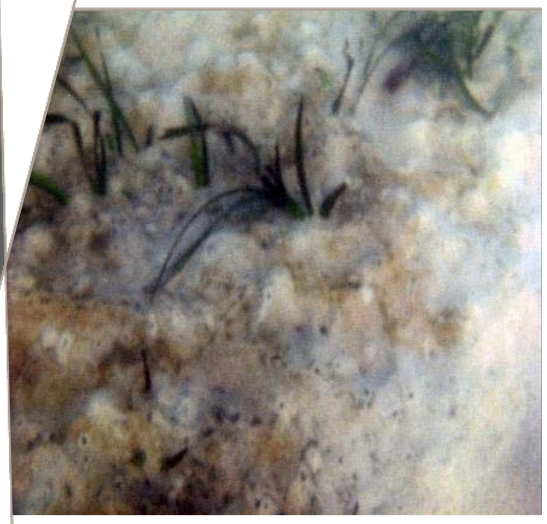
Port Botany Foreshore Beach Groynes

Pre-Construction Seagrass Survey

59916193



Prepared for
Ward Civil

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Shaping the Future

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Executive Summary

Ward Civil Pty Ltd (Ward Civil), on behalf of the Port Authority of New South Wales, propose to install several groyne structures along Foreshore Beach to protect against beach erosion. The proposal includes the construction of three low crested, primarily submerged, groynes along Foreshore Beach, with the aim of significantly decreasing the erosive forces that currently remove sediment from the beach and deposit it to the north and offshore from the beach. The design should provide a hydrological environment that allows recovery of the last remaining beds of seagrass along the northern shoreline of Botany Bay. However, these structures could also have several negative impacts on seagrasses during installation if construction is not properly managed. Potential impacts include direct impacts due to displacement of seagrass under the groyne footprint and damage / loss due to operation of plant equipment, and indirect effects due to, for example, temporary increases in turbidity and sedimentation following mobilisation of sediments during construction.

Ward Civil have requested that Cardno undertake a Pre-Construction Seagrass Survey at Foreshore Beach. The seagrass survey was a requirement of Ward Civil's contract with the Port Authority of New South Wales to install the groynes and was used to:

i. Determine if seagrass transplanting is required and if so, identify suitable areas for seagrass transplanting outside the construction zone;

ii. Determine if any *Posidonia australis* seagrass is located within 500 mm and within 1,000 mm of the footprint of the groynes;

iii. Identify exact locations for the navigational marker piles that minimise impacts on existing seagrass;

iv. Assess whether it is feasible, and the likelihood of success, of isolating any large beds of *P. australis* seagrass by surrounding them with a silt curtain and designating the isolated area as a no-go zone for construction vessels;

v. Determine the preferred position for barge working positions, in order to minimise any impact on *P. australis* or *Zostera capriconi* seagrass at low tide; and

vi. Determine appropriate jackup barge leg positions in order to minimise impacts on known or observable seagrass zones.

Cardno's divers undertook the seagrass survey at Foreshore Beach and surrounds on 23 and 26 June 2016 and used GIS software (MapInfo Pro 15.2) to combine DGPS coordinates of seagrass patches with aerial imagery to identify any areas of seagrass, particularly *P. australis*, which were within 500 to 1000 mm of the footprint of the proposed groynes. The survey indicated a reduced extent and density of seagrass at Foreshore Beach generally from what had been observed in previous studies. The main findings of the survey were:

- The two patches of *P. australis* identified at Foreshore Beach were not within 1,000 mm of the proposed groyne structures and transplanting is not required. One patch of *P. australis*, however, is sufficiently close to the proposed middle groyne structure (i.e. approximately 5 m) so that modification of the 'Barge Working Zone' is required to minimise the potential for harm (see below).
- A small patch (i.e. 0.6 m^2) of *Zostera capricorni* was observed well away (65 m) from the nearest proposed groyne location and is not considered to require specific control measures in addition to the general controls for construction vessels prescribed below.
- A very small area of *Halophila* spp. would overlap with the Working Zone for the proposed eastern groyne. However, given the ephemeral nature of *Halophila* spp., it's relatively rapid colonisation and growth rate and it's abundance locally and regionally, specific controls, such as modification of the location of the Working Zone, are not considered necessary.

Recommended Barge Working Zones

It is understood that construction vessels require a 10 m wide work zone on both sides of the footprints of the proposed groynes as well as a 20 m wide x 30 m long work zone seaward from the ends of each groyne (see **Figure 3-1** in report).

The Working Zone for the middle groyne has been modified so that it does not encompass a patch of *P. australis*. In the vicinity of this patch of *P. australis,* barges would be required to work only on the eastern side of the groyne during construction.

Recommended No Go Zones

Two 'No Go Zones' have been identified to minimise the potential for damage to remnant patches of the seagrass *P. australis*, which form part of a threatened population in Botany Bay. These areas are between the western and middle groynes (see **Figure 3-1** in report). The construction Working Zone for the middle groyne has been modified specifically to avoid one of these two patches of seagrass which is located ~ 5 m from the groyne.

It is recommended that silt curtains are placed at 2-3 m from the edges of the two patches of *P. australis* to protect them from smothering and sedimentation arising from construction activities and from light attenuation due to elevated turbidity. It is also recommended that surface maker floats be deployed throughout construction to provide a visual aid and help vessel operators avoid these locations.

Recommended No Anchoring Zones

'No Anchoring Zones' have been marked in **Figure 3-1** of the report. These provide an approximate 15 m buffer area around all seagrass patches at Foreshore Beach and are recommended as a measure to avoid anchor damage, including anchor chain scour and anchor-drag. These zones also apply to the positioning of jackup barge legs.

Recommended Locations for Navigational Markers

The proposed cardinal and special markers locations (see **Figure 3-1** in report) in the middle and seaward end points of the groynes are suitable as that are not located on seagrass

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1 Introduction

1.1 Background

Foreshore Beach, located along the northern shoreline between Sydney Airport and Port Botany, has been reduced significantly in length since its creation as a part of the original construction of Port Botany in the late 1970s. This has followed foreshore developments including the third runway for Kingsford Smith (Sydney) Airport and associated realignment of the Mill Stream, and construction of the parallel airport runway in the early 1990s. A recent expansion of Port Botany and development of a public boat ramp and creation of a flushing channel for the rehabilitated Penrhyn Estuary (The Port Botany Expansion Project, see below) further reduced beach habitat to the southeast of Foreshore Beach. At just over 500 m long, Foreshore Beach is now approximately one third as long as it was in 2007, and approximately one-tenth of its length prior to the development of the airport runways. It represents some of the only beach habitat remaining in the northern shoreline of Botany Bay.

Sydney Ports Corporation (now Port Authority of New South Wales) completed construction of the Port Botany Expansion Project in 2013. This included rehabilitation of the nearby Penrhyn Estuary to enhance the existing intertidal habitat and to expand the estuary as a long-term habitat for migratory shorebirds. Extensive dredging and modifications were required in Penrhyn Estuary and along nearby Foreshore Beach in Botany Bay. Prior to construction, monitoring works carried out in 2008 indicated that approximately 317 sq. m of seagrass (including *Zostera capricorni*, *Halophila* spp. and *Posidonia australis*) would be lost due to land reclamation, boat ramp construction and dredging works associated with the project. Changes in seagrass habitat were monitored during the construction phase and are now being monitored post-construction by Cardno in accordance with the Penrhyn Estuary Habitat Enhancement Plan (PEHEP) (Sydney Ports Corporation 2007). Monitoring includes measurement of changes in seagrass distribution and condition. Cardno (NSW/ACT) Pty Ltd (Cardno) has completed several seagrass surveys and reports as part of the PEHEP (Cardno 2014, 2015a). The most recent of which, completed during March and April 2015, indicated several patches of *Z. capricorni*, *Halophila* spp. and *P. australis* present along Foreshore Beach. All seagrass is protected under New South Wales State legislation and, in addition, *P. australis* in six locations within New South Wales (Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie) have been listed as endangered populations under the Threatened Species Schedules of the *Fisheries Management Act 1994* (FM Act). The *P. australis* seagrass meadows of the Manning-Hawkesbury ecoregion', which includes Botany Bay, is also listed as an endangered ecological community under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), however, this listing does not apply to *P. australis* at Foreshore Beach given the consultation guide (DOE 2014). According to DOE (2014), an ecological community of *P. australis* is defined as a meadow, dominated by *Posidonia,* which is greater than 1 ha in size. The *P. australis* off Foreshore Beach does not meet this guideline definition (Cardno 2014, 2015a).

Ward Civil Pty Ltd (Ward Civil), on behalf of the Port Authority of New South Wales, propose to install several groyne structures along Foreshore Beach to protect against beach erosion. The proposal includes the construction of three low crested, primarily submerged, groynes along Foreshore Beach, with the aim of significantly decreasing the erosive forces that currently remove sediment from the beach and deposit it to the north and offshore of the beach. The two outside groynes would incorporate and extend seaward from two existing stormwater outlets. The design should provide a hydrological environment that allows recovery of the last remaining beds of seagrass along the northern shoreline of Botany Bay. However, these structures could also have several negative impacts on adjacent seagrasses during installation if construction is not properly managed. Potential impacts include direct impacts due to displacement of seagrass under the groyne footprint and damage / loss due to operation of plant equipment, and indirect effects due to, for example, temporary increases in turbidity and sedimentation following mobilisation of sediments during construction.

1.2 Aims

Ward Civil have requested that Cardno undertake a Pre-Construction Seagrass Survey at Foreshore Beach. The seagrass survey is a requirement of Ward Civil's contract with the Port Authority of New South Wales to install the groynes along Foreshore Beach and has a primary aim of recording the location, extent and type of all seagrass existing on the site in the form of a GIS map. Previously, Cardno prepared the Marine Assessment

Report for the installation of the groynes along Foreshore Beach which included a review of relevant legislation, assessment of impacts and recommended impact mitigation measures (Cardno 2015b). A key component of was the mapping of seagrass in the vicinity of the proposed groynes prior to construction.

The aims of the seagrass survey included:

i. Determine if seagrass transplanting is required and if so, identify suitable areas for seagrass transplanting outside the construction zone;

ii. Determine if any *P. australis* seagrass is located within 500 mm and within 1,000 mm of the footprint of the groynes;

iii. Identifying exact locations for the navigational marker piles that minimise impacts on existing seagrass;

iv. Assess whether it is feasible, and the likelihood of success, of isolating any large beds of *P. australis* seagrass by surrounding them with a silt curtain and designating the isolated area as a no-go zone for construction vessels;

v. Determine the preferred position for barge working positions, in order to minimise any impact on *P. australis* or *Z. capriconi* seagrass at low tide; and

vi. Determine appropriate jackup barge leg positions in order to minimise impacts on known or observable seagrass zones.

This document provides the results of the seagrass survey and how this has been used to address the aims given above.

2 Methodology

2.1 Field Survey of Seagrass

Cardno's divers investigated seagrass at Foreshore Beach and surrounds on 23 and 26 June 2016 from a 5 m boat. There were light winds and no cloud cover. The underwater visibility was between 1-2 m. This was not unusual for Foreshore Beach and was adequate for divers to undertake investigations of seagrass beds.

Maps created for an earlier (March and April 2015) seagrass survey of Foreshore Beach (Cardno 2015a) were be used to plan the current survey, which included:

1. Visiting five previously identified small patches of *P. australis* and *Z. capricorni* (**Figure 2-1**) to determine their presence and, if present, to measure their extent and percentage cover. Divers were directed to these locations using a hand-held Differential GPS (DGPS). Once located, previous coordinates of these small patches were confirmed, and, for the largest patch of *P. australis,* DGPS coordinates of its present borders were collected with the aid of a diver and surface floats placed around its edges. The area of each patch was measured using a tape measure and the percentage cover was estimated visually by the diver. Some of the previously mapped five small patches of *P. australis* and *Z. capricorni* could not be located even after intensive searches by divers within a 15 m radius of their designated coordinates and were considered no longer to be present.
2. In addition to the five small patches of *P. australis* and *Z. capricorni*, the previously identified a large area of *Halophila* spp. mixed with some Z. *capricorni* was re-visited and mapped. Mapping was done along 11 fixed transects spaced 50 m apart extending up to 200 m perpendicular to Foreshore Beach (**Figure 2-1**). The cover of seagrass, in a 50 cm x 50 cm quadrat placed at each metre mark along the transects was recorded. This methodology was consistent with that undertaken previously. The presence / absence of the invasive alga *Caulerpa taxifolia* was also noted.
3. Previously, the condition of the large area of *Halophila* spp. / Z. *capricorni* was determined by examining the following indicators in five 0.25 sq. m quadrats at four locations (P1A, P2A, P1B and P2B) (**Figure 2-1**):

   > Shoot Density - The total number of shoots within each of the five quadrats was recorded to provide a measure of seagrass density.

   > Leaf Length - The length of 10 randomly selected leaves within each of the five quadrats was recorded to provide an indicator of growth which can vary widely depending on the habitat in which seagrass grows.

   > Epiphyte Load - Epiphyte load was recorded by divers on 10 randomly selected leaves within each of the five quadrats using a four-point classification scale: L=Low; M=Medium; H=High; N=None.

   No seagrass was found at sites P1A and P1B.

   The amount of epiphytic growth on the leaves is considered an indicator of seagrass health. Excessive epiphytic growth can reduce the amount of light available for and high epiphytic load may be indicative of high nutrient levels within the water column.

2.2 Mapping

Cardno used GIS software (MapInfo Pro 15.2) to map the seagrass beds at Foreshore Beach using aerial imagery and the DGPS coordinates of seagrass patches recorded by divers during the field survey. The footprint of the proposed groyne structures (supplied by Ward Civil) was overlaid on this map to identify any areas of seagrass, particularly *P. australis*, which was within 500 to 1000 mm of the proposed groynes.

The map of seagrass and proposed locations for groynes was used to determine whether any seagrass required transplanting, whether locations for the navigational markers were suitable, low risk zones (i.e. barge working zones), no-anchor zones and also high risk no-go zones.

Figure 2-1 Foreshore Beach transect, fixed patches and morphology monitoring sampling locations. Source: Cardno (2015a).

3 Results and Discussion

3.1 Distribution and Cover of Seagrass in June 2016

3.1.1 Overview

The current survey indicated that the seagrass distribution at Foreshore Beach had changed markedly since the previous survey during March and April 2015. Although all three seagrasses (*P. australis*, *Z. capricorni* and *Halophila* spp.) previously identified were also observed in June 2016, their extents and percentage covers had reduced considerably. **Figure 3-1** shows the current (June 2016) distribution of seagrass at Foreshore Beach. The reduction in extent and density of seagrass observed since March and April 2015 was considerably greater than the gradual changes observed during earlier annual surveys done between 2012 to 2015 for the Port Botany Expansion Project (Cardno 2015a). The recent reduction is potentially due to seasonal variation in growth and density of *Halophila* spp., as well as the storm conditions (high wind and rough seas) associated with the intense east coast low that occurred in early June 2016. These conditions would likely have caused shifts in bottom sediment on Foreshore beach and smothering of much of the patches of seagrass that were present. This is supported by observations of the seabed made by Cardno's divers in June 2016, including clean white sediment on the surface of the seabed indicating the sediment had recently mobilised.

The introduced pest alga *Caulerpa taxifolia* was not observed at Foreshore Beach in June 2016.

3.1.2 Posidonia australis

Posidonia australis was observed only at two of the four sites where it had occurred previously (Patches1 and 3) (**Figure 3-1).** Two other patches of *P. australis* were known from Foreshore Beach (see **Figure 2-1**, Cardno 2015a), however, these could not be located in June 1016 and are presumed to no longer be present. The co-ordinates, size and cover of *P. australis* Patches 1 and 3 are given in **Table 3-1**.

The two patches identified at Foreshore Beach in the current survey are not within 1,000 mm of the proposed groyne structures (**Figure 3-1**) and transplanting is not required. The western most of the three groynes would be the closest (approximately 50 m) proposed structure to *P. australis* in Patch 1. The middle groyne would be the closest (approximately 5 m) proposed groyne structure to *P. australis* in Patch 3.

No *P. australis* was observed along transects at Foreshore Beach in June 2016.

Table 3-1 GPS Coordinates, areas and distance to groynes of patches of *P. australis* at Foreshore Beach

Patch no.	Lat	Long	Area (m^2)	Percent Cover (%)	Distance of edge of patch to nearest groyne structure (m)
1	-33.95639498	151.194919	0.5	10	50
3 (corner a)	-33.95664199	151.195886	31.3	15-20	5
3 (corner b)	-33.95663504	151.195869			
3 (corner c)	-33.95658701	151.195905			
3 (corner d)	-33.95662196	151.195960			

Datum: WGS 84, Zone 56H

3.1.3 Zostera capricorni

The patch of *Z. capricorni* (Patch 5) observed in previous surveys was present in June 2016 but was very small (0.6 m^2) and well away (65 m) from the nearest proposed groyne location and is not considered to require specific control measures in addition to the general controls prescribed below for construction vessels (i.e. no anchoring zone). *Z. capricorni* was not observed along transects at Foreshore Beach in June 2016.

Table 3-2 GPS Coordinates of patches of *Z. capricorni* at Foreshore Beach

Patch no.	Lat	Long	Area (m^2)	Percent Cover (%)	Distance of edge of patch to nearest groyne structure (m)
5	-33.95726896	151.196525	0.6	50	65

Datum: WGS 84, Zone 56H

3.1.4 Halophila spp.

The total area of *Halophila* spp. (which co-existed with some *Z. capricorni)* at Foreshore Beach in June 2016 was less than 1,250 m^2, compared with an area of 9,589 m^2 in 2015 (Cardno 2015a). *Halophila* spp. shoots were also occasionally observed along some transects. Only three small areas of *Halophila* spp. were observed located within its previously more extensive distribution (**Figure 3-1**). The total area of *Halophila* spp. between the western and middle groynes was approximately 400 m^2. This included two patches, the smaller of which was only 1 m^2. These patches are not within the proposed barge working areas. The third patch, located between the eastern and middle groynes, measured 850 m^2. A very small area of this patch overlapped with the proposed barge operating area for the eastern groyne.

In addition to a reduction in extent, the mean density of *Halophila* spp. at Foreshore Beach was also much less than that in previous years. In June 2016, the mean density of *Halophila* spp. shoots ranged from 2.2 to 2.7 per 0.25 m^2 at patches P2A and P2B, compared with12.6 and 8.4 per 0.25 sq. m respectively, in 2015 (**Table 3-3**). Cover of epiphytes on *Halophila* spp. ranged from Low to High.

Table 3-3 Mean shoot density (shoots per 0.25 sq. m quadrat, n=5) of seagrass in morphology monitoring sites at Foreshore Beach in 2015 and 2016 surveys

Year	2015	2016
P2A	12.6	2.2
P2B	8.4	2.7

3.2 Recommended Marine Working Zones

3.2.1 Barge Working Zones

It is understood that construction vessels require a 10 m wide work zone on both sides of the footprints of the proposed groynes as well as a 20 m wide x 30 m long work zone seaward from the ends of each groyne.

The 'Working Zones' of construction vessels are indicated in yellow in **Figure 3-1**. The Working Zone for the middle groyne has been modified so that it does not encompass *P. australis* Patch 3. Barges would be required to work only on the eastern side of the groyne during construction activities in the vicinity of *P. australis* Patch 3.

A very small area of *Halophila* spp. would overlap with the Working Zone for the eastern groyne (Section 3.1.4). However, given this, the ephemeral nature of *Halophila* spp., it's relatively rapid colonisation and growth rate (compared with *Z. capricorni*, and particularly *P. australis*) and it's abundance locally and regionally, specific controls, such as modification of the location of the Working Zone, are not considered necessary.

3.2.2 No Go Zones

Two 'No Go Zones' have been identified to minimise the potential for damage to remnant patches (Patches 1 and 3) of the seagrass *P. australis*, which form part of a threatened population in Botany Bay (**Section 1**). These areas, indicated in solid red in **Figure 3-1**, are between the western and middle groynes. The construction Working Zone for the middle groyne has been modified specifically to avoid one of these two patches of seagrass which is located ~ 5 m from the groyne (see **Section 3.2.1**).

It is recommended that silt curtains are placed at 2-3 m from the edges of these two patches to protect them from smothering and sedimentation arising from construction activities and from light attenuation due to

elevated turbidity. It is also recommended that surface maker floats be deployed throughout construction to provide a visual aid and help vessel operators avoid these locations.

3.2.3 No Anchoring Zones

'No Anchoring Zones' have been marked in shaded pink in **Figure 3-1**. These provide an approximate 15 m buffer area around all seagrass patches at Foreshore Beach and are recommended as a measure to avoid anchor damage, including anchor chain scour and anchor-drag. These zones also apply to the positioning of jackup barge legs.

3.2.4 Navigational Markers

The proposed cardinal and special markers locations in the middle and seaward end points of the groynes are suitable and not located on seagrass (**Figure 3-1**).

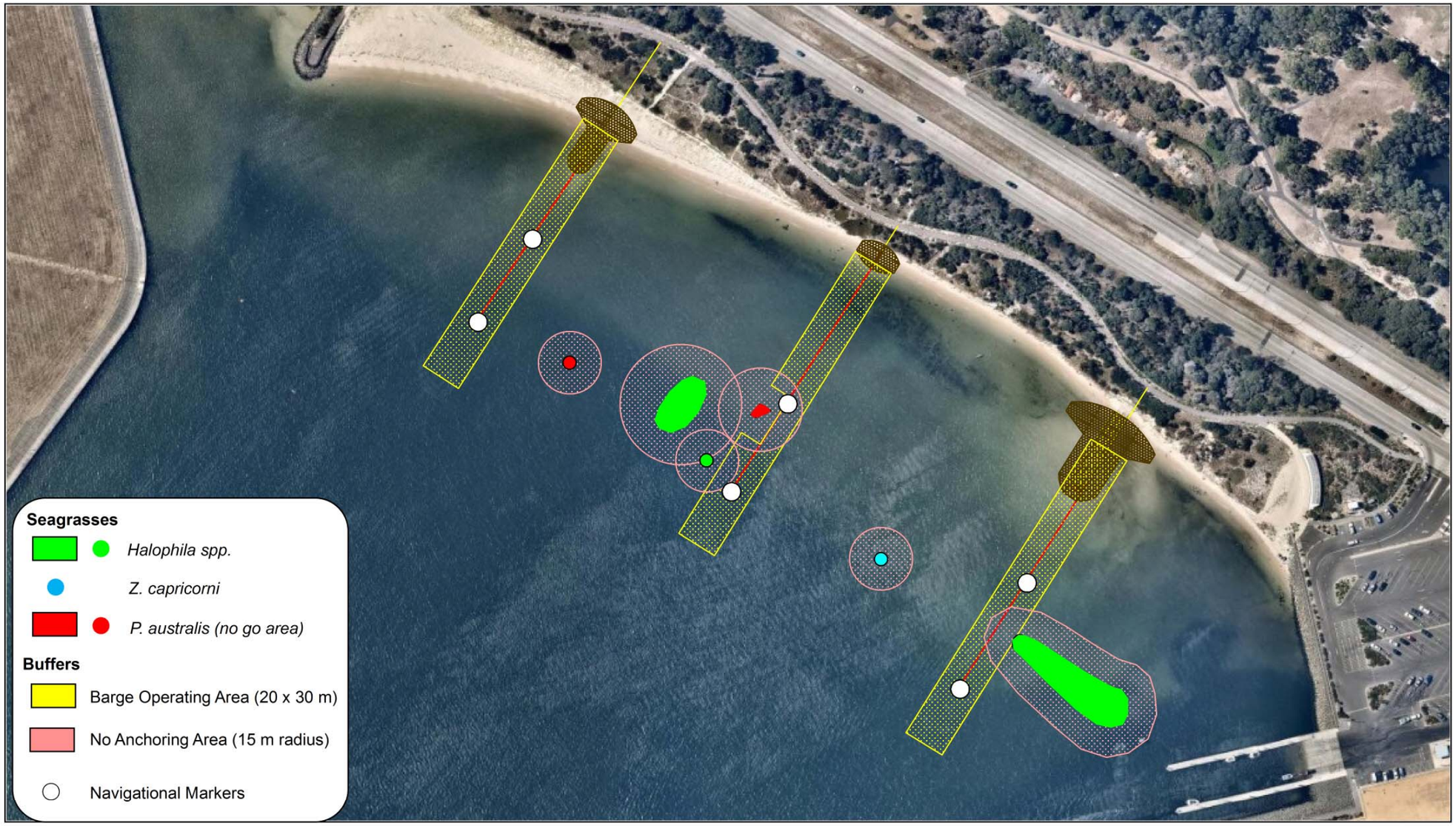

Figure 3-1 Distribution and cover of seagrass at Foreshore Beach transect in 2016.

4 References

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