.0	8.6	4.3	52	4.5	WNW	22	35	12	19	1012.3	1012.3	0.0
15/09:00pm	14.0	7.5	4.6	53	4.4	WNW	28	41	15	22	1012.2	1012.2	0.0
15/08:30pm	14.2	8.6	5.3	55	4.2	WNW	24	39	13	21	1011.8	1011.8	0.0
15/08:00pm	14.1	9.4	6.0	58	3.9	WNW	20	28	11	15	1011.5	1011.4	0.0
15/07:30pm	14.4	9.4	6.3	58	3.9	W	22	37	12	20	1011.1	1011.0	0.0
15/07:00pm	14.4	8.6	6.3	58	3.9	WNW	26	41	14	22	1010.6	1010.5	0.0
15/06:30pm	15.0	8.2	5.2	52	4.6	WNW	30	50	16	27	1010.0	1009.9	0.0
15/06:18pm	15.0	7.8	5.2	52	4.6	WNW	32	54	17	29	1009.7	1009.6	0.0
15/06:00pm	15.2	8.7	4.9	50	4.9	WNW	28	39	15	21	1010.0	1009.9	0.0
15/05:30pm	15.6	9.6	5.2	50	5.0	WNW	26	35	14	19	1009.0	1008.9	0.0
15/05:00pm	16.0	9.1	4.7	47	5.4	WNW	30	46	16	25	1008.8	1008.7	0.0
15/04:30pm	16.4	8.9	4.4	45	5.7	WNW	33	50	18	27	1008.1	1008.0	0.0
15/04:00pm	16.9	8.3	4.6	44	5.9	WNW	39	65	21	35	1008.1	1008.0	0.0
15/03:30pm	17.3	9.1	4.6	43	6.1	W	37	57	20	31	1007.5	1007.4	0.0
15/03:00pm	17.9	10.3	4.1	40	6.6	WNW	33	50	18	27	1006.4	1006.3	0.0
15/02:30pm	18.2	10.6	4.0	39	6.7	W	33	52	18	28	1006.1	1006.0	0.0
15/02:00pm	18.2	10.0	4.7	41	6.5	WNW	37	69	20	37	1006.3	1006.2	0.0
15/01:30pm	17.5	8.9	4.8	43	6.1	WNW	39	61	21	33	1006.4	1006.3	0.0
15/01:00pm	18.8	11.1	5.3	41	6.6	WNW	35	59	19	32	1006.4	1006.3	0.0
15/12:30pm	18.6	9.3	5.1	41	6.6	WNW	43	80	23	43	1006.7	1006.6	0.0
15/12:23pm	17.7	8.3	4.3	41	6.4	WNW	43	80	23	43	1006.8	1006.7	0.0
15/12:00pm	18.5	10.3	5.0	41	6.6	WNW	37	61	20	33	1006.7	1006.6	0.0
15/11:30am	18.1	10.2	4.3	40	6.6	NW	35	57	19	31	1007.1	1007.0	0.0
15/11:00am	17.6	8.8	3.5	39	6.6	WNW	39	65	21	35	1006.9	1006.8	0.0
15/10:30am	17.7	8.1	3.6	39	6.6	NW	43	63	23	34	1006.2	1006.1	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/10:00am	17.2	9.0	2.8	38	6.6	NW	35	56	19	30	1005.8	1005.7	0.0
15/09:30am	16.1	6.1	1.0	36	6.6	WNW	43	63	23	34	1006.1	1006.0	0.0
15/09:00am	15.5	4.8	0.1	35	6.6	NW	46	72	25	39	1006.2	1006.1	0.0
15/08:30am	15.3	6.0	0.7	37	6.3	NW	39	57	21	31	1006.6	1006.5	0.0
15/08:00am	14.4	3.4	0.6	39	5.9	NW	48	72	26	39	1006.6	1006.5	0.0
15/07:30am	13.9	2.6	1.2	42	5.5	NW	50	72	27	39	1006.3	1006.2	0.0
15/07:00am	13.5	2.7	1.8	45	5.1	WNW	48	69	26	37	1006.3	1006.2	0.0
15/06:30am	13.0	4.1	2.8	50	4.5	WNW	39	63	21	34	1006.4	1006.3	0.0
15/06:00am	12.5	4.9	4.0	56	3.9	NW	33	56	18	30	1006.8	1006.7	0.0
15/05:30am	12.7	3.2	3.9	55	4.0	WNW	43	69	23	37	1006.8	1006.7	0.0
15/05:00am	12.7	4.3	3.9	55	4.0	WNW	37	57	20	31	1006.6	1006.5	0.0
15/04:30am	12.8	4.4	3.7	54	4.1	WNW	37	57	20	31	1006.8	1006.7	0.0
15/04:08am	13.2	5.5	3.6	52	4.3	WNW	33	54	18	29	1006.7	1006.6	0.0
15/04:00am	13.2	5.2	3.6	52	4.4	WNW	35	50	19	27	1006.7	1006.6	0.0
15/03:32am	13.5	5.7	2.7	48	4.8	WNW	33	52	18	28	1006.7	1006.6	0.0
15/03:30am	13.5	5.3	2.7	48	4.8	WNW	35	52	19	28	1006.7	1006.6	0.0
15/03:18am	13.3	6.4	2.8	49	4.7	WNW	28	50	15	27	1006.9	1006.8	0.0
15/03:00am	13.2	6.4	3.3	51	4.5	WNW	28	41	15	22	1007.3	1007.2	0.0
15/02:30am	12.9	8.1	4.8	58	3.7	NW	19	30	10	16	1008.0	1007.9	0.0
15/02:00am	12.7	8.9	5.8	63	3.3	NW	15	26	8	14	1008.4	1008.3	0.0
15/01:30am	12.9	8.4	6.3	64	3.2	NW	19	28	10	15	1008.5	1008.4	0.0
15/01:00am	12.0	9.9	6.7	70	2.5	NNW	7	11	4	6	1008.6	1008.5	0.0
15/12:30am	12.3	9.9	7.0	70	2.6	NNW	9	11	5	6	1008.8	1008.7	0.0
15/12:00am	12.3	10.3	7.0	70	2.6	NNW	7	11	4	6	1008.7	1008.6	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/11:30pm	12.5	10.1	7.2	70	2.6	NW	9	13	5	7	1008.4	1008.3	0.0
14/11:00pm	13.0	10.3	7.5	69	2.7	NNW	11	20	6	11	1008.7	1008.6	0.0
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14/09:30pm	13.7	10.5	6.8	63	3.4	NW	13	22	7	12	1009.5	1009.4	0.0
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14/08:30pm	14.3	10.7	6.9	61	3.6	NW	15	20	8	11	1009.0	1008.9	0.0
14/08:00pm	14.9	11.5	7.7	62	3.6	NNW	15	24	8	13	1009.0	1008.9	0.0
14/07:30pm	15.3	11.3	9.0	66	3.2	WNW	20	28	11	15	1008.5	1008.4	0.0
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14/06:30pm	17.2	13.9	11.5	69	3.1	W	20	28	11	15	1007.7	1007.6	0.0
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14/04:00pm	20.5	20.5	17.1	81	2.1	NNE	13	19	7	10	1006.9	1006.8	0.0
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14/09:00am	15.2	15.5	15.0	99	0.1	NNW	7	13	4	7	1013.5	1013.4	0.4
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14/07:30am	14.0	12.4	14.0	100	0.0	WSW	15	19	8	10	1013.9	1013.8	0.4
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14/03:30am	13.1	14.1	13.1	100	0.0	CALM	0	0	0	0	1013.9	1013.8	0.0
14/03:00am	12.9	13.7	12.7	99	0.1	CALM	0	0	0	0	1014.2	1014.1	0.0
14/02:30am	13.4	14.4	13.2	99	0.1	CALM	0	0	0	0	1014.9	1014.8	0.0
14/02:00am	13.8	14.9	13.6	99	0.1	CALM	0	2	0	1	1015.5	1015.4	0.0
14/01:30am	13.7	13.7	13.5	99	0.1	WSW	6	9	3	5	1015.8	1015.7	0.0
14/01:00am	13.6	12.6	13.4	99	0.1	WSW	11	15	6	8	1016.2	1016.1	0.0
14/12:30am	13.4	14.4	13.2	99	0.1	CALM	0	0	0	0	1016.1	1016.0	0.0
14/12:00am	13.9	14.9	13.3	96	0.3	CALM	0	0	0	0	1016.6	1016.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
13/11:30pm	14.0	14.3	13.5	97	0.3	WNW	4	7	2	4	1017.5	1017.4	0.0
13/11:00pm	14.0	14.3	13.4	96	0.3	WNW	4	7	2	4	1017.4	1017.3	0.0
13/10:30pm	14.2	15.3	13.4	95	0.4	CALM	0	0	0	0	1017.8	1017.7	0.0
13/10:00pm	14.2	14.6	13.6	96	0.3	NW	4	7	2	4	1018.4	1018.3	0.0
13/09:30pm	13.8	14.6	13.6	99	0.1	NW	2	7	1	4	1018.1	1018.0	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
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13/08:30pm	14.0	13.7	13.4	96	0.3	SSW	7	17	4	9	1018.1	1018.0	0.0
13/08:00pm	14.5	14.3	13.0	91	0.8	SW	6	15	3	8	1018.3	1018.2	0.0
13/07:30pm	13.4	12.6	12.8	96	0.3	SSW	9	9	5	5	1018.3	1018.2	0.0

This page was created at **05:20 on Saturday 17 September 2016 (AEST)**

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -35.15 West: 150.39 East: 150.59 South: -35.35] returned a total of 27 records of 5 species.
Report generated on 12/03/2017 9:01 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Plantae	Flora	Convolvulaceae	2234	*Wilsonia backhousei*		Narrow-leafed Wilsonia	V,P		2	
Plantae	Flora	Myrtaceae	6809	*Melaleuca biconvexa*		Biconvex Paperbark	V,P	V	1	
Plantae	Flora	Orchidaceae	4415	*^^Cryptostylis hunteriana*		Leafless Tongue Orchid	V,P,2	V	16	
Plantae	Flora	Orchidaceae	14259	*^^Pterostylis ventricosa*			E4A,P,2		6	
Plantae	Flora	Rubiaceae	5680	*Galium australe*		Tangled Bedstraw	E1,P		2	

TERRESTRIAL FAUNA

assessment

Lot 7308 DP 1144810, Havilland Street,
Conjola Park, NSW

FEBRUARY 2017

Draft V2

Lesnok ENVIRONMENTAL

Cover photographs:

Left: Character of the western portion of Lake Conjola and foreshore vegetation within the subject site
Right: Character of the woodland within subject site.

Report produced at the request of:

Peter Dalmazzo Environmental Consultant

on behalf of

Shoalhaven City Council

by

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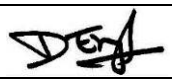
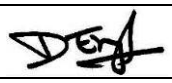
Version	Authors	Reviewers	Approved For Issue	
Draft V1	Stephen Bloomfield (Senior Ecologist), Deryk Engel (Director), Kirsty Bloomfield (research assistant)	Deryk Engel	Deryk Engel	20/02/2017
				
Draft V2	Stephen Bloomfield (Senior Ecologist), Deryk Engel (Director), Kirsty Bloomfield (research assistant)	Deryk Engel	Deryk Engel	23/02/2017
				

This report is prepared in accordance with both the 6th Edition of the Commonwealth of Australia (2002) Style Manual.

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Glossary

Abbreviation	Definition
^{0}C	Degrees Celsius
ASL	Above Sea Level
DE	Commonwealth Department of the Environment (now known as the Commonwealth Department of the Environment and Energy)
DEC	NSW Department of Environment and Conservation (now known as the NSW Office of Environment and Heritage)
DECC	NSW Department of Environment and Climate Change (now known as the NSW Office of Environment and Heritage)
DECCW	NSW Department of Environment, Climate Change and Water (now known as the NSW Office of Environment and Heritage)
DEE	Commonwealth Department of the Environment and Energy
EPA Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System[1]
ha/mm/cm/m/km/m^2	Hectares, millimetres, centimetres, metres, kilometres, square metres
KTP	Key Threatening Process
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NP	National Park
NPW Act	NSW *National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service (now known as the NSW Office of Environment and Heritage)
NSW	New South Wales
NW Act	NSW *Noxious Weeds Act 1993*
OEH	NSW Office of Environment and Heritage
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TSC Act	NSW *Threatened Species Conservation Act 1995*

For the purpose of this investigation:

Subject site	is defined as 'the area directly affected by the proposed development' (as per DECC 2007).
Study area	is defined as 'the subject site and any additional areas that are likely to be affected by the proposed work, either directly or indirectly' (DECC 2007).
Study region	is considered to 'include the lands that surround the subject site for a distance of 10 km' (DECC 2007).
Proposal	is considered to include 'all activities likely to be undertaken within the subject site' (DECC 2007).
Local population (in regards to a threatened species)	comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area (DECC 2007).
Important population	is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: o key source populations either for breeding or dispersal o populations that are necessary for maintaining genetic diversity, and/or o populations that are near the limit of the species range (DE 2013).

[1] Coordinate system used: WGS84 ± 5 m to 10 m.

1. Introduction

At the request of Peter Dalmazzo Environmental Consultant, on behalf of Shoalhaven City Council, a terrestrial fauna investigation has been undertaken within Lot 7308 DP 1144810, Havilland Street, Conjola Park, NSW (Figure 1). The investigation has been carried out as Shoalhaven City Council is proposing to establish a boat launching facility within this site. As part of the development, the following is proposed:

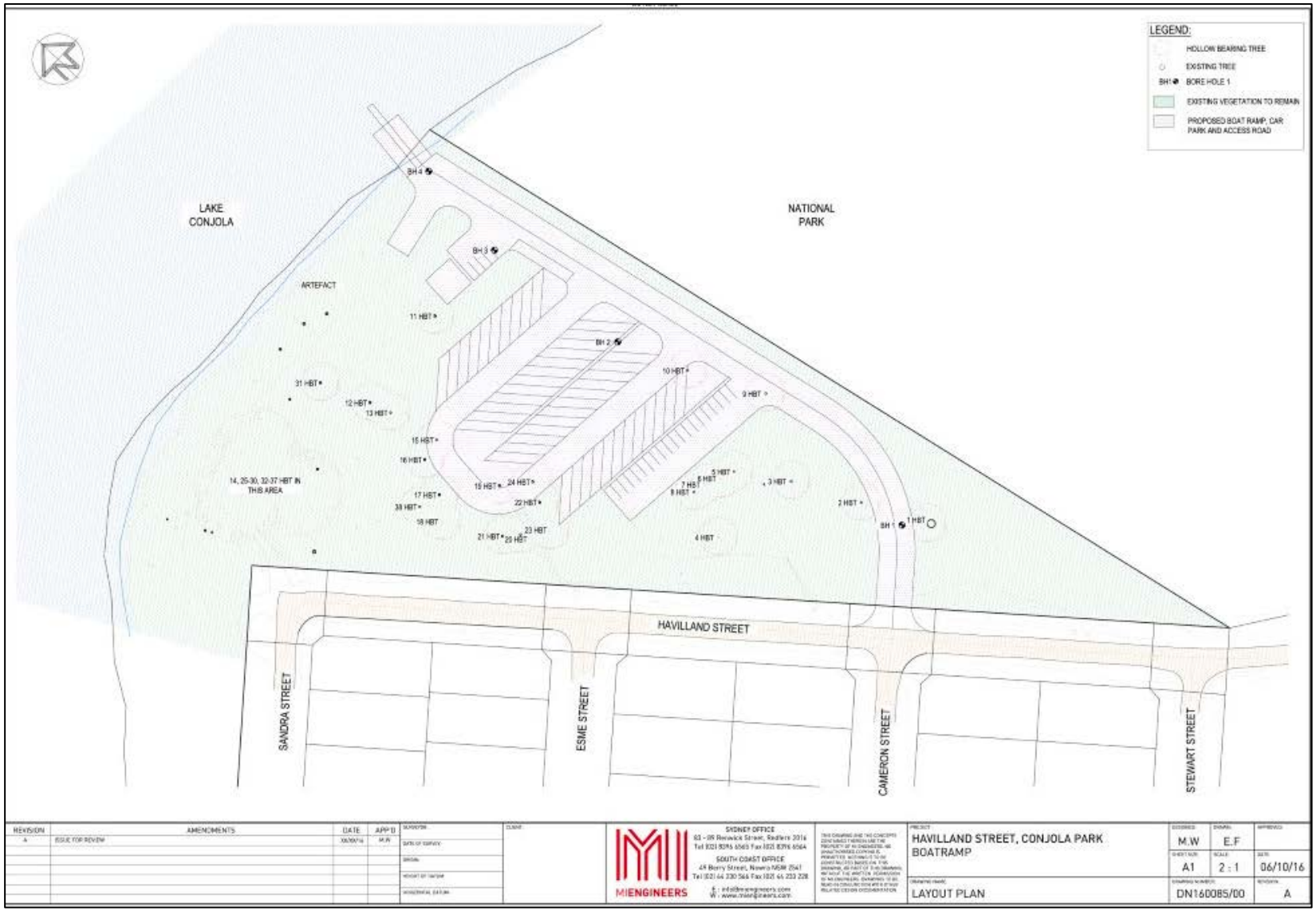
- boat ramp
- pontoon/walkway
- car park and access roads
- infrastructure services (water and electricity)
- landscaping.

The need for a new boat launching ramp was identified by Council more than 15 years ago; the intent of the proposed facility to be the main boat launching area for the western part of Lake Conjola.

For reference, a layout plan of the proposed development footprint has been provided (Figure 2).

Not to scale. Source: Google Earth (2017)

Figure 1. General/approximate boundaries of the subject site (defined by red line).



Not to scale. Source: Miengineers (2016)

Figure 2. Proposed layout plan

Lesryk initially provided a terrestrial fauna audit report to assist with a determination of a suitable layout for the boat launching facility (Lesryk Environmental Pty Ltd 2016b). Components of the audit included the retention of hollow-bearing trees and inclusion of vegetation buffers/linkages.

A development layout for the boat launching facility has resulted in a large percentage of the subject site's vegetation being retained; this supporting the majority of hollow-bearing trees present (Figure 2) and maintaining an existing bushland corridor that provides connectivity south and west to Lake Conjola NP. In addition, natural vegetation buffers will be retained between the proposed development, Lake Conjola NP, Havilland Road and the nearby residential properties (Figure 2).

The proposed boat launching facility includes retention of a vegetated riparian buffer along the foreshore of Lack Conjola, with the exception of the establishment of the boat ramp itself.

Where required, more detailed information on the proposal's scope of work is provided within the project's REF.

The assessment of possible impacts associated with the proposed development is based on a field investigation of the subject site, a literature review of previous studies undertaken in both the region and this portion of the Shoalhaven City Council LGA, the consultation of standard databases and a consideration of the objectives of the EPBC Act, EPA Act, NPW Act, TSC Act, and any relevant SEPP.

2. Legislative requirements

A number of Commonwealth, State and local Acts, policies and documents are relevant to the proposed development of the subject site and its possible impact on the locality's ecology. The most relevant items of these are listed in Table 1.

As the TSC Act has not yet been repealed, and no regulations handed down, this report does not consider the implications and requirements of the NSW *Biodiversity Conservation Bill 2016*.

3. Environmental setting

The subject site is located immediately east of Havilland Street, around 4.4 km west of the township of Lake Conjola, NSW (Figure 1). The site covers an area of around 2.5 ha; the land being entirely vegetated. The site surveyed is bound by Havilland Street and residential properties to the west, Lake Conjola to the north, and Lake Conjola NP to the east and south. The study area is located within the Shoalhaven LGA, with surrounding land uses including urban, semi-rural and agricultural properties, and recreational areas.

The landform within the study area has a north facing aspect, with natural elevations varying from 30 m ASL within the southern portion of the site, to sea level adjacent to Lake Conjola.

Within the subject site, several unsealed vehicle and walking tracks are present, these being in the order of 1 m to 2 m wide. Urban refuse and green garden waste had been dumped at various points along the western edge of the vegetation present.

For reference, a photographic record of the current condition of the study area has been provided (Appendix 1).

No drainage lines are present within the study area; however, the site is located on the foreshore of Lake Conjola, this lake eventually discharging into the Tasman Sea around 5.6 km east of the proposal area.

Table 1. Summary of legislative and policy requirements

Level	Relevant Legislation / Policy	Relevance to study area
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999*	Under this Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a MNES. MNES include listed threatened species and ecological communities, migratory species and wetlands of international importance protected under international agreements. Where applicable, the assessment criteria relevant to this Act must be drawn upon to determine whether there would be a significant effect on these species and hence whether referral to the Federal Environment Minister is required.
State	NSW *Environmental Planning and Assessment Act 1979*	Part 1, Section 5A of this Act requires that a determination be made as to whether a proposed action is likely to have a significant effect on species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act. Where found, the assessment criteria relevant to this Act (these commonly referred to as the 'seven-part test') are to be drawn upon to determine whether there would be a significant effect on these species and hence whether a SIS is required.
	NSW *Threatened Species Conservation Act 1995/Amendment 2002*	This Act makes further provision with respect to the conservation of threatened species, populations and ecological communities of animals and plants.
	NSW *National Parks and Wildlife Act 1974*	This Act defines those species listed as protected in NSW. No assessment is required under this Act, however, potential impacts of the proposed work on these species will be considered.
	NSW *Noxious Weeds Act 1993*	Part 3, Division 1, Section 13 of this Act requires land owners to control noxious weeds on their own land. Where applicable, the proponent must comply with the control class of noxious weeds.
	NSW State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)	Clause 8 of this SEPP requires consideration of whether a proposal will affect core koala habitat as defined in the SEPP. If so, a plan of management for the Koala must be prepared in accordance with Part 3 of the SEPP.
Local	*Shoalhaven Local Environmental Plan 2014*	This plan aims to make local environmental planning provisions for land in Shoalhaven in accordance with the relevant standard environmental planning instrument under Section 33A of the EPA Act. The property is zoned RE1 (Public Recreation). Objectives of this zone are: • to enable land to be used for public open space or recreational purposes. • to provide a range of recreational settings and activities and compatible land uses. • to protect and enhance the natural environment for recreational purposes.

Lake Conjola NP abuts the southern and eastern boundaries of the subject site, this reserve covering an area of around 1000 ha. A Plan of Management has been prepared for this national park (NPWS 2009). The Plan of Management notes that (in 2009) 25 fauna species listed under the TSC Act have been recorded in, or around, Lake Conjola National Park (NPWS 2009).

Additional reserves within the study region include:

- Narrawallee Creek Nature Reserve (around 880 ha in size), located approximately 350 m to the south
- Yatteyattah Nature Reserve (around 36 ha), located around 2.3 km to the west
- McDonald State Forest (around 4000 ha), located around 9 km to the north-west
- Morton NP (around 199,745 ha), located around 8.2 km west.

According to monthly rainfall figures from Nerriga Composite[2] the mean annual rainfall experienced by the study region is around 769.1 mm, with the greatest falls being experienced in March (Bureau of Meteorology 2017). January has the mean maximum summer temperature of 26.3 °C, while July is the coldest month with a mean minimum temperature of 0.2 °C (Bureau of Meteorology 2017).

Through reference to the listings provided under both the EPBC and TSC Acts, it is noted that no gazetted areas of critical habitat for any fauna species occur within, or in the vicinity of, the study area. Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and/or ecological communities.

4. Literature review and field guides

Prior to undertaking any fieldwork, previous studies conducted in the region and known databases were consulted to identify the diversity of fauna species known for, or potentially occurring in, the study region. The identification of those known or potentially occurring native species within this portion of Shoalhaven LGA, particularly those listed under the Schedules to the EPBC and TSC Acts, thereby permits the tailoring of the field survey strategies to the detection of these animals and their necessary habitat requirements. By identifying likely species, particularly any threatened animals, the most appropriate species-specific survey techniques can be selected should their associated vegetation communities/fauna habitats be present. The undertaking of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any animals that are of regional, State and/or national conservation concern. This approach also avoids issues inherent with a one off 'snap shot' study.

The studies, reports and databases referred to include:

- the DEE Protected Matters Search Tool (DEE 2017a)
- the OEH BioNet database [Atlas of NSW Wildlife] (OEH 2017a)
- the OEH Threatened Species website (OEH 2017b)
- the Conjola NP Plan of Management (NPWS 2009)
- SCC's LEP (SCC 2014).

Other reports and documents referred to are provided within the bibliography section of this report.

When accessing the DEE and OEH databases, the search area specified was a 10 km buffer around the study area. The data searches were carried out on 11/07/2016 and reviewed for any 'new' listings of species on 17/02/17[3].

All these databases and reports were reviewed and drawn upon where relevant. While reviewing these documents, particular attention was paid to identifying records of fauna species listed under the

[2] This nearest weather station to the area investigated closed in June 2014
[3] Consultation of the databases identified the addition of the Eastern Pygmy-possum (*Cercartetus nanus*), White-bellied Sea-eagle (*Haliaeetus leucogaster*) and Greater Glider (*Petauroides Volans*) to those species recorded in the study region.

Schedules of the EPBC and/or TSC Acts that have been recorded in the region and which may occur within, or in the vicinity of, the study area.
Field guides and standard texts used include:

- Cogger (2000) (used for the naming, and if needed identification of, reptiles and frogs)
- Churchill (2008) (microchiropteran [insectivorous bats])
- Simpson and Day (2008) (birds)
- Van Dyck and Strahan (2008) (non-flying mammals)
- Triggs (1996) (identification of scats, tracks and markings).

The naming of those species recorded or known for the region follows the nomenclature presented in these texts, or within the EPBC and TSC Acts.

The conservation significance of those animals recorded is made with reference to the EPBC and TSC Acts.

5. Results of the literature review

5.1. Threatened fauna species

A review of the DEE and OEH (DEE 2017a, OEH 2017a) identified 59 fauna species listed under the Schedules of the EPBC and/or TSC Acts that have been previously recorded, or are considered to have habitat, in the study region (Appendix 2).

Based on a consideration of the habitat needs of those threatened species listed in Appendix 2 (as provided in standard texts – refer to the bibliography section for those used), combined with the identification of those habitats present within the study area, there is the potential for some of the animals to occur within, or in the vicinity of, the study area. As such, during the course of the field investigations, targeted surveys for these species, or their necessary habitats, were undertaken.

Though additional threatened species have been previously recorded within the study region (as identified in Appendix 2), it is noted that these animals have specific habitat requirements (e.g. rocky outcrops, rocky foreshores and oceanic environments), no components of which are present within, or occur in close proximity to, the subject site. As such, no locally viable populations of these species would be present within, or near, the proposed boat launching facility. Therefore, as no locally viable populations of these animals would be present, it is not considered that the development of the subject site would have an adverse impact on these species, their populations or habitats.

6. Field survey methods

Field investigations of the study area were carried out by Deryk Engel $_{(B.Env.Sc.HONS)}$ [zoologist] and Stephen Bloomfield $_{(B.App.Sc.)}$ [botanist] on 14,15, 26 and 27 July, and again by Deryk Engel on 9 September 2016. For reference, the weather conditions experienced during each investigation are provided in Table 2.

The purpose of the field investigations was to identify any animals (or occurrences of their documented fauna habitats) that are of State and/or national conservation significance as listed under the Schedules to the EPBC and/or TSC Acts. When conducting the field investigations, a modification of the Random Meander Method (Cropper 1993) that is suitable for fauna surveys was adopted.

The ‘Random Meander Method’ is consistent with the stratified random sampling design as specified in section 5.1 (Stratification, sampling and replication) of the publication titled Threatened biodiversity survey and assessment: Guidelines for development and activities (DEC 2004). This method is also mentioned under sections 5.2.1 (Sampling techniques) and 5.2.7 (Targeting threatened plants) of that publication.

Table 2. Weather details and methods employed

Key
DE - Deryk Engel (B.Env.Sc.HONS) – Director Lesryk Environmental Pty Ltd
SB - Stephen Bloomfield (BApp. Sc) – Research assistant Lesryk Environmental Pty Ltd

Date and Time[4]		Researcher(s)	Weather	Methods employed
14/7/16	1545-1700	DE, SB	clear skies, cool temperatures (15˚C), still	Bird survey Echolocation detector set Infrared camera set Hair tube traps (x10) set
	1700-1900	DE, SB	clear skies, half moon, cool temperatures (15˚C) and slight breeze.	Stagwatching Call playback Spotlighting
15/7/16	0730-0930	DE, SB	clear skies, cool temperatures (12˚C), still	Dawn bird survey
26/7/16	1330 -1700	DE	clear skies, cool temperatures (10˚C), moderate breeze	Echolocation detector picked up Infrared camera picked up Hair tube traps picked up Dusk bird survey
	1700-2000	DE	cloudy skies (20% cloud cover), cool temperatures (12˚C), light to gusty winds	Call playback Spotlighting
27/7/16	0730-1200	DE	100% cloud cover, 13^{o}C and moderate breeze	Dawn bird survey Mapping hollow-bearing trees Ground debris searches Incidental observation
9/9/16	1230-1400	DE	clear skies, warm temperatures (24˚C), slight breeze	Mapping of hollow-bearing trees

To achieve the objectives of the study, the survey methods employed during the field investigations were:

- the identification of the structure of those fauna habitats present
- the direct observation of any fauna species present within, or adjacent to, the subject site
- diurnal and nocturnal call identifications of fauna species with all calls being identified in the field
- echolocation detection targeting microchiropteran, particularly those threatened bats previously recorded in this locality
- use of a Reconyx^{TM} infrared camera
- call playback
- hair tube trapping
- targeted searches for those species of State and national conservation concern, or their likely habitat areas, that were identified during the literature review stage of the project
- the identification of any indirect evidence such as tracks/scratchings that would suggest the presence of a particular fauna species
- litter and ground debris, leaf litter and tree bark searches for sheltering reptiles and frogs.

Where required, a more detailed description on one or more of the survey methods employed is provided below.

While conducting the site investigations, efforts were made to document the diversity, structure and value of those habitats present within, and adjacent to, the subject site. This involved assessing those fauna habitats present, and determining their significance for native species, particularly any that are of State and/or national conservation concern. While conducting the site assessments, efforts were made to identify features such as known vegetation associations, geological features, feed trees (including incised sap trees or ones under which crushed casuarina cone accumulations occur), mature trees with hollows, connectivity of fauna corridors, aquatic environments and other habitat

[4] 24 hour time

features important to the lifecycle needs of those threatened species previously recorded in the study region (as listed in Appendix 2).

The survey methods employed, and level of effort required, were generally based on the descriptions provided in the following publications:

- The OEH survey guidelines for:
    a. Amphibians (DECC 2009)
    b. Bats (OEH 2016 draft).
- The DEC 2004 publication titled "Threatened biodiversity survey and assessment: Guidelines for developments and activities (Working Draft)
- DE survey guidelines for detecting those species listed as threatened under the EPBC Act (DE various dates).

It is noted that the above guidelines do not provide advice on the use of infrared cameras. Therefore information on the use of these was sourced from:

- the unit's user manual
- current scientific literature (Claridge *et al*. 2010; Engel and Burcher 2010; Engel and Engel 2012; Meek *et al* 2012, Meek and Fleming 2014).

For reference, the cumulative survey effort achieved through use of those field survey methods employed is presented in Table 3.

Table 3. Cumulative survey effort

Technique	Accumulated effort
Echolocation detection	168 hours
Infrared cameras	12 camera nights
Call playbacks	65 minutes
Hair tube trapping	120 trap nights
Spotlighting	7 person hours

6.1. Echolocation

One Anabat Express™ echolocation detector was used to determine the presence of any microchiropteran that may occupy or utilise the subject site, particularly the following hollow-dependent threatened bats that have been previously recorded in the study region:

- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*)
- Large-footed Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- East-coast Freetail Bat (*Micronomus norfolkensis*).

The detector was placed approximately 80 m east of the Cameron and Havilland Street intersection, at a height of around 1.5 m above ground level (Figure 3). The GPS coordinate of this unit was Easting [E] 267499; Northing [N] 60948433.

Being programmable and waterproof, the detector was set to record microchiropteran calls between sunset (this being around 1700 hours at the time of the field investigation) and sunrise (around 0700) (i.e. 'night only' being the programmable option selected). The unit was placed out on the site on 14 July, and collected 12 days later.

Any calls recorded were analysed in house using AnalookW 4.1b computer software.

Not to scale Source: Google earth (2016)

Key

Green triangles	Hair tube traps	Red circle	Echolocation units
Yellow camera	Infrared camera	Blue square	Call playback
White line	Spotlighting		

Figure 3. Fauna survey locations

6.2. Infrared camera

One Reconyx^{TM} infrared camera was employed during the course of the field investigation, this being established on 14 July and collected 12 days later. For reference, the location of the camera is identified on Figure 3; the GPS coordinate of this being E267486; N6094894.

The cameras employ a passive infrared system, this requiring an animal to 'break' an invisible 'beam'. The cameras were set to operate diurnally and nocturnally, each being set to a sensitivity level of high and a photo interval of 3/ten seconds.

Upon collection, it is noted that the camera was still functioning.

6.3. Stag watching, call playback and spotlighting

Nocturnal surveys of the site were undertaken during the evenings of 14 and 26 July 2016.

Prior to conducting each call playback session, stag watching of several of the hollow-bearing trees present was undertaken. Stag watching involved a researcher being present on site 15 minutes prior to sunset, the researcher staying in position till 30 minutes after sunset (approximate duration 80 minutes). To observe any species that may be exiting those trees observed, the researcher positioned themselves to ensure that several hollow-bearing trees were visible and silhouetted against the night sky.

Based on the results of the literature review, these indicating the diversity of threatened nocturnal species that have been previously recorded in the study locality, during each playback session the calls of the following species were broadcast:

- Yellow-bellied Glider (*Petaurus australis*)
- Squirrel Glider (*Petaurus norfolcensis*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)
- Sooty Owl (*Tyto tenebricosa*).

The call playback sessions were carried out at three locations[5] (Figure 3), the GPS coordinates of these being:

- E267523: N6094908
- E267427: N6094689
- E267512: N6094492.

The playback sessions involved broadcasting characteristic calls of each species being targeted through a loud hailer that was connected to an iPod^{TM}. Prior to undertaking the call playbacks, a ten minute listening period (conducted concurrently with the stag watching session) was carried out to determine those vocal nocturnal species present. The calls (which were taken from either Stewart 1999 or Buckingham and Jackson 1990) were then broadcast for five minutes per species. To detect any responses to the call playbacks, a ten minute listening period was carried out at the completion of each session.

At the completion of the call playbacks, spotlighting (using 163 lumen hand-held spotlights) was undertaken. During the spotlighting sessions, efforts were made to target those habitats considered suitable for nocturnal animals, particularly those species of conservation significance identified as having been previously recorded in the study region. Where possible, to minimise flushing any species (by generating excessive noise), spotlighting was undertaken on foot, with those tracks and existing clearings present within the subject site being traversed (Figure 3).

[5] Given the size of the subject site, it was not possible to select sites that were 1.5 km apart (as per standard guidelines [DEC 2004]).

It is acknowledged that, as it was detected during the initial call playback session, to minimise disturbing the species, calls targeting the presence of the Sooty Owl were not broadcast during the evening of 26 July 2016.

6.4. Hair tube traps

Hair tube trapping, using 10 Faunatech^{TM} hair tube traps, was carried out within the study area (Figure 3); with all of the traps being placed on the ground. For reference, the GPS coordinates of the hair tube traps employed are:

1. E267483; N6094997
2. E267478; N6094964
3. E267481; N6094952
4. E267469; N6094928
5. E267465; N6094895
6. E267484; N6094855
7. E267470; N6094830
8. E267444; N6094815
9. E267494; N6094775
10. E267509; N6095029.

Five hair tube traps were baited with sardines, while the remainder were baited with the standard rolled oats, peanut butter and honey mixture. The traps were placed out sequentially (i.e. rolled oat mix, meat, rolled oat mix, meat etc.).

The hair tube traps were placed out on site on 14 July and collected 12 days later.

Any hairs collected from the hair tube traps were sent to Ms Georgeanna Story of 'ScatsAbout' (Majors Creek, NSW) for analysis.

Similarly, any carnivore scats that contained bone or hair material were sent to Ms Story for analysis. While predators can forage over large home ranges, for the purposes of this investigation, it is considered that the predator and prey species identified are resident animals within the study area.

6.5. Study limitations

Given the size of the study area, the length of time undertaken surveying the subject site is more than adequate when endeavouring to determine the broad diversity of those native species present, their associated habitats, and the conservation status of each of these. During the field investigations, no adverse weather conditions were encountered.

Limitations encountered during the course of the field investigation were the winter timing of the investigation, the surveys being conducted during the months of July and September. This timing is expected to have negated the detection of those species that migrate north, hibernate or enter extended periods of torpor. It is acknowledged that, during the survey period, warm to hot winter days were encountered, these encouraging the foraging behaviour of animals such as those microchiropteran detected.

Not all animals can be fully accounted for within any given study area. The presence of threatened species is not static; it changes over time, often in response to longer term natural forces that can, at any time, be dramatically influenced by human-made disturbances. In order to overcome these limitations, database searches were conducted for threatened species, populations and ecological communities known to occur within the region.

This report is based upon data acquired from the current investigation; however, it should be recognised that the data gathered is indicative of the environmental conditions of the site at the time the field work was conducted.

Where suitable habitat for threatened species known to occur, or that have been previously recorded, within the surrounding locality is identified within the study area, a 'precautionary approach' has been adopted.

7. Fauna

7.1. Fauna species recorded during the field investigations

By the completion of the field investigations, 12 native mammals, 47 birds and one amphibian had been recorded within, adjacent to or flying over, the subject site (Appendix 3). In addition, one introduced species was detected.

In regards to the detection of those native species recorded:

- The Short-beaked Echidna (*Tachyglossus aculeatus*) was observed.
- The Brown Antechinus (*Antechinus stuartii*) was identified through use of the hair tube traps.
- The Long-nosed Bandicoot (*Perameles nasuta*) and Sugar Glider (*Petaurus breviceps*) were both heard calling prior to conducting the playback session carried out on 14 July 2016.
- The Common Brushtail Possum (*Trichosurus Vulpecula*) was both spotlit and detected through use of the infrared camera.
- The Swamp Wallaby (*Wallabia bicolor*) was also detected through use of the infrared camera, indicative scats of this animal also being observed.
- The Feathertail Glider (*Acrobates pygmaeus*) was spotlit.
- The Eastern Grey Kangaroo (*Macropus giganteus*) was observed within the locality.
- All the microchiropteran were identified through the analysis of those echolocation calls recorded (Appendix 4).
- The Sooty Owl responded, and was subsequently observed, during the call playback session conducted on 14 July.
- All of the remaining birds were observed within, adjacent to, or flying over the proposal area, or identified from their distinctive calls.
- The Common Eastern Froglet (*Crinia signifera*) was heard calling from riparian vegetation that lines Lake Conjola. This winter calling amphibian was the only frog detected during the course of the field investigations.

Though consideration to their presence was given:

- No threatened microchiropteran were detected. It is acknowledged that the presence of hollow-dependent microchiropteran within the study area was determined through use of the echolocation detection unit.
- No additional nocturnal birds were spotlit, heard calling or responded during the call playback sessions.
- The Squirrel Glider did not respond during either call playback session.
- No incised Yellow-bellied Glider (*Petaurus australis*) feed trees were observed within the study area. This species was not heard calling during either of the nocturnal surveys and no response was elicited during the call playback sessions.
- No accumulations of crushed casuarina cones, these indicating the feeding behavior of the State listed Glossy Black-Cockatoo (*Calyptorhynchus lathami*), were observed within the study area. Within the study area, no large stands of casuarina trees were observed.
- Species such as the Spotted-tailed Quoll (*Dasyurus maculatus*) and Southern Brown Bandicoot (*Isoodon obesulus*) were not observed, indicated or detected through use of the infrared camera within the subject site. The proximity of the adjacent residential area is expected to negate the permanent presence of these medium sized, ground traversing animals.

Eight of the hair tube traps used collected hairs, analysis of this confirming the presence of the Brown Antechinus and Common Brushtail Possum. These were the only two species identified for the subject site through use of this survey technique. No carnivore scats were collected.

7.1.1. Threatened species

Of those native animals recorded:

- the White-bellied Sea-eagle (*Haliaeetus leucogaster*) – listed as a marine animal under the EPBC Act and a vulnerable species under the TSC Act
- the Sooty Owl and Little Lorikeet (*Glossopsitta pusilla*) are listed as vulnerable species under the TSC Act.

The White-bellied Sea-eagle was observed foraging over Lake Conjola (Figure 4). Within, and close to, the subject site no large stick nests indicative of the breeding habits of this species were observed.

A Sooty Owl responded during the call playback session conducted on 14 July (Figure 4). This bird was initially heard responding/calling from a small gully that occurs to the south of the broadcast location. During the playback session, the bird entered, and was observed within, the subject site itself. Within the subject site, resources for the foraging, roosting and breeding needs of this species are present. While this is the case, given the time duration between broadcasting the calls of this species and its response, it is assumed this bird is roosting to the south of the subject site. Diurnal searches of the gully did not locate any accumulations of white wash and the individual was not observed.

A flock of Little Lorikeets was heard calling as they flew over the subject site (Figure 4). No individuals of this bird were observed within the subject site during the course of the field surveys. Within the subject site, resources for the foraging, roosting and breeding needs of this species are present.

For reference, a description of the habitat requirements of these species' has been provided below.

The remainder of the native species recorded are protected, as defined by the NPW Act, but considered to be common to abundant throughout the surrounding region. These animals are all commonly recorded in association with urban and woodland areas. These species would not be solely reliant upon those habitats present within the subject site such that the removal or disturbance of a percentage of these would threaten the occurrence of these animals. The native, non-threatened species recorded are all expected to be present, adjacent to, and within the vegetation that surrounds the subject site post-development.

Five of the species recorded are listed as occurring within a Family (Families as in the Taxonomic classification system) of birds listed as migratory under the EPBC Act, these being the:

- Chestnut Teal (*Anas castanea*) – observed within the adjacent Lake Conjola
- Australian Wood Duck (*Chenonetta jubata*) – observed within Lake Conjola
- Collared Sparrowhawk (*Accipiter cirrocephalus*) – observed flying over the subject site
- Grey Goshawk (*Accipiter novaehollandiae*) – observed flying over the subject site
- Masked Lapwing (*Vanellus miles*) – observed flying over Lake Conjola.

Although listed as occurring within a Family of migratory birds, these species are not considered to be migratory within Australia. As such, the conducting of assessments that draw on the criteria provided under the EPBC Act's Significant Impact Guidelines (that are relevant to a migratory bird) is not required.

Not to scale Source: Google earth (2016)

Key

Purple diamond	Little Lorikeet (heard calling)	Blue diamond	Sooty Owl (heard calling and observed)
Yellow circle	White-bellied Sea-eagle (observed)		

Figure 4. Locations where threatened fauna species were either recorded or the researcher was positioned when they first heard the species calling

Based on the results of the field investigations, the observations of the habitats present, the timing of the study and as they have been previously recorded in the study region (Appendix 2), it is considered appropriate to adopt the precautionary principle and assume the presence of the following species, the:

- Eastern Pygmy-possum (*Cercartetus nanus*)
- Greater Glider (*Petauroides volans*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*)
- Large-footed Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- East-coast Freetail Bat (*Micronomus norfolkensis*).

Each of these species is listed as vulnerable under the TSC Act, the Greater Glider and Grey-headed Flying-fox also being listed as vulnerable under the EPBC Act.

To consider the impact(s) the proposal may have on those State listed species recorded or potentially occurring, assessments that refer to the criteria provided under Part 1, Section 5A of the EPA Act have been carried out (Appendix 5). Assessments that draw on the criteria provided under the EPBC Act's Significant Impact Guidelines have also been undertaken on the Grey-headed Flying-fox.

While the White-bellied Sea-eagle is listed as marine under the EPBC Act, the proposed work is not located within the Commonwealth marine area, this being from 3 to 200 nautical miles from the coast. As such, no assessment using the EPBC Significant Impact Guidelines that are relevant to the Commonwealth marine environment has been carried out.

In regards to the Greater Glider, it is noted that, in NSW, the species is considered to be common to abundant (its listing under the EPBC Act due to declines in the Victorian population).

In NSW, the population that is located within the Eurobodalla LGA is listed as endangered. This population is bounded by the Moruya River to the north, Coila Lake to the south and the Princes Highway and cleared land exceeding 500 m in width to the west (OEH 2017b).

Within the Shoalhaven LGA, the Greater Glider is not considered to be threatened. As such, no further assessments (in regards to the impact the proposal may have on the viability of this species) are necessary.

It is noted that, while two threatened cave-dependent microchiropteran, these being the Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bentwing Bat (*Miniopterus (schreibersii) orianae oceanensis*), were identified as having a high likelihood of occurrence within the subject site (Appendix 2), neither species was recorded during the field investigations. While these microchiropteran would utilise the subject site for foraging purposes, they would not be solely reliant upon the habitat therein for any of their life cycle requirements. In addition, no caves or suitable cave substitutes are present within the subject site. The proposed development would result in the removal of less than 1 ha of native vegetation; however, similar resources will be retained within both the subject site and surrounding region. The presence of this vegetation would ensure the local viability of these microchiropteran. Given that the proposed work is not expected to have a significant impact on these microchiropteran, it is not considered that assessments that draw upon the criteria presented in the EPBC Significant Impact Guidelines or under Part 1, Section 5A of the EPA Act are required.

7.1.1. (a) White-bellied Sea-eagle

The White-bellied Sea-eagle is found throughout coastal Australia (Frith 2007) in association with large rivers, fresh and saline lakes, reservoirs, estuaries, coastal seas, islands (Simpson and Day 2008). Feeding occurs on fish, tortoises, rabbits and nestlings (Frith 2007). Breeding occurs between May and October with nesting sites often being repeatedly used over a period of several years (Frith 2007).

During the field survey this species was observed flying over Lake Conjola; however, no characteristic White-bellied Sea-eagle nests were observed within the area investigated, and no individuals of this animal were observed foraging within the study area.

The scope of work proposed would not remove or disturb any significant resources relied upon by this species, nor would it present any barriers to its movement patterns. As such, it is considered that the proposed boat launching facility would not have a significant effect on the White-bellied Sea-eagle.

While no impacts on the presence of this species are expected to arise, to further consider the impact the proposal may have on this species an assessment that refers to the criteria provided under Part 1, Section 5A of the EPA Act has been carried out (Appendix 5).

The outcomes of this assessment concluded that the proposal would not have a significant impact on the White-bellied Sea-eagle or the viability of its local population. As such, the preparation of a SIS that further considers the impacts of the proposal on this species is not required.

7.1.1. (b) Sooty Owl

Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands (OEH 2017b). Inhabits closed and tall open forests, especially gullies (Simpson and Day 2008), roosting in tree hollows or heavy vegetation (Simpson and Day 2008, OEH 2017b). Prey species include arboreal mammals, though some birds and terrestrial mammals will be taken (Frith 2007, OEH 2017b). Accurate home range estimates for this species are presently unknown, but radiotelemetric research on tagged individuals caught in the Royal NP, Sydney, put it at approximately 3,000 ha (per. comm., R.Kavanagh, Forestry Commission). It is noted that, within this home range, the owls were only recorded as using two thirds of this total area (per. comm., R.Kavanagh).

The survival of this species is threatened through habitat clearance, fire and habitat isolation (OEH 2017b). As the sooty owl is a generalist predator, potentially consuming all arboreal and terrestrial prey species under 1500 g available to it, it is likely that its diet is an indicator to the current health of small mammal communities in an area (Bilney *et al* 2006). The Sooty Owl has therefore been described as an indicator species of undisturbed old-growth forest and hollow-dependent mammal species (Norton and Lindenmayer 1991).

The Sooty Owl was recorded on 14 July, the species responding to the call playback carried out along the eastern boundary of the subject site. The individual was initially heard responding/calling from a small gully area that occurs to the south; however, during the playback session, the bird entered, and was observed within, the subject site itself. While resources for the foraging, roosting and breeding needs of this species are present within the subject site, given the time duration between broadcasting the calls of this species and its response, it is assumed this bird is roosting within the southern gully. Diurnal searches of the gully area did not locate any obvious evidence (such as white wash or owl pellets), and the individual was not observed.

While the proposal is expected to result in the removal of seven hollow-bearing trees (at a worst case scenario) and some foraging habitat, given the amount of similar resources being retained within, and beyond the limits of, the area investigation (this including stands of woodland that support hollow-bearing trees), sheltering and foraging opportunities would be retained within both the subject site and surrounding region.

It is noted that the development layout includes retention of a vegetation buffer between the proposed boat launching facility and the area where the Sooty Owl is considered to be roosting (i.e. gully to south of the area investigated).

To further consider the impact of the proposal on the Sooty Owl an assessment drawing on the criteria provided under Part 1, Section 5A of the EPA Act has been undertaken (Appendix 5).

The outcomes of this assessment concluded that the proposal would not have a significant impact on the Sooty Owl or the viability of its local population. As such, the preparation of a SIS that further considers the impacts of the proposal on this species is not required.

7.1.1. (c) Little Lorikeet

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia (OEH 2017b). NSW provides a large portion of the species' core habitat, with lorikeets found westward to Dubbo and Albury (OEH 2017b). Little Lorikeets forage primarily in the canopy of open Eucalyptus forest and woodland, particularly along water courses (OEH 2017b, Frith 2007). It is noted that Angophoras, Melaleucas and other tree species are also used as a food source (OEH 2017b). They eat pollen, nectar, blossoms, native and cultivated fruits and seeds, feeding in small flocks (<10), though often with other lorikeets (OEH

2017b, Frith 2007). This species roosts in treetops, often distant from feeding areas (OEH 2017b). This species nests in a hollow, usually 3 cm at the entrance and usually high above the ground (2–15 m); typically in the limb or trunk of smooth-barked Eucalypts (OEH 2017b). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited (OEH 2017b). Nesting season extends from May to September (OEH 2017b).

During the investigation a flock of Little Lorikeets were heard calling as they flew over the subject site (Figure 4). While hollow-bearing trees and suitable foraging resources (i.e. nectar producing plants) are present within the subject site, no individuals of this species were observed occupying the area investigated.

While the proposal is expected to result in the removal of seven hollow-bearing trees and some foraging habitat, given the amount of resources available with the surrounding conservation areas (this including hollow-bearing trees), combined with that being retained in the subject site itself, sheltering and foraging opportunities would be retained within both the study area and surrounding region for this species.

To further consider the impact of the proposal on the Little Lorikeet an assessment drawing on the criteria provided under Part 1, Section 5A of the EPA Act has been undertaken (Appendix 5).

The outcomes of this assessment concluded that the proposal would not have a significant impact on the Little Lorikeet or the viability of its local population. As such, the preparation of a SIS that further considers the impacts of the proposal on this species is not required.

7.2. Habitat types available for native fauna species

One habitat type available for use by native species was observed within the subject site, this being eucalypt woodland.

For reference, a description of this is provided below. It is recommended this description be read in conjunction with reference to the photographic record provided (Appendix 1).

This woodland supports trees that are between 25 m and 30 m in height. Tree canopy connectivity within the subject site is consistent, the site being linked to similar vegetation to the south and east. Connectivity to the north and west is non-existent due to the presence of urban areas and Lake Conjola.

A middle storey layer of native shrubs that reach a height of 12 m is present within the woodland; this, depending on past disturbances, being of a medium to sparse density. The understorey is of sparse density and composed of native shrubs and saplings that are to 2 m in height, the density of this also dependent upon past disturbances. Throughout the subject site the understorey varies from open (southern portions) to closed (northern). The groundcover is comprised of grasses, herbs and forbs that are to 0.5 m in height. Adjacent to Havilland Street, exotic grasses and weeds are present. Leaf litter, ground debris and fallen timber is common throughout the subject site.

It is also noted that this habitat type is intersected by a number of existing earthen motorbike and walking tracks. Some dumped urban refuse and occurrences of green garden waste are present. Portions of the subject site have been affected due to the undertaking of a hazard reduction burn.

Within the subject site, 38 trees were noted to contain one or more hollows (hollow diameter ranging from 10 cm to 40 cm). The majority of these trees are located adjacent to Havilland Street, within the area of vegetation that is to be retained (Figure 2). For reference, Figure 2 provides the location of those hollow-bearing tree identified, while Appendix 6 provides their coordinates and the characteristics of the hollows observed (i.e. number of hollows, their diameter and orientation).

8. Wildlife corridors and vegetation links

Within the study area, the woodland present provides opportunities for the dispersal and movement needs of those native species recorded or expected to occur. The structure of the woodland would permit the movement of gliding and flying species, and ground traversing animals. Beyond the subject site, a series of conservation reserves provide relatively continuous vegetated corridors. While roads and rural properties partially bisect these corridors, connectivity is maintained to the north, east and west through to Conjola NP, Narrawallee Creek Nature Reserve and Morton NP, respectively. The connectivity of these corridors within the locality and wider region is important for the dispersal, movement, interbreeding and migratory needs of a number of native species.

Given the scope of the proposal, all of the animals currently traversing the study area's corridor are also expected to do so post-development. With the retention and inclusion of vegetated buffers, resultant vegetation clearing is not considered to erect any additional barriers to the movement patterns of native animals, such that the proposal would be considered to isolate or further fragment any of their habitat areas. The proposed work is not considered to have an adverse cumulative impact when associated with the existing environments that surround the subject site.

9. Legislative considerations

9.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999*

By the completion of the field investigations, one species listed as marine under this Act was recorded within the study area, this being the White-bellied Sea-eagle.

Additionally, as it has been previously recorded within the study area, and as suitable habitat is present, it is considered appropriate to adopt a precautionary approach and assume the presence of the Grey-headed Flying-fox.

With reference to the Significant Impact Guidelines provided under the EPBC Act, an assessment was undertaken on the Grey-headed Flying-fox (Appendix 5). The assessment concluded that the proposal would not have a significant adverse impact on this MNES. Therefore, referral of the matter to the Federal Minister for the Environment and Energy for further consideration or approval is not required.

The White-bellied Sea-eagle is listed as marine under the EPBC Act. The proposal is not located within a Commonwealth marine area. As such, no assessment using the EPBC Significant Impact Guidelines that are relevant to the Commonwealth marine environment is required.

9.2. State - *Environmental Planning and Assessment Act 1979*

By the completion of the field investigations, three species listed as vulnerable on this Act were recorded within, or as occurring in the vicinity of, the subject site, these being the:

- White-bellied Sea-eagle
- Sooty Owl
- Little Lorikeet.

Due to the presence of hollow-bearing trees within the proposal area, there is the possibility that the Sooty Owl and Little Lorikeet may be roosting and foraging within, or near to, the subject site.

No indicative nests of the White-bellied Sea-eagle are present within or close to the subject site. Within the subject site, this species may occupy (perch within) the riparian vegetation that lines Lake Conjola, the majority of this being retained. No Sea-eagle breeding sites are to be removed, and no foraging resources (open expanses of water) are to be significantly affected.

As they have been previously recorded in the study area and as suitable habitat is present (i.e. hollow-bearing trees, Eucalypt woodland), it is considered appropriate to adopt a precautionary approach in regards to the occurrence of the following State listed species:

- Eastern Pygmy-possum
- Grey-headed Flying-fox
- Eastern Falsistrelle
- Large-footed Myotis
- Greater Broad-nosed Bat
- East-coast Freetail Bat.

Assessments drawing on the criteria provided under Part 1, Section 5A of the EPA Act have been undertaken (Appendix 5) in regard to the threatened species recorded or considered likely to occur. These assessments concluded that, as a result of establishing the proposed boat launching facility, there would not be a significant effect on any matter of State conservation significance or their habitats. Therefore, it is considered that the preparation of a SIS is not required.

9.3. State – State Environmental Planning Policy No.44 – Koala Habitat Protection

The Shoalhaven City Council LGA is identified under Schedule 1 - LGA's of SEPP 44. This Policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas.

Within the study area, four eucalypt species were recorded (Peter Dalmazzo Environmental Consultant 2017), none of which are listed under Schedule 2 of SEPP 44 as Koala Feed Trees. As such, the subject site would not be considered Potential or Core Koala habitat. The proposal can proceed as planned without requiring the preparation of a Plan of Management for the conservation and management of areas of Koala habitat.

10. Conclusion

A terrestrial fauna assessment has been carried out within Lot 7308 DP 1144810, Havilland Street, Conjola Park, NSW. By the completion of the field investigation three species listed as vulnerable under the TSC Act had been recorded within, or in close proximity to, the subject site, these being the:

- White-bellied Sea-eagle
- Sooty Owl
- Little Lorikeet.

Based on the results of the field investigations, the observations of the habitat present, the timing of the study and as they have been previously recorded in the study region, was considered appropriate to adopt a precautionary approach and assume the presence of the:

- Eastern Pygmy-possum (vulnerable under the Act)
- Grey-headed Flying-fox (vulnerable under both the EPBC and TSC Acts)
- Eastern Falsistrelle (vulnerable, TSC Act)
- Large-footed Myotis (vulnerable, TSC Act)
- Greater Broad-nosed Bat (vulnerable, TSC Act)
- East-coast Freetail Bat (vulnerable, TSC Act).

With reference to the criteria provided in the EPBC Act's Significant Impact Guidelines and/or Part 1, Section 5A of the EPA Act, the proposed boat launching facility is not considered to have a significant effect on any of these species, or their habitats. As such, referral of the matter to the Federal Minister for the Environment and Energy for further consideration or approval in relation to the proposal would not be necessary. Similarly, the preparation of an SIS that further assesses and considers the scope of work proposed is not required.

No Koala populations are considered to occur within, or in close proximity to, the subject site. Through reference to the assessment criteria provided under SEPP 44, the study area is not considered to constitute Core Koala habitat. Giving consideration to the objectives of SEPP 44, it is considered that the proposal would not require the preparation of a Plan of Management for Koalas, or the adoption of any other appropriate mitigative measures.

The adoption of those mitigation measures provided would ensure that the development proposed is undertaken in an ecologically sustainable manner.

11. Recommendations

Based on the principles of Ecologically Sustainable Development, as identified in Schedule 2 of the Environmental Planning and Assessment Regulation, the following recommendations are provided:

- Those hollow-bearing trees present on site should be retained where possible, giving preference to those containing larger hollows.
- Any hollow bearing trees to be retained should be identified and clearly marked by a qualified independent ecologist prior to the undertaking of any clearing work.
- Prior to the undertaking of site clearing work, those hollow-bearing trees present (and which require removal) should be checked for sheltering animals by a qualified independent ecologist. The trees should be checked prior to, and after, their felling with any collected individuals being relocated locally.
- A qualified ecologist or wildlife carer should be present on-site during the felling of those hollow-bearing trees that occur within the development area.
- The ecologist/wildlife carer should provide advice on the most suitable way to fell those hollow-bearing trees that require clearing.
- 24 hours prior to the felling of those hollow-bearing trees that require clearing, all non-hollow-bearing trees, small trees, shrubs and ground cover plants should be cleared.
- Any animals injured during the clearing works should be collected and taken to a local veterinarian or wildlife carer for treatment.
- Where possible, any felled trees should not be mulched but should be relocated locally within the subject site to provide habitat for native species and their prey.
- To offset the loss of those hollow-bearing trees, nesting boxes should be erected within the retained woodland areas of the subject site. These boxes should be designed to meet the life cycle needs of both hollow dependant microchiropteran and native birds. Boxes should be erected at a ratio of two nesting boxes per hollow-bearing tree cleared.
- Nesting boxes should be monitored by a qualified ecologist for a period of no less than two years. During this time any damaged nesting boxes, or those that are occupied by exotic species (e.g. Bees), should be replaced or repaired.
- Where practical, fencing should be established between the proposed boat launch facility and the gully to the south.
- During construction, those areas that occur beyond the proposal footprint and which are to be retained should be clearly marked on site as well as on any plans provided to contractors. These areas should be marked as ‘no-go zones’.
- Personnel must be made aware of the ‘no-go zones’.

- No compound, stockpiles of material or waste, machinery or personnel shall be permitted in the 'no-go zones' during construction.

- Sewer and powerline easements should be sighted to ensure that root damage to any of the hollow-bearing trees that are being retained does not occur.

- Landscaping should employ the use of locally-occurring native plant species and avoid the use of invasive species.

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Appendix 1. Photographic record of the area investigated

Plate 1: Character of the eucalypt woodland present within the subject site (note dense understorey layer)

Plate 2: Character of the eucalypt woodland present within the subject site (note open understorey layer)

Plate 3: Character of the western portion of Lake Conjola and foreshore vegetation within the subject site

Plate 4: Example of an existing track and drainage swale that is present within the subject site. Photograph taken looking east through site from Havilland Street

Appendix 2. Threatened flora and fauna species previously recorded in the study region and their 'likelihood of occurrence'

Key
V – vulnerable EP – endangered population E – endangered CE – critically endangered M – migratory

A State or nationally listed threatened species is considered to have a:

1. **High** likelihood of occurrence if it has been recorded within 10 km of the study area and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
2. **Moderate** likelihood of occurrence if they have a predicted occurrence (via the EPBC Act Protected Matters Search Tool or OEH geographic search) and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
3. **Low** likelihood of occurrence if suitable habitat for an animal is not present regardless of whether they have been recorded within 10 km, or have a predicted occurrence.

Note:
Species underlined are those which only the EPBC PMST predicted as having habitat in the search area. All other species have been recorded within 10 km of the study area. As these habitats are not present, no pelagic or estuarine species have been considered in the following table.

* - habitat requirements were generally extracted from Harden (1992-2002), Frith (2007), Churchill (2008), Cogger (2014), Van Dyck and Strahan (2008) and OEH (2017b), with other references used being identified in the bibliography.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
MAMMALS				
Spotted-tailed Quoll *Dasyurus maculatus*	E	V	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.	Low due to proximity of urban area.
Southern Brown Bandicoot *Isoodon obesulus obesulus*	E	E	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	Low due to proximity of urban area.
Long-nosed Potoroo *Potorous tridactylus*	V	V	Inhabits coastal heath and dry and wet sclerophyll forests with dense cover which provides diurnal sheltering sites and protection from predators, while foraging in adjacent, open areas.	Low due to proximity of urban area.
Koala *Phascolarctos cinereus*	V	V	Open eucalypt forest and woodland, containing a variety of 'preferred' food tree species.	Low. No suitable habitat present.
Eastern Pygmy-possum *Cercartetus nanus*		V	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	Moderate. Not detected. Foraging and potential roosting habitat present.

[6] For the site to support, and be important for the lifecycle requirements of, a locally viable population of this species

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
Brush-tailed Rock-wallaby *Petrogale penicillata*	V	E	Habitats containing numerous ledges, caves and crevices are favoured by this species.	Low. No suitable habitat present.
Yellow-bellied Glider *Petaurus australis*		V	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Low. Not detected and no scar trees evident.
Squirrel Glider *Petaurus norfolcensis*		V	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Low. Not detected and didn't respond to call playbacks.
Greater Glider *Petauroides volans*	V		Largely restricted to eucalypt forests and woodlands, utilising tree hollows.	Moderate. Not detected. Potential foraging and roosting habitat available.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	High. May potentially fly over, or forage within, the study area.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Cave-roosting bat that forages in timbered woodland and dry sclerophyll forest.	High. Foraging habitat available only. This species would not solely rely on the habitats present within the subject site for its life cycle requirements.
Eastern Falsistrelle *Falsistrellus tasmaniensis*		V	Prefers moist habitats. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	High. Foraging and potential roosting habitat present.
Eastern Bentwing Bat *Miniopterus* (*schreibersii*) *orianae oceanensis*		V	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Forages in well-timbered habitats and open grasslands.	High. Foraging habitat available only. This species would not solely rely on the habitats present within the subject site for its life cycle requirements.
Large-footed Myotis *Myotis macropus*		V	Generally roost close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	High. Foraging and potential roosting habitat present.
East-coast Freetail Bat *Micronomus norfolkensis*		V	This species is known to predominantly roost during the day in tree hollows within dry eucalypt forest and woodlands.	High. Foraging and potential roosting habitat present.
Greater Broad-nosed Bat *Scoteanax rueppellii*		V	Preferring habitats which range from rainforests through to woodlands, this species usually roosts in tree hollows, though some individuals have been found in the roof spaces of old buildings.	High. Foraging and potential roosting habitat present.
New Holland Mouse *Pseudomys novaehollandiae*	V		Open heathland, open woodland with a heathland understorey and vegetated sand dunes.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
Smoky Mouse *Pseudomys fumeus*	E	CE	The Smoky Mouse appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast (in Victoria) to sub-alpine regions of up to 1800 metres, but sometimes occurs in ferny gullies.	Low. No suitable habitat present.
BIRDS				
Eastern Osprey *Pandion cristatus*	M	V	A fish eating raptor, the Osprey inhabits mainly coastline areas. Nests are usually constructed in a large, dead tree, though rocky outcrops and artificial structures are also known to be used.	Low. No suitable habitat present.
Sooty Oystercatcher *Haematopus fuliginosus*		V	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Low. No suitable habitat present.
Pied Oystercatcher *Haematopus longirostris*		E	Favours intertidal flats of inlets and bays, open beaches and sandbanks.	Low. No suitable habitat present.
Hooded Plover *Thinornis rubricollis*	V	CE	Endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay, NSW, south through Victoria and Tasmania to the western side of the Eyre Peninsula (South Australia). Prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting.	Low. No suitable habitat present.
Eastern Curlew *Numenius madagascariensis*	CE, M		Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves.	Low. No suitable habitat present.
Little Tern *Sternula albifrons*		E	Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	Low. No suitable habitat present.
Australian Fairy Tern *Sternula nereis nereis*	V		Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayment's of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline.	Low. No suitable habitat present.
Black Bittern *Ixobrychus flavicollis*		V	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Low. No suitable habitat present.
Fork-tailed Swift *Apus pacificus*	M		Almost exclusively aerial. Takes insects on wing over a range of habitat types, but also less then 1 m above open areas or over water. Mostly occur over inland plains but sometimes above foothills or in coastal areas.	Low. May potentially fly over study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
Bar-tailed Godwit *Limosa lapponica*	M		Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bay.	Low. No suitable habitat present.
Common Greenshank *Tringa nebularia*	M		Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity.	Low. No suitable habitat present.
Square-tailed Kite *Lophoictinia isura*		V	Coastal and sub-coastal open forests and woodlands. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
White-bellied Sea-eagle *Haliaeetus leucogaster*	Ma	V	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands. Habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea).	Recorded during the field investigation. Refer to Appendix 5.
Little Eagle *Hieraaetus morphnoides*		V	Inhabits open woodlands, open eucalypt forests, grasslands and arid regions that are rich in prey species, shunning dense forest.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Australian Painted Snipe *Rostratula australis*	E	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low. No suitable habitat present.
Latham's Snipe *Gallinago hardwickii*	M		Wet, treeless, tussocky grasslands, short grasses and/or marshes along freshwater streams and channels, though it can also be found in any vegetation around freshwater wetlands, in sedges, grasses, lignum, reeds and rushes, saltmarshes, creek edges, crops and pastures.	Low. No suitable habitat present.
Gang-gang Cockatoo *Callocephalon fimbriatum*		V	Prefers tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests during summer, these being at higher altitudes. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, or in dry forest in coastal areas.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Glossy Black-cockatoo *Calyptorhynchus lathami*		V	Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits.	Low. Not detected and no occurrences of crushed casuarina cones observed.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
Little Lorikeet *Glossopsitta pusilla*		V	Forages primarily in the open Eucalypt forest and woodland canopies, particularly along water courses; occasionally in Angophoras, Melaleucas and other tree species, also riparian habitats are used. They eat pollen, nectar, blossoms, native and cultivated fruits and seeds.	Recorded during the field investigation. Refer to Appendix 5.
Swift Parrot *Lathamus discolor*	E	E	Eucalypt forests. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements
Orange-bellied Parrot *Neophema chrysogaster*	CE	CE	Spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes.	Low. No suitable habitat present.
Oriental Cuckoo *Cuculus optatus*	M		Mainly inhabiting forests; occurs in mixed, deciduous and coniferous forest.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements
Barking Owl *Ninox connivens*		V	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas.	Low. No suitable habitat present.
Powerful Owl *Ninox strenua*		V	Large tracts of open or closed sclerophyll forest or woodlands but can occur in fragmented landscapes as well. Gullies consisting of wet to dry sclerophyll forest with a dense understorey.	Low. Species targeted but not recorded.
Masked Owl *Tyto novaehollandiae*		V	Open forest with a sparse mid-storey layer, but with patches of dense low ground cover.	Low. Species targeted but not recorded.
Sooty Owl *Tyto tenebricosa*		V	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Recorded during the field investigation. Refer to Appendix 5.
Brown Treecreeper *Climacteris picumnus victoriae*		V	Found in eucalypt woodlands 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; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
Eastern Bristlebird *Dasyornis brachypterus*	E	E	Dense, low vegetation including heath and open woodland with a heath understorey.	Low. No suitable habitat present.
Regent Honeyeater *Anthochaera phrygia*	CE	CE	Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Low. No suitable habitat present.
Varied Sittella *Daphoenositta chrysoptera*		V	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements
Pink Robin *Petroica rodinogaster*		V	Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Low. No suitable habitat present.
White-throated Needletail *Hirundapus caudacutus*	M		Almost exclusively aerial. Takes insects on wing over a range of habitat types, recorded most often above wooded areas.	Low. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements
Rufous Fantail *Rhipidura rufifrons*	M		Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts.	Low. No suitable habitat present.
Satin Flycatcher *Myiagra cyanoleuca*	M		Mainly inhabit eucalypt forests, often near wetlands or watercourses.	Low. No suitable habitat present.
Black-faced Monarch *Monarcha melanopsis*	M		Rainforest and wet eucalypt forest.	Low. No suitable habitat present.
Spectacled Monarch *Monacrha trivirgatus*	M		Rainforest, mangroves and moist gloomy gullies of dense eucalypt forest.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[6]
	EPBC Act	TSC Act		
REPTILES				
Broad-headed Snake *Hoplocephalus bungaroides*	V	E	The Broad-headed Snake is confined to the sandstone ranges within the wider Sydney basin. Often found in rocky outcrops and adjacent sclerophyll forest and woodland.	Low. No suitable habitat present.
AMPHIBIANS				
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Mostly restricted to areas of Hawkesbury Sandstone. This frog has a marked preference for sandstone ridge top habitat and broader upland valleys that run through heathland and woodland. Lives in small semi-permanent to slightly flowing streams.	Low. No suitable habitat present.
Green and Golden Bell Frog *Litoria aurea*	V	E	Inhabits a variety of environments, including disturbed sites, ephemeral ponds, wetlands, marshes, dams and stream-sides, particularly those that contain one or more of the following aquatic plants: bullrush (*Typha* spp.), spikerush (*Eleocharis* spp.), *Juncus kraussii*, *Schoenoplectus littoralis* and *Sporobolus virginicus.*	Low. No suitable habitat present.
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation.	Low. No suitable habitat present.
Stuttering Frog *Mixophyes balbus*	V	E	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Low. No suitable habitat present.

Appendix 3. Fauna species recorded or previously detected in the vicinity of the study area

Source of Records

1 = Species recorded during present study
2 = OEH (2017a)
3 = Conjola National Park Plan of Management (2009)
4 = eBird Australia (2009-2016)
5 = Lesryk Environmental Consultants (2016)
6 = Lesryk Environmental Consultants (2011)
7 = Lesryk Environmental Consultants (2010)
8 = Lesryk Environmental Consultants (2006)
9 = Lesryk Environmental Consultants (2002)

Key
A – species listed under the EPBC Act
F – migratory Family listed under the EPBC Act
M – species listed as migratory/and or marine under the EPBC Act
B – species listed under the TSC Act
E – species is endangered
C – species is critically endangered
V – species is Vulnerable
P – preliminary determination made for listing as Vulnerable
Co – confident Identification
* – introduced species

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
		MAMMALS										
			Tachyglossidae									
		Short-beaked Echidna	*Tachyglossus aculeatus*	x				x				x
			Dasyuridae									
E	V	Spotted-tailed Quoll	*Dasyurus maculatus*			x						
		Brown Antechinus	*Antechinus stuartii*	x				x				
		Dusky Antechinus	*Antechinus swainsonii*			x						
	V	White-footed Dunnart	*Sminthopsis leucopus*			x						
			Peramelidae									
E	E	Southern Brown Bandicoot	*Isoodon obesulus*		x	x						

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
		Long-nosed Bandicoot	*Perameles nasuta*	x				x				x
			Phascolarctidae									
V	V	Koala	*Phascolarctos cinereus*		x							
			Vombatidae									
		Common Wombat	*Vombatus ursinus*							x		
			Burramyidae									
	V	Eastern Pygmy-possum	*Cercartetus nanus*		x							
			Petauridae									
	V	Yellow-bellied Glider	*Petaurus australis*		x	x		x				
		Sugar Glider	*Petaurus breviceps*	x				x				x
	V	Squirrel Glider	*Petaurus norfolcensis*		x	x						
			Pseudocheiridae									
V		Greater Glider	*Petauroides volans*		x			x		x		x
		Common Ringtail Possum	*Pseudocheirus peregrinus*					x		x		
			Acrobatidae									
		Feathertail Glider	*Acrobates pygmaeus*	x								
			Phalangeridae									
		Common Brushtail Possum	*Trichosurus vulpecula*	x				x				x
			Potoroidae									
V	V	Long-nosed Potoroo	*Potorous tridactylus*		x	x						
			Macropodidae									
		Eastern Grey Kangaroo	*Macropus giganteus*	x				x	x			
		Swamp Wallaby	*Wallabia bicolor*	x				x	x	x		x
			Pteropodidae									
V	V	Grey-headed Flying-fox	*Pteropus poliocephalus*		x	x		x				x
		Little Red Flying-fox	*Pteropus scapulatus*			x						
			Emballonuridae									
	V	Yellow-bellied Sheathtailbat	*Saccolaimus flaviventris*									x
			Rhinolophidae									
		Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	Co								
			Vespertilioidae									
		Gould's Wattled Bat	*Chalinolobus gouldii*					x		x		x
		Chocolate Wattled Bat	*Chalinolobus morio*	Co				x				
	V	Eastern Falsistrelle	*Falsistrellus tasmaniensis*		x			x				x
	V	Large-footed Myotis	*Myotis macropus*		x	x						
		Long-eared Bat	*Nyctophilus sp.*					x		x		
	V	Greater Broad-nosed Bat	*Scoteanax rueppellii*		x	x				x		

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
		Eastern Broad-nosed Bat	*Scotorepens orion*									x
		Large Forest Bat	*Vespadelus darlingtoni*	Co				x		x		x
		Southern Forest Bat	*Vespadelus regulus*							x		
		Little Forest Bat	*Vespadelus vulturnus*	Co				x		x		x
			Miniopteridae									
	V	Eastern Bentwing Bat	*Miniopterus* (*schreibersii*) *orianae oceanensis*		x	x		x				x
			Molossidae									
		White-striped Freetail Bat	*Austronomus australis*					x		x		
	V	East-coast Freetail Bat	*Micronomus norfolkensis*		x							
			Muridae									
		Bush Rat	*Rattus fuscipes*					x				
			Canidae									
		* Fox	*Vulpes vulpes*									x
		* Dog	*Canis familiaris*	x								x
		BIRDS										
			Phasianidae									
		Brown Quail	*Coturnix ypsilophora*				x					
		King Quail	*Coturnix chinensis*			x						
F			**Anatidae**									
		Pacific Black Duck	*Anas superciliosa*				x	x		x		x
		Grey Teal	*Anas gracilis*					x				
		Chestnut Teal	*Anas castanea*	x			x	x		x		
		Australian Wood Duck	*Chenonetta jubata*	x			x	x	x			x
			Columbidae									
		Topknot Pigeon	*Lopholaimus antarcticus*				x					
		White-headed Pigeon	*Columba leucomela*									x
		* Rock Dove	*Columba livia*									x
		* Spotted Dove	*Streptopelia chinensis*				x	x				x
		Brown Cuckoo-Dove	*Macropygia amboinensis*				x					
		Common Bronzewing	*Phaps chalcoptera*	x								
		Crested Pigeon	*Ocyphaps lophotes*				x	x	x			x
		Wonga Pigeon	*Leucosarcia picata*				x					
			Podargidae									
		Tawny Frogmouth	*Podargus strigoides*					x				
			Aegothelidae									
		Australian Owlet-nightjar	*Aegotheles cristatus*							x		

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
			Apodidae									
M		White-throated Needletail	*Hirundapus caudacutus*				x	x				
			Phalacrocoracidae									
		Little Black Cormorant	*Phalacrocorax sulcirostris*	x								
			Ardeidae									
		White-necked Heron	*Ardea pacifica*				x					
		White-faced Heron	*Egretta novaehollandiae*	x			x					
M		Great Egret	*Ardea alba*	x								
	V	Black Bittern	*Ixobrychus flavicollis*		x	x						
E	E	Australasian Bittern	*Botaurus poiciloptilus*			x						
			Threskiornidae									
		Australian White Ibis	*Threskiornis molucca*								x	
		Straw-necked Ibis	*Threskiornis spinicollis*				x					
		Royal Spoonbill	*Platalea regia*	x								
F			**Accipitridae**									
		Black-shouldered Kite	*Elanus axillaris*				x					
M	V	Eastern Osprey	*Pandion cristatus*		x	x						
	V	Square-tailed Kite	*Lophoictinia isura*		x	x						
		Whistling Kite	*Haliastur sphenurus*				x					
M	V	White-bellied Sea-eagle	*Haliaeetus leucogaster*	x	x		x					x
		Wedge-tailed Eagle	*Aquila audax*				x					
	V	Little Eagle	*Hieraaetus morphnoides*		x							
		Collared Sparrowhawk	*Accipiter cirrocephalus*	x			x					
		Brown Goshawk	*Accipiter fasciatus*				x					
		Grey Goshawk	*Accipiter novaehollandiae*	x			x					
		Swamp Harrier	*Circus approximans*				x					
F			**Falconidae**									
		Peregrine Falcon	*Falco peregrinus*				x					
		Brown Falcon	*Falco berigora*				x					
		Nankeen Kestrel	*Falco cenchroides*				x					x
			Rallidae									
M		Spotless Crake	*Porzana tabuensis*			x						
		Purple Swamphen	*Porphyrio porphyrio*					x				
			Haematopodidae									
	E	Australian Pied Oystercatcher	*Haematopus longirostris*		x	x						
	V	Sooty Oystercatcher	*Haematopus fuliginosus*		x	x						
			Recurvirostridae									

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
M		Black-winged Stilt	*Himantopus himantopus*			x						
F			**Charadriidae**									
		Masked Lapwing	*Vanellus miles*	x			x		x			x
	C	Hooded Plover	*Thinornis rubricollis*		x	x						
M		Double-banded Plover	*Charadrius bicinctus*			x						
F			**Scolopacidae**									
M		Eastern Curlew	*Numenius madagascariensis*		x							
			Turnicidae									
		Painted Button-quail	*Turnix varius*				x					
			Laridae									
M	E	Little Tern	*Sternula albifrons*		x	x						
			Cacatuidae									
	V	Glossy Black-Cockatoo	*Calyptorhynchus lathami*		x	x				x		
		Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*				x	x				x
	V	Gang-gang Cockatoo	*Callocephalon fimbriatum*		x	x		x				
		Galah	*Eolophus roseicapillus*	x			x	x	x			x
		Little Corella	*Cacatua sanguinea*	x			x			x		x
		Sulphur-crested Cockatoo	*Cacatua galerita*	x			x	x		x	x	x
			Psittacidae									
		Rainbow Lorikeet	*Trichoglossus haematodus*	x			x	x	x	x	x	x
		Musk Lorikeet	*Glossopsitta concinna*	x			x	x		x	x	x
	V	Little Lorikeet	*Glossopsitta pusilla*	x	x			x				
		Australian King Parrot	*Alisterus scapularis*	x			x	x	x	x		x
E	E	Swift Parrot	*Lathamus discolor*		x	x						
	V	Turquoise Parrot	*Neophema pulchella*			x						
		Crimson Rosella	*Platycercus elegans*	x			x	x	x	x		x
		Eastern Rosella	*Platycercus eximius*				x				x	
			Cuculidae									
		Pallid Cuckoo	*Cacomantis pallidus*				x					
		Brush Cuckoo	*Cacomantis variolosus*				x					
		Fan-tailed Cuckoo	*Cacomantis flabelliformis*	x			x			x		
		Shining Bronze-Cuckoo	*Chalcites lucidus*				x					
		Eastern Koel	*Eudynamys orientalis*				x			x		
		Channel-billed Cuckoo	*Scythrops novaehollandiae*				x					
			Strigidae									
	V	Powerful Owl	*Ninox strenua*		x	x		x				
		Southern Boobook	*Ninox novaeseelandiae*				x	x		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
	V	Barking Owl	*Ninox connivens*		x							
			Tytonidae									
	V	Sooty Owl	*Tyto tenebricosa*	x	x	x						
	V	Masked Owl	*Tyto novaehollandiae*		x	x						
			Halcyonidae									
		Laughing Kookaburra	*Dacelo novaeguineae*	x			x	x	x	x		x
		Sacred Kingfisher	*Todiramphus sanctus*				x	x		x	x	
			Coraciidae									
		Dollarbird	*Eurystomus orientalis*				x			x		
			Menuridae									
		Superb Lyrebird	*Menura novaehollandiae*				x					
			Climacteridae									
		White-throated Treecreeper	*Cormobates leucophaea*	x			x	x	x	x	x	x
	V	Brown Treecreeper	*Climacteris picumnus*		x							
			Ptilonorhynchidae									
		Green Catbird	*Ailuroedus crassirostris*				x					
		Satin Bowerbird	*Ptilonorhychus violaceus*	x			x		x			x
			Maluridae									
		Superb Fairy-wren	*Malurus cyaneus*	x			x	x	x	x	x	x
		Variegated Fairy-wren	*Malurus lamberti*					x		x		x
			Acanthizidae									
		White-browed Scrubwren	*Sericornis frontalis*	x			x	x	x	x		x
		White-throated Gerygone	*Gerygone albogularis*				x			x		
		Brown Gerygone	*Gerygone mouki*				x					
		Brown Thornbill	*Acanthiza pusilla*	x			x	x	x			x
		Yellow Thornbill	*Acanthiza nana*				x					
		Striated Thornbill	*Acanthiza lineata*	x			x	x	x	x	x	x
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				x					
			Pardalotidae									
		Spotted Pardalote	*Pardalotus punctatus*	x			x	x	x	x		x
		Striated Pardalote	*Pardalotus striatus*				x					
			Meliphagidae									
		Red Wattlebird	*Anthochaera carunculata*	x			x	x	x	x	x	x
		Little (Brush) Wattlebird	*Anthochaera chrysoptera*				x					x
		Noisy Friarbird	*Philemon corniculatus*	x			x	x		x	x	x
C	C	Regent Honeyeater	*Anthochaera phrygia*		x	x						
		Noisy Miner	*Manorina melanocephala*					x				x

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
		Lewin's Honeyeater	*Meliphaga lewinii*	x			x		x		x	
		Yellow-faced Honeyeater	*Lichenostomus chrysops*	x			x	x		x	x	x
		White-eared Honeyeater	*Lichenostomus leucotis*					x				
		White-plumed Honeyeater	*Lichenostomus pencillatus*									x
		Brown-headed Honeyeater	*Melithreptus brevirostris*	x			x					x
		White-naped Honeyeater	*Melithreptus lunatus*				x					
		White-cheeked Honeyeater	*Phylidonyris niger*	x						x		
		New Holland Honeyeater	*Phylidonryis novaehollandiae*				x	x	x			x
		Brown Honeyeater	*Lichmera indistincta*					x				
		Eastern Spinebill	*Acanthorhynchus tenuirostris*				x	x		x		x
		Scarlet Honeyeater	*Myzomela sanguinolenta*				x	x		x		
			Psophodidae									
		Eastern Whipbird	*Psophodes olivaceus*	x			x		x	x	x	x
			Neosittidae									
	V	Varied Sittella	*Daphoenositta chrysoptera*		x		x	x			x	x
			Campephagidae									
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	x			x			x		x
		White-winged Triller	*Lalage sueurii*				x					
			Pachycephalidae									
		Crested Shrike-tit	*Falcunculus frontatus*				x					
		Grey Shrike-thrush	*Colluricincla harmonica*	x			x	x	x	x		x
		Golden Whistler	*Pachycephala pectoralis*				x					x
		Rufous Whistler	*Pachycephala rufiventris*				x			x		x
			Oriolidae									
		Olive-backed Oriole	*Oriolus sagittatus*				x					
			Artamidae									
	V	Dusky Woodswallow	*Artamus cyanopterus*				x					
		Grey Butcherbird	*Cracticus torquatus*	x			x	x	x			x
		Australian Magpie	*Cracticus tibicen*	x			x	x	x	x		x
		Pied Currawong	*Strepera graculina*	x			x					x
		Grey Currawong	*Strepera versicolor*				x					
			Rhipiduridae									
		Grey Fantail	*Rhipidura albiscapa*	x			x	x	x	x	x	x
M		Rufous Fantail	*Rhipidura rufifrons*				x				x	
		Willie Wagtail	*Rhipidura leucophrys*				x			x	x	x
			Corvidae									
		Australian Raven	*Corvus coronoides*				x	x	x	x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
			Monarchidae									
		Leaden Flycatcher	*Myiagra rubecula*	x			x	x			x	
M		Satin Flycatcher	*Myiagra cyanoleuca*				x					
M		Black-faced Monarch	*Monarcha melanopsis*				x				x	x
M		Spectacled Monarch	*Symposiarchus trivirgatus*				x					
		Magpie-lark	*Grallina cyanoleuca*	x			x	x	x	x		x
			Corcoracidae									
		White-winged Chough	*Corcorax melanorhamphos*				x					
			Petroicidae									
		Rose Robin	*Petroica rosea*				x					
	V	Pink Robin	*Petroica rodinogaster*		x							
		Eastern Yellow Robin	*Eopsaltria australis*	x			x	x	x	x	x	x
		Jacky Winter	*Microeca fascinans*				x					
			Timaliidae									
		Silvereye	*Zosterops lateralis*	x			x		x			x
			Hirundinidae									
		Welcome Swallow	*Hirundo neoxena*				x		x			x
		Fairy Martin	*Petrochelidon ariel*								x	
F			**Turdidae**									
		* Common Blackbird	*Turdus merula*				x					
			Sturnidae									
		* Common Starling	*Sturnus vulgaris*				x					x
		* Common Myna	*Sturnus tristis*				x	x				x
			Nectariniidae									
		Mistletoebird	*Dicaeum hirundinaceum*				x			x		
			Estrildidae									
		Red-browed Finch	*Neochmia temporalis*	x			x	x				x
		Beautiful Firetail	*Stagonopleura bella*			x						
			Passeridae									
		* House Sparrow	*Passer domesticus*									x
			Fringillidae									
		* Common Greenfinch	*Chloris chloris*				x					
		* European Goldfinch	*Carduelis carduelis*				x					
		REPTILES										
			Scincidae									
		Copper-tailed Skink	*Ctenotus taeniolatus*			x						
		Eastern Water Skink	*Eulamprus quoyii*					x				

A	B	Common Name	Family and Scientific Name	1	2	3	4	5	6	7	8	9
		Dark-flecked Garden Sun-skink	*Lampropholis delicata*					x		x		x
		Eastern Blue-tongued Lizard	*Tiliqua scincoides*									x
			Agamidae									
		Jacky Lizard	*Amphibolurus muricatus*							x		x
			Varanidae									
		Lace Monitor	*Varanus varius*					x				
			Elapidae									
V	E	Broad-headed Snake	*Hoplocephalus bungaroides*			x						
		Red-bellied Black Snake	*Pseudechis porphyriacus*									x
		Eastern Brown Snake	*Pseudonaja textilis*					x				
		AMPHIBIANS										
			Limnodynastidae									
V	V	Giant Burrowing Frog	*Heleioporus australiacus*			x						
		Brown-striped Frog	*Limnodynastes peronii*					x		x		x
		Spotted Grass Frog	*Limnodynastes tasmaniensis*									x
			Myobatrachidae									
		Common Eastern Froglet	*Crinia signifera*	x				x	x	x		x
		Brown Toadlet	*Pseudophryne bibronii*							x		
			Hylidae									
V	E	Green and Golden Bell Frog	*Litoria aurea*		x	x						
		Bleating Tree Frog	*Litoria dentata*					x		x		
		Eastern Dwarf Tree Frog	*Litoria fallax*					x				
		Freycinet's Frog	*Litoria freycineti*			x						
		Jervis Bay Tree Frog	*Litoria jervisiensis*							x		
		Peron's Tree Frog	*Litoria peronii*					x		x		x

Appendix 4: Echolocation results

Survey Location	Common Name	Scientific Name	Call Confidence	Time of 1st pass
13 July				
	Large Forest Bat	*Vespadelus darlingtoni*	C	2129
14 July				
	no calls			
15 July				
	Little Forest Bat	*Vespadelus vulturnus*	C	2247
16 July				
	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	C	0245
17 July				
	Little Forest Bat	*Vespadelus vulturnus*	C	2136
18 July				
	Chocolate Wattled Bat	*Chalinolobus morio*	C	2142
	Little Forest Bat	*Vespadelus vulturnus*	C	2124
19 July				
	no calls			
20 July				
	no calls			
21 July				
	no calls			
22 July				
	no calls			
23 July				
	no calls			
24 July				
	Chocolate Wattled Bat	*Chalinolobus morio*	C	2255
25 July				
	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	C	0227

C - Confident Identification. Small possibility of confusion of calls with those of other bat species.

Appendix 5: Ecological Assessments

When undertaking the assessments below the following assumptions have been made in regard to the proposed development:

- approximately seven hollow-bearing trees will require removal
- approximately 1 ha of vegetation will require removal.

Should these assumptions be untrue, the following assessments must be reviewed.

1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999*

By the completion of the field investigation, one species, the White-bellied Sea-eagle, listed as marine under the EPBC Act had been recorded. In regards to this bird it is acknowledged that the proposal is not located within a Commonwealth marine area, this being from 3 to 200 nautical miles from the coast; as such, no assessment using the EPBC Significant Impact Guidelines that are relevant to the Commonwealth marine environment is required.

Based on the results of the field investigations, the observations of the habitat present and as it has been previously recorded in the study region, it is considered appropriate to adopt a precautionary approach and assume the presence of the Grey-headed Flying-fox (which is listed as vulnerable under the Act).

The following assessment guidelines prepared under the Act (DE 2013) are used to determine whether the action has, will have, or is likely to have a significant impact on these MNES.

Potential occurring species

1. (a) Grey-headed Flying-fox – vulnerable

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of an important population of a species,*

No important Grey-headed Flying-fox populations occur within, or close to, the study area. The proposal will not have any indirect impacts that may affect an important population of this species.

Compared to the extent of similar resources being retained within the remainder of the subject site, and within the surrounding locality, the proposal is not considered to reduce the overall extent of foraging opportunities available to the Grey-headed Flying-fox, nor adversely affect the life cycle of this species such that its local population would be placed at risk of extinction. No roosting camps for this species were identified during the investigation.

The proposal would not lead to a long-term decrease in the size of an important population of this species.

- *reduce the area of occupancy of an important population,*

No important Grey-headed Flying-fox populations occur within, or close to, the study area. Therefore, the proposal would not reduce the area of occupancy available to an important population of this species.

- *fragment an existing important population into two or more populations,*

No important Grey-headed Flying-fox populations occur within, or close to, the study area. Furthermore, the Grey-headed Flying-fox's ability to fly and negotiate open spaces and urban

infrastructure would ensure that the proposal does not fragment an existing population into two or more populations.

- *adversely affect habitat critical to the survival of a species,*

No habitat critical to the survival of this species was recorded within the study area.

- *disrupt the breeding cycle of an important population,*

No important Grey-headed Flying-fox populations occur within, or close to, the study area. As such, the breeding cycle of an important population would not be disrupted. As an aside, no active or historic Flying-fox colonies were observed within the study area.

- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,*

This species is not considered to be solely reliant upon the resources offered by the subject site such that the proposed development would cause the Grey-headed Flying-fox to decline.

- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,*

The existing diversity of introduced (invasive) species that have established within the subject site are not harmful to the presence of this species. The proposed development is not expected to result in the establishment of any invasive species that may be harmful to the presence of the Grey-headed Flying-fox or its habitat.

- *introduce disease that may cause the species to decline,*

The proposal is unlikely to introduce diseases that may cause the Grey-headed Flying-fox to decline.

- *or interfere substantially with the recovery of the species.*

A National Recovery Plan (draft) for the Grey-headed Flying-fox has been prepared (DECCW 2009). The overall objectives of this plan are:

- to reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range
- to conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination
- to improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

The scope of proposed work would not affect any known roosting camps. The scope of work proposed would not be inconsistent with the objectives specified in this species' recovery plan, specifically the following four objectives of the plan:

- **Objective 1**. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.

  No foraging habitat critical to the survival of the Grey-headed Flying-fox is present within the area proposed to be disturbed.

- **Objective 2**. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.

  No seasonal Grey-headed Flying-fox foraging habitat is present within the area proposed to be disturbed.

- **Objective 3**.To identify roosting habitat critical to the survival of Grey-headed Flying-foxes.

  No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the area proposed to be disturbed.

- **Objective 4**.To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes.

  No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the area proposed to be disturbed.

Conclusion

The proposal is not considered to have a significant impact on the Grey-headed Flying-fox, its population or habitat. As such, it is not considered necessary that the matter be referred to the Federal Minister for the Environment and Energy for further consideration or approval.

2. State - *Environmental Planning and Assessment Act 1979*

The following matters listed under the TSC Act were recorded within the study area:

- White-bellied Sea-eagle – listed as vulnerable
- Sooty Owl – vulnerable
- Little Lorikeet – vulnerable.

Additionally, as suitable habitat is present and they have been previously recorded in the study region, the following State listed threatened species could potentially occur within the subject site:

- Eastern Pygmy-possum – listed as vulnerable under the TSC Act
- Grey-headed Flying-fox – vulnerable
- Eastern Falsistrelle – vulnerable
- Large-footed Myotis – vulnerable
- Greater Broad-nosed Bat – vulnerable
- East-coast Freetail Bat – vulnerable.

The potential impacts associated with the establishing the proposed boat launching facility on those species recorded or potentially occurring is considered with reference to the assessment criteria provided under Part 1, Section 5A of the EPA Act. These criteria consider factors that trigger the likelihood of a development to have a significant effect on threatened species, population or ecological communities or their habitats, and consequently whether a SIS is required.

In line with the guidelines provided by OEH (then DECC) on the Assessment of Significance (DECC 2007), due to the similarity of their habitat requirements, an assessment has been undertaken on:

- 'hollow-dependent microchiropteran' as opposed to individual assessments being carried out on the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat and East-coast Freetail Bat

Recorded species

2. (a) White-bellied Sea-eagle – 7 Part-test

(a) *in the case of a threatened species, whether the action proposed 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 White-bellied Sea-eagle was observed flying over Lake Conjola during the investigation. While this is the case, no nests typical of this species were observed within, close to or in the vicinity of, the subject site.

The loss of some native vegetation is not expected to result in the disturbance to the White-bellied Sea-eagle's dispersal or movement patterns. Suitable habitat for this species would be retained within both the subject site and surrounding locality; as such, the proposal would not have an adverse effect on the life cycle of this species such a viable local population is likely to be placed at risk of extinction.

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

An 'endangered population' is defined as a 'population specified in Part 2 of Schedule 1' of the TSC Act. The White-bellied Sea-eagle is not identified as an endangered population.

(c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(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
(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

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The White-bellied Sea-eagle is not listed as an endangered ecological community.

(d) *in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

The proposed work would remove around 1 ha of native vegetation, this including seven hollow-bearing trees (worst case scenario).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The loss of some native vegetation is not expected to result in the disturbance to the White-bellied Sea-eagle's dispersal or movement patterns. Suitable habitat for this species would be retained within

the study area and surrounding locality. As such, the proposal would not cause any further fragmentation of, or isolation to, any areas of habitat used by the White-bellied Sea-eagle.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,

The proposed work would disturb/remove around 1 ha of native vegetation. Suitable habitat for this species would be retained within the study area and surrounding locality; as such, given that no major components of this species' habitat are to be isolated or fragmented, it is not considered that proposal would have an impact on the White-bellied Sea-eagle such that the long term survival of this species in the locality would be adversely affected.

(e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3, Division 1 of the TSC Act.

(f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

No recovery plan has yet been drafted or finalised for the White-bellied Sea-eagle. Similarly, the White-bellied Sea-eagle has not yet been included under the Saving Our Species program (OEH 2017c). As such, neither priority or management sites, nor management actions, have been identified.

Foraging and breeding habitat for this species will be retained within the study area and surrounding locality, thereby ensuring the longevity of the White-bellied Sea-eagle in this locality.

(g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process,*

Currently 35 KTPs for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation' would be applicable to the proposal. While it is acknowledged that the proposed work will result in the removal of a small amount of vegetation, it is not considered that this clearance would significantly contribute to either of these KTPs such that the life cycle requirements of the White-bellied Sea-eagle would be compromised.

Expected impact on the White-bellied Sea-eagle

The establishment of the proposed boat launch facility would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the White-bellied Sea-eagle. It is not considered that the proposal would have a significant impact on this threatened species, its population or habitat. As such, the preparation of a SIS that further considers the impacts of the proposal on the White-bellied Sea-eagle is not required.

2. (b) Little Lorikeet

(a) in the case of a threatened species, whether the action proposed 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

A flock of Little Lorikeets were heard calling as they flew over the subject site. While hollow-bearing trees and suitable foraging resources (i.e. nectar producing plants) are present within the study area, no individuals of this species were observed occupying the site itself.

The proposal will require the removal of approximately 1 ha of native vegetation, this including seven hollow-bearing trees (worst case scenario). In both the study area and region, the loss of these plants is not considered to limit the extent of foraging, breeding or sheltering opportunities available to the Little Lorikeet. The proposed boat launch facility would not clear any significant areas of breeding habitat, nor would it erect any barriers that would have a negative impact on the viability of this species. Within the subject site and adjacent bushland areas, resources would be available for the life cycle needs of this species, thereby ensuring the local viability of its population. The proposal is therefore not considered to have an adverse effect on the Little Lorikeet or its local population, such that it would be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An 'endangered population' is defined as a 'population specified in Part 2 of Schedule 1' of the TSC Act. Therefore, the Little Lorikeet is not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *(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*
- *(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*

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The Little Lorikeet is not listed as an endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed work would remove around 1 ha of native vegetation, this including seven hollow-bearing trees (worst case scenario).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The loss of some native vegetation is not expected to result in the disturbance to this species dispersal or movement pattern. Suitable habitat for this species would be retained within the study area and nearby (and surrounding) localities. As such, the proposal would not cause any further fragmentation of, or isolation to, any areas of habitat used by the Little Lorikeet.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality

The proposal is not considered to remove, modify, fragment or isolate a significant amount of vegetation such that the long-term survival of the Little Lorikeet would be jeopardised. The habitats within the study area extend well beyond the limits of the proposal. Given that no major components of this species' habitat are to be further isolated or fragmented, and that the Little Lorikeet can negotiate open space areas and urban infrastructure, it is not considered that the proposal would have an impact on the Little Lorikeet such that the long term survival of this species in the locality would be adversely affected.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has not yet been drafted or finalised for the Little Lorikeet.

Under the Saving Our Species program, the Little Lorikeet has been assigned to the 'Landscape species' management stream (OEH 2017c). OEH is currently identifying priority sites for this species; in the interim, a number of management actions have been identified. Those relevant to the proposal are the retention of hollow-bearing trees.

While seven hollow-bearing trees (worst case scenario) will be removed as part of the proposal, hollow-bearing trees will be retained within, and beyond the limits of, the subject site. The presence of these resources within both the subject site and surrounding bushland will provide resources for, and ensure the longevity of, the Little Lorikeet in this locality.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Currently 35 KTP's for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the presence of the Little Lorikeet. The clearing of approximately 1 ha of native vegetation, this including seven hollow-bearing trees, is not considered a significant loss in comparison to the remaining vegetation within the subject site, study area and surrounding region. As such, it is not considered that the proposal would significantly contribute to a KTP such that the life cycle requirements of the Little Lorikeet would be compromised.

Expected impact on the Little Lorikeet

The establishment of the proposed boat launching facility would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Little Lorikeet. It is not considered that the proposal would have a significant impact on this threatened species, its population or habitat. As such, the preparation of a SIS that further considers the impacts of the proposal on the Little Lorikeet is not required.

2. (c) Sooty Owl

(a) in the case of a threatened species, whether the action proposed 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 Sooty Owl was recorded during one of the call playback sessions carried out along the eastern boundary of the subject site. When detected, this species was initially heard calling from a small gully area that occurs to the south of the broadcast location; however, during the playback session, the bird entered, and was observed within, the subject site itself. While resources for the foraging, roosting and breeding needs of this species are present within the subject site, given the time duration between broadcasting the calls of this species and its response, it is assumed this bird is roosting within the southern gully. Diurnal searches of the gully area did not locate any obvious evidence (such as white wash and owl pellets), and the individual was not observed.

The proposal would result in the removal of approximately 1 ha of native vegetation, this including seven hollow-bearing trees. A layout for the proposed boat launch facility has been designed giving consideration to the retention of the majority of hollow-bearing trees. As such, similar habitat to that being cleared would be retained within both the subject site and study area.

The retention of hollow-bearing trees would provide and retain essential sheltering resources within the subject site for those arboreal marsupials that make up the Sooty Owl's diet.

Wooded corridors available for the dispersal and interbreeding needs of this species would also be retained, these providing connectivity with the surrounding bushland areas and conservation reserves. The proposal is therefore not considered to have an adverse effect on the Sooty Owl, or its local population, such that it would be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An 'endangered population' is defined as a 'population specified in Part 2 of Schedule 1' of the TSC Act. Therefore, the Sooty Owl is not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *(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*
- *(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*

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The Sooty Owl is not listed as an endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed work would remove around 1 ha of native vegetation, this including seven hollow-bearing trees (worst case scenario).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The loss of some native vegetation is not expected to result in the disturbance to this species dispersal or movement pattern. Suitable habitat for this species would be retained within the study area and nearby (and surrounding) localities. As such, the proposal would not cause any further fragmentation of, or isolation to, any areas of habitat used by the Sooty Owl.

(*iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality*

The proposal is not considered to remove, modify, fragment or isolate a significant amount of vegetation such that the long-term survival of the Sooty Owl would be jeopardised. The habitats within the subject site extend well beyond the boundaries of the proposal. Given that no major components of this species' habitat are to be further isolated or fragmented, it is not considered that the proposal would have an impact on the Sooty Owl such that the long term survival of this species in the locality would be adversely affected.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has been prepared by DEC for the Large Forest Owls, this including the Sooty Owl (DEC 2006), the overall objective being 'to ensure that viable populations of the three species continue in the wild in NSW in each region where they presently occur'. With reference to the Recovery Objectives, Actions and Performance Criteria provided in Chapter 9 of this publication, Section 9.3.4 'Manage and protect habitat off reserves and state forests' would be relevant to the current proposal, the following being applicable to the proposal:

- Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes

Under the Saving Our Species program, the Sooty Owl has been assigned to the 'Landscape species' management stream (OEH 2017c). OEH is currently identifying priority sites for this species; in the interim, a number of actions have been identified, none of which are relevant to the current proposal. While this is the case, hollow-bearing trees will be retained within, and beyond the limits of, the work proposed. The retention of hollow-bearing trees within the property will also provide and retain essential sheltering resources within the subject site for those arboreal marsupials that make up the Sooty Owl's diet. Combined with the extent of the surrounding vegetated areas and fauna corridors, the long term survival of the Sooty Owl within, and in close proximity to, the subject site is ensured.

The proposed development is considered to be consistent with the objectives provided within the recovery plan.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Currently 35 KTP's for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the presence of the Sooty Owl. The clearing of approximately 1 ha of native vegetation, this including seven hollow-bearing trees, is not considered a significant loss of habitat for this species in comparison to the remaining vegetation within the subject site, study area and surrounding region. As such, it is not considered that the proposal would significantly contribute to a KTP such that the life cycle requirements of the Sooty Owl would be compromised.

Expected impact on the Sooty Owl

The undertaking of the proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Sooty Owl. A portion of woodland habitat available to this species (and its prey) would be removed; however, this, when compared to the extent of similar resources being retained in the subject site, study area and surrounding region, is not considered to be significant. Given the extent of clearing expected to occur, the proposal would not have an impact on any Sooty Owl dispersal or movement corridors, nor would it adversely affect any significant areas of this species' local or regional habitat. Therefore, based on the results of the field survey combined with the consultation of known literature sources, it is not considered that the proposal would have a significant impact on this threatened species, its population or habitats. As such, the preparation of a SIS that further considers the impacts of the proposal on the Sooty Owl is not required.

Potential occurring species

2. (d) Eastern Pygmy-possum

(a) *in the case of a threatened species, whether the action proposed 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*

While not detected during the current investigation, this species has been previously recorded in the locality. It is acknowledged that, within the subject site itself, few Banksia inflorescences occur (this being the main foraging resource of this species (OEH 2017b).

The proposal would require the removal of 1 ha of native vegetation, this including seven hollow-bearing trees. Compared to the extent of similar resources being retained within, and beyond the limits of, the subject site, the action is not considered to reduce the overall extent of habitat or foraging opportunities available to the Eastern Pygmy-possum, nor adversely affect the life cycle of this species such that its local population would be placed at risk of extinction.

It is acknowledged that large areas of suitable habitat for the Eastern Pygmy-possum would remain unaffected within the surrounding conservation reserves; land specifically legislated and managed for conservation purposes under the NPW Act and the Conjola Lakes NP Plan of Management (NPWS 2009).

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

An endangered population is defined under the TSC Act as 'a population specified in Part 2 of Schedule 1'. The Eastern Pygmy-possum is not listed as an endangered population.

(c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(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

(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

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The Eastern Pygmy-possum is not listed as an endangered ecological community.

(d) *in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed work would remove around 1 ha of native vegetation, this including seven hollow-bearing trees (worst case scenario).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

The loss of 1 ha of native vegetation is not expected to result in the disturbance to this species' dispersal or movement patterns. Suitable habitat for this species would be retained in both the subject

site and study area. As such, the proposal would not cause any further fragmentation of, or isolation to, any areas of habitat used by the Eastern Pygmy-possum.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The vegetation present within the subject site is not considered to be important for the long-term survival of the Eastern Pygmy-possum. Given the extent of similar resources being retained within the surrounding conservation reserve, the proposed work and removal of around 1 ha of native vegetation is not considered to limit the extent of this species' foraging resources in either the local or regional context.

(e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)*

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

(f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan*

A recovery plan has not been prepared for the Eastern Pygmy-possum.

A targeted strategy for managing this species has been developed under the Saving Our Species program, the Eastern Pygmy-possum being assigned to the 'Landscape species' management stream (OEH 2017c). While no management sites for this species have yet been identified, OEH has provided a number of actions to guide management in regards to this species, none of which are relevant to the current proposal.

(g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process*

Currently 35 KTPs for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation' and 'removal of dead wood and trees' would be applicable to the presence of the Eastern Pygmy-possum. While this is the case, the removal and/or disturbance of around 1 ha of native vegetation, this including seven hollow-bearing trees, in comparison with the retention of similar resources in both the subject site and nearby conservation reserve, is not considered to significantly contribute to this KTP such that it would adversely affect the presence or long term survival of the Eastern Pygmy-possum.

Expected impact on the Eastern Pygmy-possum

The undertaking of the proposed action would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Eastern Pygmy-possum. The removal of around 1 ha of native vegetation, this including seven hollow-bearing trees, in comparison to the extent of similar resources being retained within the subject site and surrounding areas, is not considered to significantly impact this species. Given the likely scope of work proposed, it is not considered that the boat launching facility would have an impact on the Eastern Pygmy-possum's dispersal or movement corridors, nor would it adversely affect any significant areas of this species' local or regional habitat. Therefore, the preparation of a SIS that further considers the impacts of the proposal on the Eastern Pygmy-possum is not required.

2. (e) Grey-headed Flying-fox

(a) *in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction*

While not detected during the current investigation, this species has been previously recorded in the locality.

The proposal is expected to result in the loss of around 1 ha of potential foraging habitat available to this species. The loss/disturbance of this native vegetation is not considered to affect the life cycle of the Grey-headed Flying-fox, given the extent of similar resources being retained within both the subject site and surrounding conservation areas. Therefore, the action is not considered to reduce the overall extent of foraging opportunities available to the Grey-headed Flying-fox, nor adversely affect the life cycle of this species such that its local population would be placed at risk of extinction.

It is acknowledged that large areas of suitable habitat for the Grey-headed Flying-fox would remain unaffected within the surrounding conservation areas; land specifically legislated and managed for conservation purposes under the NPW Act.

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

An endangered population is defined under the TSC Act as 'a population specified in Part 2 of Schedule 1'. The Grey-headed Flying-fox is not listed as an endangered population.

(c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- *(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*
- *(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*

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The Grey-headed Flying-fox is not listed as an endangered ecological community.

(d) *in relation to the habitat of a threatened species, population or ecological community:*

- *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed*, *and*

The proposed work would remove around 1 ha of native vegetation.

- *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action*, *and*

The Grey-headed Flying-fox's ability to fly and negotiate open spaces and urban infrastructure would ensure that the proposal does not fragment an existing population into two or more populations.

- *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

The vegetation present within the subject site is not considered to be important for the long-term survival of the Grey-headed Flying-fox. Given the extent of similar resources within both the subject site and surrounding locality, the proposal is not considered to limit the extent of this species' foraging resources in either the local or regional context.

(e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)*

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

(f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

A National Recovery Plan (draft) for the Grey-headed Flying-fox has been prepared (DECCW 2009). The overall objectives of this plan are:

- to reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range
- to conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination
- to improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

The scope of proposed work would not affect any known roosting camps. The scope of work proposed would not be inconsistent with the objectives specified in this species' recovery plan, specifically the following four specific objectives of the plan:

- **Objective 1**. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.

  No foraging habitat critical to the survival of the Grey-headed Flying-fox is present within the subject site.

- **Objective 2**. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.

  No seasonal Grey-headed Flying-fox foraging habitat is present within the subject site.

- **Objective 3**.To identify roosting habitat critical to the survival of Grey-headed Flying-foxes.

  No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the subject site.

- **Objective 4**.To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes.

  No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the subject site.

(g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Currently 35 KTP's for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation' would be applicable to the presence of the Grey-headed Flying-fox. While this is the case, the removal and/or disturbance of around 1 ha of native vegetation, in comparison with the retention of similar resources in the study area and surrounding locality is not considered to significantly contribute to this KTP such that it would adversely affect the presence or long term survival of the Grey-headed Flying-fox.

Expected impact on the Grey-headed Flying-fox

The proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Grey-headed Flying-fox. The proposed boat launching facility would not result in the significant loss of any major foraging resources for this species. Given the retention of similar resources within both the subject site and surrounding locality, the loss of a small percentage of the vegetation present would not significantly reduce the extent of foraging opportunities available to the Grey-headed Flying-fox. No known roosting/breeding camps are present within, or near, the subject site. The undertaking of the proposal is not considered to have a significant impact on the local status of the Grey-headed Flying-fox, therefore the preparation of a SIS in not considered necessary.

2. (f) Hollow-dependent microchiropteran

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

While not detected during the current investigation, hollow-dependent species have been previously recorded in the locality.

It is expected that a maximum of seven hollow-bearing trees will require removal as part of the proposal. While this is the case, the current overall extent of sheltering and breeding opportunities exhibited by the subject site would be retained for those hollow-dependent microchiropteran that have been previously detected in the study region. The proposed development would not have a significant impact on the resources available to these species' breeding or roosting requirements.

The proposal would result in the removal of approximately 1 ha of native vegetation, this including insect attracting plants. While this is the case, when compared to the amount of similar foraging habitat that is to be retained within the subject site, and surrounding locality, the amount of vegetation to be cleared is considered insignificant. The proposed development would not have a significant impact on the foraging resource available to this species.

The proposed development is not considered to disrupt the viability of a local population of hollow-dependent microchiropteran such that they would be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An 'endangered population' is defined as a "population specified in Part 2 of Schedule 1" of the TSC Act. No hollow-dependent microchiropteran are listed under Part 2, Schedule 1 of the TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *(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*
- *(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*

No hollow-dependent microchiropteran are listed as an endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed boat launching facility would remove around 1 ha of native vegetation, this including insect attracting plants and seven hollow-bearing trees (worst case scenario).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Hollow-dependent microchiropteran can easily negotiate open areas and have been recorded flying over open spaces and expanses of water (author's field notes). As such, the loss of 1 ha of native vegetation is not expected to result in the disturbance to these species' dispersal or movement patterns. Post-development, all of these bats are considered to be able to negotiate/traverse across the subject site. Therefore, no isolation or fragmentation of these species' necessary habitats would arise.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The resources present within the subject site are not considered to be unique to this locality. Within the surrounding region, including those nearby conservation areas, similar resources (i.e. hollow-bearing trees and insect attracting plants) are present. The habitats present within the subject site are not considered important for the long-term survival of any of the threatened hollow-dependent microchiropteran recorded or known to occur within the study region.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat would be adversely affected by the proposal. The subject site is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has not been prepared for the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat or East-coast Freetail Bat.

A targeted strategy for managing these species has been developed under the Saving Our Species program, the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat and East-coast Freetail Bat being assigned to the 'Landscape species management stream' (OEH 2017c). OEH is currently identifying priority sites for this species; in the interim, a number of management actions have been identified. In regard to the proposal, the management actions for each species commonly refer to the retention of hollow-bearing and recruit trees and a floristically and structurally diverse community.

While seven hollow-bearing trees will be removed, numerous others will be retained within, and throughout, the area investigated.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Currently 35 KTP's for mainland NSW are listed under Schedule 3 of the TSC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the presence of the proposal. The clearing of approximately 1 ha of native vegetation, this including seven hollow-bearing trees, is not considered a significant loss in

comparison to the remaining vegetation within the subject site, study area and surrounding region. As such, it is not considered that the proposal would significantly contribute to a KTP such that the life cycle requirements of the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat or East-coast Freetail Bat would be compromised.

Expected impact on hollow-dependent microchiropteran

The undertaking of the proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat or East-coast Freetail Bat. The loss of 1 ha of native vegetation, this including seven hollow-bearing trees, when compared to the amount of similar foraging and roosting habitat that is to be retained within the property, and surrounding locality, is not considered to have a significant impact on the Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat or East-coast Freetail Bat or any important areas of their habitat. Therefore, the preparation of a SIS that further considers the impacts of the proposal on these hollow-dependent threatened bats is not required.

Appendix 6. Hollow-bearing trees recorded and their characteristics

Key
Global Positioning System +/- 10 m

Tree number	Easting	Northing	Condition	DBH	Tree height (m)	Hollows present	Diameter (cm)	Orientation
1	267445	6094839	Dead	>0.5	15	5	1 x 5; 4 x 10	Horizontal
2	267483	6094877	Alive	>0.5	20	3	3 x 5	Horizontal
3	267482	6094874	Dead	>0.5	10	1	1 x 50	Vertical
4	267464	6094881	Alive	>0.5	20	3	3 x 10	Horizontal
5	267474	6094913	Dead	<0.5	15	1	1 x 10	Horizontal
6	267473	6094894	Alive	>0.5	20	3	2 x 5; 1 x 10	Horizontal
7	267465	6094908	Alive	>0.5	20	2	2 x 5	Horizontal
8	267465	6094914	Alive	<0.5	20	3	3 x 5	Horizontal
9	267498	6094886	Alive	<0.5	20	2	2 x 10	Horizontal
10	267504	6094905	Alive	<0.5	20	1	1 x 5	Horizontal
11	267530	6094993	Dead	>0.5	20	5	5 x 10	Horizontal
12	267510	6095008	Alive	>0.5	20	2	2 x 10	Horizontal
13	267502	6094998	Dead	<0.5	10	1	1 x 20	Vertical
14	267515	6094973	Alive	>0.5	20	2	2 x 5	Horizontal
15	267513	6094960	Alive	>0.5	15	2	2 x 10	Horizontal
16	267493	6094996	Alive	>0.5	20	5	5 x 15	Horizontal
17	267478	6094983	Alive	>0.5	30	3	3 x 5	Horizontal
18	267465	6094967	Alive	>0.5	20	3	3 x 5	Horizontal
19	267482	6094966	Alive	>0.5	20	3	2 x 5; 1 x 10	Horizontal
20	267475	6094935	Alive	<0.5	20	1	1 x 10	Vertical
21	267481	6094968	Alive	>0.5	20	4	3 x 5 1 x 10	Horizontal Vertical
22	267483	6094943	Alive	>0.5	20	2	2 x 5	Horizontal
23	267479	6094965	Alive	>0.5	20	2	2 x 5	Horizontal
24	267478	609458	Alive	>0.5	20	6	4 x 10; 2 x 5	Horizontal
25	267497	6095032	Dead	<0.5	15	2	1 x 10 1 x 40	Horizontal Vertical
26	267497	6095038	Dead	<0.5	20	2	2 x 10	Horizontal

Tree number	Easting	Northing	Condition	DBH	Tree height (m)	Hollows present	Diameter (cm)	Orientation
27	267484	6095024	Alive	>0.5	20	2	2 x 5	Horizontal
28	267473	6095023	Alive	>0.5	20	4	4 x 10	Vertical
29	267460	6095031	Dead	>0.5	15	3	1 x 15 2 x 5	Vertical Horizontal
30	267507	6095019	Dead	<0.5	10	1	1 x 40	Vertical
31	267518	6095012	Dead	<0.5	10	1	1 x 40	Vertical
32	267542	6095010	Alive	>0.5	30	3	3 x 10	Horizontal
33	267444	6095016	Alive	>0.5	30	1	1 x 10	Horizontal
34	267535	6095021	Alive	>0.5	30	3	3 x 10	Horizontal
35	267476	6095080	Dead	<0.5	15	3	1 x 5; 2 x 10	Vertical
36	267473	6095054	Alive	<0.5	20	1	1 x 5	Horizontal
37	267473	6095054	Dead	<0.5	15	2	1 x 10; 1 x 15	Vertical
38	267485	6094961	Alive	>0.5	20	2	2 x 10	Vertical

Aquatic and Riparian
Flora and Fauna Assessment

for

Proposed Public Boat Launching Facility

Lot 7308 DP 1144810
Havilland Street
Conjola Park

PROPONENT: SHOALHAVEN CITY COUNCIL

PREPARED BY: PETER DALMAZZO

DATE: 10 APRIL 2017

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Contents

1 INTRODUCTION

1.1 Background

Peter Dalmazzo was commissioned by MI Engineers to prepare this aquatic and riparian flora and fauna assessment for a proposed new public boat launching ramp and associated facilities at Havilland Street, Conjola Park. MI Engineers was the successful tenderer to Shoalhaven City Council for investigation and design of the facility, including preparation of a review of environmental factors for the project. This report deals with the aquatic and riparian ecological issues at the site of the proposed facility.

1.2 Location and Land Tenure

The location of the site is shown in Figures 1, 2 and 3. Conjola Lake is an intermittently closed and open coastal lake located in the City of Shoalhaven on the south coast of NSW, approximately 220 kilometres south of Sydney. The site of the proposed boat launching ramp is on the southwestern shore of Conjola Lake, on Lot 7308 DP 1144810 and the adjacent bed of the lake, to the east of Conjola Park village.

1.3 Description of Proposal

The intent of this facility is to be the main boat launching area for the western part of the lake. The lake is popular with water skiing, fishing and passive boating. Lake Conjola is the only major waterway in the Shoalhaven that is not provided with a reasonable boat launching facility within public ownership and the need for a new boat launching ramp at Conjola Lake was identified more than 15 years ago. After a number of design iterations, the resultant general layout for the proposed facility is shown in Figure 4 and detailed plans are attached to the review of environmental factors for the project. The facility would include a dual lane launching ramp with a central jetty, access road, car and trailer parking areas and an amenities building.

2 METHODS

Relevant existing information was collated and reviewed, including previous studies, maps and air photographs. Using the Office of Environment and Heritage's BioNet website logged in as a licensed user, the Atlas of NSW Wildlife was interrogated in July 2016 and updated in March 2017 for records of marine mammals and marine turtles that have been observed in the Shoalhaven local government area. A protected matters report was generated on 11 July 2016 using the Australian Government's internet search tool with a ten kilometre buffer.

Initial assessment of habitats and vegetation communities was made by interpreting recent air photographs available on the Internet at NSW Land and Property Management Authority's Spatial Information eXchange (SIX) Viewer. Measurements were made using the measurement tools on the above web site and measured on site. Ground-truthing of photograph interpretation was carried out during the following field observations.

The site was inspected on Friday 16 September 2016 from 15:00 to 16:00 AEST. The weather was fine and partly cloudy, with mild to warm air temperature and a light north-easterly wind. Weather observations from the Nowra and Ulladulla weather stations are in Attachment 1. Water level records for the Lake Conjola gauge

(several kilometres closer to the lake entrance than the subject site) are in Attachment 2. The lake entrance was open to the sea, though water exchange was limited by sand in the entrance. The inspection was carried out around low tide (at the site), but as can be seen from the attached chart, there was little variation in water level around the period of the survey. Visibility was poor (< 3 metres), though adequate for survey purposes, there was little current and the water was cool.

Subtidal observations were made by snorkelling and free diving from the shore. For intertidal and riparian habitats, the site was observed at close range on foot. Records were made of the nature of the vegetation and habitats present at the site and of plant and animal species that were observed.

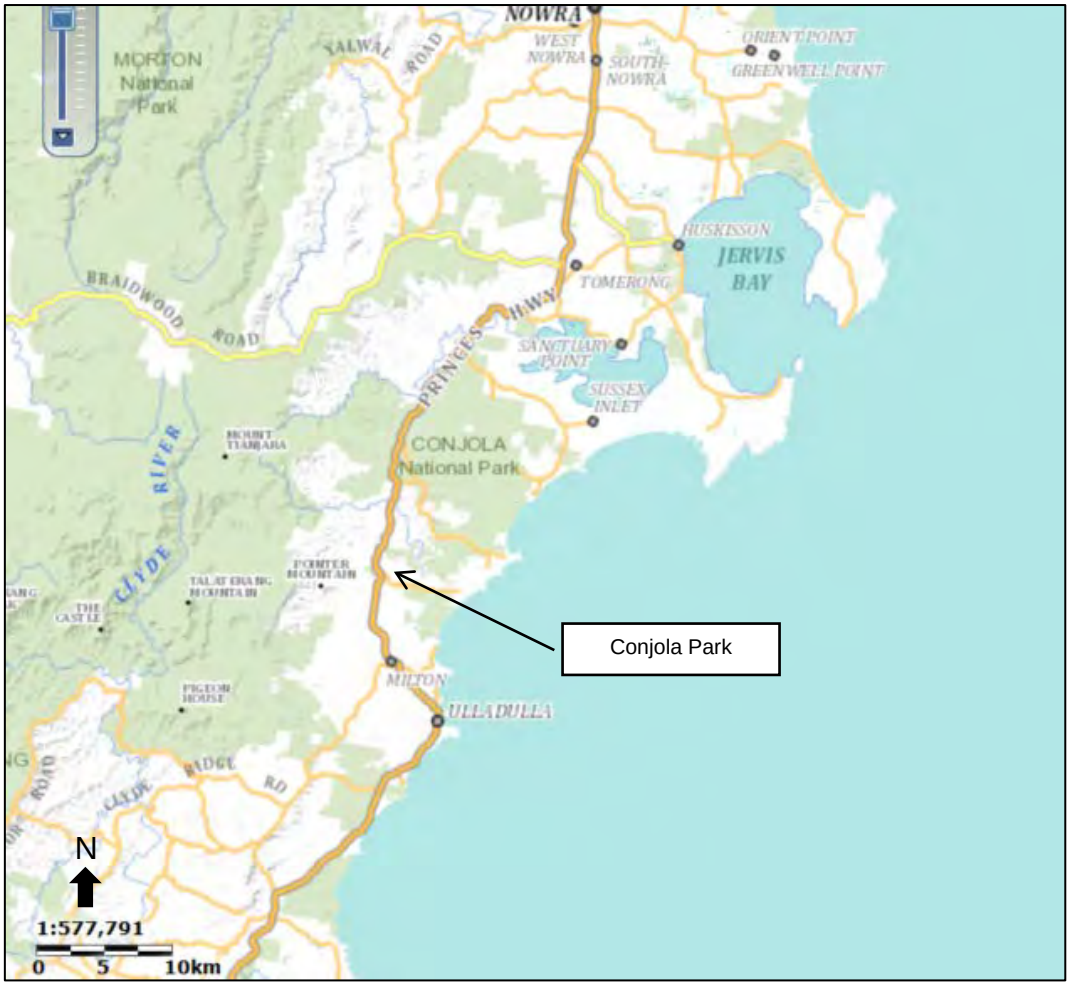

Figure 1. Location of Conjola Park.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

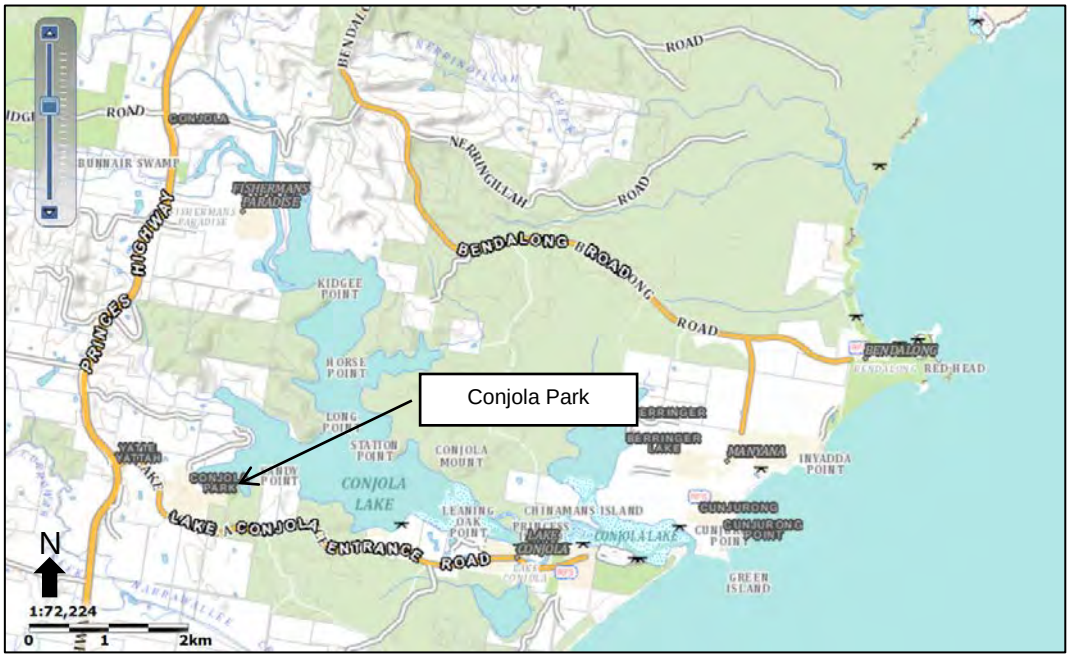

Figure 2. Location of Conjola Park.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

Figure 3. Location of Lot 7308 DP 1144810.
Source: © Land and Property Information Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

Figure 4. General layout of the proposed facility.

3 DESCRIPTION OF THE SITE, PLANTS AND ANIMALS

The character of the site is shown in Figures 5 to 24. Bathymetry of the site is shown in Figure 4. The habitats and vegetation types observed at the site were:

- the water column
- unvegetated soft substrates (sand/mud)
- rocky reef
- seagrass
- submerged timber (fallen tree branches and trunks)
- riparian vegetation.

Terrestrial forest extended close to the lake but in places there was a narrow band of Sheoaks *Casuarina glauca*, rushes and sedges, including Bare Twigrush *Baumea juncea* and Sea Rush *Juncus kraussii*, growing at the water's edge. The shoreline had an erosion scarp generally less half a metre in height and a very narrow sandy beach. The bed of the lake dropped away from the shore at a fairly even and shallow grade down to several metres depth.

The subtidal substrate at the site was generally muddy sand. In very shallow water there was a thin layer of black, oozy, organic-rich material on top of the sand, less so in deeper water. In some shallow areas there was a layer of leaf litter and twigs from the trees on the adjacent land. There were also a few submerged branches and fallen tree trunks at or near the site. At the western end of the site there was an outcropping ledge of sandstone extending from the water's edge into the lake. The sandstone was broken up in places.

Seagrasses were present at the site. In shallow areas (mostly less than 0.5 metres deep) within 5 metres of the shore and mostly closer than that, there were patches of Paddleweed *Halophila australis*, some sparse patches of Eelgrass *Zostera muelleri* and some areas of mixed Paddleweed and Eelgrass. There were a few scattered macroalgae plants (red and brown), including *Cystoseira trinodis*, growing attached to hard objects (rock and timber).

Figure 25 shows the results of seagrass a mapping exercise from 2004 (Williams *et al*., 2006) which identified *Halophila* seagrass in the eastern part of the lake but not at the location of the proposed new facility. The apparently limited distribution and diversity of seagrass in the lake from this mapping may be an artefact of the mapping techniques used or may have been real and due to impacts from the invasive marine alga *Caulerpa taxifolia*. Although it had colonised extensive areas of the lake by the year 2000 (Figure 26), the Department of Primary Industries web site indicates that between 2011 and 2014, the density of Caulerpa populations was observed to be significantly reduced in most southern NSW estuaries as a result of natural fluctuations in salinity and temperature. At the time of the current inspection, *Caulerpa taxifolia* was not observed and habitat at the site that would have previously been occupied by Caulerpa was occupied by seagrass or bare sand/mud. It is possible that small Caulerpa beds may remain in parts of Lake Conjola.

In terms of fauna, there was some bioturbation of the subtidal sediments with holes approximately 10 millimetres in diameter, probably burrows of crustaceans rather than worms. Australian Mud Whelk *Batillaria australis* was numerous, grazing on organic material and algae on the sand and particularly on hard surfaces such as submerged tree branches and rock outcrops. In very shallow water close to and all

along the shore there were many thousands of juvenile prawns present. Pleated Sea Squirt *Styela plicata* (an ascidian considered an introduced species in Australian waters) was attached to some fallen tree branches. Free-floating egg masses of Leaden Sand Snail *Conuber sordidum* were present. In the intertidal area there were empty shells of empty cases of sessile barnacles Balanomorpha and tube worms Serpulida attached to timber. It is possible that the animals that made these shells and tubes had persisted when the lake water was in a saline state for an extended period but had died when the lake water was in a relatively fresh state. No recolonization was apparent.

A few fish were observed including Yellowfin Bream *Acanthopagrus australis* (mostly amongst the submerged timber) and Dusky Flathead *Platycephalus fuscus* on the unvegetated sediments.

Figure 5. Proposed location of the boat ramp viewed from the water.

Figure 6. Limited extent of saltmarsh and Swamp Oak vegetation.

Figure 7. Typical foreshore at proposed location of the boat ramp.

Figure 8. Accumulation of twigs and leaves in shallow water near edge of lake.

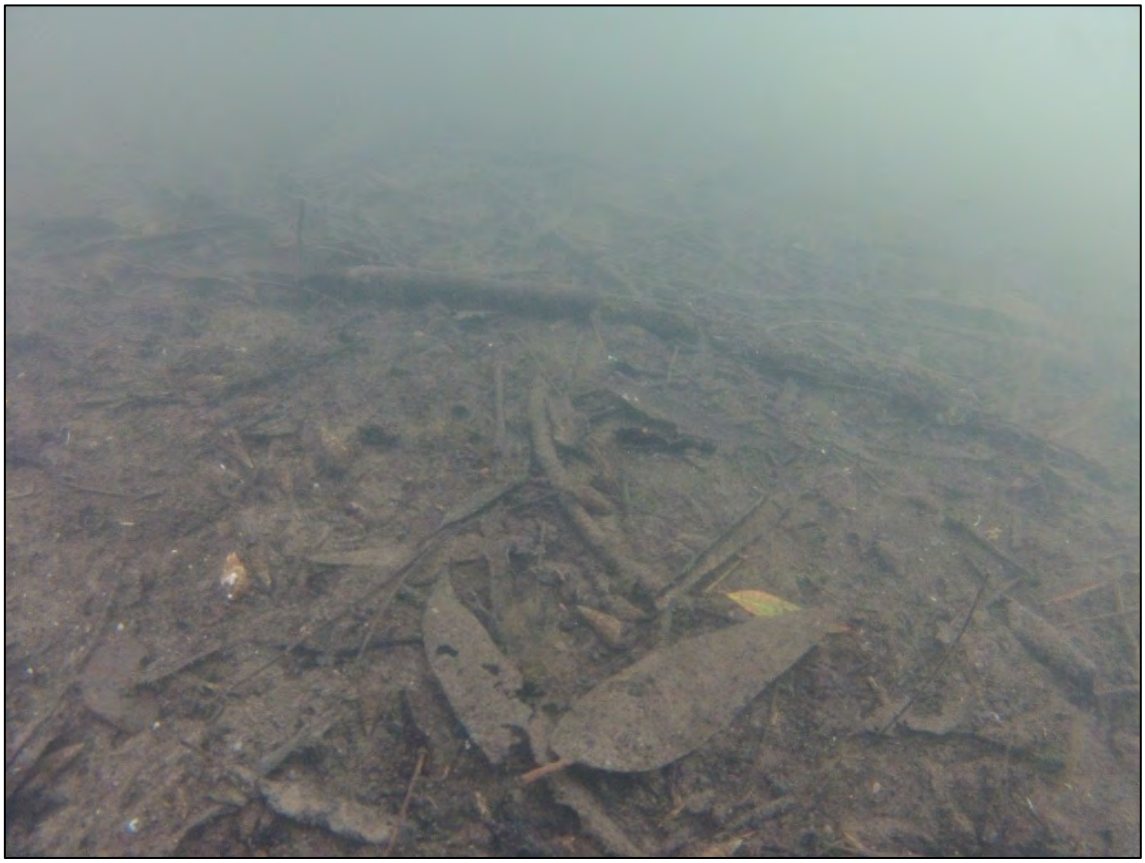

Figure 9. Partially decomposed twigs and leaves close to shore.

Figure 10. Prawns in the water column close to shore.

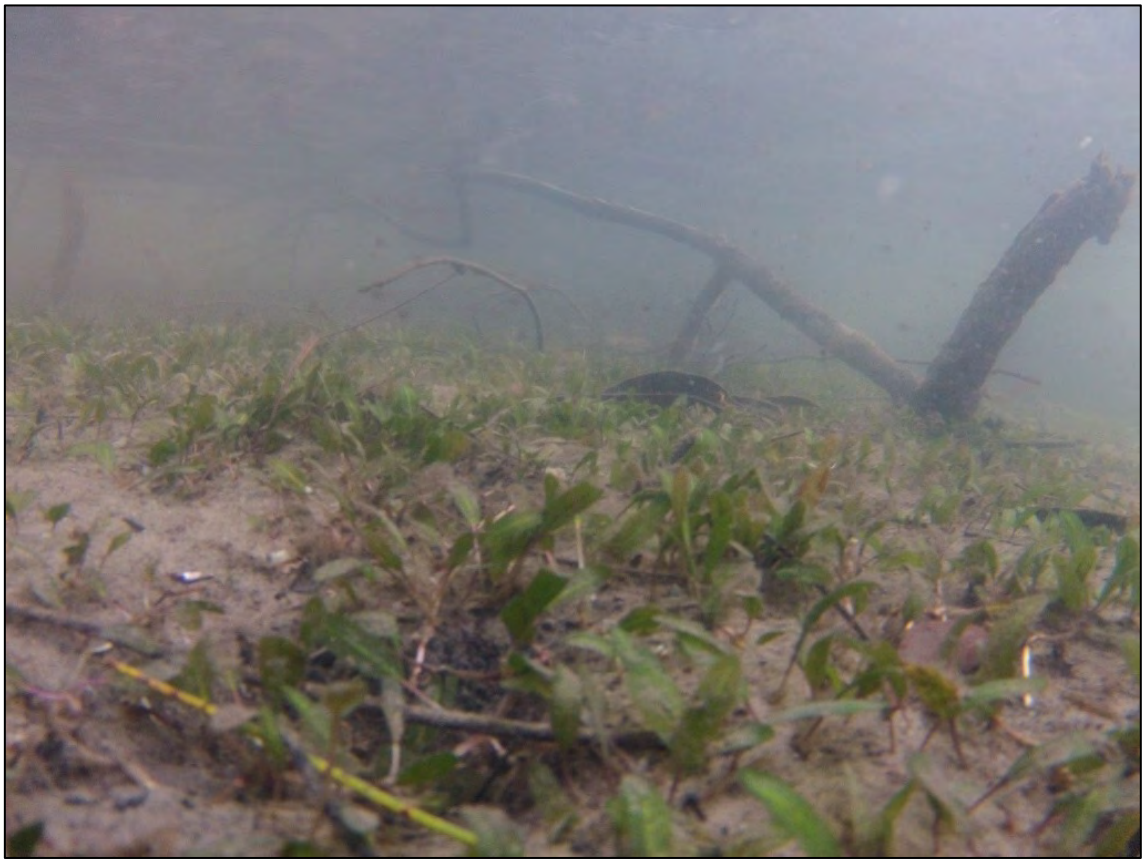

Figure 11. Patch of Paddleweed *Halophila ovalis*.

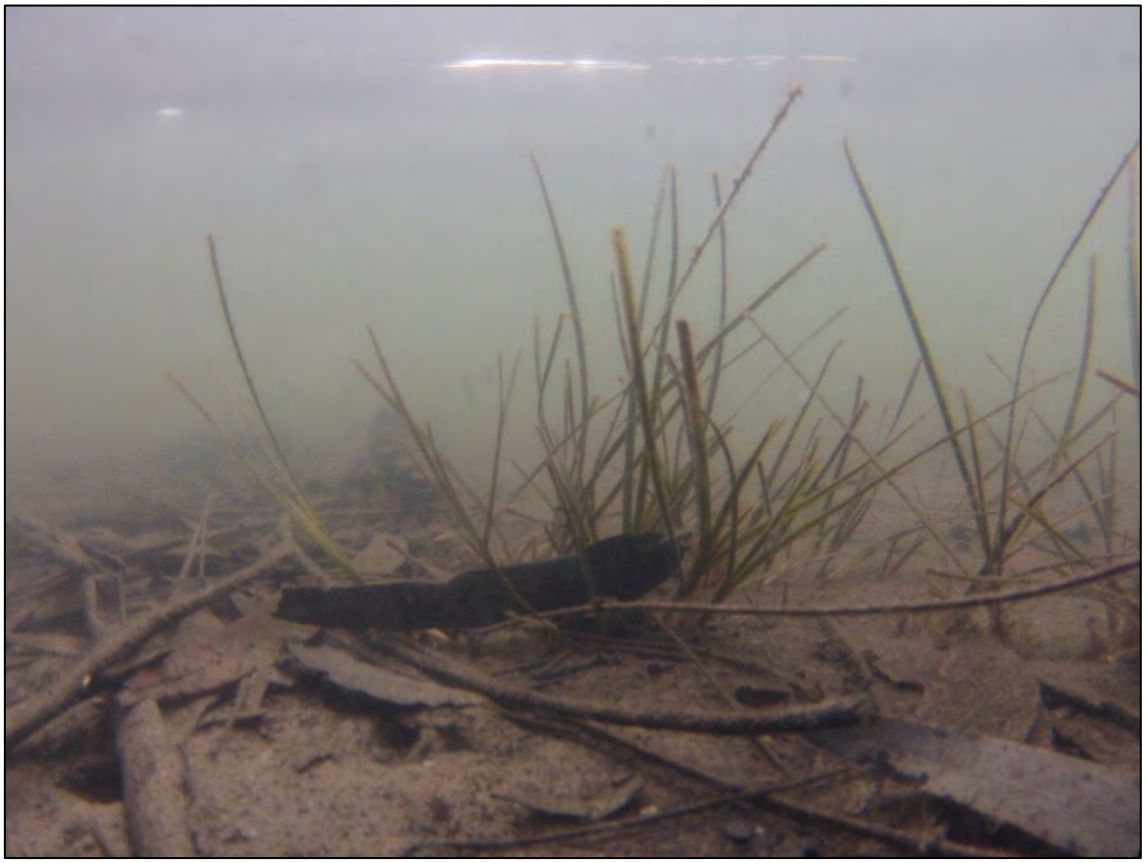

Figure 12. Patch of Eelgrass *Zostera muelleri*.

Figure 13. Patch of Eelgrass *Zostera muelleri*.

Figure 14. Eelgrass and Paddleweed growing together.

Figure 15. Eelgrass and Paddleweed growing together, with grazing whelks.

Figure 16. Submerged timber with whelks.

Figure 17. Submerged timber and Yellowfin Bream.

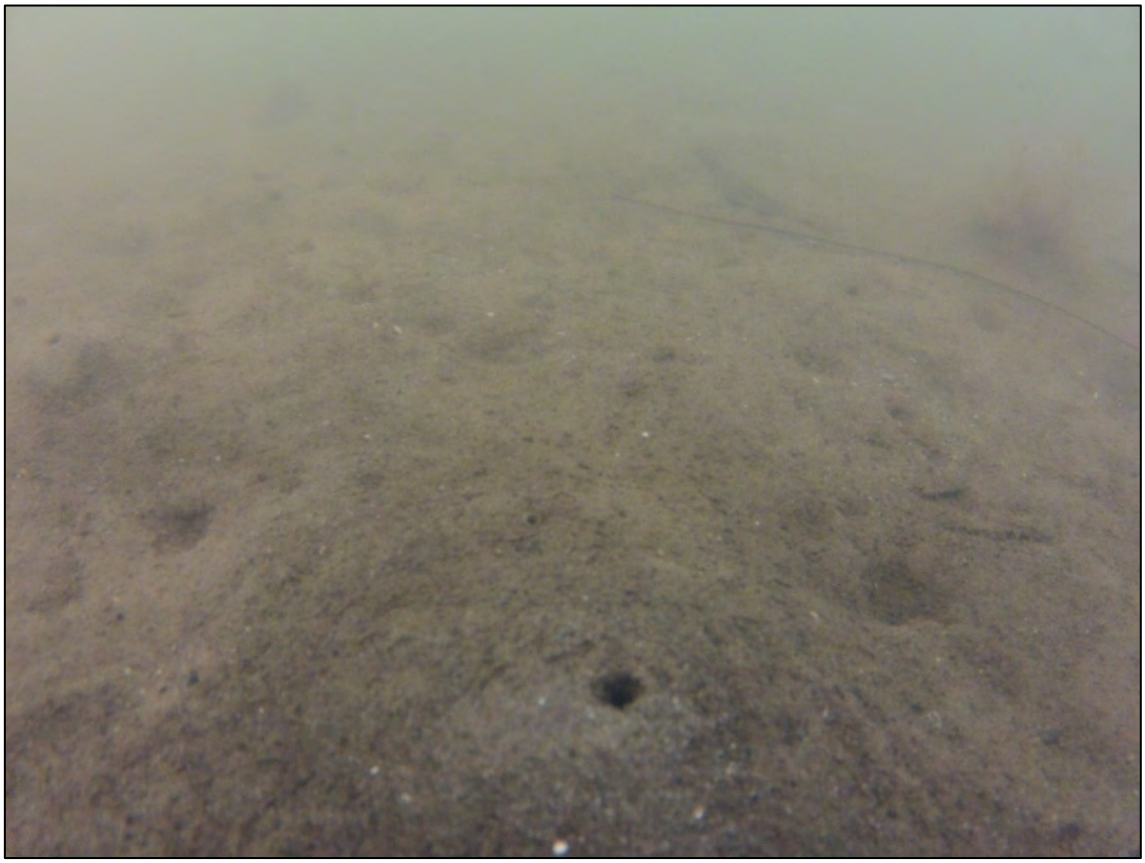

Figure 18. Unvegetated sand offshore from seagrass, with invertebrate burrows.

Figure 19. Egg mass of Leaden Sand Snail *Conuber sordidum*.

Figure 20. Introduced Pleated Sea Squirt *Styela plicata*.

Figure 21. View eastward from western end of site about 150m from proposed ramp.

Figure 22. Outcrop of sandstone at western end of site.

Figure 23. Sandstone outcrops with attached algae and whelks, western end of site.

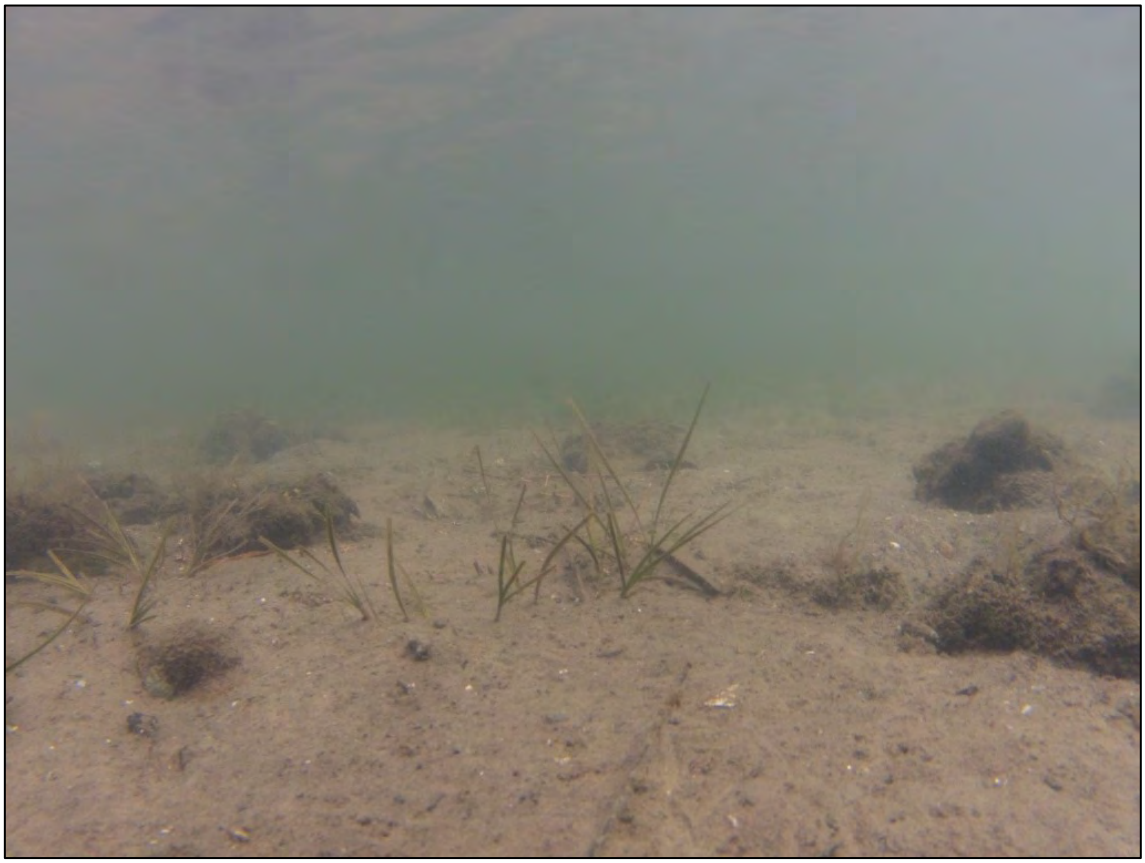

Figure 24. Eelgrass growing in sediment amongst sandstone, western end of site.

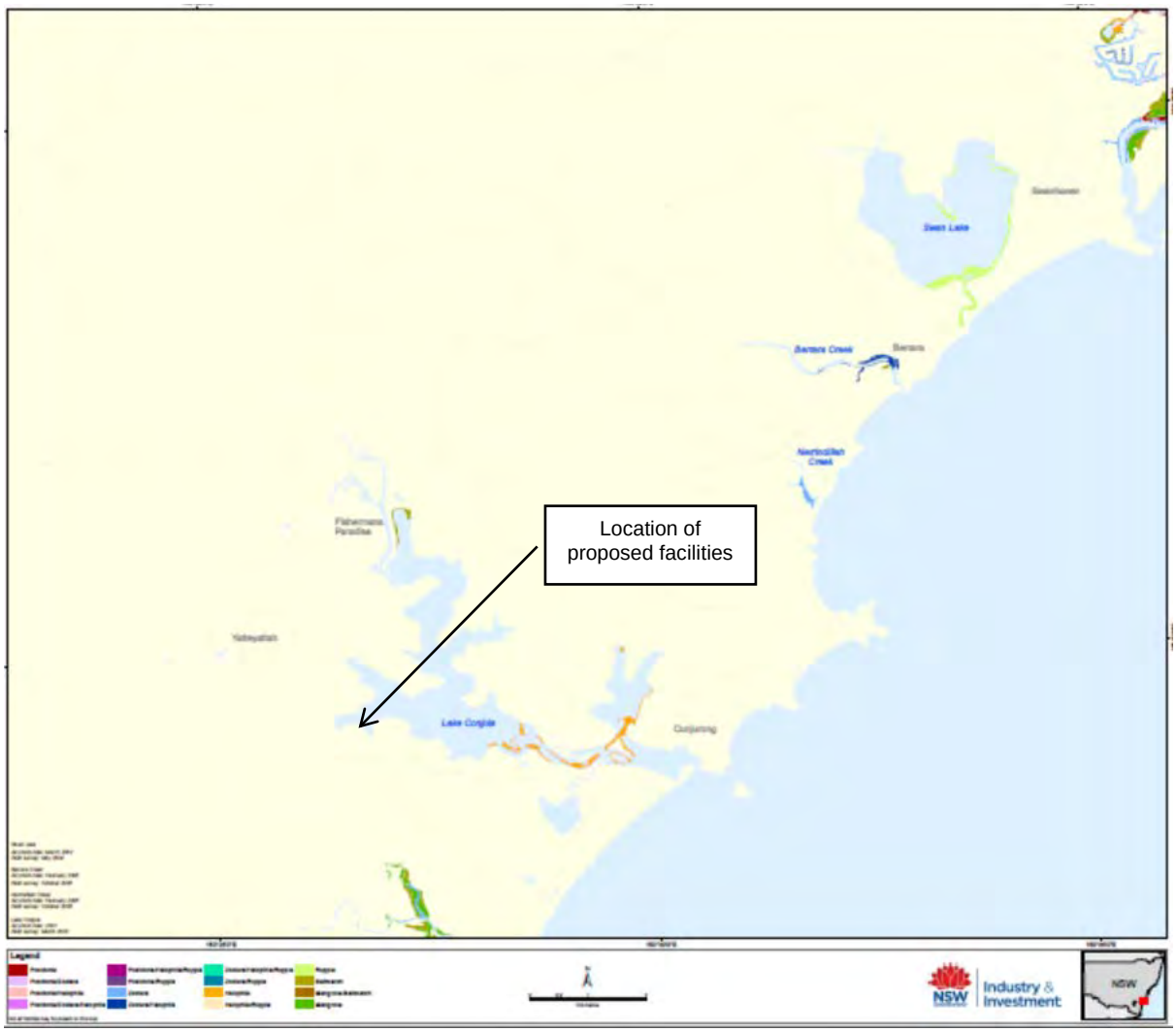

Figure 25. Seagrass mapping for Lake Conjola based on 2001 air photo and March 2002 field survey. Source: Williams *et al*. (2006).

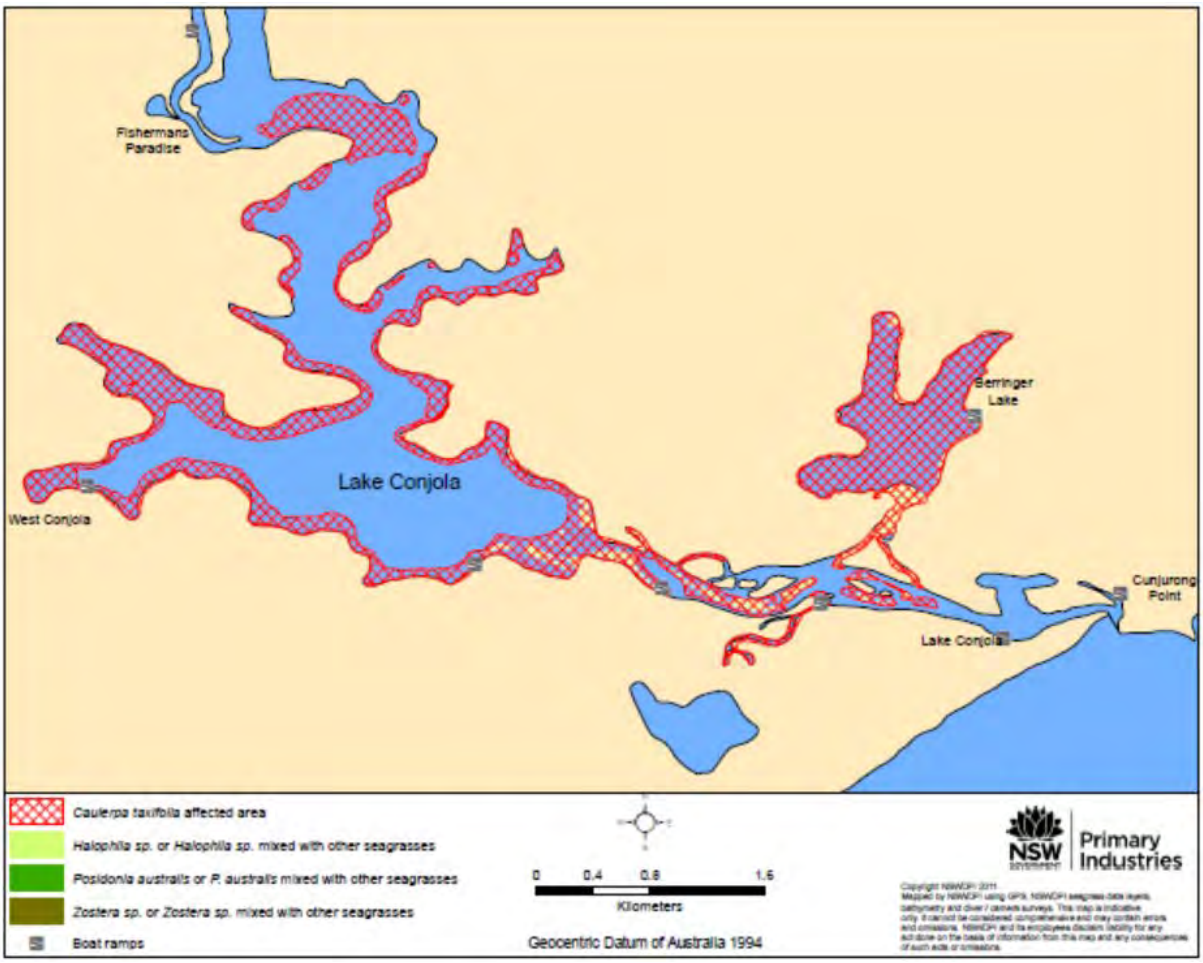

Figure 26. Cumulative distribution map (showing all known locations from historical data) of Caulerpa in Lake Conjola. Source: NSW DPI.

4 ASSESSMENT OF POTENTIAL FLORA AND FAUNA IMPACTS

4.1 Permanent/Ongoing vs Construction Impacts

The following assessment of potential impacts on aquatic and riparian plants and animals or on their habitats deals with a number of potential permanent/ongoing and construction impacts.

Permanent/ongoing impacts are those that result in long term changes to the ecosystem and could include:

- removal or modification of habitat by:
    - changes to substrate composition and orientation
    - shading
- increased human activity.

Construction activities have the potential to cause shorter term impacts on the environment than those potential permanent/ongoing impacts described above. These could involve physical impacts directly on plants and animals or effects on their habitats through:

- death or disturbance of plants or animals
- temporary impacts on water quality and consequent impacts on ecology.

The following subsections describe in more detail potential permanent/ongoing and construction impacts. Environmental safeguards to mitigate impacts have been proposed in Section 7 of this report. Overall, the ecological impacts of the proposed facility would be small and localised. The impacts on the aquatic and riparian ecosystem of the locality would not be significant.

4.2 Permanent/Ongoing Impacts

Assuming a ramp size of 11 metres width and 17 metres length, approximately 190 square metres of concrete ramp would replace sandy mud and seagrass habitats. The areas of aquatic habitat affected by the ramp would be relatively small compared to the total amount of these habitat types in the vicinity of the proposal. Nevertheless, a permit under the Fisheries Management Act would be required.

A small amount of benthic habitat would be permanently replaced by the piles for the jetty. There would be no aquatic vegetation under that part of the jetty that would extend beyond the boat ramp so there would be no need for it to be constructed of mesh to allow greater light transmission.

New habitat for sessile plants and animals would be created by parts of the hard surfaces of the supporting piles.

The current boat ramp situated in the western part of Conjola Park does not provide adequate parking and is currently degraded and discharging sediment into the Lake. As an offset for the construction of the new ramp and associated infrastructure DPI - Fisheries would require the removal of the current ramp and rehabilitation of this site.

Based on Table 1 (reproduced below) from the NSW Department of Primary Industries' 2013 Policy and Guidelines for Fish Habitat Conservation and

Management, the habitats types at the site that would be affected by the proposed facility are considered to be:

Habitat Affected	Habitat Type*
area of *Zostera* and *Halophila* >5 square metres	Type 1
unvegetated sand/mud substrate	Type 3

*Habitat types are derived from Table 1 of the NSW Department of Primary Industries' 2013a Policy and Guidelines for Fish Habitat Conservation and Management (reproduced below).

Table 1 – Key fish habitat and associated sensitivity classification scheme
(for assessing potential impacts of certain activities and developments on key fish habitat types)

TYPE 1 - Highly sensitive key fish habitat:
- *Posidonia australis* (strapweed)
- *Zostera, Heterozostera, Halophila and Ruppia* species of seagrass beds >5m^2 in area
- Coastal saltmarsh >5m^2 in area
- Coral communities
- Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)
- Marine park, an aquatic reserve or intertidal protected area
- SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia[2]
- Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants
- Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act
- Mound springs

TYPE 2 – Moderately sensitive key fish habitat:
- *Zostera, Heterozostera, Halophila and Ruppia* species of seagrass beds <5m^2 in area
- Mangroves
- Coastal saltmarsh <5m^2 in area
- Marine macroalgae such as *Ecklonia* and *Sargassum* species
- Estuarine and marine rocky reefs
- Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan)
- Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
- Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
- Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
- Weir pools and dams up to full supply level where the weir or dam is across a natural waterway

TYPE 3 – Minimally sensitive key fish habitat may include:
- Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna
- Coastal and freshwater habitats not included in TYPES 1 or 2
- Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

Increased human activity at and around the ramp can lead to greater disturbance of animals such as shore birds or fish, increased littering and other pollution, as well as degradation of surrounding aquatic habitats. The provision of a jetty at the facility would help reduce impacts in shallow water areas from boaters beaching vessels adjacent to the ramp to load or unload people or equipment.

During operation of the facility there is some scope for fuel or oil to be spilled by boat owners but this is likely to be a rare event and involve only small quantities.

It is possible that *Caulerpa taxifolia* could be spread to or from the lake by users of the facility. Advisory material shall be provided on the actions that waterway users should take to prevent reintroduction or further spread of *Caulerpa taxifolia* to unaffected areas.

4.3 Construction Impacts

Death and Disturbance of Plants and Animals

It is unlikely that many mobile birds, fish and invertebrates would be killed or injured by the construction activity, but they may be disturbed from their normal activities. Birds, fish and large mobile invertebrates living at the site may be disturbed by the

movement of machinery and people and from noise during the construction activities. Some would seek shelter, some would flee and some would be attracted as food organisms are disturbed. The effects would be localised to within a few tens of metres of the work site and would be intermittent and short term as the work is carried out. Those organisms that flee or seek shelter may return to the area when construction or other human activity is not occurring.

Some sessile, benthic fauna may be killed during the installation of the ramp or the driving of jetty piles. The number of organisms potentially affected would not be large.

Workers will be required to minimise physical disturbance to the bed and banks of the waterway and be restricted to only what is required for installation of the structures. If possible, machinery should not enter the waterway unless on a floating barge. Barges or other work vessels should not anchor in a way that would damage seagrasses or foreshore vegetation. If it is necessary for equipment to work from the estuary bed then it should do so from within the footprint of the ramp/jetty, commencing offshore and proceeding landward.

The affected areas would be recolonised by fish and other organisms from the large areas of similar habitat nearby in the estuaries. Recolonisation is likely to commence almost immediately for mobile species, but development of a functional community of infauna or fouling species will depend on availability of recruits. The recruits could be from quite close by or distant parts of the estuary depending on the reproductive and dispersal strategies adopted by particular species. Some invertebrates reproduce seasonally and recruits may not be available until some time after the construction activities. There would be large areas of unaffected estuary bed and foreshore within reasonable distance of the affected areas to provide such recruits.

Water Quality, Turbidity and Sedimentation

There is potential for indirect effects on organisms during construction from uncontained debris, turbidity, fuel and oil. Fine sediments may form turbid plumes which have the potential to affect filter feeding organisms or settle on and smother attached plants and animals. The sediments would settle or disperse quickly but may coat some plants and animals. The sediment layer is likely to be very thin and most benthic plants and animals would be expected to soon be cleared of or grow through the sediment. Nevertheless, to help manage these potential impacts, physical disturbance to the area should be minimised. As far as possible, large debris and fines should be contained during construction. A silt curtain will be deployed to contain the spread of turbid water. Appropriate soil and water management measures should be employed and disturbed areas should be stabilised as soon as possible. Stockpiles of debris and construction materials should not be stored in areas that may be inundated by the lake, such as at high tide or during large storms. Debris, including packaging and offcuts, should ultimately be removed from the site and disposed of appropriately.

Fuel and oil from construction machinery can have toxic effects on aquatic organisms. An environmental management plan should be prepared by the construction company that addresses ways in which pollution of the site by fuel and oil will be avoided. This should include protocols for equipment maintenance, storage of fuel and other chemicals and materials, and refuelling procedures.

To prevent oxidation of potential acid sulfate soil and possible degradation of the waterway, no sediment material from the bed of the waterway should be removed from the waterway or groundwater layer and exposed to air unless a preliminary assessment has been undertaken to determine whether potential acid sulfate soils are present and, if necessary, an acid sulfate soils management plan has been prepared in accordance with the ASS Assessment Guidelines (Ahern et al., 1998).

5 ASSESSMENT OF SIGNIFICANCE FOR THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS

5.1 Introduction

Section 111 of the Environmental Planning and Assessment Act 1979 requires that an assessment must be made of whether the proposed activity is likely to have a significant effect on threatened species, populations or ecological communities (as listed in schedules to the Threatened Species Conservation Act or Fisheries Management Act), or their habitats, and therefore whether or not a species impact statement and the concurrences of the Director-General of the Office of Environment and Heritage or the Department of Primary Industries are required. Section 5A of the Environmental Planning and Assessment Act provides the factors to be taken into account in deciding whether there is likely to be a significant effect and these factors are considered below.

The following assessment of significance for the proposed new public boat launching facility at Conjola Park has been carried out using the assessment guidelines approved by the Minister for the Environment under section 94A of the Threatened Species Conservation Act 1995 (NSW Department of Environment and Climate Change, 2007) and by the Minister for Primary Industries under section 220ZZA of the Fisheries Management Act 1994 (NSW Department of Primary Industries, 2008).

5.2 Threatened Species

(a) in the case of a threatened species, whether the action proposed 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

Fisheries Management Act

Several saltwater species listed as threatened in the schedules to the Fisheries Management Act are known to have occurred on the south coast of NSW. Grey Nurse Shark and the slug *Smeagol hilaris* are considered Critically Endangered, Southern Bluefin Tuna and Australian Grayling are considered Endangered, the Great White Shark and Black Rockcod are considered Vulnerable and the Green Sawfish is Presumed Extinct in New South Wales. Populations of some of these species have primarily been reduced by over-harvesting by commercial and/or recreational fishers. The sharks are also affected by beach safety meshing from Newcastle to Wollongong. Degradation of habitats is likely to be a lesser factor.

Grey Nurse Sharks *Carcharias taurus* (Critically Endangered) are found predominantly in inshore coastal waters. They have been recorded at various depths, but are mainly found in waters between 15 and 40 metres deep. Grey nurse sharks gather at a number of key sites along the coast of NSW and southern Queensland. These sites have gravel or sand filled gutters, rocky reefs or caves, and are called aggregation sites (NSW Department of Primary Industries, 2013b). Conjola Lake is not a known aggregation site for Grey Nurse Shark and the species is extremely unlikely to occur there. The proposed action would have no effect on the life cycle of this species. In the extremely unlikely event that a Grey Nurse Shark was present in the vicinity at the time of construction or operation of the facility, it

would be expected to swim away in response to the disturbance with little consequent disruption to its life cycle.

Smeagol hilaris (Critically Endangered), a pulmonate slug, has only been collected from a small isolated location at Merry Beach, south of Ulladulla. Pulmonate slugs have developed lungs instead of gills and can breathe air. *Smeagol hilaris* lives in gravel and cobble filled rocky crevices at Merry Beach. Little is known about their ecology or reproductive biology. The proposed action would have no effect on the life cycle of this species.

Southern Bluefin Tuna *Thunnus maccoyii* (Endangered) are pelagic fish occurring in oceanic waters normally on the seaward side of the continental shelf. The proposed action would have no effect on the life cycle of this species.

Australian Grayling *Prototroctes maraena* also known as the Cucumber Mullet or Cucumber Herring is a small to medium-sized slender fish that is endemic to south-eastern Australia. It is a migratory species that spawns in the lower freshwaters of coastal rivers and spends approximately 6 months in coastal seas as larvae/juveniles before migrating back into freshwater rivers and streams where they remain for the rest of their lives (NSW Department of Primary Industries, 2015a). There are no recent records from Conjola Lake and there is no a significant freshwater river flowing into the lake to provide suitable habitat for an adult population. The proposed action is unlikely to affect the life cycle of this species. In the extremely unlikely event that juvenile Grayling were migrating past the facility at the time of construction or operation of the facility, they would be expected to swim away in response to the disturbance with little consequent disruption to their life cycle.

Great White Sharks *Carcharodon carcharias* (Vulnerable) are normally found in inshore waters around rocky reefs and islands and often near seal colonies. They have been recorded at varying depths down to 1,200 metres (NSW Department of Primary Industries, 2005a). It is extremely unlikely to occur at the site of the proposed facility. The proposed action would have no effect on the life cycle of this species. In the extremely unlikely event that a Great White Shark was present in the vicinity at the time of construction or operation of the facility, it would be expected to be able to avoid injury with little consequent disruption to its life cycle.

Black Rockcod *Epinephelus daemelii* (Vulnerable) live in relatively shallow rocky reefs where they are usually found in caves, ledges, gutters and beneath bommies. The Black Rockcod is territorial and lives for years in the same place (Henrisson and Smith, 1994). The site of the proposed action is unlikely to provide suitable habitat for adult Black Rockcod. Large juveniles are sometimes found around rocky reefs in estuaries (NSW Department of Primary Industries, 2015b & 2012b). The rocky reef at the western end of the site is unlikely to provide suitable artificial habitat for juvenile Black Rockcod and would not be affected by the proposed action. In the extremely unlikely event that a juvenile Black Rockcod was present at the site at the time of construction activities, it might be able to swim away in response to the disturbance. However, it might seek shelter amongst rocks and be crushed or smothered. The adult population would not be affected and there is only limited potential to affect what is likely to be a small proportion of the juvenile population. The possible loss of a very small number of juvenile Black Rockcod is not considered likely to place a viable local population of Black Rockcod at risk of extinction.

Green Sawfish *Pristis zijsron* (Presumed Extinct in NSW) live on muddy or sandy-mud soft bottom habitats in inshore areas mainly in the tropics. They also enter estuaries, where they have been found in very shallow water. It has been recorded in Jervis Bay, but the last confirmed sighting of the green sawfish in NSW was in 1972 from the Clarence River at Yamba (NSW Department of Primary Industries, 2005b). The proposed action would have no effect on the life cycle of this species. In the extremely unlikely event that a Green Sawfish was present in the vicinity at the time of construction, it would be expected to swim away in response to the disturbance with little consequent disruption to its life cycle.

Threatened Species Conservation Act

The vulnerable Narrow-leafed Wilsonia *Wilsonia backhousei* is a plant species of the margins of salt marshes and lakes. There are no records of this plant in the Atlas of NSW Wildlife for Lake Conjola, though it has been recorded a few kilometres to the north. During surveys carried out in the current study, it was not observed on the shoreline at the subject site and is unlikely to occur at the site.

The results of the Atlas of NSW Wildlife search for marine reptiles and marine mammals are attached to this report (Attachment 3). No threatened marine animal species were seen or heard at the site. The animal species from the atlas search are considered below, with comment on their potential to occur at the site and potential impacts. Information on habitats and life history is mostly from the NSW Office of Environment and Heritage threatened species website and the Australian Department of Environment threatened species website.

Marine turtles may occasionally enter Conjola Lake but are rarely likely to occur at the site. In the unlikely event that one of these animals was present in the vicinity at the time of construction it would be expected to swim away in response to the disturbance with little consequent disruption to its life cycle. There would be no ongoing impacts on turtles.

Whales are extremely unlikely to enter Conjola Lake. Seals or dugongs may occasionally enter the lake but are likely to keep away during construction. However an injured or unwell seal might be reticent to leave the site if it has hauled out there. In the extremely unlikely event that a seal had hauled out or whale had beached at the site when the work was being done, the advice of the National Parks and Wildlife office should be sought on an appropriate course of action.

Overall, the proposed action would not be likely to have an adverse effect on the life cycle of any threatened aquatic or riparian species such that a viable local population of the species is likely to be placed at risk of extinction.

5.3 Threatened Populations

> ***(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction***

Endangered populations are listed in Part 2 of Schedule 1 of the Threatened Species Conservation Act 1995 and Part 2 of Schedule 4 of the Fisheries Management Act. No endangered populations would be affected by the proposed action.

5.4 Endangered Ecological Communities

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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

(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

Endangered ecological communities are listed in Part 3 of Schedule 4 of the Fisheries Management Act. Critically endangered ecological communities are listed under Part 1 of Schedule 4A of the Act. No ecological communities listed in the schedules to the Fisheries Management Act would be affected by the proposed action.

Endangered ecological communities are listed in Part 3 of Schedule 1 of the Threatened Species Conservation Act. Critically endangered ecological communities are listed under Part 2 of Schedule 1A of the Act. There are two endangered ecological communities listed under the Threatened Species Conservation Act that occur in the riparian habitat at the site:

Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions and

Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

Due to the steepness of the shoreline at the subject site, there is no well-developed floodplain so these two ecological communities are in turn not well-developed. In some parts of the shoreline they are absent altogether, with eucalypt forest extending all the way down to the water's edge. At most, there was a narrow band of vegetation, mostly only one plant wide and usually less than one metre wide. Small numbers of plants would be affected occupying a total area of less than 20 square metres.

In this assessment, the local occurrences of Swamp Oak Forest and Coastal Saltmarsh are taken to include all of the plants in the local estuary system on the basis that the movement of individuals and exchange of genetic material across the boundary of the affected areas can be clearly demonstrated. This is based on the fact that many saltmarsh species have propagules (seeds and pieces of plant) that can be dispersed easily either by floatation or by birds. Tidal currents and flood waters are important local vectors for movement of genetic material long distances within an estuary. Longer distance dispersal is known to be effected by migratory waders internally and externally (Saintilin, 2009; Boon *et al*., 2010). Similarly for Swamp Oaks, wind pollination, winged seeds and dispersal by seed-eating birds means that the movement of individuals and exchange of genetic material across the boundary of this stand is certain.

No data is available on the total area of Swamp Oak forest present at Lake Conjola. However, Williams *et al*. (2006) mapped 27,000 square metres of saltmarsh in Lake Conjola based on aerial photographic interpretation. The total area of saltmarsh in the system is likely to be much greater than the measurements reported by Williams *et al*. (2006) and the small patches of saltmarsh potentially affected by the proposed actions would not have been included in the measurement of area of saltmarsh in the estuaries. This is because surveys based on aerial photographic interpretation with limited ground-truthing measure large-scale distribution but do not identify all patches of coastal saltmarsh. In a study of saltmarsh in the Parramatta River, Williams *et al*. (2011) found that pedestrian survey showed a 17-fold increase in number of patches (from 45 to 757), and a four-fold increase in area (9.6 ha to 37.3 ha) compared to aerial photographic interpretation.

The affected patches of Swamp Oak Forest and Coastal Saltmarsh at the subject site are likely to be significantly less than one percent of the total amounts of these communities in the lake system.

It is concluded that the removal of a small number of Swamp Oaks and Coastal Saltmarsh plants is not likely to adversely affect the extent of an endangered ecological community nor substantially and adversely modify its composition such that a local occurrence is likely to be place at risk of extinction.

5.5 Habitat

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed areas of aquatic and riparian habitat (190 square metres) that would be affected by the facility are small compared to the amount of unaffected habitat nearby. Nevertheless, as an offset for the construction of the new ramp and associated infrastructure the current ramp situated in the west of the village shall be removed and the site rehabilitated.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

The proposal would, to a very limited extent, form a partial physical barrier between the aquatic and riparian habitats upstream and downstream. In terms of habitat connectivity, the affected area is unlikely to form part of a habitat cul-de-sac, an isolated area or an extensive habitat corridor, though some migrating animals such as small fish and prawns might move along the edge of the bay. The ramp would either be built on widely spaced piles or culverts would be included under the ramp to minimise restriction on movement of water, sediment, plants and animals. It is considered that the proposal would not adversely affect connections between areas to the extent that the maintenance of gene flow and the ability to sustain viable populations would be reduced. The proposal would not fragment or isolate an area of habitat of an aquatic or riparian threatened species, population or ecological community.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species,

population or ecological community in the locality

The habitat that would be affected is not considered likely to be significantly important to any life cycle stages or to reproductive success, and hence long term survival, of any aquatic or riparian threatened species, population or ecological communities.

5.6 Critical Habitat

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat would be affected by the proposed action.

5.7 Recovery and Threat Abatement

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Threat Abatement Plans

Threat abatement plan for removal of large woody debris from NSW rivers and streams (NSW Department of Primary Industries, 2007). This document provides guidance on the actions required to eliminate, manage or mitigate the threat posed by the removal of large woody debris from NSW watercourses. It contains 10 strategies to be achieved in 3 action areas: research and information activities, compliance and regulation activities and management activities. A number of pieces of large woody debris were observed at or near the site of the proposed facility. To mitigate potential impacts, any pieces of woody debris more than thirty centimetres in diameter that are located at the site of the proposed boat ramp and jetty or within ten metres either side should be lifted and immediately relocated to an area of similar depth in the bay to the east of the proposed facility.

Recovery Plans

Black Rockcod *Epinephelus daemelii* - There is an adopted recovery plan for the Black Rockcod. One objective of the plan is relevant: ensure that management authorities carry out appropriate planning and impact assessment and make management decisions which minimise impacts on black cod habitats. This assessment is consistent with that objective.

For other species and threats, the Department of Primary Industries has prepared a Priorities Action Statement to promote the recovery of threatened species and the abatement of key threatening processes in New South Wales. The Priorities Action Statement includes 11 recovery and threat abatement strategies.

- Research / monitoring
- Survey / mapping
- Collate and review existing information
- Habitat rehabilitation
- Enhance, modify or implement NRM planning processes to minimise adverse impacts on threatened species
- Habitat protection
- Advice to consent and determining authorities
- Community and stakeholder liaison, awareness and education
- Compliance / enforcement

- Stocking / translocation
- Pest eradication and control

The strategies identified as a priority for each species, population and ecological community and key threatening processes vary according to the abundance/size/condition of the listed species, the nature of the identified threats, the current knowledge of the species biology and ecology and the management requirements for each species. The proposed action is not inconsistent with these recovery and threat abatement strategies and actions.

5.8 Key Threatening Processes

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes are the things that threaten, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Of the thirty eight key threatening processes listed under the Threatened Species Conservation Act and eight listed under the Fisheries Management Act the following could conceivably be relevant to the proposal and require consideration.

Human-caused climate change. A small amount of fossil fuel would be burnt to operate machinery and the trees are a temporary carbon sink. However, as part of the 'forest carbon cycle', the carbon stored in the trees would ultimately have been released when the trees or their leaves and limbs died and decayed. The proposed actions would not significantly contribute to climate change.

Introduction of non-indigenous fish and marine vegetation to the coastal waters. No non-indigenous fish would be introduced as a result of this proposal. *Caulerpa taxifolia* was not present at the site when inspected in 2016 though it has been there in the past. Precautions (cleaning of equipment) for safeguarding against the spread of *Caulerpa taxifolia* and other weeds are listed in Section 7 of this report. Provided the safeguards are employed, the proposed action is neither likely to introduce non-indigenous fish or marine vegetation nor increase the impact of non-indigenous fish or marine vegetation.

The removal of large woody debris from NSW rivers and streams. Many native fish prefer to live in and around large woody debris such as branches and tree trunks that have fallen into a waterway and their numbers can often be directly correlated with the amount of large woody debris habitat available. The effects of removing large woody debris are often confounded with other human impacts on river systems however it appears that the removal of large woody debris has had major impacts on aquatic organisms. To mitigate potential impacts, any pieces of woody debris more than thirty centimetres in diameter that are located at the site of the proposed boat ramp and jetty or within ten metres either side should be lifted and immediately relocated to an area of similar depth in the bay to the east of the proposed facility.

Degradation of native riparian vegetation along New South Wales water courses is listed as a key threatening process because riparian vegetation is part of a healthy functioning ecosystem and has numerous ecological benefits. Along the shoreline at the site of the proposed ramp there was a narrow band of saltmarsh plants, Swamp

Oaks and some eucalypts. The construction of the boat ramp and jetty would result in direct removal of this narrow band of riparian vegetation along approximately 11 metres of foreshore. There is likely to be additional degradation of riparian vegetation adjacent to the ramp as people access vessels. The area is not large in relation to the size of the stands around the whole lake and revegetation using local native species would be undertaken where appropriate. The placement of sand to slow erosion on some areas will help reduce future loss of riparian vegetation and will not cause extinction of species. The proposed action is not likely to degrade riparian vegetation nor increase impacts from degradation of riparian vegetation to the extent that species are likely to become extinct.

Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. Construction and operation will take place in and beside the creek and it would be possible for some packaging, strapping or other debris to enter the waterway. The following precautions for safeguarding against waste entering the waterway would be required during construction and operation. Waste material (for example packaging, strapping, off-cuts, excess concrete) shall be contained within the land-based site and then be removed to an authorised waste disposal facility or an appropriate storage area for reuse elsewhere. No material shall be placed in any location or in any manner that would allow it to enter the waterway or escape from the site. Stockpiles of debris and construction materials shall be stored at least 10 metres outside the top of the creek bank. General refuse shall be disposed of to a covered container stored at the site. This container, when full, shall be transported to Council's authorised waste disposal centre. No waste shall be burnt or buried on-site or disposed of in the waterway. If treated timber is to be used, additional precautions for safeguarding against waste entering the waterway during construction are included in Section 7 of this report. Provided the safeguards are employed, the proposed actions are not likely to lead to, nor increase the impact of entanglement in or ingestion of anthropogenic debris in marine and estuarine environments.

Overall, provided the environmental safeguards proposed in Section 7 are employed, the proposed action is not likely to be part of a key threatening process nor is it likely to result in the operation of, or increase the impact of, a key threatening process to the extent that it could threaten the survival or evolutionary development of any aquatic or riparian threatened species, populations or ecological communities.

5.9 NSW Threatened Species Conclusion

Provided the proposed environmental safeguards are employed, there is not likely to be a significant effect on aquatic or riparian threatened species, populations or ecological communities, or their habitats from the proposed action and therefore a species impact statement is not required.

6 AUSTRALIAN ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT

6.1 Protected Matters

Actions that are likely to have a significant impact on a matter of national environmental significance, or are being undertaken on or would have an effect on Commonwealth land, are known as protected matters and may require approval under the EPBC Act. The EPBC Act identifies nine matters of national environmental significance:

- world heritage properties
- national heritage places
- Ramsar wetlands of international importance
- listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The Australian Department of Environment's online Protected Matters Search Tool was interrogated on 11 July 2016 for the area within a 10 kilometre radius of the site. The report is summarised below and the full report is attached to the review of environmental factors for this proposal.

Matters of National Environmental Significance

World Heritage Properties: None
National Heritage Places: None
Wetlands of International Importance: None
Great Barrier Reef Marine Park: None
Commonwealth Marine Areas: None
Listed Threatened Ecological Communities: 4
Listed Threatened Species: 68
Listed Migratory Species: 45

Other Matters Protected by the EPBC Act

Commonwealth Land: None
Commonwealth Heritage Places: None
Listed Marine Species: 69 (relevant to Commonwealth areas only)
Whales and Other Cetaceans: 12
Critical Habitats: None
Commonwealth Reserves: None

The proposal is not a nuclear action nor is the action a coal seam gas development and large coal mining development. The proposal is not being undertaken on Commonwealth land nor would it have an effect on Commonwealth land.

The protected matters report included a threatened ecological community, a number of listed threatened species and migratory species that have a range of distribution that includes the area of the proposed works. An assessment of the likelihood of there being a significant impact and therefore whether the matter should be referred to the Australian Government Minister for the Environment is set out below. The following assessments consider criteria from the Department of the Environment, Water, Heritage and the Arts' Significant Impact Guidelines (Australia Government, 2013).

6.2 Threatened Ecological Community

The threatened ecological community Subtropical and Temperate Coastal Saltmarsh occurs at the site. As described in Section 5.4, a very small area would be affected.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- *reduce the extent of an ecological community*

The proposed actions would not be likely to reduce the extent of an ecological community.

- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

The proposed actions would not be likely to fragment or increase fragmentation of an ecological community.

- *adversely affect habitat critical to the survival of an ecological community*

The proposed actions would not be likely to adversely affect habitat critical to the survival of an ecological community.

- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

The proposed actions would not be likely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival.

- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

The proposed actions would not be likely to cause a substantial change in the species composition of an occurrence of an ecological community.

- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community including, but not limited to:*
    - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
    - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or*

The proposed actions would not be likely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community.

- *interfere with the recovery of an ecological community.*

The proposed actions would not be likely to interfere with the recovery of an ecological community.

6.3 Threatened Species

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

As described in sections 4 and 5 of this report, the area of proposed works would affect very little aquatic or riparian habitat, if any, for the species listed in the protected matters report and is not likely to lead to a long term decrease in populations. Based on consideration of the above criteria, it is not expected that there will be significant effects on nationally threatened species.

6.4 Migratory Species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The area of proposed works would affect very little aquatic or riparian habitat, if any, for the migratory species listed in the protected matters report. Based on consideration of the above criteria, it is not expected that there will be significant effects on migratory species.

6.5 EPBC Act Conclusion

Provided the proposed environmental safeguards are employed, the proposed actions are not likely to have a significant impact on a matter of national environmental significance, nor are the actions being undertaken on or having an effect on Commonwealth land. The proposed actions therefore do not need to be referred to the Australian Minister for the Environment.

7 ENVIRONMENTAL SAFEGUARDS AND IMPACT MITIGATION

The following measures, if adopted, will assist in the protection and rehabilitation of aquatic and riparian ecological communities and their habitats at the site.

1. Application shall be made for s205 permit under the Fisheries Management Act for destruction or disturbance of marine vegetation (saltmarsh, seagrass and macroalgae).

2. If the work is not authorised under the Crown Lands Act, application shall be made for s200 permit under the Fisheries Management Act for carrying out dredging or reclamation work.

3. If there is to be any use of explosives in the waterway an approval under clauses 112-113 of the Fisheries Management (General) Regulation 2002 shall be obtained.

4. The boat ramp shall be built on widely spaced piles or culverts should be included under the ramp to minimise restriction on movement of water, sediment, plants and animals.

5. As an offset for the construction of the new ramp and associated infrastructure the current ramp situated in the west of the village shall be removed and the site rehabilitated.

6. Advisory material shall be provided on the actions that waterway users should take to prevent reintroduction or further spread of *Caulerpa taxifolia* to unaffected areas.

7. Workers shall be informed of their obligations and possible offences under the Fisheries Management Act with respect to marine vegetation.

8. Physical disturbance to the bed and banks of the waterway shall be minimised and restricted to only what is required for installation of the structures. If possible, machinery should not enter the waterway unless on a floating barge. Barges or other work vessels should not anchor in a way that would damage seagrasses or foreshore vegetation. If it is necessary for equipment to work from the estuary bed then it should do so from within the footprint of the ramp/jetty, commencing offshore and proceeding landward.

9. Environmental safeguards (e.g., silt curtains, booms etc.) should be used during construction to minimise escape of turbid plumes into the aquatic environment.

10. Any pieces of woody debris more than thirty centimetres in diameter that are located at the site of the proposed boat ramp and jetty or within ten metres either side should be lifted and immediately relocated to an area of similar depth in the bay to the east of the proposed facility.

11. Disturbed ground surfaces shall be stabilised as soon as possible using appropriate methods as specified in a soil and water management plan.

12. To prevent oxidation of potential acid sulfate soil and possible degradation of the

waterway, no sediment material from the bed of the waterway should be removed from the waterway or groundwater layer and exposed to air unless a preliminary assessment has been undertaken to determine whether potential acid sulfate soils are present and, if necessary, an acid sulfate soils management plan has been prepared in accordance with the ASS Assessment Guidelines (Ahern et al., 1998).

13. Waste material (for example packaging, strapping, off-cuts, excess concrete) shall be contained within the land-based site during construction and then be removed to an authorised waste disposal facility or an appropriate storage area for reuse elsewhere. No material shall be placed in any location or in any manner that would allow it to enter the waterway or escape from the site into adjoining bushland or residential areas. Stockpiles of debris and construction materials shall be stored at least 10 metres outside the top of the lake banks or the national park boundary. General refuse shall be disposed of to a covered container stored at the site. This container, when full, shall be transported to Council's authorised waste disposal centre. No waste shall be burnt or buried on-site or disposed of in the waterway or bushland.

14. During construction over the water appropriate measures shall be put in place to catch debris and prevent it from entering the waterway.

15. If treated timber is to be used:

    a. Pigment Emulsified Creosote (PEC), which is virtually free of surface bleeding, shall be used in preference to ordinary creosote. Treatment will be in accordance with AS/NZS2843.

    b. After the final PEC treatment the product shall be held for a minimum of six weeks to allow the emulsion to "break" which then provides the final surface condition.

    c. The supplier shall be made aware that pieces with visibly oily surfaces will not be accepted.

    d. The product shall be inspected visually to ensure that there are no excessive residual materials or preservative deposits. If the material does not appear clean and dry or has developed areas of "bleeding" it shall be rejected.

    e. Construction debris shall be prevented from entering the waterway.

    f. Construction debris, including off cuts and sawdust shall be collected and disposed of to an approved waste disposal site. This may be achieved by setting up a single cutting station and/or by use of tarpaulins to catch sawdust and drillings.

16. When treating cut surfaces of timber with preservative or paint the following precautions apply:

    a. The use of field treatment preservatives is best limited through prefabrication of the wooden structures, which reduces the need for field

cutting and drilling.

b. If field treatment with preservatives is necessary they shall be applied sparingly and with care to avoid spillage.

c. Whenever possible, the field treatment shall be applied to the member before it is placed in a structure over water. Excess preservative shall be wiped from the wood.

d. If the preservative must be applied to wood above water, a tray, bucket, pan or other collection device shall be used to contain spills and drips.

e. Field treatments shall not be applied in the rain to wood that is above water.

f. Materials treated with field preservatives shall not be placed directly into water unless the treated surface is dry and free of excess preservative.

17. An environmental management plan shall be prepared by the construction company that addresses, amongst other things, ways in which pollution by noise, dust, waste, fuel and oil will be avoided. This shall include protocols for equipment maintenance, storage of fuel and other chemicals and materials, management of waste and refuelling procedures.

18. To avoid pollution from machinery, refuelling shall generally be done off site, however if refuelling on site is required, due care shall be taken to avoid spilling fuel and a tray shall be used to catch any accidentally spilt fuel. Spill kits are to be available on site at all times during works.

19. No major equipment maintenance works shall be undertaken on-site.

20. Prior to use at the site, machinery is to be cleaned, degreased and serviced. If the machinery has previously been used in a waterway where the noxious macroalga *Caulerpa taxifolia* is present, the contractor shall:

a) inspect anchors, ropes and chains for pieces of *Caulerpa*
b) inspect diving equipment such as wetsuits, bags and other gear before and after use
c) inspect trailers, propellers and engine intakes
d) inspect construction equipment and materials
e) use dedicated 'wash-down' facilities where available, ensuring that vessel and equipment is thoroughly free of all matter before leaving the area
f) collect any fragments of *Caulerpa* that may have been picked up, seal the pieces in a plastic bag and dispose of them in a bin where they cannot re-enter the waterway.

21. A visual inspection of the waterway for dead or distressed fish is to be undertaken twice daily during the works. Observations of dead or distressed fish are to be immediately reported to the Fishers Watch hotline on 1800 043 536. In such cases all works are to cease until the issue is rectified and approval is given to proceed.

8 CONCLUSIONS

The area of the proposed public boat launching facility at Lot 7308 DP 1144810 Havilland Street Conjola Park aquatic and riparian habitats that are typical of the margins of the central basin of the lake.

A number of environmental safeguards are proposed to mitigate the impacts of the proposal.

It is concluded that the removal of approximately 20 square metres of habitat would not result in a significant environmental impact.

Provided the environmental safeguards for impact mitigation are applied, there is not likely to be a significant effect on threatened aquatic or riparian species, populations or ecological communities, or their habitats from the proposed action and therefore a species impact statement is not required.

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ATTACHMENTS

ATTACHMENT 1. WEATHER CONDITIONS AT THE TIME OF FIELD SURVEY

ATTACHMENT 2. WATER LEVELS AT THE TIME OF FIELD SURVEY

ATTACHMENT 3. ATLAS OF NSW WILDLIFE SEARCH RESULTS

Latest Weather Observations for Ulladulla

IDN60801

Issued at 7:04 pm EST Friday 16 September 2016 (issued every 30 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 069138 **Name:** ULLADULLA AWS **Lat:** -35.36 **Lon:** 150.48 **Height:** 35.7 m

Data from the previous 72 hours. | See also: Recent months at Ulladulla

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
16/07:00pm	15.2	14.9	10.0	71	2.7	ENE	2	7	1	4	1018.2	1018.2	0.0
16/06:30pm	15.2	14.5	10.2	72	2.6	ENE	4	7	2	4	1017.6	1017.6	0.0
16/06:00pm	15.2	14.2	10.2	72	2.6	ENE	6	9	3	5	1017.0	1017.0	0.0
16/05:30pm	15.5	14.4	10.5	72	2.6	ENE	7	13	4	7	1016.4	1016.4	0.0
16/05:00pm	15.8	14.9	10.6	71	2.8	NE	6	13	3	7	1016.0	1016.0	0.0
16/04:30pm	16.1	15.0	10.6	70	2.9	NE	7	13	4	7	1015.5	1015.5	0.0
16/04:00pm	16.1	14.5	10.2	68	3.1	NE	9	13	5	7	1015.3	1015.3	0.0
16/03:30pm	16.5	15.0	10.4	67	3.2	NE	9	17	5	9	1015.2	1015.2	0.0
16/03:00pm	16.5	15.2	10.1	66	3.4	NE	7	13	4	7	1015.3	1015.3	0.0
16/02:30pm	16.6	14.6	10.2	66	3.4	E	11	17	6	9	1015.1	1015.1	0.0
16/02:00pm	16.9	15.1	11.0	68	3.2	E	11	20	6	11	1015.0	1015.0	0.0
16/01:30pm	17.2	15.4	9.4	60	4.1	E	9	20	5	11	1015.1	1015.1	0.0
16/01:00pm	17.8	15.7	6.0	46	5.8	ENE	6	13	3	7	1015.1	1015.1	0.0
16/12:30pm	17.5	14.6	6.7	49	5.4	SSE	11	15	6	8	1015.0	1015.0	0.0
16/12:00pm	17.7	14.4	6.3	47	5.6	SSE	13	17	7	9	1015.1	1015.1	0.0
16/11:30am	19.4	17.2	7.8	47	6.0	SW	9	22	5	12	1015.5	1015.5	0.0
16/11:00am	18.1	16.2	6.6	47	5.7	SSW	6	11	3	6	1015.6	1015.6	0.0
16/10:30am	19.1	16.2	6.6	44	6.3	SW	11	20	6	11	1015.6	1015.6	0.0
16/10:00am	18.0	14.9	7.4	50	5.3	WSW	13	20	7	11	1015.9	1015.9	0.0
16/09:30am	15.8	13.5	7.6	58	4.1	WSW	9	13	5	7	1015.9	1015.9	0.0
16/09:00am	15.2	12.8	7.0	58	4.0	WSW	9	19	5	10	1015.9	1015.9	0.0
16/08:30am	15.2	12.3	6.5	56	4.2	W	11	20	6	11	1015.6	1015.6	0.0
16/08:00am	14.9	13.1	7.0	59	3.9	SW	6	13	3	7	1015.4	1015.4	0.0
16/07:30am	14.3	12.2	6.6	60	3.7	WSW	7	13	4	7	1015.1	1015.1	0.0
16/07:00am	13.9	12.0	6.5	61	3.6	WSW	6	9	3	5	1014.5	1014.5	0.0
16/06:30am	13.3	11.3	6.4	63	3.3	SW	6	11	3	6	1013.8	1013.8	0.0
16/06:00am	13.2	11.0	6.1	62	3.4	SW	7	13	4	7	1013.5	1013.5	0.0
16/05:30am	13.6	10.2	6.0	60	3.6	WSW	13	22	7	12	1013.1	1013.1	0.0
16/05:00am	13.4	10.7	5.8	60	3.6	WSW	9	19	5	10	1013.0	1013.0	0.0
16/04:30am	13.4	10.7	5.6	59	3.7	WSW	9	19	5	10	1012.6	1012.6	0.0
16/04:00am	12.2	9.9	5.8	65	3.0	WSW	7	19	4	10	1012.0	1012.0	0.0
16/03:30am	11.7	9.4	4.9	63	3.1	SW	6	9	3	5	1012.1	1012.1	0.0
16/03:00am	11.4	9.0	4.4	62	3.2	SW	6	9	3	5	1012.2	1012.2	0.0
16/02:30am	11.7	10.1	4.4	61	3.3	SW	2	6	1	3	1011.9	1011.9	0.0
16/02:00am	11.8	10.3	4.8	62	3.2	SW	2	7	1	4	1011.8	1011.8	0.0
16/01:30am	12.1	10.2	4.8	61	3.3	SW	4	6	2	3	1012.0	1012.0	0.0
16/01:00am	12.1	10.5	4.6	60	3.4	WSW	2	6	1	3	1012.2	1012.2	0.0
16/12:30am	13.4	11.4	4.6	55	4.1	WSW	4	9	2	5	1012.1	1012.1	0.0
16/12:00am	12.5	10.8	4.2	57	3.8	S	2	6	1	3	1012.1	1012.1	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/11:30pm	14.0	11.5	3.8	50	4.6	SW	6	15	3	8	1011.8	1011.8	0.0
15/11:00pm	14.5	11.1	3.9	49	4.9	W	11	26	6	14	1011.4	1011.4	0.0
15/10:30pm	14.8	10.2	3.6	47	5.1	WNW	17	30	9	16	1011.2	1011.2	0.0
15/10:00pm	14.6	11.1	3.7	48	5.0	W	11	26	6	14	1011.3	1011.3	0.0
15/09:30pm	14.5	11.7	3.3	47	5.1	WSW	7	20	4	11	1011.4	1011.4	0.0
15/09:00pm	14.9	10.9	3.1	45	5.3	WSW	13	32	7	17	1011.4	1011.4	0.0
15/08:30pm	15.1	12.0	3.6	46	5.3	W	9	32	5	17	1011.4	1011.4	0.0
15/08:00pm	15.1	12.4	3.9	47	5.2	WNW	7	13	4	7	1011.0	1011.0	0.0
15/07:30pm	15.4	12.7	3.9	46	5.3	SW	7	17	4	9	1010.5	1010.5	0.0
15/07:00pm	15.7	11.7	4.7	48	5.2	W	15	28	8	15	1010.0	1010.0	0.0
15/06:30pm	15.7	11.2	5.9	52	4.7	WNW	19	35	10	19	1009.3	1009.3	0.0
15/06:00pm	15.8	11.7	6.3	53	4.6	WNW	17	32	9	17	1009.0	1009.0	0.0
15/05:30pm	16.2	11.5	6.1	51	4.9	WNW	20	35	11	19	1008.6	1008.6	0.0
15/05:00pm	16.6	14.3	5.9	49	5.2	SW	7	15	4	8	1008.5	1008.5	0.0
15/04:30pm	17.1	12.8	5.4	46	5.6	WNW	17	39	9	21	1007.4	1007.4	0.0
15/04:00pm	18.3	15.5	5.2	42	6.4	WSW	9	17	5	9	1007.5	1007.5	0.0
15/03:30pm	18.3	14.0	5.2	42	6.3	NW	17	32	9	17	1006.7	1006.6	0.0
15/03:00pm	18.7	13.9	5.5	42	6.5	WNW	20	44	11	24	1005.9	1005.8	0.0
15/02:30pm	18.9	15.5	6.1	43	6.3	WNW	13	26	7	14	1006.6	1006.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/02:00pm	18.8	14.2	5.6	42	6.5	WNW	19	33	10	18	1006.3	1006.2	0.0
15/01:30pm	19.0	14.2	5.8	42	6.5	NW	20	35	11	19	1006.7	1006.6	0.0
15/01:00pm	18.4	13.6	4.9	41	6.5	WNW	19	39	10	21	1007.0	1006.9	0.0
15/12:30pm	18.3	13.7	5.8	44	6.1	WNW	19	35	10	19	1007.1	1007.0	0.0
15/12:00pm	19.4	14.8	5.8	41	6.7	WNW	19	35	10	19	1007.1	1007.0	0.0
15/11:30am	18.5	13.3	5.7	43	6.3	WNW	22	39	12	21	1006.4	1006.3	0.0
15/11:00am	18.4	12.4	5.3	42	6.4	NW	26	44	14	24	1006.3	1006.2	0.0
15/10:30am	18.1	12.7	4.7	41	6.4	NW	22	43	12	23	1006.2	1006.1	0.0
15/10:00am	18.3	13.3	3.8	38	6.8	WNW	19	33	10	18	1006.7	1006.6	0.0
15/09:30am	17.6	11.9	2.8	37	6.8	NW	22	37	12	20	1006.3	1006.2	0.0
15/09:00am	17.2	12.3	2.0	36	6.9	WNW	17	32	9	17	1006.6	1006.5	1.4
15/08:30am	16.0	10.6	1.3	37	6.4	NW	19	35	10	19	1006.8	1006.7	1.4
15/08:00am	15.7	10.0	0.3	35	6.6	NW	20	35	11	19	1006.3	1006.2	1.4
15/07:30am	15.0	9.3	0.4	37	6.2	WNW	20	41	11	22	1006.6	1006.5	1.4
15/07:00am	14.5	9.1	1.1	40	5.8	WNW	19	35	10	19	1006.7	1006.6	1.4
15/06:30am	14.0	7.7	1.3	42	5.5	NW	24	41	13	22	1006.6	1006.5	1.4
15/06:00am	13.3	7.8	1.9	46	5.0	WNW	20	35	11	19	1005.9	1005.8	1.4
15/05:30am	13.9	8.4	1.9	44	5.2	NW	20	39	11	21	1006.5	1006.4	1.4
15/05:00am	13.7	8.5	2.3	46	5.0	WNW	19	32	10	17	1006.6	1006.5	1.4
15/04:30am	13.7	10.3	2.0	45	5.1	NW	9	22	5	12	1006.0	1005.9	1.4
15/04:00am	14.0	9.8	1.6	43	5.4	WNW	13	33	7	18	1005.6	1005.5	1.4
15/03:30am	13.9	9.0	2.2	45	5.1	WNW	17	32	9	17	1005.8	1005.7	1.4
15/03:00am	14.3	8.2	2.9	46	5.1	NW	24	48	13	26	1006.2	1006.1	1.4
15/02:51am	14.5	7.6	2.4	44	5.4	WNW	28	48	15	26	1006.4	1006.3	1.4
15/02:30am	14.5	9.1	2.7	45	5.3	NW	20	32	11	17	1007.0	1006.9	1.4
15/02:00am	14.2	9.6	3.9	50	4.7	NW	17	28	9	15	1007.5	1007.5	1.4
15/01:30am	13.5	10.3	4.9	56	4.0	WNW	11	24	6	13	1007.9	1007.9	1.4
15/01:00am	12.3	10.6	6.1	66	2.9	NW	4	9	2	5	1008.3	1008.3	1.4
15/12:30am	13.4	12.1	5.8	60	3.6	WNW	2	7	1	4	1008.3	1008.3	1.4
15/12:00am	12.1	10.9	6.6	69	2.6	W	2	6	1	3	1008.1	1008.1	1.4

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/11:30pm	11.5	10.6	6.0	69	2.6	CALM	0	0	0	0	1008.2	1008.2	1.4
14/11:00pm	12.0	11.1	6.1	67	2.8	CALM	0	0	0	0	1008.2	1008.2	1.4
14/10:30pm	12.6	10.9	5.8	63	3.2	W	4	7	2	4	1008.6	1008.6	1.4
14/10:00pm	14.4	12.3	6.0	57	4.0	W	6	11	3	6	1009.0	1009.0	1.4
14/09:30pm	14.6	12.5	5.9	56	4.2	W	6	13	3	7	1008.9	1008.9	1.4
14/09:00pm	14.5	13.6	7.8	64	3.3	NW	2	6	1	3	1009.0	1009.0	1.4
14/08:30pm	15.0	12.9	6.6	57	4.1	WNW	7	15	4	8	1008.5	1008.5	1.4
14/08:00pm	15.7	12.3	7.5	58	4.1	NW	15	22	8	12	1008.2	1008.2	1.4
14/07:30pm	15.6	12.3	8.1	61	3.8	NW	15	24	8	13	1008.2	1008.2	1.4
14/07:00pm	15.3	13.7	10.3	72	2.6	WNW	9	26	5	14	1007.9	1007.9	1.4
14/06:30pm	15.6	15.4	13.1	85	1.4	WNW	6	11	3	6	1007.7	1007.7	1.4
14/06:00pm	16.8	17.8	14.4	86	1.4	WNW	2	11	1	6	1007.2	1007.1	1.4
14/05:30pm	17.7	18.1	15.3	86	1.4	W	7	17	4	9	1007.0	1006.9	1.2
14/05:00pm	18.5	19.2	15.7	84	1.7	NW	6	9	3	5	1007.0	1006.9	0.0
14/04:30pm	18.6	19.7	15.7	83	1.7	NW	4	7	2	4	1007.1	1007.0	0.0
14/04:00pm	18.4	19.2	15.8	85	1.5	NNW	6	13	3	7	1007.2	1007.1	0.0
14/03:30pm	18.6	18.7	15.5	82	1.8	NNE	9	17	5	9	1006.7	1006.6	0.0
14/03:00pm	18.5	17.8	15.4	82	1.8	NNE	13	20	7	11	1006.7	1006.6	0.0
14/02:30pm	19.2	18.4	16.2	83	1.8	NNE	15	24	8	13	1006.9	1006.8	0.0
14/02:00pm	19.1	18.3	16.0	82	1.9	NNE	15	20	8	11	1007.3	1007.3	0.0
14/01:30pm	19.6	19.9	16.1	80	2.1	NE	9	19	5	10	1007.6	1007.6	0.0
14/01:00pm	19.3	17.7	15.0	76	2.5	NNE	17	26	9	14	1008.1	1008.1	0.0
14/12:30pm	19.1	18.5	15.6	80	2.1	NNE	13	20	7	11	1008.8	1008.8	0.0
14/12:00pm	18.6	18.2	15.3	81	1.9	NNE	11	17	6	9	1009.4	1009.4	0.0
14/11:30am	18.1	17.8	15.5	85	1.5	NNE	11	17	6	9	1010.1	1010.1	0.0
14/11:00am	17.6	16.8	15.0	85	1.5	NNE	13	19	7	10	1010.4	1010.4	0.0
14/10:30am	17.4	16.9	14.9	85	1.4	NNE	11	15	6	8	1010.8	1010.8	0.0
14/10:00am	17.0	17.3	15.0	88	1.2	NW	7	11	4	6	1012.0	1012.0	0.0
14/09:30am	17.2	17.7	15.0	87	1.3	NW	6	9	3	5	1012.6	1012.6	0.0
14/09:00am	16.0	16.8	15.8	99	0.1	NW	6	9	3	5	1013.5	1013.5	0.2
14/08:30am	15.8	17.2	15.5	98	0.2	W	2	6	1	3	1013.3	1013.3	0.2
14/08:00am	15.5	16.9	15.5	100	0.0	W	2	4	1	2	1013.8	1013.8	0.2
14/07:30am	14.6	15.3	14.6	100	0.0	W	4	9	2	5	1014.2	1014.2	0.2
14/07:00am	14.1	14.1	14.1	100	0.0	S	7	17	4	9	1014.1	1014.1	0.0
14/06:30am	14.1	15.0	14.1	100	0.0	SSE	2	4	1	2	1013.3	1013.3	0.0
14/06:00am	14.2	14.8	14.2	100	0.0	SSE	4	6	2	3	1013.8	1013.8	0.0
14/05:30am	14.0	14.5	14.0	100	0.0	SSE	4	4	2	2	1013.7	1013.7	0.0
14/05:00am	14.1	14.9	13.8	98	0.2	SSE	2	4	1	2	1013.5	1013.5	0.0
14/04:30am	14.2	15.1	13.9	98	0.2	SSE	2	6	1	3	1014.1	1014.1	0.0
14/04:00am	14.5	14.7	14.3	99	0.1	SSE	6	6	3	3	1014.1	1014.1	0.0
14/03:30am	13.9	14.8	13.0	94	0.5	CALM	0	4	0	2	1013.6	1013.6	0.0
14/03:00am	14.3	15.3	13.2	93	0.6	CALM	0	0	0	0	1014.3	1014.3	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/02:30am	14.3	15.1	12.5	89	1.0	CALM	0	0	0	0	1014.9	1014.9	0.0
14/02:00am	14.5	15.3	12.5	88	1.1	CALM	0	0	0	0	1015.6	1015.6	0.0
14/01:30am	14.5	15.0	12.7	89	1.0	SSE	2	4	1	2	1015.9	1015.9	0.0
14/01:00am	14.2	14.6	12.6	90	0.9	SSE	2	6	1	3	1016.4	1016.4	0.0
14/12:30am	14.0	14.4	12.4	90	0.9	SSE	2	4	1	2	1016.1	1016.1	0.0
14/12:00am	14.5	14.5	12.4	87	1.1	S	4	7	2	4	1016.5	1016.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
13/11:30pm	14.6	15.4	12.6	88	1.1	CALM	0	0	0	0	1017.6	1017.6	0.0
13/11:00pm	14.6	15.4	12.6	88	1.1	CALM	0	2	0	1	1017.6	1017.6	0.0
13/10:30pm	14.6	14.3	12.6	88	1.1	S	6	7	3	4	1017.8	1017.8	0.0
13/10:00pm	14.5	14.6	12.7	89	1.0	SSE	4	6	2	3	1018.3	1018.3	0.0
13/09:30pm	14.1	14.1	12.5	90	0.9	SSE	4	6	2	3	1018.0	1018.0	0.0
13/09:00pm	14.2	14.3	12.6	90	0.9	SSE	4	7	2	4	1018.2	1018.2	0.0
13/08:30pm	14.4	14.5	12.8	90	0.9	SSE	4	6	2	3	1018.5	1018.5	0.0
13/08:00pm	14.4	14.4	12.4	88	1.1	SSE	4	4	2	2	1018.6	1018.6	0.0
13/07:30pm	14.5	14.6	12.7	89	1.0	SSE	4	6	2	3	1018.7	1018.7	0.0

This page was created at **05:21 on Saturday 17 September 2016 (AEDT)**

Latest Weather Observations for Nowra

IDN60801

Issued at 7:04 pm EST Friday 16 September 2016 (issued every 30 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 068072 **Name:** NOWRA RAN AIR STATION AWS **Lat:** -34.95 **Lon:** 150.54 **Height:** 109.0 m

Data from the previous 72 hours. | See also: Recent months at Nowra

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
16/07:00pm	15.1	10.5	3.6	46	5.3	WNW	17	20	9	11	1017.9	1017.8	0.0
16/06:30pm	14.7	11.2	3.5	47	5.1	WNW	11	15	6	8	1017.2	1017.1	0.0
16/06:00pm	16.2	10.5	2.6	40	6.2	W	22	32	12	17	1016.7	1016.6	0.0
16/05:30pm	17.1	11.4	2.7	38	6.6	W	22	32	12	17	1016.0	1015.9	0.0
16/05:00pm	18.2	12.4	2.5	35	7.2	W	22	33	12	18	1015.7	1015.6	0.0
16/04:30pm	18.6	11.6	2.0	33	7.6	W	28	39	15	21	1015.4	1015.3	0.0
16/04:00pm	18.7	13.2	2.1	33	7.6	W	20	33	11	18	1015.3	1015.2	0.0
16/03:30pm	18.4	12.2	1.9	33	7.5	W	24	35	13	19	1015.3	1015.2	0.0
16/03:00pm	19.4	12.5	2.3	32	7.9	W	28	37	15	20	1015.2	1015.1	0.0
16/02:30pm	19.5	12.7	3.2	34	7.7	W	28	39	15	21	1015.3	1015.2	0.0
16/02:00pm	18.4	12.4	3.1	36	7.1	W	24	33	13	18	1015.0	1014.9	0.0
16/01:30pm	18.9	12.2	3.5	36	7.3	WSW	28	39	15	21	1015.1	1015.0	0.0
16/01:00pm	18.8	13.6	3.4	36	7.2	W	20	33	11	18	1015.0	1014.9	0.0
16/12:30pm	19.3	14.9	4.6	38	7.1	WSW	17	28	9	15	1015.1	1015.0	0.0
16/12:00pm	17.6	12.9	5.2	44	6.0	WSW	19	28	10	15	1015.3	1015.2	0.0
16/11:30am	18.8	13.6	5.3	41	6.6	W	22	33	12	18	1015.5	1015.4	0.0
16/11:00am	18.5	12.4	4.7	40	6.6	W	26	37	14	20	1015.7	1015.6	0.0
16/10:30am	18.6	14.1	7.1	47	5.8	WSW	20	28	11	15	1015.7	1015.6	0.0
16/10:00am	17.4	13.3	7.7	53	4.9	WNW	19	28	10	15	1015.9	1015.8	0.0
16/09:30am	16.6	12.2	7.5	55	4.6	W	20	26	11	14	1016.1	1016.0	0.0
16/09:00am	15.4	11.3	6.4	55	4.4	WNW	17	28	9	15	1016.0	1015.9	0.0
16/08:30am	14.6	12.6	6.9	60	3.8	WSW	7	9	4	5	1015.9	1015.8	0.0
16/08:00am	14.0	11.9	6.8	62	3.5	W	7	13	4	7	1015.7	1015.6	0.0
16/07:30am	13.6	12.8	6.5	62	3.4	CALM	0	0	0	0	1015.4	1015.3	0.0
16/07:00am	13.5	11.4	6.8	64	3.2	WSW	7	9	4	5	1014.8	1014.7	0.0
16/06:30am	13.0	10.4	6.1	63	3.3	NNW	9	13	5	7	1014.2	1014.1	0.0
16/06:00am	12.9	9.9	5.8	62	3.4	NW	11	20	6	11	1013.7	1013.6	0.0
16/05:30am	13.3	8.6	5.9	61	3.5	WNW	20	26	11	14	1013.1	1013.0	0.0
16/05:00am	13.1	8.4	6.2	63	3.3	NW	20	26	11	14	1012.9	1012.8	0.0
16/04:30am	13.1	8.5	6.5	64	3.2	WNW	20	28	11	15	1012.4	1012.4	0.0
16/04:00am	13.0	8.4	6.4	64	3.2	NW	20	28	11	15	1012.6	1012.6	0.0
16/03:30am	12.9	8.3	6.3	64	3.2	NW	20	28	11	15	1012.4	1012.4	0.0
16/03:00am	12.8	7.8	6.4	65	3.1	WNW	22	30	12	16	1012.0	1012.0	0.0
16/02:30am	12.7	7.3	6.5	66	3.0	NW	24	35	13	19	1012.2	1012.2	0.0
16/02:00am	12.6	7.9	6.2	65	3.0	WNW	20	30	11	16	1012.3	1012.3	0.0
16/01:30am	12.8	7.4	6.2	64	3.1	NW	24	32	13	17	1012.5	1012.5	0.0
16/01:00am	13.0	7.9	6.1	63	3.3	WNW	22	30	12	16	1012.4	1012.4	0.0
16/12:30am	13.3	7.4	5.9	61	3.5	WNW	26	35	14	19	1012.5	1012.5	0.0
16/12:00am	13.3	7.0	5.7	60	3.6	WNW	28	35	15	19	1012.9	1012.8	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/11:48pm	13.3	7.0	5.7	60	3.6	WNW	28	46	15	25	1012.6	1012.6	0.0
15/11:30pm	13.4	7.1	5.6	59	3.7	WNW	28	39	15	21	1012.5	1012.5	0.0
15/11:00pm	13.6	7.3	5.5	58	3.8	WNW	28	43	15	23	1012.6	1012.6	0.0
15/10:30pm	13.6	7.5	5.0	56	4.0	NW	26	33	14	18	1012.4	1012.4	0.0
15/10:00pm	13.8	8.0	4.4	53	4.3	WNW	24	32	13	17	1012.5	1012.5	0.0
15/09:30pm	14.0	8.6	4.3	52	4.5	WNW	22	35	12	19	1012.3	1012.3	0.0
15/09:00pm	14.0	7.5	4.6	53	4.4	WNW	28	41	15	22	1012.2	1012.2	0.0
15/08:30pm	14.2	8.6	5.3	55	4.2	WNW	24	39	13	21	1011.8	1011.8	0.0
15/08:00pm	14.1	9.4	6.0	58	3.9	WNW	20	28	11	15	1011.5	1011.4	0.0
15/07:30pm	14.4	9.4	6.3	58	3.9	W	22	37	12	20	1011.1	1011.0	0.0
15/07:00pm	14.4	8.6	6.3	58	3.9	WNW	26	41	14	22	1010.6	1010.5	0.0
15/06:30pm	15.0	8.2	5.2	52	4.6	WNW	30	50	16	27	1010.0	1009.9	0.0
15/06:18pm	15.0	7.8	5.2	52	4.6	WNW	32	54	17	29	1009.7	1009.6	0.0
15/06:00pm	15.2	8.7	4.9	50	4.9	WNW	28	39	15	21	1010.0	1009.9	0.0
15/05:30pm	15.6	9.6	5.2	50	5.0	WNW	26	35	14	19	1009.0	1008.9	0.0
15/05:00pm	16.0	9.1	4.7	47	5.4	WNW	30	46	16	25	1008.8	1008.7	0.0
15/04:30pm	16.4	8.9	4.4	45	5.7	WNW	33	50	18	27	1008.1	1008.0	0.0
15/04:00pm	16.9	8.3	4.6	44	5.9	WNW	39	65	21	35	1008.1	1008.0	0.0
15/03:30pm	17.3	9.1	4.6	43	6.1	W	37	57	20	31	1007.5	1007.4	0.0
15/03:00pm	17.9	10.3	4.1	40	6.6	WNW	33	50	18	27	1006.4	1006.3	0.0
15/02:30pm	18.2	10.6	4.0	39	6.7	W	33	52	18	28	1006.1	1006.0	0.0
15/02:00pm	18.2	10.0	4.7	41	6.5	WNW	37	69	20	37	1006.3	1006.2	0.0
15/01:30pm	17.5	8.9	4.8	43	6.1	WNW	39	61	21	33	1006.4	1006.3	0.0
15/01:00pm	18.8	11.1	5.3	41	6.6	WNW	35	59	19	32	1006.4	1006.3	0.0
15/12:30pm	18.6	9.3	5.1	41	6.6	WNW	43	80	23	43	1006.7	1006.6	0.0
15/12:23pm	17.7	8.3	4.3	41	6.4	WNW	43	80	23	43	1006.8	1006.7	0.0
15/12:00pm	18.5	10.3	5.0	41	6.6	WNW	37	61	20	33	1006.7	1006.6	0.0
15/11:30am	18.1	10.2	4.3	40	6.6	NW	35	57	19	31	1007.1	1007.0	0.0
15/11:00am	17.6	8.8	3.5	39	6.6	WNW	39	65	21	35	1006.9	1006.8	0.0
15/10:30am	17.7	8.1	3.6	39	6.6	NW	43	63	23	34	1006.2	1006.1	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
15/10:00am	17.2	9.0	2.8	38	6.6	NW	35	56	19	30	1005.8	1005.7	0.0
15/09:30am	16.1	6.1	1.0	36	6.6	WNW	43	63	23	34	1006.1	1006.0	0.0
15/09:00am	15.5	4.8	0.1	35	6.6	NW	46	72	25	39	1006.2	1006.1	0.0
15/08:30am	15.3	6.0	0.7	37	6.3	NW	39	57	21	31	1006.6	1006.5	0.0
15/08:00am	14.4	3.4	0.6	39	5.9	NW	48	72	26	39	1006.6	1006.5	0.0
15/07:30am	13.9	2.6	1.2	42	5.5	NW	50	72	27	39	1006.3	1006.2	0.0
15/07:00am	13.5	2.7	1.8	45	5.1	WNW	48	69	26	37	1006.3	1006.2	0.0
15/06:30am	13.0	4.1	2.8	50	4.5	WNW	39	63	21	34	1006.4	1006.3	0.0
15/06:00am	12.5	4.9	4.0	56	3.9	NW	33	56	18	30	1006.8	1006.7	0.0
15/05:30am	12.7	3.2	3.9	55	4.0	WNW	43	69	23	37	1006.8	1006.7	0.0
15/05:00am	12.7	4.3	3.9	55	4.0	WNW	37	57	20	31	1006.6	1006.5	0.0
15/04:30am	12.8	4.4	3.7	54	4.1	WNW	37	57	20	31	1006.8	1006.7	0.0
15/04:08am	13.2	5.5	3.6	52	4.3	WNW	33	54	18	29	1006.7	1006.6	0.0
15/04:00am	13.2	5.2	3.6	52	4.4	WNW	35	50	19	27	1006.7	1006.6	0.0
15/03:32am	13.5	5.7	2.7	48	4.8	WNW	33	52	18	28	1006.7	1006.6	0.0
15/03:30am	13.5	5.3	2.7	48	4.8	WNW	35	52	19	28	1006.7	1006.6	0.0
15/03:18am	13.3	6.4	2.8	49	4.7	WNW	28	50	15	27	1006.9	1006.8	0.0
15/03:00am	13.2	6.4	3.3	51	4.5	WNW	28	41	15	22	1007.3	1007.2	0.0
15/02:30am	12.9	8.1	4.8	58	3.7	NW	19	30	10	16	1008.0	1007.9	0.0
15/02:00am	12.7	8.9	5.8	63	3.3	NW	15	26	8	14	1008.4	1008.3	0.0
15/01:30am	12.9	8.4	6.3	64	3.2	NW	19	28	10	15	1008.5	1008.4	0.0
15/01:00am	12.0	9.9	6.7	70	2.5	NNW	7	11	4	6	1008.6	1008.5	0.0
15/12:30am	12.3	9.9	7.0	70	2.6	NNW	9	11	5	6	1008.8	1008.7	0.0
15/12:00am	12.3	10.3	7.0	70	2.6	NNW	7	11	4	6	1008.7	1008.6	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
14/11:30pm	12.5	10.1	7.2	70	2.6	NW	9	13	5	7	1008.4	1008.3	0.0
14/11:00pm	13.0	10.3	7.5	69	2.7	NNW	11	20	6	11	1008.7	1008.6	0.0
14/10:30pm	13.1	10.0	7.3	68	2.8	NW	13	20	7	11	1008.8	1008.7	0.0
14/10:00pm	13.3	10.5	6.9	65	3.1	NNW	11	19	6	10	1009.2	1009.1	0.0
14/09:30pm	13.7	10.5	6.8	63	3.4	NW	13	22	7	12	1009.5	1009.4	0.0
14/09:00pm	14.2	9.8	6.6	60	3.7	NW	19	26	10	14	1009.3	1009.2	0.0
14/08:30pm	14.3	10.7	6.9	61	3.6	NW	15	20	8	11	1009.0	1008.9	0.0
14/08:00pm	14.9	11.5	7.7	62	3.6	NNW	15	24	8	13	1009.0	1008.9	0.0
14/07:30pm	15.3	11.3	9.0	66	3.2	WNW	20	28	11	15	1008.5	1008.4	0.0
14/07:00pm	16.5	13.1	10.6	68	3.2	WNW	19	26	10	14	1008.2	1008.1	0.0
14/06:30pm	17.2	13.9	11.5	69	3.1	W	20	28	11	15	1007.7	1007.6	0.0
14/06:00pm	19.1	15.6	12.1	64	3.9	W	22	32	12	17	1007.4	1007.3	0.0
14/05:30pm	20.4	17.8	11.9	58	4.8	WNW	17	26	9	14	1006.9	1006.8	0.0
14/05:00pm	20.8	18.3	12.2	58	4.9	NW	17	24	9	13	1006.8	1006.7	0.0
14/04:30pm	21.1	20.6	13.8	63	4.2	NW	9	15	5	8	1006.7	1006.6	0.0
14/04:00pm	20.5	20.5	17.1	81	2.1	NNE	13	19	7	10	1006.9	1006.8	0.0
14/03:30pm	21.2	21.0	16.6	75	2.8	NNE	13	17	7	9	1007.1	1007.0	0.0
14/03:00pm	22.8	22.1	15.4	63	4.5	NE	13	20	7	11	1006.8	1006.7	0.0
14/02:30pm	21.9	19.9	13.8	60	4.7	NE	17	22	9	12	1007.0	1006.9	0.0
14/02:00pm	21.9	19.1	14.3	62	4.5	NE	22	30	12	16	1007.4	1007.3	0.0
14/01:30pm	23.2	21.2	15.0	60	4.9	E	19	26	10	14	1007.7	1007.6	0.0
14/01:00pm	22.7	21.5	14.0	58	5.1	NNE	13	20	7	11	1008.1	1008.0	0.0
14/12:30pm	22.2	21.2	13.5	57	5.0	NNE	11	15	6	8	1008.8	1008.7	0.0
14/12:00pm	21.2	20.3	13.6	62	4.4	NNE	11	15	6	8	1009.5	1009.4	0.0
14/11:30am	20.4	19.8	13.6	65	3.9	NNE	9	15	5	8	1010.0	1009.9	0.0
14/11:00am	19.5	18.0	13.2	67	3.6	NNE	13	17	7	9	1010.7	1010.6	0.0
14/10:30am	19.3	18.5	14.1	72	3.0	NE	11	17	6	9	1011.0	1010.9	0.0
14/10:00am	18.3	18.2	13.8	75	2.6	N	7	11	4	6	1012.0	1012.0	0.0
14/09:30am	17.2	17.4	14.8	86	1.4	N	7	11	4	6	1012.6	1012.6	0.0
14/09:00am	15.2	15.5	15.0	99	0.1	NNW	7	13	4	7	1013.5	1013.4	0.4
14/08:30am	14.7	14.5	14.7	100	0.0	N	9	11	5	6	1013.9	1013.8	0.4
14/08:00am	14.6	14.0	14.6	100	0.0	SW	11	13	6	7	1013.8	1013.7	0.4
14/07:30am	14.0	12.4	14.0	100	0.0	WSW	15	19	8	10	1013.9	1013.8	0.4
14/07:10am	13.8	12.5	13.8	100	0.0	W	13	17	7	9	1013.7	1013.6	0.4
14/07:00am	13.3	13.6	13.3	100	0.0	E	4	13	2	7	1013.5	1013.4	0.4
14/06:46am	13.1	12.4	13.1	100	0.0	ESE	9	11	5	6	1012.1	1012.1	0.4
14/06:30am	13.2	14.2	13.2	100	0.0	CALM	0	0	0	0	1013.0	1012.9	0.4
14/06:00am	13.1	12.7	13.1	100	0.0	WSW	7	9	4	5	1013.8	1013.7	0.2
14/05:30am	12.7	13.5	12.7	100	0.0	CALM	0	0	0	0	1013.7	1013.6	0.0
14/05:00am	12.6	13.4	12.6	100	0.0	CALM	0	0	0	0	1013.6	1013.5	0.0
14/04:30am	13.0	13.9	13.0	100	0.0	CALM	0	2	0	1	1013.8	1013.7	0.0
14/04:00am	12.7	13.5	12.7	100	0.0	CALM	0	0	0	0	1013.8	1013.7	0.0
14/03:30am	13.1	14.1	13.1	100	0.0	CALM	0	0	0	0	1013.9	1013.8	0.0
14/03:00am	12.9	13.7	12.7	99	0.1	CALM	0	0	0	0	1014.2	1014.1	0.0
14/02:30am	13.4	14.4	13.2	99	0.1	CALM	0	0	0	0	1014.9	1014.8	0.0
14/02:00am	13.8	14.9	13.6	99	0.1	CALM	0	2	0	1	1015.5	1015.4	0.0
14/01:30am	13.7	13.7	13.5	99	0.1	WSW	6	9	3	5	1015.8	1015.7	0.0
14/01:00am	13.6	12.6	13.4	99	0.1	WSW	11	15	6	8	1016.2	1016.1	0.0
14/12:30am	13.4	14.4	13.2	99	0.1	CALM	0	0	0	0	1016.1	1016.0	0.0
14/12:00am	13.9	14.9	13.3	96	0.3	CALM	0	0	0	0	1016.6	1016.5	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
13/11:30pm	14.0	14.3	13.5	97	0.3	WNW	4	7	2	4	1017.5	1017.4	0.0
13/11:00pm	14.0	14.3	13.4	96	0.3	WNW	4	7	2	4	1017.4	1017.3	0.0
13/10:30pm	14.2	15.3	13.4	95	0.4	CALM	0	0	0	0	1017.8	1017.7	0.0
13/10:00pm	14.2	14.6	13.6	96	0.3	NW	4	7	2	4	1018.4	1018.3	0.0
13/09:30pm	13.8	14.6	13.6	99	0.1	NW	2	7	1	4	1018.1	1018.0	0.0

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
13/09:29pm	13.8	14.6	13.6	99	0.1	NW	2	7	1	4	1018.1	1018.0	0.0
13/09:00pm	13.7	13.3	12.9	95	0.4	WSW	7	9	4	5	1018.0	1017.9	0.0
13/08:30pm	14.0	13.7	13.4	96	0.3	SSW	7	17	4	9	1018.1	1018.0	0.0
13/08:00pm	14.5	14.3	13.0	91	0.8	SW	6	15	3	8	1018.3	1018.2	0.0
13/07:30pm	13.4	12.6	12.8	96	0.3	SSW	9	9	5	5	1018.3	1018.2	0.0

This page was created at **05:20 on Saturday 17 September 2016 (AEST)**

Australian Government
Bureau of Meteorology

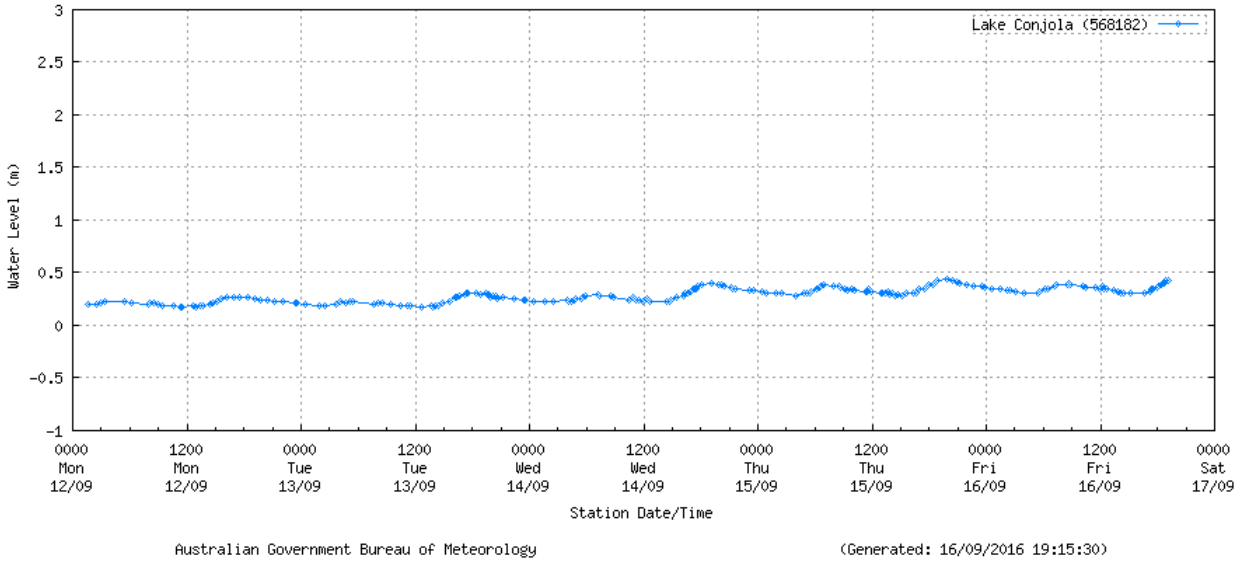
IDN60234

Latest River Heights for Lake Conjola

Issued at 7:15 pm EST Friday 16 September 2016

Station details: **Station Number:** 568182 **Name:** Lake Conjola

Data from the previous 4 days.



Data as Table | Previous Station | Next Station | Back to Bulletin

About this plot

1. The river height data is real-time operational data from automated telemetry systems and has not been quality controlled.
2. The data is provided for flood warning purposes and most data will not be available during non flood periods.
3. Most river height data is provided to the Bureau of Meteorology by other agencies. Separate approval may be required to use the data for other purposes.
4. Heights are given in metres.
5. Sites marked with ** indicate that the automatic telemeter gauge is at a different location to the historical flood gauge. Therefore, the height shown in the table is not the water level at the historical flood gauge.

This page was created at **on**

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of in SHOALHAVEN LGA returned a total of 163 records of 26 species.
Report generated on 3/03/2017 6:04 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Mammalia	Dugongidae	1558	*Dugong dugon*		Dugong	E1,P		7	
Animalia	Mammalia	Otariidae	1543	*Arctocephalus forsteri*		New Zealand Fur-seal	V,P		1	
Animalia	Mammalia	Otariidae	1882	*Arctocephalus pusillus doriferus*		Australian Fur-seal	V,P		17	
Animalia	Mammalia	Otariidae	T099	*Arctocephalus sp.*		Unidentified Fur-seal	P		10	
Animalia	Mammalia	Otariidae	1013	*Arctocephalus tropicalis*		Subantarctic Fur-seal	P		2	
Animalia	Mammalia	Otariidae	9040	*Seal sp.*		Unidentified Seal	P		8	
Animalia	Mammalia	Phocidae	1549	*Hydrurga leptonyx*		Leopard Seal	P		9	
Animalia	Mammalia	Balaenidae	1561	*Eubalaena australis*		Southern Right Whale	E1,P	E	8	
Animalia	Mammalia	Neobalaenidae	1564	*Caperea marginata*		Pygmy Right Whale	P		1	
Animalia	Mammalia	Balaenopteridae	1570	*Balaenoptera acutorostrata*		Dwarf Minke Whale	P		1	
Animalia	Mammalia	Balaenopteridae	1567	*Balaenoptera musculus*		Blue Whale	E1,P	E	K	
Animalia	Mammalia	Balaenopteridae	1575	*Megaptera novaeangliae*		Humpback Whale	V,P	V	4	
Animalia	Mammalia	Balaenopteridae	9041	*Whale sp.*		Unidentified Whale	P		2	
Animalia	Mammalia	Physeteridae	1578	*Physeter macrocephalus*		Sperm Whale	V,P		3	
Animalia	Mammalia	Kogiidae	1581	*Kogia breviceps*		Pygmy Sperm Whale	P		1	
Animalia	Mammalia	Ziphiidae	1584	*Hyperoodon planifrons*		Southern Bottle-nosed Whale	P		1	
Animalia	Mammalia	Ziphiidae	1593	*Mesoplodon grayi*		Gray's Beaked Whale	P		1	

Animalia	Mammalia	Ziphiidae	1591	*Mesoplodon layardii*	Strap-toothed Beaked Whale	P	2
Animalia	Mammalia	Ziphiidae	T098	*Mesoplodon sp.*	Unidentified Beaked Whale	P	1
Animalia	Mammalia	Delphinidae	1616	*Delphinus delphis*	Common Dolphin	P	3
Animalia	Mammalia	Delphinidae	9039	*Dolphin sp.*	Unidentified Dolphin	P	7
Animalia	Mammalia	Delphinidae	1605	*Globicephala macrorhynchus*	Short-finned Pilot Whale	P	1
Animalia	Mammalia	Delphinidae	1609	*Grampus griseus*	Risso's Dolphin	P	1
Animalia	Mammalia	Delphinidae	1630	*Lissodelphis peronii*	Southern Right Whale Dolphin	P	1
Animalia	Mammalia	Delphinidae	1899	*Tursiops aduncus*	Long-beaked Bottle-nosed Dolphin	P	52
Animalia	Mammalia	Delphinidae	1900	*Tursiops truncatus*	Bottlenose Dolphin	P	19

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Hard-shelled marine turtles (Family: Cheloniidae) in SHOALHAVEN LGA returned a total of 32 records of 5 species. Report generated on 3/03/2017 5:45 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Reptilia	Cheloniidae	2004	*Caretta caretta*		Loggerhead Turtle	E1,P	E	1	
Animalia	Reptilia	Cheloniidae	2007	*Chelonia mydas*		Green Turtle	V,P	V	26	
Animalia	Reptilia	Cheloniidae	T110	*Cheloniidae sp.*		unidentified sea turtle	P		1	
Animalia	Reptilia	Cheloniidae	2008	*Eretmochelys imbricata*		Hawksbill Turtle	P	V	3	
Animalia	Reptilia	Cheloniidae	2006	*Natator depressus*		Flatback Turtle	P		1	

Threatened Species Test of Significance
NSW Biodiversity Conservation Act
and
Update for Fisheries Management Act

for

Proposed Boat Launching Facility

Lot 7308 DP 1144810
Havilland Street
Conjola Park

PROPONENT: SHOALHAVEN CITY COUNCIL

PREPARED BY: PETER DALMAZZO

DATE: 7JULY 2020

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Contents

1 BACKGROUND

Peter Dalmazzo was commissioned by Shoalhaven City Council to update threatened species assessments for the potential impacts of a proposed new public boat launching ramp and associated facilities in Havilland Street Conjola Park to ensure compliance with the requirements of the Biodiversity Conservation Act 2016 which came into force in August 2017 and the Fisheries Management Act 1994. The proposal was assessed in 2016/17 under previous legislation (Threatened Species Conservation Act). This report refers to the previous assessments of potential impacts on aquatic and riparian flora and fauna (Dalmazzo, 2017a), terrestrial flora (Dalmazzo, 2017b) and terrestrial fauna (Lesryk Environmental Pty Ltd, 2017) and updates those reports to incorporate new information and changes to legislation. Although the layout has been changed since that assessment was done the footprint is similar and the amount of vegetation affected has not changed significantly, nor would additional significant habitat features be affected. The proposal is described in the review of environmental factors (Dalmazzo 2020) for the activity.

2 NSW FISHERIES MANAGEMENT ACT ASSESSMENT OF SIGNIFICANCE FOR THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS

Since the previous report was prepared (Dalmazzo, 2017a) there have been no relevant new listings under this legislation of threatened species, populations, ecological communities, critical habitat, recovery plans, threat abatement plans or key threatening processes. However two Greynurse Sharks (considered Critically Endangered in New South Wales) were observed within the lake in 2019. One of the sharks was found dead near the entrance of the lake on 2 July 2019. The second shark was removed from the lake and released at sea in December 2019. The conclusion reached in 2016 is still considered valid, that the proposed activity would not be likely to have an adverse effect on the life cycle of Greynurse Shark such that a viable local population of the species is likely to be placed at risk of extinction.

3 NSW BIODIVERSITY CONSERVATION ACT TEST OF SIGNIFICANCE FOR THREATENED SPECIES OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS

Since the previous reports were prepared (Dalmazzo, 2017a; Dalmazzo, 2017b and Lesryk Environmental Pty Ltd, 2017) the Biodiversity Conservation Act has replaced the Threatened Species Conservation Act. The Biodiversity Conservation Act 2016 requires that an assessment must be made of whether a proposed activity is likely to significantly affect threatened species or ecological communities (as listed in schedules to the Act), or their habitats, and therefore whether or not a biodiversity development assessment report or species impact statement must be prepared. Section 7.3 of the Act sets out the matters that are to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. The following assessment of significance considers the matters in section 7.3 and has been carried out using the assessment guidelines approved by the Minister for the Environment under section 7.3(2) of the Biodiversity Conservation Act (NSW Office of Environment and Heritage, 2018). The following ‘test of significance’ utilises information from the previous reports where relevant.

3.1 Threatened Species

(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

For species that were considered in the previous reports (Dalmazzo, 2017a, Dalmazzo, 2017b, Lesryk Environmental Pty Ltd, 2017), there is no change to the conclusions that the proposed activity would not be likely to have an adverse effect on the life cycle of any threatened species such that a viable local population of the species is likely to be placed at risk of extinction. However, since the previous reports were prepared a number of additional species have been listed as threatened under the Biodiversity Conservation Act and there have been additional sightings in the vicinity of the proposal that indicate potential occurrence on the subject site. Therefore, using the NSW Office of Environment and Heritage's BioNet website logged in as a licensed user, the Bionet Atlas was interrogated for records of threatened species listed in schedules to the Biodiversity Conservation Act that have been observed within a ten kilometre by ten kilometre area around the site. The results of the search are in Appendix 1. The animal and plant species from the Atlas search that were not considered in the previous reports are considered below with comment on their potential to occur at the site. Information on habitats and life history is mostly from the NSW Office of Environment and Heritage threatened species website. For species considered to have a reasonable likelihood of occurring at the site or that were observed at the site, more detailed assessments are provided.

Overall, it is concluded that the proposed activity would not be likely to have an adverse effect on the life cycle of any threatened species such that a viable local population of the species is likely to be placed at risk of extinction.

Rhodamnia rubescens Scrub Turpentine
Shrub or small tree to 25 m high with reddish/brown, fissured bark. Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. Seeds dispersed by birds, species is very bird attracting. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust which affects all plant parts. Recorded in 2002 off Lake Conjola Entrance Road, approximately 300 metres southsoutheast of “Yooralla Bay Boat Ramp” during Systematic Flora Survey P5MA Vegetation Survey. Although there are records of this species in nearby forests, no individuals of this species were observed at the subject site during flora surveys (Dalmazzo, 2017a and b). The proposed activity would not be likely to have an adverse effect on the life cycle of Scrub Turpentine such that a viable local population of the species is likely to be placed at risk of extinction.

Ptilinopus superbus Superb Fruit-Dove
Generally inhabits rainforest and other forest. Might occasionally forage or roost at the site but not detected during fauna surveys (Lesryk Environmental Pty Ltd, 2017). Unlikely to be affected.

Diomedea exulans Wandering Albatross
Diomedea gibsoni Gibson's Albatross
Thalassarche cauta Shy Albatross

Thalassarche melanophris Black-browed Albatross
Macronectes giganteus Southern Giant Petrel
Macronectes halli Northern Giant-Petrel
These are all marine species. No suitable habitat at the site. Unlikely to be affected.

Charadrius mongolus Lesser Sand-plover
Favours beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. No suitable habitat at the site. Unlikely to be affected.

Pezoporus wallicus wallicus Eastern Ground Parrot
Occurs in heathlands and sedgelands. No suitable habitat at the site. Unlikely to be affected.

Epthianura albifrons White-fronted Chat
Usually found foraging for insects on bare or grassy ground in wetland areas. Nests built in low vegetation, including low isolated mangroves. Might occasionally forage near the site. Unlikely to be affected.

Artamus cyanopterus cyanopterus Dusky Woodswallow
Inhabits dry, open eucalypt forests and woodlands. No evidence of nesting or roosting. Unlikely to be affected.

Petroica boodang Scarlet Robin
The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Abundant logs and fallen timber are important components of its habitat. Might occasionally forage at the site. Unlikely to be affected.

Saccolaimus flaviventris Yellow-bellied Sheathtail-bat
Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Might forage or roost at the site but not detected during fauna surveys (Lesryk Environmental Pty Ltd, 2017). Four of the twenty seven hollow-bearing trees on the site would be removed. A licenced wildlife handler would be on site during removal of hollow-bearing trees to relocate any fauna affected. The proposed activity would not be likely to have an adverse effect on the life cycle of this threatened species such that a viable local population of the species is likely to be placed at risk of extinction.

Phoniscus papuensis Golden-tipped Bat
Roost mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes. Might forage or roost at the site but not detected during fauna surveys (Lesryk Environmental Pty Ltd, 2017). Four of the twenty seven hollow-bearing trees on the site would be removed. A licenced wildlife handler would be on site during removal of hollow-bearing trees to relocate any fauna affected. The proposed activity would not be likely to have an adverse effect on the life cycle of this threatened species such that a viable local population of the species is likely to be placed at risk of extinction.

3.2 Threatened Ecological Communities

(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

(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

Potential impacts on two threatened ecological communities (Coastal Saltmarsh and Swamp Oak Forest) were assessed by Dalmazzo (2017a). The proposed activity is not likely to adversely affect the extent nor substantially and adversely modify the composition of a threatened ecological community such that a local occurrence is likely to be place at risk of extinction.

3.3 Habitat

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity

Less than one hectare of native vegetation would be removed overall (Approximately 0.63 ha in stage 1 and 0.24 ha in stage 2). The facility was redesigned a number of times to minimise the removal of hollow-bearing and other trees. Four of twenty seven hollow-bearing trees on the site would be removed. Overall, the affected area is likely to form a very small and insignificant part of the total threatened species habitat present in the locality.

(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

The proposal would not fragment or isolate an area of habitat of a threatened species or ecological community. Some of the site's value as a habitat corridor would be retained, although the facility would create some separation of tree canopy and understorey vegetation.

(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 modified is not included in a national park, nature reserve or other conservation area. As shown on Figure 1, 38 trees were noted to contain one or more hollows (hollow diameter ranging from 10 cm to 40 cm) within the subject site, during the terrestrial fauna assessment in 2016. These were mostly in the western and northern parts of the site and were considered to be important potential habitat resources for hollow-dependant species of animals. The site was searched again for hollow-bearing trees in March 2020 to assess the impact of the December 2019 bushfire on these habitat components. Some previously identified hollow bearing trees had fallen, some had burnt completely, some had been felled for safety reasons and some remained standing. Of the 38 hollow-bearing trees that were mapped in 2016, eleven were not found in 2020. Comparison of Figure 1 with Figures 2 and 3

shows that HBTS 19, 22 and 24 would be removed for stage 1 and HBT 2 would be removed for stage 2. The affected habitat is not likely to be significantly important to any life cycle stages or to reproductive success, and hence long term survival, of any threatened species or ecological community.

3.4 Area of Outstanding Biodiversity Value

(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)

No areas of land listed in the Register of Declared Areas of Outstanding Biodiversity Value would be affected by the proposed activity.

(http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/critical-habitats).

3.5 Key Threatening Processes

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Key threatening processes are the things that adversely affect threatened species or ecological communities, or could cause species or ecological communities that are not threatened to become threatened. Thirty eight key threatening processes that were listed under the Threatened Species Conservation Act (and which were carried over into the Biodiversity Conservation Act) were assessed by Dalmazzo (2017a and 2017b) and Lesryk Environmental Pty Ltd (2017).

One additional key threatening process was listed under the Biodiversity Conservation Act in November 2018 - "Habitat degradation and loss by Feral Horses (brumbies, wild horses), *Equus caballus* Linnaeus 1758." The proposed activity would not introduce feral horses nor increase the impact of feral horses.

Overall, provided the environmental safeguards for impact mitigation set out in the review of environmental factors are employed, the proposed activity is not likely to be part of a key threatening process, nor is it likely to result in the operation of, or increase the impact of, a key threatening process, to the extent that it could threaten the survival or evolutionary development of any threatened species or ecological communities.

3.6 Biodiversity Conservation Act Conclusion

Provided the environmental safeguards for impact mitigation set out in the review of environmental factors are applied, there are not likely to be significant effects on threatened species or ecological communities, or their habitats from the proposed activity and therefore a biodiversity development assessment report or a species impact statement is not required.

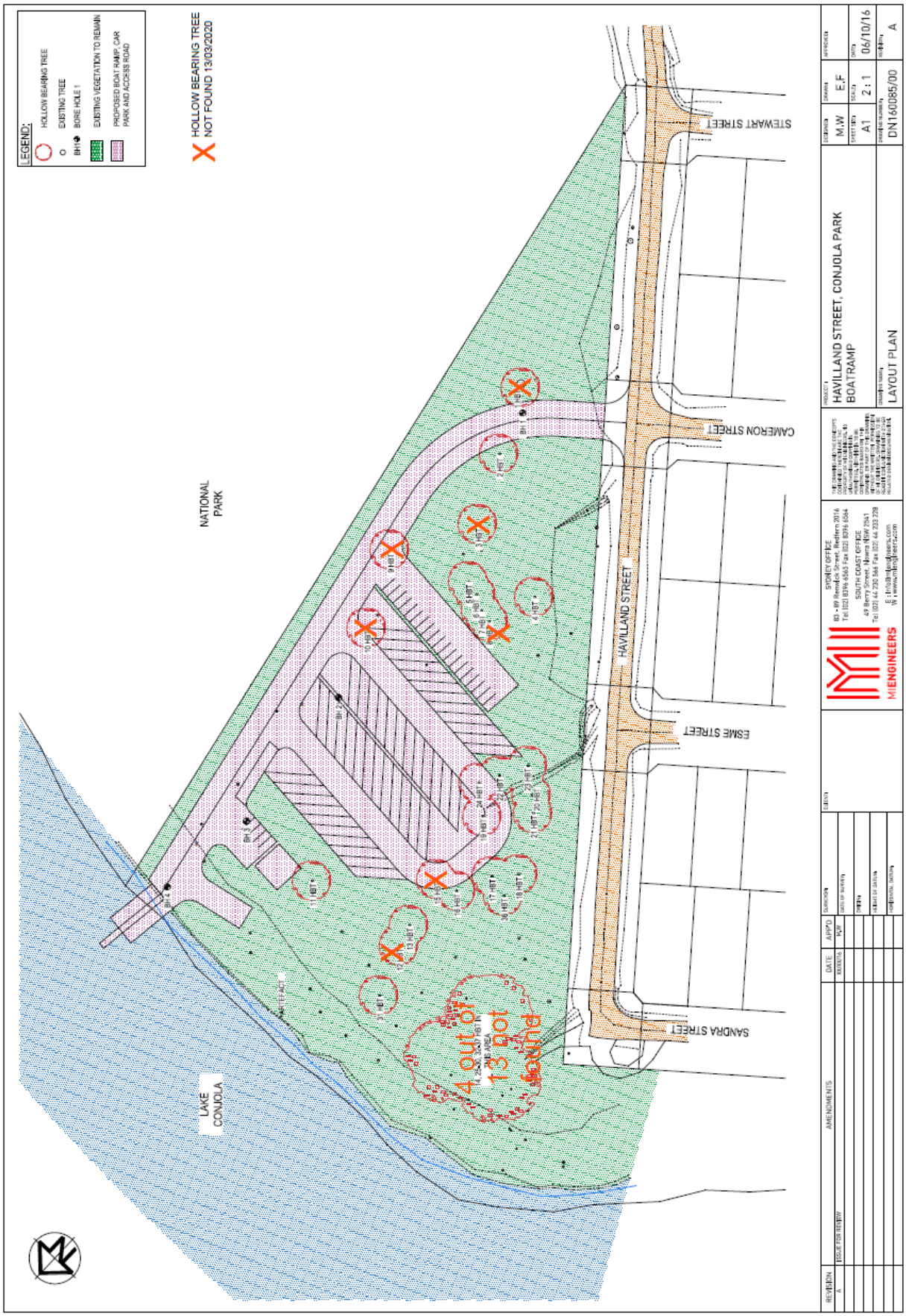

Figure 1. Results of resurvey of hollow-bearing trees in March 2020 following December 2019 bushfire. Layout of the proposed facility shown on this drawing has been superseded as shown in Figures 2 and 3.

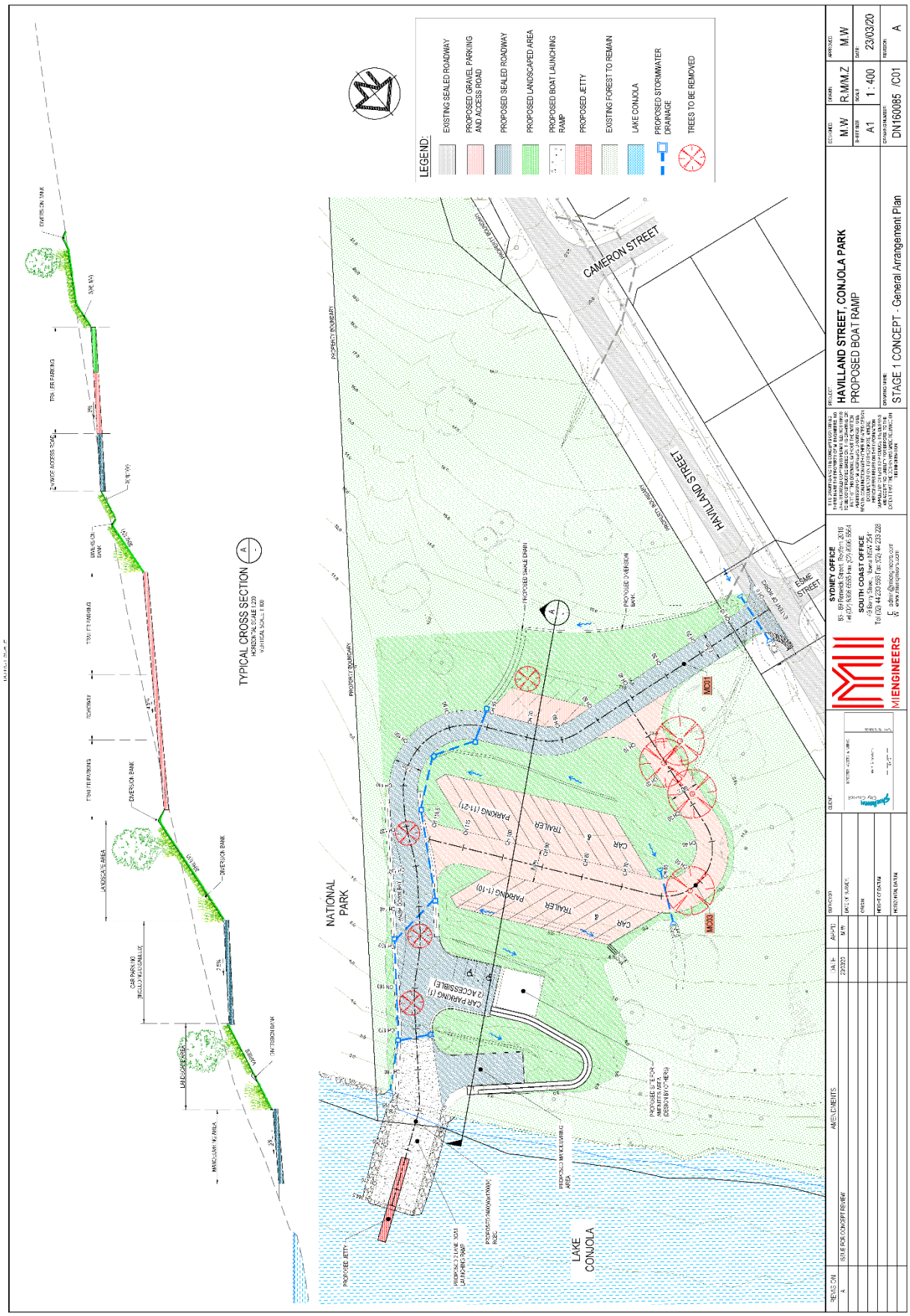

Figure 2. General layout of stage 1 of the proposed facility.

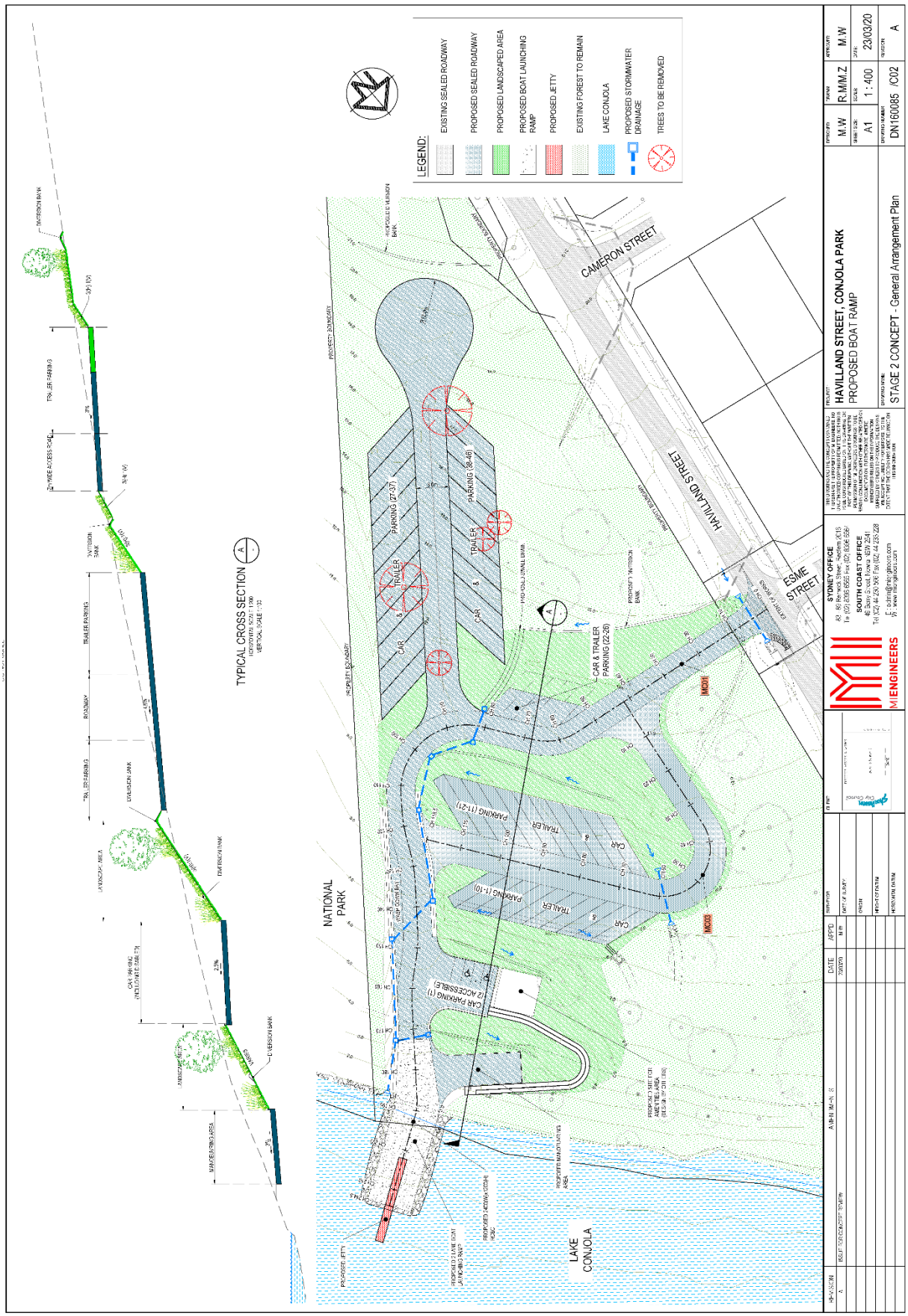

Figure 3. General layout of stage 2 of the proposed facility.

4 REFERENCES

Dalmazzo, P. (2017a) Aquatic and Riparian Flora and Fauna Assessment for Proposed Public Boat Launching Facility Lot 7308 DP 1144810 Havilland Street Conjola Park. Prepared for Shoalhaven City Council.

Dalmazzo, P. (2017b) Terrestrial Flora Assessment for Proposed Public Boat Launching Facility Lot 7308 DP 1144810 Havilland Street Conjola Park. Prepared for Shoalhaven City Council.

Dalmazzo, P. (2020) Review of Environmental Factors for Proposed Public Boat Launching Facility Lot 7308 DP 1144810 Havilland Street Conjola Park. Prepared for Shoalhaven City Council.

Lesryk Environmental Pty Ltd (2017) Terrestrial Fauna Assessment for Proposed Public Boat Launching Facility Lot 7308 DP 1144810 Havilland Street Conjola Park. Prepared for Shoalhaven City Council.

NSW Office of Environment and Heritage threatened species website http://www.threatenedspecies.environment.nsw.gov.au

NSW Office of Environment and Heritage (2018) Threatened Species Test of Significance Guidelines.

APPENDIX 1. BIONET ATLAS SPECIES SIGHTINGS SEARCH RESULTS

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Search criteria : Licensed Report of all Valid Records of Threatened (listed on BC Act 2016) or Commonwealth listed Entities in selected area [North: -35.15 West: 150.39 East: 150.59 South: -35.35] returned a total of 916 records of 64 species.
Report generated on 9/06/2020 4:22 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	31	
Animalia	Reptilia	Cheloniidae	2004	*Caretta caretta*		Loggerhead Turtle	E1,P	E	1	
Animalia	Reptilia	Cheloniidae	2007	*Chelonia mydas*		Green Turtle	V,P	V	3	
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		2	
Animalia	Aves	Apodidae	0334	*Hirundapus caudacutus*		White-throated Needletail	P	V,C,J,K	19	
Animalia	Aves	Diomedeidae	0086	*Diomedea exulans*		Wandering Albatross	E1,P	E,J	1	
Animalia	Aves	Diomedeidae	0847	*Diomedea gibsoni*		Gibson's Albatross	V,P	V	1	
Animalia	Aves	Diomedeidae	0091	*Thalassarche cauta*		Shy Albatross	V,P	V	2	
Animalia	Aves	Diomedeidae	0088	*Thalassarche melanophris*		Black-browed Albatross	V,P	V	2	
Animalia	Aves	Procellariidae	0929	*Macronectes giganteus*		Southern Giant Petrel	E1,P	E	1	
Animalia	Aves	Procellariidae	0937	*Macronectes halli*		Northern Giant-Petrel	V,P	V	2	
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*		Black Bittern	V,P		1	
Animalia	Aves	Accipitridae	0226	*Haliaeetus leucogaster*		White-bellied Sea-Eagle	V,P	C	55	
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*		Little Eagle	V,P		8	
Animalia	Aves	Accipitridae	0230	*Lophoictinia isura*		Square-tailed Kite	V,P,3		11	
Animalia	Aves	Accipitridae	8739	*Pandion cristatus*		Eastern Osprey	V,P,3		8	
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*		Sooty Oystercatcher	V,P		21	
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*		Pied Oystercatcher	E1,P		44	
Animalia	Aves	Charadriidae	0139	*Charadrius mongolus*		Lesser Sand-plover	V,P	E,C,J,K	1	
Animalia	Aves	Charadriidae	0138	*Thinornis rubricollis*		Hooded Plover	E4A,P	V	27	
Animalia	Aves	Scolopacidae	0149	*Numenius madaaascariensis*		Eastern Curlew	P	CE,C,J,K	2	
Animalia	Aves	Laridae	0117	*Sternula albifrons*		Little Tern	E1,P	C,J,K	52	
Animalia	Aves	Cacatuidae	0268	*Callocephalon fimbriatum*		Gang-gang Cockatoo	V,P,3		67	
Animalia	Aves	Cacatuidae	0265	*^^Calyptorhynchus lathami*		Glossy Black-Cockatoo	V,P,2		62	
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*		Little Lorikeet	V,P		18	
Animalia	Aves	Psittacidae	0309	*Lathamus discolor*		Swift Parrot	E1,P,3	CE	2	
Animalia	Aves	Psittacidae	8913	*Pezoporus wallicus wallicus*		Eastern Ground Parrot	V,P,3		1	
Animalia	Aves	Strigidae	0246	*Ninox connivens*		Barking Owl	V,P,3		1	
Animalia	Aves	Strigidae	0248	*Ninox strenua*		Powerful Owl	V,P,3		72	
Animalia	Aves	Tytonidae	0250	*Tyto novaehollandiae*		Masked Owl	V,P,3		14	
Animalia	Aves	Tytonidae	9924	*Tyto tenebricosa*		Sooty Owl	V,P,3		27	
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*		Brown Treecreeper (eastern subspecies)	V,P		3	
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*		Regent Honeyeater	E4A,P	CE	5	
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*		White-fronted Chat	V,P		1	
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*		Varied Sittella	V,P		15	
Animalia	Aves	Artamidae	8519	*Artamus cyanopterus cyanopterus*		Dusky Woodswallow	V,P		2	
Animalia	Aves	Petroicidae	0380	*Petroica boodang*		Scarlet Robin	V,P		2	
Animalia	Aves	Petroicidae	0383	*Petroica rodinogaster*		Pink Robin	V,P		4	
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*		Spotted-tailed Quoll	V,P	E	6	
Animalia	Mammalia	Peramelidae	1710	*Isoodon obesulus obesulus*		Southern Brown Bandicoot (eastern)	E1,P	E	6	
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*		Koala	V,P	V	4	
Animalia	Mammalia	Burramyidae	1150	*Cercartetus nanus*		Eastern Pygmy-possum	V,P		4	
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*		Yellow-bellied Glider	V,P		27	
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*		Squirrel Glider	V,P		2	
Animalia	Mammalia	Pseudocheiridae	1133	*Petauroides volans*		Greater Glider	P	V	57	
Animalia	Mammalia	Potoroidae	1175	*Potorous tridactylus*		Long-nosed Potoroo	V,P	V	17	
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*		Grey-headed Flying-fox	V,P	V	82	
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*		Yellow-bellied Sheathtail-bat	V,P		1	

Animalia	Mammalia	Molossidae	1329	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		12	
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		11	
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		12	
Animalia	Mammalia	Vespertilionidae	1369	*Phoniscus papuensis*	Golden-tipped Bat	V,P		2	
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		8	
Animalia	Mammalia	Otariidae	1882	*Arctocephalus pusillus doriferus*	Australian Fur-seal	V,P		2	
Animalia	Mammalia	Balaenidae	1561	*Eubalaena australis*	Southern Right Whale	E1,P	E	3	
Animalia	Mammalia	Balaenopteridae	1575	*Megaptera novaeangliae*	Humpback Whale	V,P	V	2	
Animalia	Mammalia	Physeteridae	1578	*Physeter macrocephalus*	Sperm Whale	V,P		2	
Plantae	Flora	Convolvulaceae	2234	*Wilsonia backhousei*	Narrow-leafed Wilsonia	V		2	
Plantae	Flora	Myrtaceae	6809	*Melaleuca biconvexa*	Biconvex Paperbark	V	V	1	
Plantae	Flora	Myrtaceae	4283	*Rhodamnia rubescens*	Scrub Turpentine	E4A		22	
Plantae	Flora	Orchidaceae	4415	*^^Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	16	
Plantae	Flora	Orchidaceae	14259	*^^Pterostylis ventricosa*		E4A,P,2		6	
Plantae	Flora	Rubiaceae	5680	*Galium australe*	Tangled Bedstraw	E1		3	
Animalia	Mammalia	Miniopteridae	3330	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		15	

NSW MARITIME
AUTHORITY

BOATING PLAN OF MANAGEMENT

LAKE CONJOLA ESTUARY

March 2005

BOATING PLAN OF MANAGEMENT
LAKE CONJOLA ESTUARY

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BOATING PLAN OF MANAGEMENT
LAKE CONJOLA ESTUARY

EXECUTIVE SUMMARY

Background

This document provides the basis for a Boating Plan of Management that applies to the tidal waters of the Lake Conjola estuarine system, including Berringer Lake and Conjola Creek. This follows a determination by the NSW Maritime Authority that it will review the effectiveness and efficiency of the current Boating Plan.

Boating Plans of Management (BPoM) are designed to:

- Protect and sustain the recreational and environmental values of a waterway
- Ensure that boating practices maximise user safety, enjoyment, public safety and amenity
- Consider the needs of shore-based estuary users as well as boating-based activities
- Review shore-based boating-related facilities or infrastructure such as launching ramps
- Provide a framework for consultation

Building on earlier Boating Plans, this Plan incorporates detail of Lake Conjola's physical, environmental and cultural heritage attributes and considers impacts of boating activity on these attributes. This specifically includes analysis of threatened species impacts and other environmental issues, both aquatic and terrestrial.

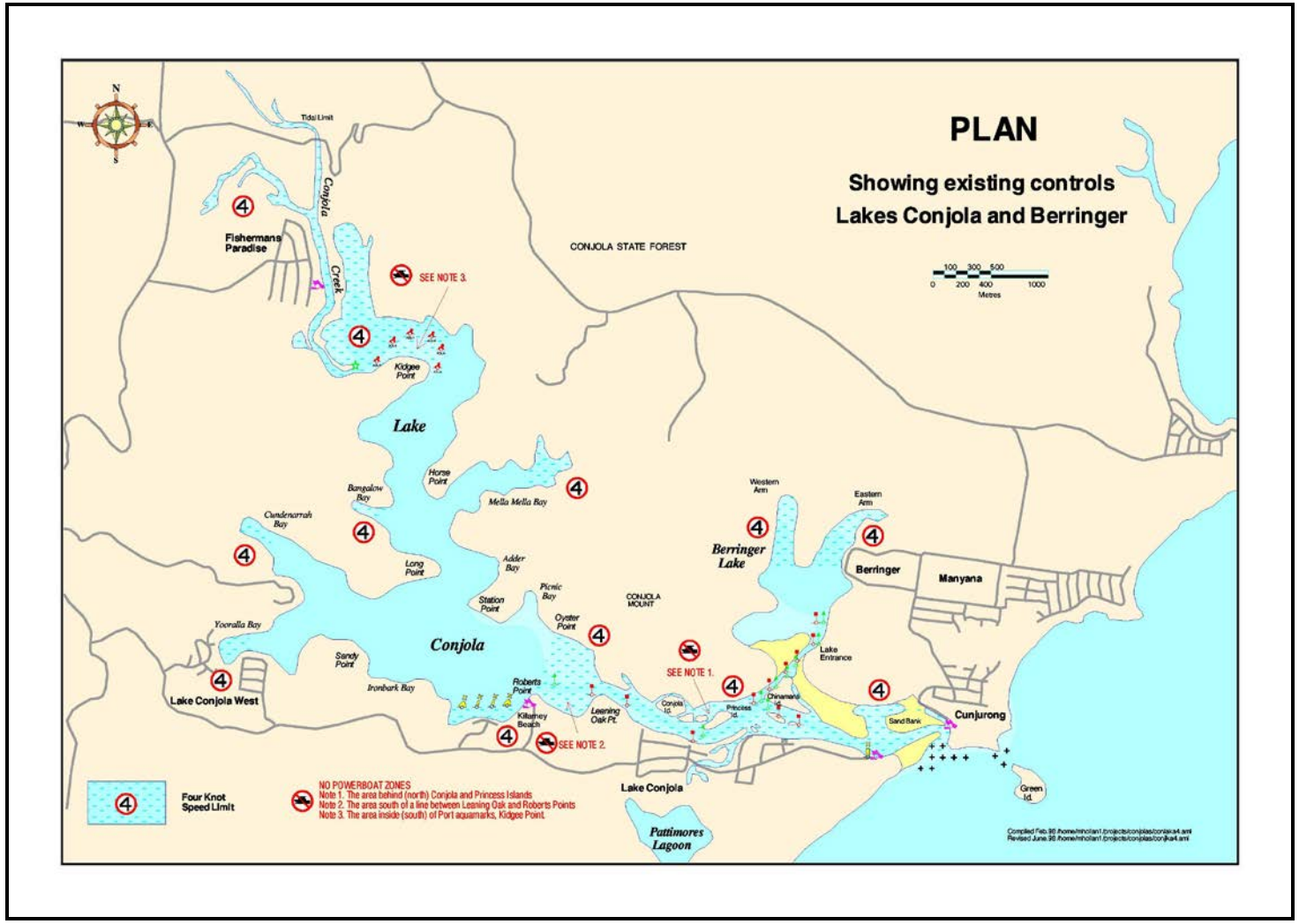
Management 'tools' available to NSW Maritime Authority to approach these issues can include:

- Four knot speed limits
- 'No Wash' zones
- 'No Skiing' restrictions
- Distance-off marks
- Restricted access
- Allocation of time or space to conflicting user classes

Current controls on the Lake Conjola estuary are depicted on **Figure 1** overleaf.

The NSW Maritime Authority is committed to promoting the sustainable and equitable use of NSW waterways for all users. The Authority's emphasis in relation to sustainable environmental management is on interagency co-operation, sharing responsibilities and developing a consultative approach to sustainable waterway management. In the context of holistic management of the Lake Conjola Estuary, the Boating Plan of Management will complement the existing Estuary Management Plan.

Figure 1 Current Waterway Controls - Lake Conjola Estuary



Process

The process of developing this Boating Plan of Management provides a number of opportunities for the Authority and stakeholders to share information and provide input to the plan. The following represents a summary of the planning process:

Seek Community Input

- Terms of Reference released and advertised in *Wavelength* (NSW Maritime Authority newsletter) and publicised via the NSW Maritime Authority Web site.
- Presentations by the Authority were made to a public meeting at Conjola, inviting public submissions to the terms of reference.

Prepare Draft Plan

- Identify values and issues arising from submissions received.
- Review existing data and relevant policies
- Conduct inspections of the estuary
- Develop a series of draft management strategies and actions.

Second Stage Public Consultation

- Draft plan placed on public display.

Finalise the Plan

- Analyse stakeholder submissions
- Review plan in light of stakeholders' responses.

Advertise, Implement, Monitor and Review Approved Plan

The strategies and actions adopted in the Lake Conjola Boating Plan of Management are designed to be responsive to changing priorities and conditions on the estuary, and will be subject to 5-yearly review.

Major Initiatives

The Lake Conjola Estuary Boating Plan of Management contains management strategies addressing values and issues relevant to both the entire estuary as well as location specific areas. The table overleaf summarises the major initiatives incorporated in the Lake Conjola Estuary Boating Plan of Management. It is noted that actions fall not only to the NSW Maritime Authority, but also to Shoalhaven City Council and NSW Department of Primary Industries (NSW DPI, previously NSW Fisheries). NSW Maritime's recommendations for the consideration of council and other agencies are made within the body of the Plan.

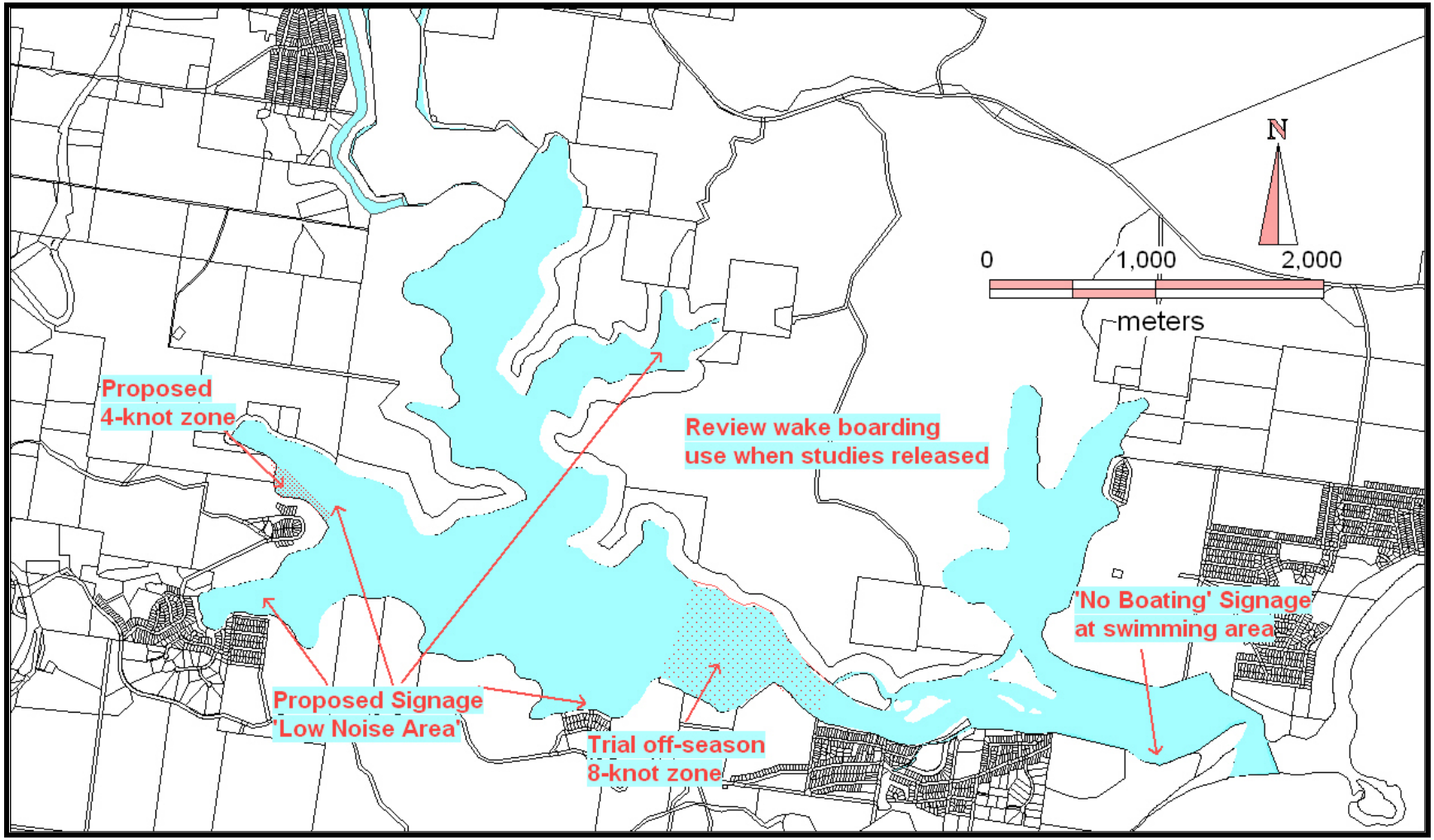
These initiatives will complement existing management strategies for the estuary. The timeframe for implementation proposes durations which are proposed loosely as:

- Short term One year
- Medium term Two to three years
- Long term Four to five years

ACTION	RESPONSIBILITY	TIMEFRAME
1. BOAT LAUNCHING ISSUES		
1.1 Provide additional washdown facilities at boatramps: • Cundenarrah Bay (*if launching is to continue*) • Sandra Street (off Havilland Street) • Prior Street • Norman Street • Berringer Crescent, Berringer Lake	NSW DPI and Council	Short term
1.2 Close Aney Street Boatramp (*subject to 1.3*)	Council	Long term
1.3 Select site for alternative town ramp, prepare concept design and seek funding • Construct ramp prior to Aney Street closure	Council (NSW Maritime to consider funding application)	Short term Medium term
1.4 Consider options for Cundenarrah Bay access track	Council	Short term
1.5 Upgrade vehicle approaches and formalise ramps for *Caulerpa* control at: • Sandra Street (off Havilland Street) • Prior Street • Norman Street • Entrance ramp (carpark) • Berringer Crescent, Berringer Lake	Council (NSW Maritime to consider funding application)	Long Term
1.6 Concept designs for new ramp and parking at Havilland Street	Council	Long term
2. ADDITIONAL *CAULERPA* CONTROLS • Expand washdown facilities to all affected boat retrieval points and formalise launching points (see 1.1) • Clarify direction signage at West Conjola	NSW DPI and Council	Short term
3. ADDITIONAL BOATING CONTROLS • Implement trial off-season 8-knot zone from Norman St to Roberts Point, and assess impact on boating safety • Consider signage for 'Low Noise Areas' • Install 'No Boating' sign at swimming area • Consider need for controls on wakeboarding when studies released • 4-knot zone along southern shore of Cundenarrah Bay	NSW Maritime NSW Maritime NSW Maritime NSW Maritime NSW Maritime	Short term
4. THREATENED SPECIES PROTECTION • Maintain 4-knot zone around estuary islands • Consider seasonal 'no boating area' at spit (if requested by Parks Service for shorebird breeding management)	NSW Maritime NSW Maritime	Ongoing Ongoing

Figure 2 on the following page depicts by location the changes to waterway controls on the Lake Conjola Estuary introduced by this plan.

Figure 2 Amendments to Boating Controls - Lake Conjola Estuary



BOATING PLAN OF MANAGEMENT
LAKE CONJOLA ESTUARY

1. Overview

1.1 Terms of Reference

The following Terms of Reference were provided to the public by publication on the NSW Maritime Authority 's Website and through a public meeting held at Lake Conjola.

The Authority will examine the degree to which the current plan ensures the safe and responsible use of Lake Conjola.

The review will consider:

(a) the effectiveness of the plan in promoting the safety of vessels and waterway users on Lake Conjola

(b) the degree to which the plan addresses actual or potential conflicts between different waterway activities, and in particular between high-speed power boats and passive waterway users

(c) the degree to which the plan addresses the possible environmental impacts of vessel activity, with reference to:

- noise
- wash and foreshore erosion
- wash and mooring areas
- waste disposal
- the fragmentation and spread of *Caulerpa taxifolia*
- the protection of aquatic flora and fauna

(d) the degree to which management arrangements within the plan complement the roles of other government agencies, including with respect to other plans or strategies applying to Lake Conjola

(e) whether the plan adequately addresses the availability and appropriateness of boating-related facilities or infrastructure around the lake

(f) the degree to which the plan still reflects current patterns of vessel use and current environmental, social and economic issues on Lake Conjola

(g) the degree to which management arrangements specified within the plan have been implemented.

The approach to waterway management in this Plan considers a number of factors in detail. The Terms of Reference have been broadened in response to values and issues raised in public submissions and in consultation with Council and State agencies.

1.2 Guiding Principles

This plan is underpinned by the following principles, and as such will seek to:

- develop strategies that promote the safety of all waterway users.
- promote sustainable and equitable use of the waterway with the minimum of regulatory measures necessary to achieve this aim.
- manage boating activities to minimise detrimental environmental impacts and protect aquatic flora and fauna in accordance with the principles of Ecologically Sustainable Development (as defined in the Environmental Planning and Assessment Act 1979).
- ensure best use of Government and community investment.
- contribute to sustainable resource management.

The NSW Maritime Authority, in line with the objectives of the Intergovernmental Agreement on the Environment (1992), adopts a partnership approach to the management of the Conjola estuary. The Authority shares the responsibility for protecting the environment and for providing public infrastructure in connection with the use of vessels on the State's waterways with other natural resource and environment management agencies and local government.

Strategies and actions identified in this Boating Plan of Management are to be consistent with those responsibilities for which the NSW Maritime Authority has jurisdiction. In accordance with the Ports Corporatisation and Waterways Management Act 1995, the Authority has jurisdiction over navigable waters. The Act defines navigable waters as ' … all waters that are from time to time capable of navigation and are open to or used by the public for navigation'.

The NSW Maritime Authority is committed to interagency co-operation, sharing responsibilities and developing a consultative approach to sustainable waterway management. Accordingly, Shoalhaven City Council has co-funded the preparation of this Plan. There are actions identified in the Plan that depart from NSW Maritime Authority responsibilities which fall under the jurisdiction of Council.

2. Lake Conjola Estuary

An aerial view of Lake Conjola and Berringer Lake (1998 photograph) is depicted on **Figure 3**.

Figure 3 Aerial view of Lake Conjola estuary

2.1 Regional Setting

General

Lake Conjola is located in Shoalhaven City Council Local Government Area on the South Coast of NSW, approximately 15 kilometres north of Ulladulla. The Shoalhaven Coast is a popular tourist destination. Tourism is seasonally based around the strong summer period, with Easter providing a second peak. Tourism promotions are successfully extending this season into the March to May period. Seasonal boating trends on Lake Conjola would be expected to follow this holiday pattern.

2.2 Conjola Estuary Physical Profile

The Lake Conjola entrance separates the townships of Cunjurong Point to the north and Lake Conjola village on the southern bank. The lake is mostly open to the ocean and untrained, and provides ocean access in calm conditions.

The total tidal waterway area is 660 hectares distributed as follows (**Table 1**):

TABLE 1 Lake Conjola Estuary Waterway Areas

Estuary Zone	Total Area (hectares)
Tidal Creeks	27
Lake Conjola (to Chinamans Id)	502
Berringer Lake	77
Entrance area (d/s Chinamans Id)	54
TOTAL AREA	**660**

The lower estuary comprises a series of shifting channels around marine sands which extend into Berringer Lake and in Lake Conjola upstream almost to Roberts Point. The main Conjola Lake basin has depths in excess of 10 meters. A number of embayments contain water depths of around 5 meters. The major tributary of the lake is Conjola Creek which connects the village of Fishermans Paradise to the main lake body.

2.3 Lake Conjola Ecological Environment

Estuary Overview

The catchment of Lake Conjola comprises 95% undeveloped, forested land, with broad areas of lake foreshore falling under National Park. The lake's foreshores are in general steep and rocky, and as a result the riparian vegetation comprises mainly dry sclerophyll forest. There are opportunities for Swamp She-oaks in flatter areas such as the floodplain deposits along Conjola Creek and at the heads of some embayments.

Aquatic habitats of significance include small areas of seagrass (mainly *Zostera* meadows estimated at about 50 hectares in 1979). The current area of *Zostera* seagrass is not known.

Areas of fringing aquatic vegetation such as saltmarsh are very limited around the lake. The foreshore gradient does not suit the development of this species, which requires flat or gently sloping semi-saline areas just above Mean High Water Mark.

A handful of sandy beaches exist around the lake shoreline. These are popular ski beaches where located in or near sheltered waters.

Caulerpa taxifolia Invasion

Shallow parts of the estuary including most seagrass areas are vulnerable to incursion by the invasive *Caulerpa* seaweed. This weed is listed as a noxious marine vegetation and it presents a serious threat to estuarine ecosystems in NSW. The largest occurrence of the weed on the NSW South Coast occurs on the Conjola estuary system. It is essential that this Plan complements the NSW Department of Primary Industries (previously NSW Fisheries) *Caulerpa taxifolia* Control Plan and is consistent with its control strategies.

This weed can grow in very shallow water, and has been recorded in NSW growing down to a depth of about 10 meters. It occurs in mainly sandy sediments but has established at Lake Conjola on rocky

substrate. Coverage of the weed can increase by a factor of ten times over a single summer growing season.

The spread of *Caulerpa* is closely related to boating activity and also to natural estuary bed disturbance from storms and wind. Propellers moving over infected shallow areas will cut the plant into fragments, which can drift into other areas and start new outbreaks.

Mapping by NSW DPI shows that in February 2004, *Caulerpa* has spread to cover 165 hectares of Lake Conjola and Berringer Lake. It now covers most of the shallow foreshore areas of the estuary system including most of Berringer Lake. The increase from February 2003 (156 hectares) to February 2004 represents 9 hectares or 6% of the 2003 coverage by area. However the density of the weed has increased significantly in that period, with 'dense' (as opposed to 'sparse') deposits growing from 58 hectares in 2003 to 148 hectares in 2004.

This suggests that activity such as boating has already allowed the weed to spread to areas where it is suited. The further spread of weed within the estuary would seem inevitable, possibly with or without boating activity. The few foreshore areas with a lack of dense coverage in February 2004 could be expected to develop the weed due to its rapid growth.

Areas of the lake where NSW DPI mapping show absence of *Caulerpa* include the deep basins and the entrance area, possibly where shifting sand deposits under higher tidal velocities have prevented its establishment.

NSW Department of Primary Industries has developed a Control Plan for *Caulerpa* in NSW waters. The Control Plan has been implemented at Conjola by Council and NSW DPI. Issues relating to boating in the *Caulerpa* Control Plan have been reviewed as part of this Plan.

Relevant issues for *Caulerpa* management are:

- Spread of *Caulerpa* from ocean currents transporting the weed to another estuary is difficult to manage. Infestations around estuary mouths are at highest risk of spreading to the ocean and have a high priority for salt treatment.
- Shallow-water infestations around boat ramps provide a high level of risk of spread to other estuaries from boat trailers and propellers dragging the bed at time of boat retrieval. Entanglement on boat hulls is less likely.
- Well-equipped washdown areas can assist to combat the spread of the weed to other estuaries. Shallow launching and retrieval areas are most vulnerable.

Threatened Bird Species

The extent of shorebird species has been researched from the Parks and Wildlife Division, Department of Environment and Conservation database. Threatened species of birds and their status under the Threatened Species Conservation Act 1995 have been recorded around the estuary as follows (**Table 2**):

Also noted within the Lake Conjola catchment is the presence of top order consumers, such as large forest owls. This indicates that the habitat within the catchment is sufficiently varied to support populations of prey species such as possums and native rodents. However, the incidence of these species has no impact on boating management considerations.

TABLE 2 Threatened species of birds around Lake Conjola

Common Name	Scientific Name	Status under TSC Act 1995	Location on Estuary
Osprey	Pandion haliaetus	Vulnerable	Nests suspected in Conjola National Park
Sooty Oystercatcher	Haematopus fuliginosus	Vulnerable	Foraging around entrance area
Pied Oystercatcher	Haematopus longirostris	Vulnerable	Nesting on islands near Chinamans Island and on Entrance Spit
Hooded Plover	Thinornis rubricollis	Endangered	Entrance Spit
Little Tern	Sterna albifrons	Endangered	Entrance Spit
Australasian Bittern	Botaurus poiciloptilus	Vulnerable	Foraging near Fishermans Paradise boatramp
Black Bittern	Ixobrychus flavicollis	Vulnerable	Head of Mella Mella Bay

2.4 Lake Conjola Cultural Environment

Aboriginal people have close associations with Lake Conjola. The Department of Environment and Conservation has recorded some 24 sites of Aboriginal cultural significance or Aboriginal objects within one kilometer of the lake. These include open camp sites and burial sites.

Boating activity could potentially impact on sites if they were in the immediate lake foreshore and were suffering direct damage from boat launching or indirect damage from boat wash. There appear to be no sites under these categories. Consequently there are no requirements for boating controls based on Aboriginal cultural significance.

3. Waterway Usage

3.1 Water Craft

Power boating, water skiing and wake boarding are very popular on Conjola due to its relatively steep and forested catchment areas, which provide opportunities for these activities sheltered from prevailing onshore winds. Estuary boat fishing is a popular recreational pastime, particularly as the estuary is one of the declared Recreational Fishing Havens in NSW.

Other craft use the estuary apart from powerboating activity. One of the more recent arrivals on the watercraft scene are Personal Water Craft (or PWC), the term used to describe craft with trade names such as Jet Skis, Waverunners and Sea Doos.

A small hire boat facility operates out of Lake Conjola near the Post Office. This appears to be low key and has no particular obvious operational difficulties.

The upper reaches of embayments on Lake Conjola provide an ideal environment for passive waterway uses such as fishing, canoeing and kayaking. These passive use areas are zoned 4 knots to provide opportunity for the safe enjoyment of passive activities and to protect the environment.

3.2 Navigability Issues

Waterway use at the Entrance Boat Ramp and in the reach upstream of the Entrance Boat Ramp is limited in places by shoals and a meandering channel. This sand is of marine origin, and will continue to migrate up the channel at varying rates under incoming tides whenever the entrance is open. Ongoing inspection of markers for this channel is operational practice for NSW Maritime Authority Boating Officers.

Even shallow-drafted vessels have trouble negotiating the Berringer Lake entrance from Lake Conjola. The lake bed in the channel between the marker beacons shows clear signs of propeller damage. Use of this shallow entrance inevitably will chop up and spread *Caulerpa* seaweed. This is largely unavoidable.

3.3 Growth Projections

Analysis of growth figures for boating licences and registered craft numbers has been carried out by NSW Maritime Authority for the Nowra to Ulladulla region (see **Table 3**). These suggest an average annual growth rate of 5.5% for boating licences has occurred over the last four years since June 2000. There are 9,220 people in the region with a boat licence as at 1st June 2004.

Similarly boating registrations have increased from 4,955 in June 2000 to 6,055 in June 2004. This represents an average annual growth rate of 5.1% since June 2000.

It is difficult to apply these statistics directly to boat usage on Lake Conjola as there are many estuaries that these boats may use in the region. Further, the majority of peak holiday users are visitors and tourists. One limiting factor for areas such as Conjola will be the available level of tourist accommodation within a short drive to the lake.

Local submissions suggest that boating numbers have decreased since the 1970's, when powerboat clubs were in full operation, attracting competitors to the lake for both local and regional events. One

would expect that regardless of statistical projections and with or without powerboat clubs, boat ownership and boat use will continue to increase in the region.

TABLE 3 Boating Licences and Registrations - Nowra to Ulladulla

As at Date	Boating Licences	Boating Registrations	Annual Growth	Boating Licences	Boating Registrations
01-06-2004	9220	6055			
01-06-2003	8735	5753	2003 to 2004	5.6%	5.2%
01-06-2002	8208	5428	2002 to 2003	6.4%	6.0%
01-06-2001	7849	5184	2001 to 2002	4.6%	4.7%
01-06-2000	7452	4955	2000 to 2001	5.3%	4.6%
Average	**8292.8**	**5475**	**Average**	**5.5%**	**5.1%**

3.4 Estuary Capacity for Boating Activities

NSW Maritime Authority considers that a total of 200 vessels may be visible at peak times, however not all would be in use simultaneously - many would be beached. Public submissions consider that 40 ski boats on the lake would be a busy day. This number could well have been greater with organised ski races when the Highlands Ski Club was operating.

This plan makes an estimate of the sustainable number of boats that the estuary could support concurrently. This estimate is based on the area available for waterskiing, based on an average area of 5 hectares water space per vessel. It also makes allowance for passive uses, based on an allowance of 1.2 hectares per vessel over the balance of the waterway. These figures are derived from historical boating studies and, although generic, provide a theoretical approximation of waterway capacity.

Based on waterway area figures derived elsewhere in this plan, there are 306 hectares suitably zoned for waterskiing / wake boarding and a residue of 354 hectares is available solely for passive uses. Naturally, not all of these areas may be suitable concurrently, dependent on prevailing wind conditions. Also clearly passive uses can utilise the whole lake. The capacity calculations based on zoned and residue areas therefore provide an estimate of a potential maximum number of waterskiing vessels.

BOATING CAPACITY: The capacity of the Lake Conjola estuary system - based on its waterway area and the current level of boating controls - is estimated at **300 passive use vessels** (fishing, low-speed pleasure boating, canoeing, kayaking, sailing, windsurfing etc) and **60 waterskiing boats**.

3.5 Boating Safety

Regulations provide guidance on proper behaviour on the water, however safety should not be totally reliant on regulations only. Boating safety awareness is paramount as attendance by boating officers cannot be permanently guaranteed.

NSW Maritime considers that a reasonably high level of regulation on Lake Conjola exists at present, far more than on many other coastal lakes and estuaries. Much of this regulation is related to protection of environmentally sensitive areas. Other regulation that has regard to boating safety relating to boating congestion solely would be relevant at peak usage periods only. This issue is further discussed later in the Plan.

A compiled history of boating incidents on Lake Conjola recorded by NSW Maritime database shows a total of five reported events since 1997. The most serious injury occurred in December 1997 but this was due to lack of judgment rather than any factors requiring waterway regulation or controls.

While a number of unreported incidents are likely, the available data clearly suggests that dangerous incidents causing serious injury are relatively uncommon on the waterway. NSW Maritime continue to monitor this situation by recording details of reported incidents.

4. Community Consultation

The NSW Maritime Authority is aware that this Boating Plan of Management must reflect community values and address as far as possible community issues.

The BPoM review has been preceded by a number of submissions to NSW Maritime Authority from both local and remotely-based holiday estuary users. Submissions from the public consultation process provided the Authority with a broad range of information relating to the characteristics which the community values about the estuary and the associated issues which impinge upon these values.

Initial public responses to NSW Maritime Authority announcing a review of boating controls were followed by a series of publicly held meetings at Conjola. Concern was voiced about the perceived possibility of closure of a number of areas on the estuary, effectively confining waterskiing to the main lake basin. A number of submissions were received by the Authority, leading up to a public meeting at Conjola called by NSW Maritime Authority early in June 2004. At this meeting, further public submissions relating to the terms of reference were invited. This attracted a total of 54 submissions from estuary users and local residents. This round of submissions produced further detail such as estuary use patterns and detailed information covering the terms of reference. Information provided has allowed a greater depth of coverage of these issues.

A summary of common issues raised within public submissions is presented in tabular form below. By necessity this summary is brief and does not detail every point made in every submission. It follows the format of the Terms of Reference for clarity.

TABLE 4 Issues raised in public responses to NSW Maritime Authority

Issues Raised in Submissions	Plan Response
Safety Issues	
Lake is considered 'safe' by the majority of users and as evidenced by a lack of serious boating incidents over the last five years.	Evidence of no serious boating-related accidents is accepted.
30 metre 'distance off' regulation is most often contravened, of concern to safety of passive users.	Enforcement issue
NSW Maritime Authority presence is an issue, necessary to enforce 30m zone and 4-knot limits.	Enforcement issue
Concentration of powerboating at fewer locations would be more dangerous at peak times.	No proposal for more concentration of powerboating activity.
Strategic locations with intense skiboat use such as Killarney would benefit from specific safe boating signage.	New signage depicting anticlockwise travel, safe departure and arrival directions and give way rules supported.

Issues Raised in Submissions	Plan Response
Conflicts between Active and Passive Users	
Wide range of passive uses – snorkeling, swimming, surf-ski / kayak paddling, shore-based fishing and sightseeing as well as traditional boating activities.	Plan addresses all uses.
User conflicts and passive estuary uses	Plan covers this issue to the level of available information
Environmental Impacts of Vessel Activity	
Noise	
Problem of inboard stereos and louder engines	Consideration of additional signage proposed.
Expect noise (and traffic congestion) around boat launching points.	Boatramp locations addressed in detail.
Boating noise at foreshore houses inevitable and ongoing for many decades.	Agreed.
Wash and Foreshore Erosion	
Erosion mainly due to high lake levels when lake closed or from king tides.	Previous erosion study is supported by this Plan..
Cundenarrah Bay erosion escalated – increase in 'erratic' boating maneuvers in the bay.	Area inspected and reviewed in detail.
Mooring areas	
Effects of wind waves on moored boats can be more extreme than boat wash.	Agreed, no action necessary.
Waste Disposal	
Less rubbish noted on Mella Mella Bay inner beaches since 4-knot zone introduced.	Result of decreased use as a ski beach is implied.
Quote "*Waste disposal remains a concern to all Australians in all environments. It is a matter of education*."	Agreed
Spread of *Caulerpa taxifolia*	
Problem could be addressed more aggressively by responsible agencies.	Recommended responses to *Caulerpa* are covered in the Plan.
Boat washing is more likely routine if facilities located at retrieval point.	NSW Maritime supports washdown facilities at at-risk boatramps.
Aquatic flora and fauna	
Sydney Port Corporation took these factors into account in the last review of boating controls.	This review largely concurs with the view of Sydney Ports Corporation.
Complement roles of other Agencies	
No comments received.	Mandatory role of plan, not requiring public input.

Boating facilities and infrastructure	
Need for boat ramp accessing deep water	Agreed, plan covers options for this issue in detail
Need for more jetties to fish from, tie up to and board boats without associated degradation of the foreshore.	Investigations for a new boatramp with holding jetty are recommended for Council consideration.
Propose that regional boatramps be provided at eastern and western ends of estuary with amenity blocks, parking, fish cleaning and BBQ facilities.	Plan addresses to a limited extent based on natural constraints and availability of suitable land.
Current lake access areas should be upgraded and maintained	Usage reviewed within environmental limits.
Patterns of Vessel use, social and economic Issues	
Large proportion of multi-purpose recreational watercraft replacing inboard speedboats / skiboats. Used for a variety of activities - fishing, waterskiing, general pleasure boating.	Shift in boating usage pattern concurred with.
Importance of all passive uses, fishing and boating to tourist population. Association with tourist trade and stability of local economy.	Comments agreed with.

Following the exhibition of the Draft Boating Plan of Management in January 2005, a further 45 submissions were received by NSW Maritime. Comments raised therein have been taken into account in reviewing and finalising the Plan.

This round of submissions provided more detailed information on local issues than earlier submissions. A total of 23 submissions supported the draft with no or minimal comment on specific issues. Four (4) of these submissions were critical of the timing of the Draft Plan exhibition.

A total of nine (9) supporters of the 'status quo' commented about unenforceable noise controls and signage proposed under the Draft. NSW Maritime supports trialing this signage despite these objections.

Berringer Lake received more attention in this round of submissions, with three (3) requests for further speed zonings and/or boating or launching bans. NSW Maritime does not support these requests but will continue to intermittently monitor boating activity on Berringer Lake.

Five (5) submissions called for investigation into the possible launching ramp at the Public Reserve east of the end of Havilland Street. While this is a matter for Shoalhaven City Council to pursue, the Plan supports the provision of additional launching facilities if environmental impacts are sustainable and if they can be associated with trailer parking.

The issues of boating controls and access to Cundenarrah Bay was raised by a total of fifteen (15) submissions. Environmental issues and conflicts with swimmers in Cundenarrah Bay were also raised. This bay appears to be the most controversial area for boating conflicts, and accordingly the draft Plan's recommendations have been reviewed in detail, with an additional 4-knot zone to be established along the bay's southern foreshore (**Figure 2**). Public access issues to the foreshore of the bay will be dealt with by Council and the Department of Lands in a negotiation process outside the scope of this Plan.

5. Estuary-Wide Issue Discussion

Estuary-wide issues are dealt with in the following discussion. Area-specific actions which are aimed at reducing the impact of boating are detailed in the respective area management sections. These loosely follow the Terms of Reference but are grouped for convenience under the headings:

1. Safety and Equity
2. Protection of Eroding Estuary Foreshores
3. Habitat Protection
4. Provision of Infrastructure
5. Social and Economic Issues

5.1 Safety and Equity

Interactions with Passive Waterway Users

The nature of the upper reaches of Lake Conjola estuary is suited to passive uses such as canoeing, fishing, sightseeing and picnicking. There are unspoilt upper estuarine environments at the heads of the estuary's bays that are a natural attraction worthy of preservation. Excessive boat wash is a safety issue while passive waterway uses are experienced nearby.

NSW Maritime has examined the waterway area available for passive uses (**Table 5**). The following areas are suited solely for passive use by way of either current speed restrictions or by the regulations' definition of the 30 metre wide 'distance off' exclusion:

TABLE 5 Areas of Passive Use Zones - Lake Conjola & Berringer Lake

Estuary Zone	Area (hectares)
4 knot zone in Creeks	27
4 knot zones in bays	55
'Barefoot Alley' 4 knot zone	61
4 knot zone from lake entrance upstream to Roberts Point	136
30 metre 'distance off' zone around lake perimeter	75
TOTAL PASSIVE USES	**354**

The total area of the Conjola estuary is 660 hectares, so approximately 54% of the waterway is specifically available for passive uses. This proportional split appears adequate for the concurrent needs of both active and passive user groups based on most public submissions.

As a check, estimates of boating capacity suggest that 1.2 hectares of waterway area per vessel is required on average for passive uses. The 354 hectares of available area would have capacity for almost 300 vessels engaged in passive uses. This number of passive use vessels would never be reached under current usage patterns.

Naturally passive uses are not excluded from any parts of the estuary. NSW Maritime considers there to be appropriate opportunity for safe passive uses on the estuary under its current zonings.

Swimming in the estuary is reported to conflict with boating activity in the area of the spit immediately downstream of the entrance ramp. The waterway area below the steep sand hill has been targeted by the Plan as a *'No Boating Area'* to address safety issues. NSW Maritime supports this proposal. Conflicts between swimmers and powerboats in Cundenarrah Bay are discussed in Section 6.

Vessel Speed

Speeding is the main compliance issue on the estuary and enforcement action has ensued where offences have been detected.

Speed limits have been imposed under previous boating reviews in 1997 and 2000 with the aims to protect seagrass beds and sensitive locations / passive use areas at the heads of bays. Vessel speed impact on bank erosion was also investigated in these past reviews, and is discussed in that section. Speed controls also allow for safe navigation in congested areas and in the entrance area with its shifting channels.

Accordingly, vessel speed is regulated by signage to 4 knots in a number of locations. These locations are discussed in detail in their respective management sections.

Within 30 meters from estuary shorelines (the 'distance off' zone) a generic 10 knot limit is set by regulation. This speed limit is possibly the one most often disregarded by the boating public. However it provides a zone around the estuary of total area 75 hectares for equitable passive estuary uses.

Noise

Noise from boating activity affecting foreshore residents is an issue raised by a small number of submissions. Submissions point out the natural amphitheatre effect of the steep estuary catchment. Other submissions made comment that to live on an estuary goes hand in hand with an expectation of boat noise. Some foreshore residents commented that boating noise has been a normal part of the lifestyle for many decades. This view is largely concurred with.

Comments by the public are also made about loud stereo systems aboard boats. NSW Maritime Authority officers can deal with issues of noise from vessels under the Protection of the Environment Operations (POEO) Act. To reinforce this issue with the boating public, the Authority is prepared to consider signage requesting consideration of residents when entering residential waterfront areas. Signage stating *'Low Noise Area'* will be considered for implementation by NSW Maritime at a number of localities noted on **Figure 2**.

PWC Usage

Typical issues raised in other areas with PWC use related to

- noise,
- reckless and dangerous riding, and
- environmental issues.

Boating regulations define legal operating conditions for PWC's. They are not permitted to operate irregularly within 200 meters of the shoreline where a residence is visible. They must maintain a

minimum 60 meters from persons in the water, when traveling at speeds of 10 knots or more. These regulations define the legal limits of interaction between PWC's and swimmers / surfers.

Based on submissions received, there have been isolated incidents with PWC's interfering with swimmers in the entrance area. However these incidents are covered by current legislation. There would not appear to be a need for any further controls placed on PWC use on the estuary.

5.2 Protection of Eroding Estuary Foreshores

The causes of bank erosion can include flooding, wind-wave action, human and cattle activities, bank susceptibility, vessel traffic and the size, speed and distance-off of vessels. The following overview extracted from the Authority's Tweed River Plan includes a number of considerations relating to bank erosion that were common in a wide range of studies. Those aspects appropriate to Lake Conjola are:

- Erosion from vessel wake contributes more to bank erosion when the structure and composition of banks are considered to have high erosion potential e.g. loose soil composition; and areas with no natural protection such as trees.
- When vessels plane, the wake waves produced are lower and have less energy than those of semi-planing or displacement hulled vessels.
- Larger, displacement and/or semi-planing vessels operating at speeds between 6 and 20 knots produce waves with the highest potential to erode banks.
- Water-skiing vessels and PWCs, to be effective, operate best while planing.
- Water-skiing vessels produce a larger and more intense wake when conducting power turns e.g. when returning to pick-up fallen skiers.
- The further a craft is from shore, the less impact its waves will have.

Boat Wash

It is generally accepted that it is not possible to quantify with any certainty the extent to which boat wash contributes to bank erosion, due to the confounding effects of wind waves, elevated lake levels during closure and flood damage. The 1997 Lake Conjola Boating Review by the Sydney Ports Corporation provided a technical assessment of the impacts of vessel speed / boat wash combinations on erodible shorelines. Wave energy from boat wash was compared to the average wind wave climate using standard wave energy calculations. Conservative assumptions on boat use frequency were made in order to produce an estimate of wave energies from boat wake. The assumptions used are consistent with similar technical studies on other South Coast estuaries, and although estimates are by their nature not exact, they are supported by NSW Maritime as the best available.

The management recommendations by Sydney Ports Corporation, which NSW Maritime supports, were that impacts of boat wash on the Conjola estuary were largely considered minimal in the main lake basin where there are rocky shores and long fetch distances for wind waves to develop.

Most recommendations for speed controls arising from the 1997 study were for 8 knot zones in a number of locations where the shoreline was determined to be potentially erodible. For the eroding banks of Conjola Creek, boat wash is a significant issue, the creek comprising low-strength silts and is not subject to wind waves. Consequently on Conjola Creek and at Yooralla Bay, both areas were recommended for 4-knot zones, which produces significantly less wash (and hence much less wave

energy) than an 8 knot speed. However the subsequent 2000 review determined the existing 4-knot zone in the head of Yooralla Bay to provide reasonable protection. Additional recommendations for signage requiring 'no irregular navigation or riding' to manage boat wash inside the entrance of Yooralla Bay in the 2000 review were considered impractical and have not been followed up.

The area where boat wash appears to be an issue, albeit very localised, is at the boat launching point on Cundenarrah Bay. Here localised bank erosion and undercutting would appear to be exacerbated by powerboat landings onto the bank. Public submissions suggest that erosion along the bay's southern foreshore is an ongoing issue, exacerbated by boats passing by close to the shoreline. This area is discussed further in the area-specific management section for Cundenarrah Bay.

Wake Boarding

Wake boarding is becoming more and more popular on Lake Conjola as the sport grows. Current evidence from studies undertaken is inconclusive as to whether the impacts of wakeboarding on foreshore erosion has a greater impact than that of water skiing.

The plan recommends that NSW Maritime review the outcomes of relevant wakeboarding studies as they are published to determine the need for any appropriate controls.

5.3 Habitat Protection

Sensitive Areas

Sensitive environmental areas of the estuary are the intertidal flats and adjoining estuarine wetlands around Chinamans, Princess and Conjola Islands. Threatened shorebird nesting (see discussion below) is occurring seasonally on some of these islands (L Shields Parks and Wildlife Division Department of Environment and Conservation pers. comm.) The sensitivity of these areas related to potential boating impacts is currently adequately addressed by the 4-knot zone along this area.

The current 4-knot zones established in the heads of embayments will have benefits to the environmental characteristics of these parts of the estuary. There are no environmental attributes that warrant extension of 4-knot zones beyond their current location. No extension of these 4-knot areas is proposed.

Potential Shorebird Impacts

Boating activity is considered to not interfere with bird foraging activities. If disturbed, birds will simply relocate to a more convenient or quieter part of the shoreline. Many of the sitings of threatened species of birds described earlier in this review would reflect one-off visits for foraging.

Boating impacts on management of migratory and threatened birds on this estuary would be confined to repeated noise in localities with the potential to interfere with breeding activity. The localities of estuarine breeding areas are reasonably well understood, based on suitable habitat requirements. The possibility for potential boating conflicts with threatened bird species are described in **Table 6** below.

TABLE 6 Potential boating impacts on threatened shorebirds

Common Name	Breeding Location	Comment re Boating
Osprey	High in dead trees or dead crowns of trees (mostly in National Park within 1 km of the coast).	Interference with bird activity not likely.
Sooty Oystercatcher	Offshore islands only	Foraging activity on rocky coastline and in estuary. Interference with breeding activity not likely.
Pied Oystercatcher	Lower estuary islands and Conjola Entrance Spit.	Foraging in intertidal zone. Interference with breeding activity not likely within 4-knot zones.
Hooded Plover	Conjola Entrance Spit	Human and dog / fox impacts are the greatest current threats.
Little Tern	Conjola Entrance Spit	Human and dog / fox impacts are the greatest current threats.
Australasian Bittern	Freshwater wetlands with dense vegetation	No breeding habitat near estuary.
Black Bittern	Dense riparian vegetation such as Swamp She-oaks and mangroves overhanging the water	Breeding habitat near estuary limited. No boating impacts on breeding birds expected.

The most significant areas at Lake Conjola for threatened bird species' breeding activity are at the entrance sand spit and on islands within the lake near the entrance. The sand spit is one of the major breeding sites on the South Coast for Hooded Plover and Little Tern. Little Tern breed locally from October to March, while Hooded Plover may be present in breeding pairs from August / September through to March. The lake's islands are valuable habitat in providing safe refuge from foxes, and contributed to two fledgling Pied Oystercatchers from two resident pairs in the 2003/04 breeding season. Pied Oystercatcher breeding season can extend from August to January.

There have been recorded losses of both eggs and fledglings at the Entrance Spit to foxes and storm surge in the 2003/04 breeding season. Attempts at breeding at these sensitive locations does not seem to be impacted by boating activity. The existing 4-knot zone encompasses the entrance spit along the extent of breeding areas. This is considered an appropriate level of protection at this site. However, should breeding be more successful in future seasons, there is some doubt that boating activity associated with beach visits is totally appropriate.

If it were to prove necessary in future to provide more protection to shorebird breeding pairs at this location, the proposed 'no boating area' at the sand dune (proposed at the western end of the spit) may need to be temporarily extended over the breeding season further along the back-beach area. This would depend on the exact locations of nests on the spit and the success of fences to restrict pedestrian activity.

Boating Impacts on Seagrass Beds

Seagrass beds are important estuarine habitats. They provide habitat diversity, stabilise the sediments and provide shelter for juveniles of many fish species. As well as providing protection for small fish, these beds contain high densities of invertebrate animals such as shrimps, prawns, crabs and worms, on which fish feed. Major seagrass habitat areas are protected by the existing 4-knot zone upstream of Kidgee Point.

There are four potential sources of boating damage to seagrass beds.

Mooring Damage

Moorings can cause scouring and thus loss of seagrass beds. Chain drag around a mooring can kill the adjacent seagrass. Such problems are unlikely to occur in this estuary.

Groundings

When boats are grounded on seagrass beds on low tide, they can crush the plants and animals in the seagrass. As most boats used in the lake are small, this is not an extensive problem.

Anchoring

Anchors can damage the plants and dig them out when being retrieved. This is a limited problem on the estuary.

Propeller Damage

Potentially the biggest boating problem for seagrass on Lake Conjola is damage from propellers. Studies have found that propeller scars may take several years to recover, potentially because damage recurs on a regular basis. Furthermore, where there are high currents, propeller damage can initiate erosion and the permanent loss of seagrass beds.

The area in the estuary where propeller damage to seagrass is occurring regularly is in the creek at the Aney Street boat launching ramp. Healthy beds of *Zostera* seagrass are located on either side of the launching area, and further into the shallow creek. These areas provide potential quality fish breeding environments.

NSW Maritime recommends to Council that alternative arrangements for boat launching in this section of the estuary be investigated urgently, with a view to closure of this access point in the short- to medium- term.

Caulerpa Taxifolia (Invasive Seaweed)

NSW Department of Primary Industries has listed *Caulerpa* as a noxious marine vegetation. All State agencies and Shoalhaven City Council recognise the invasion of *Caulerpa* seaweed as a major threat to estuary habitat biodiversity. All efforts should be made to prevent its spread to other unaffected estuaries.

NSW Primary Industries' February 2004 mapping of Conjola and Berringer Lakes shows weed infestation to cover most of the estuary's shallow areas along the foreshores. The following boat launching points were inspected in early August 2004 and are confirmed to be affected :

- **Cundenarrah Bay** (informal launching area) – *Caulerpa* at sand launching area in very shallow water almost to water's edge. A small remnant patch of *Zostera* exists at the launch site.
- **Yooralla Bay** (both Sandra Street and Valley Drive ramps) – *Caulerpa* at both these sites is in deeper water than at Cundenarrah Bay.
- **Prior Street,** with *Caulerpa* at sand launching area and immediate surrounds.
- **Killarney**, inspected from Prior Street, appears to be similarly impacted.
- **Conjola Lakeside Van Park** (private ramp), inspected from Norman Street, appears to be similarly impacted.
- **Norman Street** , *Caulerpa* clear of sand launching area in winter 2004 but is growing immediately adjacent to and on both sides of the launching area in very shallow water.
- **Berringer Crescent, Berringer Lake** has *Caulerpa* at sand launching area in shallow water and some remnant patches of *Zostera.*

Boat retrieval at shallow infected areas has major potential for spreading the weed by entanglement on the boat propeller or on the trailer. The presence of *Caulerpa* at a large number of shallow boat retrieval points suggests that an urgent review of washdown facilities is required as part of this plan. NSW Maritime considers that washdown areas need to be conveniently located at all infected boat launching sites, to give maximum opportunity for combating the spread of invasive weed.

Of the above affected launching ramps NSW Maritime recommends that the following areas, which have inadequate washdown facilities, be considered jointly by Council and NSW Department of Primary Industries for action as follows:

- **Cundenarrah Bay** (informal launching area) has no washdown facility. As the nearest facility is at West Conjola, this area should have a facility installed if public use for boat launching is to continue.
- **Sandra / Havilland Street** has no washdown facility. This area is remote from other washdown areas and requires such a facility.
- **Prior Street** similarly has no washdown facility and requires such a facility due to its remoteness.
- **Norman Street** has no washdown area and should have a facility installed or alternatively be closed.
- **Berringer Crescent, Berringer Lake** has no washdown area and should have a facility installed.

Overall the level of *Caulerpa* information signage is suitable for its purpose. In specific locations such as West Conjola om the main road entering the area, clearer signage directing users to the nearest washdown facility would add value to the *Caulerpa* control strategy.

Incidents of missing or vandalised hoses and taps are difficult to manage and require good reporting mechanisms and response times. A number of logical additional washdown facilities are proposed. Detailed recommendations to Council lists these proposals in the executive summary of this document.

5.4 Provision of Boating Infrastructure

Review of Boat Launching Facilities

The lake has a number of boat launching ramps (both formal and informal), located around the estuary. Their locations are depicted on **Figure 1** along with current boating controls. These facilities were inspected over the period May to September 2004 and are described in **Table 7** on the following pages.

Under this Plan, NSW Maritime makes recommendations for upgrading or closure of boat launching facilities for Shoalhaven City Council's consideration. Upon approach from Council, NSW Maritime will be available to further discuss these issues and offers assistance in formulating a WADAMP application for 50% grant funding of proposed improvements or additions to boating infrastructure under the plan.

TABLE 7 Review of Current Boat Launching Facilities

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Fishermans Paradise Excellent concrete ramp suited for most sizes of vessel. The minor inconvenience for the lake user who may choose to launch here is a long trip down Conjola Creek, wholly within a 4-knot zone, before reaching the lake's unrestricted waters.	Excellent. Scour on both sides of the ramp itself could use minor repairs.	Sealed parking area adequate.	Nil.	Tap and hose in parking bay at exit of parking area. Improved drainage required on road shoulder downslope to prevent long-term road pavement damage.	Nil
Lake Conjola West (Valley Drive) A small ramp, part bitumen sealed and part sand / gravel. Location at the head of Yooralla Bay in reserve, adjoining quiet residential area on Valley Drive. Holding jetty 16m long with 5m long T-head also provides access for recreational fishing.	Appropriate for use and location.	Very limited formal parking. Traffic conflicts in cul-de-sac head. Need to monitor informal parking on slope in reserve. Eventual damage to reserve could require bollards to protect grass cover. Usage to date sustainable.	Heavy *Caulerpa* infestation in this part of the estuary.	Tap and hose in cul-de-sac head. Directional signage on main road requires clarification.	Limited parking will restrict usage with no opportunities for expansion.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Cundenarrah Bay (off Lakeside Drive) An informal launching point for small craft is located on privately owned (Aboriginal) land (previously Crown Reserve subject to a Native Title land claim granted by the Minister for Lands). It is accessed from a gravel track off Lakeside Drive.	Boat access shallow but reasonable, access track degraded. Foreshore erosion evident, very localised to launching area.	Degraded bush area suited to 2 or 3 vehicles. Vehicle access track degraded, requires scour protection and gravelling.	Erosion of track producing fine sand and some clay material, and some localised impact on the bay during heavy rainfall is likely. Some bank undercutting below She-oaks. Foreshore nearby mostly sandstone shelf. Heavy *Caulerpa* infestation in this part of the estuary in very shallow water.	None provided. Existing general NSW DPI *Caulerpa* signage insufficient. The nearest (West Conjola) washdown point is not convenient for users of this launch point. Additional washdown facility required here.	Ineffective erosion controls on access track. Retention as a launching site would require necessary maintenance to access track, stabilised parking area and a local washdown facility. Continued public use is understood to be under negotiation. Washdown facilities are required if access is to be continued.
Sandra (Havilland) Street (Yooralla Bay) Twin gravel tracks at Sandra Street (off Havilland Street) provide access to a short concrete ramp. A sandy holding beach is located nearby.	Adequate. Eastern track very steep, requires drainage and gravelling.	Limited opportunities for roadside parking will limit ramp usage.	Heavy *Caulerpa* infestation in this part of the estuary.	None provided. Suggest washdown area should be provided.	Track access and lack of washdown facilities both require attention. Potential new launching ramp and trailer parking area in the reserve to the east of Havilland Street warrants consideration.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Prior Street					
Access along a reserve to sound gravel / sand ramp. Confusing signage associated with previous ramp closure requires removal.	Some local scour of access track in steep section immediately off sealed road.	On street only.	Sand build-up caused by log groyne will be preventing sand drift towards Killarney. Insignificant erosion downdrift was noted. Minor erosion upstream of ramp has been managed by placement of bricks and rubble to stabilise undercutting below She-oaks. Heavy *Caulerpa* infestation in this part of the estuary.	None provided. Suggest washdown area should be provided.	Track access and lack of washdown facilities both require attention. Removal of signage previously closing this ramp.
Killarney (private)					
Private concrete ramp with gravel approaches. Long sandy holding beach / ski beach and swimming area.	Private facility. Rough gravel entrance and approach road.	Paid entry and ample parking on private land.	Heavy *Caulerpa* infestation in this part of the estuary.	Adequate – tap and hose provided on sealed lay-by on access road.	Private ownership and access which could be closed. This would make unmanageable demands on other existing launching facilities for large boats.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Conjola Lakeside Van Park (private) Old short concrete ramp provides good access to lake for park users. A newer concrete ramp in excellent condition cannot be used due to potential seagrass impacts.	Adequate.	Used by park patrons only, no parking necessary.	Heavy *Caulerpa* infestation in this part of the estuary.	A hose adjacent to the launching ramp will shortly be relocated at the rear of the park to manage noise issues associated with motor flushing. This may not encourage wash-down prior to leaving the area. However a large number of regular users store boats at the caravan park, so transfer of weed to other estuaries is less likely.	Nil.
Norman Street Informal access to lake via sandy foreshore at the end of Norman Street,. Shallow water would limit use to small boats.	Poor - 0.3m drop-off from pavement to scoured sandy beach would suit four-wheel drive use only.	Limited parking along road verge.	Heavy *Caulerpa* infestation in this part of the estuary. Water very shallow at launch site.	None evident, NSW Maritime would recommend provision of tap and hose nearby.	No washdown, limited launching access due to scour. NSW Maritime recommends that Council review use and either upgrade to a sealed access and concrete ramp and provide washdown facility or close off to public use if funding is unavailable.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Aney Street					
Track through low she-oak forest gives access to gravel launching area on shallow tidal creek. Popular all-year launching for local small tinny use. Also utilised daily in peak season by nearby caravan park users.	Ramp itself is adequate for usage. However access track and parking is over flat, boggy degraded soils that will continue to destabilise in wet weather.	Limited in wet weather by poor drainage.	Damage to *Zostera* seagrass beds in creek either side of launching area is noted. Seagrass also likely at shallow creek entrance to lake. Vehicle damage to She-oak forest and wetland fringe by soil compaction and trackside parking. No mapped *Caulerpa* infestation in this part of the estuary at present.	None nearby.	Environmental degradation (marine and terrestrial) makes continued use unsustainable. NSW Maritime recommends that Council consider closure.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Entrance Boat Ramp					
Council facility provides boat launching for small to medium vessels. Concrete ramp with bitumen approach road accessed through Lake Conjola Entrance Tourist Park. Public toilets located here.	Ramp and approaches good.	Informal parking on irregular gravel carpark area does not lend to effective trailer parking. Vehicles parking on grass beyond the gravel carpark were evident at time of inspection. Could use further bollards to limit vehicle access to grassed recreation areas.	No *Caulerpa* infestation in this part of the estuary.	None provided, none necessary.	Removed from main lake basin by shallow flood-tide delta and long 4-knot zone. Shallow water limits use for larger vessels. Sand shoals will continue to move around. Confusion at Tourist Park entrance for non-locals. Directional signage to public ramp could be improved. NSW Maritime recommends that Council consider sealing the gravel carpark and parking arrangements formalised for more effective vehicle and trailer parking and to prevent vehicles parking on grass. Opportunity exists for landscaping and grassed trailer parking spaces.
Cunjurong Point					
Concrete ramp on northern shore of Lake Conjola located near entrance.	At the time of inspection, marine sand build-up limits use to small to medium vessels at higher tides.	Bitumen roadside parking with overflow parking along gravel access road if needed.	No *Caulerpa* infestation in this part of the estuary.	None provided, none necessary.	Ramp mostly unusable at medium tides or lower. Boat turning circle area requires signage to prevent illicit parking.

Description	Condition	Parking	Environmental	Washdown Facilities	Main Issues
Berringer Lake					
Informal soft access and landing area at end of Berringer Crescent provides the only public launching point into Berringer Lake. Multiple launch points used as holding and ski beaches. Some conflict of usage expected at peak times.	Reasonable conditions for launching, beach stable. Approach tracks require better definition. Maneuverability limited amongst trees. Long reversing required.	Parking amongst trees for up to six vehicles. Overflow parking along roadway available.	Heavy *Caulerpa* infestation in this part of the estuary. Sand launching area shallow. Small patches of healthy *Zostera* seagrass in shallow water adjacent launching areas.	None provided - nearest facilities on Inyadda Drive out of Manyana. Local washdown area required considering level of existing usage and shallow water.	Standard of vehicle access and tight maneuvering around trees unacceptable, given the level of use at this location. NSW Maritime recommends that Council consider sensitive improvements to the launching and vehicle maneuvering area, to limit launching to a single formalised ramp and to provide a turn-around area. NSW Maritime also recommends that washdown facilities be installed adjacent to this launching site to encourage usage.

Caravan Parks

No description of boating infrastructure in the area would be complete without a mention of the four lake-frontage caravan parks that provide holiday accommodation to visitors to the area. These provide a varying but significant level of boating-related facilities that assist with meeting boating demands in peak periods. The issues relevant to boating infrastructure and management are as follows:

Conjola Lakeside Van Park is largely self-contained as far as boating facilities are concerned. That is, it provides boat storage, a concrete launching ramp and incorporates a washdown facility on site. This relieves somewhat the load that would otherwise be placed on public facilities around the estuary. Park users generally do not moor their boats overnight as launching and retrieval is convenient within the park.

Patrons of Lake Conjola Caravan Park (Lake Conjola Deepwater Resort) launch boats generally from the Norman Street or Aney Street ramps (see over for discussion of launching ramp sites). Overnight moorings are available along the park's lake frontage and in the creek behind the park. This means that most park users would launch (and later retrieve) their boats only once during a stay. A plan to upgrade the park's lake frontage will allow for improved mooring, canoe launching and recreational access.

Island View Caravan Park has creek frontage but no launching facility. Park users would commonly launch their vessels at the Aney Street site located at the park entrance. Most users of this park would retrieve and launch their boat daily, despite moorings in the creek being available. Overnight security is the biggest concern. The park has a boat wash facility near the park entrance.

Lake Conjola Entrance Tourist Park has lake frontage but no mooring or launching access. Boat owners are directed to the various launching ramps in town, or in the case of large vessels, to Killarney. A bitumen public road through the park accesses the Council Entrance Boat Ramp, a graveled parking area and walking access beyond to the beach and lake swimming areas along Conjola Beach spit.

New Boat Launching Facilities

Existing boat launching facilities have been detailed in the previous section and various issues have been highlighted. Perhaps the most evident issue that was also raised in the Lake Conjola Estuary Management Plan is a lack of public boatramp facilities accessing deep water, suited to the majority of boats.

The Lake Conjola Estuary Management Plan makes mention of a potential new boat ramp on Reserve for Public Recreation east of Havilland Street, specifically on Part Lot 7002 DP 1075136. This land has an area of about 3.2 hectares and a water frontage of about 220 meters. Shoalhaven city Council has the responsibility of determining the suitability of this parcel for boat launching and trailer parking, consistent with its environmental values and potential impacts.

NSW Maritime would consider a secondary 'boating facilities' issue to be the lack of boatramp car and trailer parking at most locations. This is evident at West Conjola, which is serviced with two ramps,

both of which would be difficult to park at or near in peak holiday periods. The Entrance ramp has excellent facilities but is too far to the eastern end of the estuary to suit many lake users. It is also inconveniently located with regard to navigation to other areas with its intervening sand shoals. The numerous smaller facilities around Lake Conjola village have little or no parking and generally poor vehicular access.

NSW Maritime's recommendation to Council that the popular Aney Street ramp be closed would suggest that a new centrally located replacement facility would, quite reasonably, be demanded by the boating public. In particular a new facility should be ideally within or close to Lake Conjola village, in order to service the focus of boating activity derived from this residential community and the patrons of the four caravan parks situated east of Milham Street. It should also ideally provide for deepwater access. This issue is also one for Shoalhaven City Council to determine.

Navigation Aids

Among the NSW Maritime Authority's prime statutory responsibilities is the achievement of the highest possible standards for the safety of all users of NSW navigable waters. A major contributor in meeting this responsibility is the provision of aids to navigation on each of the state's navigable waters. Navaids as they are commonly known, are the road signs and traffic lights of waterways. They include buoys and beacons for marking channels, signage announcing special conditions and restrictions, and navigational lighting marking dangerous water and safe boating zones.

The Authority uses both the technical expertise and experience of its on-water staff as well as data gleaned from its management systems and feedback from the community when reviewing navaid requirements. The existing configuration on the Conjola Estuary has evolved from monitoring both boating activity, changing channel conditions, and feedback from the boating community.

5.5 Social and Economic Issues

South Coast villages such as Lake Conjola have a heavy reliance on tourism for their livelihood. There is no question that tourist visitors holiday at Lake Conjola because of the beaches and waterways. Clearly from our discussion with tourist accommodation proprietors, and from the broad coverage of submissions received, a majority of the visitors to Lake Conjola are boating enthusiasts. NSW Maritime sees it as essential to consider the social and economic impact of the Plan on boating controls.

It is evident that the estuary supports a number of waterway activities. With the all-purpose watercraft available today, boaters can enjoy fishing, water skiing, sightseeing etc from the one vessel on the same day.

The economy benefits from tourism by a number of possible outlets:

- Accommodation
- Grocery, take-away food shops and restaurants
- Fuel suppliers and mechanical repairs
- Bait and fishing equipment outlets
- Sports and hardware stores
- Clubs

The economic benefits of boating activity are difficult to allocate to specific local areas. For instance not all the above commercial outlets are available from within the villages of Conjola, Fishermans Paradise, Manyana and Bendalong. However public submissions notably provide strong support for the activity's importance to the local economy. The cumulative benefits of boating pursuits to the regional economy is undoubtedly also very significant.

NSW Maritime recognises these relevant issues and aims to maintain sustainable boating activity in all its forms on Lake Conjola for future generations.

6. Area-Specific Actions

6.1 Conjola Entrance Area

Main issues in this reach are the shifting navigation channels in response to incoming marine sand. This is a natural process for open estuaries and could be expected to continue. This reach contains a boatramp at Cunjurong Point, which is rendered almost unusable at present due to shoaling. On the southern shore, the Entrance Boatramp serves lower estuary users.

NSW Maritime recognises the risks associated with navigation in this area by the current appropriate 4-knot zone. NSW Maritime's strategy is to maintain the existing zoning.

6.2 Berringer Lake

Berringer Lake is a shallow basin of approximate area 77 hectares. It forms the sole practical waterway access for boating activities to residents of Manyana, Cunjurong Point and Bendalong.

The Berringer Crescent informal boat launching point is in need of upgrading to meet anticipated demands from these areas. Loss of remnant foreshore vegetation should be minimized with sensitive design. Boat access requires redesign to replace the multiple random accesses and incorporate a single formalised launching and retrieval point. A concrete ramp would considerably decrease the risk of *Caulerpa* entanglement on props and trailers.

Boating activity on Berringer Lake is sustainable despite its shallowness and heavy infestation of *Caulerpa*. However it requires the installation of local washdown facilities as a priority.

Entry to Berringer from the entrance area is via a narrow marked channel which is extremely shallow. The existing markers are appropriate and require no amendments.

East Arm and West Arm

Both arms of the upper part of Berringer Lake have been zoned with a 4-knot limit to reflect their environmental sensitivity. This suits the area's passive uses. NSW Maritime's strategy is to maintain the existing zoning.

6.3 Lake Conjola Village Reach

This reach extends from the eastern end of Chinamans Island to the main lake basin at Roberts Point. It is characterised by a narrow navigation channel and shallow marine sands. The flood-tide delta drops into the main basin at the upstream extremity of this reach.

Most of the southern foreshore is under rock protection. Tidal flows are relatively high and westerly winds can generate large wind waves. This reach is mostly unaffected by *Caulerpa*, apparently due mainly to strong sediment movement. However NSW DPI maps indicate a sparse cover spreading into the more protected areas and increasing in density from Roberts Point to Leaning Oak Point.

This reach contain a focus of general boating activity, with five caravan parks generating high peak season boating use. It contains three launching ramps, one private formal ramp at a caravan park and two informal access points. NSW Maritime recommends to Council that investigations into a deep water ramp in this reach be initiated.

This reach incorporates Killarney, a popular launching point and ski beach for waterskiers. Although a privately-owned facility, NSW Maritime recognises the long-term importance of this area to boating activities on the lake. It is essential that owners of this facility be encouraged to participate in waterway planning issues on the estuary. Informal signage on water-ski etiquette and regulations at this site is in need of renewal. Its presence adds to the education of waterway users that utilise this area.

NSW Maritime considers the 4-knot zone from the lake entrance extending upstream to Roberts Point to be in need of review. This reach is extremely long, extending some 3.5 kilometres or 2 nautical miles. A journey from the spit to Roberts Point, traveling strictly at 4 knots would take 30 minutes. The 2000 Boating Review proposed a relaxation of the 4-knot limit upstream from Leaning Oak Point but did not mention seasonal changes.

NSW Maritime Authority Boating Officers have observed repeated breaches of the 4-knot limit in this area. NSW Maritime would consider a relaxation to an 8-knot limit over part of this area in non-peak periods to be a reasonable compromise. However there are a number of constraints which must be taken into account.

- It is essential that the 4-knot limit be retained from the eastern tip of Chinamans Island to the western end of Conjola Island, for the protection of threatened and migratory shorebirds. These birds are present during the summer tourist peak.
- The lake entrance upstream to Chinamans Island should be retained as a permanent 4-knot zone due to the periodic rapid shifts in the navigation channel from marine sand ingress. Safe navigation would be compromised, particularly for those unfamiliar with the estuary's latest channel configuration, under anything above a 4-knot limit. NSW Maritime's strategy is to maintain the existing zoning in this part of the reach.

NSW Maritime proposes the area west of Norman Street upstream to Roberts Point as suited to an 8-knot zone outside peak tourist periods. Although this area is shallow due to marine sand, it does not tend to shift in configuration as rapidly as the downstream reach. It would retain its current 4-knot limit at peak usage times. NSW Maritime proposes that this 8-knot zone be introduced on trial for the period 1st May to 31 November 2005. Should boating safety not be compromised, subject to assessment by the Authority, this would become either a permanent or a seasonal arrangement.

6.4 Conjola Lake Basin

The Plan defines the main lake basin as extending from Roberts Point upstream to Kidgee Point. It contains the deepest water in the estuary and comprises mainly estuarine muds and sandy muds. The edges of the basin suit the colonization of *Caulerpa* which covers most of the shallow water in non-rocky foreshore areas in a dense cover.

The study finds that existing controls in the lake basin are achieving the necessary level of management and control.

The main issues associated with the basin are considered to be within its embayments as follows:

Ironbark Bay

There are no known issues with this location.

Yooralla Bay

Yooralla Bay contains a dense cover of Caulerpa in the shallow inner bay area. The majority of the upper bay foreshore supports residential development, and a 4-knot zone exists in this part of the bay. NSW Maritime's strategy is to maintain the existing zoning and to enforce the 4-knot limit.

Two boat launching points service West Conjola boat users, one with a useful holding jetty which provides recreational fishers with access to slightly deeper water in the bay.

Changes proposed under the Plan are to improve access to the Sandra Street boatramp and provide local washdown facilities.

Cundenarrah Bay

This shallow bay contains a short residential area along its southern shore near the bay entrance. Noise issues at these residences are related to boating use and on-board stereo systems. A 4-knot zone at its head provides protection to environmental values. NSW Maritime finds reasons put forward in submissions for an extension of the 4-knot zone across the whole bay to be outweighed by its use as a quality sheltered waterskiing area. However submissions to NSW Maritime have documented in detail conflicts between powerboats and swimmers or shore-based fishers along the southern foreshore. There is also documented evidence of erosion along this foreshore in a number of locations.

NSW Maritime's strategy is to maintain the existing zoning and to introduce a new 4-knot limit along the southern foreshore for reasons of safety and environmental protection.

In response to noise issues at the residential area, the Authority proposes to investigate the installation of signage designating the bay a *'low noise area'* and requesting that boat users respect the rights of residents when entering this bay.

The bay contains an informal boat launching site which NSW Maritime considers to not be sustainable in its present form due to parking, access and localised bank and foreshore erosion issues. Shoalhaven City Council is currently in negotiation with relevant stakeholders in an effort to resolve many of these issues.

Bangalow Bay

This bay wholly comprises a 4-knot zone for protection of its natural environment. The bay is short (250 meters) and any reduction in the 4-knot zone would prove to be ineffectual. NSW Maritime's strategy is to maintain the existing zoning and to enforce the 4-knot limit.

Mella Mella Bay

Mella Mella Bay is the largest bay on the eastern shore of the lake basin, and is surrounded by Conjola National Park. The head of Mella Mella Bay is zones a 4-knot zone in recognition of environmental values and for passive uses.

The upper bay area contains three sandy beaches, one of which is still used as a ski beach. The beach at the head of the bay is unsuited for skiing access as it is situated well inside the 4-knot zone. A second beach just inside the 4-knot zone is used for skiing although this usage is believed to have reduced considerably since the zone was introduced.

The 2000 boating Review by the Sydney Ports Corporation examined the need for further boating controls in Mella Mella Bay. Its findings are concurred with, namely that no other areas of the bay require boating controls to manage boat wash.

The southern arm of Mella Mella Bay is reported to be an area of suitable habitat for threatened bird species, although site inspection suggests that habitat is not suited to locally listed threatened species. The disparity may be due to apparent clearing of riparian vegetation at the head of the bay within the National Park. The head of the northern arm has far more environmental values, and is adequately protected by the current 4-knot area. There are no threatened species or other environmental issues that would require an extension of the 4-knot zone further out across the bay. NSW Maritime's strategy is to maintain the existing zoning in both arms of Mella Mella Bay and to enforce the 4-knot limit.

Adder Bay

There are no known issues with this location.

Picnic Bay

There are no known issues with this location.

6.5 'Barefoot Alley'

This area was effectively closed to skiing as a result of the last boating review. This closure was effected by introduction of a 4-knot zone from the extremity of Kidgee Point extending upstream to the estuary's tidal limits. A series of port marks now define shallow seagrass beds which provide a key fish habitat area on the estuary.

The aims of this 4-knot zone were to better manage shoreline erosion at the creek entrance spit and on grazing land on the northern foreshore, to manage seagrass beds at Conjola Creek entrance spit and to avoid shallow water on the inside of the bend north of Kidgee Point. This will protect the estuary's environmental attributes including healthy seagrass beds, has safety benefits, and reduces boat wash at the turning area near the tip of the creek entrance spit, which threatened to breakthrough. NSW Maritime's strategy is to maintain the existing zoning and to enforce the 4-knot limit.

6.6 Conjola Creek

At Fishermans Paradise, the boatramp that provides access to the lake via the creek is an excellent facility. This area is part of the 4-knot zone discussed above. Lake access is via a long 4-knot zone which would provide some frustration to regular users.

This 4-knot zone has been reviewed, however NSW Maritime finds no opportunity to rezone this reach due to a combination of hazards associated with boat wash and the narrow boating channel. For instance, if unrestricted by speed zoning, boating activity would still be limited to less than 10 knots, as the 30m 'distance off' regulation cannot be met. This speed would amplify boat wash in most vessels to a far more damaging level. Hence alternatives such as a No Wash Zone would be unworkable. Further, boating at speed would compromise safety at a number of blind bends in the creek.

Conjola Creek suffers from bank erosion, with the primary causes likely to be flooding and boat wash. Excessive boat wash could overtop the spit that divides the creek from the remainder of the estuary. Speeding vessels close to the bank would exacerbate existing bank undercutting and could eventually destabilise the spit. NSW Maritime's strategy is to maintain the existing zoning and to enforce the 4-knot limit.

7. Plan Review

Distribution of the Plan for the purpose of consultation has been undertaken by the NSW Maritime Authority as follows:

LOCAL

- Shoalhaven City Council outlets
- Southern Shoalhaven Natural Resource & Floodplain Management Committee
- Jerrinja Local Aboriginal Land Council
- Advertisement of availability for comment in local newspapers
- Download from NSW Maritime Authority Website www.maritime.nsw.gov.au

STATE AGENCIES

- Department of Infrastructure Planning and Natural Resources
- NSW Dept of Primary Industries
- Parks and Wildlife Division, Department of Environment and Conservation

The Lake Conjola Boating Plan of Management will be subject to review on a five yearly basis, both internally by NSW Maritime Authority and with reference to Shoalhaven City Council and the Southern Shoalhaven Natural Resource & Floodplain Management Committee. If significant redrafting of the Plan and resultant waterway restrictions were to occur, public comment would be sought at that time.

8. References

Healthy Rivers Commission — **Independent Inquiry into Coastal Lakes** (2000)

Keating, J. & Jarman, M. — **South Coast Shorebird Recovery Program Breeding Season 2003/04** Report prepared by the then NSW National Parks & Wildlife Service

NSW Dept of Primary Industries — **Website** www.fisheries.nsw.gov.au

NSW Dept of Primary Industries — **NSW Control Plan for the Noxious Marine Weed *Caulerpa taxifolia* in NSW Waters** (February 2004)

NSW Dept of Primary Industries — **NSW Fisheries Policy and Guidelines** (1999)

Shoalhaven City Council — **Lake Conjola Estuary Management Plan**

Sydney Ports Corporation — **Recreational Boating Controls on Lake Conjola** (1997 and 2000 papers)

West R. J., *et al* — **An Estuarine Inventory for New South Wales, Australia.** Report prepared for NSW Department of Agriculture, Division of Fisheries NSW. Published in Fisheries Bulletin No. 1 (1985)

NSW Maritime Authority — **Corindi River Boating Plan of Management** (November 2002)

NSW Maritime Authority — **Tweed Estuary Boating Plan of Management** (Draft August 2004)

NSW Maritime Authority — **Website** www.maritime.nsw.gov.au

Figure 4 ***Caulerpa taxifolia***

(Photograph courtesy of NSW Dept of Primary Industries website)

National Native Title Tribunal

Register of Native Title Claims Details

Back to search results

NC2017/003 - South Coast People

Tribunal file no.	NC2017/003
Federal Court file no.	NSD1331/2017
Application name	South Coast People
State or Territory	New South Wales;
Representative A/TSI body area(s)	New South Wales
Local government area(s)	Bega Valley Shire Council,Campbelltown City Council,Canterbury-Bankstown Council,Eurobodalla Shire Council,Georges River Council,Goulburn Mulwaree Council,Liverpool City Council,Queanbeyan-Palerang Regional Council,Shellharbour City Council,Shoalhaven City Council,Snowy Monaro Regional Council,Sutherland Shire Council,The Council Of The Municipality of Kiama,Wingecarribee Shire Council,Wollondilly Shire Council,Wollongong City Council
Date filed	03/08/2017
Date claim entered on Register	31/01/2018

Register extract and attachments

Register extract	**RNTCExtract_NC2017_003.pdf**
Register extract attachment/s	**NNTT Map of the application area RNTC.pdf** **Attachment B Description RNTC.pdf** **Attachment C Map RNTC.pdf**

View this map in NTV: **NC2017/003**

From: carmel.smith@crownland.nsw.gov.au on behalf of CL ALC
To: Peter Dalmazzo
Subject: Re: Lake Conjola - land claims on proposed work sites?
Date: Tuesday, 30 June 2020 9:55:34 AM

Good Morning,

I have conducted a search of Crown Lands databases - Crownview and Clidnet on this date with the following results:

Lot 7308 DP 1144810 is subject of;

Aboriginal Land Claim 42454 lodged by New South Wales Aboriginal Land Council on 15 December 2016: Status: Incomplete.
Aboriginal Land Claim 42493 lodged by New South Wales Aboriginal Land Council on 19 December 2016: Status: Incomplete.

Please be aware the Office of the Registrar Aboriginal Land Rights Act is the responsible authority for maintaining the currency and accuracy of the Aboriginal Land Claims register.

Any anomalies identified in a response from the Office of the Registrar should be raised with the Office of the Registrar.

For further information on Aboriginal Land Claims please visit www.crownland.nsw.gov.au or contact our unit on 6883 3396.

Kind Regards,

Carmel Smith

Aboriginal Land Claim Assessment Team

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45 Wingewarra Street Dubbo NSW 2830 | PO Box 2185 | Dangar NSW 2309
www.dpie.nsw.gov.au

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

On Tue, 30 Jun 2020 at 08:10, Peter Dalmazzo <peter@peterdalmazzo.com.au> wrote:

> Hi CL ALC

Would you mind searching again to see whether there are Aboriginal Land Claims over Lot 7308 DP 1144810?

It's been four years since I got below advice from you!

Thanks for your help.

Regards,

Peter Dalmazzo

peter@peterdalmazzo.com.au

02 4448 6164

0466 930 775

From: renate.sherring@crownland.nsw.gov.au <renate.sherring@crownland.nsw.gov.au> **On Behalf Of** CL ALC
Sent: Tuesday, 12 July 2016 9:33 AM
To: Peter Dalmazzo <peter@peterdalmazzo.com.au>
Subject: Re: Lake Conjola - land claims on proposed work sites?

Good morning Peter

A search of our available records reveal there are no undetermined Aboriginal Land Claims over Lot 7308 DP 1144810.

It is recommended a search also be undertaken with the Office of the Registrar of the Aboriginal Land Rights Act as the responsible agency for maintaining the register of Claims - http://www.oralra.nsw.gov.au/

Kind regards

Renate Sherring

Aboriginal Land Claim Investigation Unit

Department of Primary Industries
45 Wingewarra Street Dubbo Nsw 2830 | PO Box 2185 | Dangar NSW 2309

T: +61 2 6883 3396 |

E: alc@crownland.nsw.gov.au

W: www.dpi.nsw.gov.au

On 12 July 2016 at 02:21, Peter Dalmazzo <peter@peterdalmazzo.com.au> wrote:

> Dear ALC Unit
>
> I am collating information on behalf of Shoalhaven City Council for environmental assessment of a proposed new boat launching facility at Lot 7308 DP 1144810 Havilland Street West Lake Conjola and the adjacent part of the Lake Conjola waterway. Council needs to know if there are any claims under the Aboriginal Land Rights Act 1983 that affect the land.
>
> Maps showing the location of the proposed facility are attached.
>
> Can you please tell me whether there are any claims on land near the proposal?
>
> Thanks for your assistance.
>
> Regards,

Peter Dalmazzo

peter@peterdalmazzo.com.au

+47 988 59 734 (until 30 August 2016)

02 4448 6164

0466 930 775

This message is intended for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender. Views expressed in this message are those of the individual sender, and are not necessarily the views of their organisation.

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : conjola ramp

Client Service ID : 233438

Peter Dalmazzo

157 Cedarvale Lane
Jaspers Brush New South Wales 2535

Attention: Peter Dalmazzo

Email: peter@annaglynn.com

Date: 11 July 2016

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 7308, DP:DP1144810 with a Buffer of 200 meters, conducted by Peter Dalmazzo on 11 July 2016.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

1	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : conjola ramp

Client Service ID : 233438

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
58-1-0962	CS27 - Conjola Sewerage 27	AGD	56	267108	6094591	Open site	Valid	Artefact : 3		99330,99719,100646

Contact T Russell **Recorders** Navin Officer Heritage Consultants Pty Ltd **Permits** 2292

Report generated by AHIMS Web Service on 11/07/2016 for Peter Dalmazzo for the following area at Lot : 7308, DP:DP1144810 with a Buffer of 200 meters. Additional Info : Assessment of public boat ramp proposal for Shoalhaven City Council. Number of Aboriginal sites and Aboriginal objects found is 1

Proposed boat ramp and associated facilities, Conjola Park, NSW.
Aboriginal cultural heritage due diligence assessment.

By
Sue Feary

August 2016 [updated 7 March 2017]

Report to MI Engineers, Nowra

Sue Feary
Conservation & Heritage Planning & Management
p. +61 2 4441 5996 m. +61 428 342 758 e. suefeary@hotkey.net.au
53 Saumarez St, Vincentia NSW 2540
ABN: 68 866 296 524

Frontispiece: Lake Conjola looking N from subject area

Executive Summary

Shoalhaven City Council intends to construct a new boat ramp and associated facilities on a 3.5 hectare wedge of bushland between Conjola National Park and Havilland St east of the Conjola Park hamlet, on the southern shore of Lake Conjola. A preliminary review of environmental factors included the initial steps of the due diligence process for Aboriginal objects and recommended further archaeological investigation.

Archaeologist Dr Sue Feary conducted a full due diligence process which included a review of relevant literature and databases and a field inspection of the subject area, but no Aboriginal consultation.

The subject area comprises a gentle slope descending from a NW – SE trending ridgeline to the lakeshore, culminating in a flat bench around the shores of the lake and vegetated with coastal woodland. With the exception of a network of well-used vehicle and pedestrian tracks and evidence of past logging, the area is relatively undisturbed.

A search of the AHIMS database showed two recorded sites in the immediate vicinity, being a small artefact scatter within the Conjola Park streetscape and a possible scarred tree near the junction of Havilland St and Lake Conjola Entrance Road. No sites are recorded in the subject area but it is unlikely to have ever been surveyed for Aboriginal sites.

Field inspection of the subject land found a single Aboriginal stone artefact at the base of the slope, close to the present edge of lake. Early concept plans suggest that this will not be impacted by the proposed development as it is located in a proposed buffer zone. Due to the presence of heavy leaf litter and a grassy understorey, ground visibility was restricted to existing tracks and a few patches of bare ground. By necessity, archaeological survey concentrated on these areas, hence coverage was not comprehensive.

Previous studies in the area included excavation and salvage of an artefact scatter approximately 2 kms east of the subject area, at 'Kilarney' just west of Roberts Point. Over 200 artefacts were recovered from alluvial fan deposits, to a depth of 100 cms. The environmental setting of the Kilarney site is comparable to the subject area, suggesting that even though only one artefact was found during survey, there is a reasonable likelihood that other artefacts will be present but were not visible at the time of survey.

The due diligence assessment concluded that further investigation is required to have more certainty about whether or not Aboriginal objects will be harmed by the proposed development. The presence of a large stratified site nearby suggests that similar sites could be present in the subject area but were detected due to either poor ground visibility or downslope movement of sediment covering them up.

The report recommends that the proponent consider conducting further investigation to reduce the risks of harming Aboriginal objects during the course of development. Options include a re-survey for

Aboriginal objects once vegetation is cleared for infrastructure, or conducting archaeological test pitting of areas to be affected by ground disturbance. Requirement 14 of the OEH Code of Archaeological Practice allows for test pitting without an excavation permit in this instance.

Subsequent investigations in March 2017 identified two additional objects – a possible scarred tree and a single stone flake. None are in the area to be affected by the proposed development.

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Figures

Abbreviations

AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
Council/SCC	Shoalhaven City Council
DECCW	Department of Environment, Climate Change and Water [now OEH]
LALC	Local Aboriginal Land Council
MIE	MI Engineers
NOHC	Navin Officer Heritage Consultants Pty Ltd
OEH	Office of Environment and Heritage (NSW)
REMS	Regional Effluent Management Scheme
SCC	Shoalhaven City Council

1. Introduction

Shoalhaven City Council (SCC) intends to build a new boat ramp and associated facilities at a greenfields site east of the small hamlet of Conjola Park, on the southern side of Lake Conjola, about 8 kms west of mouth of the lake. Lake Conjola is an intermittently opening and closing lake (ICOL) located about 10 kms north of Ulladulla on the NSW south coast.

SCC engaged MI Engineers (MIE) to develop plans and designs for the new facility and ecologist Peter Dalmazzo was commissioned by MI Engineers to compile a Review of Environmental Factors. As part of his assessment, Dalmazzo undertook the initial steps of a due diligence assessment for Aboriginal cultural heritage. This included an extensive site search of AHIMS and an assessment of the archaeological sensitivity of the affected landform. He concluded that the presence of recorded sites in the vicinity of the subject area and the potential for the landform to contain archaeological sites warranted further assessment by a qualified archaeologist (Dalmazzo, 2016).

MI Engineers subsequently engaged consultant archaeologist Dr Sue Feary to conduct a visual inspection of the subject area and a desktop assessment in accordance with the OEH Due Diligence guidelines (DECCW, 2010b). The subject area for the due diligence assessment encompassed a 3.5 hectare of vegetated land between Havilland Street and the boundary of Conjola National Park.

This report presents the results of the due diligence assessment and provides advice regarding the likely impacts of the proposed works on recorded and unrecorded Aboriginal sites and offers measures and options for mitigation and further assessment.

2. Due Diligence process

All Aboriginal objects in NSW are protected under the *National Parks and Wildlife Act 1974* and its 2010 Amendment. In most instances it is an offence to 'harm' an object without a permit from the regulatory authority, currently the NSW Office of Environment and Heritage (OEH). Under the 2010 amendments, the Act states that a person who exercises due diligence in determining that their actions will not harm Aboriginal objects has a defence against prosecution for the strict liability offence if they later unknowingly harm an object without first obtaining an Aboriginal Heritage Impact Permit (AHIP) from the NSW Office of Environment and Heritage.[1]

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW, 2010b) aims to assist individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects and to determine whether they will need to apply for consent in the form of an AHIP.

[1] Formerly the National Parks and Wildlife Service/ Department of Environment and Climate Change/Department of Climate Change and Water and now in the Department of Premier and Cabinet.

The code of practice sets out reasonable and practicable steps developers need to take in order to:

- identify whether or not Aboriginal objects are, or are likely to be, present in an area
- determine whether or not their activities are likely to harm Aboriginal objects (if present)
- determine whether or not an AHIP application is required.

Section 8 of the Due Diligence Code provides a generic due diligence process to determine the above. The due diligence process requires the proponent or their agent to consider the proposed activity or proposal and review whether:

- the activity will disturb the ground surface
- the AHIMS database or other relevant databases record previously identified sites/places
- the activity occurs in areas where certain landscape features may indicate the presence of Aboriginal objects (on land that is not disturbed)
- harm to Aboriginal objects or disturbance of the landscape feature can be avoided
- a desktop assessment and/or visual assessment is required
- further investigation and impact assessment is required (DECCW, 2010a).

Appendix 1 is a flow diagram showing the due diligence process.

Dalmazzo (2016) noted that step 2b of the due diligence process was relevant, as the subject area is within 200 metres of waters;

> **Step 2b. Activities in areas where landscape features indicate the presence of Aboriginal objects**
>
> Regardless of whether your AHIMS search indicates known Aboriginal objects, you still need to consider whether Aboriginal objects are likely to be in the area of the proposed activity having regard to the following landscape features. 12 Due Diligence Code of Practice.
>
> Aboriginal objects are often associated with particular landscape features as a result of Aboriginal people's use of those features in their everyday lives and for traditional cultural activities. Examples of such landscape features are rock shelters, sand dunes, waterways, waterholes and wetlands. Therefore it is essential to determine whether the site contains landscape features that indicate the likely existence of Aboriginal objects.
>
> Consequently, if your proposed activity is:
>
> - **within 200m of waters[2], or**
> - located within a sand dune system, or
> - located on a ridge top, ridge line or headland, or
> - located within 200m below or above a cliff face, or
> - within 20m of or in a cave, rock shelter, or a cave mouth

[2] 'Waters' means the whole or any part of: any river, stream, lake, lagoon, swamp, wetlands, natural watercourse, tidal waters (including the sea). Note: the boundary of tidal waters is defined as the high water mark

- and is on land that is not disturbed land (see Definitions) then you must go to step 3 (DECCW 2010b:12).

He noted further that the subject land was relatively undisturbed and advised that further assessment was warranted, based on the known presence of Aboriginal objects adjacent to the subject area, landscape features with potential to contain Aboriginal objects and constraints to varying the location or nature of the proposed development to avoid Aboriginal objects if present. Dalmazzo recommended that an archaeologist be commissioned to undertake additional steps in accordance with the Due Diligence code (Dalmazzo, 2016).

3. Environmental setting

The proposed boat ramp is located on the southern shores of Lake Conjola, approximately eight kilometres west of the lake entrance and immediatley adjacent to the small hamlet of Conjola Park. Lake Conjola is located approximatelyt 10 kilmetres north of the the town of Ulladulla and Conjola Park is accessed from the Lake Conjola Entrance Road which comes off the Princes Highway at Yatte Yattah. The subject area is in Parish Conjola, County St Vincent in the Shoalhaven Local Government Area, at grid coordinates 267498/6094907 [mid-point] on the Milton 1:25K topographic mapsheet (Figure 1).

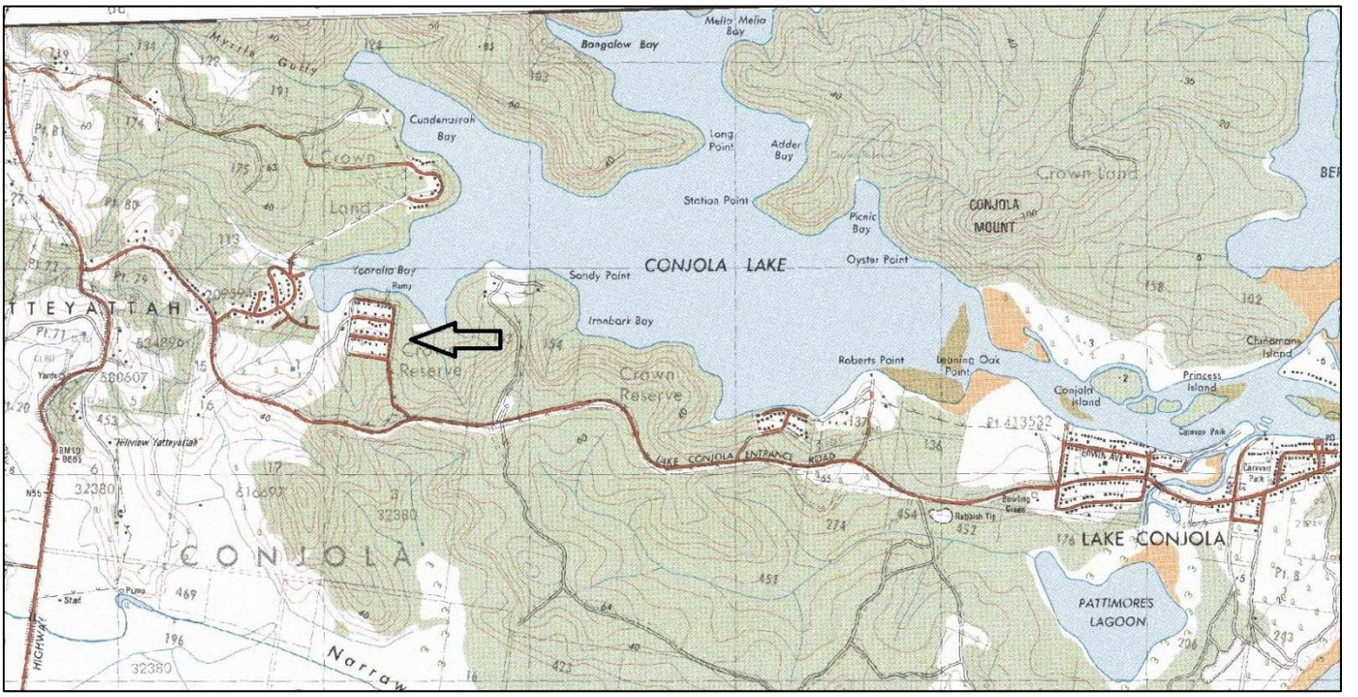

Figure 1: Map showing location of subject area (black arrow). Source: Milton 1:25K topographic map sheet.

The subject area comprises a 3.5 hectare wedge of land between Havilland St, the lake's edge and the boundary of Conjola National Park (Figures 2 and 3). The land is Crown Land managed by Shoalhaven City Council as Trustees of the land .

Figure 2: Google map showing subject area

Figure 3: Map showing subject area (yellow) and land tenure. Green is Conjola NP. Source: MIE.

The subject area is a north – northeast facing slope descending gently from a northwest to southeast trending ridge to a flat bench on top of an approximately 1 metre sandy bank and beaches surrounding the lake (Figure 4).

Figure 4: Part of shoreline showing low bench at back of beach

The area is naturally vegetated with eucalypt and banksias forest with the occasional rainforest copse, and *Casuarina sp.* fringing parts of the shoreline. The understorey comprises bracken fern, *Acacia s*p. and

various species of shrubs, with a ground cover of grasses. There are no mature eucalypts, suggesting that selective logging has occurred in the past.

Bedrock geology consists of conglomerates, sandstones and silty sandstones of the Conjola Formation, a component of the Shoalhaven Group of Permian aged rocks. Conjola Creek incised into sandstone rather than the weaker siltstone, producing the narrow, winding and branching pattern of Lake Conjola, after the valley was drowned by rising sea levels (Young & Young, 2007). Basaltic lava that flowed across the landscape and into coastal valleys during the Tertiary outcrops nearby at Red Head, Manyana, Green Island , Bannister Point and east of Pattimore Lagoon (Young & Young, 2007). The silcrete outcrops associated with some of these basalts were an important source of stone for Aboriginal tool manufacture (Navin Officer , 2005). Alluvial deposits occur around Lake Conjola, and Quaternary dunes are found closer to the entrance.

Soils comprise upper layers of sands and gravels and thin brown loam layers, overlying yellow sticky clay. Sandstone bedrock is exposed along some of the tracks in the subject area.

Numerous vehicle tracks criss cross the area, linking Havilland St with various locations along the water's edge where people launch their boats or go fishing (Figure 5).

Figure 5: A typical informal vehicle track in subject area

Figure 6: Existing boat launching area, below Havilland St.

An existing informal boat launching area is located north of the village (Figure 6) and narrow footpads occur around the lake's edge in and adjacent to the subject area (Figure7).

Figure 7: Section of footpad around lake margin

4. Archaeological context

4.1. AHIMS search

An AHIMS search was conducted by Peter Dalmazzo on 11 July 2016 for Lot: 7308, DP: DP1144810 with a buffer of 200 meters (Appendix 1). One site was identified; 58-1-0962 [CS 27] comprises three stone artefacts recorded within the Conjola park streetscape during a survey for modifications to the Conjola regional effluent management scheme (Navin Officer Heritage Consultants PL, 2004), (Appendix 2 and Figure 8). An Aboriginal Heritage Impact Permit (AHIP) was issued for this site to allow harm arising from construction of the REMS scheme in this location.

AHIMS also records a possible scarred tree [58-1-0961] southeast of the subject area near the junction of Havilland St with Lake Conjola Entrance Road.

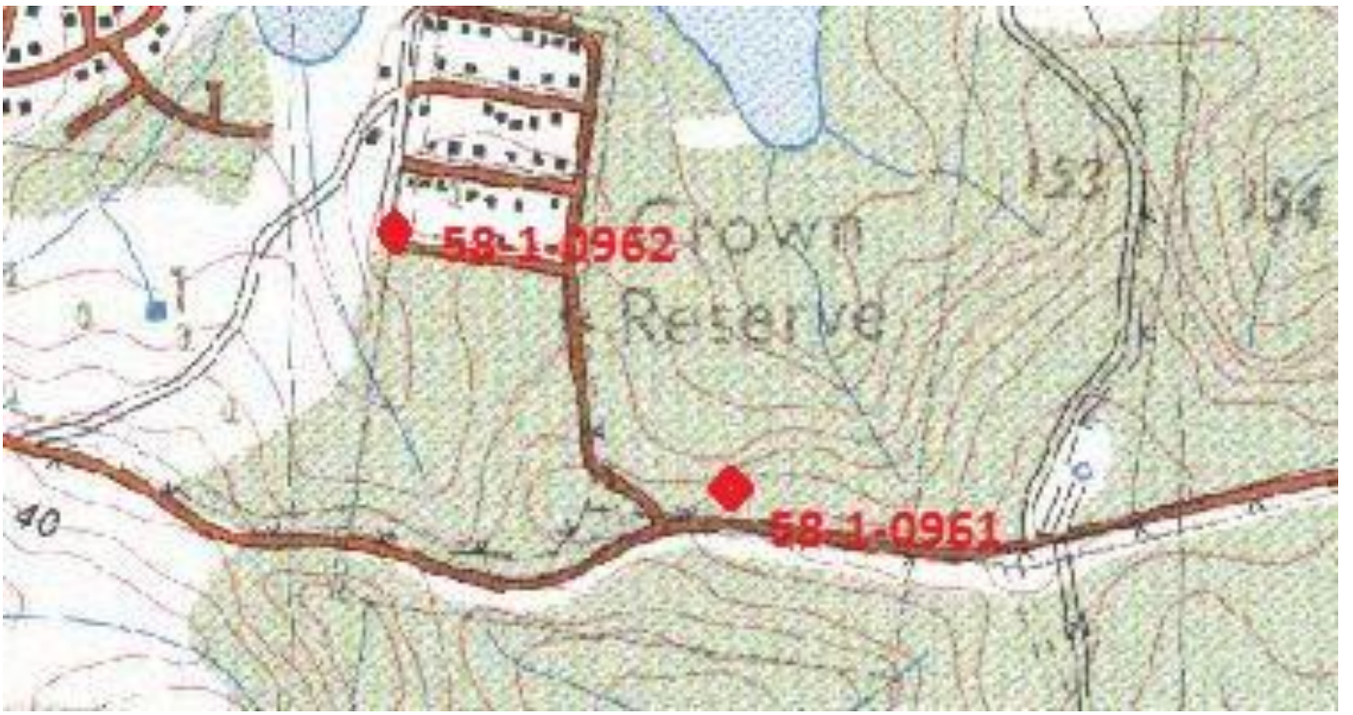

Figure 8: map showing recorded site close to subject area

No Aboriginal objects are recorded within the subject area; however it is unlikely that it has ever been systematically surveyed. No Aboriginal Places or Aboriginal Areas occur in the subject area.

It is important to note that the presence or absence of sites on AHIMS is merely a reflection of whether a site has been recorded on a site form and submitted to OEH for entry onto AHIMS. Hence, many sites, both known and unknown, do not appear on AHIMS. However, the south coast has been quite intensively and extensively studied by archaeologists since the late 1960s and many hundreds of sites have been recorded, and information has been provided to AHIMS. Hence in this instance AHIMS can provide

adequate data to enable a reasonably reliable characterisation and understanding of the regional archaeological record.

4.2. Regional archaeology

The Lake Conjola area is very well known archaeologically, due to the numerous archaeological studies that have been conducted in the region since the 1980s. These include systematic surveys for subdivisions at Cunjurong Point, Manyana and Bendalong, and in particular, for the Conjola sewerage treatment scheme since 1998. Navin Officer (2012) provides an excellent summary of previous archaeological investigations;

> Archaeological investigations in the broader Milton/Ulladulla and Conjola/Bendalong/Manyana region include studies carried out in an academic research framework (e.g. Lampert 1971, Bindon 1976, Officer 1991a, Boot 1994), and management plans (Officer 1991b) and commercial consulting investigations (e.g. Attenbrow 1981, Cane 1985a & b, Lance 1987, Silcox 1990, Kuskie 1994, 1995, 1996, 1997a & b, Heffernan & Klaver 1996, Navin 1996a & b, Navin & Officer 1997).
>
> Attenbrow (1981) surveyed pipeline routes and reservoir sites for the Northern Shoalhaven Water Supply project including sections of a pipeline between Bendalong and Lake Conjola. A shell midden with *in situ* deposit (Manyana Creek) was located on the northern bank of the lagoon behind Inyadda Beach. Sites were also located at Berrara Creek and Nerrindillah Creek at North Bendalong.
>
> Cane (1985a) carried out a survey of proposed reservoir sites and four water supply pipeline routes between Lake Conjola and Lake Tabourie. Cane (1985b) also surveyed a 20 km long pipeline from Porters Creek Dam to Conjola Inlet and Ulladulla, along a route which principally followed existing easements. No sites were located by Cane in either of these surveys although he noted that visibility was poor and sites may be present along the ridgeline and hilltop south of Fishermans Paradise.
>
> Lance (1987) surveyed a proposed electricity transmission line easement between Nowra and Ulladulla located mostly on the western side of, and parallel to, the Princes Highway. Lance located one artefact scatter and four isolated finds in the course of his survey.
>
> In 1990 Silcox recorded two artefact scatters (MG1 and MG2) in the course of survey and subsurface investigations for a proposed deviation of the Princes Highway at Myrtle Gully, several kilometres southwest of Fishermans Paradise. The artefacts recovered from the test excavations comprised mostly quartz and silcrete (Silcox 1990).
>
> A preliminary archaeological survey of the Milton Ulladulla Expansion Area was undertaken by Stone in 1995. The subject area comprised a strip of land approximately 5 km wide extending from Croobyar Creek in the north to Burrill Lake and Lagoon Head in the south. Stone located five open camp sites and two isolated finds. The sites were located near Stony Creek, Burrill Lake, Lagoon Head and Croobyar Creek (Stone 1995).
>
> Navin (1996a) conducted a survey of a proposed Sewage Treatment Plant (STP), access road and a pipeline from the existing Sewage Treatment Plant to the proposed STP, located west of Ulladulla. The STP area consisted of approximately 23 ha of forested ridgeline crest and mid-slopes and the proposed road and pipeline easements had a combined length of 2.25 km. Two possible Aboriginal scarred trees,

Racecourse Creek 1 and Racecourse Creek 2, were identified within the general area of the proposed access road and pipeline easements.

A survey for an upgrade and extension to facilities at the West Ulladulla Sporting Complex located within the northern catchment of Racecourse Creek did not locate any Aboriginal sites (Navin 1996b). A route selection study for the proposed Milton-Ulladulla Bypass (Navin & Officer 1997) resulted in the recording of four Aboriginal sites (two scarred trees and two artefact scatters) and the identification of four areas of potential archaeological deposit in the proposed road easement.

Kuskie (1994, 1995) conducted a survey and program of subsurface testing in a 66 ha parcel of land located immediately south of Fishermans Paradise. Surface survey resulted in the location of one artefact scatter (Fishermans Paradise 1) and one isolated find (IF Fishermans Paradise 2). Sixty seven artefacts were recovered as a result of the subsurface testing, with raw material predominantly quartz and silcrete and lesser quantities of volcanics, siltstone and crystal quartz.

Kuskie also conducted a survey of zones of predicted high archaeological sensitivity in forest compartment #1087 in Conjola State Forest. A small artefact comprising three silcrete artefacts and an isolated find were recorded in the compartment which was located between Red Head Road and Nerrindillah Road (Kuskie 1996).

An archaeological assessment of approximately 26 km of roads within Cudmirrah National Park resulted in the location of fifteen artefact scatters and eight isolated finds. Two of the artefact locations were associated with shell fragments. Artefacts comprised mostly grey silcrete flakes and flaked pieces with some pink and red silcrete, quartz, rhyolite, volcanics and quartzite artefacts (Kuskie 1997a).

Kuskie (1997b) surveyed an 80 ha property, the site of a proposed golf course, between Manyana and Bendalong and west of Inyadda Beach. Five artefact scatters and one shell midden previously recorded by Attenbrow (Manyanah Creek) in 1981 were located during the field survey. Flakes and flaked pieces comprised almost half of the artefact assemblage with silcrete dominating the assemblage (95%) (Kuskie 1997b:31).

No sites were located by Navin (1992) in a survey of a 2.1 ha area of land located northwest of the township of Cunjurong and in Portion 420, Parish of Conjola. The area was situated on the north facing mid-slopes of a low and evenly graded ridgeline which terminated at Cunjurong Point. Similarly no Aboriginal sites were located by Heffernan and Klaver in a 1996 survey for a power route and communications tower site south of Fishermans Paradise.

In 1998 NOHC undertook a cultural heritage study to assess a number of proposed sewage treatment plant and exfiltration sites at Bendalong, Lake Conjola and Conjola West. Two Aboriginal sites (artefact scatters) and two isolated finds were located in the course of the sewerage scheme investigation. That study was the first in a series of cultural heritage assessments for the Conjola Regional Sewerage Scheme that spanned eight years and resulted in a number of reports by Navin Officer Heritage Consultants Pty Ltd.

Various subsequent studies have investigated specific aspects of the proposed sewerage development including potential wastewater treatment plant sites (NOHC 1999a, 1999b, 2003), an access track and exfiltration site (NOHC 2000), an alternative pipeline route (Navin Officer 2001) and design modifications (NOHC 2004). Other, more general studies have been associated with EIS assessment (NOHC 2001b, 2002) and involved a subsurface testing program (NOHC 2005). In 2006, Navin Officer

undertook an archaeological salvage program for the development, which yielded a total of 900 stone artefacts from eight sites (NOHC 2006b).

A number of archaeological investigations have been conducted at Manyana, a small village located one kilometre north of Cunjurong Point at the entrance of Conjola Lake. A survey of 80 ha for a residential development at Manyana by Baker and Davies (2004) resulted in the re-location of three of six previously recorded sites. An additional site was recorded comprising one hammerstone and two silcrete artefacts.

In 2005 Navin Officer Heritage Consultants (NOHC) conducted a survey of three residential lots in a Manyana subdivision (2005a). Five sites comprising four artefact scatters and one isolated find were recorded. In addition, two previously recorded sites and two areas of PAD were re-located. A program of subsurface testing was recommended to determine the nature and significance of archaeological deposits. During the subsequent subsurface testing 479 artefacts were recovered from 21 of the 27 test pits excavated. The assemblage was identified as 'microlithic' in character and most likely accumulated at some time within the last 3,000 years (NOHC 2008).

In 2006 Kuskie conducted a cultural heritage assessment of 20 hectares of proposed residential development at Manyana. Only one Aboriginal artefact scatter was identified due to low surface visibility and a program of subsurface testing was recommended (Kuskie 2006). The subsequent testing involved excavation of 31 test pits which revealed 173 artefacts. Kuskie concluded that although dating was not possible, the artefact assemblage was similar to other assemblages from the local area that dated to the last 5,000 years (Kuskie 2007).

No Aboriginal sites or objects were recorded by NOHC during a survey of a 132 KV transmission line access track in Conjola National Park for Integral Energy (NOHC 2006a).

A cultural heritage assessment of a proposed water pipeline between Berrara and Manyana was conducted by Kelleher Nightingale in 2008. During the survey of the 10.3 km long easement, five Aboriginal sites were recorded comprising three isolated finds and two artefact scatters. In addition, the location of 15 previously recorded sites was revisited with artefacts identified at all but two of these sites. Of the total recorded sites, four were assessed to have high scientific significance with high potential for further research. As such salvage of these sites was recommended (Kelleher Nightingale 2008) (Navin Officer Heritage Consultants PL , 2012, pp. 14-15).

In 2011 Navin Officer conducted an Aboriginal heritage due diligence assessment for replacement of a submarine cable between Lake Conjola and Cunjurong (Navin Officer Heritage Consultants PL, 2011). No sites were found but test pitting was recommended for the exit hole/bore recovery location on the southern side of Lake Conjola, approximately west of the car park. Five test pits recovered only a single stone artefact (Navin Officer Heritage Consultants PL , 2012).

An archaeological survey for a shared path between Manyana and Bendalong re-located site 58-2-0241 which was salvaged during studies for the Conjola REMS. An additional 19 artefacts were recorded; some artefacts were assigned to this site while others were assigned to new site 58-2-0438. The artefacts were assessed as having low scientific value; noting that 58-2-0241 had been previously studied through test pitting and subsequent salvage (Feary, 2013).

An archaeological due diligence investigation was conducted in early 2015, for proposed dredging and rewatering at the Lake Conjola estuary. This study recorded two new sites on the northern side of the lake and identified an area of high archaeological potential associated with a recorded burial in sand dunes on the southern side of the Lake Conjola entrance channel (Feary, 2015). [3]

A due diligence assessment for replacement of a wooden boardwalk on the southern side of the Lake Conjola entrance channel identified the potential for further human skeletal remains to be present and recommended a programme of test pitting (Feary, 2016). Shoalhaven City Council currently has an application with OEH for an AHIP to allow test pitting to be undertaken.

The large numbers of sites in the Conjola area are a reflection of the large amount of investigation, but also of the traditional pattern of Aboriginal life, which utilised headlands and estuaries/coastal lakes as foci of occupation and resource use.

4.3. Local archaeology

The local archaeology warrants further scrutiny as it directly informs the recommendations of this report. During the 2001 survey for the Conjola REMS, pipeline routes for serving residences at Conjola Park and Kilarney, and the route adjacent to the Lake Conjola Entrance Road were surveyed for sites and several small artefact scatters were recorded along Lake Conjola Entrance Road, CS1, CS2 and 58-1-722 (Navin Officer Heritage Consultants PL, 2001) (Figure 9).

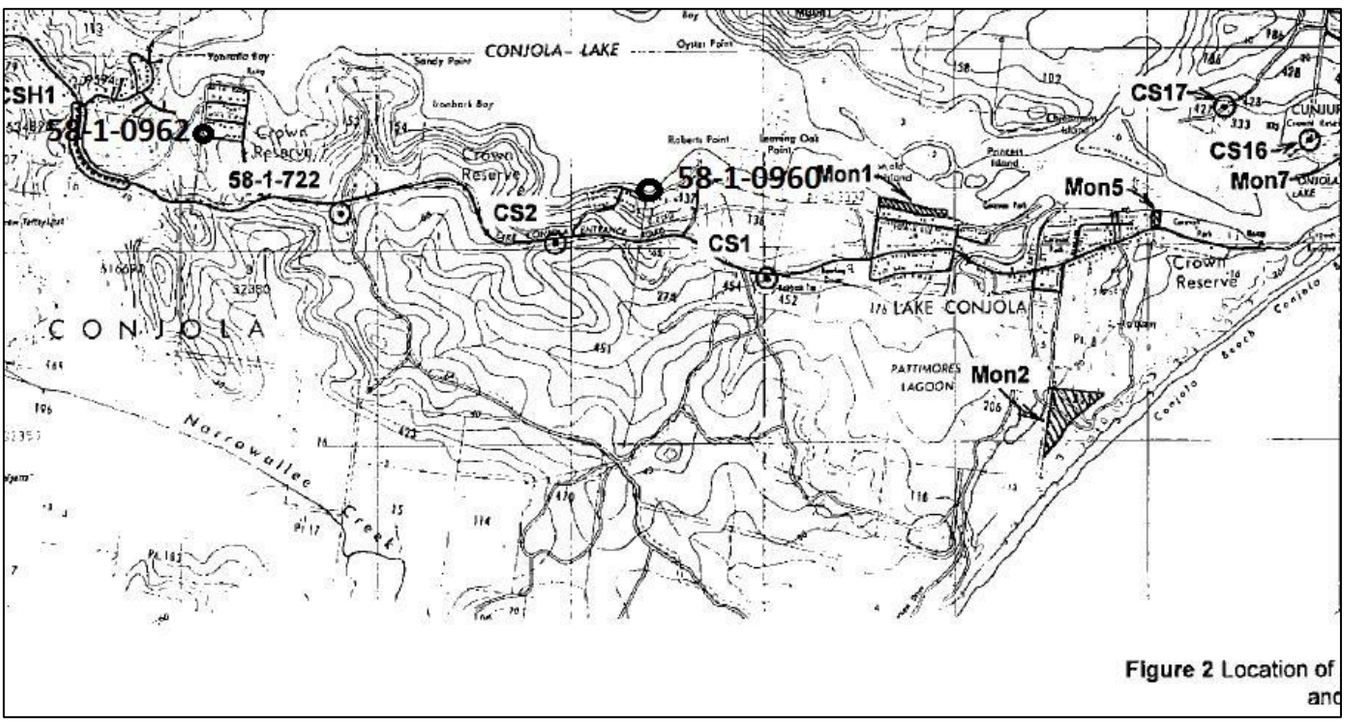

Figure 9: Sites recorded in vicinity of subject area. Source: NOHC (2001).

[3] The burial and associated midden was recorded [58-2-0347] and salvaged by OEH in 1998 (see Feary (2015; 2016)).

Feary, S. 2016. Proposed boat ramp and associated facilities, Conjola Park, NSW Aboriginal cultural heritage due diligence assessment. Report to MI Engineers, Nowra

Design modifications and further survey at Conjola Park identified a new site, comprising three artefacts at Conjola Park (58-1-0962) (Navin Officer Heritage Consultants PL, 2004)(see Figure 8). NOHC also recorded a possible scarred tree [58-1-0961] near the junction of Conjola Entrance Road with Havilland St within the road reserve/Conjola national Park.

Subsequent surveys identified an area of high archaeological potential (PAD) at Kilarney, west of Roberts Point, being an alluvial fan at the base of the slope above the lake edge (58-1-0960) (Figure 9). This was subsequently test excavated (Navin Officer , 2005) and then salvaged (Navin Officer Heritage Consultants PL, 2006). The salvage excavations recovered over 200 stone artefacts to a depth of 100 centimetres and the site was assessed as containing complex artefact assemblages, representing a wide range and/or unique human activities including artefact manufacture using locally available stone (Navin Officer Heritage Consultants PL, 2006).

Figure 10 shows where surveys were done within Conjola Park, which identified one archaeological site. The surveys around Conjola Park did not include the subject area to the east of Havilland St.

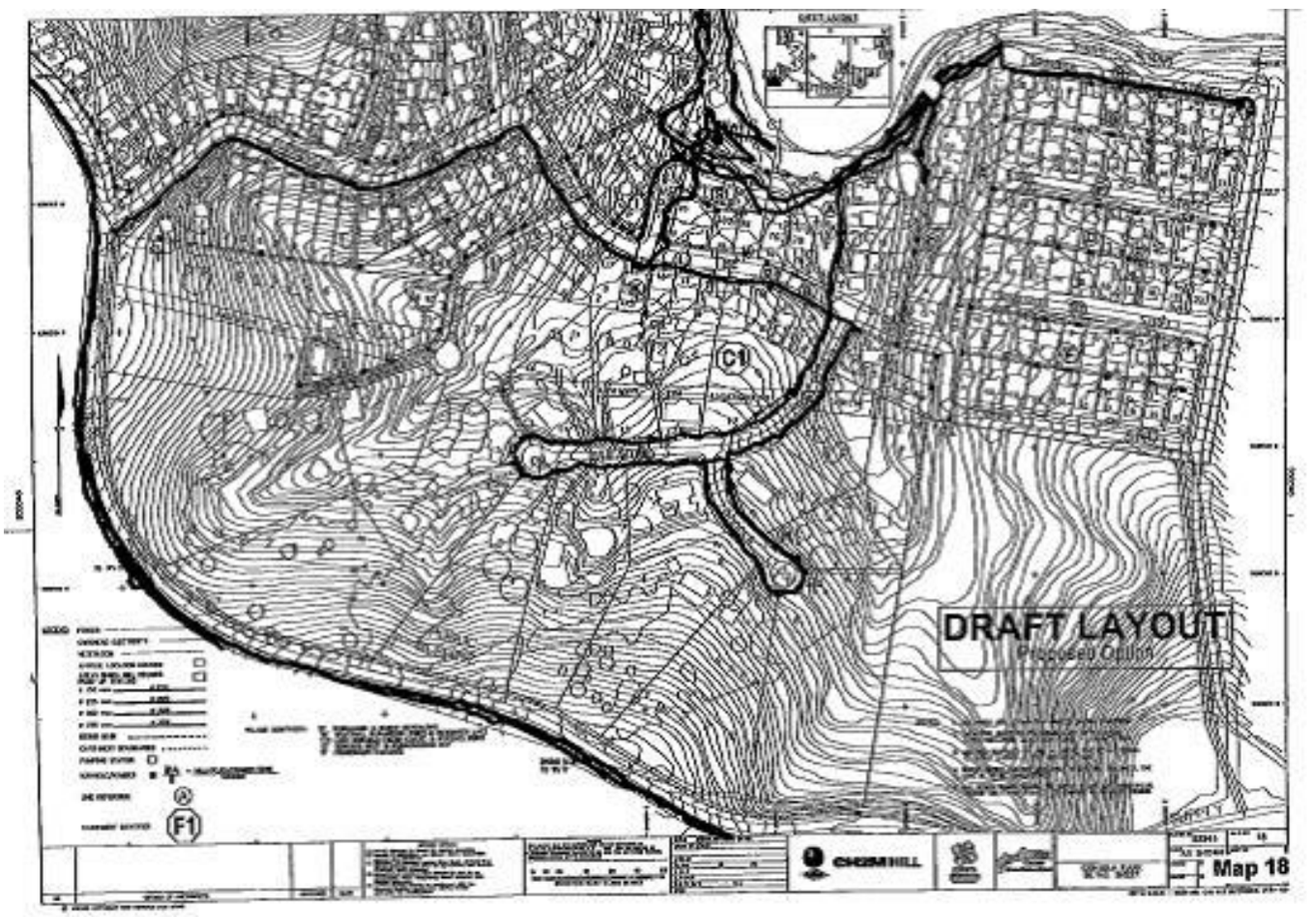

Figure 10: surveyed areas black lines) in Conjola Park precinct. Source: NOHC (2001).

5. Predictions

Predictive models use a number of parameters to determine where certain site types may be present. Parameters can include:-

- aspects of the natural landscape such as proximity of potable water, slope, aspect, geology, and natural routes for human movement;
- the regional history of pre-contact Aboriginal use and occupation;
- presence of resources such as stone or particular foods e.g. shellfish on rocky shore platforms.
- location of ceremonial, secret, or sacred sites;
- disturbance history, which influences whether or not sites are extant;
- geomorphological processes (erosion and colluvial/alluvial deposition), which can affect the likelihood of detecting the sites.
- Aboriginal oral traditions and local knowledge where known.

These models can be useful at a broad planning scale, especially in regard to predicting the location of artefact scatters, which tend to occur on flat, elevated, well-drained land close to a source of potable water. Artefact scatters generally reflect where Aboriginal people camped, with large scatters tending to represent longer periods of stay/ more people/ repeated visits over time, or all three. Small artefact scatters or single finds may represent transient movement. Some artefacts reflect the actual manufacture of artefacts, rather than just their use. Artefact size (amount of reduction) can also reflect the proximity of the stone source.

Shell middens also represent places where people camped and processed shellfish for consumption. Deep undisturbed shell midden deposits preserve a wealth of organic evidence and their systematic excavation over many decades has contributed greatly to the body of knowledge on pre-contact Aboriginal society and culture on the NSW south coast.

Desk top evaluation of landforms and a review of previous archaeological work indicate that the site types mostly likely to be present across the subject area are:-

- **Artefact scatters –** on flat well drained land above the flood level of the lake.
- **Midden**s **–** middens of estuarine shell may be present around the edges of the lake above the usual flood level.

Further ethnographic research and consultation with Aboriginal people may also identify the following site types;

- **Places of cultural/spiritual value** – natural features with spiritual value or places where ceremonies and rituals were conducted.
- **Places of social value –** traditional resource collecting, meeting or camping places, usually related to the historic period.

Site types unlikely to be present are:-

Rockshelters – due absence of sandstone escarpments
Quarries – absence of suitable rock such as silcrete although silcrete quarries are recorded nearby at Bannisters Point.
Burials – these are usually associated with middens in Quaternary sand dunes, viz. close to the lake's entrance.
Axe grooves – no large slabs of fine grained sandstone in or adjacent to creeklines
Scarred trees – no mature forest present.

Previous archaeological investigations described in Sections 4.2 and 4.3 identified large numbers of sites on the landforms surrounding Lake Conjola, including artefact scatters, scarred trees, middens and burials. Artefact scatters ranged from isolated finds to stratified deposits containing large numbers of artefacts, including site 58-1-0960 [CS26/PAD 5], only two kilometres east of Conjola Park. On the basis of the previous studies, the subject area is assessed as being archaeologically sensitive, with artefact scatters being the most likely site type to be present on flat well drained land above the highest lake levels and close to ephemeral water sources.

6. Proposed activity

The proposed activity involves construction of a boat ramp and associated facilities as shown in Figure 11. The development is still in the concept design stage, pending outcomes of environmental and heritage and community consultation. The installation of public recreation facilities will, rationalise the currently uncontrolled use of the area and reduce environmental damage to the lake edge. Figure 11 shows that the development includes a boat ramp, car and trailer parking area, access road, toilets, play and barbeque area, club house facilities and buffers of natural vegetation.

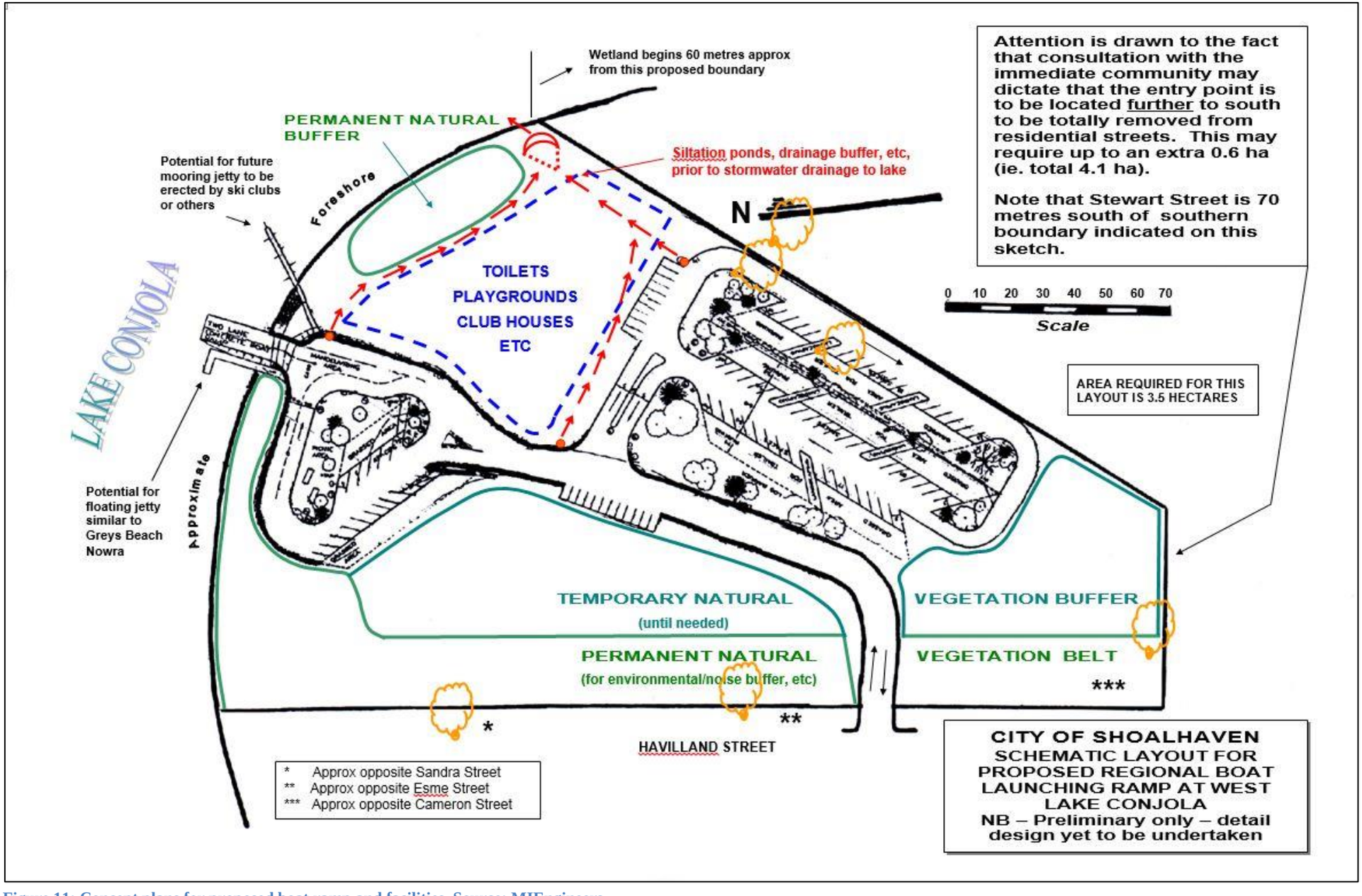

Figure 11: Concept plans for proposed boat ramp and facilities. Source: MIEngineers

7. Field inspection

A field inspection was conducted by the consultant archaeologist on 8th August 2016 on a fine day with no wind.

The aims of the field investigation were to:-

- Look for evidence of a past Aboriginal presence, specifically stone artefacts and midden material within and adjacent to the subject area and record the evidence in accordance with relevant OEH codes. The largest trees were also inspected for scarring.
- Identify taphonomic processes affecting the detectability of Aboriginal objects, including their loss, burial or exposure.
- Where relevant, determine the extent of Aboriginal sites and whether the proposed works will cause harm to objects and therefore require an Aboriginal Heritage Impact Permit (AHIP) from the office of Environment and Heritage (OEH).
- Determine whether additional field investigation will be required to assessment potential impacts on Aboriginal objects.
- Assess the scientific significance of any Aboriginal objects recorded during the field inspection.

A further field inspection was conducted on 2nd March 2017 to record a possible scarred tree identified by Peter Dalmazzo while carrying out an endangered species survey. Possible scarred tree 58-1-0961 was also inspected.

7.1. Methodology

- The due diligence assessment related to 3.5 hectares of the subject land and immediately adjacent areas. By necessity it focussed on existing tracks where there was some level of ground visibility, and around the shores of the lake.
- Inspections were conducted on foot and involved looking at the ground for evidence of midden shell and stone artefacts.
- Factors affecting site detectability and visibility were noted.
- Evidence of previous disturbance and landscape modification was noted.
- Larger eucalypts were inspected for Aboriginal-made scars.
- A handheld GPS was used to record where inspections were conducted.

7.2. Survey design

The five survey units were as follows (see Figure 12):

1. Sandra St extension – 2 metre wide slightly eroded vehicle track heading east from Havilland St, with two offshoots down steep banks to the water's edge (Points 121 and 122). Track continues mid slope, roughly parallel to lake on contour and joins up with other tracks.

2. Esme St extension - two transects. The one south of Esme St is narrow and partly overgrown. It eventually joins up with other tracks (Points 114 and 115) that lead down to an extensive flat area next to the lake, within the national park (Point 116). This track meanders around and joins up with another track (Point 117) that comes out just north of Esme St (Point 118).

3. Cameron St extension– this track is currently closed off to vehicles; it traverses along and down a gentle slope then swings north to join up with the other tracks (Point 119), and east to join tracks leading to Point 116.

4. Lakeshore /top of bank - narrow foot pad on top of a low wave-cut embankment around the edge of the lake [Point 126 to Point 116, including new boat ramp location)

5. Havilland St extension – highly eroded track down to current boat launching area

6. Road verges/embankments along eastern side of Havilland St.

Figure 12: Google earth map showing [approximately] location of transects walked along existing tracks and trails [red lines]. Numbered points are specific inpection locations.

7.3. Results and discussion

One Aboriginal object, a stone flake was recorded during the initial field inspection. It is located on the foot pad as shown in Figure 13, among exposed tree roots. Despite careful searching no other artefacts were found in the vicinity of the artefact.

Figure 13: Photo showing location of artefact

Artefact description

Conjola Park 1
Grid reference: 267546/6095021
Description: 1 large light grey silcrete primary flake (Figure 14).
Location: among exposed roots of a collapsed eucalypt tree, on a narrow foot track on a flat bench on top of a low wave-cut lake embankment. It was sitting on top of loamy soils among forest floor litter, and is probably not *in situ,* being more likely to have rolled down from above (Figure 15).

Figure 14: Conjola Park 1

Figure 15: photo showing environmental context of artefact.

Ground visibility was totally confined to existing tracks and trails, and varied according to the amount of leaf litter, but was generally poor (Figure 16).

Figure 16: Relatively good ground visibility on a track.

An additional stone artefact was observed during the inspection on 2 March 2017 [Conjola Park 2]. This comprised a single primary flake of light grey silcrete, located in the middle of a rough vehicle track on gently sloping ground, leading to the small embayment. This artefact is within Conjola National Park at Grid Coordinates 0267596/6094918 and will not be affected by the proposed development.

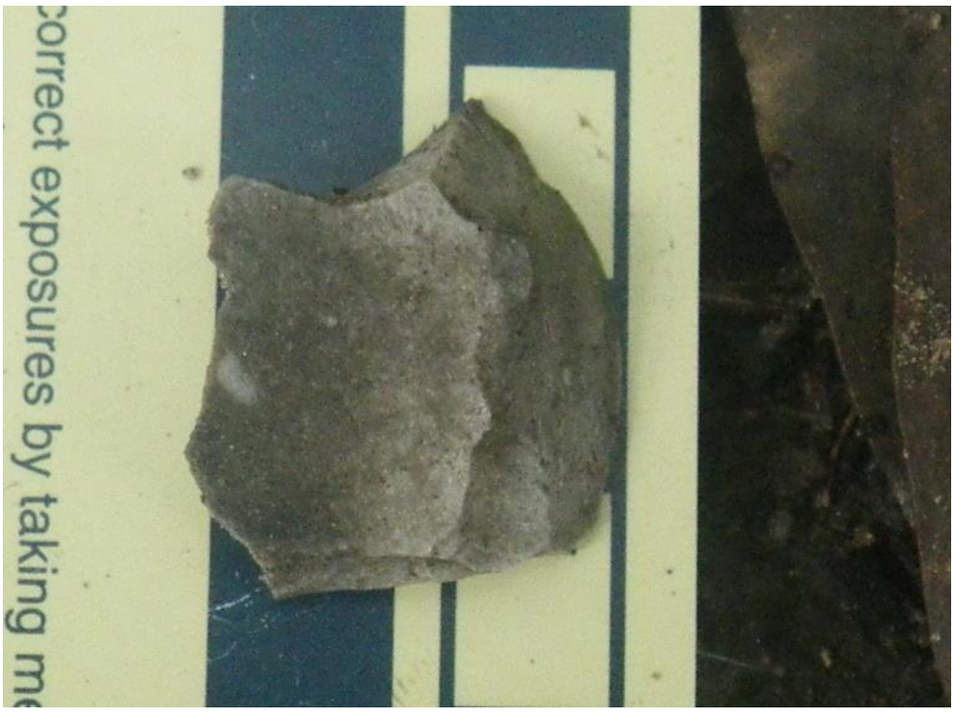

Figure 17: Isolated artefact Conjola Park 2

The field inspection on 2 March 2017 recorded a possible scarred tree identified by ecologist Peter Dalmazzo during fieldwork for a review of Environmental factors for the proposed development. The tree is a dead and fallen over blackbutt *[E. pilularis]*.

Conjola Park possible scarred tree (Figure 18)

GRID CORDS: 0267452/6094806.
LOCATION: 54 metres from centre of Havilland St along track opposite Cameron St and 52 metres south of this track.
ENVIRONMENT: ENE aspect, 0-5 degrees slope, open forest, previously logged, very few large trees.
DESCRIPTION: Scar is on uphill side of tree [WSW facing]. The scar is a well-defined oval, which has been broken in two by the tree falling over.
It was impossible to determine whether the scar had been made by a stone or steel axe. There are cuts across the scar suggestive of a steel axe but this could have been done much later. The tree is probably around 100 - 200 years old.
SCAR MEASUREMENTS:

Distance from ground to bottom of scar = 70 cm

Total length of scar = 96 cm + 35 cm = 131 cm
Width of scar at top = 42 cm
Width of scar at bottom = 56 cm
Depth of scar tissue at top = 13 cm
Depth of scar tissue at bottom = 5 cm
Girth = 3.62 m

Figure 18: Possible scarred tree

The tree will not be impacted by the proposed development.

Figure 19 shows locations of sites discussed above. Neither tree has scars indicative of bark removal for a canoe, despite the proximity to the lake. The two stone artefacts suggest a very low level of use by Aboriginal people at this particular location in pre-contact times.

Figure 19: sites recorded in and adjacent to subject area

8. Assessment of cultural significance

8.1. Criteria

The ICOMOS Burra Charter provides the framework for cultural significance assessment using the key criteria of social, aesthetic, scientific and historic values (ICOMOS 2000). The OEH assessment guidelines also provide some direction on how to apply these criteria (OEH, 2011).

8.2. Social

Aboriginal people have not been consulted on social or spiritual significance. However, previous studies in the Lake Conjola area have identified the presence of burials which have high cultural significance. The general area is known to have cultural significance to local Aboriginal communities.

8.3. Scientific significance

The two isolated Aboriginal stone artefact can offer very limited insight into pre-contact Aboriginal occupation of the area, other than to confirm a fleeting presence at some time in the past. The artefacts are made from silcrete which is locally available at Bendalong; there no evidence of their use or function and there are no associated cultural deposits and they are probably not *in situ.* The scientific significance of the artefacts is negligible; however they are an indication that other artefacts may be present. The landform is therefore assessed as having a medium scientific significance for containing further stone artefacts.

The two scarred trees would require further assessment to determine whether the scars are of Aboriginal origin. If so, they would be assessed as having high scientific significance due to their rarity value. However, this significance is diminished by the very poor physical condition of both trees.

9. Potential harm to objects

It appears from the concept plans that Conjola Park 1 is situated within a 'natural buffer zone', so harm can be avoided. The two possible scarred trees and the additional artefact noted during field inspection of 2 March 2017 will not be impacted by the proposed development.

Harm may occur to unrecorded artefacts from levelling the ground and construction of the car park, access roads and other facilities across the subject area, above the flood level.

The absence of mature eucalypts within the development envelope makes it very unlikely that scarred trees will be present. However, if scarred trees of potential Aboriginal origin are encountered, they must not be harmed. OEH should be notified.

10. Recommendations

The due diligence field inspection identified a single Aboriginal stone artefact within the development envelope, but this is likely to be in the natural buffer zone and won't be impacted. If it is to be impacted, the proponent will need to apply for an Aboriginal Heritage Impact Permit [AHIP] from the Office of

Environment and Heritage. This will trigger a full archaeological assessment, including Aboriginal consultation.

Other recorded objects are outside the development area and won't be impacted.

Because of poor ground visibility it is not possible to be confident that the area has been comprehensively assessed for stone artefacts. Given the medium potential for additional artefacts to be present, the following options are presented for consideration by the proponent.

Option 1
Ensure that the artefact found in the subject area during survey is not going to be impacted, i.e. is in the buffer zone. Proceed with caution and stop work if objects are found. Because of the medium potential for artefacts to be present, this is a high-risk strategy which, if objects are found, could lead to long delays while further assessment is done and an AHIP is issued.

Option 2
Once plans have been finalised and vegetation removed to allow for infrastructure construction, re-survey the areas where vegetation has been removed. This increases the chances of finding Aboriginal objects if they are present and also gives more confidence that they are not present. However, there will still be long delays if objects are found, although it may be possible to continue work at locations where no objects were found.

Option 3
Conduct archaeological test excavations at the locations where ground disturbance is planned to occur and there is a likelihood of sites being present, i.e. across the entire area above the lake flood zone. Under current legislation, a permit is not required to conduct the test excavations, but the Code of Practice for Archaeological Investigation must be followed, which requires Aboriginal consultation (DECCW, 2010a). The results of the test excavations will determine whether an AHIP is required before the proposed development can proceed.

11. Summary of due diligence process

Step 1. Will the activity disturb the ground surface?

Yes, in some locations.

Step 2a. Search the AHIMS database and use any other sources of information of which you are already aware.

No sites recorded in the subject area, but some recorded nearby, with a large site at Kilarney.

Step 2b. Activities in areas where landscape features indicate the presence of Aboriginal objects

The activity is close to 'waters' as defined in the due diligence code. The gentle slope leading down to the water has potential to contain artefacts, above the lake's natural flood zone.

Step 3. Can you avoid harm to the object or disturbance of the landscape feature?

The object found during the survey can be avoided as it is in a buffer zone. Depending on where they occur, some unrecorded artefacts may be able to be avoided, but the landscape feature cannot be avoided.

Step 4. Desktop assessment and visual inspection

Desktop assessment and comprehensive visual inspection conducted.

Step 5. Further investigations and impact assessment

As the potential impact of the development could not be fully assessed due to poor ground visibility, further investigation by limited test pitting is a recommended option where ground above the lake's flood zone will be disturbed by the proposed development.

12. References

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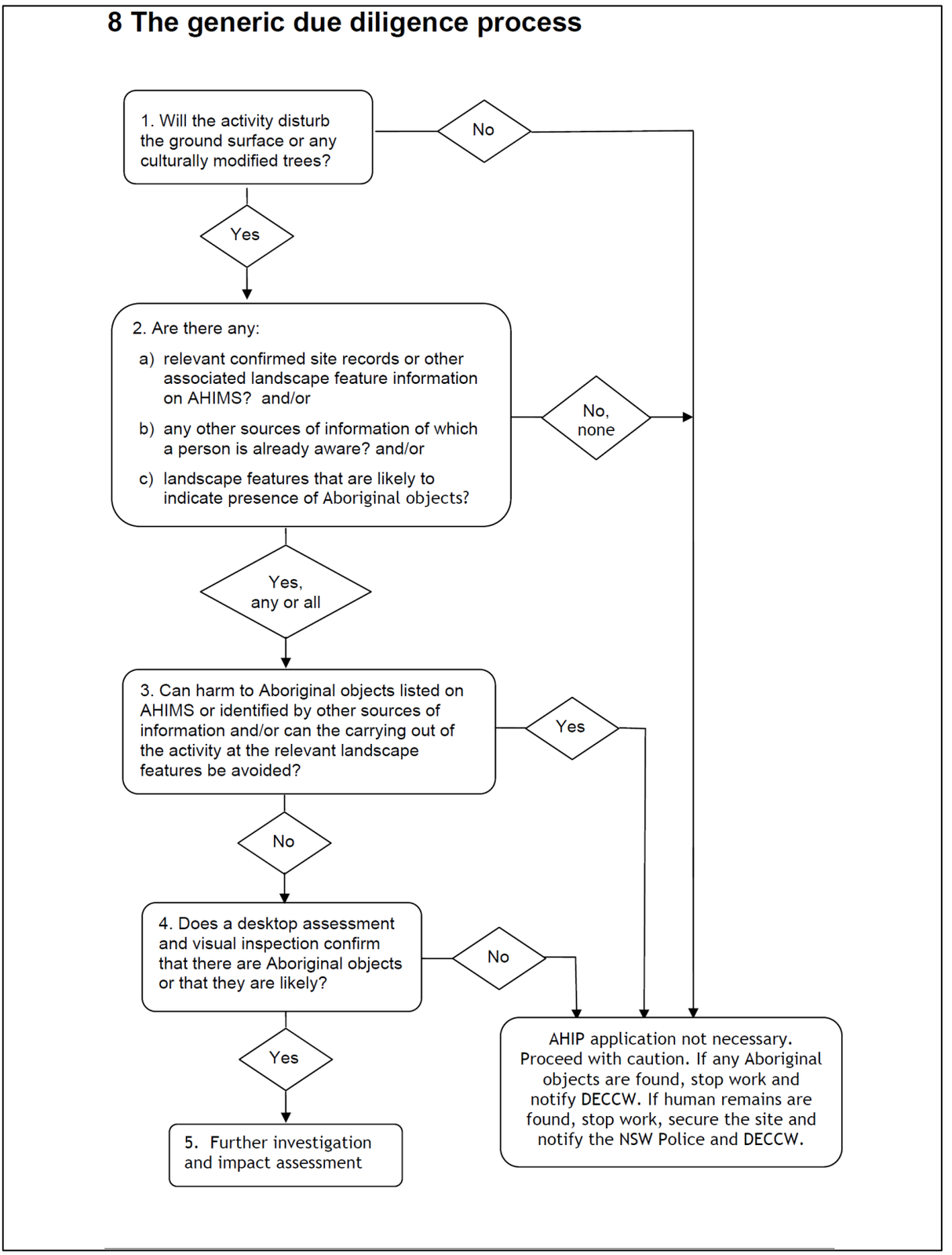
Appendix 1: Due Dilgence flow diagram (DECCW, 2010a)



Appendix 2: AHIMS site records for study area

Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : conjola ramp

Client Service ID : 233438

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
58-1-0962	CS27 - Conjola Sewerage 27	AGD	56	267108	6094591	Open site	Valid	Artefact : 3		99330,99719,100646

Contact T Russell **Recorders** Navin Officer Heritage Consultants Pty Ltd **Permits** 2292

Report generated by AHIMS Web Service on 11/07/2016 for Peter Dalmazzo for the following area at Lot : 7308, DP:DP1144810 with a Buffer of 200 meters. Additional Info : Assessment of public boat ramp proposal for Shoalhaven City Council. Number of Aboriginal sites and Aboriginal objects found is 1

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Page 1 of 1

Appendix 3: Site card for 58-1-0962

Aboriginal Sites Register of NSW

NPWS, PO Box 1967, Hurstville NSW 2220

Standard Site Recording Form

58-1-0962

New Recording ☒ Additional information ☐

SITE IDENTIFICATION					
Site name	CS27 – Conjola Sewerage 27			**NPWS Site #**	58-1-962
Owner/manager	Shoalhaven Water Group (SW) of Shoalhaven City Council (SCC) and the Department of Energy, Utilities and Sustainability (DEUS)				
Owner Address					
LOCATION					
Location	Rising Main, Conjola Park				
How to get to the site	See attached map				
1:250,000 map name				**NPWS map code**	
AMG Zone		**AMG Easting**	0267108	**AMG Northing**	6094591
Method for grid reference	1:25000 map	**Map scale (if method = map)**	1:25,000	**Map name**	Milton, Tianjara, Sussex Inlet, Cunjurong, all 2nd ed.
NPWS District Name (see map)				**NPWS Zone (see map)**	
Portion no.				**Parish**	
SITE DESCRIPTION					
Site type(s)	Artefact Scatter			**Site type code (NPWS use only)**	

Description of site and contents
CHECKLIST: eg. length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of decorated surface, motifs, colours, wet,/dry pigment, engraving technique, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead. likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried

This site is a low density scatter of stone artefacts located on the upper slopes of a spurline shoulder adjacent to Lake Conjola. The site is on the corner of Stewart Street and Windemere Drive in area of dumped blue metal next to a driveway. Three artefacts were visible within an 8 m exposure in the road reserve. Exposure incidence was 25%, visibility in the exposures was 30%.

Artefacts

1. red/brown silcrete flaked piece, possible mechanical crushing, 5% reef cortex, 32 x 20 x 16 mm
2. grey silcrete core, three platforms, 40 x 28 x 27 mm
3. grey silcrete flake, broken longitudinally, 27 x 16 x 6 mm

Attach photographs and sketches, eg. plan & section of shelter.
Do NOT dig, disturb or damage site or contents.

SITE ENVIRONMENT

Version: June 1998 Data entered by: J. Taylor Date entered: 23/08/05

Aboriginal Sites Register of NSW

NPWS, PO Box 1967, Hurstville NSW 2220

Standard Site Recording Form

Land form	Flat to undulating	**Aspect**	open	**Slope**	
Mark position of the site					
Local rock type	Conglomerates, sandstones, silty sandstones of the Conjola Formation, silcrete	**Land use/effect**	Silica mining		
Distance from drinking water		**Source**			
Resource zone (eg. estuarine, river, forest)		**Vegetation**			
Edible plants		**Faunal resources** (include shellfish)			
Other exploitable resources (eg. ochre)					
Are there other sites in the locality	yes	**Are they in the Sites Register**	some	**Other site types include**	Artefact scatters, potential archaeological deposits, isolated finds

SITE MANAGEMENT

Site condition	See Report		
Management recommendations	See Report		
Have artefacts been removed from site	unknown	**When**	
By whom		**Deposited at**	
Consent applied for	☐	**Consent issued**	☐
Date of issue		**Consent number**	

SITE INSPECTION AND RECORDING

Reason for investigation	Regional Sewerage Scheme Design Modifications		
Were local Aborigines contacted or present for the recording	☐Not contacted ☒Contacted and present ☐Contacted but not present	**Names and addresses**	Ms Anne Reid Jerrinja Local Aboriginal Land Council PO Box 117 ORIENT POINT NSW 2540 Ms Marie Connolly and Mr Greg Connolly Jerrinja Wandiwandian Peoples Group C/- PO Box 117 ORIENT POINT NSW 2540
Is the site important to local Aborigines			
Verbal/written reference sources	1. Navin Officer Heritage Consultants (2004). *Conjola Regional Sewerage Scheme – Design Modifications. Cultural Heritage Assessment.* A Report to NSW Department of Commerce	**ASR report number(s) (or title)**	C- C-
Photographs taken	Yes	**No. of Photos attached**	2
Site recorded by	Navin Officer Heritage Consultants Pty Ltd	**Date of recording**	October 2004
Address/institution	4/71 Leichhardt Street, KINGSTON, ACT 2604		

Version: June 1998 Data entered by: Date entered:

0

Proposed boat ramp and associated facilities, Conjola Park, NSW. Report on archaeological monitoring.

Sue Feary
October 2016
Report to MI Engineers
Nowra

Frontispiece: Commencement of augering, Bore Hole 1, Conjola Park, 22/9/2016. Photo: S. Feary

Introduction

A due diligence assessment for Aboriginal archaeological sites in respect of a proposed regional boat ramp and associated facilities adjacent to Conjola Park village identified a single stone flake and indicated the subject area had some potential for containing further Aboriginal objects (Feary, 2016).

Further archaeological investigation was conducted by way of observation and recording during machine augering to obtain critical geotechnical data. This report presents the results of the archaeological monitoring programme.

Background

The due diligence assessment, conducted in August 2016 involved field inspection and a comprehensive review of relevant previous archeological investigations, particularly those associated with the Conjola REMS (Feary, 2016). The REMS study , which included field survey, test excavations and salvage excavations, recorded several sites in the vicinity of the proposed boat ramp (Navin Officer Heritage Consultants PL, 2002, 2006). Generally, the Lake Conjola area contains numerous recorded sites, including middens, scarred trees, artefact scatters and burials (Feary, 2016; 2015).

The field inspection recorded a single stone artefact close to the existing edge of the lake. The analysis r suggested that further sites may be present but were not detected at the time due to variable ground visibility at the time of survey. This, together with the presence of other recorded sites in the vicinity, indicated a medium potential for artefact scatters to be present. However, the generally sloping nature of the landform and absence of sand dunes reduced this potential somewhat.

The report recommended avoiding the recorded artefact by establishing a vegetation buffer zone along the edge of the lake. This has been incorporated in the current concept plans for the boat ramp. Options for further limited archaeological investigation were also provided.

After the due diligence assessment was completed, MI Engineers received a letter from the Office of Environment and Heritage providing advice on conducting due diligence assessments and recommending a full Aboriginal cultural heritage assessment of the subject area.

Following discussions between the consultant archaeologist and MI Engineers, it was agreed that archaeological monitoring of geotechnical works would provide more certainty regarding the presence or absence of Aboriginal objects and the likelihood of their potential harm.

Monitoring programme

MI Engineers are required to conduct geotechnical investigations as part of developing the concept plan and specifications for the proposed regional boat ramp adjacent to Conjola Park. Figure 1 shows the

locations of the four bore holes dug to retrieve geotechnical data, associated with the alignment of the access road to the new boat ramp.

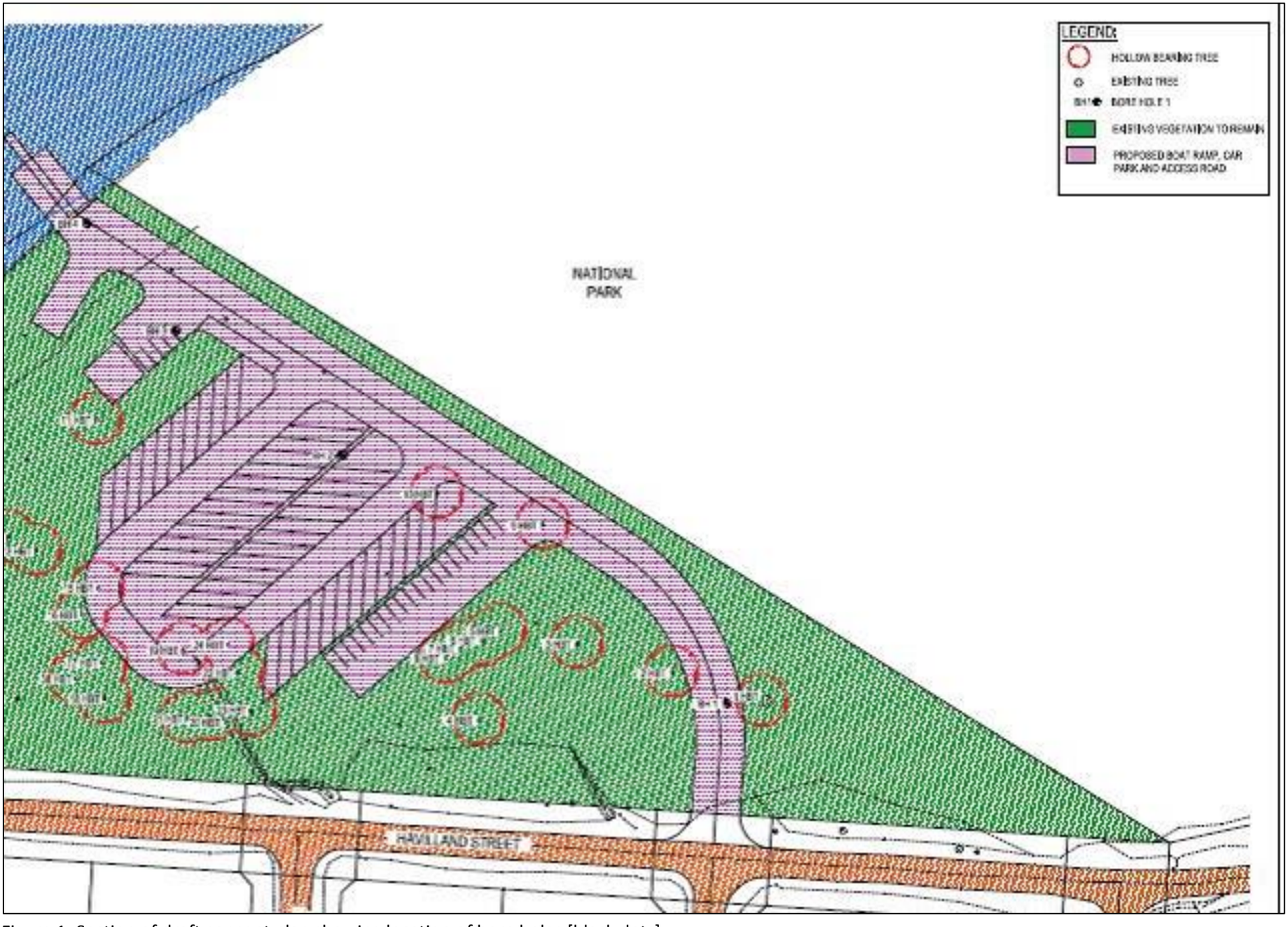


Figure 1: Section of draft concept plan showing location of bore holes [black dots].

Bore Holes 1 – 3 were dug to a depth of 700 mm with a 300 mm diameter auger using a small Dingo machine.

Bore Hole 1 is on an informal vehicle track, where the upper A1 horizon has eroded away (see Frontispiece).

Bore Holes 2 and 3 are on natural, eroded surfaces adjacent to informal vehicle tracks (Figure 2).

Figure 1: Location of Bore Hole 3.

Bore Hole 4 is close to edge of the lake and was dug using a 100 mm diameter auger. This was not monitored as it was unlikely to encounter Aboriginal objects.

All locations had a top layer of leaf litter.

The monitoring methodology involved augering initially to a depth of 200 mm, removing the sediment from the auger and spreading it out on the ground to see if artefacts were present. Clay or rock predominates below approximately 200 mm, so depths below this were not monitored for Aboriginal objects.

Once the auger hole was completed, the stratigraphy was noted, as well as whether any Aboriginal objects could be seen in the walls or base of the auger hole (Figure 3).

Figure 2: Bore Hole 3

Results

The monitoring did not identify any Aboriginal objects in either the auger holes or the excavated sediment.

Sediments comprised an upper humic layer of leaf litter and organic material, grading down into sandy/clayey soil with rounded sandstone gravels, broken and whole quartz pebbles and occasional larger pieces of rock. Orange clays increased with depth.

Conclusions and Recommendations

The geotechnical monitoring did not identify any Aboriginal objects and the previous field inspection identified a single stone flake. Factors potentially affecting these outcomes were the fairly limited scope of the monitoring and the poor ground visibility of some sections of the subject area during field inspection.

In looking at the overall landscape, the results of the due diligence and monitoring, and the previous investigations, it seems likely that Aboriginal people would have camped on the flatter, better drained and more elevated land where Conjola Park village is now situated.

Although the possibility of Aboriginal objects - stone artefacts – being present cannot be totally discounted, the chances of them being present within the areas to be impacted by the proposed development is considered to be extremely low.

It is therefore recommended that no additional archaeological investigation is required. If any Aboriginal objects are encountered during development, works must cease immediately and OEH notified.

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Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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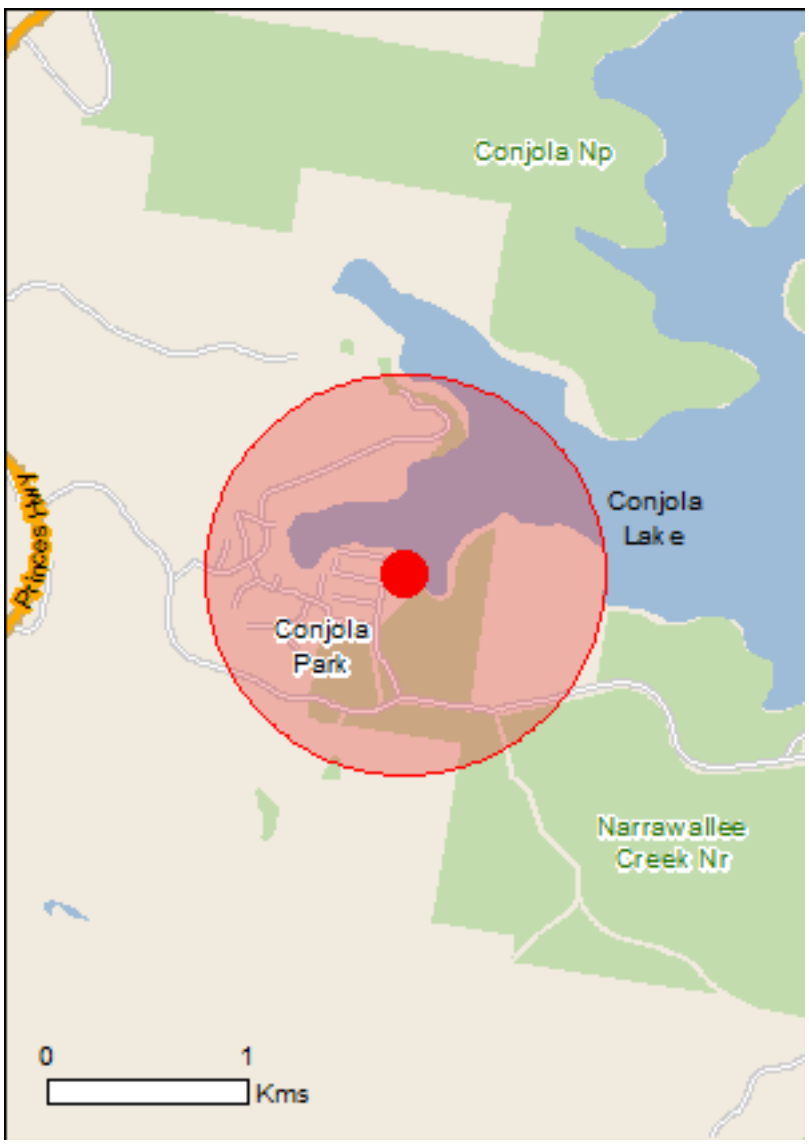

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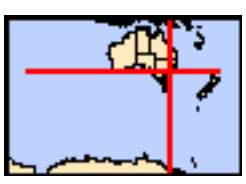

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	58
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	46
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	37
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Caladenia tessellata		
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat may occur within area
Genoplesium vernale East Lynne Midge-orchid [68379]	Vulnerable	Species or species habitat may occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Thalassarche bulleri](#) Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
[Thalassarche cauta](#) Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
[Thalassarche eremita](#) Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
[Thalassarche impavida](#) Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
[Thalassarche melanophris](#) Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
[Thalassarche salvini](#) Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Thalassarche steadi](#) White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Lamna nasus](#) Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
[Manta birostris](#) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov.		
Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Conjola	NSW
Narrawallee Creek	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Southern RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat may occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-35.2614 150.4445

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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