

# EASTERN CURLEW IMPACT MANAGEMENT PLAN

## SHORELINE URBAN DEVELOPMENT

Prepared for  
Lendlease Communities (Shoreline) Pty Ltd



Biodiversity Assessment and Management Pty Ltd  
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## Document Control Sheet

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Project Author/s: Dr Jo Chambers, Adrian Caneris and Dr Penn Lloyd

Project Summary: Identify potential impacts to Eastern Curlew and other migratory shorebirds as a result of the Shoreline Urban Village Development and provide management strategies to avoid or mitigate significant impacts.

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### Purpose of Report

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Signed on behalf of  
**Biodiversity Assessment and Management Pty Ltd**

Date: 28/1/2020



Managing Director

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I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Management Plan *Eastern Curlew Impact Management Plan (0345-004 Version 3)* is complete, current and correct.

2. I am duly authorised to sign this declaration on behalf of the approval holder.

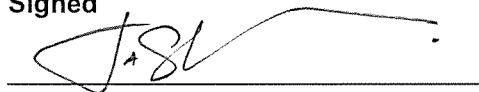
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Signed



Full name (please print)

Joel SALMON

Organisation (please print)

Lendlease Communities (Shoreline) P/L.

Date 30/01/20

## EXECUTIVE SUMMARY

### **Environmental Outcomes**

The objectives of this Eastern Curlew Impact Management Plan (ECIMP) are to ensure there is no decline in Eastern Curlew density, foraging habitat quality, or foraging habitat extent of shorebird foraging habitats (as shown in Figure 5.1 of this report) as a result of the approved Shoreline urban village development, Redland Bay, Queensland (the development)..

### **Potential Impacts**

As there will be no development within foraging or potential roosting habitats for Eastern Curlew and other migratory shorebirds within the adjacent Moreton Bay, there will be no direct impacts on these habitats. However, the development has potential to cause indirect impacts to Eastern Curlew and other migratory shorebirds, which can be broadly grouped into two categories:

1. Physical disturbance causing flight response, which could be the result of humans, dogs or boats traversing low-tide feeding habitats or traversing areas in line of sight of feeding shorebirds, increased boat traffic or increased noise and light spillage.
2. Reduction in food resources within the adjacent Moreton Bay, caused by increased runoff of pollutants, increased sedimentation and increased freshwater inundation entering potential shorebird habitats.

### **Management Measures**

The existing band of mangrove vegetation, which ranges in width from approximately 30 m to 120 m, provides an effective barrier to potential human and/or dog disturbances to Eastern Curlew and other migratory shorebirds whilst foraging, due to the dense growth form of mangroves and associated ground cover of pneumatophores growing in soft mud. This band of mangrove vegetation, which will assist in minimising noise and light disturbances for foraging birds, will be retained, protected and managed as part of the proposed development.

Community education, including educational signage along the foreshore, will be used to ensure physical disturbances from humans and/or dogs do not increase as a result of the proposed development. Advice from Council and DES will be sought when compiling the community education package to ensure this mitigation strategy achieves the objectives of this plan.

Foreshore walkways will be lit by bollard style lighting. Any other lighting required for safety purposes will be directional away from Moreton Bay.

Modelling results (Design Flow 2017) indicate the proposed treatment and control of storm water runoff from the proposed development will result in an improvement in water quality entering Moreton Bay.

### **Monitoring – Eastern Curlew**

In order to be able to detect changes in the number of Eastern Curlew attributable to the Shorelines development, the shorebird foraging habitats adjacent to the development site will be surveyed prior to construction commencing within 250m of Moreton Bay to provide baseline data for comparison with future monitoring data. To detect if changes in Eastern Curlew numbers have been influenced by the construction and occupation of the development, control site monitoring will be undertaken in conjunction with the development site monitoring at each of two control sites with similar total areas of foraging habitat to the impact site area.

All monitoring will be undertaken in accordance with DoEE guidelines, and will include the numbers of targeted shorebirds (i.e. Eastern Curlew, Whimbrel and Bar-tailed Godwit) using the area at low tide and any real or potential sources of disturbance observed and the response of the birds to these disturbance sources. To test for an impact of the Project on Eastern Curlew, a generalised linear mixed model (GLMM) approach shall be used to account for repeated measures of Eastern Curlew numbers through each summer season (year).

### **Monitoring – Foraging Habitat Quality**

Foraging habitat quality will be monitored indirectly through the monitoring of: (1) disturbance; and (2) the densities of Eastern Curlew and two other migratory shorebirds that feed on similar foods, namely Whimbrel and Bar-tailed Godwit. Monitoring will be undertaken at the impact site and the two control sites identified for Eastern Curlew monitoring, in conjunction with the Eastern Curlew monitoring (pre-commencement, construction and operational).

A decline in habitat quality will be evidenced by a significant decrease (in comparison with the baseline or over time) in the numbers of Eastern Curlew, Whimbrel and Bar-tailed Godwit at the impact site, independent of the control sites, using the generalised linear mixed model statistical approach. Foraging habitat monitoring will also include recording any signs of human/dog presence, including signs of bait collection and signs of rubbish within foraging habitats.

In addition, inspections of mangrove habitats, including stormwater outlet sites for signs of weed incursions, plant die-back, erosion and human/dog disturbances (e.g. footprints, refuse) will be undertaken during each monitoring event. As part of the community education program, community members will also be encouraged to report to the Project Manager any observed disturbances to migratory shorebirds or human/dogs traversing migratory shorebird foraging habitats that adjoin the Shorelines development.

### **Monitoring – Foraging Habitat Extent**

Foraging habitat extent for Eastern Curlew shall be monitored using two main methods:

- Mapping the extent of intertidal mudflat foraging habitat exposed at spring low tide using aerial imagery and recording the seaward edge of exposed mudflat using a mobile GPS system. This mapping shall be undertaken once prior to construction commencing within 250m of Moreton Bay (pre-impact baseline) and once each year thereafter for the duration of monitoring.
- As a measure of the extent of effective foraging habitat, the approximate locations of all Eastern Curlew observed foraging within the foraging habitat extent shall be recorded during the annual Eastern Curlew monitoring surveys.

The total area of intertidal foraging habitat shall be compared with the baseline area, with any areas of change in extent investigated to determine if the change in extent is attributable to the Project.

### **Management Objectives**

- Eastern Curlew are at densities that reflect baseline densities in the adjacent feeding habitats, controlling for natural temporal variation and a background decline in shorebird populations relating to ongoing habitat loss at key stop-over sites in Asia.
- There is no reduction in migratory shorebird foraging habitat extent.
- There is no weed intrusions or mangrove vegetation die-back in areas adjacent to migratory shorebird foraging habitats.
- There is no human and/or dog disturbance of foraging Eastern Curlew or other migratory shorebirds.

- There are no human/dogs traversing migratory shorebird foraging habitats.
- There is no increase in light or noise to foraging migratory shorebirds.
- There are no recreational activities causing sudden loud noises within the foreshore open space area.
- Water quality objectives (Design Flow 2017) and Acid Sulfate Soil objective (Douglas Partners 2017) have been met during construction and operation.

### **Corrective Measures**

If the Project Manager is alerted to any incidence of shorebird disturbance, or if targeted shorebird monitoring surveys detect significant changes in Eastern Curlew numbers and/or human or dog disturbance to foraging shorebirds, these incidences will be investigated within 24 hours of being reported and actions to rectify any breaches of mitigation measures or mangrove vegetation buffer habitats will be commenced within three days of the initial report. DES and Council will be contacted to request guidance on additional measures required to rectify/eliminate disturbances.

Corrective actions for water quality and potential acid sulfate have been provided in (Design Flow 2017 & Douglas Partners 2017 respectively).

### **Contingency Measures**

This ECIMP provides contingency measures that will be enforced if results from Eastern Curlew or foraging habitat monitoring events indicate a significant change in Eastern Curlew numbers or foraging habitat quality that could be attributed to the Shoreline development.

### **Reporting**

A monitoring report will be prepared at the end of each annual monitoring period, noting any significant changes in measured variables, trends and conditions to ensure alignment with DoEE reporting requirements. The report will include tabulated data (migratory shorebird census and feeding habitat quality, records of disturbances, vegetation health and stormwater outlet site stability) from all monitoring events to allow assessment of trends. A copy of the yearly report will be provided for Annual Compliance Reporting documentation.

Should monitoring results indicate a decline in Eastern Curlew densities, foraging habitat quality, or foraging habitat extent; the following information will be reported to DoEE within 14 days of noting the decline/s:

- the nature of the decline (Eastern Curlew densities, foraging habitat quality/extent);
- where the decline has been detected;
- how the decline was evidenced;
- suspected cause of decline and whether the decline is attributable to the development;
- corrective actions proposed, and why they are likely to be effective.

The results of each monitoring period will be publicly available on the developers' website for the life of the project.

### **Auditing**

A suitably experienced, independent ecologist will be engaged to inspect each staged development area adjacent to the foreshore to ensure mitigation measures have been implemented. Audits of the Project Manager's incidence reports and the yearly targeted shorebird survey reports will be

undertaken on a yearly basis to ensure the mitigation measures and any necessary corrective actions specified within this ECIMP have been undertaken to ensure the objectives of this ECIMP have been achieved.

The need for additional audits will be triggered if any breaches in the mitigation measures have been recorded.



# EASTERN CURLEW IMPACT MANAGEMENT PLAN SHORELINE URBAN DEVELOPMENT

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Figure 5.1: Location of potential human/dog disturbance to foraging shorebirds

## *Table of Terms and Abbreviations*

BAAM Biodiversity Assessment and Management Pty Ltd

DoEE Commonwealth Department of the Environment and Energy

ECIMPEastern Curlew Impact Management Plan

EPBC Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*

## *Appendices*

Appendix 1 Proposed Development Plans near Moreton Bay

Appendix 2 Baseline survey data for migratory shorebirds

## 1.0 INTRODUCTION

In accordance with EPBC Act approval for EPBC 2016/7776 approval Condition 3 (CoA 3), this Eastern Curlew *Numenius madagascariensis* Impact Management Plan (ECIMP) has been prepared for Lendlease Communities (Shoreline) Pty Ltd to ensure there is no decline in Eastern Curlew density, foraging habitat quality, or foraging habitat extent of shorebird foraging habitats (as shown in Figure 5.1 of this report) as a result of the approved Shoreline urban village development, Redland Bay, Queensland (the development).

This ECIMP addresses Condition 4 of the EPBC Act approval for EPBC 2016/7776 approval for the Shoreline urban village development. **Table 1.1** lists the EPBC approval conditions relating to Eastern Curlew and indicates the relevant section of this ECIMP where each condition is addressed. Text within this ECIMP that relates specifically to the approval conditions are notated with the corresponding condition number (e.g. Co4a.i).

**Table 1.1 Section of this ECIMP addressing each EPBC approval condition.**

Condition	Section of ECIMP
4.a. Scientifically valid monitoring program.	6.0
4.b. Contingency Measures	7.0
4.c. Timeframe for contingency measures	7.0
4.d. Reporting	8.0
4.e. Monitoring results	9.0

## 2.0 BACKGROUND

### 2.1 THE DEVELOPMENT

The Shoreline development will include approximately 3800 new residences, a town centre, school, recreational and sporting facilities, restaurants, 22 ha of foreshore parkland and over 20 ha of rehabilitated flora and fauna habitats. It is anticipated to bring 10,000 new residents to the area, and will be constructed over approximately 15 years.

No development is proposed within or below the highest astronomical tide level; therefore, there will be no direct disturbance to Eastern Curlew or other migratory shorebird habitats (**Appendix 1**).

The closest built form to potential shorebird habitats is a pedestrian walkway, which is generally 100 – 150 m away from potential foraging habitats.

### 2.2 MORETON BAY

The Shoreline development area is adjacent to Moreton Bay, which is recognised as important habitat for migratory shorebirds, including Bar-tailed Godwit *Limosa lapponica*, Whimbrel *Numenius phaeopus* and Eastern Curlew, three of the four migratory shorebird species recorded from areas adjacent to the development (Bamford *et al.* 2008).

Moreton Bay is listed as a wetland of international importance under the Ramsar Convention on Wetlands 1971. General principles for the management of wetlands of international importance are outlined under Schedule 6 of the *Environment Protection and Biodiversity Conservation Regulations 2000*, these being:

- 1.01 *The primary purpose of management of a declared Ramsar wetland must be, in accordance with the Ramsar Convention:*
  - (a) *to describe and maintain the ecological character of the wetland; and*
  - (b) *to formulate and implement planning that promotes:*
    - (i) *conservation of the wetland; and*
    - (ii) *wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.*
- 1.02 *Wetland management should provide for public consultation on decisions and actions that may have a significant impact on the wetland.*
- 1.03 *Wetland management should make special provision, if appropriate, for the involvement of people who:*
  - (a) *have a particular interest in the wetland; and*
  - (b) *may be affected by the management of the wetland.*
- 1.04 *Wetland management should provide for continuing community and technical input.*

## 2.3 SHOREBIRD OCCURRENCE

A total of eight migratory shorebird surveys were conducted during the summer months between March 2015 and March 2018 within the portion of Moreton Bay immediately adjacent to the development site (study area). Eight low-tide and four high-tide surveys were conducted in accordance with the survey guidelines outlined in *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DoE 2015). Details of the survey approach are provided in BAAM (2016).

The results of the targeted high-tide surveys showed no Eastern Curlew, or any other migratory shorebirds, use habitats within the study area as roosting sites. Furthermore, the database of the Queensland Wader Study Group does not identify a migratory shorebird roost site in the environs of the Shoreline development.

The low-tide mudflats adjacent to the development (**Photo 1**), which provide foraging habitats for Eastern Curlew and other shorebirds, cover an area of approximately 109 ha (**Figure 2.1**). The results of the baseline surveys for migratory shorebirds foraging within the study area at low tide are summarised in **Table 2.1**, with additional details provided in **Appendix 2**. The maximum number of Eastern Curlew recorded during the eight low-tide surveys was 7 and the average number was 4.



**Photo 1. Low-tide mudflats adjacent to the development site.**

During the targeted shorebird surveys, migratory shorebirds foraged across all areas of mudflat from the bayside edge of the mangroves to the waterline edge. Locations of Eastern Curlews plotted during the four low-tide surveys conducted in 2018 are shown in **Figure 2.1**. The average foraging density of Eastern Curlew adjacent to the development is 3.7 birds per 100 ha of mudflat, which is at the lower end of the range of foraging densities for this species of between 3.7 and 71.9 birds per 100 ha across Moreton Bay (Finn 2010).

The surveys also indicated the development area does not support roosting habitats. The closest known Eastern Curlew and other shorebird roosting area to the development is Point Halloran; approximately 9 km north of the development area.

**Table 2.1. Results of the total number of migratory shorebirds recorded foraging at low tide on intertidal mudflats adjacent to the proposed Shoreline development.**

Species/Tide height	Common name	EPBC	19/03 2015	11/12 2015	22/12 2015	13/01 2016	16/02 2018	20/02 2018	22/02 2018	1/03 2018
Low tide height (m)			0.29	0.53	0.60	0.32	0.52	0.54	0.74	0.37
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit	V, M	6	1		4	1	3	6	3
<i>Numenius phaeopus</i>	Whimbrel	M	26	43	29	40	29	31	28	31
<i>Numenius madagascariensis</i>	Eastern Curlew	CE, M	1	4	1	7	5	6	5	3
<i>Tringa nebularia</i>	Common Greenshank	M		9	6	9		7	4	2
<b>Total migratory shorebirds</b>			<b>33</b>	<b>57</b>	<b>36</b>	<b>60</b>	<b>35</b>	<b>47</b>	<b>43</b>	<b>39</b>

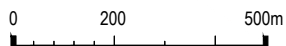
\* Status under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*: CE = critically endangered, V = vulnerable, M = migratory.



**LEGEND**

- Shoreline Footprint
- Eastern Curlew (2018 surveys)
- Intertidal mudflat surveyed

Scale 1 : 15,000



Aerial Photo: Nearmap - November 2015



Lendlease Communities (Shoreline)			Project	Eastern Curlew Impact Management Plan
Design	BAAM	6.03.2018	Title	Shorebird low-tide foraging habitat surveyed adjacent to Shoreline
Drawn	Bentline   MP	6.03.2018	FIGURE	2.1
Scale	1:15,000	Job # 0345-004		
Cad File	BAAM_SFS016.dwg	Rev 1.0		

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## 2.4 EASTERN CURLEW PROFILE

EPBC Act Status: Critically Endangered.

Distribution: The Eastern Curlew is the world's largest migratory shorebird and it is endemic to the East Asian-Australasian Flyway (EAAF). It breeds in north-eastern Asia during the northern summer and migrates through eastern Asia to spend the non-breeding season in the Philippines, Indonesia and Papua New Guinea (25% of the population), Australia (73% of the population) or New Zealand (2% of the population) during the austral summer.

Habitat and ecology: In Australia, Eastern Curlew feeds during the low tide phase of the tide cycle on open intertidal mudflats or sandflats with relatively soft sediments with or without seagrass, and usually within 50 m of the low-water mark (Finn et al. 2007). In Moreton Bay, the average summer density of feeding Eastern Curlews ranges between 3.7 and 71.9 birds per 100 ha of mudflat (Finn 2010) and is most strongly related to substrate resistance, with the birds preferring areas with softer sediments they can more easily probe into to capture prey (Finn et al. 2007, 2008). In Moreton Bay, Eastern Curlews feed primarily on crustaceans, particularly Mictyridae (soldier crabs), Brachyura (other crabs), Caridea (shrimp) and Thalassinidea (yabbies), which made up 15.4%, 9.8%, 4.7% and 2.8% of food items consumed respectively, and small molluscs (Finn et al. 2008). During the high tide phase of the tidal cycle, Eastern Curlews roost in small to large flocks on sandy spits, sandbars, shallow lagoons, saltmarshes and claypans near the high-water mark.

Migrating Eastern Curlews leave Moreton Bay over a period of about one month in March but arrive back over a more extended period from August through to December (Driscoll and Ueta 2002); however, 25% of Eastern Curlews in Moreton Bay do not migrate and remain through the austral winter (Finn et al. 2001). Most Eastern Curlews appear to migrate along the east coast of China (Driscoll and Ueta 2002) and the Yellow Sea provides extremely important stopover feeding habitat for about 80% of the flyway population to replenish their fat reserves before continuing their migration (TSSC 2015).

Threats: Threats to Eastern Curlew in Australia include ongoing human disturbance at feeding and roost sites, habitat loss, habitat degradation from pollution, changes to the water regime and invasive plants (Milton et al. 2011, TSSC 2015). Key threats along their migration route are feeding habitat loss resulting from large land reclamation projects and habitat degradation resulting from aquaculture, gross pollution and invasion of salt marshes by exotic *Spartina* grass, particularly at key stopover migration staging sites in the Yellow Sea (Yang et al. 2011, Murray et al. 2014, Melville et al. 2016, Moores et al. 2016).

Eastern Curlews have been shown to initiate flight response to disturbance (referred to as FID – flight-initiation distance) at greater distances than other shorebirds (Smit and Visser 1993; Paton et al. 2000; Glover et al. 2011). A study of shorebird FID conducted at Victoria, Australia showed the mean FID for Eastern Curlew was 126 m (Glover et al. 2011). Larger species such as Eastern Curlew and Whimbrel tend to be more 'flighty', meaning they are more sensitive to disturbance and tend to take flight at greater distances from disturbance agents than most other shorebirds (Smit and Visser 1993, Glover et al. 2011). Joggers and walkers with a leashed dog are more disturbing than a walker alone (Lafferty 2001, Glover et al. 2011), and unleashed dogs are substantially more disturbing (Pfister and Harrington 1992, Kyne 2010, Stigner et al. 2016). Shorebirds living in environments that are heavily used by humans habituate to repetitive sources of disturbance that do not present a direct mortality risk, whereafter they tolerate closer approach distances to reduce their energetic costs of responding to disturbance (Smit and Visser 1993, West et al. 2002, Baudains and Lloyd 2007).

Sound levels of 43-87 dBA in the receiving environment have limited effects on foraging shorebirds, but sound levels of 84-100 dBA cause most shorebirds in an habituated population to leave the area of disturbance (Smit and Visser 1993). Disturbance reactions are generally stronger when disturbing sounds are combined with visual disturbance (Smit and Visser 1993). Also, intermittent bursts of noise are generally more disturbing than continuous noise; birds habituate more readily to the latter (Smit and Visser 1993).

Population trend: The estimated population size of Eastern Curlew within the 20-year period 1986-2006 was 28,000 birds spending the non-breeding season in Australia, making up 74% of the total flyway population estimate of 38,000 (Bamford et al. 2008). However, the flyway population has experienced a substantial decline since this estimate. Over the 19 years 1996-2014, the rate of decline has been greater in southern Australia (6.95% per year) than in northern Australia (2.91% per year), with an overall rate of decline of 3.2% nationally (Clemens et al. 2016). The annual rate of decline of the Eastern Curlew population using Moreton Bay over the 15-year period 1992-2008 was estimated at 2.4% per year (Wilson et al. 2011). The most recent analysis suggests the population of Eastern Curlew migrating to Australia has undergone a severe population decline of 66.8% over 20 years (5.8% per year) and 81.4 % over 30 years, which for this species is equal to three generations (TSSC 2015, Studds et al. 2017). This decline is thought to be largely due to ongoing loss of intertidal feeding habitat at key migration staging sites in the Yellow Sea that Eastern Curlew is highly reliant on (Murray et al. 2014, Moores et al. 2016, Studds et al. 2017).

### 3.0 EXISTING THREATS AND IMPACTS

For the past 50 years or more, much of the development area has been previously cleared for agricultural activities, including a plant nursery and vegetable/crop farming.

Existing potential threats to Eastern Curlew and other migratory shorebirds from current and past land uses include:

- Humans and dogs disturbing feeding birds.
- Untreated stormwater runoff into Moreton Bay, which may contain excess levels of fertilizers, herbicides and pesticides, as well as suspended sediment. Stormwater runoff could impact on food resources for Eastern Curlew and other migratory shorebirds (benthic invertebrates).
- Noise disturbance to feeding Eastern Curlew and other migratory shorebirds from farm machinery.
- Construction of dams, which change natural hydrological flows that could impact on Eastern Curlew and other migratory shorebirds' food resources.
- Invasive pests encroaching into mangrove vegetation causing impacts to overall ecological values of these areas.
- Clearing of mangrove vegetation for infrastructure and boat access (Google aerial imagery shows a number of boat launch points in close proximity to the development).
- Recreational and commercial marine traffic.

These existing threats, with the exception of marine traffic, will be eliminated or appropriately mitigated as part of the development (refer **Section 5.0**).

### 4.0 POTENTIAL IMPACTS FROM THE DEVELOPMENT

As there will be no development within foraging or potential roosting habitats for Eastern Curlew and other migratory shorebirds, there will be no direct impacts on these habitats. However, the development has potential to cause indirect impacts to Eastern Curlew and other migratory shorebirds, which can be broadly grouped into two categories:

#### 1. Potential Physical Disturbance causing Flight Response

Any form of disturbance that causes a bird to take flight can lead to a decrease in energy uptake and an increase in energy expenditure, which can lead to an overall reduction in health and fitness, dependent on the frequency and duration of disturbance. Increased disturbance as a result of the development could potentially cause additional pressures on shorebird populations that are already showing signs of population decline.

Potential physical disturbances from the development could be the result of:

- I. Humans and/or dogs traversing low-tide feeding habitats.
- II. Humans and/or dogs traversing areas in line of sight of feeding shorebirds.
- III. Increased boat traffic adjacent to feeding areas.
- IV. Increased noise and light spillage.

#### 2. Potential Reduction in Food Resources

Any impacts to water quality within Moreton Bay can cause impacts to essential food resources (benthic invertebrates) for Eastern Curlew and other migratory shorebirds.

Potential impacts to food resources as a result of the development could be caused by:

- Increased runoff of potentially toxic pollutants entering Moreton Bay;
- Increased sedimentation causing smothering of feeding grounds;
- Increased freshwater inundation impacting on the health of benthic invertebrates.

## 5.0 MANAGEMENT MEASURES

### 1. Physical Disturbance causing Flight Response

- i. Humans and/or dogs traversing low-tide feeding habitats

During the targeted shorebird surveys (BAAM 2016) the only potential disturbance as a result of human and/or dog traffic could occur along a narrow and relatively small sandy beach located approximately 300 m north of the development (refer **Figure 5.1**). People walking dogs were occasionally observed walking along this narrow beach.

A band of mangrove vegetation ranging in width from approximately 30 m at its narrowest point to approximately 120 m at its widest cover will be retained, protected and managed to separate the development area from Eastern Curlew low-tide feeding habitats (**Figure 5.1**). This band of mangrove vegetation would form an effective barrier to human and dog traffic accessing low-tide Eastern Curlew habitats due to the dense growth form of mangroves and associated ground cover of pneumatophores (**Photos 2 and 3**).



**Photo 2 shows broad band of mangrove vegetation separating Eastern Curlew habitats from the development.**

The mudflats associated with the mangrove vegetation consist of very soft mud, which will restrict people from entering or traversing these zones. No persons or dogs were observed traversing the low-tide mudflats during the targeted surveys.

The proposed development includes foreshore open space ranging in width from approximately 35 m at its narrowest point to approximately 300 m at its widest point. A pedestrian walkway will

be established throughout much of the foreshore open space area, adjacent to, but not within, the existing mangrove vegetation (refer **Appendix 1**). The closest point of the proposed walkway to shorebird foraging habitats is approximately 45 m, with intervening mangrove vegetation screening the walkway from the foraging habitat; therefore, there will be a low level of risk of disturbance to Eastern Curlew foraging at this closest point.



**Photo 3 shows dense growth form of mangrove vegetation.**

Three community destinations and recreational parks and one neighbourhood recreational park are proposed within this foreshore open space area (refer **Appendix 1**). The closest of these recreational parks to shorebird foraging habitats is approximately 70m.

If an intrepid walker or dog did manage to traverse through the band of mangroves to access Eastern Curlew feeding habitats, the very soft mud substrate would effectively restrict further movements.

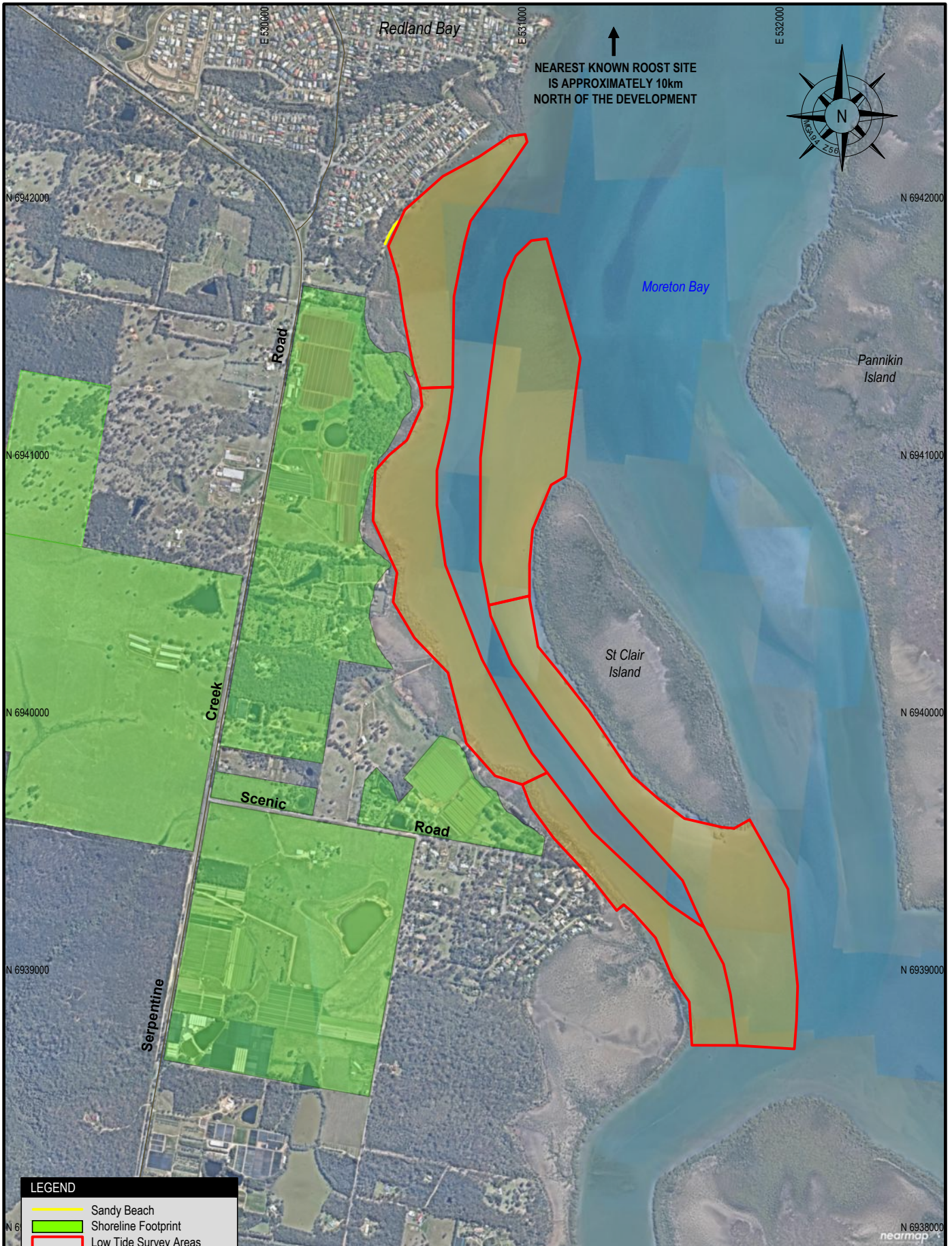
The risk of humans and/or dogs entering Eastern Curlew feeding habitats is therefore low.

### Mitigation Measures

#### During Construction

As part of the induction process for site construction, it will be the responsibility of the Project Manager (refer **Section 6.2**) to advise all contractors that bringing dogs into the development area is prohibited during construction and that no contractor/employee is to traverse the mangrove lined intertidal area.





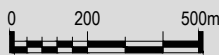
↑  
 NEAREST KNOWN ROOST SITE  
 IS APPROXIMATELY 10km  
 NORTH OF THE DEVELOPMENT



**LEGEND**

- Sandy Beach
- Shoreline Footprint
- Low Tide Survey Areas
- Shorebird Foraging Habitats

Scale 1 : 20 000



Client		Lendlease Communities (Shoreline)	
Design	BAAM	19.11.2019	
Drawn	Bentline   MP	19.11.2019	
Scale	1:20,000	# 0345-004	
Cad File	BAAM_SFS008.dwg	NTP 17	

Project	Easten Curlew Impact Management Plan	
Title	Area of Potential Haman / Dog Disturbance	ATTACHMENT 5.1

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Regardless of the low risk of threat, a community education program will be developed prior to the occupation stage, which includes educational signage erected at strategic locations along the formed walkway running adjacent to the band of mangroves.

The community education program will inform residents/visitors of the presence of Eastern Curlew and other migratory shorebirds and the impacts caused by disturbance to feeding birds. It is proposed that the education program will be prepared in leaflet form to be provided to all new and prospective property buyers at time of purchase/inspection. It will be the Principal's responsibility (refer **Section 7.1**) to ensure all local real estate agents and the Shoreline website <https://communities.lendlease.com/queensland/shoreline/> display this leaflet.

Advice from DES and Council will be sought when compiling the community education package to ensure this mitigation strategy achieves the objectives of this ECIMP. Research has shown community education can play a significant role in decreasing physical disturbance threats to migratory shorebirds (Burger *et al.* 2005).

### **Corrective Actions**

If the Project Manager is alerted to any incidence of shorebird disturbance, or targeted shorebird monitoring surveys detect significant changes in Eastern Curlew numbers and/or human or dog disturbance to foraging shorebirds, these incidences will be investigated within 24 hours of being reported and actions to rectify any breaches of mitigation measures or mangrove vegetation buffer habitats will be commenced within three days of the initial report. DES and Council will be contacted to request guidance on additional measures required to rectify/eliminate disturbances.

- ii. Humans and/or dogs traversing areas in line of sight of feeding shorebirds

Mangrove vegetation ranging in width from approximately 30 m to approximately 120 m separates shorebird foraging habitats from the proposed active open space within the Shoreline foreshore open space area; therefore, there is minimal risk that humans and dogs traversing the proposed walkway would be sighted by (and disturb) foraging shorebirds.

The soft muddy substrate of shorebird foraging habitats adjacent to the proposed development is expected to create an effective barrier to human or dog intrusions into foraging habitats; therefore, there is minimal risk that humans or dogs would traverse foraging habitats.

It is expected the mitigation measures, performance and completion criteria and corrective actions proposed to address the impact of humans and/or dogs traversing low-tide feeding habitats (above) would also be sufficient in managing the impact of humans and/or dogs traversing areas in line of sight of feeding shorebirds.

- iii. Increased boat traffic

At low tide, areas adjacent to the development are too shallow to allow boat traffic. The distance between Eastern Curlew feeding habitats and potential boat traffic ranges from approximately 100 m at the narrowest point to approximately 250 m at the widest point (refer **Figure 5.1**). The mean FID response for Eastern Curlew has been shown to be 126 m (Glover *et al.* 2011); therefore, there is a low risk that increased boat traffic could disturb foraging Eastern Curlew.

**Figure 5.1** shows the narrow, deep-water channel that separates Eastern Curlew feeding habitats adjacent to the development from feeding habitats adjacent to Pannikin Island.

During the targeted shorebird surveys (BAAM 2016), recreational 'crabbers' were observed using this channel on two occasions at high tide only. It is expected this channel would be too shallow for boat traffic during low tide. The proposed development does not include construction of a boat ramp within the development area; therefore, it is considered the proposed development will not cause an increase in boat traffic at this location.

As there are no Eastern Curlew or other migratory shorebirds using the development area or adjacent Pannikin Island as a roost site, the proposed development will not cause any significant impacts on roosting Eastern Curlew or other migratory shorebirds.

As there are no plans to construct a boat ramp within the development area as part of the proposed development, there is unlikely to be a significant increase in boat traffic that could cause significant impacts to foraging Eastern Curlew or other shorebirds.

#### iv. Increased Noise and Light

A band of mangrove vegetation ranging in width from approximately 30 m at its narrowest point to approximately 120 m at its widest cover will be retained, protected and managed to separate the development area from Eastern Curlew low-tide feeding habitats (**Figure 5.1**). This band of mangrove vegetation would form an effective barrier to noise and light disturbances to Eastern Curlew and other migratory shorebirds due to the dense growth form of mangroves (**Photos 2 & 3**).

The proposed development includes foreshore open space that is generally 100 m wide but ranges in width from approximately 35 m at its narrowest point, to approximately 300 m at its widest point. A pedestrian walkway will be established throughout much of the foreshore open space area, adjacent to, but not within, the existing mangrove vegetation (refer **Appendix 1**). The closest point of the proposed walkway to shorebird foraging habitats is approximately 45 m.

Three community destinations and recreational parks and one neighbourhood recreational park are proposed within this foreshore open space area (refer **Appendix 2**). The closest of these recreational parks to shorebird foraging habitats and, therefore, the closest potential threat of noise and light disturbance from recreational activities, is approximately 70m.

#### **Mitigation Measures**

The retention, protection and ongoing management of retained intertidal vegetation will assist in minimising the threat of noise/light pollution disturbing foraging shorebirds.

Prior to occupation educational signage will be erected at a minimum of three locations (to be determined in consultation with developers and DES/Council on completion of final designs) along the pedestrian walkway that will maximise engagement with residents and visitors. Educational material will advise residents/visitors of the nearby presence of shorebirds and the threat that increased or sudden loud noises can disturb foraging shorebirds.

Any public events within the foreshore open space area will require authorised permits from Redland City Council. Permits will have controls on noise levels for any events.

The walkway will be lit by bollard style 'smart' lighting (**Photo 4**). Any other lighting required for safety purposes will be directional away from Moreton Bay.



**Photo 4 shows example of bollard lighting (source: ledoutdoor.net.au).**

#### **Corrective Actions**

If the Project Manager is alerted to any incidence of shorebird disturbance as a result of light or noise, or targeted shorebird monitoring surveys detect significant changes in Eastern Curlew numbers and/or human or dog disturbance to foraging shorebirds, these incidences will be investigated within 24 hours of being reported and actions to rectify any breaches of mitigation measures or mangrove vegetation buffer habitats will be commenced within three days of the initial report. DES and Council will be contacted to request guidance on additional measures required to rectify/eliminate disturbances.

## 2. Reduction in Food Resources

Baseline water quality testing and MUSIC modelling (DesignFlow 2017) determined that, with the proposed mitigation measures, water quality entering Moreton Bay will be improved as a result of the proposed development.

The Shoreline Redlands - Water Quality Management Plan V04 (DesignFlow, November 2019) details the management measures, corrective actions and performance criteria to ensure changes in water quality as a result of the development will not impact on Eastern Curlew or other shorebird foraging habitats

It is therefore considered storm water runoff will not have any significant impacts on shorebird foraging habitats.

## 6.0 MONITORING

### 6.1 EASTERN CURLEW (Co4.1i)

In order to be able to detect changes in the number of Eastern Curlew attributable to the Shorelines development, the shorebird foraging habitats adjacent to the development site (**Figure 5.1**) will be surveyed prior to construction commencing within 250m of Moreton Bay to provide baseline data for comparison with future monitoring data (Co4a.i).

To detect if changes in Eastern Curlew numbers have been impacted by the construction and occupation of the development, monitoring at other known Eastern Curlew habitats within the local area that would not be influenced by the development (control sites (Co4.a.iii)) will be conducted. Control site monitoring will be undertaken in conjunction with the development site monitoring at each of two control sites with similar total areas of foraging habitat to the impact site area: Control site 1 will include the Oyster Point and Point O'Halloran monitoring areas (97 ha, average Eastern Curlew density 9.1 birds per 100 ha); Control site 2 will include the Point O'Halloran - Victoria Point and Victoria Point - Redland Bay N monitoring areas (83 ha, average Eastern Curlew density 22.7 birds per 100 ha; see **Table 6.1**).

The results of baseline surveys of control sites and the impact area adjacent to the Shorelines development are summarised in **Table 6.1**, with more detailed survey data provided in **Appendix 2**.

#### 6.1.1 Eastern Curlew Monitoring Methodologies

Monitoring will be undertaken in accordance with DoEE (2017) guidelines. Using a high-powered spotting telescope, each monitoring survey will be conducted within the four-hour period either side of low tide and will cover the shorebird foraging habitats shown in **Figure 5.1**. Data collected during the surveys will include the numbers of targeted shorebirds (i.e. Eastern Curlew, Whimbrel and Bar-tailed Godwit) using the area at low tide and any real or potential sources of disturbance observed and the response of the birds to these disturbance sources.

Wherever practical, dependent on tide times, surveys will be conducted at times of peak use of the Foreshore Area.

**Table 6.1. Average number of individuals and average density (birds/100 ha) of Eastern Curlew, Whimbrel and Bar-tailed Godwit along different sections of low-tide foraging habitat in south-western Moreton Bay between Cleveland Point and the proposed Shoreline development.**

Survey sector	Foraging habitat surveyed Area (ha)	Eastern Curlew		Whimbrel		Bar-tailed Godwit	
		No.	Density	No.	Density	No.	Density
Cleveland Pt - Toondah	74.5	5.5	7.4	10.3	13.8	13.0	17.4
Oyster Point	65.7	3.8	5.7	11.5	17.5	14.3	21.8
Point O'Halloran	30.9	5.3	17.0	10.8	34.8	9.0	29.1
Point O'Halloran - Victoria Point	36.5	7.0	19.2	11.8	32.2	15.0	41.1
Victoria Point - Redland Bay N	46.8	15.7	33.5	31.0	66.2	32.7	69.8
Redland Bay S	12.8	0.0	0.0	1.7	13.0	1.0	7.8
Shoreline mainland & Pannikin Island (impact area)	108.9	4.8	4.4	29.8	27.3	4.0	3.7
<b>Total</b>	<b>376.1</b>	<b>43.7</b>	<b>11.6</b>	<b>111.7</b>	<b>29.7</b>	<b>89.0</b>	<b>23.7</b>

## 6.1.2 Monitoring Schedule

### Pre-commencement Monitoring

To ensure the statistical power of the monitoring program, including baseline monitoring data, permits statistically reliable assessment of cause-effect. To this end, eight pre-commencement surveys for Eastern Curlew will be undertaken between 1 September until 30 March in the year immediately prior to construction commencing within 250m of Moreton Bay (Co 4.a i).

### Construction Period

During the construction period, where activities pose a risk of potentially significant impacts to migratory shorebirds, the monitoring program will involve eight low-tide, targeted shorebird surveys, undertaken on an annual basis and in accordance with DoEE (2017) guidelines. These will include monthly surveys between 1 September and 30 March.

### Operational Phase

During the operational phase, a single annual low-tide, targeted shorebird survey will be undertaken within the peak Eastern Curlew season (November to January). This monitoring program will continue for the life of the EPBC approval (i.e. until 2038).

### 6.1.3 Statistical Analysis

To test for an impact of the Project on Eastern Curlew, a generalised linear mixed model (GLMM) approach shall be used to account for repeated measures of Eastern Curlew numbers through each summer season (year). In the analysis, the response variable is the count of Eastern Curlew at each site during the months November to February (when numbers are expected to be most stable in Moreton Bay), explanatory variables are year (to capture temporal change over time), tide height (a continuous variable) and site (impact, control 1, control 2), with year as a random effect within each site to control for repeated measures.

## 6.2 FORAGING HABITAT QUALITY

Foraging habitat quality for Eastern Curlew is affected by multiple factors, including benthic invertebrate abundance, substrate penetrability and the extent of disturbance. Foraging habitat quality will therefore be monitored indirectly through the monitoring of: (1) disturbance; and (2) the densities of Eastern Curlew and two other migratory shorebirds that feed on similar foods, namely Whimbrel and Bar-tailed Godwit. Both Eastern Curlew and Bar-tailed Godwit are known to be experiencing ongoing population declines due to factors outside of Australia, whereas Whimbrel is not known to be declining. Monitoring will be undertaken at the impact site and the same two control sites identified in **Section 6.1** above. A decline in habitat quality will be evidenced by a significant decrease (in comparison with the baseline or over time) in the numbers of Eastern Curlew, Whimbrel and Bar-tailed Godwit at the impact site, independent of the control sites, using the statistical approach outlined in **Section 6.1.3**.

Monitoring surveys of Eastern Curlew foraging habitats that adjoin the Shorelines development (**Figure 5.1**) will be undertaken in conjunction with Eastern Curlew monitoring (pre-commencement, construction and operational). Foraging habitat monitoring will include recording any signs of human/dog presence, including signs of bait collection and signs of rubbish within foraging habitats.

In addition, inspections of mangrove habitats, including stormwater outlet sites for signs of weed incursions, plant die-back, erosion and human/dog disturbances (e.g. footprints, refuse) will be undertaken during each monitoring event (Co4a. i). As part of the community education program, community members will also be encouraged to report to the Project Manager any observed disturbances to migratory shorebirds or human/dogs traversing migratory shorebird foraging habitats that adjoin the Shorelines development.

### 6.3 FORAGING HABITAT EXTENT

Foraging habitat extent for Eastern Curlew shall be monitored using two main methods. First, the extent of intertidal mudflat foraging habitat exposed at spring low tide shall be mapped at a standardised spring low tide level of 0.3 m using aerial imagery and recording the seaward edge of exposed mudflat using a mobile GPS system. This mapping shall be confined to the mainland extent of intertidal mudflat opposite the full length of the Project that interacts closely with the foreshore; i.e. from east of Scenic Road in the south to east of the northernmost extent of the Project. This mapping shall be undertaken once prior to construction commencing within 250m of Moreton Bay (pre-impact baseline) and once each year thereafter for the duration of monitoring. Second, as a measure of the extent of effective foraging habitat, the approximate locations of all Eastern Curlew observed foraging within the foraging habitat extent shown in **Figure 5.1** of this Plan shall be recorded during the annual monitoring surveys outlined in **Section 6.1** above.

To test for an impact of the Project on foraging habitat extent, the total area of intertidal foraging habitat shall be compared with the baseline area. Any areas of change in extent shall be investigated to determine if the change in extent is attributable to the Project or not.

### 6.4 MANAGEMENT OBJECTIVES

- Eastern Curlew are at densities that reflect baseline densities in the adjacent feeding habitats, controlling for natural temporal variation and a background decline in shorebird populations relating to ongoing habitat loss at key stop-over sites in Asia.
  - There is no reporting or other evidence of a reduction in migratory shorebird foraging habitat extent during construction and for five years following total occupation of the proposed development.
  - There is no weed intrusions or mangrove vegetation die-back in areas adjacent to migratory shorebird foraging habitats.
  - There is no human and/or dog disturbance of foraging Eastern Curlew or other migratory shorebirds .
  - There are no human/dogs traversing migratory shorebird foraging habitats.
- There is no increase to light or noise in foraging migratory shorebirds.
  - There is no recreational activities causing sudden loud noises within the foreshore open space area.
  - Water quality objectives (Design Flow 2017) and Acid Sulfate Soil objective (Douglas Partners 2017) have been met during construction and operation.

## 7.0 CONTINGENCY MEASURES (CO4B)

**Table 7.1** provides contingency measures that will be enforced if results from Eastern Curlew or foraging habitat monitoring events indicate a significant change in Eastern Curlew numbers or foraging habitat quality that could be attributed to the Shoreline development (4.b).

**Table 7.1. Contingency measures to be enacted if Eastern Curlew densities, or foraging habitat quality, or extent have decreased.**

Trigger	Contingency Measure	Responsible Persons	Timeframe
Numbers of Eastern Curlew are significantly reduced at the impact site compared to baseline and control sites.	<p>Immediately investigate cause/s of the decline:</p> <ul style="list-style-type: none"> <li>Check water quality monitoring data. If necessary, update Stormwater Management Plan to mitigate changes in water quality;</li> <li>Check during low tide for persons/dogs accessing foraging habitats. If necessary, erect fencing where access is occurring.</li> </ul>	<p>Shorebird expert;</p> <p>Water quality expert;</p> <p>Project Manager;</p> <p>Principal;</p> <p>RCC Officers;</p> <p>DES Officers</p>	<p>Shorebird expert to notify Project Manager immediately if monitoring data indicates a significant decrease in Eastern Curlew densities.</p> <p>Within 24 hours of being notified, Project Manager will request an update on water quality. If measured water quality parameters indicate a decline in water quality, the Project Manager will engage a qualified erosion/sediment control expert to investigate and remediate cause of the decrease in water quality.</p>
People/dogs observed within foraging habitats	<p>Identify where access to foraging habitats is occurring. Discuss fencing requirements to exclude access to foraging habitats with RCC and DES</p>	<p>Shorebird expert;</p> <p>Project Manager;</p> <p>Principal;</p> <p>RCC Officers;</p> <p>DES Officers</p>	<p>If fencing is deemed necessary, it is to be erected within 10 business days of receiving approval.</p>
Eastern Curlew observed in flight response as a result of noise.	<p>If noise is caused by construction works, cease works until Eastern Curlew have left the area, either during high tide or at end of summer migration period.</p> <p>If noise is caused by persons walking along foreshore, erect more signage regarding sensitivity of Eastern Curlew along foreshore.</p> <p>Conduct additional community education sessions.</p>	<p>Shorebird expert;</p> <p>Project Manager;</p> <p>Principal;</p>	<p>Project Manager is to issue a 'cease works' notification within 24 hours of being advised that construction is disturbing Eastern Curlew.</p> <p>Signage to be erected within one week of being advised that human traffic along the foreshore is disturbing foraging Eastern Curlew.</p>



## 8.0 MANAGEMENT RESPONSIBILITIES

### 8.1 LENDLEASE COMMUNITIES (SHORELINE) PTY LTD (PRINCIPAL)

The roles and general responsibilities of the Principal are to:

- Comply with the Eastern Curlew Impact Management Plan (ECIMP);
- Comply with the *Nature Conservation Act 1992*;
- Develop a community education program;
- Nominate a Project Manager who will represent the Principal in reviewing the performance of contractors, issue instructions and variations, and be responsible for ECIMP implementation; and
- Promptly notify the DoEE of any changes to this ECIMP and its implementation, reporting or monitoring, and any breach of Administrating Authority conditions and proposed corrective action.

It will be the responsibility of the Principal to ensure the contents of the ECIMP are adequately communicated to all contractors, residents and visitors and they are advised of the seriousness of potential impacts if the recommended actions are not observed.

### 8.2 PROJECT MANAGER

This Eastern Curlew Impact Management Plan (ECIMP) will be overseen by the Project Manager.

The Project Manager is responsible for:

- Implementation of the ECIMP to minimise environmental impacts from the project;
- Ensuring the mitigation measures detailed in this ECIMP, including the community education program, are implemented;
- Ensuring a review of this ECIMP is undertaken in year 3 in the first instance and then at intervals of not less than five years or sooner if required. Any significant or unexpected alteration in the proposed development may require the ECIMP to be revised and amended accordingly. Any

changes or amendments proposed to the ECIMP will be confirmed by the Principal;

- Keeping up-to-date records of all disturbance incidence reports, monitoring events, results and corrective actions;
- Reviewing and advising the DoEE of any proposed changes to the ECIMP; and
- Designate suitably experienced persons for the management and auditing of the ECIMP as required.

### 8.3 DESIGNATED PERSON (DP)

The roles and responsibilities of the Designated Person are to:

- Liaise with the Project Manager to facilitate compliance with legislation, Council policy and conditions during the development;
- Conduct audit inspections as required /requested during earthworks, and clearing or other inspections as triggered by environmental events or incidents;
- Advise the Project Manager on the compliance and effectiveness of the ECIMP /Site Instructions and its implementation;
- Immediately contact the Project Manager regarding any environmental incidents that have the potential to cause environmental harm to Moreton Bay and request written details within 24 hours of occurrence;
- Issue Site Instructions (for correction of non-compliance) to the Project Manager within three (3) days of inspections and completion of the Inspection Procedures and Checklist(s);
- Maintain accurate reports (incidents, near miss, results of monitoring) to be provided to DoEE within ten days of request.

## 9.0 REPORTING

A monitoring report will be prepared at the end of each annual monitoring period, noting any significant changes in measured variables, trends and conditions to ensure alignment with DoEE reporting requirements. The report will include tabulated data (migratory shorebird census and feeding habitat quality, records of disturbances, vegetation health and stormwater outlet site stability) from all monitoring events to allow assessment of trends. A copy of the yearly report will be provided for Annual Compliance Reporting documentation.

Should monitoring results indicate a decline in Eastern Curlew densities, foraging habitat quality, or foraging habitat extent; the following information will be reported to DoEE within 21 days of noting the decline/s:

- the nature of the decline (Eastern Curlew densities, foraging habitat quality/extent);
- where the decline has been detected;
- how the decline was evidenced;
- suspected cause of decline and whether the decline is attributable to the development;
- corrective actions proposed, and why they are likely to be effective.

The results of each monitoring period will be published with the Annual Compliance Report, and made publicly available on the Lendlease's website for the life of the project.

## 10.0 AUDITING

On completion of each stage of development within areas adjacent to the foreshore and prior to occupation, a suitably experienced, independent ecologist (auditor) will be engaged to inspect lighting, signage and retained mangrove vegetation to ensure all mitigation measures provided in the ECIMP have been implemented.

On a yearly basis the auditor will review the Project Manager's incidence reports and the yearly targeted shorebird survey reports to ensure the mitigation measures and any necessary corrective actions specified within this ECIMP have been undertaken to ensure the objectives of this ECIMP have been achieved.

Any reported breaches of the mitigation measures detailed in this ECIMP will trigger the need for additional auditing to ensure corrective actions have been implemented and the reported breach has been rectified.

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## **APPENDIX 1**

### **Proposed Development Plans near Moreton Bay**



**Legend**

- District Sports and Recreation Park
- Community Destination and Recreation Park with Neighbourhood Recreation Park functions
- Neighbourhood Recreation Park
- Neighbourhood Recreation Park functions within District Sports and Recreation Park
- Conceptual Staged Precincts / Park Catchments
- Walkable catchments - 400m radius
- POS Private Open Space

**Notes**

Local Authority: Redland City Council  
 Contour interval: 1.0m

Design is conceptual only and subject to detailed design and Council approvals for each relevant stage. Areas and dimensions are approximate only and are subject to final survey.

Foreshore RP line plotted from DCDB records and is approximate only and subject to detailed site survey.

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Drawing Ref: UD-7558-031-A  
 Date: 30/11/2016  
 Scale: 1:10,000 @ A3 - 1:5,000 @ A1

**Conceptual Masterplan**  
**Shoreline - Redland Bay**  
 for Redland Bay Southpark Corporation Pty Ltd & Sutgold Pty Ltd

# Sports, Recreation & Open Space

## **APPENDIX 2**

### **Baseline survey data for migratory shorebirds**

**Table A2.1. Detailed results for low-tide migratory shorebird surveys conducted in intertidal mudflats adjacent to the proposed Shoreline development, with the total number of individuals of each waterbird species recorded on mainland mudflats between Talburpin Park point and Scenic Road (M) and mudflats fringing St Clair Island (StCI).**

Species	Common name	EPBC*	19/03/2015		11/12/2015		22/12/2015		13/01/2016		16/02/2018		20/02/2018		22/02/2018		1/03/2018	
			M	StCI	M	StCI	M	StCI	M	StCI	M	StCI	M	StCI	M	StCI	M	StCI
<i>Limosa lapponica baueria</i>	Bar-tailed Godwit	V,M	2	4	1				3	1		1		3		6		3
<i>Numenius phaeopus</i>	Whimbrel	M	10	16	12	31	6	23	13	27	8	20	6	25	12	16	14	17
<i>Numenius madagascariensis</i>	Eastern Curlew	CE,M	1		3	1	1		2	5	4	1	4	2	4	1	2	1
<i>Tringa nebularia</i>	Common Greenshank	M			8	1	6		8	1			7		4		2	
<b>Total migratory shorebirds</b>			<b>13</b>	<b>20</b>	<b>24</b>	<b>33</b>	<b>13</b>	<b>23</b>	<b>26</b>	<b>34</b>	<b>12</b>	<b>22</b>	<b>17</b>	<b>30</b>	<b>20</b>	<b>23</b>	<b>18</b>	<b>21</b>
<i>Vanellus miles</i>	Masked Lapwing				2								5					
<i>Himantopus himantopus</i>	Black-winged Stilt						8		2		6		25		2	2	7	
<i>Anas castanea</i>	Chestnut Teal				3												2	
<i>Pelecanus conspicillatus</i>	Australian Pelican		2						5	12								
<i>Threskiornis molucca</i>	Australian White Ibis		15		12	2	19	8	12	4	8	2	11		11	4	6	
<i>Platalea regia</i>	Royal Spoonbill		1							2	1	2					2	
<i>Ardea modesta</i>	Eastern Great Egret		2				1	2		1		2					3	5
<i>Egretta novaehollandiae</i>	White-faced Heron		3	2		1			2				3		1	1	6	
<i>Egretta garzetta</i>	Little Egret		3	1	2		2	1	1						2		4	
<i>Butorides striata</i>	Striated Heron						1								1		1	
<i>Chroicocephalus novaehollandiae</i>	Silver Gull						1										1	
<i>Gelochelidon nilotica</i>	Gull-billed Tern	M	2	4	7	10	5	4		1	4	1	1	2	2	4	2	2
<i>Haliastur indus</i>	Brahminy Kite			1	1												1	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle			1														
<b>Total other wetland birds</b>			<b>28</b>	<b>9</b>	<b>27</b>	<b>13</b>	<b>37</b>	<b>15</b>	<b>22</b>	<b>20</b>	<b>19</b>	<b>7</b>	<b>45</b>	<b>2</b>	<b>19</b>	<b>11</b>	<b>35</b>	<b>7</b>

\* Status under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. CE = critically endangered, V = vulnerable, M = migratory.



**Table A2.2. Survey conditions during low tide (LT) and high tide (HT) surveys in habitats adjacent to the proposed Shoreline development.**

Date	LT ht (m)	LT time	HT ht (m)	HT time	Start time	End time	Cloud	Rain	Wind speed (km/hr)	Wind direction
19/03/2015			2.56	8:40			0	0	17	N
19/03/2015	0.29	15:17					0	0	28	NNE
11/12/2015			2.4	9:41	8:10	9:40	0	0	13	NNW
11/12/2015	0.53	16:14			15:40	16:30	4	0	24	NNE
22/12/2015			2.29	7:05	5:20	7:00	1	0	6	NNE
22/12/2015	0.6	13:31			13:00	13:45	1	0	19	N
13/01/2015	0.32	5:42			5:50	6:35	1	0	9	NNE
20/01/2016			2.29	6:50	5:50	7:00	0	0	0	
16/02/2018	0.52	16:52			18:00	18:30	4	0	30	NNE
20/02/2018	0.54	6:25			5:30	6:00	4	0	13	SSE
22/02/2018	0.74	8:01			9:00	9:35	4	0	33	ESE
01/03/2018	0.37	16:07			14:45	15:15	1	0	15	NNE

**Table A2.3. Survey conditions during low tide (LT) surveys for Eastern Curlew, Whimbrel and Bar-tailed Godwit between Cleveland Point and the proposed Shoreline development.**

Date	LT height (m)	LT time	Survey time	Wind speed (km/hr)	Wind direction	Rain	Cloud (0-4)
16/02/2018	0.52	16:52	15:15-18:30	30	NNE	0	4
20/02/2018	0.54	6:25	05:30-08:30	13-28	SSE	0	4
22/02/2018	0.74	8:01	06:30-09:35	26-35	ESE	0	4
01/03/2018	0.37	16:07	14:45-17:55	15	NNE	0	1

**Table A2.4. Eastern Curlew low-tide surveys of the number of birds on foraging habitats between Cleveland Point and the proposed Shoreline development, together with the average number (Avg.) and average density (birds per 100 ha of foraging habitat)(Figure 1).**

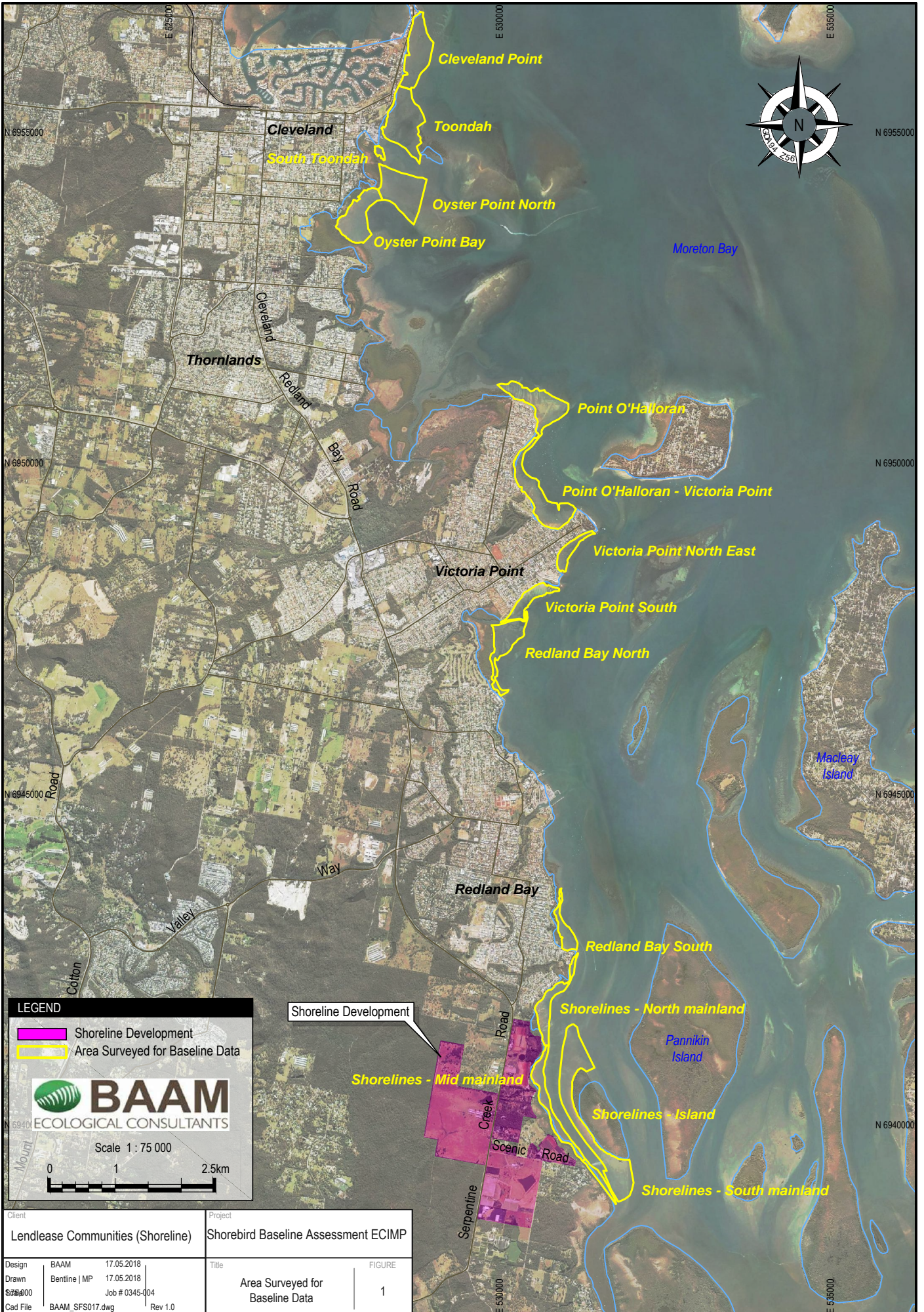
Survey sector	Area (ha)	16/02/2018	20/02/2018	22/02/2018	1/03/2018	Avg.	Density
Cleveland Pt - Toondah	74.5	4	8	4	6	5.5	7.4
Oyster Point	65.7	3	6	2	4	3.8	5.7
Point O'Halloran	30.9	4	5	5	7	5.3	17.0
Point O'Halloran - Victoria Point	36.5	5	10	8	5	7.0	19.2
Victoria Point - Redland Bay N	46.8	No survey	18	16	13	15.7	33.5
Redland Bay S	12.8	No survey	0	0	0	0.0	0.0
Shoreline mainland	41.1	4	4	4	2	3.5	8.5
St Clair Island	67.8	1	2	1	1	1.3	1.8
Total	376.1		53	40	38	43.7	11.6

**Table A2.5. Whimbrel low-tide surveys of the number of birds on foraging habitats between Cleveland Point and the proposed Shoreline development, together with the average number (Avg.) and average density (birds per 100 ha of foraging habitat).**

Survey sector	Area (ha)	16/02/2018	20/02/2018	22/02/2018	1/03/2018	Avg.	Density
Cleveland Pt - Toondah	74.5	5	7	13	16	10.3	13.8
Oyster Point	65.7	8	9	8	21	11.5	17.5
Point O'Halloran	30.9	8	10	9	16	10.8	34.8
Point O'Halloran - Victoria Point	36.5	9	13	11	14	11.8	32.2
Victoria Point - Redland Bay N	46.8	No survey	32	27	34	31.0	66.2
Redland Bay S	12.8	No survey	1	2	2	1.7	13.0
Shoreline mainland	41.1	9	6	12	14	10.3	25.0
St Clair Island	67.8	20	25	16	17	19.5	28.8
Total	376.1	No survey	103	98	134	111.7	29.7

**Table A2.6. Bar-tailed Godwit low-tide surveys of the number of birds on foraging habitats between Cleveland Point and the proposed Shoreline development, together with the average number (Avg.) and average density (birds per 100 ha of foraging habitat).**

Survey sector	Area (ha)	16/02/2018	20/02/2018	22/02/2018	1/03/2018	Avg.	Density
Cleveland Pt - Toondah	74.5	No survey	12	10	17	13.0	17.4
Oyster Point	65.7	No survey	11	9	23	14.3	21.8
Point O'Halloran	30.9	No survey	8	12	7	9.0	29.1
Point O'Halloran - Victoria Point	36.5	No survey	14	15	16	15.0	41.1
Victoria Point - Redland Bay N	46.8	No survey	34	29	35	32.7	69.8
Redland Bay S	12.8	No survey	3	0	0	1.0	7.8
Shoreline mainland	41.1	No survey	0	0	0	0.0	0.0
St Clair Island	67.8	No survey	3	6	3	4.0	5.9
Total	376.1	No survey	85	81	101	89.0	23.7



**LEGEND**

- Shoreline Development
- Area Surveyed for Baseline Data



Scale 1 : 75 000



Shoreline Development

Shorelines - Mid mainland

Shorelines - North mainland

Shorelines - Island

Shorelines - South mainland

Client Lendlease Communities (Shoreline)		Project Shorebird Baseline Assessment ECIMP	
Design BAAM 17.05.2018	Drawn Bentline   MP 17.05.2018	Title Area Surveyed for Baseline Data	FIGURE 1
Cad File BAAM_SFS017.dwg		Rev 1.0	

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