Appendix G

Ecology

G1 Ecology Impact Assessment

G2 Marine Ecology Impact Assessment

Appendix G1

Ecology Impact Assessment

Flora and Fauna Assessment

Caltex Refineries (NSW) Pty Ltd - Kurnell Refinery Demolition

Prepared for URS Australia Pty Ltd

16 October 2014

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- Jane Murray and Carl Corden, fieldwork and reporting
- Jayne Hanford, background research assistance
- Lachlan Milne, GIS mapping

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Summary

Biosis Pty Ltd was commissioned by URS Australia Pty Ltd to undertake a terrestrial flora and fauna assessment at the Caltex Refinery on the Kurnell Peninsula (the Site) to inform an application by Caltex for a modification to development consent SSD 5544. Previously approved works (conversion works) proposed the conversion of the Kurnell Refinery into a finished product terminal. The modification works (the demolition works) involve the demolition, dismantling and removal of redundant infrastructure at the Site.

The study area (**Figure 1**) for the flora and fauna assessment is located at Kurnell Peninsula within the Sutherland Shire Local Government Area (LGA), approximately 15 kilometres (km) south of Sydney's Central Business District (CBD) and is bounded by other parts of the Kurnell Refinery, Kamay Botany Bay National Park (KBBNP), residential areas, light industrial areas and roads (**Figure 2**).

Ecological values

The study area was identified as being highly disturbed with minimal areas for flora and fauna habitation, foraging and usage. The Site has been active since 1953 as a refinery and includes tanks of all shapes and sizes and pipework, which store and transfer a range of petroleum based products. Between the tank areas the majority of the land is hard stand, non-permeable road networks, workshops, car parks and buildings. Presence of flora, fauna and general habitat for ecology is lacking in most parts, however ecological values identified within the study area include:

- 0.03 hectares of known foraging habitat and potential nesting habitat for shorebirds along the Silver Beach foreshore;
- potential dispersal habitat for the threatened Green and Golden Bell Frog and Wallum Froglet; and
- nesting and perching structures for large birds on the built infrastructure within the study area.

Government legislation and policy

An assessment of the demolition works against key biodiversity related legislation and policy is provided and summarised below (**Table 1**).

Table 1: Relevant legislation assessment

Legislation / Policy	Relevant ecological feature within study area	Permit / Approval required	Notes
Environment Protection Biodiversity Conservation Act 1999 (**EPBC Act**)	No EPBC Act listed matters found within the study area. Impacts to potentially occurring; Green and Golden Bell Frog and the Towra Point Nature Reserve Ramsar site.	No	Significant Impact Criteria assessments prepared for: Green and Golden Bell Frog and the Towra Point Nature Reserve Ramsar site (**Appendix 5**).
Threatened Species Conservation Act 1995	No TSC Act listed matters found within the study area.	No	Assessments of Significance have been prepared for; Green

Legislation / Policy	Relevant ecological feature within study area	Permit / Approval required	Notes
(**TSC Act**)	Impacts to potentially occurring; Green and Golden Bell Frog, Wallum Froglet, Shorebirds, Coast Groundsel, *Freshwater Wetlands on Coastal Floodplains* and *Swamp Sclerophyll Forest on Coastal Floodplains*.		and Golden Bell Frog, Wallum Froglet, Coast Groundsel, *Freshwater Wetlands on Coastal Floodplains* and *Swamp Sclerophyll Forest on Coastal Floodplains* (**Appendix 4**).
Fisheries Management Act 1994 (**FM Act**)	No FM Act listed matters found within the study area	No	N/A
Environmental Planning & Assessment Act 1979 (**EP&A Act**)	Potential Green and Golden Bell Frog and Wallum Froglet dispersal habitat. Potential for *Freshwater Wetlands on Coastal Floodplains* and *Swamp Sclerophyll Forest on Coastal Floodplains*.	Overall Project Approval required under Part 4, the demolition works are being approved as a modification to development consent SSD 5544.	Assessments prepared for these species (**Appendix 4** and **Appendix 5**) conclude that a significant impact as a result of the demolition works are unlikely.
Native Vegetation Act **1993** (**NV Act**)	No removal of native vegetation required	No	N/A
National Parks and Wildlife Act, 1974 (**NPWS Act**)	No removal of threatened species habitat	No	N/A
Noxious Weeds Act 1993 (**NW Act**)	Four noxious weeds: *Lantana camara, Ricinus communis, Chrysanthemoides monilifera* subsp. *rotundata* and *Ludwidgia peruviana.*	No	Duty to control noxious weeds as per NW Act control requirements for each noxious weed found within the study area.
State Environmental Planning Policy No. 14 Coastal Wetlands	Towra Point Nature Reserve (**Figure 1**) forms as SEPP 14 Coastal Wetlands, which adjoin the study area.	No	Demolition works to ensure there are no adverse stormwater runoff impacts on the adjoining SEPP 14 Coastal Wetlands as per Section 5.
State Environmental Planning Policy No. 71 Coastal Protection	SEPP 71 coastal areas adjoin Kamay Botany Bay National Park (**Figure 1**).	No	The Coastal Protection zone is distant enough to ensure the demolition works would not cause impact.

Recommendations

The primary measure for the demolition works to avoid impacts to ecological values within the study area is to ensure there is minimal clearance to the Silver Beach foreshore vegetation areas. This foreshore area (i.e. the Silver Beach dunes, beach and intertidal areas) is to be re-instated using sand of similar particle size and composition (Cardno 2014a) and rehabilitated using endemic coastal dune species following pipeline excavation.

Removal of tall tower infrastructure (Refinery infrastructure or redundant tanks) is proposed as part of the demolition works. Removal of these structures would need to consider the loss of potential nest and perch sites for large birds including the threatened Osprey and migratory White-bellied Sea-eagle. Protocols should include inspection of tall structures for active nests prior to commencing the demolition works, or works should be completed outside of the known nesting periods for these species (July to September for Osprey and June to January for White-bellied Sea-eagle).

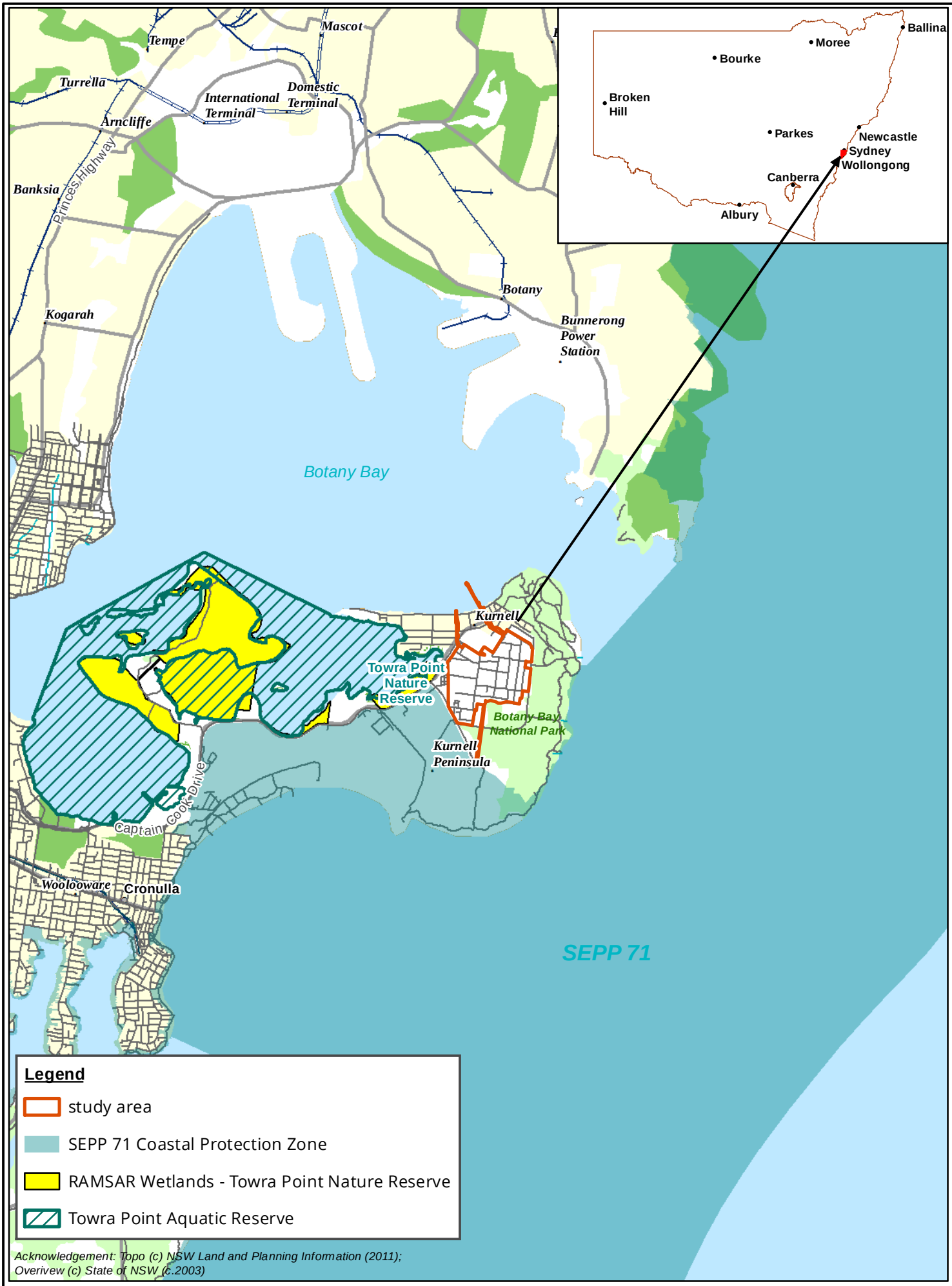
Stop work procedure on the chance encounter of any dispersing threatened frogs or nesting shorebirds, Osprey or White-bellied Sea-eagle during works should be implemented to avoid death or injury to frogs dispersing across the study area, or disturbance to nesting birds. Should the threatened frogs, Green and Golden Bell Frog or Wallum Froglet be identified, active searching should be undertaken by a qualified zoologist experienced in the identification and management of the Green and Golden Bell Frog and Wallum Froglet. If nesting shorebirds are encountered in the Silver Beach foreshore area in the vicinity of works (within 20 meters (m)) it is recommended that a qualified zoologist investigate the area to determine potential for impact, and that works cease until chicks have fledged; or works should be completed outside of the known nesting periods for nesting shorebirds (August to January for Pied Oystercatcher and Spring/Summer for Little Tern).

When open trenching/digging/excavating, Caltex should ensure that trenches/holes are back-filled daily or covered overnight. Trenches/holes should be inspected prior to works commencing each morning. This should be maintained all seasons of the year given the active season for the Green and Golden Bell Frog extends from September to April and the Wallum Froglet peak activity period occurs during the colder months. Injured frogs that become trapped within trenches should be assessed by a veterinarian or ecologist. Otherwise frogs to be captured and released into the nearest suitable habitat to the south of the study area.

All demolition workers on the Site should be provided with the threatened fauna species information sheets attached in **Appendix 6**.

Caltex would modify existing controls for the demolition works to manage the noxious weeds found within the study area, Ludwidgia *Ludwidgia peruviana* as well as; Lantana *Lantana camara*, Caster Oil Plant *Ricinus communis* and Bitou Bush *Chrysanthemoides monilifera* subsp. *Rotundata*.

During the demolition works all stormwater would continue to be be controlled and managed on the Site to avoid potential impacts to adjacent aquatic habitats, Marton Park wetland, Towra Point Nature Reserve and Botany Bay. Stormwater management is discussed in **Appendix D Water Mangement Report** of this Statement of Environmental Effects (SEE).



Acknowledgement: Topo (c) NSW Land and Planning Information (2011); Overivew (c) State of NSW (c.2003)

Figure 1: Location of the study area - Kurnell, New South Wales

Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangarratta & Wollongong

Matter: 17867
Date: 02 October 2014, Checked By: JMM, Drawn By: apritchard
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0 800 1,600 2,400 3,200
Metres
N

Scale 1:80,000 @ A4, GDA1994 MGAZone 56

Figure 2: Extent of the study area

1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by URS Australia Pty Ltd (URS) to undertake a flora and fauna assessment for the demolition and removal of redundant infrastructure at the Kurnell Refinery for Caltex Refineries (NSW) Pty Ltd (hereafter referred to as Caltex).

It is understood that the proposed works involve the demolition, dismantling and removal of redundant infrastructure at the Site (the demolition works) which forms a modification to the previously approved works to convert the Kurnell Refinery to a finished product terminal (the Project). These works were approved as SSD 5544. As the demolition works are being assessed under Section 96 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), a statement is required to outline the modification works and to provide a description of the expected impacts of the modification. As such a Statement of Environmental Effects (SEE) will be lodged in support of the modification application.

1.2 Project Overview

The demolition, dismantling and removal of redundant infrastructure at the Site would broadly involve the following works:

- demolition, dismantling or removal of:
  - refinery process units;
  - redundant tanks;
  - redundant pipeways;
  - redundant services; and
  - redundant buildings.
- associated minor civil works with the removal of foundations and underground services;
- waste management activities; and
- returning the works areas to grade.

These works would be completed following the shutdown, deinventorisation and cleaning of redundant infrastructure. Following the demolition works the Site would operate as a finished product terminal. This modification does not change the operation of this terminal, as approved by SSD 5544.

1.2.1 Demolition works

The majority of the demolition works would be completed within the boundary of the Site (**Figure 1**). The exceptions to this include (**Figure 2**):

- the removal of the Continental Carbon Pipeline which is located on land owned by Caltex to the south of the Site;

- sections of the redundant pipelines that run through the Western and Eastern ROWs that are located outside of the Site (i.e. under the roads that cross the ROWs and under Silver Beach); and
- the removal of the cooling water intake pipelines and associated infrastructure from the Kurnell Wharf.

For the purpose of the modification application, it has been assumed that all of the redundant components would be demolished. The demolition works would mainly be to ground level, with the removal of associated foundations and some redundant services. These works would also involve the removal of insulation, corrosion protection materials and other building materials prior to the demolition works taking place.

The demolition works are to include:

- Demolition of the refinery process units and associated pipework;
- Removal of the foundations for the process units and redundant slabs. Removal of the foundations would require excavation work;
- Removal of redundant cabling and certain underground services including the Oily Water Sewer from the area beneath the refinery process units. Removal of the underground services would require excavation work;
- Removal of a number of tanks and vessels from both the eastern and western tank areas. These structures would be demolished using heavy machinery. Once the tanks are cut up they would be stored in an appropriate location on Site prior to disposal;
- Removal of underground pipelines. This work would include removing the soil from above the pipeline and stockpiling it close to the trench, removing the redundant pipes and backfilling the trench. It is expected that the removal of the pipelines would require excavation to a depth of approximately 2 m. The underground pipelines that would be removed include:
  - the cooling water outlet line running from the Site through the Western Right of Way (ROW) to Botany Bay (including the Silver Beach foreshore area to 20m beyond the low tide mark) (**Figure 2**).
  - two cooling water intake lines running from Kurnell Wharf through the Eastern ROW (**Figure 2**).
  - three redundant product pipelines running from Kurnell Wharf through the Eastern ROW.
  - the Continental Carbon Pipeline running south from the Site (**Figure 2**).
- Demolition and removal of a number of buildings on Site related to the operation of the refinery using heavy machinery such as bulldozers and hydraulic excavators. Building foundations and services would also be removed. Some minor excavations may be required.

1.2.2 Spoil Management

As the works progress, the soil removed during the excavation work would be stockpiled and, where appropriate, reused as backfill. Appropriate sediment and erosion controls would be implemented as per the Demolition Environmental Management Plan (DEMP).

For the underground pipelines, excavation would occur in discrete sections, so that the length of time temporary stockpiles are required is minimised.

Where no contamination issues are identified, excavated material would be used as backfill to bring the excavated area back to grade as soon as practicable. If required, Virgin Excavated Natural Material, Excavated Natural Material or suitably remediated material would be used to provide additional backfill material. For the rehabilitation of Silver Beach, sand of a similar particle size and composition would be used (Cardno 2014a).

Contaminated soils would be stored on the Site in the area if the former Caltex Lubrication Oil Refinery (CLOR). These soils would be stockpiled and appropriately covered, bunded and managed. **Chapter 9 Soils, Groundwater and Contamination** of the SEE provides further detail on the mitigation measures that would be implemented to minimise impacts related to the excavation works.

1.3 Scope of assessment

The objectives of this flora and fauna assessment are to:

- undertake background research relevant to the demolition works to determine the likelihood for NSW and/or Commonwealth threatened biota to be present within the study area (**Figure 2**);
- undertake additional ecological assessment across the study area with a focus on the Pipelines, including the; Western ROW, Eastern ROW (including Gate 5 area), areas to the north of Western and Eastern ROWs between Prince Charles Parade and the Silver Beach low tide mark, and the route of Continental Carbon Pipeline;
- determine ecological impacts or risks that may result due to the demolition works;
- describe the flora and fauna present within the new study area and understand its general condition;
- map any additional ecological constraints such as suitable habitat for threatened and/or migratory biota (e.g. hollow-bearing trees, coarse woody debris, rocky outcrops, water bodies), noxious weeds and vegetation communities;
- determine presence or absence of NSW and Commonwealth listed threatened and migratory biota, listed under the TSC Act, FM Act or EPBC Act considered as having the potential to occur;
- identify potential implications of the demolition works and provide recommendations to assist with development design; and
- prepare a report to outline the findings of the background review and ecological assessment sufficient to inform the preparation of an SEE.

It should be noted that a separate assessment has been undertaken for marine ecology (Cardno 2014b). This assessment is provided in Appendix G2 of this SEE and focusses on the area affected by removal of the cooling water outlet beyond the low tide mark into Botany Bay.

A Coastal Processes assessment has also been undertaken (refer to Appendix H of the SEE). This assessment focuses on the potential impacts of removing the cooling water outlet from beneath Silver Beach and 20 m beyond the low tide mark on coastal processes (Cardno 2014a).

1.4 Location of the study area

The study area (**Figure 1**) is located at Kurnell Peninsula within the Sutherland Shire Local Government Area (LGA), approximately 15 km south of Sydney's CBD and is bounded by Kamay Botany Bay National Park (KBBNP), residential areas, light industrial areas and roads. The study area encompasses 130.50 ha of land comprised of Caltex owned land and small areas of public land (where underground pipelines pass beneath roads, and Silver Beach foreshore).

The study area also falls within the:

- Sydney Basin Bioregion;
- Sydney-Metro Catchment Management Authority (CMA); and
- Sutherland Shire LGA.

2. Methods

2.1 Literature and database review

In order to provide a context for the study area, information about flora and fauna from within 5 km of the study area (the 'local area') was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the EPBC Act;
- Department of Primary Industries (DPI) Threatened & Protected Species – Records Viewer for Sydney Metro CMA;
- NSW Bionet Atlas of NSW Wildlife, Office of Environment and Heritage (OEH);
- PlantNET for Rare or Threatened Australian Plant information (The Royal Botanic Gardens and Domain Trust, 2014); and
- BirdLife Australia, the New Atlas of Australian Birds 1998-2012 (BA).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - *Ocean Shores to Desert Dunes: Vegetation of NSW and the ACT* (Keith, 2004);
  - *Native Vegetation of the Sydney Metropolitan CMA Area* (Sydney Metropolitan CMA, 2009); and
  - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands (SCIVI) (Tozer et al. 2006).

The following reports were also reviewed:

- Kurnell Refinery – Proposed Demolition: Cooling Water Outlet Demolition – Coastal Processes (Cardno 2014a);
- Kurnell Refinery – Proposed Demolition: Cooling Water Outlet Demolition – Marine Ecology Assessment (Cardno 2014b);
- Flora and Fauna Assessment - Caltex Refineries (NSW) Pty Ltd - Kurnell Refinery Conversion. Report for URS Australia Pty Ltd. (Biosis Pty. Ltd. Sydney 2012);
- Kurnell B Line Upgrade - Environmental Assessment. Report for Caltex Refineries. (URS Australia Pty Ltd April 2011);
- Major Project Assessment: Caltex Jet Fuel Pipeway Upgrade Project (Stage 2) MP 11_0004. NSW Dept. of Planning and Infrastructure (August 2011);
- Director Generals Requirements – Caltex Jetfuel Pipeway Upgrade Project. NSW Dept. of Planning (January 2011);

- Biodiversity Study: flora and fauna assessment for native bushland at the Caltex Oil Refineries, Captain Cook Drive, Kurnell. Report prepared for Caltex Refineries (NSW) Pty Ltd. (UBM Ecological Consulting Pty Ltd October 2012);
- Draft V1 Wetland Monitoring Plan: flora and fauna populations at the Marton Park. Draft report prepared for Caltex Refineries (NSW) Pty Ltd. (UBM Ecological Consultants Pty Ltd January 2014);
- Vegetation Monitoring Program Final Report - Caltex Refineries Towra Point (Eco Logical, 2011);
- Flora and Fauna Biodiversity Survey & Weed Management Plan for Caltex Oil Refinery, Kurnell (Urban Bushland Management Consultants Pty Ltd, 2006);
- The Effects of the New Biological Treatment Process at the Caltex Refinery on Sub-tidal Fauna in the Vicinity of Yena Gap (Centre for Research on Ecological Impacts of Coastal Cities, 2006);
- Environmental Sampling at the Caltex 72" Outfall (Botany Bay, NSW) (Institute of Marine Ecology, University of NSW, 2006);
- Stormwater Management Plan, Environmental Protection Licence #837 Condition U10.1 PRP U 24.1 (Caltex 2011);
- Marton Park Wetland Management Plan (Molino Stewart, 2009);
- Weed Management Plan for Native Bushland, Caltex Refineries (NSW) Kurnell (UBM Ecological Consultants Pty Ltd, 2012); and
- Biodiversity Study: flora and fauna investigations for native bushland at the Caltex Oil Refineries, Captain Cook Drive, Kurnell (UBM Ecological Consultants Pty Ltd, 2012).

2.2 Site investigation

2.2.1 Flora assessment

The flora assessment was initially undertaken by Biosis on 30 October 2012, and again for the the demolition works on 20 June 2014, by qualified and appropriately licenced botanist Jane Murray (Principal Ecologist of Biosis). The entire study area was traversed using a combination of random meanders (Cropper, 1993), vegetation association (Specht, 1970) and transects to determine the vegetation assemblage and the relevant classification. Flora and fauna surveys were also undertaken of the areas between Prince Charles Parade and the Silver Beach low tide mark by a qualified and experienced ecologist (Carl Corden of Biosis) on 18 September 2014. Information collected during this survey was reviewed by Jane Murray.

A list of flora species was compiled for the study area. The general condition, structure and connectivity of native vegetation were observed, as well as the effects of current seasonal conditions. Notes were made on specific issues such as noxious weeds, evidence of management works and general impacts. Habitat features were also searched for including, hollow-bearing trees, coarse woody debris and waterbodies.

Targeted surveys were undertaken for the threatened Coast Groundsel *Senecio spathulatus* (endangered, TSC Act) as well as threatened ecological communities such as; *Sydney Freshwater Wetlands in the Sydney Basin Bioregion*, to determine whether such biota was present within the study area, or whether suitable habitat exists based on OEH data (**Appendix 2**).

2.2.2 Fauna assessment

The fauna assessment was undertaken initially on 30 October 2012, and again following modification of the Project (the demolition works) on 20 June 2014, by qualified and appropriately licenced zoologist Carl Corden, to determine the Site values for fauna. Additional fauna and habitat surveys were undertaken by Carl Corden on 18 September 2014 to determine the fauna habitat values of areas between Prince Charles Parade and the Silver Beach low tide line (**Figure 2**). Site values were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks, woody debris and artificial debris, examination of tracks and scats and identifying calls. Particular attention was given to searching for significant species and their habitats. Fauna species were recorded with a view to characterising the values of the study area. The investigation was not intended to provide a comprehensive survey of all fauna that could potentially utilise the study area over time.

The field inspection aimed to identify potential habitat for threatened fauna species. During the June 2014 and September 2014 surveys, searches were conducted for threatened fauna species as well as their suitable habitat likely to occur within the study area. The details of the study area surveyed and the methods utilised are outlined in **Appendix 1**. Fauna records will be submitted to OEH for incorporation into the Wildlife Atlas.

2.2.3 Permits and licenses

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act* (SL100758, expiry date 31 March 2015). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee.

2.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a location during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values.

The survey effort for the demolitaion works was conducted in winter, with additional inspection of areas north of Prince Charles Parade in early spring. No targeted surveys were undertaken for frogs, bats or fish and this assessment is based on available potential habitats within the study area and previous surveys undertaken on the Kurnell Peninsula. The survey effort was sufficient to assess the general values and habitat available within the study area.

Database searches and associated conclusions on the likelihood of species to occur within the study area are reliant upon external data sources and information managed by third parties.

Note: guidance provided in this report does not constitute legal advice.

2.4 Legislation and policy

The following key pieces of biodiversity legislation and policy were reviewed and the implications for the demolition works were assessed accordingly:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Environmental Planning and Assessment Act 1979* (EP&A Act), including:
  - State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14);
  - State Environmental Planning Policy No. 71 - Coastal Protection Zone;
  - State Environmental Planning Policy No. 17 (Kurnell Peninsula) 1989
- *Threatened Species Conservation Act 1995* (TSC Act);
- *Fisheries Management Act 1994* (FM Act);
- *Native Vegetation Act 2003* (NV Act);
- *Noxious weeds Act 1993* (NW Act); and
- Sutherland Shire Local Environment Plan, 2006 (Sutherland Shire LEP).

2.5 Mapping

Mapping was conducted using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation sourced via Nearmap imagery (copyright 2014). The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Locations of pest species and/or areas of ecological sensitivity were recorded using hand-held (uncorrected) GPS units (generally ± 7 metres accuracy).

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files which contain our flora and fauna spatial data are available to incorporate into design concept plans. However this mapping may not be sufficiently precise for detailed design purposes.

3. Results

The ecological features of the study area are described below and mapped accordingly (**Figure 3, 4, 5, 6** and **7**).

Species recorded during the flora and fauna assessment are listed in **Appendix 2** (flora) and **Appendix 3** (fauna). A list of NSW and Commonwealth threatened species recorded (**Figure 5, 6** and **7**) or predicted to occur in the local area is also provided in those appendices, along with an assessment of the likelihood of the species occurring within the study area.

3.1 Vegetation and fauna habitat

The vegetation and fauna habitat throughout the majority of the study area has been highly modified by past and current disturbance related to the Kurnell Refinery since its development in 1953. The majority of the study area is devoid of vegetation and associated habitat due to the highly modified nature of the Site. What vegetation remains is also significantly degraded, providing limited value for native fauna. Across the study area amongst the tanks, bunded areas, hard stand areas, roads and pipeway easements, a range of weeds and exotic grasses were observed growing in numerous crevices (**Plate 1**).

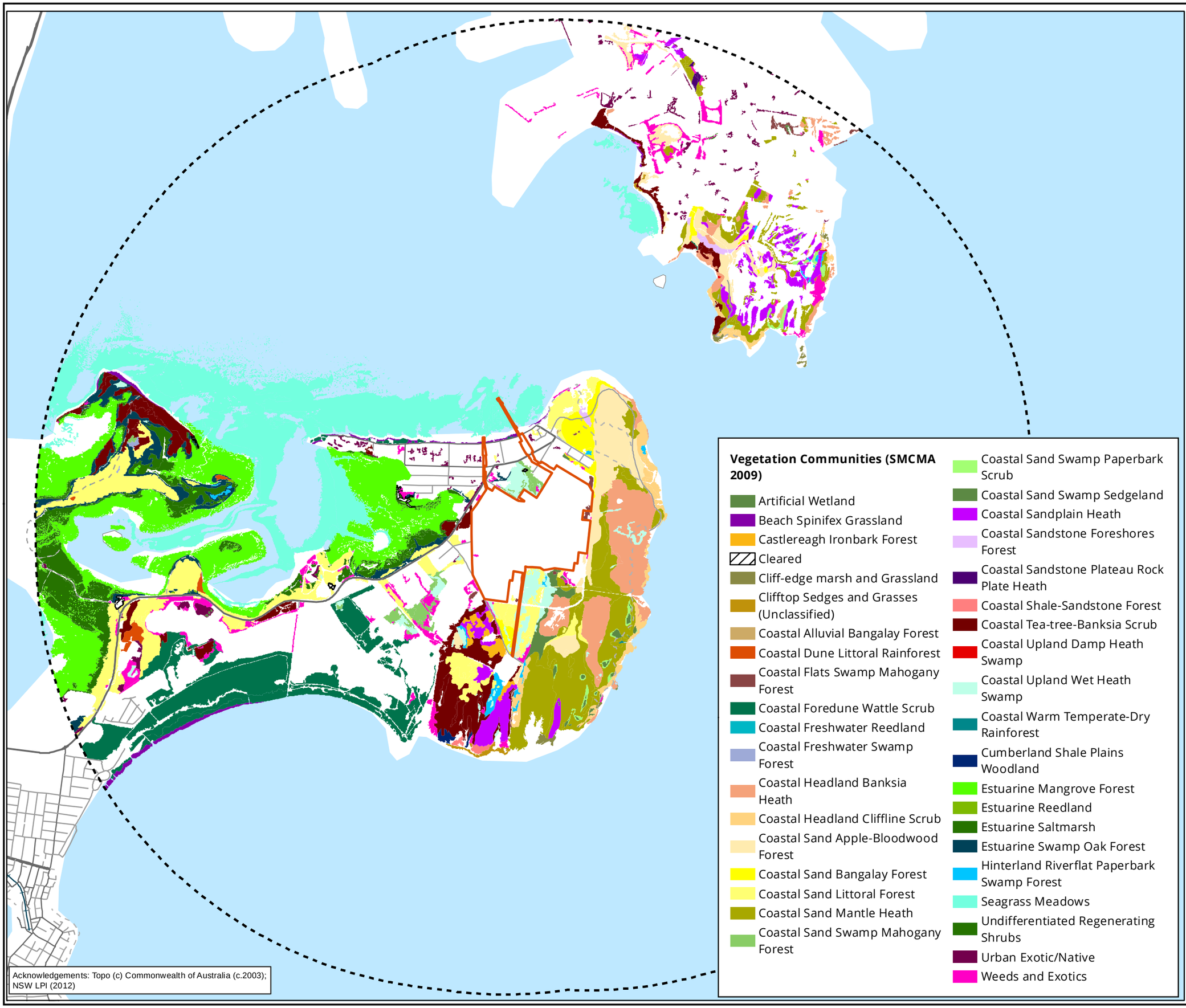
Across the two flora assessments 113 flora species were recorded within the study area including 54 native species and 59 exotic species of which four were classed as noxious weeds. No threatened flora species, ecological communities or Rare or Threatened Australian Plants (ROTAP) were recorded. A total of 40 fauna species were recorded within the study area comprising 37 bird species, two amphibians and one reptile. One threatened species and one migratory species were recorded within the study area during surveys. Three of the birds recorded were introduced species.

Plate 1: Eastern ROW and Western ROW

The study area supports four patches of vegetation within and adjacent to the pipeways (**Figure 4**):

1. Western ROW exotic grassland;
2. Silver Beach foreshore vegetation;
3. Eastern ROW exotic grassland; and
4. Continental Carbon Pipeline exotic grassland.

These patches of vegetation are discussed below.



Legend

study area

5km search area (locality)

Figure 3: Vegetation communities recorded within 5km of the study area

0 400 800 1,200 1,600 2,000

Metres
Scale: 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Date: 02 October 2014,
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Location:P:\17800s\17867\Mapping
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Legend

- study area
- Caltex land ownership
- Vegetation exclusion zones

Noxious weeds

- *Chrysanthemoides monilifera* subsp. *rotundata*
- *Lantana camara*
- *Ludwidgia peruviana*
- *Ricinus communis*

Vegetation

- Exotic grassland
- Silver Beach foreshore vegetation

Figure 4: Vegetation communities and noxious weeds within the study area

0 120 240 360 480 600

Metres
Scale: 1:12,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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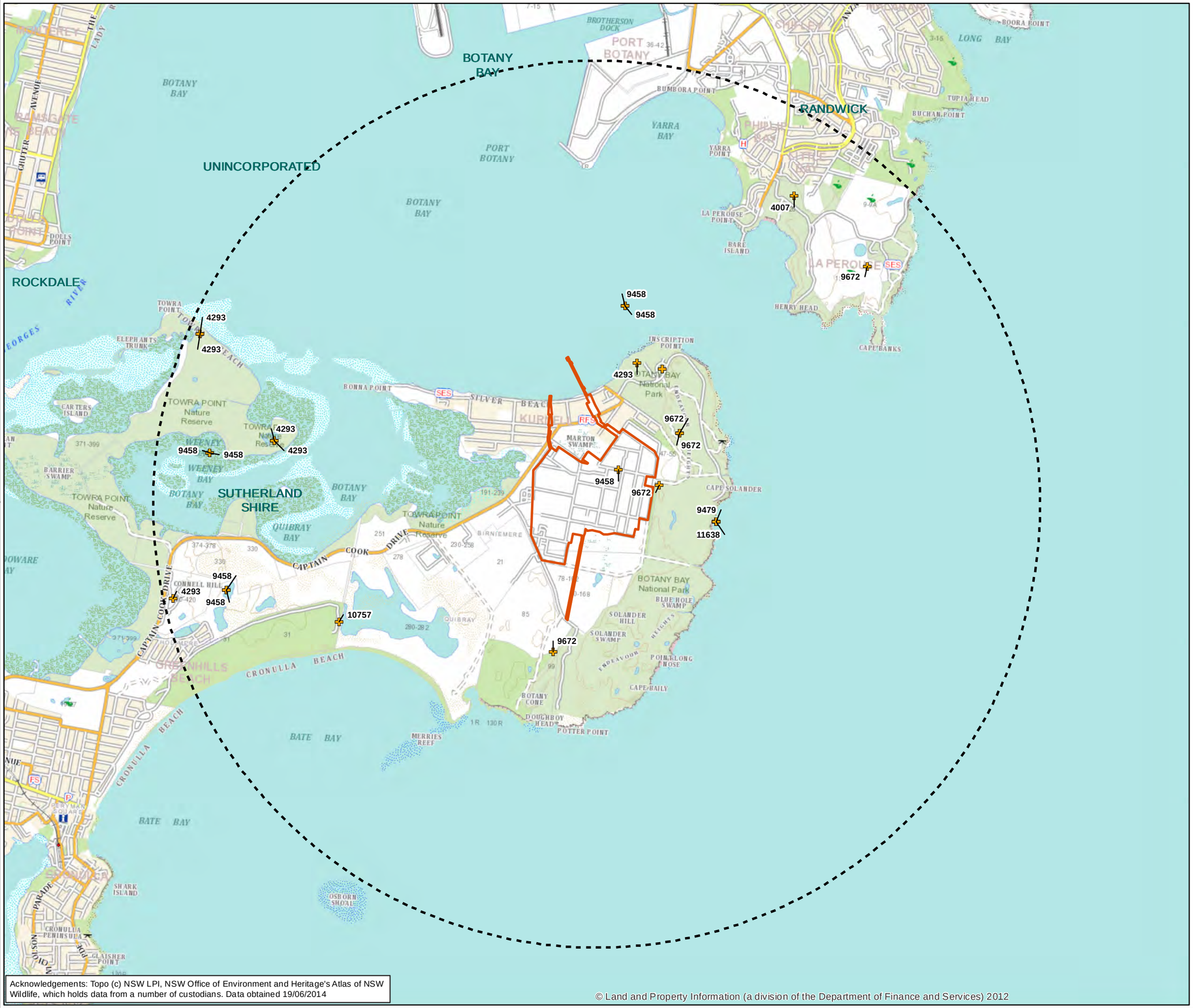
17867_F4_VegandWeeds_20141002



Legend

- study area
- search area

Threatened flora

- 10757; Coprosma baueri
- 11638; Thelymitra atronitida
- 4007; Callistemon linearifolius
- 4293; Syzygium paniculatum
- 9458; Senecio spathulatus
- 9479; Pterostylis sp. Botany Bay
- 9672; Acacia terminalis subsp. terminalis

Figure 5: Threatened Flora within 5km of the study area

0 400 800 1,200 1,600 2,000

Metres
Scale: 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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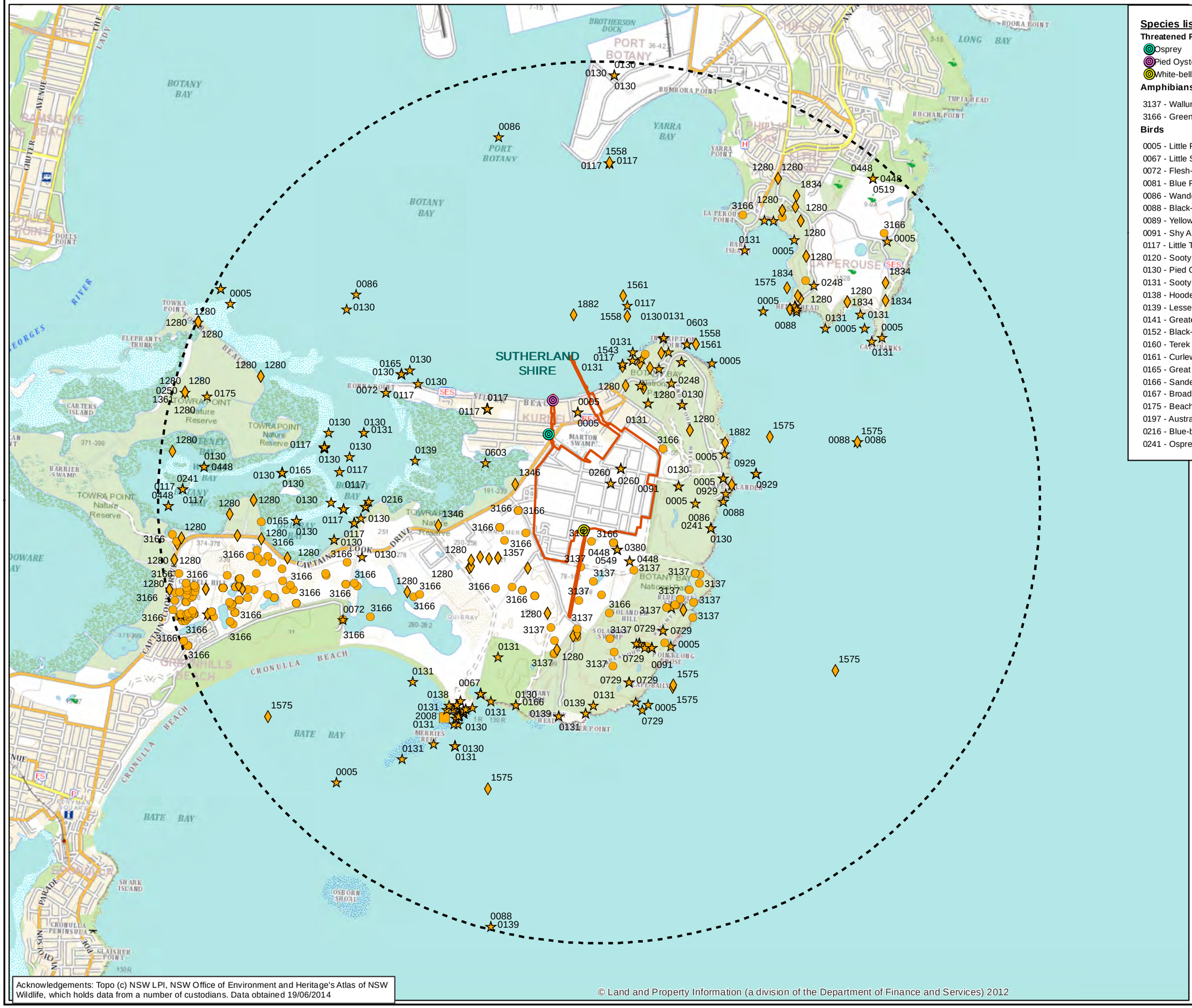
Matter:
Date: 02 October 2014,
Checked by: CAC, Drawn by: LDM, Last edited by: apritchard
Location:P:\17800s\17867\Mapping
17867_F5_ThrFlora_20141002

Acknowledgements: Topo (c) NSW LPI, NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 19/06/2014



Species list

Threatened Fauna (Biosis 2014)

- Osprey
- Pied Oystercatcher
- White-bellied Sea-eagle

Amphibians

- 3137 - Wallum Froglet
- 3166 - Green and Golden Bell Frog

Birds

- 0005 - Little Penguin
- 0067 - Little Shearwater
- 0072 - Flesh-footed Shearwater
- 0081 - Blue Petrel
- 0086 - Wandering Albatross
- 0088 - Black-browed Albatross
- 0089 - Yellow-nosed Albatross
- 0091 - Shy Albatross
- 0117 - Little Tern
- 0120 - Sooty Tern
- 0130 - Pied Oystercatcher
- 0131 - Sooty Oystercatcher
- 0138 - Hooded Plover
- 0139 - Lesser Sand-plover
- 0141 - Greater Sand-plover
- 0152 - Black-tailed Godwit
- 0160 - Terek Sandpiper
- 0161 - Curlew Sandpiper
- 0165 - Great Knot
- 0166 - Sanderling
- 0167 - Broad-billed Sandpiper
- 0175 - Beach Stone-curlew
- 0197 - Australasian Bittern
- 0216 - Blue-billed Duck
- 0241 - Osprey
- 0248 - Powerful Owl
- 0250 - Masked Owl
- 0260 - Little Lorikeet
- 0277 - Superb Parrot
- 0309 - Swift Parrot
- 0380 - Scarlet Robin
- 0448 - White-fronted Chat
- 0519 - Eastern Bristlebird
- 0549 - Varied Sittella
- 0603 - Regent Honeyeater
- 0663 - Star Finch
- 0729 - Eastern Grass Owl
- 0929 - Southern Giant Petrel
- 0937 - Northern Giant-Petrel
- 0955 - Black-winged Petrel
- 0971 - Providence Petrel
- 0972 - White Tern
- 8684 - Gould's Petrel
- 9926 - Grey Ternlet

Mammals

- 1280 - Grey-headed Flying-fox
- 1321 - Yellow-bellied Sheathtail-bat
- 1346 - Little Bentwing-bat
- 1357 - Southern Myotis
- 1361 - Greater Broad-nosed Bat
- 1543 - New Zealand Fur-seal
- 1558 - Dugong
- 1561 - Southern Right Whale
- 1575 - Humpback Whale
- 1834 - Eastern Bentwing-bat
- 1882 - Australian Fur-seal

Reptiles

- 2008 - Hawksbill Turtle

Legend

- study area
- Search Area

Threatened Fauna

- Amphibians
- Birds
- Mammals
- Reptiles

Figure 6: Threatened Fauna within 5km of the study area

0 400 800 1,200 1,600 2,000

Metres
Scale: 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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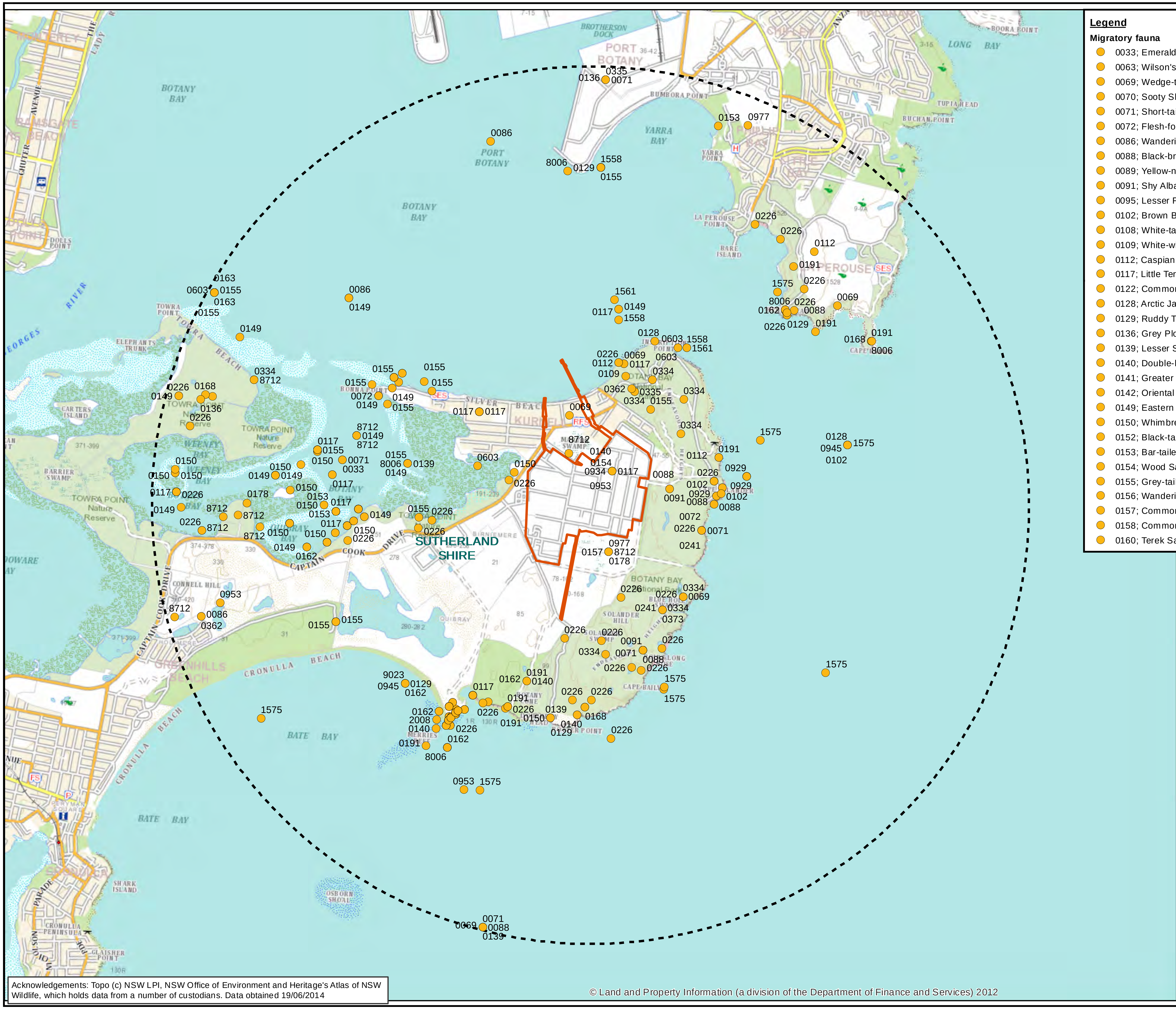
Matter: 15743
Date: 02 October 2014,
Checked by: , Drawn by: SMV, Last edited by: apritchard
Location:P:\17800s\17867\Mapping
17867_F6_ThrFauna_20141002

Acknowledgements: Topo (c) NSW LPI, NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 19/06/2014



Legend

study area

search area

Figure 7: Migratory Fauna within 5km of the study area

0 400 800 1,200 1,600 2,000

Metres

Scale: 1:40,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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17867_F7_MigFauna_20141002

3.1.1 Western ROW exotic grassland

Vegetation within the Western ROW was characterised by exotic mown grasses (0.99 ha) (**Plate 2**, **Figure 4**), particularly; Common Couch *Cynodon dactylon*, Panic Veldt Grass *Ehrharta erecta,* Prairie Grass *Bromus catharticus*, African Love Grass*Eragrostis curvula*, Buffalo Grass *Stenotaphrum secundatum,* Rhodes Grass *Chloris gayana*, Cocksfoot *Dactylis glomerata* and Parramatta Grass *Sporobolus africanus*. The mown nature of this community and lack of shrub or canopy strata means that fauna habitat is restricted to limited foraging resources.

Plate 2: Western ROW exotic grassland

3.1.2 Silver Beach foreshore vegetation

The Silver Beach foreshore vegetation (0.03 hectares),is located to the north of Prince Charles Parade on the primary dune area adjoining Silver Beach and the shoreline (**Figure 4, Plate 3**). The community is characterised by native dune vegetation such as; Australian Saltgrass *Distichlis distichophylla*, Pig Face *Carpobrotus rossii* and Spinifex *Spinifex sericeus* and exotic species such as Gazania *Gazania sp*. This community provides limited potential nesting habitat for birds such as Pied Oystercatcher and other shore birds.

Plate 3: Foreshore vegetation of Silver Beach north of Prince Charles Parade

3.1.3 Eastern ROW exotic grassland

Vegetation within the Eastern ROW, which extends to the north of Prince Charles Parade abutting the Kurnell Wharf, was characterised by exotic mown grasses (3.07 ha), particularly Common Couch, Rhodes Grass, Buffalo Grass and Parramatta Grass (**Plate 4**, **Figure 4**). The mown nature of this community and lack of shrub or canopy strata means that fauna habitat is restricted to limited foraging resources.

Plate 4: Eastern ROW exotic grassland

3.1.4 Continental Carbon Pipeline exotic grassland

The vegetation within the Continental Carbon Pipeline corridor is predominantly comprised of exotic grasses and groundcovers with limited native regeneration along the boundary fence, to a total area of 1.90 ha (**Plate 5**, **Figure 4**). Typical exotic species present include Buffalo Grass *Stenotaphrum secundatum,* African Love Grass *Eragrostis curvula,* Prairie Grass *Bromus catharticus*, Scrub Pigeon Grass *Setaria sp*., Red Natal Grass *Melinis repens*, Kikuyu Grass *Pennisetum clandestinum* and Whiskey Grass *Andropogon virginicus*. Amongst the exotic grasses were scattered exotic ground covers and herbs including Scarlet pimpernel *Anagallis arvensis*, Hydrocotyle *Hydrocotyle bonariensis*, Common Sowthistle *Sonchus oleraceus*, Common vetch *Vicia sativa* and Crofton Weed *Ageratum adenophora.*

The vegetation outside of the Continental Carbon Pipeline boundary fence (**Plate 5**) was predominantly native heath and woodland with some wetland communities occurring in scattered patches. Natural regeneration of native vegetation has occurred along the boundary fence, particularly adjacent to these wetland communities. Typical wetland and swamp community species were prevalent, particularly Bare Twigrush *Baumea juncea* with scattered Needlebush *Hakea teretifolia*, Variable Sword-sedge *Lepidosperma laterale*, *Leptocarpus tenax*, Common Reed *Phragmites australis*, *Schoenus brevifolius,* Streaked Arrowgrass *Triglochin striatum*and Swamp Selaginella *Selaginella uliginosa*.

Plate 5: Continental Carbon Pipeline exotic grassland (right) and external vegetation (left)

3.1.5 Fauna habitat features within the study area

The vegetation patches described above form the primary fauna habitat in the study area. Other potential fauna habitat or foraging related assets include: nesting and perch structures for raptors (i.e. tower infrastructure within the Caltex Land Ownership boundary, **Figure 2**) and debris, such as concrete blocks in areas around the edges of the study area providing sheltering sites for common reptiles and amphibians.

No natural water bodies occur within the study area, although some permanent and ephemeral water bodies lie adjacent to the Continental Carbon Pipeline easement. Aquatic habitat within the study area was limited to a single reservoir of water located at Chisholm Drive at the western extent of the study area near Captain Cook Drive (**Plate 6**). This reservoir has sheer exposed sides, negligible aquatic habitat and does not provide culvert roosting opportunities for microbats. Other water bodies include concrete stormwater drainage channels.

Connectivity across most of the study area is limited, however given that the adjoining KBBNP abuts the eastern boundary of the study area, some dispersal across the Site is possible. The study area is largely devoid of vegetation with localised patches of sparse vegetation remaining at the periphery of the Site and

along the Pipeline ROWs. Barriers to fauna passage along the Pipeline ROWs include fencing, surrounding urban development (along the northern ROWs) and mowing or slashing of vegetation within the Pipeline ROWs to remove vegetation cover. Despite these barriers it is likely that some fauna would still move across the Pipeline ROWs (especially the Continental Carbon Pipeline which is surrounded by good quality native vegetation).

Most drainage across the Site occurs across hard surfaces or areas of mown/slashed vegetation. Drainage is managed according to the surrounding use of the catchment as described in the Caltex Stormwater Management Plan (Caltex 2011). Stormwater collected from roof tops, vegetated areas, unpaved 'clean' areas, roadways and pipeways is directed into the storm water system. The drainage channels and pipeways within the Caltex Land Ownership boundary which capture and direct stormwater may provide dispersal passage for mobile fauna. The catchments within the study area which filter contaminated water however may not provide tolerable habitat for highly sensitive amphibian species. Piles of debris and rubble on the Site (**Plate 6**) may provide temporary refuge for frogs if they are traversing the study area to access adjacent areas of preferred habitat, however these areas are often localised and not well connected, leaving large exposed areas to be traversed without refuge opportunities.

Fauna habitat values within the ROWs are significantly reduced due to management practices such as mowing/slashing. Despite this a number of fauna species may occasionally utilise habitat within or adjacent to the ROWs. Common species adapted to heavily altered or cleared habitats may occupy the northern ROWs, while the Continental Carbon Pipeline provides potential (albeit limited) habitat for amphibians during periods of inundation.

The Silver Beach foreshore, between Prince Charles Parade and the low tide mark to the north of the Western ROW, provides habitat for a range of shorebirds, including some listed as threatened under the TSC Act. This area provides suitable forage habitat for both non-breeding migrants and resident species. The foreshore vegetation also provides limited potential breeding habitat for the Pied Oystercatcher *Haematopus longirostris* and the Little Tern *Sternula albifrons*. This vegetation currently occurs close to a urbanised environment, with frequent disturbance by people and dogs along Silver Beach and the cycleway. Although nesting by Pied Oystercatcher and Little Tern are highly unlikely here, it cannot be completely discounted given the presence of suitable habitat.

Plate 6: Fauna habitat features

The following habitat resources were searched for during the survey, however were found to not be present within the study area:

- hollow-bearing trees;
- caves and culverts;
- coarse woody debris;
- ephemeral and intermittent water bodies/wetlands; and
- rock outcrops.

The remainder of the study area has been substantially modified and is of negligible habitat value except for common native and introduced fauna species.

3.2 Site context

Whilst the Caltex Refinery has been present since 1953, the study area is in close proximity to other areas of significant ecological value (**Figure 1**) including;

- Botany Bay;
- SEPP 14 Wetlands;
- SEPP 17 Kurnell Peninsula;
- SEPP 71 Coastal Protection Zone;
- Towra Point Nature Reserve (Ramsar wetland);
- Towra Point Aquatic Reserve;
- Marton Park Wetland (a Groundwater Dependent Ecosystem); and
- KBBNP.

Botany Bay is a shallow bay covering 4600 ha located approximately 10 km south of the Sydney CBD. It is used to access Sydney's main commercial port (Port Botany). The Bay is designated a Special Port Area, and as such, there are as number of controls regarding the management of the waters and waterside lands (Sydney Ports, 2012). There are a number of competing economic, recreational and ecological interests related to the aquatic environment within the Bay, including aquatic ecosystems, primary

industries such as aquaculture, recreation and aesthetics interests (such as fishing) and cultural and spiritual values (SMCMA, 2007). Botany Bay and its catchment waterways are subject to ongoing threats due to nutrient and sediment-laden run-off from various non-agricultural land uses. A substantial part of the catchment is highly developed with almost 40% of its area used for urban, industrial or commercial purposes. Particular pollutants of concern are nitrogen, phosphorus, and total suspended solids (SMCMA, 2012).

SEPP14 - Coastal Wetlands aims to protect and conserve coastal wetlands by ensuring: *that the coastal wetlands are preserved and protected in the environmental and economic interests of the state*. SEPP 14 provides guidance for consent authorities (consent authorities being the council of the LGA in which the proposed development is to be carried out of the Minister for Planning), in terms of issues to consider when determining whether there is potential for a listed wetland to be affected by a Project. The provisions of this SEPP are not directly relevant to the demolition works, as this SEPP was not found to be present within 5 km of the study area, or to coincide with the Towra Point Nature Reserve Ramsar site or Marton Park Wetland.

SEPP 17 – Kurnell Peninsula aims to conserve the natural environment of the Kurnell Peninsula and ensure that development is managed having regard to the environmental, cultural and economic significance of the area to the nation, State, region and locality. SEPP 17 (Kurnell Peninsula) applies to the land within the Sutherland Shire, known as Kurnell Peninsula, and adjacent waterways. The provisions of the SEPP (Kurnell Peninsula) cover the zoning of land and land use conflict.

The SEPP 17 (Kurnell Peninsula) provides for the land use and zoning in the area. Pursuant to the SEPP, the Site falls within zone 4(c1) (Special Industrial (Oil Refining) Zone. The objectives of zone 4 (c1) are to recognise land used for oil refinery, liquid fuel depot and liquefied petroleum gas extraction purposes, and to ensure that development has regard to environmental safety planning principles. As the demolition works would allow for the continued the use of the land as a liquid fuel depot, the demolition works are deemed permissible under the land use zones in this SEPP.

The SEPP (Kurnell Peninsula) states five general aims and objectives and nine environmental planning aims and objectives. A number of these aims and objectives relate to the consideration and protection of the ecological resources as well as groundwater vulnerability and protection of wetlands, found on and close to Kurnell. Ecological resources that are specifically mentioned include national parks, nature reserves, wetland areas, areas of ecological significance and the aquatic environment.

SEPP 71 - Coastal Protection aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast through the preservation of a range of coastal assets. The policy aims to ensure that development in the NSW coastal zone is appropriate and suitably located, to ensure that there is a consistent and strategic approach to coastal planning and management and to ensure there is a clear development assessment framework for the coastal zone. Although the provisions of this SEPP will not be directly relevant to the demolition works, the SEE will have regard to the aims and matters that relate to the SEPP, which ensure that the coastal zone is managed in accordance with the principles of ecologically sustainable development.

Groundwater Dependent Ecosystem - Marton Park Wetland. The online Groundwater Dependent Ecosystems Atlas (funded by National Water Commission and hosted by the Bureau of Meteorology) was accessed to determine the proximity of the demolition works to potential GDEs. This GDE is the Marton Park Wetland, a freshwater wetland which includes fringing TSC Act listed *Swamp Oak Floodplain Forest*. The Marton Park Wetland features on the northern boundary of the Caltex Land Ownership boundary between adjoining residential areas and roads. According to the Marton Park Wetland Management Plan

(Molino Stewart Pty Ltd, 2009) the wetland is currently a freshwater wetland with limited tidal influence. The wetland plays an important role in the drainage of the surrounding area, including the eastern portion of Kurnell, part of the Site and the KBBNP. Much of the Site is bunded and surface runoff is treated within the Site before discharging directly to Botany Bay, however, surface runoff from the non-industrial components of the refinery (e.g. the administration centre and car parks) flows into this wetland. Marton Park Wetland is recharged by ground water seepage through the sandy bed during dry periods. Although not directly identified as a GDE within the Management Plan (Molino Stewart Pty Ltd, 2009), the interaction between the surface water and the ground water is acknowledged to be high given the sandy nature of the soil allowing potential contaminants to move through the groundwater relatively quickly.

Towra Point Nature Reserve (**Ramsar Wetland**) consists of 386.5 ha of wetlands that lie on the mouth of the Georges River on the southern shores of Botany Bay, and located approximately 16 km from the Sydney CBD (DECCW, 2010). The Reserve is bounded by the Kurnell Headland, Botany Bay, and Dolls Point. The most eastern extent of the Ramsar listed portion of the Site is approximately 2 km west of the study area. The study area stormwater discharges to Quibray Bay, adjacent to the Towra Point Nature Reserve Ramsar site. Based on historical flooding events, there is potential for study area storm-water to enter the Towra Point Nature Reserve. The demolition works should not result in any direct disturbance to the Towra Point Nature Reserve as a result of the demolition works.

Towra Point Aquatic Reserve surrounds Towra Point and covers an area of approximately 1,400 ha. The reserve is managed by the NSW Department of Primary Industries (DPI). The reserve is considered to support high levels of aquatic biodiversity.

Kamay Botany Bay National Park extends north south along the eastern coastline of Kurnell Peninsula bound by Botany Bay marine waters and borders the study area. The northern extent of KBBNP is location along the southern coast of La Perouse headland and is disjunct from the Kurnell Peninsula. The total area of the National Park occupies approximately 492 ha across both headlands and supports a diversity of natural resources including threatened species and ecological communities and is recognised for its significant cultural heritage values (OEH, 2012a; NSW NPWS, 2002).

3.3 Threatened species

3.3.1 EPBC Act & TSC Act listed species

Lists of threatened species recorded or predicted to occur within 5 km of the study area are provided in **Appendix 2** (flora, **Figure 4**) and **Appendix 3** (fauna, **Figure 6**). An assessment of the likelihood of these species occurring in the study area and an indication of where within the Site (i.e. which habitats or features of relevance to the species) is included. A summary of those species recorded or with a moderate or higher likelihood of occurring in the study area is provided in **Table 2**.

Table 2: Summary of threatened species most likely to occur in the study area

Species name	Study area relationship
EPBC Act	
Green and Golden Bell Frog	This species has the potential to be found throughout the study area on occasion during dispersal, however it is more likely to be found within the northern section of the

Species name	Study area relationship
	Continental Carbon Pipeline easement, the eastern boundary vegetation patch and the north-east vegetation area based on their proximity to the adjacent KBBNP where historical records occur.
TSC Act	
Green and Golden Bell Frog **Wallum Froglet**	These species have the potential to be found within the study area on occasion during dispersal, however are more likely to be found within the Continental Carbon Pipeline easement, the eastern boundary vegetation patch and the north-east vegetation area (**Figure 6**) based on their proximity to the adjacent Botany Bay NP where historical records occur.
Eastern Grass Owl	No breeding or preferred foraging resources occur within the study area. Given that this species was recorded approximately 1.5 km south of the study area within Botany Bay NP as recently as 2010, it is possible that this species will move through the study area to forage, particularly the areas surrounding the Continental Carbon Pipeline easement, the eastern boundary vegetation patch and the north-east vegetation area identified within **Figure 6**.
White-fronted Chat	No breeding or preferred foraging habitat occurs within the study area. The closest records are approximately 500m south within KBBNP, however the most recent of these records dates from 1988. More recent records occur within Towra Point Nature Reserve 5 km east of the study area. Although unlikely, if individuals from this population were to enter the study area it would most likely be associated with the Continental Carbon Pipeline easement or other vegetation patches identified within **Figure 6**.
Osprey	The Osprey was recorded during the 2014 survey in the southern portion of the Western ROW. This species has also been recorded as recently as 2011, 5 km to the east of the study area. No foraging or breeding sites occur within the study area. However the study area contains tall infrastructure suitable as perching habitat for large birds such as the Osprey.
Shorebirds	There is a small area of potential foraging habitat for non-breeding summer migrant shorebirds in the tidal zone of Silver Beach north of the Western ROW. Species include; Lesser Sand-plover, Greater Sand-plover, Black-tailed Godwit, Terek Sandpiper, Curlew Sandpiper, Great Knot, Sanderling and Broad-billed Sandpiper. A small area of limited potential breeding habitat also exists for migrant and resident shorebirds in the vegetated

Species name	Study area relationship
	foreshore between Prince Charles Parade and Silver Beach. Potential nesting threatened shorebirds include: Pied Oystercatcher and Little Tern, Although habitat is suitable, the urbanized nature of surrounding areas combined with frequent disturbance by people and dogs are likely to preclude nesting by these species at this location.
Coast Groundsel *Senecio spathulatus*	Although *Senecio spathulatus* has been recorded within the study area recently, the accuracy of the record is ~1 km and given the lack of suitable habitat, it is considered likely that the record was located in the adjacent KBBNP. A precautionary Assessment of Significance has been undertaken for this species (**Appendix 4**).
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner (SSFCF)	Although a threatened ecological community (TEC) equating to the SSFCF has been previously mapped at three separate patches within the study area, ground truthing of these areas identified one as being unvegetated and the remaining two as not consistent with the final determination of the TEC. Outside of these areas, no potential habitat for SSFCF was identified within the study area. For these reasons the demolition works are not considered to have a significant impact on this TEC.
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (FW)	Freshwater Wetlands TEC was identified as occurring within the Site, adjacent to the Continental Carbon Pipeline boundary fence, but not within the pipeline easement. As such it was not recorded within the study area and would not be directly impacted by the demolition works.

3.3.2 Aquatic Fauna habitat features within the study area

Database searches have indicated that no known threatened freshwater fish species listed under the FM Act and/or EPBC Act have been recorded within the Sydney Metropolitan CMA (DPI Fisheries Database). Database searches indicated that threatened marine fish species listed under the EPBC Act have known potential habitat in Botany Bay, however, within the study area aquatic habitats were limited to a single reservoir of water at Chisholm Drive lacking connectivity and in a highly degraded condition (**Plate 6**).

3.4 Noxious Weeds

Four noxious weeds, listed by NSW DPI for the Sutherland Shire Council listed under the *Noxious Weed Act 1993* (NW Act) were recorded in the study area (**Figure 4**), including:

- Ludwidgia *Ludwidgia peruviana*;
- Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata* (**Plate 7**);
- Caster Oil Plant *Ricinus communis;* and
- Lantana *Lantana camara.*

Plate 7: Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata*

Three of the noxious weeds are considered to be Class 4 weeds in accordance with NSW DPI within the Sutherland Shire Council area under the *Noxious Weed Act 1993* (NW Act).These weeds are; Lantana, Caster Oil Plant and Bitou Bush. Class 4 weeds are required to be controlled in the following manner; *'the growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction'* (NSW DPI).

The study area was also found to have one Class 3 noxious weed, Ludwidgia *Ludwidgia peruviana* in accordance with NSW DPI within the Sutherland Shire Council area under the *Noxious Weed Act 1993* (NW Act). Class 3 weeds are required to be controlled in the following manner; *'must be fully and continuously suppressed and destroyed in the region in which they are so listed, with the purpose of reducing the area of infestation and the negative impact of infestations in those regions'.*

The locations of noxious weeds within the study area are shown in **Figure 4.**

3.5 Threatened ecological communities

No NSW or Commonwealth threatened ecological Communities (TEC) were found within the study area, however the SMCMA (2013) mapping (**Figure 3**) identifies the following community, *Coastal Flats Swamp Mahogany Forest* as occurring within the study area, in three separate patches along the eastern boundary. This SMCMA community, by definition aligns with TSC Act listed TEC, *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions*.

The SMCMA mapping, however, as outlined through the associated SMCMA (2013) Technical Report, identifies the vegetation in question as not having been ground truthed/surveyed and had been interpreted by aerial photograph imagery only. Based on this knowledge, the field survey assessed the potential for the vegetation, in the two patches (as only two patches exist, not three as depicted in the SMCMA mapping) on the eastern boundary (NECR and EBDNV) to comprise of the TEC.

It was determined that the vegetation did not comprise the TEC however, aligned instead closer with the adjoining KBBNP SMCMA (2013) mapped, *Coastal Sand Apple-Bloodwood Forest* (**Figure 3**) given the presence of diagnostic tree, shrub and ground cover species, as described by the SMCMA (2013) and discussed in Section 3.1 of this report.

Based on the DECC (2007) identification guidelines, final determination (OEH, 2011) and profile information (OEH, 2012) for the TSC Act listed TEC, *Swamp Sclerophyll Forest on Coastal Floodplains*, the NECR and ENDNV vegetation patches do not comprise the associated stratum nor associated required habitat. *Swamp Sclerophyll Forest on Coastal Floodplains* is characterised by several layers of vegetation, including wetland plants and is generally found close to standing water on waterlogged soils or periodically inundated soils. However, the NECR and ENDNV vegetation found within the Site is dominated by the shrubby stratum, with low species diversity on dry sandy soils. Further, the vegetation does not have enough key indicator or characteristic species in the shrub (one only) and ground cover (two only) layers and contains none of the canopy tree category listed key indicator or characteristic species. Therefore, this vegetation community does not constitute the TEC, *Swamp Sclerophyll Forest on Coastal Floodplains* under the TSC Act.

No Freshwater Wetlands (FW) TEC was recorded within the study area, however it was seen to be occurring outside the study area in adjoining lands, not far (less than 200 m) from the Continental Carbon Pipeline, but outside the pipeline easement. Such areas of FW TEC are situated in areas that are unlikely to be impacted by the demolition works given that the direct impacts of the demolition works would be confined to the pipeline easement.

4. Biodiversity Legislation and Government Policy

This section provides an assessment of the demolition works against key biodiversity legislation and government policy.

Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

4.1 Commonwealth

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Further information including a guide to the referral process is available at:
http://www.environment.gov.au/epbc/index.html

Matters of NES relevant to the demolition works are summarised in **Table 3**. It includes an assessment against the EPBC Act policy statements published by the Australian Government which provide guidance on the practical application of EPBC Act.

Table 3: Assessment of the demolition works against the EPBC Act

Matter of NES	Demolition works specifics	Assessment against guidelines
Wetlands of international importance (Ramsar sites).	The study area is identified as being within the catchment of the Towra Point Nature Reserve Ramsar site.	The study area discharges stormwater to Quibray Bay, adjacent to the Towra Point Nature Reserve Ramsar site, and based on historical flooding events, there is potential for study area storm water to enter the Towra Point Nature Reserve Ramsar site. A Significant Impact Criteria assessment has been prepared (**Appendix 6**) which concluded that the development is **not likely** to result in a significant impact to the Ramsar site.
Vulnerable species	The Green and Golden Bell Frog has been recorded adjacent to the study area (**Figure 6**) and may traverse the study area on occasion during dispersal.	Although only limited breeding or foraging habitat occurs within the Continental Carbon Pipeline easement of the study area, this species has the potential to be found throughout the study area on occasion during dispersal. A Significant Impact Criteria assessment has been prepared (**Appendix 6**) which concluded that the development is **not likely** to result in a significant impact to the Green and Golden Bell Frog.
Migratory species	Fifty-five migratory species have been recorded or predicted to occur in the search area (**Appendix 3**).	While some of these species would be expected to pass over the study area on occasions, and some of them may do so regularly or may be resident in the adjacent Botany Bay National Park, Marton Park Wetland or Towra Point Nature Reserve, the study area **does not** provide important habitat for an ecologically

Matter of NES	Demolition works specifics	Assessment against guidelines
		significant proportion of any of these species, hence no Significant Impact Criteria assessments were undertaken, refer to **Appendix 3** for more detail.
Key threatening process: ***Anthropogenic climate change***	This KTP is listed under both the TSC and EPBC Acts. The final determination for this KTP lists some impacts as: • affect current fire regimes; • affect the current distribution of most species, populations and communities; and • affect evolutionary processes.	The demolition works are likely to result in minor greenhouse gas emissions being released into the atmosphere from demolition related traffic. However, these releases would be temporary in nature.
Key threatening process: ***Competition and grazing by the feral European rabbit (Oryctolagus cuniculus)***	This KTP is listed under both the TSC and EPBC Acts. The final determination for this KTP lists some impacts as: • increasing the prevalence of introduced predators such as the Feral Cat, Red Fox and Wild Dog; • increase competition for resources with indigenous species; • causing changes to the structure, composition of vegetation and increasing land degradation; • reducing the survival and recruitment of threatened plant species and ecological communities; and • increase erosion through the removal of vegetation.	Rabbit scats were observed on site during the Site inspection. However the demolition works are **unlikely** to increase the prevalence of Rabbits within the study area and should not contribute to the increase of this KTP. KTPs are further addressed in **Appendix 7.**

Separately to the above mentioned relevant EPBC matters, no critical habitat listed under the EPBC Act was located within the study area nor is of relevance to the demolition works.

On the basis of criteria outlined in the relevant *Significant Impact Guidelines* (DoE 2013) it is considered unlikely that a significant impact on any of the above outlined Matters of NES would result from the demolition works.

4.2 State

4.2.1 Threatened Species Conservation Act 1995

The TSC Act provides for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and communities; key threatening processes; and critical habitat for threatened species, populations and communities.

Native vegetation within the study area does not constitute a listed TEC nor was the Site found to contain threatened flora or fauna species. The Site provides only limited habitat for threatened species. Impacts to the threatened species, populations and communities must be assessed through the Assessment of Significance (AOS) process under Section 5A of the EP&A Act (refer to Section 4.2.2 below).

Habitat critical to the survival of an endangered or critically endangered species, population or ecological community can be identified under the TSC Act and listed on the Register of Critical Habitat kept by the OEH. The study area does not contain declared 'critical habitat'.

Key Threatening processes (KTPs) relevant to the demolition works, under the TSC Act have been addressed in **Table 4** and **Appendix 7**. More information regarding KTPs can be found: http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm

Table 4: Key Threatening Processes relevant to the demolition works

Key Threatening Process	Deolition works specifics	Assessment against Guidelines
Anthropogenic climate change	The key potential greenhouse gas emissions from the demolition works are nitrous oxide (N_2O) and carbon dioxide (CO_2). Greenhouse gas emissions would result from increased traffic to, from and within the Site during construction.	The demolition works are likely to result in greenhouse gas emissions being released into the atmosphere from demolition related traffic. However, these releases are temporary in nature and are significantly less than the emissions related to an operational refinery.
Invasion of native plant communities by Chrysanthemoides monilifera (bitou bush and boneseed)	Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata* was recorded within the study area during the Site investigation. The demolition works have the potential to increase the presence of Bitou Bush, through the movement of vehicles and increased disturbance within the study area.	The demolition works have the potential to cause the spread of this species off the Site, through wind and water seed dispersal.
Invasion and establishment of exotic vines and scramblers	The demolition works have the potential to increase the spread and establishment of exotic vines and scramblers through the disturbance of soils and the spread of seeds.	Where exotic vines and scramblers are already present within the study area, there is potential for these species to be spread via construction vehicles and natural dispersal into cleared and disturbed areas.

4.2.2 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The Act is administered by the NSW Department of Planning and Environment.

Sections of the EP&A Act of primary relevance to the natural environment are considered further below in relation to the demolition works.

Six AOS have been developed for the proposed demolition works (**Table 5**, **Appendix 4**) to cover potentially present threatened biota for which all conclusions determined that no significant impact was likely, for:

- Coast Groundsel *Senecio spathulatus*;
- Green and Golden Bell Frog *Litoria aurea*;

- Wallum Froglet *Crinia tinnula*;
- TSC Act listed shorebirds;
- Coastal Flats Swamp Mahogany Forest *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner;* and
- *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.*

Table 5: Potential for impacts to threatened species listed on the TSC Act

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Potential Impacts on Threatened Species			Impact Assessment (AoS) Required?
					Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	
Flora species								
Coast Groundsel		E1		None, however prior mapped record (~1 km accuracy)	No	No	No	Yes, due to record (**Figure 4**).
Fauna species								
Green and Golden Bell Frog	VU	E1		No vegetated water bodies occur within the study area. Storm water across the Site is channeled through hard surfaces with extraction of oils and pollutants via hay stack filtration. No suitable habitat occurs within the study area to sustain foraging or breeding activities. However, given the proximity of records immediately adjacent to the study area it is possible that individuals may move across the Site during dispersal.	No	No	No	Yes, given the potential for frogs to move through the study area during dispersal.
Wallum Froglet		V		No vegetated water bodies occur within the study area. Storm water across the Site is channeled through hard surfaces with extraction of oils and pollutants via hay stack filtration. No suitable habitat occurs within the study area to sustain foraging or breeding activities. However, given the proximity of records	No	No	No	Yes, given the potential for frogs to move through the study area during dispersal.

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Potential Impacts on Threatened Species			Impact Assessment (AoS) Required?
					Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	
				immediately adjacent to the study area it is possible that individuals may move across the Site during dispersal.				
Non breeding shorebirds		E1 and V		Very small area of potential forage habitat for shorebirds in the tidal zone of Silver Beach north of the Western ROW.	No	No	No	No, due to extent of suitable forage habitat along Silver Beach and the very small area to be temporarily impacted.
Breeding shorebirds		E1		Very small area of potential breeding habitat for Pied Oystercatcher and Little Tern in vegetated foreshore area between Silver Beach and Prince Charles Parade, north of Western ROW.	Yes	No	No	Yes, due to the presence of limited potential breeding habitat, albeit within a highly urbanised landscape.
Threatened Ecological Communities								
Coastal Flats Swamp Mahogany Forest Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales		E3		None, however given the prior SMCMA (2013) mapping (**Figure 3**).	No	No	No	Yes, due to SMCMA (2009) record.

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Potential Impacts on Threatened Species			Impact Assessment (AoS) Required?
					Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	
North Coast, Sydney Basin and South East Corner.								
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E3		None although the TEC was recorded within the Site, adjacent to the Continental Carbon PipelineContinental Carbon Pipeline	No	No	No	Yes due to proximity to study area.

- Definitions: E1 – endangered (Part 1, Schedule 1, TSC Act), E2 – endangered (Part 2, Schedule 1, TSC Act), E3 – endangered ecological community (Part 3, Schedule 1, TSC Act), V1 – vulnerable (Part 1, Schedule 2, TSC Act), VU – Vulnerable (EPBC Act)

4.2.2.1 State Environmental Planning Policies (Part 3 Division 2)

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to state wide issues. The SEPPs and the relationship with the demolition works are listed below and outlined in Section 3.2:

- SEPP No. 14 – Coastal Wetlands (SEPP 14);
- SEPP No. 71 - Coastal Protection Zone;
- SEPP No. 17 (Kurnell Peninsula) 1989.

4.2.3 Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat through NSW. Impacts to threatened species, populations and communities listed under the FM Act must be assessed through the AOS process under Section 5A of the EP&A Act. Database searches have indicated that no known threatened freshwater fish species listed under the FM Act have been recorded within the Sydney Metropolitan CMA area (DPI Fisheries Database). Key Threatening Processes (KTPs) under the FM Act, associated with the demolition works have been addressed within **Appendix 7**.

4.2.4 Native Vegetation Act 2003

The NV Act provides for, encourages and promotes the management of native vegetation on a regional basis. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council approved by the relevant Catchment Management Authority.

None of the identified native vegetation patches are proposed to be cleared for the demolition works.

4.2.5 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. Declared noxious weeds identified in the study area are listed in **Appendix 2** (**Table 6, Table 7, Figure 7**). An occupier (other than a public authority or a local control authority) must take all reasonable steps to eradicate state prohibited weeds and comply with the requirements in the NW Act for a notifiable weed for restricted plants. As an area within Sutherland Shire Council, the occupier must also take all reasonable steps to eradicate regionally prohibited weeds; fully and continuously suppress and destroy regionally controlled weeds; and prevent the growth and spread of locally controlled weeds.

5. Ecological Constraints and Recommendations

This section identifies the potential implications of the proposed demolition works on the ecological values of the study area and includes recommendations to assist Caltex to guide the demolition works to minimise impacts on biodiversity.

A summary of potential implications of the demolition works within the study area, and recommendations to minimise impacts during the preparation for and implementation of the demolition works, is provided in **Table 6**.

Table 6: Summary of potential implications and recommendations to minimise ecological impacts

Ecological feature	Implications of development	Recommendations
Native vegetation including trees	Potential for removal or disturbance to native vegetation resulting from demolition works.	No native or planted vegetation identified as no-go zones in **Figure 4** would be removed as a result of the demolition works. No-go zone areas are to be fenced off to restrict personnel and equipment and thus limit access or damage to these areas from construction equipment/vehicles.
Noxious Weeds	Potential for demolition works to result in the spread of noxious weeds due to soil disturbance and inappropriate demolition protocols.	Noxious weeds (**Figure 7**); Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata*, Ludwigia *Ludwigia peruviana* and Lantana *Lantana camara* are not in planned demolition areas, however, should be continue to be removed as part of the Caltex current and ongoing weed removal works. These three Class 4 noxious weeds are listed by NSW DPI, Sutherland Shire Council and under the *Noxious Weed Act 1993* (NW Act). Control should include the following measure: *the growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction* (NSW DPI).
Frog dispersal habitat occurs across the study area	Potential for demolition works to result in impacts on threatened frogs due to excavation that could trap dispersing individuals.	The primary measures to avoid impacts during the construction phase are to avoid and minimise impacts to potential frog habitat as a result of the demolition works. Stop work procedure on the chance encounter of any dispersing threatened frogs during works should be implemented to avoid death or injury to frogs dispersing across the study area. Caltex should ensure that trenches/holes are back-filled daily or covered overnight. Trenches/holes should be inspected for frogs prior to works commencing each morning. This

Ecological feature	Implications of development	Recommendations
		should be maintained all seasons of the year given the active season for the Green and Golden Bell Frog extends from September to April and the Wallum Froglet peak activity period occurs during the colder months. Injured frogs that become trapped within trenches should be assessed by a veterinarian or ecologist. Uninjured frogs to be captured and released into the nearest suitable habitat to the south of the study area. Provide all demolition workers active within the Site with the threatened frog species information sheets attached in **Appendix 6**.
Breeding and foraging habitat for shorebirds	Low potential for demolition works in Silver Beach foreshore area to impact on nesting Pied Oystercatcher and/or Little Tern.	Given the highly urbanised landscape surrounding the Silver Beach foreshore vegetation, the extent of suitable habitat outside of the small impact footprint and existing disturbance by people and dogs it is highly unlikely that Pied Oystercatcher or Little Tern would nest within the impact area. The primary measure to avoid potential impacts on threatened shorebirds during removal of pipeline north of the Western ROW is to ensure that no shorebird species are nesting in proximity to the works. This can be managed by completing works at Silver Beach outside of the known nesting periods for nesting shorebirds (August to January for Pied Oystercatcher and Spring/Summer for Little Tern). Or by completing pre-demolition surveys of the area to ensure that no nests are present. If nesting shorebirds are detected, works at Silver Beach shall cease until chicks have fledged or as otherwise advised by a qualified zoologist.
Nesting and perching structures	Potential for demolition works to impact on nesting Osprey and/or White-bellied Sea Eagle that may be utilising artificial structures within or adjacent to demolition works.	The primary measure to avoid impacts during the demolition works include inspection of tall structures for active nests prior to commencing the demolition works or scheduling of the demolition works for tall structures outside of the known nesting periods for these species (July to September for Osprey and June to January for White-bellied Sea-eagle).

Ecological feature	Implications of development	Recommendations
		Once presence/absence of nesting raptors has been determined, if raptors are found to be present, nesting would need to be discouraged prior to demolition and/or demolition to occur outside of breeding season for the raptor species.
Silver Beach foreshore	Disturbance to foreshore vegetation and intertidal areas resulting from the removal of the cooling water outlet pipeline north of Prince Charles Parade, involving excavation to a depth of 2 m.	The affected Silver Beach area (i.e. dunes, beach, intertidal and sub tidal areas) to be re-instated using sand of similar particle size and composition (Cardno 2014a) and rehabilitated using endemic coastal dune species following pipeline excavation.

The principal means to reduce impacts on biodiversity values within the study area would be to limit removal of native vegetation, managed any contaminated soil that is exposed through the demolition works, educate workers and keep a watch for threatened frog dispersal and control the small amount of noxious weeds.

The results of this flora and fauna assessment should therefore be used to inform the design of the demolition works. The design phase of the demolition works are key to determining specifics of how ecological values would be incorporated and managed. It is also the time during which requirements for infrastructure and services must be forecast and allowance made within the design plan for all demolition works to be sited away from native vegetation areas so they would be treated as no-go zones and not be encroached upon as construction progresses.

Prescriptions for mitigation of potential impacts of construction activities on retained native vegetation and habitat should be addressed in a site-specific Demolition Environmental Management Plan.

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Appendices

Appendix 1: Survey Methods

A1.1 Flora Survey Methods

The flora assessment was conducted under the terms of Biosis's Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act* (SL100758, expiry date 31 March 2015). Standard practices were used to collect data relating to flora as outlined below.

Vascular Flora

Random Meander and Traverses

Given the highly disturbed nature of the study area, vascular plant species were recorded via detailed traverse and random meander (Cropper 1993) methods. All vascular plant species (ferns, conifers and flowering plants) observed were identified and recorded across the study area. Voucher specimens of unknown species were collected and later identified using nomenclature provided with various botanical reference books.

Information on vegetation structure, vegetation condition, site aspect and topography and any other information considered to be informative for the description of the vegetation was recorded.

Targeted Threatened Species

Given the prior record of the TSC Act listed Coast Groundsel *Senecio spathulatus* within 1 km accuracy within the study area (**Appendix 2**), suitable habitat for this species was sought out and assessed to determine the potential for presence of the species.

Noxious Weeds

All noxious weed declarations for the Sutherland Shire Council area, as declared by NSW Department of Primary Industries, were targeted during the study area traverses and random meander and any located species were recorded by a hand held GPS.

A1.2 Fauna Survey Methods

The fauna assessment was conducted under the terms of Biosis ' Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act* (SL100758, expiry date 31 March 2015). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee.

Fauna Surveys

Active searching for fauna species was undertaken initially on 30 October 2012, and following modification of the Project again on 20 June 2014 and 18 September 2014 as part of this assessment. This included direct observation of species within the study area boundary and flying overhead. Active searching under rocks, logs and artificial debris throughout the study area was undertaken excluding the bund areas surrounding the tanks. No scats were found on site to be analysed and tracks left in the sandy substrates were recorded and identified where possible. Calls of bird species were identified during the Site inspection. No frogs were calling during the morning of the survey. Information on habitat complexity, artificial and natural barriers to movement and drainage connectivity throughout the study area as well as any other information considered to be informative for the description of the fauna habitats was recorded.

Targeted Threatened Species

Given the prior records of threatened species within 5 km accuracy within the study area (**Appendix 2**), suitable habitat for these species was sought out and assessed to determine the potential for presence of any of these species.

Biosis Pty Ltd conducts fauna survey within Standard Operating Procedures (SOPs) approved by the Wildlife and Small Institutions Animal Ethics Committee of the Department of Primary Industries (Biosis Research 2010). A copy of these SOPs is available on request.

Aquatic Habitat Surveys

The aquatic habitat assessment was based on the presence and condition of the following features:

- pool substrate characterisation;
- pool variability;
- channel flow status;
- bank stability and vegetation; and
- epifaunal substrate / available cover.

Appendix 2: Flora

Notes to tables:

Australian status (EPBC Act): **CR - Critically Endangered** **EN - Endangered** **VU - Vulnerable**	**New South Wales status (TSC Act):** C1 – critically endangered CE – critically endangered ecological communities (Part 2, Schedule 1A) E1 – endangered (Part 1, Schedule 1) E2 – endangered (Part 2, Schedule 1) E3 – endangered ecological community (Part 3, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) V1 – vulnerable (Part 1, Schedule 2) V2 – vulnerable ecological communities (Part 2, Schedule 2)
# - seedlings *** - noxious weed species declared under the Noxious Weeds Act** **NWCP - North West Corner Planting** **NECR – North East Corner Revegetation** **EBDNV – Eastern Boundary Disturbed Native Vegetation**	**Noxious weed status:** SP State prohibited species (Class 1) RP Regionally prohibited species (Class 2) RC Regionally controlled species (Class 3) RR Regionally restricted species (Class 4) R Restricted plant (Class 5)
OEH: Species recorded by Atlas of NSW Wildlife	

A2.1 Flora species recorded from the study area

Table 7: Flora species recorded from the study area (2012/2014)

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
Indigenous species						
	Acacia longifolia subsp. *longifolia*	Coastal Wattle	+		X	
	Acacia suaveolens	Sweet Wattle	+			
	Acacia terminalis	Sunshine Wattle			X	
	Acacia ulicifolia	Prickly Moses	+			
	Actinotus helianthi	Flannel Flower	+			
	Allocasuarina sp				X	
	Angophora costata	Sydney Red Gum	+			
	Astroloma humifusum	Native Cranberry			X	
	Banksia ericifolia	Heath-leaved Banksia	+			
	Banksia integrifolia	Coastal Banksia	+		X	X
	Baumea articulata	Jointed Twig-rush			X	
	Baumea juncea	Bare Twigrush	+		X	
	Bossiaea heterophylla	Variable Bossiaea	+			
	Carpobrotus rossii	Pig Face				X
	Casuarina glauca	Swamp She-oak	+			
	Commelina cyanea	Native Wandering Jew			X	
	Cynodon dactylon	Common Couch	+	X	X	X
	Dianella caerulea	Blue Flax Lilly	+			
	Dianella revoluta	Blueberry Lily			X	
	Dichelachne sp.	Plumegrass	+			

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
	Distichlis distichophylla	Australian Saltgrass				X
	Eucalyptus robusta	Swamp Mahogany			X	
	Ficinia nodosa	Knobby Club Rush				X
	Gahnia clarkei	Tall Saw-sedge			X	
	Gonocarpus teucrioides	Germander Raspwort			X	
	Hakea teretifolia	Needlebush			X	
	Hardenbergia violacea	False Sarsaparilla			X	
	Hibbertia vestita				X	
	Imperata cylindrical	Blady Grass	+			
	Kunzea ambigua	Tick Bush	+		X	
	Lepidosperma laterale	Variable Sword-sedge			X	
	Leptocarpus tenax				X	
	Leptospermum juniperinum	Prickly Tea-tree			X	
	Leptospermum lavegatum	Coastal Tee Tree	+		X	
	Lomandra longifolia	Matt Rush	+		X	
	Macrozamia communis	Burrawang	+			
	Melaleuca ericifolia	Swamp Paperbark	+		X	
	Monotoca elliptica	Tree Broom-heath			X	
	Omalanthus populifolius	Bleeding Heart	+		X	
	Pelargonium austral	Common Stork's Bill	+		X	

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
	Persoonia lanceolata	Lance-leaf geebung	+		X	
	Phragmites australis	Common Reed			X	
	Pimelea linifolia	Slender Rice Flower	+		X	X
	Pteridium esculentum	Bracken	+			
	Schoenus brevifolius				X	
	Selaginella uliginosa	Swamp Selaginella			X	
	Smilax glycyphylla	Sweet Sarsaparilla	+			
	Spinifex sericeus	Spinifex				X
	Sporobolus virginicus			X	X	
	Themeda australis	Kangaroo Grass	+			
	Triglochin striatum	Streaked Arrowgrass			X	
	Wahlenbergia stricta	Bluebell	+			
	Westringia fruticosa	Coastal Rosemary		X		
Introduced species						
	Acacia saligna	Golden Wreath Wattle			X	
	Ageratum adenophora	Crofton Weed	+		X	
	Anagallis arvensis	Scarlet pimpernel	+	X	X	
	Andropogon virginicus	Whiskey Grass	+		X	
	Anthoxanthum ordatum	Sweet Vernal Grass	+	X	X	
#	*Araucaria bidwillii*	Bunya Pine		X		
	Arrhenatherum elatius	Oat Grass	+	X		
	Asparagus africanus	Asparagus Fern	+			

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
	Atropa belladonna	Deadly Nightshade	+		X	
	Bidens pilosa	Bidens	+	X	X	
	Brassica sp.	Wild Mustard	+	X	X	
	Briza maxima	Quaking Grass	+			
	Bromus catharticus	Prairie Grass	+	X	X	
	Cenchrus echinatus	Mossman River Grass	+			
	Chloris gayana	Rhodes Grass	+	X		
*** N.E Corner**	*Chrysanthemoides monilifera* subsp. *rotundata*	Bitou Bush	+			
	Conyza bonariensis	Fleabane	+	X		
	Coreopsis lanceolata	Coreopsis			X	
	Cupaniopsis anacardioides	Tuckeroo	+			
	Cyperus eragrostis	Umbrella sedge	+		X	
	Dactylis glomerata	Cocksfoot	+	X		
	Echinochloa sp.		+			
	Ehrharta erecta	Panic Veldt Grass	+	X		
	Eragrostiscurvula	African Love Grass	+	X	X	X
	Gamochaeta calviceps	Cud Weed	+	X		
	Gazania linearis	Treasure Flower		X		X
	Hordeum leporinum	Barley Grass	+	X		
	Hydrocotyle bonariensis	Hydrocotyle	+	X	X	X
	Ipomoea indica	Morning Glory		X		
*	*Lantana camara*	Lantana			X	
	Lolium sp.		+			

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
	Malva sp.	Common Mallow		X		X
	Melinis repens	Red Natal Grass	+		X	
	Murraya paniculata			X		
	Nerium oleander	Oleander	+			
	Onopordum acanthium subsp. acanthium	Scotch Thistle			X	
	Paspalum dilatatum	Paspalum	+	X		
	Pennisetum clandestinum	Kikuyu Grass		X		
	Phalaris angusta	Swamp Canary Grass	+			
	Pinus radiata	Radiata Pine	+			
	Plantago lanceolata	Ribwort	+	X		
	Pseudognaphalium luteoalbum	Cud Weed	+			
*#	*Ricinus communis*	Caster Oil	+			
	Senecia linearifolius					
	Senecio madagascariensis	Fireweed		X	X	
	Setaria sp	Scrub Pigeon Grass		X	X	
	Sida Rhombifolia	Paddys Lucerne	+	X		
	Solanum nigrum	Black-berry Nightshade		X		
	Sonchus oleraceus	Common Sowthistle	+	X	X	
	Sporobolus africanus	Parramatta Grass	+	X		X
	Stenotaphrum secundatum	Buffalo Grass	+	X	X	X
	Tagetes minuta	Stinking Roger			X	
	Taraxacum officinalis	Dandelion	+	X	X	X

Status	Scientific name	Common name	2012	2014		
				Eastern and Western ROW	Continental Carbon Pipeline ROW	Silver Beach foreshore vegetation
	Trifolium sp.	Clover	+	X	X	
	Typha orientalis	Bull Rush	+	X	X	
	Urochloa panicoides	Liverseed Grass	+			
	Verbena bonariensis	Purpletop	+			
	Vicia sativa	Common vetch	+	X	X	
	Vulipia sp.	Tuffted Grass	+			

A2.2 Threatened flora species and threatened ecological communities

Includes national and state significant species from the following sources:

- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the EPBC Act (accessed on 19/06/2014).
- NSW National Parks and Wildlife Service (NPWS) Wildlife Atlas © The State of New South Wales, Office of Environment and Heritage (OEH) (accessed on 19/06/2014).
- Species specific habitat and ecological information is has been sourced from OEH species profiles.

Likelihood of occurrence	Potential criteria
High	• Have a high incidence of previous records in the study area and locality • Populations are known in the study area or locality
Moderate	• There are infrequent recorded for the species in the study area and locality • Preferential habitats of the species are present in the study area but these are mainly in a poor or modified condition • Are cryptic flowering flora species that were not seasonally targeted during survey
Low	• Have not been recorded previously in the study area or locality and the study area is beyond the known distribution or range • Are dependant on a narrow range or specific habitats that do not or are not likely to occur in the study area • Are considered locally extinct • Are a non-cryptic perennial flora species that were targeted during field surveys • Are flora species that have a very limited range and highly specific dispersal mechanisms
Negligible	• Habitat not present within study area • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species was not recorded

Table 8: Threatened flora species recorded / predicted to occur within 5 km of the study area

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Cryptostylis hunteriana	Leafless Tongue Orchid	VU	V	#	Negligible	No suitable habitat found. Not located in study area.	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts but has also been recorded on steep bare hillsides. Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland. This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera* and *Allocasuarina littoralis*; appears to prefer open areas in the understorey of this community and is often found in association with the *Cryptostylus subulata*. It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers. Inconsistent flowering times Dec-February
Melaleuca biconvexa	Biconvex Paperbark	VU	V	#	Negligible	No suitable habitat found (damp areas or soils). Not located in study area.	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Catchment regions include: Hunter/Central Rivers, Hawkesbury/Nepean, Southern Rivers, and Northern River Catchments. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October.
Pimelea curviflora var. curviflora		VU	V	#	Negligible	No suitable habitat found (soils or	Occurring in Hawkesbury/Nepean and Sydney Metropolitan Catchment Authority Areas. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Occurs on lateritic soils

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						vegetation association). Not located in study area.	and shale-sandstone transition soils on ridge tops in woodland. Associated with Dry Sclerophyll forests and Coastal valley grassy woodlands. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Flowers October to May.
Thesium australe	Austral Toadflax	VU	V	#	Negligible	No suitable habitat found (soils or vegetation association).	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. *Thesium australe* is a root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. It is often found in damp sites in association with *Themeda australe*, but also found on other grass species at inland sites. Occurs on clay soils in grassy woodlands or coastal headlands.
Caladenia tessellata	Thick Lip Spider Orchid	VU	E1	#	Negligible	No suitable habitat found (soils or vegetation association).	*Caladenia tessellata* is found in the following Catchment Management Regions Sydney Metropolitan, Southern Rivers, Hawkesbury/Nepean, and Hunter/Central Rivers. Currently known from three disjunct areas: Braidwood on southern tablelands, Ulladulla on the south coast and three populations in Wyong area on the Central Coast. It is generally found in grassy, dry sclerophyll forests/woodland, particularly those associated with clay loam, or sandy soils. However, there is one population at Braidwood in lowland on stony soil. This species only grows in very dense shrubbery in coastal areas. Flowers appear between September and November, but generally late September or early October in extant southern populations.
Syzygium paniculatum	Magenta Lilly Pilly	VU	E1	2011/#	Negligible	No suitable habitat found (vegetation association).	Subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea. Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. The species occurs in the following Catchment Authority Regions - Hunter/Central Rivers, Hawkesbury/Nepean, Sydney Metropolitan, and Southern Rivers.
Acacia terminalis* subsp. *Terminalis	Sunshine Wattle	EN	E1	2008/#	Negligible	Present outside the study area, nearby, however, no suitable habitat found within the study area.	Occurs in the Sydney Metropolitan Catchment Authority Region. It has very limited distribution between Botany Bay to the northern foreshore of Port Jackson. *Acacia terminalis* subsp. *terminalis* occurs in Coastal scrub and Dry Sclerophyll.
Pterostylis sp. Botany Bay	Botany Bay Bearded Orchid	EN	E1	1998/#	Negligible	No suitable habitat found (vegetation association).	Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. The species was first collected at Maroubra in 1908, although it has not been recorded at Maroubra since that time. Occupies moist level sites on skeletal sandy soils derived from sandstone. Associated vegetation is coastal heath dominated by *Melaleuca nodosa* and *Baeckea imbricata*. Occurs in small localised populations, usually in areas within the heath where the canopy allows filtered light to reach the ground.
Coprosma baueri	Coastal Coprosma	EN		1952	Negligible	Only records now exist on Norfolk Island	Shrub or small tree. Norfolk Island, prior Central Coast records.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Streblus pendulinus	Sia's Backbone, Siah's Backbone, Isaac Wood	En		#	Negligible	No suitable habitat found (vegetation association and altitude).	Sia's Backbone is a tree/large shrub that occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.
Callistemon linearifolius	Netted Bottle Brush		V	2011	Negligible	No suitable habitat found (vegetation association and altitude).	Occurs chiefly from Georges River to the Hawkesbury River where it grows in dry sclerophyll forest, open forest, scrubland or woodland on sandstone. Found in damp places, usually in gullies.
Thelymitra atronitida	Black-hooded Sun Orchid		E4A	1988	Negligible	No suitable habitat found (vegetation association and soils).	In New South Wales, *Thelymitra atronitida* is known from two highly disjunct localities, Cape Solander in Botany Bay National Park in southern Sydney, and Bago State Forest south of Tumut. At Cape Solander this species is recorded from shallow black peaty soil in coastal heath on sandstone. The size of the Cape Solander population is not known with certainty but it is known to be very small.
Senecio spathulatus	Coast Groundsel		E1	2008	Moderate	A record (2008) exists, however is noted as having a 1 km accuracy, which could locate the record beyond the study area.	Found in Sydney Metropolitan, Hunter/Central Rivers and Southern Rivers Catchment Management Authority Regions on coastal dune areas. More specifically in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence.

Table 9: Threatened ecological communities recorded / predicted to occur within 5 km of the study area

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Blue Gum High Forest in the Sydney Basin Bioregion	Blue Gum High Forest in the Sydney Basin Bioregion	CE	E4B		Negligible	Vegetation community not recorded within the locality	Blue Gum High Forest is dominated by a tall canopy of eucalypts that may exceed 30m in height. Its understorey is typically multi-layered with a midstorey of mesophyllous shrubs and small trees and a diverse ground layer of herbs, ferns and some grasses. Most stands of the community are in a state of regrowth after past clearing or logging activities, and consequently trees may be shorter, less dense or more dense than less disturbed stands and is typically found on upper slopes.
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion		V2		Negligible	Vegetation community not recorded within the locality	Castlereagh Scribbly Gum Woodland occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium (Tozer 2003). It is most often found on sandy soils and tends to occur on slightly higher ground. In the Sydney Basin Bioregion occurs within the local government areas of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith (James 1997), but may occur elsewhere within the Sydney Basin Bioregion.
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E3		Negligible	Study area too far away from saline influence	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is frequently found as a zone landward of mangrove stands. Occasional scattered mature *Avicennia marina* trees occur through saltmarsh at some sites, and *Avicennia* (and less frequently *Aegiceras corniculatum*) seedlings may occur throughout saltmarsh. In brackish areas dense stands of tall reeds (*Phragmites australis, Bulboschoenus spp., Schoenoplectus spp., Typha spp.*) may occur as part of the community.
Cumberland Plain Woodland in the	Cumberland Plain	CE	E4B		Negligible	Vegetation community not	Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Sydney Basin Bioregion	Woodland in the Sydney Basin Bioregion					recorded within the locality	Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain, a rainshadow area to the west of Sydney's Central Business District. The mean annual rainfall of this area is typically in the range of 700-900 mm, and is generally lower than that received on more elevated terrain that partially surrounds the Plain. The community typically occurs on flat to undulating or hilly terrain up to about 350 m elevation but may also occur on locally steep sites and at slightly higher elevations.
Duffys Forest Ecological Community in the Sydney Basin Bioregion	Duffys Forest Ecological Community in the Sydney Basin Bioregion		E3		Negligible	Vegetation community not recorded within the locality	Duffys Forest Ecological Community is the accepted name for the ecological community that occurs on the ridgetops, plateaus, upper slopes and occasionally mid slopes on Hawkesbury sandstone geology, typically in association with laterite soils and soils derived from shale and laminite lenses. It has the structural form predominantly of open-forest to woodland. The Duffys Forest Ecological Community has been reported from the Warringah, Pittwater, Ku-ring-gai, Hornsby and Manly Local Government Areas
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	E	E3		Negligible	Vegetation community not recorded within the study area vicinity	The Eastern Suburbs Banksia Scrub represents the plant communities occurring in Sydney's eastern and south-eastern suburbs that has the structural form of sclerophyllous heath or scrub occasionally with small areas of woodland, forest or wetland vegetation. Predominantly a sclerophyllous heath or scrub community although, depending on site topography and hydrology, some remnants contain small patches of woodland, low forest or limited wetter areas. Common species include *Banksia aemula, B. ericifolia, B. serrata, Eriostemon australasius, Lepidosperma laterale, Leptospermum laevigatum, Monotoca elliptica* and *Xanthorrhoea resinifera*. The plant community grows on nutrient poor sand

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							deposits in the eastern and south eastern suburbs of Sydney. It has a structural form predominately of sclerophyllous heath or scrub occasionally with small areas of woodland or low forest. The community is now restricted to less than 1% of its original area and currently exists only as a number of remnants (DoE 2012). Although this TEC may be present within 5 km of the study area, no suitable habitat occurs within the study area.
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E3		Moderate	Vegetation community mapped at Kurnell adjoining and within the Site, however not present within study area.	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains.
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	Kurnell Dune Forest in the Sutherland Shire and City of Rockdale		E3		Negligible	Vegetation community not recorded within the study area or immediate surrounds	The Kurnell Dune Forest is a low open sclerophyll forest community with a distinct mesophyll element found on sand, often in association with areas of sclerophyll heath and scrub.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	CE	E3		Negligible	Vegetation community not recorded within the locality	The ecological community represents a complex of rainforest and coastal vine thickets, including some that are deciduous, on the east coast of Australia. Typically, the ecological community occurs within two kilometres of the coast or adjacent to a large salt water body, such as an estuary and, thus, is influenced by the sea. It is naturally distributed as a series of disjunct and localised stands occurring on a range of landforms derived from coastal processes that can include dunes and flats, cheniers, berms, cobbles, headlands, scree, seacliffs, marginal bluffs, spits, deltaic deposits, coral rubble and islands. As a result, the ecological community is not associated with a particular soil type and can occur on a variety of geological substrata. The community is very rare and occurs in many small stands. Although this community has been previously recorded on Kurnell headland within Botany Bay National Park and Towra Point Nature Reserve no potential suitable habitat exists for this TEC within the Site.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner		E3		Negligible	Vegetation community not recorded within the locality	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
	Bioregions						
Shale gravel Transition Forest in the Sydney Basin Bioregion	Shale gravel Transition Forest in the Sydney Basin Bioregion	CE	E3		Negligible	Vegetation community not recorded within the locality	Mainly found in the northern section of the Cumberland Plain, western Sydney, in the Richmond, Marsden Park and Windsor districts. Also appears in the Liverpool/ Holsworthy area, and there are small occurrences at Bankstown, Yennora and Villawood and the Kemps Creek area. There are 1,721 ha remaining intact. Good examples can be seen at Windsor Downs Nature Reserve and Kemps Creek Nature Reserve. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel.
Shale/Sandstone Transition Forest	Shale/Sandstone Transition Forest	E	E3		Negligible	Vegetation community not recorded within the locality	Shale/Sandstone Transition Forest (SSTF) is the name given to the plant community, which occurs on areas transitional between the clay soils derived from Wianamatta Shale and the sandy soils derived from Hawkesbury Sandstone on the margins of the Cumberland Plain.
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin		E3		Negligible	Vegetation community not recorded within the locality	The community typically has an open forest structure, although disturbance may result in local manifestations as woodland or scrub. The community is typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates, such as shale/ironstone caps or dolerite dykes, in adjacent areas.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
	Bioregion						
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E3		Negligible	Vegetation community recorded in the surrounding 5 km broader area	Swamp Oak Floodplain Forest is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees (OEH Bionet, 2012). Although this TEC may be present within 5 km of the study area, however there was no presence of this community within the study area.
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E3	2009 SMCMA	Moderate	Vegetation community mapped at Kurnell adjoining the Site, however not present within study area.	This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The community is further characterised by several layers of vegetation, including wetland plants and is generally found close to standing water on waterlogged soils or periodically inundated soils.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	Sydney Freshwater Wetlands in the Sydney Basin Bioregion		E3		Negligible	Vegetation community not recorded within the locality	Sydney Freshwater Wetlands are restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplain sites in coastal areas. These areas are generally on the sands of the Warriewood and Tuggerah Soil Landscapes (Chapman & Murphy 1989).
Sydney Turpentine-Ironbark Forest	Sydney Turpentine-Ironbark Forest	CE	E3		Negligible	Vegetation community not recorded within the locality	The structure of the community was originally forest, but may now exist as woodland or as remnant trees. Characteristic tree species in the STIF are *Syncarpia glomulifera*, *Eucalyptus globoidea*, *Eucalyptus resinifera*, *Eucalyptus paniculata*, *Angophora costata* and *Angophora floribunda*. STIF occurs within the local government areas Ashfield, Auburn, Canterbury, Concord, Drummoyne, Leichhardt, Marrickville, Bankstown, Ryde, Hunters Hill, Baulkham Hills, Ku-ring-gai, Hornsby, Parramatta, Bankstown, Rockdale, Kogarah, Hurstville, Sutherland. The area is within the County of Cumberland and entirely within the Sydney Basin Bioregion.
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin	CE	E3		Negligible	Vegetation community not recorded within the study area immediate surrounds	Themeda grassland on seacliffs and coastal headlands in NSW is an ecological community described by Adam et al. (1989). The community is found in the NSW North Coast, Sydney Basin and South East Corner Bioregions, on seacliffs and coastal headlands. The structure of the community is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs. The community belongs to the Maritime Grasslands vegetation class of Keith

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
	and South East Corner Bioregions						(2004).

The most recent record relates to:

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above

Appendix 3: Fauna

Notes to tables:

Australian status (EPBC Act):	**New South Wales status (TSC Act):**
EX - Extinct	C1 – critically endangered
CR - Critically Endangered	E1 – endangered (Part 1, Schedule 1)
EN - Endangered	E2 – endangered (Part 2, Schedule 1)
VU - Vulnerable	E4 – presumed extinct (Part 4, Schedule 1)
CD - Conservation dependent	V1 – vulnerable (Part 1, Schedule 2)
*** - introduced species** **M - Migratory species listed under a provision of the EPBC Act** **H - heard** **O - observed**	

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

A3.1 Fauna species recorded from the study area

Table 10: Vertebrate fauna recorded from the study area

Status	Scientific Name	Common Name	2012	2014	
				Northern Pipeways Right of Way	Continental Carbon Pipeway
	Birds				
	Acanthiza nana	Yellow Thornbill	O		
	Acanthorhynchus tenuirostris	Eastern Spinebill			O
	Anas castanea	Chestnut Teal	O		
	Anthochaera carunculata	Red Wattlebird	H		OH
	Anthochaera chrysoptera	Little Wattlebird		H	H
	Cacatua galerita	Sulphur-crested Cockatoo	OH	O	
	Cacomantis flabelliformis	Fan-tailed Cuckoo			H
	Circus approximans	Swamp Harrier			O
	Cisticola exilis	Golden-headed Cisticola			O
*	*Columba livia*	Rock Dove	O		
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	OH	O	
	Corvus coronoides	Australian Raven	OH	H	H
	Cracticus tibicen	Australian Magpie	OH	O	O
	Cracticus torquatus	Grey Butcherbird		H	
	Dacelo novaeguineae	Laughing Kookaburra		O	
	Dicrurus bracteatus	Spangled Drongo			O
	Grallina cyanoleuca	Magpie-lark	OH	O	
V	*Haematopus longirostris*	Pied Oystercatcher		O (Silver Beach foreshore only)	

Status	Scientific Name	Common Name	2012	2014	
				Northern Pipeways Right of Way	Continental Carbon Pipeway
Mi	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	O		O
	Hirundo neoxena	Welcome Swallow	O	OH	O
	Malurus cyaneus	Superb Fairy-wren	H		H
	Manorina melanocephala	Noisy Miner		H	
	Neochmia temporalis	Red-browed Finch			O
Mi, V	*Pandion haliaetus*	Osprey		O	
	Pardalotus punctatus	Spotted Pardalote	H		H
*	*Passer domesticus*	House Sparrow	OH	O	
	Phylidonyris novaehollandiae	New Holland Honeyeater			OH
	Pycnonotus jocosus	Red-whiskered Bulbul			OH
	Rhipidura leucophrys	Willie Wagtail	OH	OH	
	Sericornis frontalis	White-browed Scrubwren			H
	Strepera graculina	Pied Currawong	OH		
*	*Streptopelia chinensis*	Spotted Turtle-Dove	OH	OH	
	Sturnus tristis	Common Myna		H	
	Sturnus vulgaris	Common Starling	OH	OH	
	Trichoglossus haematodus	Rainbow Lorikeet	OH	OH	
	Vanellus miles	Masked Lapwing		OH	OH
	Zosterops lateralis	Silvereye			OH
	Amphibians				
	Crinia signifera	Common Eastern Froglet			H
	Litoria fallax	Eastern Dwarf Tree Frog			H

Status	Scientific Name	Common Name	2012	2014	
				Northern Pipeways Right of Way	Continental Carbon Pipeway
	Reptiles				
	Amphibolurus muricatus	Jacky Lizard	O		

A3.2 Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list of species is sourced from the Atlas of NSW Wildlife and the Protected Matters Search Tool (DoE; accessed on 19/06/2014).

The most recent record relates to:

#	species predicted to occur by the DoE database (not recorded on other databases)
Year	recorded on databases listed above

The criteria for determining the likelihood of occurrence for threatened species as a guide for writing the rationale for likelihood is featured below.

Likelihood of occurrence	Potential criteria
High	• Have a high incidence of previous records in the study area and locality • Preferentially use habitats that are present in the study area which are abundant and/or in good condition • Resident populations are known in the study area or locality • Are known to regularly use habitats of the Site or locality or are highly likely to visit the Site during seasonal dispersal or migration
Moderate	• There are infrequent recorded for the species in the study area and locality • Preferential habitats of the species are present in the study area but these are mainly in a poor or modified condition • May use or occur in habitats within the study area opportunistically during seasonal migration but are unlikely to be present on permanent basis as a populations or vagrant individuals
Low	• Have not been recorded previously in the study area or locality and the study area is beyond the known distribution or range • Are dependant on a narrow range or specific habitats that do not or are not likely to occur in the study area • Are considered locally extinct
Negligible	• Habitat not present within study area • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species was not recorded

Table 11: Threatened fauna species recorded, or predicted to occur, within 5 km of the study area

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Birds							
Anthochaera phrygia	Regent Honeyeater	EN	E4A	1977	Low	No preferred foraging or breeding habitat occurs within study area. No recent records of this species occur within the locality.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests . Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: *E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E. mckieana, E. macrorhyncha, E. laevopinea* and Angophora floribunda. Nectar and fruit from the mistletoes *A. miquelii, A. pendula, A. cambagei* are also eaten during the breeding season . Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.
Ardenna carneipes	Flesh-footed Shearwater	-	V	2001	Negligible	No preferred foraging or breeding habitat for this oceanic species occur within the study area.	The Flesh-footed Shearwater is an oceanic species usually found beyond the edge of the continental shelf.
Botaurus poiciloptilus	Australasian	EN	E1	2007/#	Low	Despite two records	The Australasian Bittern is distributed across south-

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
	Bittern					of this species occurring within the study area, only limited foraging or breeding habitat for this species occurs within the study area. The records within the study area date from 1985 and 1940.	eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including Typha spp. and Eleoacharis spp. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
Calamanthus fuliginosus	Striated Fieldwren		E1	2002	Low	No suitable habitats for this species occur within the study area.	The Striated Fieldwren is found in coastal swamp heaths and tussock fields of south-eastern NSW, into southern Victoria and the south-east of South Australia. It is also found in Tasmania. There are no recent records for the northern Blue Mountains (Bilpin) or Botany Bay, where small and isolated subpopulations were last recorded in the 1970s, nor any recent reports north of the main subpopulations in Morton National Park and Ben Boyd National Park/Nadgee Nature Reserve.
Calidris alba	Sanderling		V	2011	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within	Occurs on the coast mostly on open sand beaches exposed to open sea-swells.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						the study area in the foreshore areas north of the Western ROW.	
Calidris ferruginea	Curlew Sandpiper		E1	2009	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland.
Calidris tenuirostris	Great Knot		V	2009/#	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	Mainly found on intertidal mudflats, sandflats and sandy beaches.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V, E2	1990	Low	No breeding or foraging resources occur within the study area for this	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						species.	or dead.
Charadrius leschenaultii	Greater Sand-plover		V	2004	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries and roosting during high tide on sandy beaches or rocky shores. Individuals have been recorded on inshore reefs, rock platforms, small rocky islands and sand cays on coral reefs, within Australia. Occasional sightings have also occurred on near-coast saltlakes, brackish swamps, shallow freshwater wetlands and grassed paddocks.
Charadrius mongolus	Lesser Sand-plover		V	2009/#	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	In Australia, the species is known to favour coastal environs including beaches, mudflats and mangroves. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide.
Daphoenositta chrysoptera	Varied Sittella		V	1943	Low	No suitable habitat occurs within the study area for this species. No recent records of this species occur within the locality.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Dasyornis brachypterus	Eastern Bristlebird	EN	E1	#/1921	Negligible	No suitable habitat occurs within the study area for this species. No recent records of this species occur within the locality.	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands}.
Diomedea exulans	Wandering Albatross	VU	E1	2004	Negligible	No habitat available within study area for this exclusively pelagic species. Despite a recent record of this species occurring from the study area. This record is likely to be of an individual flying over the Site as this species would not be dependent on	A marine, pelagic and aerial species. Versatile feeders in pelagic and shelf waters. Breed on subantarctic and antarctic islands.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						resources within the study area.	
Diomedea exulans amsterdamensis	Amsterdam Albatross	EN		#	Negligible	No habitat available within study area for this exclusively pelagic species	A marine pelagic species.
Diomedea exulans antipodensis	Antipodean Albatross	VU	V	#	Negligible	No habitat available within study area for this exclusively pelagic species	A marine pelagic species rarely visiting Australia.
Diomedea exulans exulans	Tristan ablbatross	EN		#	Negligible	No habitat available within study area for this exclusively pelagic species	*Diomedea exulans exulans* is a newly defined species and its 'at sea' range is yet to be defined. Currently, only one definitive record of this species exists; on Gough Island and was recaptured 4 years later off Wollongong.
Diomedea gibsoni	Gibson's Albatross	VU	V	#	Negligible	No habitat available within study area for this exclusively pelagic species	A marine pelagic species which breeds on the Auckland islands, New Zealand.
Epthianura albifrons	White-fronted Chat		V, E2	2011	Moderate	Limited habitat occurs within the study area given the very sparse vegetation present.	Sydney Metropolitan CMA: The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In NSW it occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the species is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. Nests are built in low vegetation and in the Sydney region nests have also been observed in low isolated mangroves. An Endangered Population occurs in the Sydney Metropolitan CMA area, at Newington Nature Reserve near Homebush and at Towra Point Nature Reserve.
Erythrotriorchis radiatus	Red Goshawk	VU	E4A	#	Negligible	No historical records of this species occur within the locality.	Occur in forest and woodland habitat near permanent water. In NSW prefer Melaleuca swamp forest and open eucalypt woodland. Require greater than 20 m tall trees for nesting.
Esacus magnirostris	Beach Stone-curlew		E4A	2010	Negligible	The study area does not support undisturbed habitat	Occurs on open, undisturbed beaches, islands, reefs and estuarine intertidal sand and mudflats.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						suitable for this species to regularly inhabit.	
Fregetta grallaria grallaria	White-bellied Storm-Petrel	VU	V	#	Negligible	No habitat available within study area for this pelagic species	A marine pelagic species.
Glossopsitta pusilla	Little Lorikeet		V	2002	Low	No tree hollows required for breeding or mature Eucalypt trees providing foraging resources occur within the study area to support this species.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Gygis alba	White Tern		V	1981	Negligible	No habitat available within study area for this exclusively pelagic species	The extreme west of this species range touches the mid-east coast of Australia, where it may be occasionally observed during the breeding season foraging over reefs. Otherwise this pelagic species only comes to land to breed which occurs exclusively on Lord Howe and Norfolk Islands.
Haematopus fuliginosus	Sooty Oystercatcher		V	2012	Negligible	Despite the density of records occurring along the headland	The Sooty Oystercatcher is found on undisturbed tidal rocks on ocean shores and islands. Occasionally it is observed on sandspits and mudflats. It forages on

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						no preferred foraging or breeding resources occur within the study area.	exposed rock or coral at low tide for limpets and mussels. The Sooty Oystercatcher breeds in spring and summer almost exclusively offshore or on isolated promontories.
Haematopus longirostris	Pied Oystercatcher		E1	2012 2014 (Biosis)	High	Recorded in foreshore areas of Silver Beach north of the Western ROW during 18 September 2014 surveys. Suitable foraging habitat in intertidal zone of Silver Beach. Very limited (and highly impacted) potential breeding habitat occurs within the study area in the foreshore vegetation north of the Western ROW.	An intertidal forager found on undisturbed sandy beaches and spits, tidal mudflats and estuaries. Its food supply (beach macroinvertebrates) have been negatively affected by human impact. The Pied Oystercatcher is restricted to the littoral zone of beaches and estuaries, nesting on the ground above the tideline. A pair will re-nest in the same spot each year, rarely shifting their territory. Occasionally the Pied Oystercatcher is found in paddocks near the coast.
Halobaena caerulea	Blue Petrel	VU		1954	Negligible	No habitat available within study area for this pelagic	A marine species, usually pelagic but sometimes observed over shallow waters. A regular visitor to southern Australian waters.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						species	
Lathamus discolor	Swift Parrot	EN	E1	1975/#	Low	No breeding or foraging habitats occur within the study area. No recent records of this species occur within the locality.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum Corymbia maculata, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon,* and White Box *E. albens*. Commonly used lerp (disease) infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
Limicola falcinellus	Broad-billed Sandpiper		V	1988/#	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	Occurs in sheltered parts of coasts, such as estuaries, harbours, embayments and lagoons, which have shell or sandbanks nearby.
Limosa limosa	Black-tailed Godwit		V	2006/#	Moderate	Non breeding summer migrant.	Mainly coastal, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						Potential foraging habitat occurs for this species within the study area in the foreshore areas north of the Western ROW.	
Macronectes giganteus	Southern Giant Petrel	EN	E1	2011/#	Negligible	No habitat available within study area for this exclusively pelagic species	The Southern Giant-Petrel is a marine species found throughout the Antarctic to subtropical waters occasionally venturing to inshore waters.
Macronectes halli	Northern Giant-Petrel	VU	V	3#/1983	Negligible	No habitat available within study area for this exclusively pelagic species	Marine, pelagic species found mainly in subantarctic waters.
Neochmia ruficauda	Star Finch	EN	E4	1986	Negligible	No preferred habitats (i.e. swamps, tall grass or rivers) occur within the study area. This species has not been recently recorded within the locality.	Found in tall grass next to swamps and rivers.
Neophema	Orange-bellied	CE	E4A	#	Negligible	No breeding or	A single breeding population of fewer than 200

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
chrysogaster	Parrot					foraging habitats occur within the study area. No recent records of this species occur within the locality.	individuals occurs in a narrow coastal strip of south-west Tasmania. Adult birds depart Tasmania for the mainland in February. The first adults begin leaving the mainland for Tasmania in September with the last birds having departed by November. It is a coastal species inhabiting saltmarshes, sedgeplains, coastal dunes, pastures, shrublands and moorlands, generally within 10 km of the coast. Critical winter habitat for the species includes natural saltmarshes dominated by *Sarcocornia quinqueflora* (Beaded Glasswort) and *Sclerostegia arbuscula* (Shrubby Glasswort), as well as the associated grassy or weedy pastures. Historical records indicate that the Orange-bellied Parrot was formerly more abundant and widespread in NSW than it is now, however the species' distribution continues to extend into south-eastern NSW where suitable habitat is still available.
Ninox strenua	Powerful Owl		V	2003	Low	No tree hollows occur within study area to support breeding for this species. No forage habitat present within the study area. Given the proximity of records of this species large	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully area. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						territories individuals may forage adjacent to the study area on occasion.	height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
Onychoprion fuscata	Sooty Tern		V	2009	Negligible	The study area does not support breeding or foraging resources for this pelagic species.	The Sooty Tern is a pelagic species found over tropical waters were it feeds offshore far away from land. It breeds off the coast of WA and QLD rarely venturing to the south-east of Australia.
Oxyura australis	Blue-billed Duck		V	1990	Negligible	The study area does not support large permanent waterbodies suitable to sustain this species.	Almost wholly aquatic, preferring deep water in large, permanent wetlands with an abundant aquatic flora.
Pandion cristatus	Osprey		V	2011 2014 (Biosis)	Low	Recorded from adjacent to the study area during 2014 surveys. The Osprey may fly over the study area whilst foraging in adjacent coastal waters. The high	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						infrastructure within the study area provides potential perching and nesting locations that this species may use on occasion.	
Petroica boodang	Scarlet Robin		V	1943	Low	No breeding or foraging habitats occur within the study area. No recent records of this species occur within the locality.	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet. The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground . It is conspicuous in open and suburban habitats.
Polytelis swainsonii	Superb Parrot	VU	V	1995	Negligible	No tree hollows occur within study area to support breeding for this species. No suitable foraging habitats	Found mainly in open, tall riparian River Red Gum forest or woodland. Often found in farmland including grazing land with patches of remnant vegetation. Breeds in hollow branches of tall Eucalypt trees within 9 km of feeding areas.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						(grassy woodlands) occur within the study area.	
Procelsterna cerulea	Grey Ternlet		V	1986	Negligible	No recent records of this species occur within the locality. No preferred habitats occur within the study area.	Occurs on tropical or subtropical islands and roosts on rock stacks and cliffs. Usually found in near shore waters. Breeds on cliffs and occasionally on beaches.
Pterodroma leucoptera leucoptera	Gould's Petrel	EN	V	#/1988	Negligible	No habitat available within study area for this exclusively pelagic species	The Gould's Petrel is a marine species which only comes to shore to breed. It breeds exclusively on Cabbage Tree Island, 1.4 km offshore from Port Stephens and on nearby Boondelbah Island. The first arrival of Gould's petrel on cabbage tree Island occurs from mid to late September. Fledglings depart the island from late March to early May.
Pterodroma neglecta neglecta	Kermadec Petrel (west Pacific subspecies)	VU	V	#	Negligible	No habitat available within study area for this exclusively pelagic species	Marine pelagic, in subtropical and tropical waters. They breed on islands, atolls and rock cliff where they nest on the ground or in rock crevices under ferns, shrubs or trees. Forage far away from breed sites.
Pterodroma nigripennis	Black-winged Petrel		V	1964	Negligible	No habitat available within study area for this exclusively pelagic species	The Black-winged Petrel is a pelagic marine species rarely coming closer to shore than the continental shelf. It breeds on Lord Howe and Norfolk islands.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
Pterodroma solandri	Providence Petrel		V	1973	Negligible	No habitat available within study area for this exclusively pelagic species	The Providence Petrel is a pelagic marine species which rarely comes closer to the Australian mainland than the continental shelf. It breeds exclusively on Lord Howe and Phillip Islands since suffering extinction in 1800 on the larger Norfolk Island .
Puffinus assimilis	Little Shearwater		V	1988	Negligible	No recent records of this species occur within the locality.	The Little Shearwater is pelagic marine species found in subantarctic and subtropical (occasionally tropical) waters and often seen in continental shelf waters. It breeds on subtropical and subantarctic islands.
Rostratula australis	Australian Painted Snipe	VU	E1	#	Low	No historical records of this species occur within the locality. Standing waters within the study area are not preferred by this species.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters.
Stagonopleura guttata	Diamond Firetail		V	2003	Negligible	No watercourses or wooded vegetation occur within the study area to sustain this species.	Found in a range of habitat types including open eucalypt forest, mallee and acacia scrubs. Often occur in vegetation along watercourses.
Sternula albifrons	Little Tern		E1	2010/#	Moderate	Very limited (and highly impacted) potential breeding	The Little Tern favours sheltered coasts, harbours, bays, lakes, inlets, estuaries, coastal lagoons and ocean beaches especially with sand-spits and sand islets. It

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						habitat occurs within the study area in the foreshore vegetation north of the Western ROW.	forages over shallow waters close inshore or over sandbars and reefs.
Sternula nereis nereis	Fairy Tern	VU		#	Negligible	No historical records of this species occur within the locality. No suitable habitats occur within the study area for this species.	A small piscivorous (fish-eating) bird, the Fairy Tern is approximately 22–27 cm in length, 70 g in weight and has a wingspan of 44–53 cm. The Fairy Tern is bulky and round bodied. Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there.
Thalassarche bulleri	Buller's Albatross	VU		#	Negligible	No habitat available within study area for this exclusively pelagic species	A marine pelagic species rarely visiting Australia.
Thalassarche cauta	Shy Albatross	VU	V	2011	Negligible	No habitat available within study area for this exclusively pelagic species	The Shy Albatross is a marine pelagic species inhabiting sub-antarctic and subtropical waters, spending the majority of their time at sea. Occasionally it is observed in continental shelf waters in bays and harbours.
Thalassarche cauta cauta	Shy Albatross	VU	V	#	Negligible	No habitat available within study area for this exclusively	The Shy Albatross is a marine pelagic species inhabiting sub-antarctic and subtropical waters, spending the majority of their time at sea. Occasionally it is observed

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						pelagic species	in continental shelf waters in bays and harbours.
Thalassarche chlororhynchos	Yellow-nosed Albatross	VU		2011	Negligible	No habitat available within study area for this exclusively pelagic species	A marine pelagic species which visits the south-east coast of Australia.
Thalassarche melanophris	Black-browed Albatross	VU	V	2011/#	Negligible	No habitat available within study area for this exclusively pelagic species	Inhabits Antarctic, subantarctic and subtropical waters. Although generally pelagic the species also occurs on the continental shelf and can be seen from land.
Thalassarche melanophris impavida	Campbell albatross	VU		#	Negligible	No habitat available within study area for this exclusively pelagic species	Inhabits Antarctic, subantarctic and subtropical waters.
Thalassarche salvini	Salvin's Albatross	VU		#	Negligible	No habitat available within study area for this exclusively pelagic species	An exclusively pelagic species.
Thalassarche steadi	White-capped Albatross	VU		#	Negligible	No habitat available within study area for this exclusively pelagic species	An exclusively pelagic species.
Tyto longimembris	Eastern Grass Owl		V	2010	Low	No preferred breeding or foraging habitat occurs within the	Occurs mainly in open tussock grassland, usually in treeless areas. Can also occur in marshy areas with tall dense tussocks of grass. Occasionally occurs in densely vegetated agricultural lands such as sugarcane fields.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						study area. Based on the proximity of recent records this species may move across the Site on occasion.	
Tyto novaehollandiae	Masked Owl		V	2006	Low	No suitable hollows for breeding or vegetated areas to support prey species are found within the study area. A single record of this species was recorded at Towra Point Nature Reserve approximately 5 km to the west of the study area.	The Masked Owl may be found across a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. The nest hollows are usually located within dense forests or. Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet. It has a large home range of between 500 to 1000 ha.
Xenus cinereus	Terek Sandpiper		V	2003/#	Moderate	Non breeding summer migrant. Potential foraging habitat occurs for this species within	Mainly found on saline intertidal mudflats in sheltered estuaries, embayments, harbours and lagoons.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						the study area in the foreshore areas north of the Western ROW.	
Reptiles							
Caretta caretta	Loggerhead Turtle	EN	E1	#	Negligible	No habitat available on within the study area for this exclusively marine species.	In Australia, the Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. While nesting is concentrated in southern Queensland and from Shark Bay to the North West Cape in Western Australia, foraging areas are more widely distributed. Small Loggerhead Turtles live at or near the surface of the ocean and move with the ocean currents. In eastern Australia, there is evidence that they spend around 15 years or more in the open ocean, with much of their feeding in the top 5 m of water, before recruiting to their chosen inshore or neritic feeding area. Loggerhead Turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas and show fidelity to both their foraging and breeding areas.
Chelonia mydas	Green Turtle	VU	V	#	Negligible	No habitat available on within the study area for this exclusively marine species.	Marine species with a pan-tropical distribution throughout the world. More abundant along the tropical coasts of Australia and the Great Barrier Reef. Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							driftlines and rafts of Sargassum (a floating marine plant that is also carried by currents). Once Green Turtles reach 30 to 40 cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. The shallow foraging habitat of adults contains seagrass beds or algae mats on which Green Turtles mainly feed.
Dermochelys coriacea	Leathery Turtle	EN	V	#	Negligible	No habitat available on within the study area for this exclusively marine species.	Marine species usually sighted along the eastern seaboard often in bays, estuaries and rivers. No major nesting has been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the Northern Territory. Some nesting has occurred in northern NSW near Ballina. However, no nesting has occurred in Queensland or NSW since 1996. Diet is dominated by gelatinous organisms such as jellyfish, salps, squid and siphonophores.
Eretmochelys imbricata	Hawksbill Turtle	VU		#	Negligible	No habitat available on within the study area for this exclusively marine species.	Hawksbill Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with rafts of Sargassum (a floating marine plant that is also carried by currents). Once Hawksbill Turtles reach 30 to 40 cm curved carapace length, they settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. They primarily feed on sponges and algae. They have

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							also been found, though less frequently, within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries. Major nesting of Hawksbill Turtles in Australia occurs at Varanus Island and Rosemary Island in Western Australia, and in the northern Great Barrier Reef and Torres Strait.
Natator depressus	Flatback Turtle	VU		#	Negligible	No habitat available on within the study area for this exclusively marine species.	The Flatback Turtle has a low domed, fleshy carapace (shell) with reflexed margins and is grey, pale grey-green or olive in colour. The Flatback Turtle is found only in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya and is one of only two species of sea turtle without a global distribution. Nesting is confined to Australia and four genetic stocks are recognised, Eastern Queensland, Western Australia, Northern Territory and Torres Strait and Gulf of Carpentaria.
Amphibians							
Crinia tinnula	Wallum Froglet		V	2010	Moderate	No breeding or foraging habitat occurs within the study area. Given the proximity of the resident population at Kurnell, dispersal across the Site is	The Wallum Froglet is a coastal species, confined to acid, paperbark swamps and sedge swamps of the "wallum" country. The species occurs from near Noosa in southern Queensland south to the central coast of NSW, with a disjunct population on Kurnell Peninsula. The species is a late winter breeder and males call in choruses from within sedge tussocks or at the water edge.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						highly unlikely however possible.	
Heleioporus australiacus	Giant Burrowing Frog	VU	V	#	Low	No historical records of this species occur within the locality. No preferred habitats occur within the study area.	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creek. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250m from breeding sites.
Litoria aurea	Green and Golden Bell Frog	VU	E1	2010/#	Moderate	No preferred breeding habitats occur within the study area. Dispersal across the Site is highly unlikely however possible.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VI. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits,

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.
Mixophyes iteratus	Giant Barred Frog	EN	E1	#	Negligible	No suitable habitat occurs within the study area or surrounds. No historical records of this species occur within the locality.	Occurs along coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. Found in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m, often hiding in leaf litter near permanent fast-flowing streams. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. When not breeding the frogs disperse hundreds of metres away from streams.
Mammals							
Arctocephalus forsteri	New Zealand Fur-seal		V	2008	Negligible	No habitat available within study area for this exclusively marine species	This is a marine species.
Arctocephalus pusillus doriferus	Australian Fur-seal		V	2008	Negligible	No habitat available within study area for this exclusively marine species	This is a marine species.
Balaenoptera	Blue Whale	EN	E1	#	Negligible	No habitat available	An oceanic species, which can be recorded in Australian

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
musculus						within study area for this exclusively marine species	waters.
Chalinolobus dwyeri	Large-eared Pied Bat	VU	V	#	Low	No historical records of this species occur within the locality. No breeding or roosting habitat occurs within the study area and only limited foraging habitat is available.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.
Dasyurus maculatus	Spotted-tailed Quoll	EN		#	Low	No historical records of this species occur within the locality. No denning or breeding sites or refuge are found within the study area.	Occurs along the east coast of Australia and the Great Dividing Range .Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless area. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha. Breeding occurs from May to Augus.
Dugong dugon	Dugong		E1	1993/#	Negligible	No habitat available within study area for this exclusively marine species	Dugongs were sighted in coastal and estuarine waters around Wallis Lake, Port Stephens, Lake Macquarie and Brisbane Water in the summer of 2002/2003. These areas are associated with some of the largest seagrass beds in NSW, some of which contain the Halophila species preferred by Dugongs. The presence of Dugongs in these areas at this time coincided with warm water temperatures (>18°C).
Eubalaena australis	Southern Right Whale	EN	E1	2001/#	Negligible	No habitat available within study area for this exclusively marine species	A marine species with a circumpolar distribution in the southern hemisphere.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	EN	E1	#	Low	No historical records of this species occur within the locality. No potential habitats for this species occur within the study area.	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.
Megaptera	Humpback	VU	V	2009/#	Negligible	No habitat available	A marine species that has a worldwide distribution. It

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
novaeangliae	Whale					within study area for this exclusively marine species	has a circumpolar distribution in the Southern Hemisphere.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V	2010	Low	No breeding or roosting habitat present within the study area. Foraging resources are also of limited quality being highly disturbed within the study area however may be used on occasion.	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.
Myotis macropus	Southern Myotis		V	2009	Low	No breeding or roosting habitat present within the study area. Foraging resources are also of limited quality being highly disturbed within the study area however may be used on occasion.	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
Petrogale penicillata	Brush-tailed	VU	E1	#	Negligible	No historical	Occurs along the Great Dividing Range south to the

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
	Rock-wallaby					records of this species occur within the locality. No rock overhangs or cliffs to support this species occur within the study area.	Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha.
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	VU	V	#	Negligible	No historical records of this species occur within the locality. No stands of preferred feed trees occur within the study area.	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemostoma* and *E. signata*. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100 ha.
Potorous tridactylus tridactylus	Long-nosed Potoroo	VU	V, E2	#	Low	No historical records of this species occur within the locality. No preferred habitats occur within the study area.	Occurs from Queensland to Victoria, normally within 50 km of the coast . Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, buts tends to aggregate in small groups. It has two breeding

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
							seasons, one in late winter-early spring and the other in late summer. This species appears to benefit from a lack of recent disturbance.
Pseudomys novaehollandiae	New Holland Mouse	VU		#	Low	No historical records of this species occur within the locality. No preferred habitats occur within the study area.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha - 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2010/#	Low	No roost camps were detected during the Site investigation and no significant foraging	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps),

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						resources were detected within the study area.	commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	2000	Low	No hollow-bearing trees were found to occur within the study area. Potential foraging resources are limited given the lack of vegetation across the study area.	Found throughout NSW. They have been reported from southern Australia between January and June. Reported from a wide range of habitats throughout eastern and northern Australia, including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies of up to 30 (but more usually two to six) and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. Its high-flying, making it difficult to detect. It forages above the canopy of eucalypt forests, but comes lower to the ground in mallee or open country.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2006	Low	No hollow-bearing trees were found to occur within the study area. Potential foraging resources are limited given the lack of vegetation across the study	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						area.	
Fish							
Carcharias taurus	Grey nurse shark	CE		#	Negligible	No habitat occurs within the study area for this exclusively aquatic species.	This is a marine species.
Carcharodon carcharias	Great white shark	CE		#	Negligible	No habitat occurs within the study area for this exclusively aquatic species.	This is a marine species.
Epinephelus daemelii	Black cod	VU		#	Negligible	No habitat occurs within the study area for this exclusively aquatic species.	This is a reef dwelling marine species.
Pristis zijsron	Green sawfish	VU		#	Negligible	No habitat occurs within the study area for this exclusively aquatic species.	This is a marine species.
Prototroctes maraena	Australian Grayling	VU		#	Negligible	No habitat occurs within the study area for this	The Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range from Sydney southwards to the Otway Ranges in

Scientific Name	Common Name	Conservation status		Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
		EPBC	TSC				
						exclusively aquatic species.	Victoria, and Tasmania. Australian grayling do not occur in the inland Murray–Darling Basin system. Grayling is a diadromous species; migrating between freshwater streams and the ocean. This species has been found in clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops, and also in muddy-bottomed, heavily silted habitats.
Rhincodon typus	Whale shark	VU		#	Negligible	No habitat occurs within the study area for this exclusively aquatic species.	Whale sharks have a broad distribution in tropical and warm temperate seas, usually between latitudes 30°N and 35°S. They are known to inhabit both deep and shallow coastal waters and the lagoons of coral atolls and reefs. Sightings have been confirmed at Eden (on the NSW south coast).

A3.2 Migratory species (EPBC Act listed)

Includes records from the following sources:

- Atlas of NSW Wildlife (refer to Section 2.1).
- DoE database (accessed on 19/06/2014).
- Current surveys.

* denotes species recorded in the study area during the current assessment.

Table 12: Migratory fauna species recorded or predicted to occur within 5 km of the study area

Scientific Name	Common Name	Most recent record
Actitis hypoleucos	Common Sandpiper	2005/#
Anous stolidus	Common Noddy	1954
Apus pacificus	Fork-tailed Swift	2007/#
Ardea ibis	Cattle Egret	2009/#
Ardea modesta	Eastern Great Egret	2011/#
Ardenna grisea	Sooty Shearwater	1988
Ardenna pacificus	Wedge-tailed Shearwater	2009
Ardenna tenuirostris	Short-tailed Shearwater	2010
Arenaria interpres	Ruddy Turnstone	2012
Calidris acuminata	Sharp-tailed Sandpiper	2009/#
Calidris canutus	Red Knot	2011/#
Calidris ruficollis	Red-necked Stint	2012
Chalcophaps indica	Emerald Dove	1960
Charadrius bicinctus	Double-banded Plover	2009
Charadrius veredus	Oriental Plover	1982
Chlidonias leucopterus	White-winged Black Tern	2010
Chlidonias niger	Black Tern	1990
Egretta sacra	Eastern Reef Egret	2012

Scientific Name	Common Name	Most recent record
Fregata ariel	Lesser Frigatebird	1980
Gallinago hardwickii	Latham's Snipe	2011/#
Haliaeetus leucogaster	White-bellied Sea-Eagle	Recorded during 2012 and 2014 surveys
Hirundapus caudacutus	White-throated Needletail	2010/#
Hydroprogne caspia	Caspian Tern	2011
Limosa lapponica	Bar-tailed Godwit	2010/#
Merops ornatus	Rainbow Bee-eater	#
Monarcha melanopsis	Black-faced Monarch	#/1992
Myiagra cyanoleuca	Satin Flycatcher	#
Numenius madagascariensis	Eastern Curlew	2012/#
Numenius minutus	Little Curlew	#
Numenius phaeopus	Whimbrel	2010/#
Oceanites oceanicus	Wilson's Storm-Petrel	1963
Phaethon lepturus	White-tailed Tropicbird	1978
Philomachus pugnax	Ruff	1971
Plegadis falcinellus	Glossy Ibis	2006
Pluvialis dominicus	American Golden Plover	2009
Pluvialis fulva	Pacific Golden Plover	2012/#
Pluvialis squatarola	Grey Plover	2012/#
Procellaria westlandica	Westland Petrel	1959
Puffinus leucomelas	Streaked Shearwater	#
Rhipidura rufifrons	Rufous Fantail	2006/#
Stercorarius parasiticus	Arctic Jaeger	2007

Scientific Name	Common Name	Most recent record
Stercorarius pomarinus	Pomarine Jaeger	2009
Sterna hirundo	Common Tern	2009
Sula leucogaster	Brown Booby	2009
Tringa brevipes	Grey-tailed Tattler	2012/#
Tringa glareola	Wood Sandpiper	1982
Tringa incana	Wandering Tattler	2012
Tringa nebularia	Common Greenshank	2010
Tryngites subruficollis	Buff-breasted Sandpiper	1965
Puffinus gavia	Fluttering Shearwater	2011
Balaenoptera edeni	Bryde's Whale	#
Caperea marginata	Pygmy Right Whale	#
Lagenorhynchus obscurus	Dusky Dolphin	#
Orcinus orca	Killer Whale	#
Lamna nasus	Porbeagel, mackerel shark	#

Appendix 4: Assessments of Significance

The following section provides for AOS according to the factors outlined under the *Threatened Species Assessment Guidelines – The assessment of significance* (DECC, 2007) for all species listed as requiring assessment based on potential impact to habitat or connectivity. AOSs have been prepared for these species as a matter of ecological due diligence for species and communities with a moderate likelihood or greater in **Appendix 2** and **3**. AOSs have been conducted below for:

- Coast Groundsel *Senecio spathulatus;*
- Coastal Flats Swamp Mahogany Forest *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner*;
- *Sydney Freshwater Wetlands in the Sydney Basinn Bioregion*;
- *Litoria aurea* Green and Golden Bell Frog;
- *Crinia tinnula* Wallum Froglet; and
- TSC Act listed Shorebirds.

Coast Groundsel *Senecio spathulatus*

Senecio spathulatus is listed as Endangered on the TSC Act. *S.spathulatus* is a low-growing smooth-stemmed daisy, often forming hummocks to 30 cm tall. It has short (1 to 5 cm long) fleshy, entire or sometimes divided leaves with toothed margins and large fleshy yellow flower heads. The yellow flowers consist of 8 to 16 ray florets (with petals) to 13 mm long and up to 70 disc florets (in the central section of the flower). Coast Groundsel occurs in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah).

Ten records of *S.spathulatus* are located within the 5 km locality of the study area, one of which was located within the study area, dating from 2008. *S.spathulatus* is historically recorded and likely to occur within the KBBNP. Given the close proximity of the study area to the KBBNP, the 1 km accuracy for this particular record and the lack of potential habitat within the study area, it is likely that the species was actually recorded in the adjacent KBBNP.

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.

Despite habitat assessment and targeted surveys for this species within the study area *S.spathulatus* was not recorded in the recent site assessment. The species is not a cryptic species and as such should have been recorded if present.

The proposed activity would not involve the direct removal of individuals or habitat. The study area is heavily disturbed and comprised predominantly of hard standing, not offering potential habitat for *S.spathulatus* colonisation. For these reasons it is considered unlikely the proposed activities would result in the disruption of the lifecycle of this species.

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

Not relevant as this species 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,***

Not relevant as this species is not 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,***
- ***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***
- ***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,***

No habitat for *S.spathulatus* occurs within the study area. The three vegetated areas within the study area, NECR, NWCP and EBDNV, are not considered potential habitat due to the managed nature of these areas and a dense canopy allowing limited light into the understory. The areas with the greatest potential for *S.spathulatus* are the bunded sections surrounding the tanks, however these are subject to regular herbicide applications for weed control.

The study area has been subject to various forms of disturbance including removal of native vegetation, soil profile disturbance, industrial development, introduction of non-native species and weed control. The demolition works are unlikely to compound the effects of the current disturbance regimes.

KBBNP does provide potential habitat for the species and it is likely that the species currently occurs there. The isolated nature of the locality offers limited habitat connectivity both due to the close proximity to Botany Bay, as well as industrial development in the area. The demolition works are unlikely to further reduce the habitat connectivity of *S.spathulatus.*

The study area is at the southern extent of the known distribution of *S.spathulatus*. No individuals or potential habitat were observed within the study area and the demolition works are unlikely to have an impact on this species.

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

Under the TSC Act (sections 53-55), OEH maintains a register of critical habitat. To date, no critical habitat has been declared for *S.spathulatus.*

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

There are no recovery plans or threat abatement plans identified by NSW OEH for this species.

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.

The proposed action has the potential to trigger the following KTPs relevant to *S.spathulatus*:

- Clearing of native vegetation.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara.*

- Invasion of native plant communities by exotic perennial grasses.
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

Given the limited requirement for clearing of native vegetation and the level of recruitment of exotic species within and adjacent to the study area it is considered unlikely that the demolition works would cause a significant increase in the operation of the aforementioned KTPs.

Conclusion

Although *S.spathulatus* has been recorded within the study area recently, given the lack of suitable habitat it is considered likely that the record was located in the adjacent KBBNP. In determining the nature and magnitude of impacts on the potential habitat of *S.spathulatus*, the demolition works and the Project as a whole is unlikely to have a significant impact given the species was not recorded during the field surveys of the study area and no potential habitat was identified within the study area.

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

Swamp Sclerophyll Forest is listed as an Endangered Ecological Community in Part 3, Schedule 1 of the NSW TSC Act and occurs on waterlogged or periodically inundated alluvial flats and drainage lines associated with sandy coastal floodplains. The community is typically rich floristically and may include elements of fernland, tall reedland and sedgeland. Dominant tree species may include *Eucalyptus robusta*, *Melaleuca quinqenervia*, *Eucalyptus botryoides* and *Eucalyptus longifolia*. Other tree species may include *Callistemon salignus*, *Casuarina glauca*, *Eucalyptus resinifera, Livistona australis* and *Lophostemon suaveolens*. A layer of small trees may be present, including *Acacia irrorata, Acmena smithii*, *Melaleuca linariifolia, Melaleuca ericifolia* and *Glochidion ferdinandi*. Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata* and *Leptospermum polygalifolium*. Herbs, ferns, grasses and sedges include *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Imperata cylindric*a and *Entolasia marginata*.

The SMCMA (2013) mapping (**Figure 3**) identifies the community Coastal Flats Swamp Mahogany Forest (Native Vegetation of the Sydney Metropolitan CMA Area, Sydney Metropolitan as occurring within the study area, in three separate patches along the eastern boundary, totalling 1.15 ha. This SMCMA community profile aligns with TSC Act listed TEC, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

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.

N/A

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

N/A

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,***

The study area has been subject to various forms of disturbance including removal of native vegetation, soil profile disturbance, industrial development, introduction of non-native species and weed control. The demolition works are unlikely to compound the effects of the current disturbance regimes.

No potential habitat for SSFCF was identified within the study area. Within the 5 km locality a total of 29.5 ha of communities equating to SSFCF have been identified by SMCMA (2013) mapping. This is currently present as a number of vegetation patches with limited connectivity. Given that the demolition works does not involve any vegetation clearing or works outside of the current industrialised footprint, it is not considered likely that the demolition works would have a significant impact on habitat connectivity for SSFCF.

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***
- ***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***
- ***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,***

No TEC were found within the study area, however the SMCMA (2013) mapping (**Figure 3**) identifies two patches of a community aligning with the TEC Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions with a total area of 1.15 ha. Ground truthing of these areas identified that, based on the DECC (2007) identification guidelines, final determination (OEH, 2011) and profile information (OEH, 2012) for the TSC Act listed endangered ecological community, the NECR and ENDNV vegetation does not comprise the stratum nor habitat associated with this community. Outside of these vegetated areas, the study area is comprised of hard standing and industrial buildings offering no potential habitat to this community. For these reasons it is not considered likely that the demolition works would have a significant impact on habitat for SSFCF.

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

Under the TSC Act (sections 53-55), OEH maintains a register of critical habitat. To date, no critical habitat has been declared for SSFCF.

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

NSW OEH has identified 12 priority actions to help recover the Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions in New South Wales:

- undertake research to determine minimum fire frequency;
- determine location, species composition and threats to remaining remnants to assist with prioritising restoration works;
- collect seed for NSW Seedbank. Develop collection program, all known provenances (conservation collection);
- investigate seed viability, germination, dormancy and longevity (in natural environment and in storage);
- collate existing information on vegetation mapping and associated data for this TEC and identify gaps in knowledge. Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants;
- prepare identification and impact assessment guidelines and distribute to consent and determining authorities;
- use mechanisms such as Voluntary Conservation Agreements to promote the protection of this TEC on private land;
- liaise with landholders and undertake and promote programs that ameliorate threats such as grazing and human disturbance;
- enhance the capacity of persons involved in the assessment of impacts on this TEC to ensure the best informed decisions are made;
- undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan and associated PAS actions;
- identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required; and
- investigate the ecology of Swamp sclerophyll forest species with particular emphasis on the importance of drying and wetting cycles in maintaining ecosystem health.

The demolition works are considered unlikely to result in an increased impact to the Swamp Sclerophyll Forest through any of the aforementioned KTPs should the mitigation measures as outlined in Section 5 of this report, be implemented.

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.

The proposed action has the potential to trigger the following KTPs relevant to SSFCF TEC:

- Clearing of native vegetation.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara.*
- Invasion of native plant communities by exotic perennial grasses.
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

Given the limited requirement for clearing of native vegetation and the level of recruitment of exotic species within and adjacent to the study area it is considered unlikely that the demolition works would cause a significant increase in the operation of the aforementioned KTPs.

The demolition works are considered unlikely to result in an increased impact to the Swamp Sclerophyll Forest through any of the aforementioned KTPs should the mitigation measures outlined in Section 5 of this report be implemented.

Conclusion

Although an ecological community equating to the TEC SSFCF has been previously mapped at three separate patches within the study area, ground truthing of these areas identified one as being unvegetated and the remaining two not consistent with the final determination of the TEC. Outside of these areas, no potential habitat for SSFCF was identified within the study area. For these reasons the demolition works and the Project as a whole is not considered to have a significant impact on this TEC.

References

OEH, 2011, *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* - Détermination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act.

OEH, 2012, Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – profile.

SMCMA, 2013, *Native Vegetation of the Sydney Metropolitan CMA Area, Sydney Metropolitan.* Sydney Metropolitan Catchment Management Area.

DECC, 2007, *Identification Guidelines for Swamp Sclerophyll Forest on Coastal Floodplains*.

Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Freshwater Wetlands on Coastal Floodplains (FW) is an Endangered Ecological Community listed under Part 3 of Schedule 1 of the TSC Act. It is associated with coastal areas subject to periodic flooding (greater than 1 in 100 years) and in which standing fresh water persists for at least part of the year in most years (OEH, 2012). The TEC is often dominated by herbaceous plants and has very few woody species. Instances lacking regular standing water are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Where they are subject to regular inundation and drying the vegetation may include large emergent sedges over 1 metre tall, such *as Baumea articulata, Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogsmouth), *Ludwigia peploides subsp. montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum spp.* (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant.

No FW was recorded within the study area, however it was recorded adjacent to the study area outside of the Continental Carbon Pipeline easement. The largest areas of FW were observed from a distance, to the south of the Caltex Refinery Site, outside the study area.

(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.

Not Applicable to Endangered Ecological Communities.

(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

Not Applicable to 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.***

As no FW was recorded within the study area, the direct impacts of the demolition works on the TEC would be minimal, however the demolition works have the potential to have direct impacts on FW. The existing chain-link boundary fence and associated concrete bund provide substantial buffering capacity to the adjacent TEC. Since the direct impacts of the demolition works would be confined to the easement of the Pipeway, within the boundary fence, it is considered unlikely that the demolition works would have any impact on the extent of the TEC.

The FW that was recorded adjacent to the study area and therefore most likely to be indirectly impacted by the demolition works was considered to be in poor condition. This was owing to the low diversity of native species; with Bare Twig-rush dominant and recruitment of exotic species such as Whiskey Grass and Ribwort Plantain. Standing water outside of the Continental Carbon Pipeline easement exhibited signs of hydrocarbon introduction in the form of a slick on the surface. This, however, appears to have had no impact on the flora of the wetlands. The existing concrete bunding along the easement boundary should ensure that no further pollution occurs during the completion of the demolition works. Furthermore, larger areas of FW TEC are located at great distance from the study area and therefore indirect impacts to these better quality patches are considered to be negligible. Based on

the poor condition of the existing FW TEC outside of the easement and the distance to better quality representations, it is considered unlikely that the demolition works would significantly modify the composition of the TEC.

(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

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

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 demolition works would require the removal of pipe infrastructure within the Continental Carbon Pipeline easement which is, by design, elevated from the surrounding vegetation. Standing water is not present within the easement therefore the study area is not considered to provide potential habitat for the TEC.

The linear nature of the Continental Carbon Pipeline easement and its location within a large area or remanent native vegetation means that its original construction did fragment habitat for the TEC. The demolition works would be confined to the existing easement and therefore would not further fragment or isolate FW habitat beyond the current state.

Since the study area is not considered to provide potential habitat for FW, its importance for the TEC is negligible. Adjacent to the study area, the TEC and its habitat is present in the form of wet depressions and standing water. It is not anticipated that there would be any direct impacts to this recorded FW. Much higher quality representations of the TEC and its habitat are located further from the study area, to the east of the Continental Carbon Pipeline easement. The potential habitat immediately adjacent to the easement is therefore considered to be of relatively low importance.

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

Under the TSC Act (sections 53-55), OEH maintains a register of critical habitat. To date, no critical habitat has been declared for FW.

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

To date there is no recovery plan for FW. The OEH lists 13 interim management strategies to maximise the extent and condition of the TEC. The proposed development is not in conflict with any of these strategies.

(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.

The proposed action has the potential to trigger the following KTPs relevant to FW TEC:

- Clearing of native vegetation.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara.*
- Invasion of native plant communities by exotic perennial grasses.
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).

Given the limited requirement for clearing of native vegetation and the level of recruitment of exotic species within and adjacent to the study area, it is considered unlikely that the demolition works would cause a significant increase in the operation of the aforementioned KTPs.

Conclusion

The demolition works and the Project as a whole is unlikely to have a significant impact on the FW TEC recorded within the study area. This conclusion is based on:

- The lack of FW within the study area and the low condition of the FW recorded adjacent to the study area.
- Potential impacts of the demolition works are limited to indirect impacts to low quality FW.
- The demolition works are considered unlikely to significantly exacerbate any currently operating KTPs.

References

NSW Scientific Committee, 2011, Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing.

OEH, 2012, Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - Profile.

DECC, 2008, Freshwater wetlands on coastal floodplains (Freshwater Wetlands) – Identification Guidelines for Endangered Ecological Communities.

Green and Golden Bell Frog *Litoria aurea*

The Green and Golden Bell Frog is listed as endangered under the New South Wales TSC Act. The Green and Golden Bell Frog is known to occupy areas with a variety of habitat features throughout its range. However, there are important habitat components that the species requires to survive, including ephemeral water bodies, grassy surroundings for foraging and refuge, shelter sites, basking sites and over-wintering sites. The presence of exotic predatory fish *Gambusia holbrooki* is considered a crucial limiting factor, affecting the long-term survival of the species.

The species breeds in still or slow flowing waterbodies with some aquatic emergent vegetation such as *Typha spp.* or *Eleocharis spp.* The Green and Golden Bell Frog spends much of its time amongst emergent aquatic or riparian vegetation but also uses and disperses into other areas including fallen timber adjacent to breeding habitat and other vegetation such as grassland, cropland and modified pastures.

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 Kurnell Peninsula is a significant locality for Green and Golden Bell Frogs as there have been a number of records of the species here in recent years. A total of 525 records of Green and Golden Bell Frog available from within a radius of 5 km around the locality, however, there are no recent records of the species from within the study area.

Habitat that may potentially be suitable for the Green and Golden Bell Frog within the study area is restricted to stormwater drains and surface runoff areas. However, these do not provide continuous connectivity across the study area as the Site is divided into separate catchments and the presence of standing surface water is highly temporal. The high density of records within close proximity to the study area raises the expectation that individuals may traverse the Site to access other areas of the peninsula and thus the study area would act as a movement corridor. Only limited breeding or foraging resources were identified within the study area. Impacts on potential habitat for the Green and Golden Bell Frog would be minimal. For these reasons the demolition works are considered unlikely to affect the lifecycle of the species.

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 a population listed under Part 2 of Schedule 1 of the TSC Act and is defined as a population that, in the opinion of the NSW Scientific Committee, is facing a very high risk of extinction in NSW in the near future. A population is not eligible to be listed as an Endangered Population if it is a population of a species already listed in Schedule 1 or 1A (i.e. already listed as an Endangered or Critically Endangered species). Therefore, populations of the GGBF within NSW are not eligible to be listed as Endangered Populations.

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,***

Not applicable to threatened species.

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***
- ***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***

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 Green and Golden Bell Frog's current distribution is limited to the east coast of New South Wales between Byron Bay in northern NSW and Gippsland Lakes in north-eastern Victoria. However, there are large gaps in its coastal distribution. Any populations of this species within the locality of the study area would not be at the limit of the species' known distribution.

The locality surrounding the study area is known to contain an established population of Green and Golden Bell Frog. The species of often associated with habitats with high variability such as fluctuating environmental conditions and are therefore pre-adapted for colonising and occupying disturbed environments such as the industrial land at Kurnell. Despite this, no suitable breeding ponds with dense stands of emergent vegetation occur within the study area. No breeding or foraging habitat for Green and Golden Bell Frog was identified within the study area.

Green and Golden Bell Frogs are known to move considerable distances and have been found several kilometres from the nearest breeding habitat. The Kurnell Peninsula does provide habitat for known populations of the species. Being at the headland of the peninsula any connectivity from the extremity of the peninsula is likely to occur along the coastline to the north and south of the study area through the Botany Bay National Park where intact native vegetation and naturally occurring drainage channels remain. The study area itself offers limited habitat connectivity both due to the close proximity to Botany Bay, as well as industrial development in the area. The demolition works are unlikely to further reduce the habitat connectivity for the Green and Golden Bell Frog given the industrial use of the study area and extent of activity would remain the same.

The study area has been subject to various forms of disturbance including removal of native vegetation, soil profile disturbance, industrial development, introduction of non-native species and weed control. The demolition works are unlikely to compound the effects of the current disturbance regimes.

It is therefore concluded that the demolition works are unlikely to affect the habitat of the species.

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

Under the TSC Act (sections 53-55), OEH maintains a register of critical habitat. To date, no critical habitat has been declared for the Green and Golden Bell Frog

Kurnell Peninsula is an important area for Green and Golden Bell Frogs in the Sydney Region, and the population of the species at Kurnell is considered one of 43 "key populations". While the species has also been recorded in KBBNP , Marton Park Wetland and Towra Point Nature Reserve in Kurnell, these areas and the study area itself are not considered critical habitat for the Kurnell population (DEC 2005).

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

The broad objectives of the Green and Golden Bell Frog Recovery Plan are timeframe dependant. The first objective designed to operate within the first five years of the plan is to: "*manage threats impacting on currently known populations so as to stabilise and prevent the decline of the species*". The longer term objective is "*returning the species to its former distribution, abundance and role in the ecosystem wherever possible*". The demolition works are not inconsistent with the guidelines set out in the recovery plan for this species.

The demolition works are therefore consistent with the objectives of the threat abatement 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.

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act. Those related to the Green and Golden Bell Frog are:

- alteration of natural flow regimes of rivers and streams and their floodplains and wetlands;

- clearing of native vegetation;
- infection by amphibian Chytridiomycosis disease;
- predation by the European Red Fox;
- predation by the Feral Cat (*Felis catus*); and
- predation by *Gambusia holbrooki* (Plague Minnow).

The demolition works are considered unlikely to result in an increased impact to the GGBF through any of the aforementioned KTPs.

Conclusion

The assessment concludes that it is unlikely that the demolition works or the Project has the potential to significantly impact the Green and Golden Bell Frog given that no potential breeding sites or foraging habitats would be negatively impacted as a result of the Project and connectivity around the study area would remain the same. As such, a referral to the Minister is not required. A number of measures are recommended in Section 5 of this report to mitigate the degree of impact to ensure that biodiversity values within the study area are maintained or improved.

The draft recovery plan prepared for the Green and Golden Bell Frog identifies a specific objective for the Kurnell population, which is to implement a coordinated peninsula wide management strategy across all land tenures to improve the long-term conservation status of this likely Green and Golden Bell Frog metapopulation (DEC 2005).

Wallum Froglet *Crinia tinnula*

The Wallum Froglet is a state threatened species. It is listed as vulnerable under the New South Wales TSC Act.

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 Wallum Froglet is a coastal species, confined to acid, paperbark swamps and sedge swamps of the "wallum" country. The species is a late winter breeder and males call in choruses from within sedge tussocks or at the water edge.

According to the National Recovery Plan for wallum frog species, essential habitat for these species may be defined as freshwater wetlands and associated vegetation communities occurring on low nutrient sandy soils along the east coast of Australia. The frog species in this plan are typically found amidst heath vegetation and sedges where water collects above organic hardpan layers forming 'perched' swamps and lakes. These acidic (pH < 6.0) swamps and lakes provide essential breeding habitat for wallum frog species (Meyer et al. 2006).

The extent to which wallum frog species rely on vegetation away from breeding sites is largely unknown, however, wallum frog species have also been recorded in woodland and forest some distance from water. Vegetation surrounding swamps may facilitate movement of animals and gene flow between catchments/populations. Vegetation within swamp and lake catchments may therefore also be considered important for the survival of the wallum frog species (Meyer et al. 2006).

A total of 36 records of Wallum Froglet are located within the 5 km locality, the majority of which are within 2 km of the study area and within KBBNP. Although a significant population is known to occur in close proximity to the study area, only limited potential habitat for Wallum Froglet was identified within the study area along the Continental Carbon Pipeline. It is possible that the boundary of the study area may be used by individuals moving between habitat pockets within both KBBNP and the greater Kurnell Peninsula, however it is unlikely that they would enter the majority of the study area given the lack of breeding or foraging habitat present. Given the demolition works would impact on only very small areas of marginal breeding or foraging habitats along the Continental Carbon Pipeline it is considered unlikely to impact on the lifecycle of the species.

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 a population listed under Part 2 of Schedule 1 of the TSC Act and is defined as a population that, in the opinion of the NSW Scientific Committee, is facing a very high risk of extinction in NSW. A population is not eligible to be listed as an Endangered Population if it is a population of a species already listed in Schedule 1 or 1A (i.e. already listed as an Endangered or Critically Endangered species).

There are currently no endangered populations listed for the Wallum Froglet in NSW.

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,***

Not applicable to threatened species.

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***
- ***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***
- ***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,***

Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney. The study area is located at the southern extent of the known distribution of Wallum Froglet. Given that the demolition works are considered unlikely to impact on breeding or foraging habitat, it would not affect the species even though it is at the extent of its range.

The study area has been subject to various forms of disturbance including removal of native vegetation, soil profile disturbance, industrial development, introduction of non-native species and weed control. The demolition works and Project as a whole are unlikely to compound the effects of the current disturbance regimes.

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

Under the TSC Act (sections 53-55), OEH maintains a register of critical habitat. No critical habitat has as yet been declared for the Wallum Froglet and the study area is not considered in this assessment to be habitat critical to the survival of a local population of the Wallum Froglet. As such, the demolition works are consistent with the recovery plan with regards to critical habitat.

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

A National Recovery Plan has been prepared for the four frog species dependent on wallum environments, including the Wallum Froglet (Meyer et al. 2006). The objectives of this plan include:

- to identify areas of habitat critical to the survival of wallum frog species more accurately;
- to protect habitat critical to wallum frog survival and important wallum frog populations from threatening processes;
- to rehabilitate degraded Wallum Frog habitat; and
- to determine population trends in areas of disturbed, undisturbed and rehabilitated habitat.

The threat abatement plan (TAP) for the predation by *Gambusia holbrooki* is relevant to this species (NPWS 2003). The NSW TAP identifies the Wallum Froglet as one of four threatened species as most likely to be at risk from Plague Minnow predation. Actions include minimising human dispersal of Plague Minnow and reducing impacts of Plague Minnow on threatened frog species at key sites. The threat abatement plan has not yet identified key sites, however, as the study area is not considered to contain habitat critical to the survival of a local population of the Wallum Froglet, therefore it is considered unlikely that the study area would be considered a key site. It is also unlikely that the demolition works would result in an increase in human dispersal of Plague Minnow. As such, the demolition works are consistent with threat abatement actions of the Plague Minnow TAP relevant to the Wallum Froglet.

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.

The Wallum Froglet is threatened by the following KTPs:

- clearing of native vegetation - the demolition works do not involve clearing of intact native vegetation;

- ecological consequences of high frequency fires – the Wallum Froglet is threatened by grazing and associated frequent burning of coastal wetlands. The demolition works are unlikely to alter the frequency of fire within areas that are potential habitat for the Wallum Froglet;
- predation by the European Red Fox – the demolition works are unlikely to lead to an increase in fox numbers;
- predation by Feral Cats – the demolition works are unlikely to lead to an increase in cat numbers;
- infection of Frogs by *Chytrid* fungus causing the disease Chytridiomycosis – the demolition works are unlikely to lead to an increase in the spread of Chytridiomycosis;
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands (DEC 2005a). The demolition works could impact potential breeding habitat for the Wallum Froglet due to run-off containing contaminants reducing the water quality and modifying the acidity in wetlands where this species breeds; and
- predation by *Gambusia holbrooki* (Plague Minnow) – the demolition works are not likely to increase the threat of predation by the Plague Minnow.

Conclusion

The demolition works and the Project as a whole are not likely to result in a significant impact on a local population of the Wallum Froglet, as:

- no individuals are likely to be removed as a results of the demolition works;
- no breeding/foraging habitat would be removed;
- the demolition works would not have an adverse effect on critical habitat (directly or indirectly); and
- the habitat to be impacted by the demolition works are not considered to be important for the long term survival of the species in the locality.

References

Meyer, E., J.M. Hero, L. Shoo & B. Lewis, 2006. *National recovery plan for the wallum sedgefrog and other wallum-dependent frog species*.

Breeding migrant and resident shorebirds: Little Tern *Sternula albifrons* and Pied Oystercatcher *Haematopus longirostris*

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 **Little Tern** (Endangered, TSC Act) is almost exclusively a coastal species, migrating from Asia to the north, east and south-east Australian coasts. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months (NSW DEH 2014a). Little Terns nest 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. They are often seen feeding in flocks, foraging for small fish, crustaceans, insects, worms and molluscs by plunging into the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight (NSW DEH 2014a).

The **Pied Oystercatcher** (Endangered, TSC Act) is an easily recognisable large wading bird, with distinctive black and white colouring and bright scarlet eyes and bill. The species is found around the entire Australian coastline, through in NSW distribution is patchy, with fewer than 200 breeding pairs estimated to occur in the State (NSW DEH 2014b). Nests are usually located on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas, and are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Pied Oystercatchers are usually observed on intertidal flats of inlets and bays, open beaches and sandbanks, foraging on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish (NSW DEH 2014b).

Based on the unlikely occurrence of nesting Little Terns and Pied Oystercatcherswithin the study area, and the presence of larger areas of suitable breeding habitat along the length of Silver Beach, the demolition works associated with the pipeline removal north of the Western ROW are considered unlikely to affect the life cycle of these species, such that their local existence is put at risk of extinction.

In order to avoid potentially affecting the nests of these species, when relevant demolition workers are being inducted, they would be provided with fact sheets (**Appendx 6**) showing Little Terns or Pied Oystercatchers. Workers would check the area where the works would occur prior to any demolition works taking place in the foreshore area of Silver Beach to detect any nesting Little Terns or Pied Oystercatchers. If nesting shorebirds are encountered in the Silver Beach foreshore area in the vicinity of works (within 20 meters (m)) it is recommended that a qualified zoologist investigate the area to determine potential for impact, and that works cease until chicks have fledged; or works should be completed outside of the known nesting periods for nesting shorebirds (August to January for Pied Oystercatcher and Spring/Summer for Little Tern).

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

Not applicable, this factor refers to endangered populations listed in Part 2 of Schedule 1 of the TSC Act and Part 2 of Schedule 4 of the FM Act.

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

- ***III. 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***
- ***IV. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

Not applicable, this factor relates to endangered ecological communities listed under Part 3 of Schedule 1 of the TSC Act and Part 3 of Schedule 4 of the FM Act and the critically endangered communities listed under Part 2 of Schedule 1A of the TSC Act and Part 2 of Schedule 4A of the FM Act.

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***
- ***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***
- ***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 demolition works associated with the removal of the Western ROW pipeline would result in removal of 0.03 hectares of foredune vegetation that currently provides very limted potential breeding habitat for the Little Tern and the Pied Oystercatcher. Despite the presence of suitable vegetation, nesting is unlikely given the surrounding urban landscape and frequent disturbance by people and dogs using Silver Beach and the cycleway/walkway along the foreshore.

This vegetation occurs throughout the foreshore area of Silver Beach, and is also well represented along other foreshore areas in the locality. Although Pied Oystercatchers were recorded foraging along Silver Beach, it has not been confirmed whether either Little Terns or Pied Oystercatchers utilise the Silver Beach foreshore as breeding habitat. Inspections would clarify the presence/absence of nesting birds prior to demolition works.

Given the small area to be removed during demolition works,the extent of other suitable breeding habitat and the existing limitations of urbanisation and frequent disturbance, it is unlikely that the demolition works would fragment or isolate breeding habitat for the Little Tern or the Pied Oystercatcher. The area to be impacted is not considered to be important for the long-term survival of either of these species.

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

Not applicable. No Critical habitat is listed on the register of Critical Habitat kept by the Director-General, OEH or I&I NSW within the study area.

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

A formal approved NSW Recovery Plan exists for the Little Tern (NSW NPWS 2003) that identifies a number of actions to be undertaken to ensure the long-term viability of the species. Activities considered to be relevant to the current project include:

- Support local community groups acting as nest site wardens.
- Manage estuaries and the surrounding landscape to ensure the natural hydrological regimes are maintained.
- Erect fences and interpretive signage to minimise human disturbance and advise how their behaviour can affect the threatened species' survival.
- Protect and maintain known or potential habitats, including implementation of protection zones around known habitat sites and sites of recent records.
- Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape.
- Flag beaches with lines of bunting or raise nests on sandbags to protect nesting birds in flood prone areas.

No formal recovery plan exists for the Pied Oystercatcher, however a number of activities have been identified to assist the recovery of this species. Those considered to be relevant to the current project include:

- Manage estuaries and the surrounding landscape to ensure the natural hydrological regimes are maintained.
- Install interpretive signs at major nesting sites.
- Protect and maintain known or potential habitat, including the implementation of protection zones around known habitat sites and sites of recent records.

The proposed demolition works conform with the objectives of the Recovery Plan for the Little Tern.

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.

The proposed removal of the Cooling Water Outlet pipeline may result in an increase to the following key threatening processes, which are considered relevant to migratory shorebirds:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Clearing of native vegetation.

Although the proposed demolition works have the potential to trigger or exacerbate the clearing of native vegetation, the impacts on nesting shorebirds are unlikely to be significant.

Conclusion

The demolition works and the Project as a whole are not likely to result in a significant impact on the Little Tern or the Pied Oystercatcher, as:

- no nesting birds would be removed or disturbed as a result of the demolition works;
- only a very small area of potential breeding habitat is to be removed;
- the demolition works would not have an adverse effect on critical habitat (directly or indirectly); and
- the habitat to be impacted by the demolition works are not considered to be important for the long term survival of these species in the locality.

References

NSW National Parks and Wildlife Service [NSW NPWS](2003) Little Tern (*Sterna albifrons*) Recovery Plan. NSW NPWS, Hurstville.

NSW Department of Environment and Heritage [NSW DEHa] Threatened Species Profile - Little Tern. Accessed 22 September 2014.

NSW Department of Environment and Heritage [NSW DEH] Threatened Species Profile - Pied Oystercatcher. Accessed 22 September 2014.

Appendix 5: Significant Impact Criteria assessments

The following section provides two Significant Impact Criteria assessments to determine whether the proposed action is likely to have a significant impact on the following matters of NES (and hence whether a Referral to the Commonwealth Minister (Director General) is required):

1. Green and Golden Bell Frog *Litoria aurea;* and
2. *Towra Point Nature Reserve Ramsar site*

Green and Golden Bell Frog *Litoria aurea*

The Green and Golden Bell Frog (GGBF) is listed as Vulnerable under the EPBC Act. The species was not recorded within the study area during the current survey.

Individuals of GGBF potentially occurring within the study area are not considered to form part of an 'important population' as defined in Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013) because they are:

- unlikely to represent a key source population either for breeding or dispersal as the species has not been recorded within the study area and habitat connectivity is limited;
- unlikely to be a population necessary for maintaining genetic diversity; and
- not located at or near the limit of the species' range.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population of the species?

No Green and Golden Bell Frogs have recently been recorded within the study area, though the species has been recorded on 525 occasions within a 5 km radius of the study area. It is assumed that the study area may be utilised as a movement corridor by the species, but subsequent residency and/or settlement here is unlikely as the study area provides insufficient habitat for the Green and Golden Bell Frog. At best, temporary habitat is restricted to stormwater drains and surface runoff areas.

Given the above, the demolition works are considered unlikely to lead to a long-term decrease in the size of an important population of Green and Golden Bell Frog.

Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population of the species?

Green and Golden Bell Frogs generally occur in marshes, dams and streams with much of these habitats characterised by *Typha* spp. or *Eleocharis* spp., which provide much needed shelter (DEC 2005). The study area lacks such suitable habitat.

Furthermore, the study area does not lie near the limit of the area of occupancy of the Green and Golden Bell Frog, which extends from south-eastern Victoria to near Byron Bay in northern NSW. Therefore it is considered unlikely that the demolition works would reduce the area of occupancy of an important population of Green and Golden Bell Frog.

Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?

Green and Golden Bell Frogs are known to move considerable distances and have been found several kilometres from the nearest suitable breeding habitat (Gillespie 1996; Pyke and White 2001). No potential breeding or foraging

habitat for Green and Golden Bell Frog was identified within the study area. The Kurnell Peninsula does provide habitat for known populations of the species. Being at the headland of the peninsula any connectivity from the extremity of the peninsula is likely to occur along the coastline to the north and south of the study area through to the KBBNP where intact native vegetation and naturally occurring drainage channels remain. The study area itself offers limited habitat connectivity both due to the close proximity to Botany Bay, as well as industrial development in the area. The demolition works unlikely to further reduce the habitat connectivity for the Green and Golden Bell Frog given the industrial use of the study area and extent of activity would remain the same.

It is therefore considered unlikely that the demolition works would fragment an existing important population of the Green and Golden Bell Frog into two or more populations.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of the species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. A Register of Critical Habitat is maintained by the Minister under the EPBC Act. To date, no critical habitat has been declared for the GGBF (DoE 2013).

Kurnell Peninsula is an important area for Green and Golden Bell Frogs in the Sydney Region, and the population of the species at Kurnell is considered one of 43 "key populations" (DEC 2005). While the species has also been recorded in KBBNP , Marton Park Wetland and Towra Point Nature Reserve in Kurnell, these areas, and the study area itself are not considered critical habitat for the Kurnell population (DEC 2005).

Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population of the species?

The high density of records within close proximity to the study area raises the expectation that individuals may traverse the Site to access other areas of the peninsula and thus the study area would act as a movement corridor. No breeding or foraging resources were identified within the study area. It is therefore considered unlikely that the demolition works would disrupt the breeding cycle of an important population of the Green and Golden Bell Frog.

Is there a real chance or a possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The study area provides only a very restricted amount of potential habitat and the species is expected to be using the study area as a movement corridor and/or utilise the restricted habitat only temporarily at most. The study area has been subject to various forms of disturbance including removal of native vegetation, soil profile disturbance, industrial development, introduction of non-native species and weed control. The demolition works are therefore considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat?

Predation by *Gambusia holbrooki* has been identified as a serious threat to the Green and Golden Bell Frog (DEC 2005). It is unknown at this stage whether *G. holbrooki* may have established in the stormwater drains within the study area. However, their establishment and/or spread whether present or in future would be unlikely facilitated by the presence of the Green and Golden Bell Frog in the study area.

A threat abatement plan relevant to the Green and Golden Bell Frog is the 'Predation by *Gambusia holbrooki* (Plague Minnow) Threat Abatement Plan' (NPWS 2003). The demolition works are consistent with the objectives of the threat abatement plan.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Infection by amphibian chytridiomycosis disease has been identified as a serious threat to the Green and Golden Bell Frog and is also considered a 'Key Threatening Process' under the TSC and EPBC Acts. This disease has been identified as being widespread in NSW populations by the threat abatement plan: Infection of Amphibians with Chytrid fungus resulting in Chytridiomycosis (DEH 2006). However, the demolition works are highly unlikely to introduce this disease into the study area. Nevertheless, all works related to the demolition works should adhere to the guidelines developed by the NPWS, Hygiene Protocol for the Control of Disease in Frogs (NPWS 2001).

Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?

A recovery plan has not yet been made for the Green and Golden Bell Frog under the EPBC Act, however, a draft recovery plan has been developed by the former DEC (2005). The broad objectives of the Draft Green and Golden Bell Frog Recovery Plan (DEC 2005) are time frame dependant. The first objective designed to operate within the first five years of the plan is to: "*manage threats impacting on currently known populations so as to stabilise and prevent the decline of the species*". The longer term objective is "*returning the species to its former distribution, abundance and role in the ecosystem wherever possible*".

The Green and Golden Bell Frog has not been recorded within the study area. The demolition works are consistent with the guidelines (NPWS 2003) set out in the recovery plan for this species and is therefore considered unlikely to interfere substantially with the recovery of this species.

Conclusion

Based on the above assessment the Green and Golden Bell Frog is unlikely to be significantly impacted by the demolition works or the Project as a whole, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

References

DEC NSW, 2005, Threatened species profiles – Green and Golden Bell Frog. Department of Environment and Conservation. Access online 30/11/2012 - http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10483.

Pyke, G.H. and White, A.W. , 2001, *A review of the biology of the Green and Golden Bell Frog Litoria aurea. Australian Zoologist 31(4) 563-598.*

NSW NPWS, 2003, *Draft Green and Golden Bell Frog Litoria aurea Recovery Plan*. NPWS Hurstville, NSW.

Towra Point Nature Reserve Ramsar site

Is there a real chance or a possibility that the proposal will result in areas of the wetland being destroyed or substantially modified?

The Towra Point Nature Reserve Ramsar site consists of 386.5 hectares of wetlands that lie on the mouth of the Georges River on the southern shores of Botany Bay, and located approximately 16 kilometres from the Sydney CBD (DECCW, 2010).

The most eastern extent of the Ramsar listed portion of the Site is approximately 2 km west of the study area. The Reserve is bounded by the Kurnell Headland, Botany Bay, and Dolls Point.

The study area is located in the north eastern extent of Kurnell Peninsula south of Captain Cook Drive and bound by Botany Bay National Park to the east. Despite Kurnell Peninsula being historically subjected to heavy industry, Towra Point Nature Reserve remains the largest and most diverse estuarine wetland complex remaining in the Sydney region (NSW NPWS, 2001; City of Botany Bay Council, 2012).

The demolition works would not result in any direct disturbance to the Towra Point Nature Reserve through the demolition works. However based on historical events there is a risk that during a flood event potentially contaminated oily waters can wash out of the study area and enter the Towra Point Nature Reserve system. On three separate occasions in June 2012, March 2011 and April 2011 oily waters had been discharged to waters of Botany Bay and Towra Point Nature Reserve during flood events (Caltex 2011). In response to these incidents Caltex has invested in improving its on stormwater system performance and Stormwater Management Plan (Caltex 2011). This plan is underway and being reassessed during 2014.

Towra Point Nature Reserve lies in proximity to the study area, however taking into consideration the current management strategies and procedures in place to circumvent contamination which had occurred in the past, it is considered unlikely that the demolition works would have a significant impact on the ecological character of the Towra Point Nature Reserve Ramsar site such that areas of the wetland are destroyed or substantially modified.

Is there a real chance or a possibility that the proposal will result in a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland?

The proposed demolition works would not substantially change the hydrology occurring within or outside the study area. Consequently despite the proximity of the study area from the listed Ramsar Wetland, it is considered unlikely that the works would result in a substantial or measurable change in the hydrological regime of the adjacent wetland – in terms of a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetlands.

Is there a real chance or a possibility that the proposal will result in the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected?

The proposed conversion of the refinery to a fuels terminal and the associated conversion and demolition works should not affect the lifecycle of native species dependent on the Towra Point Nature Reserve Ramsar wetland.

Is there a real chance or a possibility that the proposal will result in a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health?

The demolition works would not result in any direct disturbance to the Towra Point Nature Reserve through the demolition works. However based on historical events there is a risk that during a flood event potentially contaminated oily waters can wash out of the study area enter the Towra Point Nature Reserve system. On three separate occasions in June 2012, March 2011 and April 2011 oily waters had been discharged to waters of Botany Bay and Towra Point Nature Reserve during flood events (Caltex 2011). In response to these

incidents Caltex has invested in improving its on stormwater system performance and Stormwater Management Plan (Caltex 2011). This plan is underway and being reassessed during 2014.

Towra Point Nature Reserve lies in proximity to the study area, however taking into consideration the current management strategies and procedures in place to circumvent contamination which had occurred in the past, it is considered unlikely to have the potential to result in a substantial or measurable change in the water quality of the wetlands – in terms of salinity levels, pollutants, water nutrients, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health.

Is there a real chance or a possibility that the proposal will result in an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland?

The Towra Point Nature Reserve is considered to be an area of important habitat for a number of threatened species, including a range of listed-migratory species. The main aquatic noxious weed found in Botany Bay is considered to be *Caulerpa taxifolia* (Caulerpa). The invasive Cane Toad has been recorded at Taren Point (recorded during 2010) however no individuals have been found within Towra Point Nature Reserve Ramsar site. The proposed works are unlikely to alter current conditions to facilitate colonisation of this wetland by invasive species.

It is considered unlikely that the works associated with the demolition works would result in an invasive species that is harmful to the ecological character of the wetland being established, or an existing invasive species being spread, in the wetland.

Conclusion

The significant impact criteria assessment concludes that it is unlikely that the demolition works or the Project as a whole has the potential to significantly impact Wetlands of International Importance. As such, a referral to the Minister is not required. A number of measures are recommended in Section 5 of this report to mitigate the degree of impact to ensure that biodiversity values are maintained or improved.

References

City of Botany Bay Council, 2012, *A short history of the city of Botany Bay*. Accessed online 10/7/2012 - http://www.botanybay.nsw.gov.au/index.php/your-city/a-short-history-of-the-city-of-botany-bay

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NSW NPWS, 2001 *Towra Point Nature Reserve – Plan of Management.* National Parks and Wildlife Services. Accessed online November 2012 - http://www.environment.nsw.gov.au/resources/parks/pomfinaltowra.pdf

Appendix 6: Threatened Fauna Information

The Wallum Froglet *Crinia tinnula*

The Wallum Froglet is a state threatened species. It is listed as vulnerable under the New South Wales *Threatened Species Conservation Act 1995*.

Photo 1: Adult Wallum Froglet. Accessed from OEH threatened species profile http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10183#

General Appearance

The Wallum Froglet is a small frog (only 30 mm long) with highly variable colour and pattern, ranging from light grey or brown to dark grey above and usually white or light brown below. Its most distinguishing feature is having a fine median line of white dots along the underside of the throat. The Wallum Froglet lacks webbing in its feet, toe pads are absent and their pupils are horizontal.

Note: there are other small frog species which are similar in appearance.

Habitat

Wallum Froglets inhabit a range of habitats usually associated with acidic swamps on coastal sandplains including sedgelands, wet heathlands, paperbark swamps and drainage lines as well as within disturbed areas. The Wallum Froglet is generally very cryptic sheltering during the day under leaf litter and debris or in small ditches.

What should you do if you find a Wallum Froglet?

Stop work and tell your environmental manager immediately who will provide advice on what to do next.

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The Green and Golden Bell Frog *Litoria aurea*

The Green and Golden Bell Frog is a nationally and state threatened species. It is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and as endangered under the New South Wales *Threatened Species Conservation Act 1995*.

Photo 1: Adult female Green and Golden Bell Frog, Port Kembla. Copyright © Biosis Pty Ltd 2012

General Appearance

The Green and Golden Bell Frog is recognisable by its large size (up to 10cm) and usually striking colour combination of green and gold. Most individuals appear to have a bright green background colour with irregular large spots and stripes of gold, although sometimes the frogs appear an olive green or even brown colour. The groin is a distinctive turquoise blue colour and the frog has an obvious eardrum (dark circular disc just behind the head).

Note: there are other small green frog species which are similar in appearance although they are much smaller than adult Green and Golden Bell Frog (up to 5cm).

Habitat

Green and Golden Bell Frogs inhabit a range of habitats including creeks, drains, wetlands and dams. The Green and Golden Bell Frog can sometimes be seen basking amongst water plants during sunny weather but is most often encountered sheltering under logs or rocks in the day. It can move long distances and can sometimes be found away from water.

What should you do if you find a Green and Golden Bell Frog?

Stop work and tell your environmental manager immediately who will provide advice on what to do next.

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Threatened Shorebirds: Pied Oystercatcher *Haematopus longirostris* and Little Tern *Sternula albifrons*

The Pied Oystercatcher and the Little Tern are listed as endangered under the New South Wales *Threatened Species Conservation Act* 1995.

Photo 1: Pied Oystercatcher observed in the study area. Photo: Carl Corden. Copyright © Biosis Pty Ltd 2014

Pied Oystercatcher

The Pied Oystercatcher is an easily recognisable wading bird, displaying distinctive black and white colouring and bright scarlet eyes and bill. They are a large bird reaching 50 cm in length, and are usually observed foraging at low tide on intertidal flats of inlets and bays, and open beaches where they also nest. Nesting occurs between August and January and only two to three eggs are laid. In NSW the species is thinly scattered, with fewer than 200 breeding pairs estimated to occur in the state.

Little Tern

The Little Tern is a small, slender, migratory or partly migratory seabird with a pale-grey upper body, white chest and long, deeply forked tail. During breeding (spring-summer) they display a prominent black cap, and yellow bill and legs, which shrinks to a black nape, and black bill and legs during non-breeding.

Little terns are usually observed in sheltered coastal environments, and are often seen foraging for small fish, crustaceans, insects and worms in shallow wasters of channels and estuaries, or in the surf on beaches. They nest in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes.

What should you do if you see a Pied Oystercatcher or Little Tern?

Stop work and tell your environmental manager immediately who will provide advice on what to do next.

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Appendix 7: Key Threatening Process

The demolition works have the potential to impact on biodiversity through the following Key Threatening Process (KTP) listed under the TSC Act, EPBC Act and FM Act. KTPs are considered to adversely affect threatened species, populations and/or communities and habitats. The works specifically relate to the following KTPs (**Table 13**).

Table 13: KTPs relevant to the demolition works

Key threatening process	Potential impacts	Demolition works specifics
Anthropogenic climate change	This KTP is listed under both the TSC and EPBC Acts. The final determination for this KTP lists some impacts as: • affect current fire regimes; • affect the current distribution of most species, populations and communities; and • affect evolutionary processes.	The demolition works may result in green house gas emissions being released into the atmosphere and increase the operation of this KTP. The key potential greenhouse gas emissions from the demolition works are nitrous oxide (N_2O) and carbon dioxide (CO_2). Greenhouse gas emissions would result from increased traffic to, from and within the Site.
Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)	This KTP is listed under both the TSC and EPBC Acts. The final determination for this KTP lists some impacts as: • increasing the prevalence of introduced predators such as the Feral Cat, Red Fox and Wild Dog; • increase competition for resources with indigenous species; • causing changes to the structure, composition of vegetation and increasing land degradation; • reducing the survival and recruitment of threatened plant species and ecological communities; and • increase erosion through the removal of vegetation.	Rabbit scats were observed within the study area. However the demolition works are unlikely to increase the prevalence of Rabbits within the study area and should not contribute to the increase of this KTP.
Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)	This KTP is listed under the TSC Act. The final determination for this KTP lists some impacts as: • invade and displace native plants • decrease diversity in native vegetation communities; and • decrease habitat for native fauna species.	Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata* was recorded within the study area during the investigation. The demolition works have the potential to increase the presence of Bitou Bush during construction and operation of the Project, through the movement of vehicles and increased disturbance within the study area. The demolition works therefore have the potential to cause the spread of this species off site, through wind and water seed

Key threatening process	Potential impacts	Demolition works specifics
		dispersal.
Clearing of native vegetation	This KTP is listed under both the TSC and EPBC Acts. The final determination for this KTP lists some impacts as: • reducing biodiversity; • destruction of habitat resulting in the loss of local populations and species; • increasing fragmentation; • increasing dryland salinity; • increasing degradation of riparian vegetation; • increasing green house gas emissions; • increasing habitat for invasive species; • disruption to ecological function; • loss of leaf litter layer; and • changes to soil biota.	No intact native vegetation would be removed as part of the demolition works. Consequently the demolition works should not contribute to the increase of this KTP.
Invasion and establishment of exotic vines and scramblers	This KTP is listed under the TSC Act. The final determination for this KTP lists some impacts as: • invade and displace native plants; • decrease diversity in native vegetation communities; and • decrease habitat for native fauna species.	The demolition works have the potential to increase the spread and establishment of exotic vines and scramblers through the disturbance of soils and the spread of seeds. Where exotic vines and scramblers are already present within the study area, there is potential for these species to be spread via construction vehicles and natural dispersal into cleared and disturbed areas.
Removal of large woody debris from New South Wales rivers and streams	This KTP is listed under the FM Act. The final determination for this KTP lists some impacts as: • decreases in habitat for benthic plants, algae, invertebrates and microorganisms; • reduction in hiding places (refuges) and resting places out of the main river flow for threatened species; • reduction in spawning sites essential for successful reproduction; • erosion from the reduction in the stabilising effects of large woody debris on stream banks and stream beds; and • reduction in organic enrichment from captured fallen leaves and other detritus.	The demolition works do not involve the removal of large woody debris and therefore this KTP will not apply.
Degradation of native riparian vegetation	This KTP is listed under the FM Act. The final determination for this KTP lists some impacts	The demolition works would not result in the degradation of native riparian vegetation and

Key threatening process	Potential impacts	Demolition works specifics
along New South Wales water courses	as: • increasing the amount of sediment and nutrients reaching streams as runoff, and increasing light penetration of the water body; • reducing the inputs of organic carbon, via leaves, twigs, and branches; • reducing the amount of large woody debris entering the aquatic ecosystem and thereby negatively impacting on habitat and spawning sites of several vulnerable and endangered species listed under the FM Act; and • destabilising river banks.	therefore this KTP does not apply.
Installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams	This KTP is listed under the TSC and FM Acts. The final determination for this KTP lists some impacts as: • decreases in water quality, such as increased turbidity, which negatively affect aquatic ecosystems; • changes in species composition due to altered physical, chemical and biological conditions; • prevention of passage of aquatic biota; and • cold water pollution.	The demolition works do not involve the installation and operation of instream structures and therefore this KTP would not apply.

Appendix G2

Marine Ecology Impact Assessment

Kurnell Refinery – Proposed Demolition

Cooling Water Outlet Demolition– Marine Ecology Assessment

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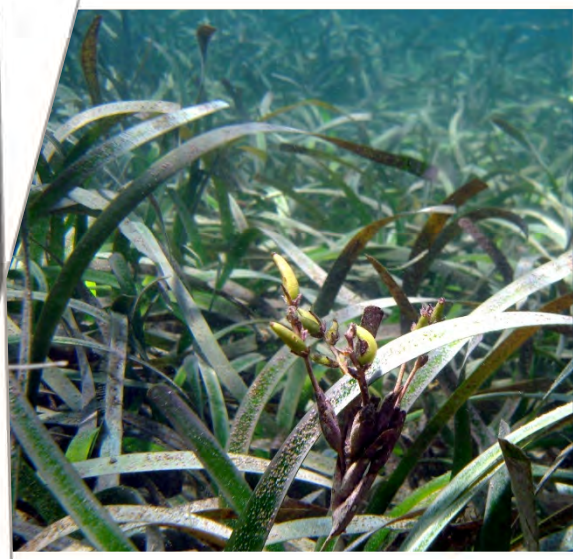

Prepared for
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Executive Summary

Scope

URS Australia Pty Ltd (URS) have been engaged by Caltex Refineries (NSW) Pty Ltd (Caltex) to prepare a Statement of Environmental Effects (SEE) for proposed demolition (the demolition works) of the Kurnell refinery (the Site). The demolition works include the removal of redundant infrastructure such as process units, tanks and pipelines. As part of these works, Caltex are proposing to remove the 1.8 m diameter concrete cooling water outlet pipeline that passes under Prince Charles Parade between two rock groynes on Silver Beach, seaward to a distance of 20 m from the low tide mark. Cardno (NSW/ACT) Pty Ltd (Cardno) have been engaged by URS to specifically investigate the potential effect of the pipeline removal on the marine ecology of the area, especially sea grass habitat.

The specific aims of this report are to:

- Determine current seagrass distribution in the vicinity of the pipeline, from the low tide mark to approximately 20 m seaward, using existing, detailed maps and recent aerial imagery. This includes identifying the distance between the pipeline and the nearest occurrence the endangered ecological seagrass community containing *Posidonia australis,* which has been previously recorded in the area;
- Determine the amount and probable species composition of seagrasses and macroalgae on and in the vicinity of the pipeline;
- Provide advice on mitigation measures to minimise impacts of pipeline removal on seagrass; and
- Assess the likelihood of the impacts of proposed removal of the pipeline on other protected species in Botany Bay including marine mammals and shorebirds.

This assessment relates only to the removal of the cooling water pipeline and therefore considers the following issues identified by NSW Department of Primary Industries (NSW Fisheries) and NSW Environment Protection Agency:

- Accurate description of works;
- Disturbance and suspension of sediments and contaminants due to removal of pipeline;
- Measures to ensure nearby seagrass are not impacted by turbidity from the works;
- Potential for disturbance of acid sulphate soils.

Demolition Methodology

The duration of in-water pipe removal activities is expected to be in the order of two weeks and would be confined to the areas between rock groynes 2 and 3. The pipeline would be excavated with a terrestrial backhoe and may be cut into sections prior to lifting and removal. A gabion would be placed inside the landward end of the remaining, redundant pipe that would remain below the seabed in Botany Bay to stop sediments moving down into the pipe over time. The backhoe would be used to backfill the shallow (2 m) excavation with suitable material to restore the seabed profile. The beach and dune areas would also be rehabilitated using suitable material (refer to **Chapter 18 Coastal Processes** of Main Report of the SEE).

Marine Vegetation in the Vicinity of the Proposed Works

Marine vegetation in the vicinity of the pipeline removal works was interpreted using details from previous, field-based mapping overlaid with recent aerial photographs. Recent aerial photographs of the intertidal and shallow subtidal areas show that the obvert of the pipe is covered with marine algae. This algae includes the kelp *Ecklonia radiata* which would be lost as the pipe sections are removed. Wrack (dislodged algae and seagrass) is present within the groyne compartment but requires no specific mitigative measures. Approximately 21.5 m to the east of the pipeline removal works are patches of medium to high density strapweed (*Posidonia australis*) mixed with patches of low to medium density eelgrass *Zostera capricorni* and paddleweed *Halophila ovalis*).

Patches of seagrass consisting of low to medium density *Z. capricorni* and *H. ovali*s are located more than 40 m to the north and north-west of the approximate extent of pipeline removal works. Two additional patches of mixed *P. australis*, *Z. capricorni* and *H. ovalis* are located more than 40 m to the northwest of the approximate extent of pipeline removal works.

Assessment of Impacts on Seagrass

Seagrasses in the vicinity of the works have potential to be impacted if elevated levels of turbidity caused by the proposed pipeline removal persisted for long periods of time (greater than 2 months during growing season). Nearby seagrasses would be adequately protected from increased turbidity due to sediment suspension if silt curtains are installed seaward of the area where the pipeline would be removed. Silt curtains have been used successfully in the past on a number of similar nearshore projects and have been shown to be effective in mitigating effects of increased turbidity (refer to **Appendix H Coastal Processes** of this SEE).

A small amount of kelp would be removed with the pipe. The loss, estimated at no more than 20 m^2, is considered insignificant with respect to the amount of algae present along the southern shoreline of Botany Bay.

Measures would need to be taken to ensure that demolition equipment is free of fragments of the invasive algae *Caulerpa taxifolia*. The pest algae can establish from small fragments and, if established, can outcompete native seagrass species.

Acid sulphate soils have been recorded in the area of the proposed pipeline removal works but are classified in the low risk category (Class 5). This is due to the mobile nature of these recently deposited sediments which have low potential to cause significant acidification of estuarine waters, and hence little to no potential to damage seagrass or fish in the area.

Tributyltin (TBT) is present at elevated levels in sediments near the Kurnell Wharf but is absent or at negligible levels in the nearshore environment (URS 2013). The suspension of nearshore sediments as a result of the pipeline removal works, together with the use of silt curtains present little to no likelihood of impacts on oysters and marine snails in the intertidal and shallow subtidal zones due to dispersion of TBT.

The opening of the cut off pipe 20 m seaward from the low tide mark would be blocked using a gabion and the trench backfilled with sandy sediment with similar characteristics as surrounding sand. This would prevent sand from being sucked back into the pipe and prevent slumping of sediments which could otherwise potentially destabilise seagrass patches.

Filling the excavation would be completed while silt curtains are in place, with equipment accessing the works area from the beach. Back filling is expected to take less than one week, further reducing the risk of adverse effects on seagrass due to increased turbidity.

Assessment of Potential Impacts on Protected Areas, Species, Populations and Communities

Formal assessments against Significant Impact Criteria or Assessments of Significance were not undertaken as part of this assessment, as no species, populations or endangered communities are considered to have a high likelihood of being impacted on by the proposed cooling water outlet pipeline removal works from Silver Beach and Botany Bay with the implementation of the planned mitigation measures. The proposed pipeline removal works are considered to present a low to negligible risk to protected areas, communities, populations and species because:

- Works would be in very shallow water with sandy substratum making the habitat unlikely for the vast majority of protected species such as seabirds, whales, dolphins, sharks etc.;
- Works would be of short duration, with the expected demolition period of two weeks unlikely to disrupt breeding migrations, block access to significant feeding grounds or fragment populations of migratory species;
- Works would be staged from land, eliminating potential spills and leaks from boats, in the context of an area with significant existing boat traffic;
- Short-term disturbance to protected shorebirds using the groynes as foraging or roosting habitat would be limited to groynes 2 and 3 and alternative, suitable habitat occurs along Silver Beach (other

groynes) and along the intertidal zone of Kamay Botany Bay National Park to the east of Kurnell Wharf;

- Formal assessment of potential impacts on protected areas, species and communities undertaken for works of greater duration and involving higher levels of sediment and shoreline disturbance have concluded that impacts on these protected ecological components were unlikely. Subsequent monitoring of such works have demonstrated no impacts to protected species and communities associated with much larger projects of longer duration (URS 2013, Cardno Ecology Lab 2014).

Conclusion

The proposed works to remove a section of cooling outlet pipeline in the intertidal and subtidal habitats of Silver Beach are unlikely to impact on nearby patches seagrasses given the implementation of the key mitigation measure, the use of silt curtains. The proposed pipeline removal works are unlikely to impact on protected species, populations and communities given they would be of short duration, limited in scope and confined between rock groynes.

Glossary

Term or Acronym	Definition
Estuary	An enclosed or semi-enclosed body of water having an open or intermittently open connection to coastal waters and in which water levels vary in a periodic fashion in response to ocean tides.
Foreshore	The area of shore between low and high tide marks and land adjacent thereto.
Groyne	Rock structure usually built approximately perpendicular to the shoreline intended to retard longshore drift of sediments and hence reduce foreshore erosion.
Intertidal	Pertaining to those areas of land covered by water at high tide, but exposed at low tide, e.g. intertidal habitat.
Littoral Zone	An area of the coastline in which sediment movement by wave, current and wind action is prevalent.
Littoral Drift Processes	Wave, current and wind processes that facilitate the transport of water and sediments along a shoreline.
Marine Sediments	Sediments in sea and estuarine areas that have a marine origin.
NTU	Nephelometric Turbidity Units, one estimate of turbidity
Obvert	Top of a culvert
Spring Tides	Tides with the greatest range in a monthly cycle, which occur when the sun, moon and earth are in alignment (the gravitational effects of the moon and sun act in concert on the ocean)
SS	Suspended Solids, one estimate of turbidity
Tides	The regular rise and fall in sea level in response to the gravitational attraction of the Sun, Moon and Earth.
TBT	Tributyltin, an organic compound present in the marine environment due to its use as an antifoulants.
Turbidity	A measure of the ability of water to absorb light.

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Tables

Figures

1 Introduction

URS Australia Pty Ltd (URS) have been engaged by Caltex Refineries (NSW) Pty Ltd (Caltex) to prepare a Statement of Environmental Effects (SEE) for proposed demolition (the demolition works) of the Kurnell refinery (the Site). The demolition works include the removal of redundant infrastructure such as process units, tanks and pipelines (discussed in detail in **Chapter 4 Proposed Modification** of the Main Report of the SEE). The location of the works is presented on **Figure 1-1**.

Cardno (NSW/ACT) Pty Ltd (Cardno) have been engaged by URS to specifically investigate the demolition works that relate to the removal of the cooling water outlet pipeline that passes under Silver Beach and discharges to Botany Bay. The pipeline is 1.8m in diameter and made from reinforced concrete. Caltex are proposing to remove the pipeline from under Silver Beach up to 20 m seaward from the low tide mark (**Figure 1-2**). Beyond this point the seaward part of the cooling water outlet pipeline would be left in situ. A gabion would be installed at the landward end of the remaining pipeline to prevent water and sediment ingress.

This investigation addresses the potential effect of the pipeline removal on the marine ecology of the area, especially sea grass habitat, and describes the data, methods of investigation, outcomes and mitigation advice related to this task.

The specific aims of this report are to:

- Determine current seagrass distribution in the vicinity of the pipeline, from the low tide mark to approximately 20 m seaward, using existing, detailed maps and recent aerial imagery. This would include identifying the distance between the pipeline and the nearest occurrence of the endangered ecological seagrass community containing *Posidonia australis,* (which has been recorded previously in the area);
- Determine the amount and probable species composition of seagrasses and macroalgae on and in the vicinity of the pipeline;
- Provide advice on mitigation measures to minimise impacts of pipeline removal on seagrass; and
- Assess the likelihood of the impacts of proposed removal of the pipeline on other protected species in Botany Bay including marine mammals and shorebirds.

It should be noted that a separate assessment has been undertaken for terrestrial ecology (Biosis 2014). This assessment is provided in **Appendix G1** of this SEE and focusses on the remainder of the area where the demolition works would occur (i.e. the area above the low tide mark in Botany Bay, and the remainder of the demolition works area (refer to **Figure 1-1**)).

1.1 Consultation

Consultation with NSW Department of Primary Industries (Fisheries) (NSW Fisheries) indicates a priority for avoidance and/or mitigation of impacts on seagrass in the area (refer to **Chapter 6 Consultation** of the Main Report of the SEE). NSW Fisheries indicated that the assessment of impacts on marine ecology should include:

- an accurate description of the works - especially in describing the areas of excavation below the mean high water mark, spoil deposition and the type of any material to be used for infill below the mean high water mark;
- consideration of appropriate erosion and sedimentation measures to ensure that nearby seagrasses are not impacted by turbidity from these works; and
- an assessment of potential acid sulphate soil issues and mitigation measures.

Consultation with NSW Environmental Protection Agency (EPA) (refer to **Chapter 6 Consultation** of the Main Report of the SEE) identified potential issues that should be considered, including:

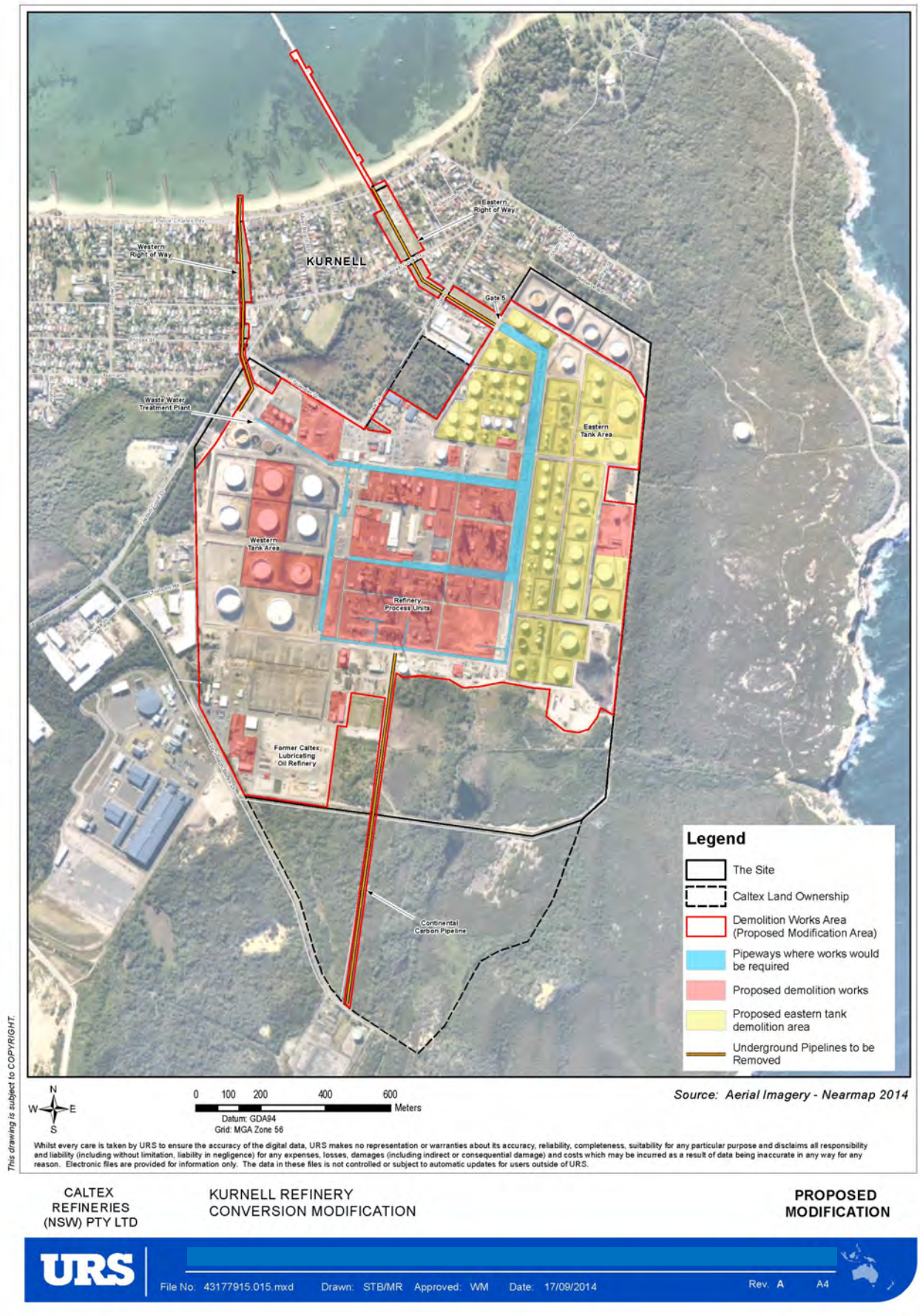
- Residual spills/leaks from redundant product pipelines on to land and water;

- Potentially offensive odours from residual pipeline products;
- Contaminated land from old and potentially new spills/leaks;
- Disturbance and suspension of sediments/contaminants within the water of Botany Bay. This would primarily be associated with the excavation, cutting, extraction and lifting of the cooling water outlet pipeline for up to 20 m seaward from the low tide mark into Botany Bay;
- Sedimentation/contaminated water runoff from the barge associated with the removal of the cooling water outlet pipeline; and
- Acid sulphate soils are known to exist within the Kurnell area and sediments of Botany Bay. This issue should also be taken into consideration for all excavations and rehabilitation activities.

This assessment relates only to the removal of the cooling water outlet pipeline from under Silver Beach and Botany Bay and therefore considers the following of the issues identified by DPI (NSW Fisheries) and EPA:

- Accurate description of works;
- Disturbance and suspension of sediments and contaminants due to removal of pipeline;
- Measures to ensure nearby seagrass are not impacted by turbidity from the works;
- Potential for disturbance of acid sulphate soils.

Figure 1-1 Site of the proposed demolition works (Source: URS 2014)



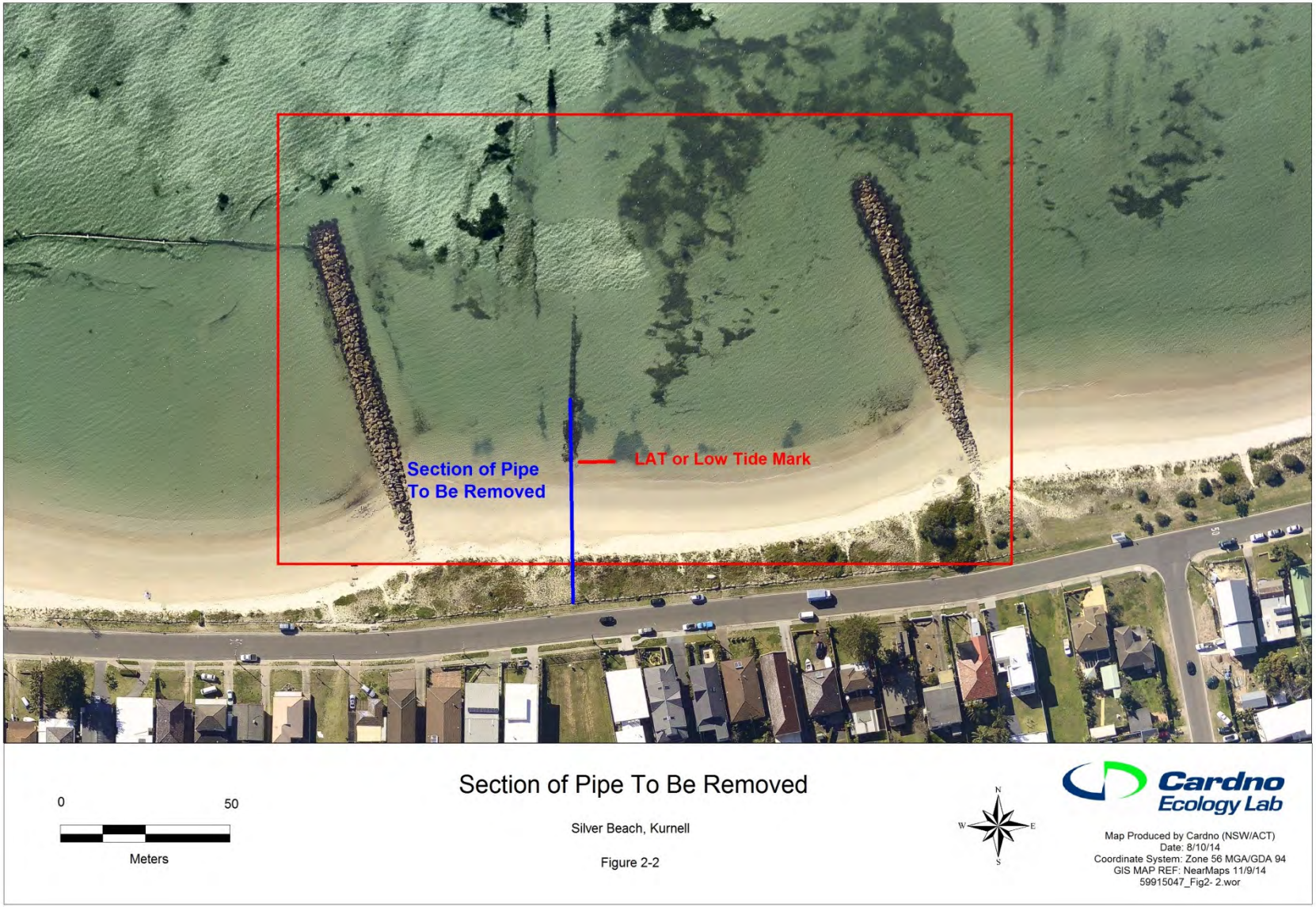
2 Silver Beach

The area which is the subject of this assessment is on and seaward of Silver Beach, Kurnell on the southern shoreline of Botany Bay **(Figure 2-1)**. The buried cooling water outlet pipeline extends seaward from the Western Right of Way (Western ROW) into Botany Bay for a distance of approximately 600 m. The intertidal and subtidal portions of the pipeline are located between rock groynes two and three (counting westward from the Kurnell Wharf (**Figure 2-2**). These groynes were constructed to prevent longshore sand transport and protect Prince Charles Parade from shoreline erosion. The pipeline lies only a short distance below the seabed, as evidenced by the irregular dark patches of marine algae (kelp) that form a line that is clearly visible in **Figure 2-2**. The length of pipeline to be removed seaward of Prince Charles Parade is about 65 m, of which about 20 m is located below the low tide mark.

The intertidal and subtidal waters offshore from Silver Beach contain the largest beds of seagrass in Botany Bay (West et al 1985) which have diminished over the last 50 years (Larkum and West 1990). The largest of these is located to the west of the area of the proposed demolition works. Patches of three species of seagrass occur seaward of the point at which the pipeline is proposed to be removed, including the endangered ecological community containing the strapweed *Posidonia australis* (Cardno Ecology Lab 2011). *Posidonia australis* in Botany Bay was listed as an ecologically endangered community in 2010 (NSW Fisheries 2010). Refer to **Section 4** and **Figure 4-1** for further detail.

Figure 2-1 Overview of the Study Area

Figure 2-2 Pipe section to be removed



3 The Outlet Pipeline Demolition Work

3.1 Proposed Demolition Works

The cooling water outlet would be removed from the Site, the Western ROW; the roads under which it passes in Kurnell, Silver Beach and part of Botany Bay (refer to **Figures 1-1 and 2-2)**. This pipeline is 1.8m in diameter and is made of reinforced concrete.

Relevant to this assessment, the cooling water outfall would be excavated and removed from the north Prince Charles Parade to 20 m beyond the low tide mark. The remaining section of the pipe in Botany Bay would be left in situ.

The pipeline would be excavated with a terrestrial backhoe where it is covered with sediment/sand. The pipeline may be cut, but ideally be dismantled at the original construction joints prior to lifting and removal. Where the pipeline needs to be cut into sections, excavations may be deeper (i.e. as deep as the pipe) than elsewhere (possibly only half the pipe height).

Once dismantled or cut, sections of the pipe would be lifted out of the sea bed. It is likely that the sections of pipe will be lifted using a backhoe with a lifting attachment. It is likely that this would be completed with a terrestrial backhoe due to the shallow bathymetry and the proximity of the seagrass beds.

The excavated sections of pipe would be moved to the Western ROW for storage (if required) prior to being loaded onto a truck and transported to the main Site.

The removal of the pipe would require suitable backfill material to be sourced and brought to Silver Beach to return the dunes, beach, intertidal and sub tidal areas to grade. The beach and dune areas would also be rehabilitated following the works (refer to **Chapter 18 Coastal Processes** of Main Report of the SEE).

A gabion would be placed inside the landward end of the remaining, redundant pipe that would remain below the seabed in Botany Bay to stop sediments moving down into the pipe over time.

Silt curtains are likely to be required around the works area to ensure that the increased amount of sediment in the water column does not adversely affect the nearby seagrass communities.

The works at Silver Beach would be completed before the rest of the cooling water outlet pipeline is removed from the Western ROW.

3.2 Assumptions Relevant to Assessment of Impacts on Aquatic Ecology

The assessment of impacts on seagrass and threatened species, communities and populations is based on the following assumptions:

- The description of seagrass in the immediate area of proposed pipeline removal (between groynes 2 and 3) is based on detailed, field-based mapping of the area completed in April 2011 (Cardno Ecology Lab 2011). The presumptive map of seagrass distribution (**Figure 4-1**) was prepared by overlaying digital seagrass patch boundaries on to a recent aerial photograph (11 September 2014) and interpreting current seagrass species and boundaries. This approach to identifying seagrasses in the vicinity of the proposed works is considered adequate given the high correlation of boundaries of seagrass patches in a series of detailed maps from 2008 to 2011 (Cardno Ecology Lab 2011) and the apparent boundaries in the recent aerial photograph;
- The duration of works to remove the 20 m section of pipe is expected to be a maximum of 2 weeks;
- The maximum depth of water over the section of pipeline to be removed would typically vary from 0.5 m to 2.5 m due to the bathymetry of the seabed and typical tidal heights;
- Silt curtains would be used during demolition works to isolate nearby seagrass beds from temporary effects of increased turbidity.

The assessment of impacts on threatened species, communities and populations has been completed under the assumption that silt curtains would be use to mitigate impacts.

4 Description of Seagrass in the Vicinity of the Cooling Water Outlet

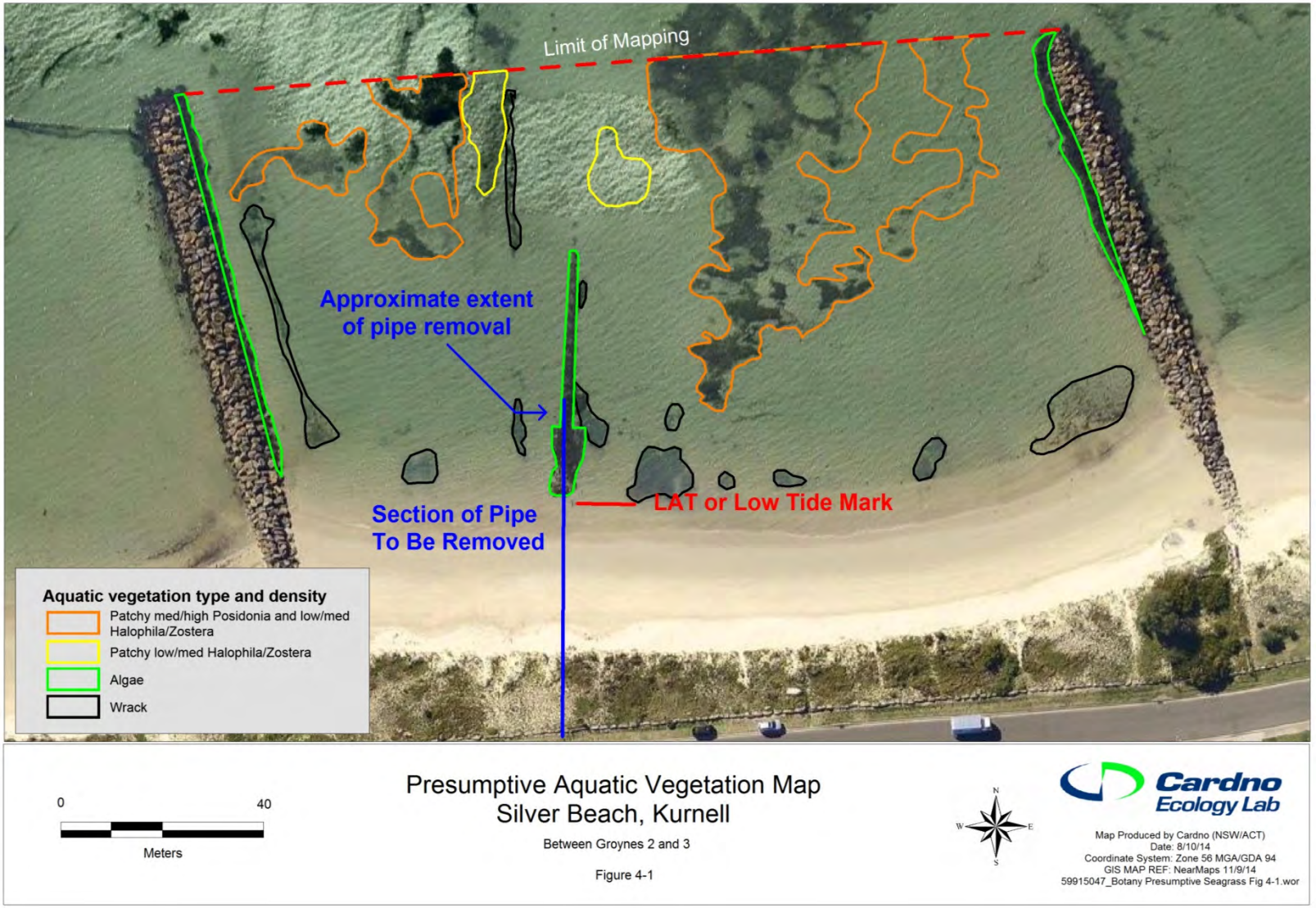
The obvert of the pipe is covered with marine algae, including the kelp *Ecklonia radiata* (shown as green polygons in **Figure 4-1**). The dark areas visible on recent aerial photographs in the intertidal and shallow subtidal areas shown as "Wrack" on **Figure 4-1** (black polygons) are composed of dislodged vegetation (algae and seagrass) which moves with the tide and nearshore currents within the groyne compartment. It is likely that these would have changed distribution by the time the works commence, however they require no specific consideration within the context of seagrass protection related to the removal of the cooling water outlet.

To the east of the approximate extent of pipeline removal (**Figure 4-1**) there are patches of medium to high density strapweed *Posidonia australis* mixed with patches of low to medium density eelgrass *Zostera capricorni* and paddleweed *Halophila ovalis* (orange polygon in **Figure 4-1**). The distance between the approximate extent of pipeline removal and the patchy seagrass is approximately 21.5 m.

Patches of seagrass consisting of low to medium density *Z. capricorni* and *H. ovalis* are located more than 40 m to the north and north-west of the approximate extent of pipeline removal (shown as yellow polygons in **Figure 4-1**). Two additional patches of mixed *P. australis, Z. capricorni* and *H. ovalis* are located more than 40 m to the northwest of the approximate extent of pipeline removal works (shown as orange polygons in **Figure 4-1**).

The main, contiguous beds of seagrass are located more than 500 m to the west of the pipeline removal works and are separated by four intervening groyne structures. The second contiguous seagrass bed is located approximately 400 m to the east of the Kurnell Wharf.

Figure 4-1 Presumptive aquatic vegetation map, Silver Beach Kurnell



5 Assessment of Potential Impacts on Seagrass

5.1 Protection of seagrass

Seagrasses in the vicinity of the works have potential to be impacted if elevated levels of turbidity caused by the propose pipe removal persisted for long periods of time (greater than 2 months during growing season). Nearby seagrasses would be adequately protected from increased turbidity as a result of increased sediment suspension if silt curtains are installed seaward of the approximate extent of the pipeline removal works. Options include either one long or two shorter curtains isolating the closest patches of seagrass from disturbance due to works.

It is recommended that curtain(s) be anchored at the pipeline, approximately 50 m seaward of the pipeline removal works, and extend to the west and be anchored on Groyne 3. The silt curtain to the east would be most effective if it was anchored on the beach. Silt curtains have been used successfully in the past on a number of similar nearshore projects and have been shown to be effective in mitigating effects of increased turbidity.

A small amount of kelp would be removed with the pipe. The loss, estimated at no more than 20 m^2,is considered insignificant with respect to the amount of algae present along the southern shoreline.

Measures would be taken to ensure that demolition equipment used in the water column is appropriately prepared, checked and cleaned to avoid potential pollution impacts. Particularly, prior to entering the water, any demolition equipment would be also inspected to ensure fragments of the invasive algae *Caulerpa taxifolia* are not present. The algae can establish from small fragments and, if established, can outcompete native seagrass species. Spill kits should be readily available.

5.2 Potential Acid Sulphate Soil and Sediment-bound Contaminants

Acid sulphate soils have been recorded and classified by Sutherland Shire Council in the immediate area of the proposed pipeline removal works (**Figure 5-1**). The sand close to shore is classified in the low risk category (Class 5). This is due to the mobile nature of these recently deposited sediments which have low potential to cause significant acidification of estuarine waters, and hence little to no potential to damage seagrass or fish in the area.

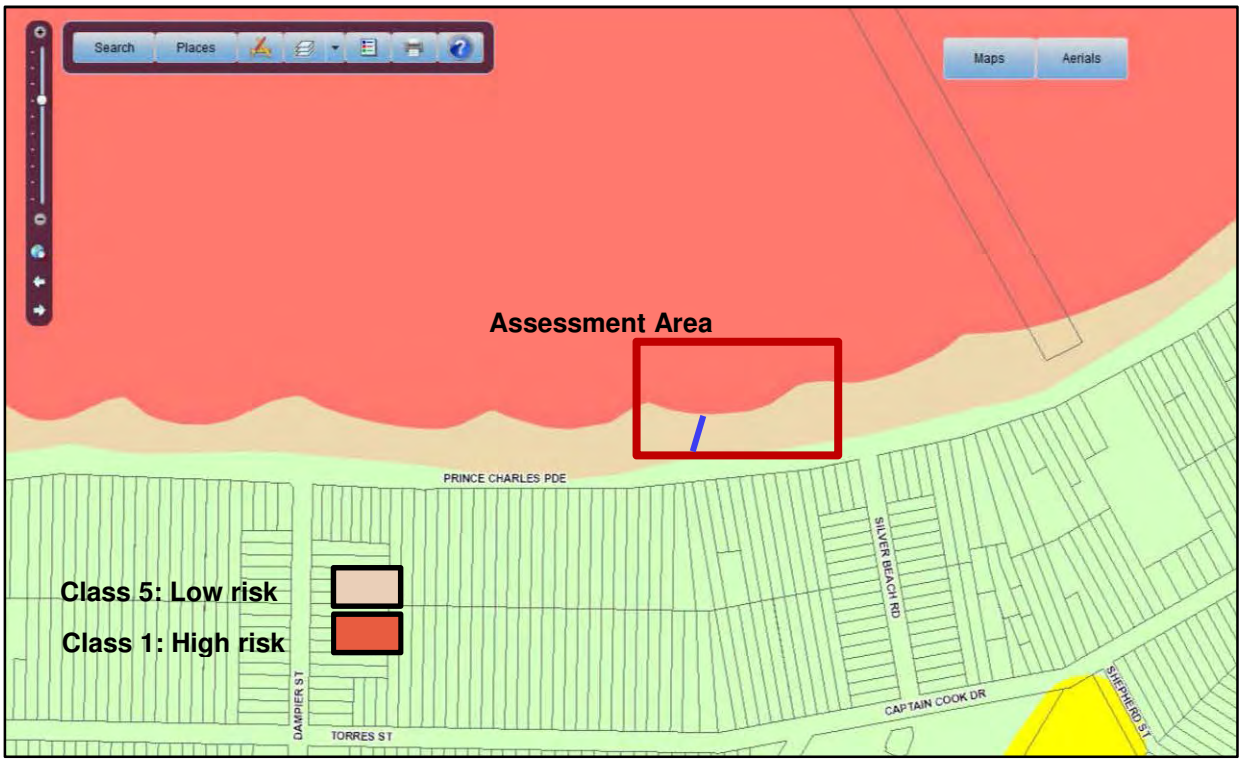
Recent investigations of tributyltin (TBT) in sediments near the Kurnell Wharf have identified hotspots in their concentration, but none or very low levels in the nearshore environment, consistent with the areas used by large vessels (URS 2013). The suspension of nearshore sediments as a result of the pipeline removal works, together with the use of silt curtains present little to no likelihood of impacts on oysters and marine snails in the intertidal and shallow subtidal zones due to dispersion of TBT. Refer also to **Appendix C Human Health and Ecological Risk Assessment** of the SEE.

5.3 Rehabilitation of Excavated Site

The opening of the remaining cooling water outlet pipe 20 m seaward from the low tide mark would be blocked using a gabion and the trench backfilled with sandy sediment with similar characteristics as the surrounding sand. This would prevent sand from being sucked back into the pipe and prevent slumping of sediments which could otherwise potentially destabilise seagrass patches.

Filling the excavation would be completed while silt curtains are in place, with equipment accessing the area from the beach. Due to the relatively small volume of sediment required it is anticipated that back filling would take less than one week, further reducing the risk of adverse effects on seagrass due to increased turbidity. Optimal timing for filling activities would be during spring tide phases when low tide occurs late morning to early afternoon.

Figure 5-1 **Map of potential Acid Sulphate soil in the vicinity of the proposed pipeline removal.** Blue line indicates approximate extent of pipeline removal. *Source: Sutherland Shire Council website Mapping Tools, Accessed October 2014.*



6 Assessment of Potential Impacts on Protected Aquatic Species and Ecological Communities

A range of protected areas, marine habitats, flora and fauna occur in the broad area of the proposed pipeline removal works (**Table 6-1**). These ecological components have varying levels of protection under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC) Act, NSW Threatened Species Conservation (TSC) Act and NSW Fisheries Management (FM) Act. They include Towra Point Nature Reserve, a designated Ramsar wetland, the ecologically endangered community *Posidonia australis* and a number of migratory and threatened species.

Within the aquatic environment the proposed pipeline removal works are considered to present a low to negligible risk to protected habitats, communities and species for the following reasons:

- The proposed pipeline removal works would be in very shallow water with sandy substratum making the habitat unlikely for the vast majority of protected species such as seabirds, marine mammals, sharks etc.;
- The works would be of short duration, with the expected construction period of two weeks unlikely to disrupt breeding migrations, block access to significant feeding grounds or fragment populations of migratory species;
- The works would be staged from land, eliminating potential spills and leaks from boats;
- Short-term disturbance to protected shorebirds using the groynes as foraging or roosting habitat would be limited to groynes 2 and 3 and alternative, suitable habitat occurs along Silver Beach (other groynes) and along the intertidal zone of Kamay Botany Bay National Park to the east of Kurnell Wharf;
- Formal assessment of potential impacts on protected areas, species and communities undertaken for works of greater duration and involving higher levels of sediment and shoreline disturbance have concluded that impacts on these protected ecological components were unlikely. Subsequent monitoring of such works have demonstrated no impacts to protected species and communities associated with much larger projects of longer duration (URS 2013, Cardno Ecology Lab 2014).

Taking the above considerations together, no formal assessments against Significant Impact Criteria or Assessments of Significance have been undertaken as part of this assessment, as no species, populations or endangered communities are considered to have a high likelihood of being impacted on by the proposed pipeline removal works with the implementation of the planned mitigation measures.

Table 6-1 Protected ecological components and justification for lack of impact by the pipeline removal

Ecological Component	Legislation	Justification
Towra Point Nature Reserve (Ramsar Wetland)	EPBC	Distance from minor works
Towra Point Aquatic Reserve	NSW DPI (Fisheries)	Distance from minor works
Black Cod (*Epinephelus daemelii*)	TSC, EPBC	Estuarine intertidal habitat not suitable for juvenile fish
Grey Nurse Shark (*Carcharias taurus*)	TSC, EPBC	Shallow water
White Bellied Sea-Eagle (*Haliaeetus leucogaster*) and Little Tern (*Sterna albifrons*)	EPBC	Works of short duration
Dugong (*Dugong dugon*)	TSC, EPBC	Not likely to occur, unsuitable habitat
New Zealand Fur-seal (*Arctocephalus forsteri*)	EPBC	Not likely to occur, unsuitable habitat
Australian Fur-seal (*Arctocephalus pusillus doriferus*)	EPBC	Not likely to occur, unsuitable habitat

Ecological Component	Legislation	Justification
Southern Right Whale (*Eubalaena australis*)	EPBC	Not likely to occur, unsuitable habitat
Humpback Whale (*Megaptera novaeangliae*)	EPBC	Not likely to occur, unsuitable habitat
Migratory species Green Turtle (*Chelonia mydas*) Blue-billed Duck (*Oxyura australis*) Wandering Albatross (*Diomedea exulans*) Shy Albatross (*Thalassarche cauta*) Black-browed Albatross (*Thalassarche melanophris*) Flesh-footed Shearwater (*Ardenna carneipes*) Southern Giant Petrel (*Macronectes giganteus*) Northern Giant-Petrel *(Macronectes halli)* Gould's Petrel *(Pterodroma leucoptera leucoptera*) Kermadec Petrel (west Pacific subspecies) (*Pterodroma neglecta neglecta*) Black-winged Petrel (*Pterodroma nigripennis*) Providence Petrel (*Pterodroma solanderi*) Little Shearwater (*Puffinus assimilis*) Australasian Bittern (*Botaurus poiciloptilus*) Eastern Osprey (*Pandion cristatus*) Sooty Oystercatcher (*Haematopus fuliginosus*) Pied Oystercatcher (*Haematopus longirostris*) Greater Sand-plover (*Charadrius leschenaultii*) Lesser Sand-plover (*Charadrius mongolus*) Sanderling (*Calidris alba*) Curlew Sandpiper (*Calidris ferruginea*) Great Knot (*Calidris tenuirostris*) Broad-billed Sandpiper (*Limicola falcinellus*) Black-tailed Godwit (*Limosa limosa*) Terek Sandpiper (*Xenus cinereus*) White Tern (*Gygis alba*) Sooty Tern (*Onychoprion fuscata*) Grey Ternlet (*Procelsterna cerulean*) Little Tern (*Sternula albifrons*)	EPBC	Minor works of short duration of short duration undertaken over small spatial scale with respect to occurrence of species
Posidonia australis in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie	FM Act	Mitigation measures adequate to protect patches of community in vicinity of proposed works as presented in **Section 5.1**.

7 Summary

The proposed works to remove a section of cooling outlet pipeline in the intertidal and subtidal habitats of Silver Beach are unlikely to impact on nearby patches seagrasses given the implementation of the key mitigation measure, the use of silt curtains. The proposed pipeline removal works are unlikely to impact on protected areas, species, populations and communities given they would be of short duration, limited in scope and confined between rock groynes.

8 References

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