Nuwi Wetland Ecological Survey

23 Bennelong Parkway

Final

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

About this document

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Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field, Lisa Jones and Julian Reyes with qualifications BSc. Majoring in Ecology.

Limitations Statement

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

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Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia

Executive Summary

Purpose

This wetland mapping was conducted to fulfill requirements and answer questions relating to potential impacts from shading on the wetlands. It is in additional to work done by SMEC for the same project in 2018.

The correspondence requests have been included at the front of this report.

- The key requirement was the detailed mapping of the saltwater wetland vegetation – particularly Saltmarsh and searches for Wilsonia and Zannichellia.
- Then with this data detail the potential impacts on Saltmarsh in general and in consideration to it being an EEC. With respect to Saltmarsh there is also the need to provide an accurate area m2 of it within the wetland and the area potentially impact such that the triggers for the need biodiversity off-setting can be accurately accessed.
- Also to address the presence or likelihood of threatened flora species not covered in detail in the SMEC report – in particular the presence of:
    - Horned Pondweed Z*annichellia palustris,* and the terrestrial plants
    - *Pomaderris prunifolia, Epacris purpurpascens* var *purpurpascens* and *Wahlenbergia multicaulis.*
    - Searches were also made for the endangered *Wilsonia backhousei* as it is in other parts of Sydney Olympic Park.

Methods

- Two field survey events occurred. One focused on the fauna and open water areas and the other focusing on the vegetation and included an on-site survey of the entire wetland. The Wetland was walked including the full perimeter and all accessible inner areas (and all areas where Saltmarsh could grow) were assessed on-foot by experts (GDB and SP).
- GPS data was collected, as were photos. Saltmarsh patches exceeding 2m in size were measured with measuring tape. Smaller patches were photographed and noted on the aerial map. It's noted most of the saltmarsh exists as small patches or isolated plants.
- Any plant indicative of Saltmarsh was mapped as Saltmarsh (e.g. an individual Sueada)

Results

- Saltmarsh is scarce in this wetland – occurring as sporadic plants along the edges and the two 'access ways/berms'. The main area of saltmarsh is around the transmission tower.
- There is less than 15m^2 of saltmarsh within the area of proposed shading.
- The greatest abundance (patch 15.5x3.5m and 15.5 x 7.5) is near and within the reception tower (outside the shaded area) and another strip of mainly Sueada along Hill Road.

- The remaining wetland area is mostly mangroves *Avicenea marina* of various ages. Mangrove ages relate to specific hydrological events and these are known (by SOPA).
- While the vegetative parts of the mangroves appeared in good condition the flowers were dead and no seed set was apparent. Some older mangoes are showing signs of stress with aerial roots having been formed.
- The third vegetation community is She-oaks. Casuarina Forest and this is growing as almost linear strips on the access ways/bunds. The She-Oaks here do not constitute the Swamp Oak EEC.
- An area that was designed as a saltmarsh on the northern side is entirely mangroves.
- Crab holes were observed throughout the Mangroves, casuarina forest and tidal edges (weeds and saltmarsh).
- Searches for Horned Pondweed Z*annichellia palustris* and *Wilsonia backhousei* revealed none present on-site the considerations for these species is included within this report.
- Habitat doesn't occur within the wetland area for *Pomaderris prunifolia, Epacris purpurpascens* var *purpurpascens* and *Wahlenbergia multicaulis.* One *Pomaderris* has been planted on the Western edge of the wetland. It is the only one present and surrounded by weed species. It is not *P. prunifolia* but shows Pomaderris can grow in the terrestrial area of the site.

Conclusions

- The proposed shading will not impact Saltmarsh such that a viable population would be threatened with extinction. There is not a viable saltmarsh population currently present.
- The area of saltmarsh is well below the threshold to trigger Biobanking offsets. The total area of saltmarsh for the entire wetland is under
- Shading of Mangroves will occur – refer to SMEC report and conclusions within. Ideally shading should be kept under 3hrs for mangroves.
- Mangrove and Saltmarsh environments can be dynamic and it could be that the wetland area provides potential for future saltmarsh colonisation should the water levels drop on a more permanent basis or the land rise such that it is infrequently inundated.
- Weeds along the wetland perimeter are abundant and in areas vines are growing onto the Mangroves. A thin saltmarsh fringe on the western side is boarded by a dense mass of exotic species. Spiny Rush *Juncus acutus* is growing in 3 areas, currently the numbers are low (under 20) for all wetland however eradication is recommended and SOPA have arranged this.

Recommendations

Spiny Rush *Juncus acutus* to be removed (on-going)

Monitor wetland edge and modify if possible to expand the saltmarsh fringe.

If the wetland becomes brackish (rather than salty) then monitor for Z*annichellia palustris.*

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1.1 Limitations of the Study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, biological life-cycle patterns as in the case of small plants such as species of orchids etc. No specific invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year or in the case of Z*annichellia* be related to salinity. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame and assess the suitability of habitat for particular species and make assumptions of likelihood where necessary.

Considering the site and habitat availability Kingfisher are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions in this report.

2 Purpose of this Report

Ecological Consultants Australia (ECA) has been contracted by SUTHERLAND & ASSOCIATES PLANNING to undertake a detailed field survey and provide information to enable the direct and indirect impacts on any threatened species, populations and communities to be assessed and thus fulfil the ecological questions / requests from assessing agencies. It adds to the work already done by SMEC including the Oct 2018 reporting.

2.1 Scope of works

To provide a flora and fauna assessment for assessing the potential direct and indirect impacts of any threatened species, populations and communities on the site. The assessment includes a specific search and mapping for saltmarsh, Wilsonia and Z*annichellia* within Nuwi Wetlands.

The objectives of this Flora and Fauna Impact Assessment are to build upon the report and studies by SMEC (2018) to:

- Survey the wetland for significant species or significant habitat features present within the study area.
- Identify any known or potential habitat for threatened species.
- Targeted searches for significant species.

Works included a site survey/assessment, review of project design and previous ecological reports to answer the questions raised in the following correspondence.

NSW GOVERNMENT | Office of Environment & Heritage

DOC18/735053
MP09_0160 MOD 4

Attachment A

Modification request to Concept Approval for Residential Development, 23 Bennelong Parkway, Wentworth Point (MP09_0160 MOD 4) – Environmental Assessment

Office of Environment and Heritage (OEH) has reviewed the following documents:

- Section 75W Modification to Concept Plan Mp09_0160 (MOD 4) - modification to approved building envelopes – September 2018
- Nuwi wetland shadowing assessment by SMEC - 3 September 2018
- One the Waterfront Urban Design Report – August 2018

and provides the following comments.

The Modification proposal seeks to modify the approved Concept Plan for a residential development at 23 Bennelong Parkway, Wentworth Point and includes, among other things:
• increase the building envelope height for building C from 9 storeys to 25 storeys
• increase the building envelope height for Building F from 9 storeys to 35 storeys.

The Nuwi wetland is located to the south-west of the proposed development site on the opposite side of Bennelong Parkway to the proposal (see Figure 1 in SMEC report).

- OEH notes that vegetation and flora/ fauna surveys were not conducted in the Nuwi Wetland as part of the assessment, as access was restricted by security perimeter fencing. Such surveys do not provide an adequate assessment, such that it can be concluded with any confidence that the proposal will not significantly impact any threatened species or ecological communities. Of particular concern to OEH are potential impacts on the endangered Green and Golden Bell Frog or the threatened Narrow-leaved Wilsonia (*Wilsonia backhousei*).
- The SMEC report states that there are three Plant Community Types present on the Nuwi wetland site of which two are endangered ecological communities (EECs). The identification and extent of these communities should have been confirmed through a vegetation survey of the site using quantitative analysis
- As the impact of shadowing on the EECs is clearly an issue of concern, the report should have included diagrams of the mapped EECs overlaid with the shadow analysis diagrams as shown in the 'Architectural package'.
- The SMEC report states that "Estuarine Saltmarsh is excluded as an EEC if patches of saltmarsh within a mosaic (i.e. patches within 30 m of each other) collectively are less than 0.1 ha in size or if isolated patches are less than 0.1 ha in size." However, this definition only applies to Estuarine Saltmarsh listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. There are no size thresholds in the NSW Scientific Committee's description of for Coastal Saltmarsh listed under the *Biodiversity Conservation Act 2016*. (BC Act). Therefore, OEH considers that the saltmarsh at the Nuwi Wetlands is likely to constitute Coastal Saltmarsh EEC as listed under the BC Act.
- Section 4 of the report concludes that saltmarsh may be sensitive to the effects of shading, but that this is not an issue in this instance, as the saltmarsh on site does not meet the definition of the EEC. However, given the above that the saltmarsh on site is likely to meet the definition of the EEC, the conclusion that saltmarsh will not be impacted, needs to be revisited.

- Appendix C of the SMEC report shows the results of searches of databases, including BioNet, for species that have been recorded within 10 km of the site. However, this list has omitted a number of species that have been recorded nearby. For example, there are recent records of BioNet of the following threatened plant species within 1 km of the site in Sydney Olympic Park: *Pomaderris prunifolia*, *Epacris purpurascens* var. *purpurascens* and *Wahlenbergia multicaulis*
- Most significantly, there is no mention in the report of the aquatic threatened plant *Zannichellia palustris*. There are a number of recent records of the species nearby in Sydney Olympic Park. If the species does occur in the Nuwi Wetlands, then its presence is likely to be of high conservation significance as the species only occurs in two locations in NSW, in the lower Hunter and at Sydney Olympic Park.

- Appendix C states that the habitat requirements for the Australasian Bittern include saltmarsh, but the table concludes that the species has a low likelihood of occurrence as there is no suitable habitat present, without any further explanation of why the saltmarsh on site is not suitable habitat.
- Also, Appendix C states that the habitat requirements for the White-fronted Chat include bare or grassy ground in wetland areas, but the table concludes that the species has a low likelihood of occurrence as there is no suitable habitat present, even though from aerial photographs of the site there appears to be grassy areas adjoining the Nuwi Wetland
- Many of these assessments of significance in Appendix D do not provide enough justification against each of the criteria. For example, in relation to the Eastern Osprey, in response to the assessment of 'whether the proposal is likely to have an adverse effect on the life cycle of the species' it is not sufficient to simply state that the proposal is 'unlikely to have an adverse effect on the life cycle' of the species without any justification as to why such a conclusion can be reached.
- The assessment of significance for *Wilsonia backhousei* concludes that the proposal '*is unlikely to, though may, have a significant adverse impact on this species*'. This is not adequate. The conclusion should be that either it will or it won't be likely to have a significant impact.
- Given the above, the statement in Section 5 of report, that the assessments of significance concluded that there would be no significant impact upon any threatened species with the potential to occur at the site, is not accurate.
- the conclusions in Section 5 of the SMEC report include that the Nuwi Wetland site may provide habitat connectivity between breeding populations at Narawang Wetlands and those to the south-east of the site in Sydney Olympic Park. Given this has been highlighted as a particular issue, the report should have included a discussion of the potential impacts of the proposal on the habitat connectivity values of the site for this species.
- OEH notes that there is a remnant of the EEC, Sydney Turpentine-Ironbark Forest mapped as occurring to the west of the site. OEH understands the scope of the SMEC report has been limited to assessing impacts on the Nuwi Wetland, but it is not clear if there has been any consideration of potential impacts from shadowing or other indirect impacts on this adjoining remnant.

(END OF SUBMISSION)

NSW GOVERNMENT | Planning & Environment

Planning Services
Key Sites Assessments
Contact: Emily Dickson
Phone: 8275 1032
Email: emily.dickson@planning.nsw.gov.au

Our Ref: MP 09_0160 MOD 4

Environmental impacts

- Serious concerns have been raised by Government agencies about the impact of the proposal on the Nuwi wetlands, including:

- overshadowing of the proposal on fauna and flora
- identification of, and impacts to, endangered ecological communities and habitats.

- The adequacy of the Ecological Assessment provided is insufficient, as access was not obtained to the wetland, a habitat survey was not undertaken and a detailed vegetation survey, including shadow analysis has not been carried out.
- The Department is concerned how these impacts are able to be mitigated, taking into account the precautionary principle and presence of endangered ecological communities within the wetland.

Your Reference:	MP09_0160 MOD 4
Our Reference:	NCA/8/2018
Contact:	Kate Lafferty
Telephone:	9806 5393

Director, Urban Assessments
Department of Planning
GPO Box 39 Sydney NSW 2001

IMPACTS ON NUWI WETLAND

The subject site is located directly north of Nuwi Wetland, which has been mapped by the NSW Office of Environment and Heritage (OEH) to contain Estuarine Saltmarsh, Estuarine Swamp Oak Forest and Estuarine Mangrove Forest. The modification proposes a significant increase in building heights from 9 storeys to accommodate 25 storey (Building C) and 35 storey (Building F) towers. Nuwi Wetland provides an important habitat linkage between Narawang Wetland and the northern end of Haslams Creek, and will be subject to overshadowing from the proposed building height increase (particularly during the winter months).

The Nuwi Wetland Shadowing Assessment prepared by SMEC dated 3 September 2018 (SMEC Report) confirms that Nuwi Wetland comprises Estuarine Saltmarsh (Endangered Ecological Community), Estuarine Swamp Oak Forest (Endangered Ecological Community) and Estuarine Mangrove Forest plant community types (PCTs). The most likely impact on these PCTs is reduced solar access, the duration and extent of which will be most significant during the winter months. Whilst the extent of overshadowing declines throughout the day from approximately 33% at 9am to 7% at 12.00pm at the winter solstice reducing to approximately 8% (9am) and 1% (12noon) at the March and September Equinoxes, no shadow diagrams are provided with the report to indicate the extent/duration of overshadowing impacts on the mapped PCTs.

It is noted that a comprehensive habitat survey of Nuwi Wetland was not undertaken due to perimeter security fencing and that the assessment is therefore based on perimeter visual inspections (stated in both the 2014 and 2018 SMEC reports). The extent and condition of the

three native vegetation communities has not been groundtruthed and is therefore based on OEH Sydney Metropolitan Native Vegetation mapping (Version 3, 2016) only.

Estuarine Saltmarsh (EEC)
The SMEC report states:

"Estuarine Saltmarsh may be sensitive to the effects of shading. However, Estuarine Saltmarsh is excluded as an EEC if patches of saltmarsh within a mosaic (i.e. patches within 30 m of each other) collectively are less than 0.1 ha in size or if isolated patches are less than 0.1 ha in size. Estuarine Saltmarsh within the Nuwi Wetland form a mosaic of individual patches which collectively cover an area of 0.09 ha and an isolated patch that covers an area of 0.03 ha, and therefore is not considered to constitute an EEC in this instance."

This definition applies to the Coastal Saltmarsh Ecological Community listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth), with listing under the Biodiversity Conservation Act 2016 (NSW) based on species composition. Notwithstanding this, the extent of Saltmarsh within Nuwi Wetland is based upon OEH Native Vegetation Mapping that comprises a mosaic of three connected individual patches totalling 0.108 hectares. In the absence of a more comprehensive site survey to confirm the extent and composition of Saltmarsh (PCT 1126) within Nuwi Wetland, it is considered to constitute Coastal Saltmarsh listed under both the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999*. As research suggests that Estuarine Saltmarsh 'may be sensitive to the effects of shading' and in accordance with the precautionary principle, a targeted survey is required to confirm the condition and extent of Estuarine Saltmarsh within Nuwi Wetland to adequately assess the likely impact of overshadowing from the proposed increased building heights.

Wilsonia backhousei
The SMEC report 'Test of Significance' for *Wilsonia backhousei* found that '*Nuwi Wetland likely supports suitable habitat for this species however due to a lack of survey effort its status on the site is unknown'* and that *'increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway may have an adverse effect on the life cycle of the Narrow-leaved Wilsonia such that a viable local population of Narrow-leaved Wilsonia is likely to be placed at risk of extinction given periodic shading may have significant impacts on aspects of this species' lifecycle processes such as flowering, recruitment, fruiting, germination and competition.'* Furthermore it states that '*approximately 1.9 ha of suitable habitat will be affected by periodic shading which may have significant impacts on aspects of this species' lifecycle processes such as flowering, recruitment, fruiting, germination and competition'* and that *'an area of habitat may become fragmented or isolated if the species is indeed present at Nuwi Wetland and periodic shading significantly impacts individuals present at the site.'*

In accordance with the precautionary principle and in the absence of a comprehensive survey to confirm its presence/absence and extent, Council officers are not satisfied that the proposed development will not have a likely impact on 'Wilsonia backhousei' (listed as vulnerable under the Biodiversity Conservation Act 2016).

In order to address the above concerns, Council officers recommend the following:

(i) The incorporation of the relevant shadow diagrams into the report that clearly indicates the duration and extent of shadowing on the wetlands – and particularly the Estuarine Saltmarsh (and Wilsonia backhousei if present)
(ii) The undertaking of a targeted survey of the Nuwi Wetland to confirm:
- the extent and condition of the Estuarine Saltmarsh Ecological Community
- the absence/presence and extent of Wilsonia backhousei

SydneyOlympicPark

Your reference: MP 09_0160 MOD 4

Ecological Assessment and Overshadowing Impact on Nuwi Wetlands

SOPA considers the ecological impact assessment to be inadequate, as mapping of ecological communities was limited to a perimeter survey without full access to the wetlands.

The report needs to include an accurate and up-to-date site survey of the wetlands so that the impacts of the overshadowing can be properly understood. This is particularly relevant, as the report estimated a total area of coastal saltmarsh in a mosaic of patches of 0.09ha, when the threshold for an Endangered Ecological Community is 0.1ha.

SOPA is happy to facilitate access to Nuwi Wetlands to allow SMEC to carry out the detailed ground mapping.

With regard to the impacts of the proposed modifications:

- The proposed additional tower heights will result in sections of the wetlands being overshadowed for three or more hours per day during winter. Based on the shadow studies included in the Urban Design Report prepared by Urbis, this level of overshadowing would not occur under the current height controls.
- There are likely to be adverse impacts on the mangrove and coastal saltmarsh communities from overshadowing of three or more hours.
- Until the ecological communities are accurately mapped, the impact of the overshadowing on the overall health and function of the wetlands cannot be adequately understood and an informed assessment cannot be made regarding the of the reasonableness of the additional overshadowing.

2.2 Site Location

The study area is Nuwi Wetlands opposite 23 Bennelong Parkway, Wentworth Point, NSW 2127 (see Figure 1.1).

Figure 1.1 Study Area Nuwi Wetlands. Main Study area in bold yellow line. Other areas surveyed in narrow yellow line. Source: Six Maps

3 Methods

3.1 Site Inspections

Two field survey events occurred. One focused on the fauna and vegetation edges and open water areas February 14th 2019 and the other focusing on the vegetation and included an on-site survey of the entire wetland Monday 4th 2019 at low tide (2pm-5pm). Weather was fine and sunny during both inspections.

- The Wetland was walked including the full perimeter and all accessible inner areas (and all areas where Saltmarsh could grow) by experts (GDB and SP).
- GPS data was collected, as were photos.

- Saltmarsh patches exceeding 3m in size were measured with measuring tape. Smaller patches (individual plants) were photographed and noted on the aerial map. It's noted most of the saltmarsh in Nuwi Wetlands exists as small patches or isolated plants.
- Any plant indicative of Saltmarsh was mapped as Saltmarsh (e.g. an individual *Suaeda australis*)

During site visits, notes and photos were taken of the vegetation types, flora and fauna present. Surveys detailed yet also opportunistic in nature (traversing where possible) and were performed by traversing the site. Surveys took in all areas of potential Saltmarsh, including Wilsonia, habitat and included the shallow still water areas for *Zannichellia palustris.*

Surveys included one diurnal bird and fauna survey and a detailed vegetation survey and a general habitat survey in which fauna habitat resources were identified.

3.2 Previous studies

- SMEC (Oct 2018) and reports associated with the DA
- SOPA mapping and discussion with Swapan Paul SOPA who has expert and detailed knowledge of the estuarine habitat on-site.

4 Results

4.1 Habitat Assessment for Threatened Species

The detailed site survey included assessment of habitat for Threated species.

- Saltmarsh is scarce in this wetland – occurring as sporadic plants along the edges and the two 'access ways/berms'. The main area of saltmarsh is around the transmission tower.
- There is less than 15m2 of saltmarsh within the area of proposed shading.
- The greatest abundance (patch 15.5x3.5m and 15.5 x 7.5) is near and within the reception tower (outside the shaded area) and another strip of mainly Sueada along Hill Road.
- The remaining wetland area is mostly mangroves Avicenna marina of various ages. Mangrove ages relate to specific hydrological events and these are known (by SOPA).
- While the vegetative parts of the mangroves appeared in good condition the flowers were dead and no seed set was apparent. Some older mangoes are showing signs of stress with aerial roots having been formed.
- The third vegetation community is She-oaks. Casuarina Forest and this is growing as almost linear strips on the access ways/bunds. The She-Oaks here do not constitute the Swamp Oak EEC.
- An area that was designed as a saltmarsh on the northern side is entirely mangroves.
- Crab holes were observed throughout the Mangroves, casuarina forest and tidal edges (weeds and saltmarsh).
- Searches for Horned Pondweed Zannichellia palustris and Wilsonia backhousei revealed none present on-site the considerations for these species is included within this report.

- Habitat doesn't occur within the wetland area for Pomaderris prunifolia, Epacris purpurpascens var purpurpascens and Wahlenbergia multicaulis. One Pomaderris has been planted on the Western edge of the wetland. It is the only one present and surrounded by weed species. It is not P. prunifolia but shows Pomaderris can grow in the terrestrial area of the site.

4.2 Detailed Site Survey

The purpose of the flora work was an investigation to determine the flora composition of the site, particularly vulnerable and endangered species. It also included an assessment of the flora as habitat. Figure 4.2 and 4.3 show the location of saltmarsh. Following the figure are images from the site showing the saltmarsh.

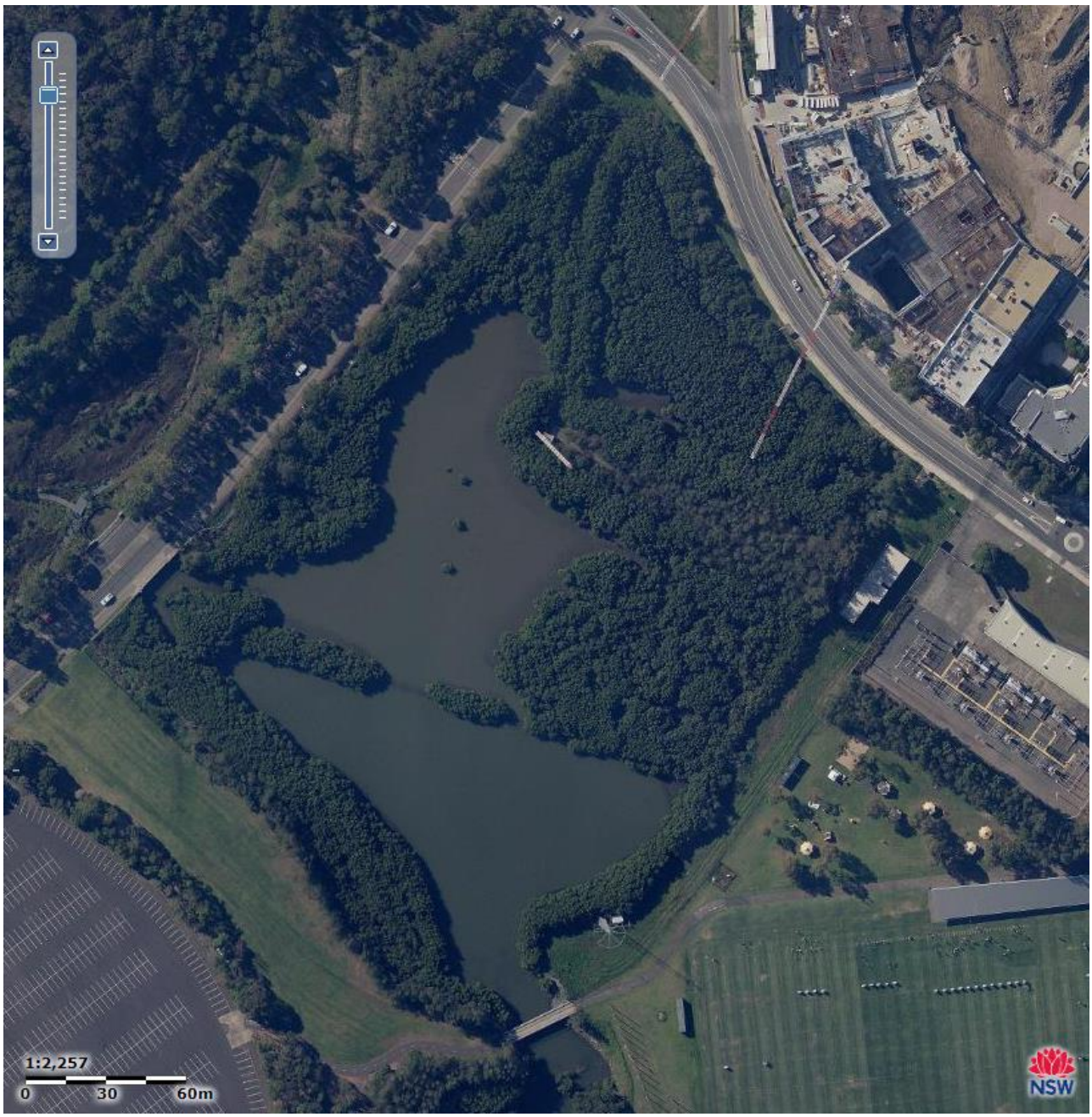

Figure 4.1 whole of Nuwi Wetlands.

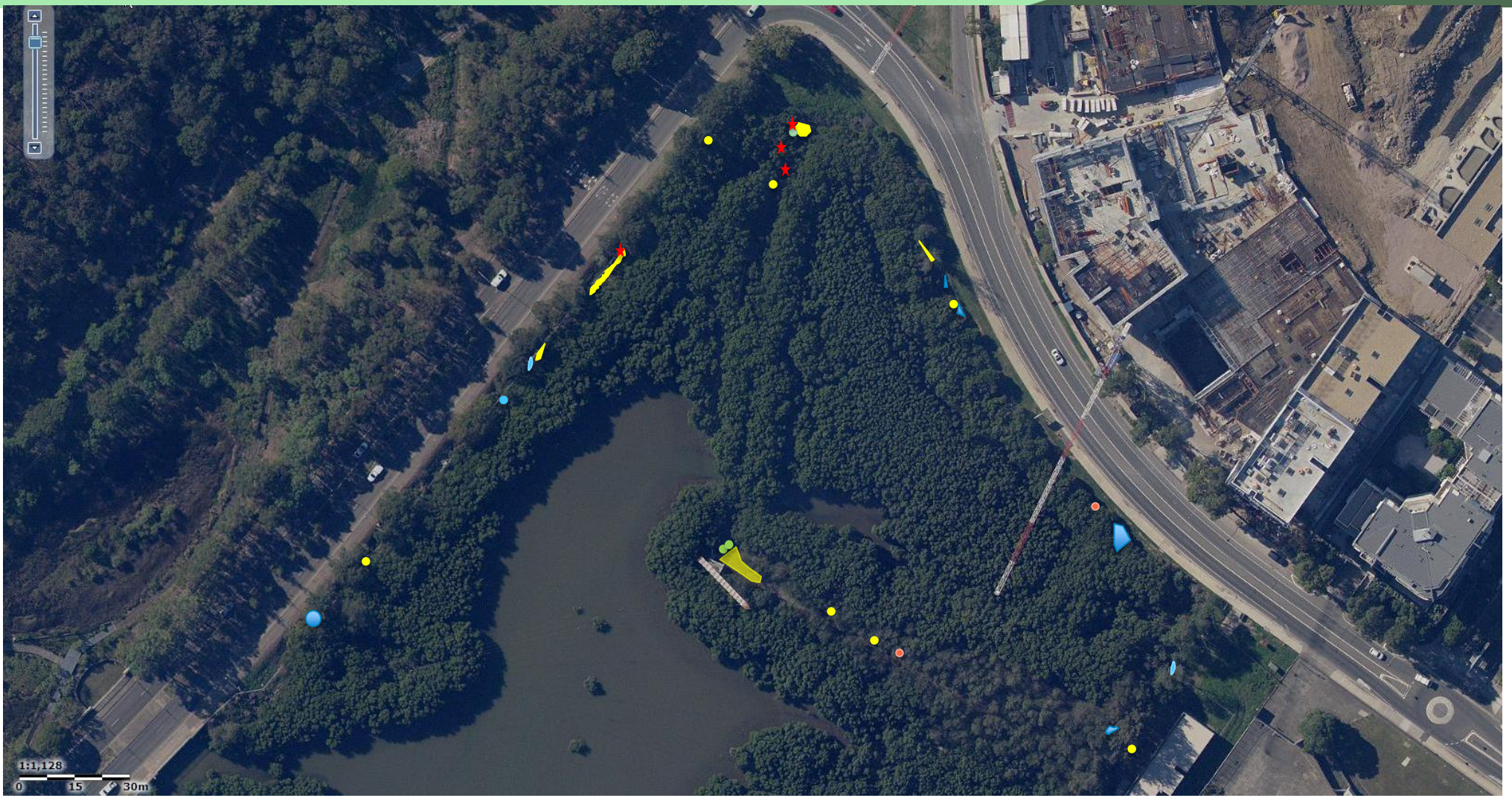

Figure 4.2 Northern half of Nuwi Wetlands – Saltmarsh Mapping

Yellow: *Suaeda australis*	Green*:* *Sarcocornia quinquenervia*	Red *Einadia hastata*	Blue *Tetragonia tetraganoides*	Red star, *Juncus acutus* (weed)

Figure 4.3 Southern half of Nuwi Wetlands

Yellow: *Suaeda australis*	Green: *Sarcocornia quinquenervia*	Red *Einadia hastata*	Blue *Tetragonia tetraganoides*	Red star, *Juncus acutus* (weed)

Following are images of any saltmarsh areas observed
















	
	
	

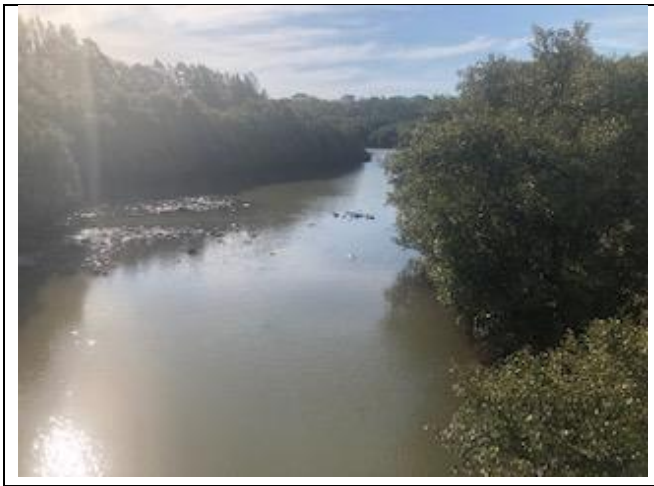

	
	

Conclusions

- The proposed shading will not impact Saltmarsh such that a viable population would be threatened with extinction. There is not a viable saltmarsh population currently present.
- The area of saltmarsh is well below the threshold to trigger Biobanking offsets. The total area of saltmarsh for the entire wetland is under
- Shading of Mangroves will occur – refer to SMEC report and conclusions within. Ideally shading should be kept under 3hrs for mangroves.
- Mangrove and Saltmarsh environments can be dynamic and it could be that the wetland area provides potential for future saltmarsh colonisation should the water levels drop on a more permanent basis or the land rise such that it is infrequently inundated.
- Weeds along the wetland perimeter are abundant and in areas vines are growing onto the Mangroves. A thin saltmarsh fringe on the western side is boarded by a dense mass of exotic species. Spiny Rush *Juncus acutus* is growing in 3 areas, currently the numbers are low (under 20) for all wetland however eradication is recommended and SOPA have arranged this.

Recommendations

Spiny Rush *Juncus acutus* to be removed (on-going)

Monitor wetland edge and modify if possible to expand the saltmarsh fringe.

If the wetland becomes brackish (rather than salty) then monitor for Z*annichellia palustris.*

5 Expertise of authors

Geraldene Dalby-Ball
DIRECTOR

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene a valuable contribution to any project.

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

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

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

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

SPECIALISATIONS

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

CAREER SUMMARY

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

QUALIFICATIONS AND MEMBERSHIPS

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

Laura Conde-Barona

ENVIRONMENTAL ENGINEER INTERN

Laura has great passion about the natural environment, sustainable development and biodiversity conservation. Laura is in her last semester of her double degree of Environmental Engineering and Science at the University of New South Wales.

Laura has valuable on-ground experience working with conservation organisations in different parts of the world, as well as contributing to environmental educational projects. Laura has participated in educational talks focused on ecological and sustainability matters and currently volunteers for organisations around the globe to help raise awareness, promote sustainable living and natural protection.

Laura has attended fundamental courses and workshops such as Sustainability in Construction; Environmental Frameworks, Law and Economics; Applied Geotechnics and Engineering Geology; and Contaminant Transport. Laura participated as one of the leading members of the Environmental Committee at her University in Colombia organising various campaigns promoting environmental awareness.

Laura has also prepared two theses, one on Orica's Botany Industrial Park Groundwater Clean-up Plan based on remediation technologies for contaminated land and groundwater; and the other one on Environmental Impacts in Port Stockton Development: Air, Water and Noise Pollution, based on the proposal of creating a new port as an extension to Port of Newcastle.

SPECIALISATIONS

- Creative and sustainable solutions in environmental engineering, particularly in waterways and wetlands, sustainable design and development.
- Engineering and environmental project management focusing on creating environmental and social outcomes.
- Engaging others in environmental protection and sustainability.

CAREER SUMMARY

- **Environmental Consulting Internship,** Ecological Consultants Australia, 2018 present
- **Marine Turtle Internship Program,** Conflict Island's Conservation Initiative, 2017

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Engineering and Marine Science**, University of New South Wales (Expected June 2018)
- **Study Abroad Program in Science,** University of New South Wales (2015)
- **Initiated Bachelor's Degree in Environmental Engineering and Biology,** Universidad de los Andes, Bogotá, Colombia (Transferred to UNSW in 2016)
- **Practicing member** Australian Herpetological Society
- Emergency First Response Certificate (2016)