GOLDEN BAY

MINISTERIAL IMPLEMENTATION STATEMENT NO. 297 COMPLIANCE ASSESSMENT REPORT YEAR 2018

Prepared for:	Peet Golden Bay Pty Ltd/Department of Communities
Report Date:	30 August 2019
Version:	1
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pgv ENVIRONMENTAL

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1 INTRODUCTION

1.1 Background

The proposal to develop Part Lot 12 and Reserve 34664, Golden Bay for urban development was referred to the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986* (EP Act) in 1992 by H & B Developments. The EPA set the level of assessment as a Public Environmental Review (PER) (Assessment No. 604). The Minister for the Environment approved the proposal through Ministerial Statement 297 subject to environmental conditions in January 1993 (Attachment A).

Ministerial Statement 297 gave environmental approval subject to conditions to develop the landholding then known as Part Lot 12 and Reserve 34664, Golden Bay.

The Minister for the Environment confirmed on 30 July 1997 that the project had been substantially commenced, and as a result the environmental approval remains valid.

The Department of Environmental Protection (now the Department of Water and Environmental Regulation (DWER)) recognised the change in ownership to the Department of Housing and Works (now known as the Department of Communities (DoC)) and issued an Audit Table detailing the status of the Environmental Conditions and Commitments on 3 April 2001 (Attachment B).

The landholding is now referred to as Lot 2 Warnbro Sound Avenue and Lot 3 Dampier Drive, Golden Bay.

1.2 Golden Bay Project Description

Golden Bay is located on the coast, approximately 62km south of the Perth Central Business District and 20km south of The City of Rockingham (Figure 1).

The landholding covers an area of approximately 161 hectares (ha) and is situated west of Mandurah Road (Figure 2). Lot 2 has approximately 800m of coastal frontage and the foreshore reserve covers an area of 10.61ha with vegetation that is largely in Excellent condition. Lot 3 has a Landscape Protection Area that conserves the parabolic dunal formation associated with Mandurah Hill, the highest point in the region.

The key environmental elements of the Golden Bay Proposal as described in the PER were listed as:

- Foreshore Reserve designation;
- Foreshore Reserve management;
- Landscape protection;
- Southern Brown Bandicoot Protection; and
- Protection of the heritage site.

1.3 Proponent

Peet Golden Bay Pty Ltd (Peet) and the Housing Authority (now DoC) formed a co-ownership in November 2014. The change in Proponent was endorsed by the OEPA (now DWER) on 1 August 2016.

1.4 Environmental Approval to Implement the Project

The proposal to develop the site was assessed through a Section 38 Public Environmental Review (PER) assessment process under the WA *Environmental Protection Act 1986* (EP Act). The project was approved through Ministerial Statement 297 in January 1993 (Appendix 1).

The Minister for the Environment confirmed on 30 July 1997 that the project had been substantially commenced.

1.5 Scope of the Report

Condition 8 of MS297 states the following:

8. Compliance Auditing

In order to ensure that environmental conditions and commitments are met, an audit system is required.

8-1 The Proponent shall prepare periodic 'Progress and Compliance Reports' to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.

Procedure

The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of the Minister for the Environment or any other government agency.

If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

The reporting requirements set out in the Audit Table indicated that the first compliance report was due before clearing activities commenced and the second one year after the clearing had commenced. Thereafter the submission of compliance reports was as required by the OEPA.

The OEPA advised in correspondence dated 8 April 2016 (Appendix 2) that a CAR was required to be submitted by 30 August 2016 and annually thereafter and to report on the period of the previous calendar year.

This is the seventh Compliance Assessment Report (CAR), the previous CARs were submitted on the following dates:

- 20 May 2010;
- 30 May 2011;
- 30 May 2012;
- 30 August 2016 (Report Period Year 2015);
- 30 August 2017 (Report Period Year 2016); and
- 20 August 2018 (Report Period Year 2017).

This CAR has been prepared in accordance with the OEPA *Guidelines for Preparing a Compliance Assessment Report, August 2012*. This report is based on the Proponent's assessment of compliance with the conditions in accordance with the MS297 and MS297 Audit Table. This CAR covers the period between January 2018 to December 2018.

2 CURRENT STATUS OF PROJECT IMPLEMENTATION

2.1 Golden Bay Project

Peet is delivering the urban development project on behalf of the landowners in accordance with the approved Comprehensive Development Plan (Figure 2) will deliver the following:

- Residential Lots;
- Commercial Precinct;
- Primary and Secondary Schools;
- Local Public Open Space (recreational and drainage functions);
- Landscape protection area; and
- A Foreshore Reserve.

2.2 Current Project Activities

Development construction has progressed over Lot 2 both east and west of Warnbro Sound Avenue and progressed on Lot 3 Dampier Drive (Figure 3). The following tasks have been undertaken to date:

- The Foreshore Reserve adjacent to Lot 2 has been surveyed and demarcated with flagging tape;
- Phase 1 works have commenced in the Foreshore Reserve in accordance with the FMP;
- The Southern Brown Bandicoots are being managed on the site and within the foreshore reserve;
- The wetlands within the foreshore reserve have been monitored annually;
- Rehabilitation works have commenced in the southern portion of the foreshore reserve adjacent to the existing Golden Bay;
- The landscape protection area on Lot 3 has been fenced off on the eastern perimeter; and
- Stage 5 earthworks have commenced on Lot 3.

3 INSTANCES OF POTENTIAL NON-COMPLIANCE AND PREVENTATIVE ACTIONS UNDERTAKEN

In accordance with Condition 8-1 of MS 297, all instances of potential non-compliance with the conditions of MS 297 that are identified during the reporting period are to be reported in the annual CAR, and corrective and preventative actions taken are to be described. The status of all conditions is presented in Table 1 and Appendix 3.

There were no non-compliance issues during this reporting period.

4 PUBLIC AVAILABILITY OF REPORT

This CAR will be made publicly available within one month of being submitted to the OEPA. A copy of the most recent CAR will be placed on the Proponent's website until the subsequent annual CAR is placed on the website.

The website URL is www.peet.com.au/GoldenBay

5 COMPLIANCE

5.1 Compliance Assessment Method

An audit of the Golden Bay project was conducted in June/July 2019 to facilitate the assessment of compliance against MS 297 and the implementation of actions to meet environmental conditions. The audit was conducted by Belinda Heath of PGV Environmental.

The compliance status terminology to define the level of compliance used during the audit follows the EPA *Post Assessment Guideline for Preparing an Audit Table* and is listed below:

- C = Compliant;
- CLD = Completed;
- NC = Non – compliant
- NR = Not Required at this stage;
- IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the guideline

The information reviewed and the evidence obtained during this audit has been presented within the Compliance Assessment Audit Table (Appendix 3), along with additional information gathered during a desktop study/investigation.

5.2 Statement of Compliance

The Statement of Compliance and the Compliance Assessment Audit Table are attached at Appendix 3.

5.3 Summary Audit Table

Details on compliance with the MS297 conditions and management plans are presented below in a summary audit table (Table 1). The detailed Compliance Assessment Audit Table is provided in Appendix 3.

Table 1: Summary Audit Table Status

Audit Code	Requirement	Status	Comment
297:M1-1	Fulfil the commitments	CLD	All commitments have been fulfilled
297:M2-1	Adhere to the Proposal	C	
297:M2-2	Seek approval for modifications to the Proposal	C	No modifications sought
297:M3-1	Provide a foreshore reserve for conservation and recreation which: 1. Protects the Peelhurst Wetlands and the Southern Brown Bandicoot (*Isoodon obesulus*) population; and 2. Includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.	CLD	4 June 1993
297:M3--2	Transfer to public ownership the proposed foreshore reserve as required by M3-1.	CLD	4 June 1993
297:M4-1	Liaise with the Department of Planning and Urban Development and the CoR to incorporate planning measures which recognise and protect the landscape value of the parabolic ridge on the eastern edge of Golden Bay.	CLD	5 April 1994
297:M5-1:1	Establish the regional implications of disturbing the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay.	CLD	6 February 1996
297:M5-1:2	Initiate management of the population of the Southern Brown Bandicoot (*Isoodon obesulus*)	CLD	Submitted 20 May 2010
297:M5-2:1	Carry out the ongoing management of the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay as proposed in M5-1.	C	All stages of development have included a relocation program prior to any clearing activity.
297:M5-2:2	Carry out the ongoing management of the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay as proposed in M5-1.	NR	Post development management
297:M6-1	Seek approval for transfer of ownership, control or management of this project.	C	Proponents are DoC and Peet Golden Bay Pty Ltd
297:M7-1	Seek approval to extend approval to implement proposal.	CLD	Minister for Environment confirmed project has commenced on 30 July 1997
297:M8	Prepare a periodic 'Progress and Compliance Report' to help verify the environmental performance of this project.	C	OEPA has requested (Appendix 2) that from August 2016 compliance reports are to be submitted annually by 30

			August for the previous calendar year.
297:P1	Provide in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD.	CLD	26 October 1995 Not Audited (duplicated by condition M3-1) – Audit Branch
297:P2	Prepare a Management Plan for the coastal reserve at Golden Bay.	CLD	Golden Bay Foreshore Management Plan approved by the OEPA on 30 March 2012 (on advice from DoP and CoR) An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016
297:P3	Include the historic aboriginal camping site within the proposed Public Open Space for the development.	CLD	13 December 1995
297:P4	Protect against Bushfire	CLD	Fire Management Plan for the Golden Bay Structure Plan Area was approved by the City of Rockingham in March 2012.
297:P5	Provide reticulated sewerage and stormwater drainage designated to infiltrate stormwater into the soil within the development site.	CLD	A Local Water Management Strategy (LWMS) has been prepared for the Structure Plan Area and approved by the Department of Water and the City of Rockingham. Urban Water Management Plans are being prepared in accordance with the

			LWMS for each stage of subdivision.
297:P6	Liaise with CALM regarding the presence of bandicoots at Golden Bay and examine feasibility of relocating bandicoots if required by CALM.	CLD	13 December 1995

5.4 Compliance with Management Plans

Commitment 2 of the Ministerial Statement required that a management plan be prepared for the foreshore reserve on advice from the Department of Planning and the City of Rockingham.

The Golden Bay Foreshore Management Plan was prepared in consultation with the Department of Planning and the City of Rockingham and approved by the OEPA on 30 March 2012 (Appendix 3).

An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016 (Appendix 8).

The FMP provides for the management and conservation of the Peelhurst Wetlands, Southern Brown Bandicoot, TEC 19a (Sedgelands in Holocene Dune Swales) and the Indigenous Heritage site located within the approved Foreshore Reserve. In addition, the FMP details the proposed infrastructure, recreational activities and relevant management strategies as proposed in the Public Environmental Review.

Implementation of the FMP has commenced and a status update on the management actions are provided in Appendix 4.

5.4.1 TEC19a Photo Point Monitoring

The condition of the TEC19a (*Sedgelands in Holocene Dune Swales*) has been recorded annually through photo point monitoring survey conducted in late September/October. The survey records the overall condition of the TEC and provides a basis to determine if the TEC is improving/degrading over time.

The photo point monitoring survey results are provided in Appendix 5.

Plate 1: TEC19a (Sedgelands in Holocene Dune Swales)

5.4.2 Southern Brown Bandicoot Monitoring

The local population of Quenda within the foreshore reserve have been monitored in autumn and spring for six years. The monitoring reports for 2018 are provided at Appendix 6.

Based on the results of the 2018 trapping program, there has been an increase in the number of individuals (46) surveyed in the Foreshore Reserve in comparison to the previous four surveys. Of the 46 individuals captured 28 were male and 18 were female. The higher capture rate is in part due to 10 individuals being relocated from other surveys in East Rockingham, Florida and Madora Bay to supplement the Golden Bay population and that the vegetation has regrown to provide additional suitable habitat (Terrestrial Ecosystems, 2018).

The 2018 monitoring results showed a higher ratio of large males to females. The overabundance of large males very probably reflects predation by foxes and feral cats on the smaller Quenda and the large males being able to escape or avoid foxes and feral cats. Dense vegetation around the wetland will provide additional suitable habitat for Quenda and better protection from feral predators (Terrestrial Ecosystems, 2018).

Most of the adult females had pouch young or evidence of recently nursing pouch young. However, the previous data has indicated there is very low recruitment of juveniles into the adult population, almost certainly because of predation by feral predators (Terrestrial Ecosystems, 2018).

Several Quenda had Sarcoptic Mange which is caused by the parasitic burrowing mite *Sarcoptes scabiei*. Due to the burrowing activity of the mite the host develops a range of symptoms, the most common of which are a thickening of the skin, irritation of the skin, dermatitis and patchy hair loss (Bornstein et al. 1995, Little et al. 1998, Davidson et al. 2008). This parasite is typically found on foxes but will infect other native mammals. When untreated an infected fox will usually die within two to four months (Borg 1987, Newman et al. 2002), so it is probably the same for Quenda (Terrestrial Ecosystems, 2018).

Fox and cat trapping were undertaken post the 2016 fire event and additional cat trapping is undertaken during the biannual Quenda monitoring surveys. The number of foxes has increased, and it is likely that the Sarcoptic Mange, which can be carried by foxes, has infected some of the Quenda. This disease can kill foxes within 2-4 months if left untreated and it is thought to be the same for Quenda (Terrestrial Ecosystems, 2018). Fox management is best done in cooperation with surrounding landholders as foxes move freely through the remnant vegetation.

The City of Rockingham undertakes annual fox trapping in the region, but no foxes were caught at Golden Bay between Autumn 2018 and Autumn 2019. It is unknown if trapping for foxes is proposed in proximity to the Peet landholdings in the near future.

Plate 2: Southern Brown Bandicoot (photo source G. Thomson Terrestrial Ecosystems)

5.4.3 Groundwater Levels Monitoring

The groundwater levels in the foreshore reserve are monitored each month. The levels for the period July 2012 to December 2018 are provided at Appendix 7.

Plate 3: Groundwater Monitoring Bore (WB02)

5.4.4 Landscape Protection Management Plan

Development on the northern end of Lot 3 Dampier Drive commenced in 2017.

The Landscape Protection Area (LPA) has been fenced along the north east to protect it from construction activity.

Peet provided correspondence dated 17 April 2019 to EPA Services providing the detailed planning and engineering for the development interface with the northern end of the LPA (Appendix 8). Under the 1994 endorsed Management Plan the interface was to include batters and a series of tiered walls. The City of Rockingham has advised recently that the tiered walls should be reconsidered and replaced with pitched rocks at the base of the slope and a vegetated batter upslope. The reasons for the change

are that the batter slope is easier to revegetate and look after in the long term and will blend back into the natural dune vegetation providing better view amenity than a set of tiered walls. The clearing and revegetation within the LPA to accommodate engineering requirements was envisaged and approved in the 1994 Landscape Protection Management Plan.

The final detailed survey of the development interface with the LPA has indicated that a small additional area will require clearing to accommodate the 1:3 batter. The revised earthworks plan is provided at Appendix 9.

Rehabilitation works will commence as per the Landscape Protection Area Management Plan as part of subdivisional works.

6 REFERENCES

Environmental Protection Authority (EPA) (2012) *Post Assessment Guideline No. 3 for Preparing a Compliance Assessment Report* Perth Western Australia.

Office of the Environmental Protection Authority (2012). *Post Assessment Guideline for Preparing an Audit Table*. Office of the Environmental Protection Authority, Government of Western Australia. August 2012

Office of the Environmental Protection Authority (2010c). *Post Assessment Guideline for making information publicly available.* Office of the Environmental Protection Authority, Government of Western Australia. August 2012

Bornstein, S., G. Zakrisson, and P. Thebo (1995). Clinical picture and antibody response to experimental *Sarcoptes scabiei var vulpes* infection in red foxes (*Vulpes vulpes*). *Acta Veterinaria Scandinavica* 36:509-519.

Little, S. E., W. R. Davidson, E. W. Howerth, P. M. Rakich, and V. F. Nettles (1998). Diseases diagnosed in red foxes from the southeastern United States. *Journal of Wildlife Diseases* 34:620-624

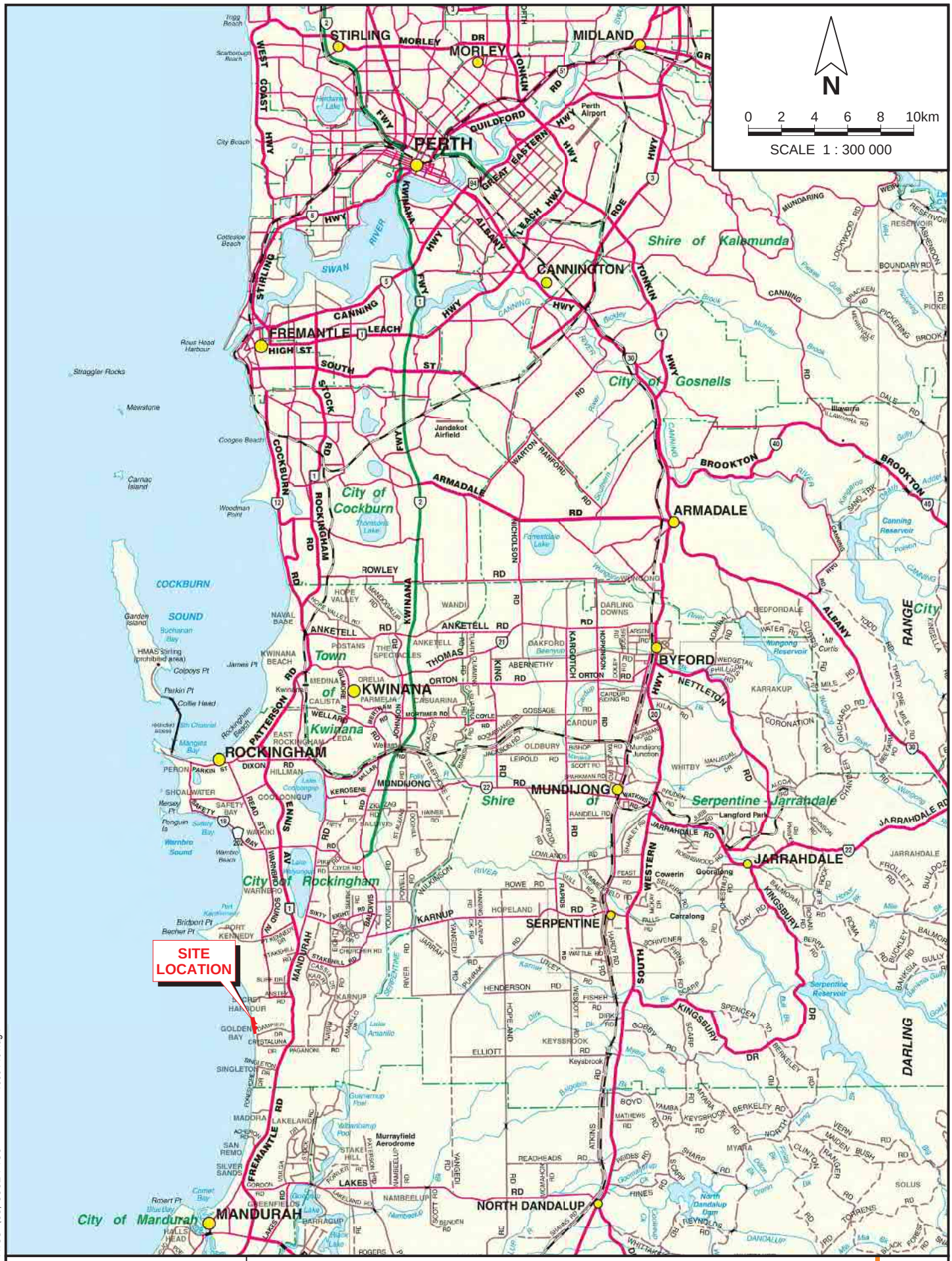
Davidson, R. K., S. Bornstein, and K. Handeland (2008). Long-term study of *Sarcoptes scabiei* infection in Norwegian red foxes (Vulpes vulpes) indicating host/parasite adaptation. *Veterinary Parasitology* 156:277-283

Borg, K. (1987). A review of wildlife diseases from Scandinavia. *Journal of Wildlife Diseases* 23:527-533.

Newman, T. J., B. P.J., and S. Harris. 2002. Nutritional condition and survival of red foxes with sarcoptic mange. *Canadian Journal of Zoology-Revue Canadienne De Zoologie* 80:154-161.

Terrestrial Ecosystems (2018). *Quenda Monitoring Golden Bay – Spring 2018. Report prepared for Peet Limited.*

FIGURES



PINPOINT CARTOGRAPHICS (08) 9562 7136 10004-f01.dgn

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Department of Housing
COMPLIANCE ASSESSMENT REPORT
GOLDEN BAY

Drawn: B. Heath	Date: 10 Aug 2011
Job: 10004	Revision: A

REGIONAL LOCATION

Figure 1

LEGEND

- Comprehensive Development Plan Boundary
- Stage 1 Boundary (Refer note 6)
- 400m Walkable Catchment to Neighbourhood Centre

Zones:

- Residential R5
- Residential R20
- Residential R30
- Residential R40
- Residential R60
- Residential R80
- Commercial Zone Neighbourhood Centre Precinct - (Refer notes 4 and 5)

Road Heirachy:

- Primary Distributor
- District Distributor A / Integrator A
- Integrator B
- Neighbourhood Connector A
- Neighbourhood Connector B

Reserves:

- Public Open Space/ Drainage
- Local Reserve Public Purposes Drainage
- Existing Open Space
- Landscape Protection Area (refer note 2)
- Existing MRS Parks and Recreation Reserve
- MRS Reserve Public Purposes Primary School/High School

NOTES:

1. The boundary to the Comprehensive Development Plan (CDP) Update is in accordance with the approved CDP 1994 and original lot 12 boundary.
2. Landscape Protection Areas are in accordance with the approval of the state Minister for the Environment 1993.
3. The access street layout is indicative only and subject to refinement as part of the detailed subdivision design process.
4. The Neighbourhood Centre Precinct is a main street based centre and is subject to the preparation of a Detailed Area Plan. Refer CDP Update Report.
5. Where residential uses are proposed in the Neighbourhood Centre Precinct an R60 density code shall apply.
6. Stage 1 approved pursuant to endorsed CDP, refer WAPC Ref. 141268 and 141271.
7. Full movement four way intersection at Wambro Sound Avenue and Coastal Boulevard, and full movement T intersection north of traffic lights as approved in principle by Main Roads WA Dec 2010.
8. POS areas are indicative only and subject to further detailed design and drainage considerations.
9. All road carriageway detail depicted on this Plan including pavements, road treatments, medians and parking are for illustrative purposes only and are subject to final engineering design and any relevant approvals. The detail reflects the intent of the road network standards preferred for this subdivision. All dimensions and areas depicted on this Plan are subject to pre-cal and final survey and will vary from the figures shown.
10. All development on lots that fall within a hazard separation zone, as identified by the endorsed Golden Bay Fire Management Plan, must be constructed to the appropriate standard as specified in *Australian Standard 3959 Construction of Buildings in Bushfire Prone Areas.*

SECRET HARBOUR

COMET BAY HIGH SCHOOL

Coastal Node:
Surf club and beach access facilities
Refer Foreshore Management Plan

RES 27066

FORESHORE RESERVE

COASTAL PRECINCT

NEIGHBOURHOOD CENTRE PRECINCT

HIGH SCHOOL 0.8ha

Wambro Sound Avenue Intersections. Refer note 7.

RHONDA SCARROTT RESERVE

Existing Community Building

PRIMARY SCHOOL 3.5ha

STAGE 1

WOODLANDS ROAD

TANGADEE ROAD

DAMPIER DRIVE

CENTRAL AVENUE

Existing roundabout subject to upgrading. Refer CDP Update Transport Assessment.

LANDSCAPE PROTECTION AREAS

MARILLANA DRIVE

MINDEROO CRESCENT

GOLDEN BAY

INDIAN OCEAN

FUTURE KARNUP STATION

N

0 50 100 150 200 250m

SCALE 1 : 8 000

SOURCE: Chappell Lambert Everett, Plan No. 2187-29U-01, 28-02-2011.

CHAPPELL LAMBERT EVERETT

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Department of Housing
FCOMPLIANCE ASSESSMENT REPORT
GOLDEN BAY

Drawn: B. Heath	Date: 10 Aug 2011
Job: 10004	Revision: A

COMPREHENSIVE DEVELOPMENT PLAN

Figure 2

APPENDIX 1

MINISTERIAL STATEMENT 297

Ass # 604
Bull # 648
State # 297

WESTERN AUSTRALIA
MINISTER FOR THE ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664 (AFFECTING PART OF SYSTEM SIX RECOMMENDATION M107), GOLDEN BAY (604)

H & B DEVELOPMENTS PTY LTD

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments
The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review and included in Environmental Protection Authority Bulletin 648. (A copy of the commitments is attached.)

2 Implementation
Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Foreshore Reserve

3-1 The proponent shall provide a foreshore reserve for conservation and recreation which:

1 protects the Peelhurst wetlands and the Southern Brown Bandicoot (*Isoodon obesulus*) population; and
2 includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.

3-2 Prior to the lifting of Urban Deferment, the proponent shall identify the foreshore reserve as required by condition 3-1, and at subdivision the proponent shall transfer to public ownership the proposed foreshore reserve, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

Published on
12 JAN 1993

18th FLOOR, ALLENDALE SQUARE, 77 ST GEORGE'S TERRACE, PERTH, W.A. 6000 TELEPHONE 325 9422 FAX. 325 5621

4 Landscape Protection
The landscape value of the parabolic dune ridge on the eastern edge of Golden Bay should be recognised.

4-1 Prior to subdivision approval, the proponent shall liaise with the Department of Planning and Urban Development and the City of Rockingham to incorporate planning measures which recognise and protect the landscape value of the parabolic dune ridge on the eastern edge of Golden Bay, to the requirements of the Minister for the Environment and the Minister for Planning on advice of the Department of Planning and Urban Development, the City of Rockingham and the Environmental Protection Authority.

5 Southern Brown Bandicoot (*Isoodon obesulus*)
The population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay requires special consideration.

5-1 Prior to the commencement of development and in consultation with the Department of Conservation and Land Management, the proponent shall establish the regional implications of disturbing the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay and shall initiate management of the population, to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.

5-2 The proponent shall carry out the on-going management of the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay to the requirements of the Department of Conservation and Land Management.

6 Proponent
These conditions legally apply to the nominated proponent.

6-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

7 Time Limit on Approval
The environmental approval for the proposal is limited.

7-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority.)

8 Compliance Auditing
In order to ensure that environmental conditions and commitments are met, an audit system is required.

8-1 The proponent shall prepare periodic "Progress and Compliance Reports", to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.

Procedure

The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other government agency.

If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

Jim McGinty, MLA
MINISTER FOR THE ENVIRONMENT

12 JAN 1993

PROPONENT'S COMMITMENTS

URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664
(AFFECTING PART OF SYSTEM SIX RECOMMENDATION M107)
GOLDEN BAY (604)

H & B DEVELOPMENTS PTY LTD

The proponent has made the following environmental commitments:

CONSOLIDATED LIST OF COMMITMENTS FOR GOLDEN BAY

1. The proponent will provide, in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent to the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD. This will be done to the satisfaction of the EPA, DPUD and the Local Authority at the rezoning stage.

2. The proponent will prepare a Management Plan for the Coastal Reserve at Golden Bay prior to development commencing. This will be done to the satisfaction of DPUD and the Local Authority.

3. The proponent will include an historic aboriginal camping site within the proposed Public Open Space for the development. This will be done to the satisfaction of the Local Authority.

4. The proponent will continue to provide and maintain a network of firebreaks and access tracks to protect against bushfire until the Local Authority takes on this responsibility. This will be done to the satisfaction of the Local Authority.

5. The proponent will provide reticulated sewerage and will design the development so that stormwater drainage is disposed of on site. This will be done during the installation of services within the development to the satisfaction of DPUD and the Local Authority.

6. The proponent will liaise with CALM regarding the presence of bandicoots at Golden Bay and if required by CALM will examine the feasibility of relocating the bandicoots to an appropriate location elsewhere. This will be done prior to any disturbance of the vegetation at Golden Bay and will be done to the satisfaction of both CALM and the EPA.

APPENDIX 2

OEPA CORRESPONDENCE

Government of **Western Australia**
Office of the **Environmental Protection Authority**

Mr Alex Horsburgh
Senior Project Manager
Department of Housing
169 Hay Street
EAST PERTH WA 6175

3RD HAY ST.

Our Ref: *16-006294*
Enquiries: *Rowan Inglis, 6145 0849*
Email: *rowan.inglis@epa.wa.gov.au*

Dear Mr Horsburgh

MINISTERIAL STATEMENT 297 – URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664, GOLDEN BAY – ANNUAL COMPLIANCE ASSESSMENT REPORT REQUIRED

Ministerial Statement 297 places conditions on the implementation of the proposal above. Condition 8-1 of Statement 297 requires preparation and submission of a Compliance report.

The Office of the Environmental Protection Authority (OEPA) advises the Department of Housing that a Compliance Report reporting on the period of the previous calendar year (January to December 2015) is required to be submitted by **30 August 2016** and annually thereafter to demonstrate compliance with Statement 297.

The CAR must be developed in accordance with the following:

- Post Assessment Guideline for Preparing a Compliance Assessment Report
- Post Assessment Guideline for Preparing an Audit Table

These documents are available on the OEPA website www.epa.wa.gov.au

If you have any queries regarding this matter, or wish to align the submission of the Compliance Report with reporting submitted to other government agencies, please contact Rowan Inglis on 6145 0849.

Yours sincerely

Mr Ian Munro
MANAGER COMPLIANCE BRANCH

31 March 2016

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Locked Bag 10, East Perth WA 6892

www.epa.wa.gov.au

Reserve Enquiry Detail [5100L]

Screen Friendly Print Page

Reserve	34664	**Legal Area (ha)**	1.2757
Name		**Status**	Current
Type		**Current Purpose**	PUBLIC RECREATION
Notes			
File Number	3915/62		

Class	Responsible Agency	Date of Last Change
C	DEPARTMENT FOR PLANNING AND INFRASTRUCTURE	23/10/1995

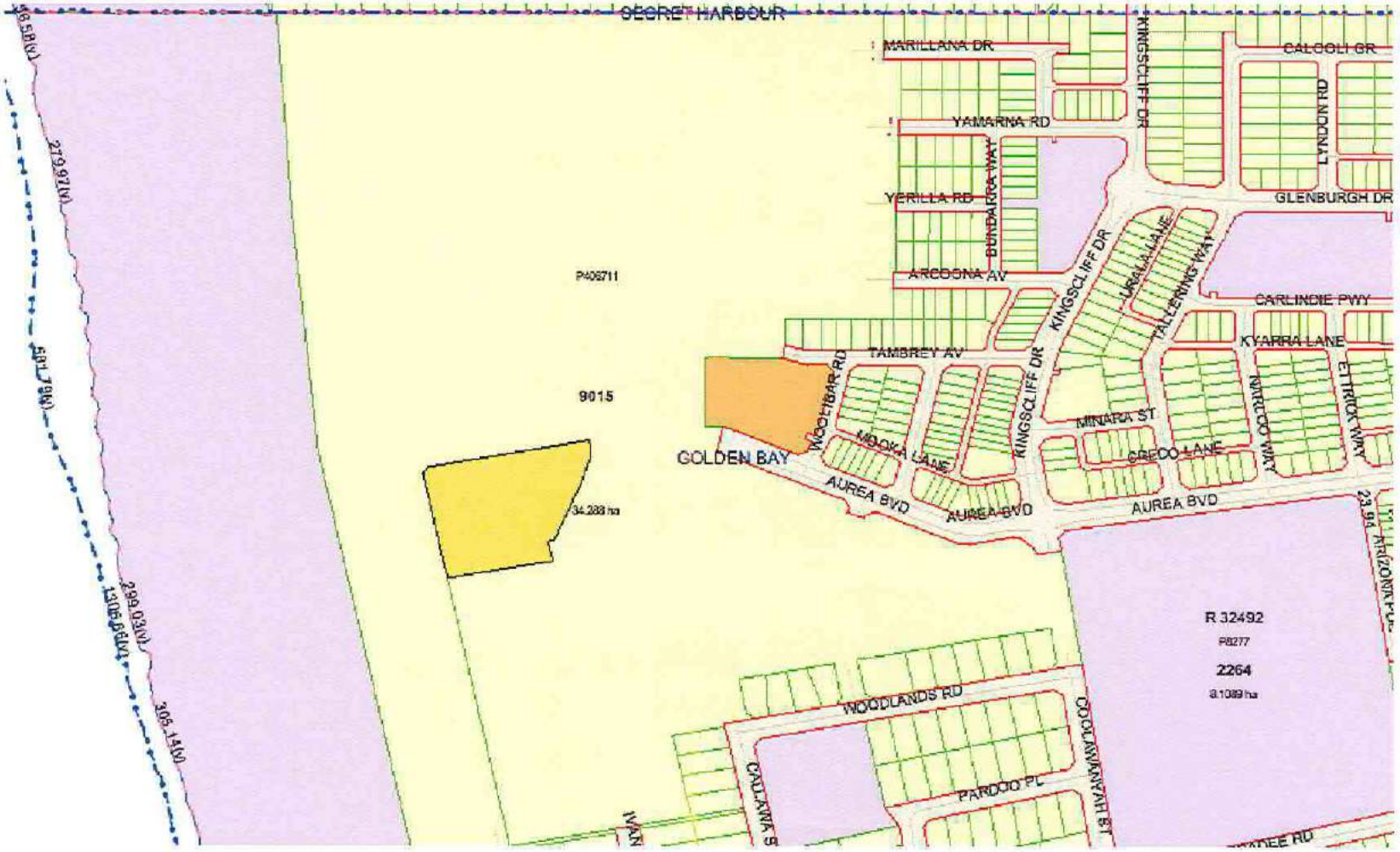
Management Orders	Document	Land Use	Local Government Authority
THE CITY OF ROCKINGHAM		PUBLIC RECREATION	ROCKINGHAM, CITY OF

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
☐	LR3067-211	Lot 2486 On Diagram 28721			3915/1962.	368857	12757.0	

Reserve Number 34664

Previous Certificates of Title		Historic Crown Allotments		
LR3053-222	Cancelled	COCKBURN SOUND	Location	2486

Gaz Page/Document	Date	Type	Text
4852	17/10/1995	Current Area	1.2757
4852	17/10/1995	Public Plan	BG33 (2) 7.13
2593	12/08/1977	Current Vesting	VEST SHIRE OF ROCKINGHAM
1841	17/06/1977	Formerly	FORMERLY PTN COCKBURN SOUND 16 LOT 246-D:28721
1841	17/06/1977	Original Gazettal and page	ORIGINAL GAZETTE
	17/06/1977	Class	C
	17/06/1977	Current Purpose	PUBLIC RECREATION
	17/06/1977	Correspondence File Number	3915/62
	17/06/1977	Historical Area	2.4306
	17/06/1977	Location	COCKBURN SOUND,2486


SECRET HARBOUR
MARILLANA DR
YAMARNA RD
YERILLA RD
ARCOONA AV
TAMBREY AV
KINGSCLIFF DR
BUNDARRA WAY
LYNDON RD
GLENBURGH DR
CARLINDIE PWY
KYARRA LANE
MINARA ST
GRECO LANE
AUREA BVD
GOLDEN BAY
MOOKA LANE
WOOLYBAR RD
WOODLANDS RD
PARDOO PL
P406711
9015
34.288 ha
R 32492
P8277
2264
3.1089 ha
279.97(M)
299.03(M)
309.14(M)

APPENDIX 3

STATEMENT OF COMPLIANCE AND AUDIT TABLE

Statement of Compliance

1. Proposal and Proponent Details

Proposal Title	*Urban Development of Part Lot 12 and Reserve 34664*
Statement Number	*Ministerial Statement 297*
Proponent Name	*Peet Golden Bay Pty Ltd and Department of Communities*
Proponent's Australian Company Number *(where relevant)*	94 600325 175 56 167 671 885

2. Statement of Compliance Details

Reporting Period	*1/01/18* to *31/12/18*

Implementation phase(s) during reporting period (please tick ✓ relevant phase(s))							
Pre-construction		Construction	✓	Operation	✓	Decommissioning	

Audit Table for Statement addressed in this Statement of Compliance is provided at Attachment:	3
An audit table for the Statement addressed in this Statement of Compliance must be provided as Attachment 2 to this Statement of Compliance. The audit table must be prepared and maintained in accordance with the Department of Water and Environmental Regulation (DWER) *Post Assessment Guideline for Preparing an Audit Table*, as amended from time to time. The 'Status Column' of the audit table must accurately describe the compliance status of each implementation condition and/or procedure for the reporting period of this Statement of Compliance. The terms that may be used by the proponent in the 'Status Column' of the audit table are limited to the Compliance Status Terms listed and defined in Table 1 of Attachment 1.	

Were all implementation conditions and/or procedures of the Statement complied with within the reporting period? (please tick ✓ the appropriate box)			
No (please proceed to Section 3)		Yes (please proceed to Section 4)	✓

3. Details of Non-compliance(s) and/or Potential Non-compliance(s)

The information required Section 3 must be provided for each non-compliance or potential non-compliance identified during the reporting period covered by this Statement of Compliance.

Non-compliance/potential non-compliance 3-1

Which implementation condition or procedure was non-compliant or potentially non-compliant?
Was the implementation condition or procedure non-compliant or potentially non-compliant?
On what date(s) did the non-compliance or potential non-compliance occur (if applicable)?

Was this non-compliance or potential non-compliance reported to the Chief Executive Officer, DWER?	
☐ Yes ☐ Reported to DWER verbally Date _____ ☐ Reported to DWER in writing Date _____	☐ No

What are the details of the non-compliance or potential non-compliance and where relevant, the extent of and impacts associated with the non-compliance or potential non-compliance?
What is the precise location where the non-compliance or potential non-compliance occurred (if applicable)? (please provide this information as a map or GIS co-ordinates)
What was the cause(s) of the non-compliance or potential non-compliance?
What remedial and/or corrective action(s), if any, were taken or are proposed to be taken in response to the non-compliance or potential non-compliance?
What measures, if any, were in place to prevent the non-compliance or potential non-compliance before it occurred? What, if any, amendments have been made to those measures to prevent re-occurrence?
Please provide information/documentation collected and recorded in relation to this implementation condition or procedure: • in the reporting period addressed in this Statement of Compliance; and • as outlined in the approved Compliance Assessment Plan for the Statement addressed in this Statement of Compliance. **(the above information may be provided as an attachment to this Statement of Compliance)**

For additional non-compliance or potential non-compliance, please duplicate this page as required.

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.
INITIALS: _____

4. Proponent Declaration

I, Craig Raynor (Senior Development Manager)

declare that I am authorised on behalf of Peet Golden Bay Pty Ltd

(being the person responsible for the proposal) to submit this form and that the information contained in this form is true and not misleading.

Signature:..... Date: 3/9/19

Please note that:

- it is an offence under section 112 of the *Environmental Protection Act 1986* for a person to give or cause to be given information that to his knowledge is false or misleading in a material particular; and
- the Chief Executive Officer of the DWER has powers under section 47(2) of the *Environmental Protection Act 1986* to require reports and information about implementation of the proposal to which the statement relates and compliance with the implementation conditions.

5. Submission of Statement of Compliance

One hard copy and one electronic copy (preferably PDF on CD or thumb drive) of the Statement of Compliance are required to be submitted to the Chief Executive Officer, DWER, marked to the attention of Manager, Compliance (Ministerial Statements).

Please note, the DWER has adopted a procedure of providing written acknowledgment of receipt of all Statements of Compliance submitted by the proponent, however, the DWER does not approve Statements of Compliance.

6. Contact Information

Queries regarding Statements of Compliance, or other issues of compliance relevant to a Statement may be directed to Compliance (Ministerial Statements), DWER:

Manager, Compliance (Ministerial Statements)

Department of Water and Environmental Regulation

Postal Address:	Locked Bag 33 Cloisters Square PERTH WA 6850
Phone:	(08) 6364 7000
Email:	compliance@dwer.wa.gov.au

7. Post Assessment Guidelines and Forms

Post assessment documents can be found at www.epa.wa.gov.au

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.
INITIALS: _____

ATTACHMENT 1

Table 1 Compliance Status Terms

Compliance Status Terms	Abbrev	Definition	Notes
Compliant	C	Implementation of the proposal has been carried out in accordance with the requirements of the audit element.	This term applies to audit elements with: • ongoing requirements that have been met during the reporting period; and • requirements with a finite period of application that have been met during the reporting period, but whose status has not yet been classified as 'completed'.
Completed	CLD	A requirement with a finite period of application has been satisfactorily completed.	This term may only be used where: • audit elements have a finite period of application (e.g. construction activities, development of a document); • the action has been satisfactorily completed; and • the DWER has provided written acceptance of 'completed' status for the audit element.
Not required at this stage	NR	The requirements of the audit element were not triggered during the reporting period.	This should be consistent with the 'Phase' column of the audit table.
Potentially Non-compliant	PNC	Possible or likely failure to meet the requirements of the audit element.	This term may apply where during the reporting period the proponent has identified a potential non-compliance and has not yet finalized its investigations to determine whether non-compliance has occurred.
Non-compliant	NC	Implementation of the proposal has not been carried out in accordance with the requirements of the audit element.	This term applies where the requirements of the audit element are not "complete" have not been met during the reporting period.
In Process	IP	Where an audit element requires a management or monitoring plan be submitted to the DWER or another government agency for approval, that submission has been made and no further information or changes have been requested by the DWER or the other government agency and assessment by the DWER or other government agency for approval is still pending.	**The term 'In Process' may not be used for any purpose other than that stated in the Definition Column.** The term 'In Process' may not be used to describe the compliance status of an implementation condition and/or procedure that requires implementation throughout the life of the project (e.g. implementation of a management plan).

Urban Development of Part Lot 12 and Reserve 34664, Golden Bay (Assessment 604, Statement 297)

Ministerial Statement 297 Audit Table

Note:

Phases that apply in this table = Pre-Construction, Construction, Operation, Decommissioning, Overall (several phases)

This audit table is a summary and timetable of conditions and commitments applying to this project. Refer to the Minister's Statement for full detail/precise wording of individual elements.

Code prefixes: M = Minister's condition; P = Proponent's commitment; A = Audit specification; N = Procedure.

Abbreviations: CAR = Compliance Assessment Report; LPA= Landscape Protection Area; FMP- Foreshore Management Plan; CEO = Chief Executive Officer of OEPA; Minister for Env = Minister for the Environment; OEPA = Office of the Environmental Protection Authority; CoR - City of Rockingham; DoT - Department of Transport; CALM Conservation and Land Management (now known as Department of Parks and Wildlife); DPUD = Department of Planning and Urban Development (now Department of Planning)

Compliance Status: C = Compliant, CLD = Completed, NC = Non – compliant, NR = Not Required at this stage. Please note the terms NA = Not Audited and VR = Verification Required are only for OEPA use. IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the *Post Assessment Guideline for Preparing an Audit Table*.

Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
297: M1-1	Commitments	Fulfil the commitments	As per attachment to the Minister's statement.	CAR	Overall	EPA DPaW		C	
297: M2-1	The Proposal	Adhere to the Proposal	In accordance with any designs, specifications, plans or other technical material submitted by the Proponent to the OEPA.	CAR	Overall	EPA DPaW	Throughout life of the project	C	No changes proposed
297: M2-2	The Proposal	Seek approval for modifications to the Proposal	Submit a written request to the Minister for Env. Detailing changes to designs, specifications, plans or other technical material.	Correspondence to OEPA	Overall	Minister for Env. EPA	Throughout life of the project	C	No changes proposed
297: M3-1	Foreshore Reserve	Provide a foreshore reserve for conservation and recreation which: 3. Protects the Peelhusrt Wetlands and the Southern Brown Bandicoot (Isoodon obesulus) population; and 4. Includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.	Make a submission to the Minister for Env. For approval on advice of the EPA.	Submission to the Minister for Env.	Pre development	Minister for Env. EPA	Prior to lifting of 'Urban Deferred'	CLD	4 June 1993
297: M3--2	Foreshore Reserve	Transfer to public ownership the proposed foreshore reserve as required by M3-1.	Make a submission to the Minister for Env. On advice of the Department of Conservation and Land Management	Submission to the Minister for Env.	Pre development	Minister for Env. EPA	Prior to lifting of 'Urban Deferred'	CLD	4 June 1993
297: M4-1	Landscape Protection	Liaise with the Department of Planning and Urban Development and the CoR to incorporate planning measures which recognise and protect the landscape value of the parabolic ridge on the eastern edge of Golden Bay.	Make a submission to the Minister for Env. And the Minister for Planning for approval on advice of the DPUD, CoR, EPA	Submission to the Minister for Env. And Minister for Planning	Pre development	Minister for Env Minister for Planning DPUD CoR EPA.	Before or as a condition of subdivision	CLD	5 April 1994

Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
297: M5-1:1	Southern Brown Bandicoot	Establish the regional implications of disturbing the population of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay.	Make a submission to the Minister for Env. On advice of the Department of Conservation and Land Management	Correspondence with Minister for Env.	Pre development	Minister for Env CALM	Prior to any clearing/construction activities commencing	CLD	6 February 1996
297: M3-1:2	Southern Brown Bandicoot	Initiate management of the population of the Southern Brown Bandicoot (Isoodon obesulus)		Report on this in the first report required under M8	Pre development	Minister for Env CALM	Prior to any clearing/construction activities commencing	CLD	CAR Submitted 20 May 2010
297: M5-2:1	Southern Brown Bandicoot	Carry out the ongoing management of the population of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay as proposed in M5-1.	Agreement with CALM	Report on this under M8	Development	CALM	Ongoing	C	All stages of development have included a relocation program prior to any clearing activity.
297: M5-2:2	Southern Brown Bandicoot	Carry out the ongoing management of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay as proposed in M5-1.	Agreement with CALM	Report on this under M8	Post Development	CALM	Ongoing	NR	
297: M6-1	Project Ownership, management, control	Seek approval for transfer of ownership, control or management of this project.	Letter to the Minister for Env. Together with the new proponent's endorsement of the Ministerial Statement	Letter and statement endorsed by the replacement proponent	overall	Minister for Env. EPA	Before transfer of ownership	C	DoC and Peet Golden Bay Pty Ltd were recognised by the OEPA as joint Proponents 1 August 2016.
297: M7-1	Time limit on approval	Seek approval to extend approval to implement proposal.	Application to be made before the end of five years (from the publish date of the Minister's statement)	Letter application	Overall	Minister for Env. EPA	Before 12 January 1998 if project has not commenced substantially	CLD	
297: M8	Compliance auditing	Prepare a periodic 'Progress and Compliance Report' to help verify the environmental performance of this project.	The report (CAR) should be an update on the project giving evidence of how compliance has been achieved. It should list each condition and commitment to be reported on showing for each: its code no. Form the audit table; what action it requires; what has been done to meet the condition or commitment including any problems that may have arisen and what the proponent has done to address them; how compliance can be verified.	CAR providing evidence of compliance for each relevant audit element in the audit table.	Overall	EPA	First report before clearing activities commence, second report one year after clearing has commenced, then as required by the OEPA.	C	OEPA has requested (Appendix 2) that from August 2016 compliance reports are to be submitted annually in August for the previous calendar year.
297: P1	Foreshore Reserve	Provide in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD.	Duplicated by M3-1		Predevelopment	EPA, DPUD CoR	At the rezoning stage	CLD	26 October 1995 Not Audited (duplicated by condition M3-1) – Audit Branch
297: P2	Management Plan	Prepare a Management plan for the coastal reserve at Golden Bay.	In a submission to the local authority, Minster for Planning and EPA.	Management Plan for foreshore reserve to be submitted	Predevelopment	EPA, Minister for planning, local authority, DEP	before clearing/construction activities commence	CLD	Golden Bay Foreshore Management Plan approved by the OEPA on 30 March 2012 (on advice from DoP and CoR).

Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
									An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016.
297: P3	Historic Site	Include the historic aboriginal camping site within the proposed Public Open Space for the development.	Present a submission to the local authority		Predevelopment	EPA Local Authority	before clearing/construction activities commence	CLD	13 December 1995
297: P4	Fire	Protect against Bushfire	By providing and maintaining a network of firebreaks and access tracks until the local authority takes on this responsibility	Report on this under M8	overall	EPA DEP	until the local authority takes on this responsibility	CLD	Fire Management Plan for the Golden Bay Structure Plan Area has been approved by the City of Rockingham in March 2012.
297: P5	Reticulated sewerage and stormwater drainage:	Provide reticulated sewerage and stormwater drainage designated to infiltrate stormwater into the soil within the development site.	To the satisfaction of Minister for planning and local authority	Report on this under M8	Development	EPA Minister for Planning Local Authority	During provision of services within the development	CLD	A Local Water Management Strategy (LWMS) has been prepared for the Structure Plan Area and approved by the Department of Water and the City of Rockingham. Urban Water Management Plans will be prepared in accordance with the LWMS for each stage of subdivision.
297: P6	Bandicoots	Liaise with CALM regarding the presence of bandicoots at Golden Bay and examine feasibility of relocating bandicoots if required by CALM.	Duplicated by M5			EPA CALM	Prior to any disturbance of the vegetation at Golden Bay	CLD	13 December 1995

APPENDIX 4

FORESHORE MANAGEMENT PLAN MANAGEMENT ACTION TABLE

FORESHORE MANAGEMENT PLAN

MANAGEMENT COMMITMENTS AND RESPONSIBILITIES

Compliance Status: C = Compliant, CLD = Completed, NC = Non – compliant, NR = Not Required at this stage.

Task	Responsibility	Timeframe FMP Stages	Priority	Status
Locate roads, access tracks and DUPs, and the Coastal node along existing routes where possible, or realign them to move through areas of disturbed vegetation	Developer	Stage 4	2	C
Erect temporary fencing between the Foreshore Reserve vegetation and proposed development	Developer	Stage 2	1	C
Survey and peg the Foreshore Reserve area to ensure this is protected from potential impacts of subdivision development	Developer	Stage 2	1	CLD
Replace temporary fencing in appropriate areas with a permanent barrier once earthworks have been completed, to prevent unauthorised access to areas of native vegetation (embedded limestone and native vegetation can be used for this purpose)	Developer	Stage 3	3	NR
Erect interpretative signage on access paths near the TEC to inform DUP users of the conservation value of the vegetation	Developer	Stage 4	3	NR
Maintain grassed parkland area, toilets and showers, access paths, DUPS and fences.	Developer (2 years post- construction)	Stage 3-5	3	NR

	then City of Rockingham			
Transfer of proposed Foreshore Reserve to public ownership (to the City of Rockingham)	Developer	Post Stage 5	3	NR
Machinery and vehicles will use the cleared, degraded areas for access, and must be clean on entry to the site.	Developer	Stage 2-5	2	NR
Vegetation clearing will be undertaken in weather conditions that are conducive to effective dust control.	Developer	Stage 2-5	1	NR
Wind-fencing will be used as required in conjunction with water sprays and tankers to control and limit excessive dust from earthworks operations and roads.	Developer	Stage 2-5	2	NR
The size of soil stockpiles will be limited and water or stabilising agents used to control dust.	Developer	Stage 2-5	2	NR
Soil stabilisation methods will be used to reduce the risks associated with wind erosion through the use of mulches, dust suppression agents or by revegetation as appropriate.	Developer	Stage 2-5	2	NR
Work will be planned to ensure construction or stabilisation follows demolition wherever possible.	Developer	Stage 2-5	2	NR
Dust suppression equipment and/or agents will be regularly inspected and maintained as required to prevent unacceptable dust emissions.	Developer	Stage 2-5	2	NR
Regular inspections of adjacent roads will be undertaken for dust creating materials.	Developer	Stage 2-5	2	NR

Excessive build-up of mud, debris or any other deleterious matter deposited on any road used for access to or egress from the project site will be removed.	Developer	Stage 2-5	2	NR
Construction staff will be made aware of issues relevant to dust control and will be familiar with the requirements prescribed in this management plan.	Developer	Stage 2-5	2	NR
Revegetate areas not likely to be impacted during construction as indicated in Figure 5	Developer	Stage 1	1	NR
Apply brush to large dune “blowout” area	Developer	Stage 1-3	1	NR
Revegetate areas impacted during construction with species consistent with City of Rockingham’s *Coastal Rehabilitation Policy* (CoR, 2002a)	Developer	Stage 2-5	2-3	NR
Implement a monitoring program using visual inspections and photographs to monitor the progress of revegetation plans.	Developer (2 years post- construction) then City of Rockingham	Stage 1-5 Monitoring will be undertaken on a six-monthly basis, reviewed annually	3	NR
Replace failed plants if coverage is not adequately achieved.	Developer (2 years post- construction) then City of Rockingham	As required, on a yearly basis post-construction	3	NR
Carry out a visual inspection onsite to determine the success of weed control applied as determined in above task, and establish a weed control program for the following two years.	Developer	Stage 2-5	2	NR

		Six monthly following initial weed management		
Carry out the weed control program devised in the above task. Potentially regular spot-spraying or removal by hand, done periodically over several years.	Developer (2 years post- construction) then City of Rockingham	Stage 2-5 Pre-, during and post-construction	3	NR
Erect a dog-proof fence between the residential subdivision and the Foreshore Reserve to protect Bandicoots within the conservation areas from domestic pets and feral animals.	Developer	Stage 2 During Construction	2	NR
Construct fauna access underpasses beneath paths intersecting known Bandicoot habitat vegetation.	Developer	Stage 3	2	NR
Ensure site crew are aware of the 24hr Wildcare Helpline number to call ((08) 9474 9055) in the case of wildlife being encountered during clearing of construction.	Developer	Stage 2-5	2	C
Erect signage indicating the conservation status of the Bandicoot nearby to their known habitat areas.	Developer	Stage 4	3	NR
Educate landowners on the effect of domestic animals on native fauna, such as by erecting signs addressing responsible pet ownership and protection of habitat for Bandicoot. Signs should also include information on the general biology of Bandicoots.	Developer (2 years post- construction) then City of Rockingham	Stage 3-5	2	NR
Consider seeking community consent for the trapping of cats (particularly after Bandicoot breeding) within conservation areas in the Foreshore Reserve	Developer (2 years post- construction)	Ongoing	3	NR

	then City of Rockingham			
Conserve and rehabilitate any good quality, dense wetland habitat which is planned for protection and provides protection for Bandicoots. The addition of further vegetation and cover (such as hollow logs) may assist with the survival of Bandicoot within protected areas at the Golden Bay site. (Such management actions should continue in parallel with the population monitoring.)	Developer (2 years post- construction) then City of Rockingham	Ongoing	1	C TEC19a Photo Point Monitoring Survey
Undertake an annual bandicoot trapping survey of seven nights in spring and autumn each year within the Foreshore Reserve (targeting conservation areas with known Bandicoot habitat).	Developer	Stage 2-5 During construction and for a period of 2 years post-construction.	1	C Bandicoot Monitoring Survey
Continue to rehabilitate areas degraded as a result of construction and implement weed control.	Developer (2 years post- construction) then City of Rockingham	Ongoing	3	NR
Removal of debris from bandicoot underpasses to prevent blockages.	Developer (2 years post- construction) then City of Rockingham	Ongoing (monthly)	3	NR
Remove all rubbish from conservation areas.	Developer (2 years post- construction) then City of Rockingham	Ongoing (monthly)	3	NR

Have regard to the Aboriginal Heritage site reserve boundary and erect signage to indicate the significance of the site.	Developer	Stage 1-5 Construction	2	C
Ensure adequate provision of emergency vehicle access through the Foreshore Reserve.	Developer	Ongoing	2	C
Provide suitable drainage infrastructure such as soakwells for hardstand areas (e.g. Car parks)	Developer	Stage 2-5 Construction	2	NR
Provision of passive surveillance such as lighting within the Foreshore Reserve.	Developer	Stage 2-5 Construction	2	NR

APPENDIX 5

TEC19A PHOTO POINT MONITORING SURVEY

GOLDEN BAY FORESHORE RESERVE

2018 VEGETATION PHOTO POINT MONITORING REPORT

Prepared for:	Peet Golden Bay Pty Ltd and Department of Communities
Report Date:	30 August 2019
Version:	1
Report No.	2019-461

pgv ENVIRONMENTAL

CONTENTS

LIST OF ATTACHMENTS

Figures

Appendices

1 INTRODUCTION

1.1 Background

The urban development of Lots 2 and 3, Golden Bay was subject to a Public Environmental Review (EPA Assessment 604) and was approved in Ministerial Statement 297 in January 1993 (Appendix A). Ministerial Statement 297 contains three conditions relevant to the Foreshore Reserve at Golden Bay as follows:

> *Condition 3-1 The proponent shall provide a foreshore reserve for the conservation and recreation which:*
>
> > *1 Protects the Peelhurst wetlands and the Southern Brown Bandicoot (Isoodon obesulus) population; and*
> >
> > *2 Includes landscape and recreation values at least equivalent to this proposal which is within System 6 Recommendation M106 Area.*
>
> *Commitment P-2 The proponent will prepare a Management Plan for the Coastal Reserve at Golden Bay prior to development commencing. This will be done to the satisfaction of the DPUD* [now Department of Planning, Lands and Heritage] *and the Local Authority.*

1.2 Location

The Golden Bay Foreshore Reserve (the study area) is situated 50km south of Perth and 16km south of the Rockingham Town Centre, within the City of Rockingham (Figure 1). The site is bounded by Secret Harbour to the north, the developing residential area on Lots 2 Warnbro Sound Avenue to the east and the existing Golden Bay Township to the south.

1.2.1 Foreshore Reserve Description

The Foreshore Reserve covers an area of approximately 10.61ha, is 800m in length and incorporates the beach, foredune and near-coastal dune systems. The width of the reserve from the back of the beach to its eastern extent ranges between approximately 400m (centre), 200m (southern end) and 250m (northern end). The western boundary of the reserve is marked by the high-water mark, the northern and southern boundaries in line with the northern and southern Lot 2 property boundaries and the eastern boundary marks the western limit of urban zoning. The extent of the reserve is shown in Figure 3.

1.2.2 Foreshore Reserve Ecological Values

The Foreshore Reserve contains wetlands that belong to the Peelhurst suite of wetlands. These wetlands form in low lying depressions within the Quindalup Dunes which have intercepted the water table and are typically small, seasonally inundated sumplands or seasonally wet damplands. The Golden Bay wetlands have been listed as Conservation Category in the *Geomorphic Wetlands of the Swan Coastal Plain* database.

The Threatened Ecological Community (TEC) 19a *Sedgelands in Holocene Dune Swales* is located in all the wetlands in the Foreshore Reserve at Golden Bay. This TEC is listed as "Critically Endangered" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and is also recognised as a TEC at State level.

The vegetation in the Foreshore Reserve supports a population of Southern Brown Bandicoot (*Isoodon fusciventer*). Bandicoots have been identified as a species of state significance and are listed as a Priority 5 species by the Department of Biodiversity, Conservation and Attractions (DBCA).

An indigenous heritage site (DIA 2519) is located in the southern end of the Foreshore Reserve.

1.3 Report Purpose

A Foreshore Management Plan (FMP) was prepared for the study area by the developers of Lot 2 Warnbro Sound Ave (Peet Golden Bay Pty Ltd and Department of Housing now Department of Communities) and approved on 30 March 2012. An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016.

The FMP contained a commitment to monitor the health of the vegetation in the wetlands using permanent photo points.

The initial photo point monitoring assessment was conducted in October 2012. This report documents the methods and results of the annual photo point monitoring undertaken in the Golden Bay Foreshore Reserve over the period from 2012 to 2018.

The objectives of the photo point monitoring report are to:

- Provide a qualitative assessment of the condition of the TEC19a vegetation in the wetlands;
- Assess any requirement for weeding;
- Assess any requirement for grazing control; and
- Determine if any erosion control is required.

2 EXISTING ENVIRONMENT

2.1 Topography

The topography of the Foreshore Reserve ranges from 1 to 10m AHD. The dunes closest to the coast are part of a recent parallel dune ridge system with dune crests up to 5-6m AHD. The eastern half of the Foreshore Reserve contains a low linear flat swale at an elevation of 1-2m AHD with some taller dunes up to 10m AHD.

2.2 Wetlands

The eastern half of the Foreshore Reserve contains a number of small wetlands within the flat swale directly behind the frontal dunes. The wetlands are described as sumplands and contain shallow freshwater above-ground in spring during an average rainfall season. The wetlands are rated as Conservation Category wetlands.

2.3 Vegetation

The Foreshore Reserve was subject to a bushfire on 1 January 2016. The fire was reported as being ignited by fireworks/boat flares. The area of the Foreshore Reserve impacted by the fire was estimated to be approximately 7ha. The northern section was burnt in patches and the eastern part of the central section was largely burnt.

The area burnt by the January 2016 bushfire was monitored in accordance with the FRP to assess the progress of regeneration. The monitoring program concluded in October 2018 and it was determined that supplementary planting would not be required. The Post Fire Vegetation Monitoring Survey results are provided in Appendix 4.

2.3.1 Vegetation Types

A variety of coastal Quindalup vegetation types occur in the Foreshore Reserve as listed below:

Western Half

- *Spinifex hirsutus* Grassland: Located on the foredune with *Spinifex longifolius, Tetragonia decumbens* and *Cakile maritima* present on the seaward facing slopes and *Ficinia nodosa* and *Carpobrotus virescens* frequent near the crest and leeward sides.
- *Olearia axillaris* Shrubland: Located immediately behind the foredune and forms a wide band parallel to the coast, containing *Cassytha* sp., *Pelargonium capitatum* and *Trachyandra divaricata*. It grades into the *Spyridium globulosum* Open Heath.
- *Spyridium globulosum* Open Heath: Located on the lower dunes and containing *Acacia cyclops, Hibbertia cuneiformis, Alyxia buxifolia, Pelargonium capitatum* and the creeper *Hardenbergia comptoniana*.

Eastern Half

- *Acacia rostellifera/Spyridium globulosum* Closed Shrub: An intermediate unit located in the central part of the site.

- *Juncus kraussii* Sedgeland: Located within the eastern low linear flat swale in the wetland areas, containing *Baumea juncea, Centella asiatica, Ficinia nodosa, Dampiera alata* and *Lepidosperma gladiatum.* Mature Paperbark trees (*Melaleuca rhaphiophylla* and *Melaleuca cuticularis*) also occur in the wetlands. The 2016 fire caused a multitude of *M. rhaphiophylla* seedlings to germinate from one mature tree in one of the wetlands in the reserve.
- *Spyridium globulosum* Closed Heath: Making up the majority of the transitional vegetation on slightly higher ground within the swale, it contains similar species to the *Spyridium globulosum* Open Heath on the low dunes and additionally a dense ground coverage of the Sword Sedge *Lepidosperma gladiatum*.

The *Juncus kraussii* Sedgeland vegetation type generally describes the vegetation in the wetlands.

2.3.2 Vegetation Condition

The vegetation in most of the Foreshore Reserve was rated as mostly being in Excellent condition with only a few tracks through it. Some wetland areas had previously been impacted by off road vehicles. These tracks have been closed off to allow for natural regeneration of the wetlands.

A weed survey of the Foreshore Reserve conducted by PGV Environmental in May 2015, identified the most prevalent introduced species in the area as Rose Pelargonium (*Pelargonium capitatum*) and False Onion Weed (*Trachyandra divaricata*). Both species were more common on the western part of the Foreshore Reserve on sand dunes than in the eastern swales. Hares Tail Grass *(Lagurus ovatus)* and Geraldton Carnation Weed *(Euphorbia terracina)* were also present in parts of the Foreshore Reserve.

The wetlands on the site contained few weeds.

2.4 Native Fauna

The Foreshore Reserve at Golden Bay contains a population of Quenda (*Isoodon fusciventer*). The size and health of the Quenda population has been monitored by the developers for six years. The number of Quenda recorded during surveys in the foreshore reserve declined in 2016 after much of the bushland was burnt which resulted in reduced habitat and an increased exposure of Quenda to predators. Since 2016, the number of bandicoots has increased. This is partially a result of ten additional individuals being relocated into the Foreshore Reserve from other sites in East Rockingham, Florida and Madora Bay, but also post-fire recovery of the habitat. The Quenda population now has Sarcoptic Mange.

The Foreshore Reserve contains a population of Western Grey Kangaroos (*Macropus fuliginosus*). The condition of the wetland vegetation is being adversely impacted by kangaroos moving through or resting in the dense sedgelands. It is anticipated there will be a progressive increase in the kangaroo population.

2.5 Pest Fauna

The Foreshore Reserve contains an abundance of rabbits as evidenced by the quantity and distribution of scats and diggings. Foxes and cats are also common in the Foreshore Reserve.

Fox and cat trapping were undertaken post the 2016 fire event and additional cat trapping is undertaken during the biannual Quenda monitoring surveys. The number of foxes has increased, and it is likely that the Sarcoptic Mange, which can be carried by foxes, has infected some of the Quenda.

This disease can kill foxes within 2-4 months if left untreated and it is thought to be the same for Quenda (Terrestrial Ecosystems, 2018). Fox management is best done in cooperation with surrounding landholders as foxes move freely through the remnant vegetation.

The City of Rockingham undertakes annual fox trapping in the region, but no foxes were caught at Golden Bay between Autumn 2018 and Autumn 2019. It is unknown if trapping for foxes is proposed in proximity to the Peet landholdings in the near future.

3 MONTORING RESULTS

3.1 Photo Point Monitoring

Photo point monitoring was undertaken on 29 September 2018 at the eight monitoring sites established in the wetland vegetation in 2012 (Plate 1). Sites 5 and 7 have been combined into one site due to their proximity (4m apart).

Four photos (east, north, west, south) were taken from the permanent photo points which are marked with a metal dropper and flagging tape. The location of markers is recorded in eastings and northings as shown in Table 1 and shown in Plate 1.

Table 1: Photo Point Locations.

Site	Eastings	Northings
1	382545	6411987
2	382527	6412049
3	382544	6412057
4	382501	6412185
5	382469	6412279
6	382507	6412293
8	382458	6412346

3.2 Condition Assessment Method

The condition of the vegetation in the wetland areas was assessed using key indicators to facilitate comparison between the results from different years. A number of indicators were considered in the condition assessment, each of which were allocated a score using a three-point scoring system of 1 to 3 (Table 2). Relevant comments on condition indicators were also recorded as supplementary information. The scoring system will enable broad comparison over time between results, however, due to the subjective nature of the method, the scores are indicative only.

The nature of many of the indicators for the condition assessment is such that they will not change over the short term, for example surface water and fire history. The attributes most likely to change over time include weed invasion, grazing and flattening.

A standard proforma is used to document the condition assessment to ensure consistency across the subsequent monitoring events. The proforma is provided at Appendix 1.

Table 2: Condition Indicators

Indicator	Rating	Measure
Grazing	1	Severe/heavy
	2	moderate (limited but evident)
	3	nil very low
Clearing	1	30% +cleared
	2	10-30% cleared
	3	<10% cleared
Weeds	1	30% +cover
	2	1-30% cover
	3	<10% cover
Erosion	1	severe impacting >30% of site
	2	moderate (limited but evident)
	3	nil very low (minimal impact)
Fire History	1	<10 years
	2	10 to 20 years
	3	>20 years
Surface Water	1	Damp at Surface
	2	<10cm
	3	>10cm

Plate 1: Photo Point Locations

3.3 Condition Assessment Results

The results of the qualitative condition assessment for each monitoring point are provided in Table 3. The condition assessment photos are shown in Appendix 2.

The vegetation has recovered to pre-fire cover levels.

Five of the seven monitoring sites had surface water greater than 10cm deep. Site 1 had an approximate water depth of 40cm. Site 3 and 6 were damp at the surface but did not contain any above ground water. The groundwater levels (JHD, 2018) in the ground water monitoring bore WB01 in the foreshore wetlands showed maximum levels of around 1.19m AHD in October 2018 (Appendix 3). Ground Water monitoring bore WB02 had maximum levels of 1.23m in October 2018 (Appendix 3). The ground water levels were higher than all preceding years (2013-2017).

The number of kangaroo trails and resting places were similar to the numbers from 2017. There was evidence of grazing on the sedges in Sites 2, 4, 5, and 6.

Weed invasion has not changed significantly since 2012.

Erosion rating has not changed significantly since 2012.

Site 3 is a wetland that has had a 4WD track through it for many years and, as such, started with a low condition score and high rating for clearing. Site 3 had evidence of additional clearing either during or post fire which is now recovering.

Plate 2: Site 3 Area regeneration after cleared for fire management purposes

Table 3: Condition Assessment (2018)

Condition Attribute	Site	1	2	3	4	5	6	8
Grazing/flattening by rabbits or kangaroos	2018	2	2	3	2	2	2	3
	2017	2	2	3	2	2	2	3
	2016	2	3	3	3	3	3	3
	2015	2	2	2	2	2	3	3
	2012	1	2	3	3	3	3	2
Clearing	2018	3	3	1	3	3	2	3
	2017	3	2	1	3	3	2	3
	2016	3	1	1	2	2	2	2
	2015	3	3	1	3	3	2	3
	2012	3	3	1	3	3	1	2
Weed Invasion	2018	3	2	2	3	3	2	3
	2017	3	2	2	3	3	2	3
	2016	3	2	2	2	2	2	2
	2015	3	3	2	3	2	2	3
	2012	3	3	2	3	3	2	2
Erosion	2018	3	3	2	3	3	3	3
	2017	3	3	2	3	3	3	3
	2016	3	3	1	3	3	3	3
	2015	3	3	2	3	3	3	3
	2012	3	3	1	3	3	2	2
Fire History	2018	2	1	1	1	1	1	1
	2017	2	1	1	1	1	1	1
	2016	2	1	1	1	1	1	1
	2015	2	2	2	2	2	1	2
	2012	2	2	2	2	2	2	2
Surface Water	2018	3	3	1	2	3	1	3
	2017	3	2	1	3	3	1	2
	2016	2	1	1	1	1	1	1
	2015	1	1	1	1	1	1	1
	2012	2	1	1	1	2	1	2

3.4 Photo Point Monitoring Results

The full set of photos for each site year 2018 is provided in Appendix 2.

3.4.1 Site 1

Comparison of photos from 2015, 2016, 2017 and 2018 showed that there was similar damage by kangaroos passing through and/or sleeping in the wetland at Site 1. There was approximately 40cm of standing water in the wetland.

Plate 3: Year 2015

Plate 4: Year 2016

Plate 5: Year 2017

Plate 6: Year 2018

3.4.2 Site 2

Comparison of photos from 2015, 2016, 2017 and 2018 shows the site is recovering from the fire. The sedges in the wetland have regrown to approximately 50cm in height. The surrounding vegetation is also regenerating. The wetland was damper than previous years with standing water to greater than 10cm.

Plate 7: Year 2015

Plate 8: Year 2016

Plate 9: Year 2017

Plate 10: Year 2018

3.4.3 Site 3

Comparison of photos from 2015, 2016 and 2017 shows the recovery of the vegetation after the fire.

Plate 11: Year 2015

Plate 12: Year 2016

Plate 13: Year 2017

Plate 14: Year 2018

3.4.4 Site 4

Comparison of photos from 2015, 2016 and 2017 show the vegetation within the wetland has recovered completely from the fire event. The sedges in the wetland have regenerated and were approximately 40-50cm in height. The wetland had approximately 20cm of surface water on the day of the survey. The level of surface water was greater than in previous years. There was evidence of increase of kangaroos passing through the wetland.

Plate 15: Year 2015

Plate 16: Year 2016

Plate 17: Year 2017

Plate 18: Year 2018

3.4.5 Site 5

Comparison of photos from 2015, 2016 and 2017 shows the impact of the fire on the wetland and good regrowth in year 2017. There was approximately 20cm of surface water across the wetland which was more than previous years.

Plate 19: Year 2015

Plate 20: Year 2016

Plate 21: Year 2017

Plate 22: Year 2018

3.4.6 Site 6

Comparison of photos from 2015, 2016 and 2017 shows good vegetation recovery across the wetland and surrounding areas.

Plate 23: Year 2015

Plate 24: Year 2016

Plate 25: Year 2017

Plate 26: Year 2018

3.4.7 Site 8

Comparison of photos from 2015, 2016 and 2017 shows good regeneration of vegetation across the wetland. There greater than 10cm of standing water in parts of the wetland.

Plate 27: Year 2015

Plate 28: Year 2016

Plate 29: Year 2017

Plate 30: Year 2018

4 CONCLUSIONS

The photo monitoring of vegetation in the wetlands of the Golden Bay Foreshore Reserve shows the vegetation regeneration after the impact of the fire on 1 January 2016. The sedges in the wetlands have regrown and the surrounding vegetation is close to pre-fire density and condition.

There has been little change in the condition of the wetland in site 1 which wasn't impacted by the fire.

The impact of the fire in increasing weeds in the fire-affected areas is being monitored and, if required, weed control will be implemented. Currently, monitoring has not detected an increase in weed density or species richness after the fire. With the rapid recovery of the native vegetation the status of weeds in the wetlands is unlikely to change.

There is continued evidence of kangaroos passing through the wetlands and some evidence of grazing on the new sedges. The impact of kangaroos on the vegetation will be monitored further. If the impact is considered to be having long-term adverse effects, a programme to remove the kangaroos from the Foreshore Reserve will need to be investigated. Any kangaroo management in the Foreshore Reserve, however, will need to be a collaborative effort between all developers in the area, the City of Rockingham and the Department of Biodiversity, Conservation and Attractions.

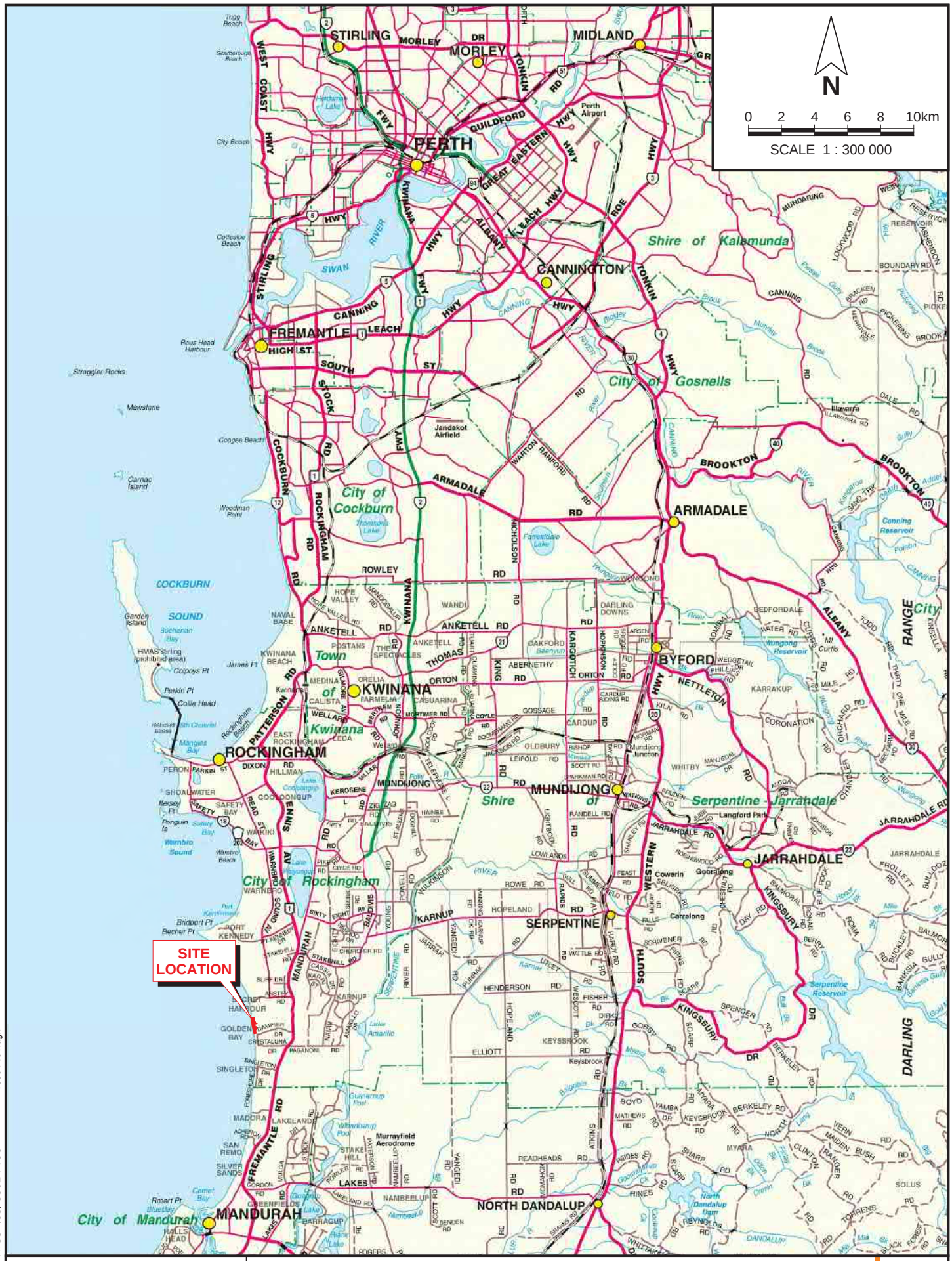
5 REFERENCES

JDA Consultant Hydrologists (2019). *Golden Bay – Wetland Groundwater Levels to end of 2018.*

PGV Environmental (2011). *Lots 2 and 3 Warnbro Sound Avenue Golden Bay Foreshore Management Plan.* Prepared for the Department of Housing. Report No. 2011-13 V6.

Terrestrial Ecosystems (2018). *Quenda Monitoring Golden Bay – Spring 2018.* Report prepared for Peet Limited.

FIGURES



PINPOINT CARTOGRAPHICS (08) 9562 7136 10004-f01.dgn

pgv ENVIRONMENTAL

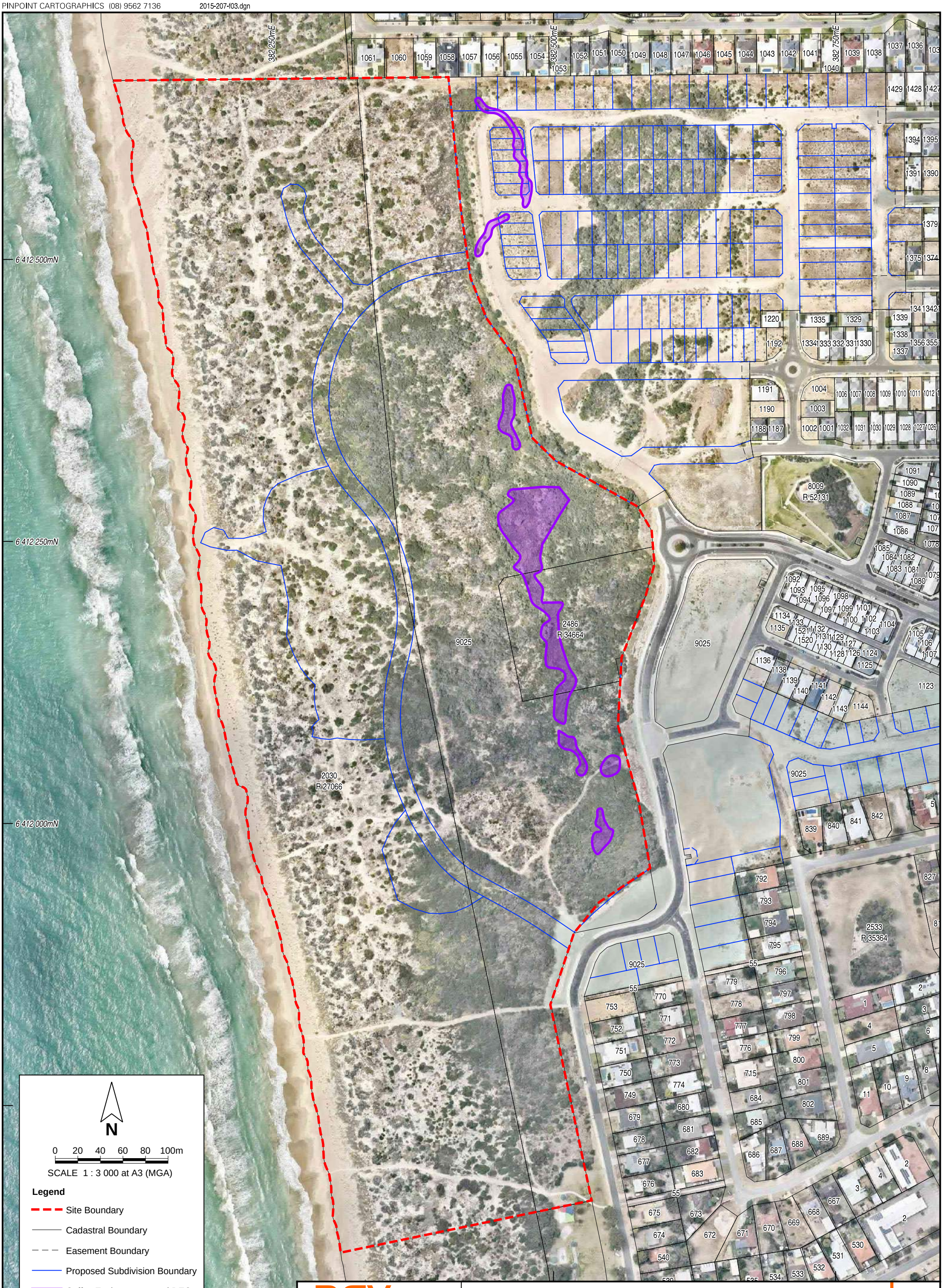
Department of Housing
VEGETATION PHOTO POINT MONITORING REPORT
GOLDEN BAY

Drawn: B. Heath	Date: 10 Aug 2011
Job: 10004	Revision: A

REGIONAL LOCATION

Figure 1

PINPOINT CARTOGRAPHICS (08) 9562 7136 2015-207-f03.dgn



N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Proposed Subdivision Boundary
- Coffey Environments and DEC Approved TEC19a Boundary October 2010

CADASTRAL SOURCE: Landgate, February 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2018.

pgv ENVIRONMENTAL

Department of Housing and Peet Golden Bay Pty Ltd
FORESHORE REHABILITATION PLAN
LOT 2 WARNBRO SOUND AVENUE, GOLDEN BAY FORESHORE RESERVE

Drawn: B. Heath | Date: 22 Feb 2019

Job: 10004 Rpt: 2015-207 | Revision: A

WETLAND AND TEC MAPPING

Figure 2

APPENDIX 1

SITE ASSESSMENT PROFORMA

Site No.	Recorder (s)		Date	
GPS Point	Easting		Northing	
Fencing: fully/partial/not fenced	Current Land Use			
Monitoring Photos No. (taken from Stake)	East	South	West	North
Position of Marker in TEC				
Attribute of Site	**Score**	**Comments**		
Grazing				
1 = severe/heavy				
2= moderate (limited but evident)				
3=nil very low				
Clearing				
1 = 30% + cleared				
2 = 10-30% cleared				
3 = <10% cleared				
Weed Invasion				
1 = 30% + cover				
2 = 1--30%				
3 = <10%				
Erosion				
1 = severe impacting >30% of site				
2= moderate (limited but evident)				
3=nil very low (minimal impact)				
Fire History				
1 = <20 years				
2 = 20-50 years				
3 = > 50 years				
Surface Water				
1 = Damp at surface (no standing water)				
2 = < 10cm				
3 = >10cm				

APPENDIX 2

SITE PHOTOS

Site Photos 2018 – Taken from permanent marker in each of the wetlands

Site 1

382545 m E **6411987 m S**

-32 25 22.93 **115 45 2.08**

Plate 1: Looking East

Plate 2: Looking south

Plate 3: Looking west

Plate 4: Looking north

Site 2

382527 m E **6412049 m N**

32 25 21.10 **115 45 1.90**

Plate 5: Looking East

Plate 6: Looking south

Plate 7 Looking west

Plate 8: Looking north

Site 3

382544 m E **6412057 m S**

32 25 20.61 **115 45 2.79**

Plate 9: Looking East

Plate 10: Looking south

Plate 11: Looking west

Plate 12: Looking north

Site 4

382501 m E **6412185 m S**

32 25 16.6 **115 45 1.03**

Plate 13: Looking East

Plate 14: Looking south

Plate 15 Looking west

Plate 16: Looking north

Site 5 and 7 combined

382469 m E **6412279 m S**

32 25 13.6 **115 44 59.78**

Plate 17: Looking East

Plate 18: Looking south

Plate 19: Looking west

Plate 20: Looking north

Site 6 -

382507 m E **6412293 m S**

32 25 12.93 **115 45 1.5**

Plate 21: Looking East

Plate 22: Looking south

Plate 23 Looking west

Plate 24: Looking north

Site 8

382458.00 m E **6412346.00 m S**

Plate 29: Looking East

Plate 30: Looking south

Plate 31: Looking west

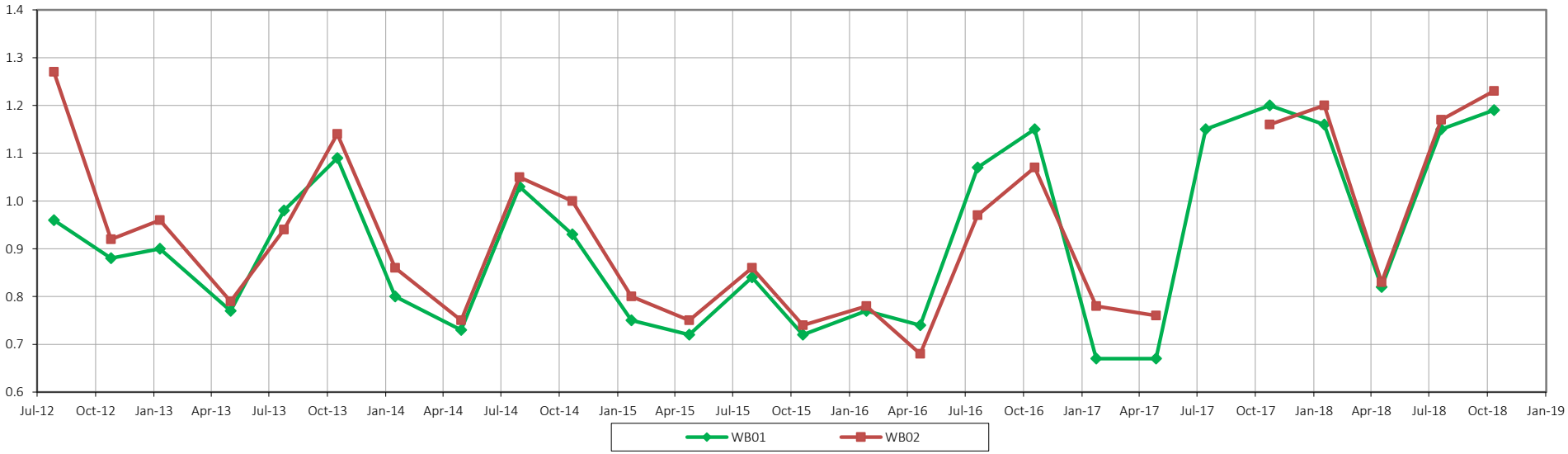
Plate 32: Looking north

APPENDIX 3

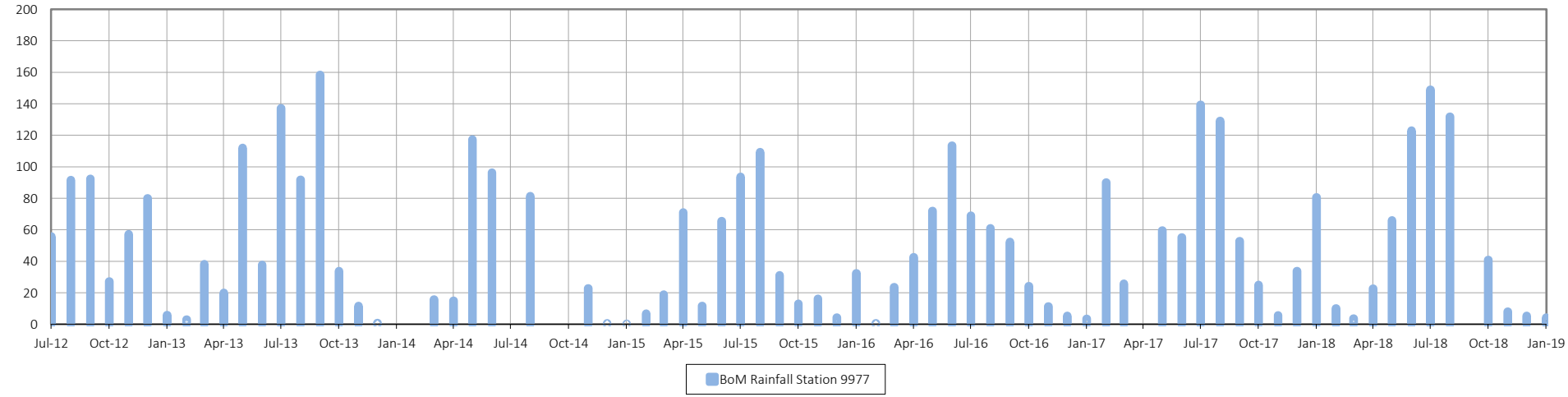
GROUNDWATER LEVELS IN WETLAND BORES

Wetland Bores - Groundwater Levels 2018

Groundwater Levels (mAHD)



Rainfall (mm)



Job No. J6798

PEET / Dept of Housing

Golden Bay Groundwater Monitoring

Figure 1: Groundwater Levels in Wetland Bores 2012 - 2018

APPENDIX 4

POST FIRE VEGETATION MONITORING REPORT

LOT 2 WARNBRO SOUND AVENUE, GOLDEN BAY FORESHORE RESERVE

POST-FIRE VEGETATION MONITORING SURVEY

Prepared for: The Housing Authority and Peet Golden Bay Pty Ltd

Report Date: 29 November 2018

Version: 1

Report No. 2018-416

pgv ENVIRONMENTAL

CONTENTS

LIST OF ATTACHMENTS

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1 INTRODUCTION

1.1 Background

The Housing Authority and Peet Golden Bay Pty Ltd are developing Lot 2 Warnbro Sound Avenue and Lot 3 Dampier Drive, Golden Bay for residential purposes. The development abuts a Foreshore Reserve, established under Condition 3 of Ministerial Statement 297 which is the environmental approval for the development.

A Foreshore Management Plan (FMP) was prepared by the developers for the Foreshore Reserve and was approved by the Environmental Protection Authority (EPA) on 30 March 2012. Subsequent to the approval of the FMP a Foreshore Rehabilitation Plan (FRP) was prepared to outline the rehabilitation and weed management requirements to be implemented within the Foreshore Reserve.

The Foreshore Reserve was subject to a bushfire on 1 January 2016. The fire was reported as being ignited by fireworks/boat flares. The area of the Foreshore Reserve impacted by the fire was estimated to be approximately 7ha (Appendix 1). The northern section was burnt in patches and the eastern part of the central section was largely burnt out (Plates 1 and 2).

The area burnt by the 1 January 2016 bushfire is required by the FRP to be monitored for 3 years to assess the progress of regeneration. The monitoring is to determine whether any supplementary planting will be required to assist regeneration and whether any weed control needs to be undertaken during the recovery period.

This report presents the results of the final monitoring undertaken in March and October 2018.

1.2 Site Location

The Golden Bay Foreshore Reserve is located approximately 50km south of Perth and 16km south of Rockingham Town Centre, within the City of Rockingham (Figure 1). The site is bound by Secret Harbour to the north, the Lot 2 Golden Bay development to the east, the existing Golden Bay Township to the south and the high water mark of the Indian Ocean to the west.

The Foreshore Reserve covers an area of approximately 10.61ha and is around 800m in length from north to south and ranges between approximately 150m to 300m wide.

1.3 Objectives

The objectives of this post-fire vegetation monitoring report are to:

- Monitor permanent plots set up in the Baseline Survey; and
- Assess any requirement for in-fill planting and weeding.

2 EXISTING ENVIRONMENT

2.1 Topography

The topography of the Foreshore Reserve ranges from 1 to 10m AHD. The dunes closest to the coast are part of a recent parallel dune ridge system with dune crests up to 5-6m AHD. The eastern half of the Foreshore Reserve contains a low linear flat swale at an elevation of 1-2m AHD with some taller dunes up to 10m AHD.

The 1 January 2016 fire was largely contained to the eastern half of the Foreshore Reserve.

2.2 Wetlands

The eastern half of the Foreshore Reserve contains a number of small wetlands within the flat swale directly behind the frontal dunes. The wetlands are described as sumplands and contain shallow freshwater above-ground in spring during an average rainfall season. The wetlands are rated as Conservation Category wetlands.

The 1 January 2016 fire burnt more than half the area of wetlands in the Foreshore Reserve.

2.3 Vegetation

2.3.1 Vegetation Types

A variety of coastal Quindalup vegetation types occur in the Foreshore Reserve as listed below:

Western Half

- *Spinifex hirsutus* Grassland: Located on the foredune with *Spinifex longifolius, Tetragonia decumbens* and *Cakile maritima* present on the seaward facing slopes and *Ficinia nodosa* and *Carpobrotus virescens* frequent near the crest and leeward sides.
- *Olearia axillaris* Shrubland: Located immediately behind the foredune and forms a wide band parallel to the coast, containing *Cassytha* sp.*, Pelargonium capitatum* and *Trachyandra divaricata*. It grades into the *Spyridium globulosum* Open Heath.
- *Spyridium globulosum* Open Heath: Located on the lower dunes and containing *Acacia cyclops, Hibbertia cuneiformis, Alyxia buxifolia, Pelargonium capitatum* and the creeper *Hardenbergia comptoniana*.

Eastern Half

- *Acacia rostellifera/Spyridium globulosum* Closed Shrub: An intermediate unit located in the central part of the site.
- *Juncus kraussii* Sedgeland: Located within the eastern low linear flat swale in the wetland areas, containing *Baumea juncea, Centella asiatica, Ficinia nodosa, Dampiera alata* and *Lepidosperma gladiatum.* Three isolated, mature Paperbark trees (*Melaleuca rhaphiophylla* and *Melaleuca cuticularis*) also occur in the wetlands.
- *Spyridium globulosum* Closed Heath: Making up the majority of the transitional vegetation on slightly higher ground within the swale, it contains similar species to the *Spyridium globulosum*

Open Heath on the low dunes and additionally a dense ground coverage of the Sword Sedge *Lepidosperma gladiatum*.

The vegetation in the wetlands in the Foreshore Reserve is a Threatened Ecological Community (TEC) – Floristic Community Type 19 'Sedgelands in Holocene Dune Swales'.

The 1 January 2016 fire did not affect any of the vegetation types on the western half of the Foreshore Reserve. All three vegetation types in the eastern half including large sections of the TEC were burnt to some extent.

2.3.2 Vegetation Condition

The vegetation in most of the Foreshore Reserve pre-fire was rated as mostly being in Excellent Condition with only a few tracks through it.

A weed survey of the Foreshore Reserve conducted by PGV Environmental in May 2015 identified the most prevalent introduced species in the area as Rose Pelargonium (*Pelargonium capitatum*) and False Onion Weed (*Trachyandra divaricata*). Both species were more common on the western part of the Foreshore Reserve on sand dunes. The wetlands on the site contained few weeds.

Hares Tail Grass *(Lagurus ovatus)* and Geraldton Carnation Weed *(Euphorbia terracina)* were also present in parts of the Foreshore Reserve.

Plate 1: Aerial Photography of a Section of the Site from January 2016 showing burnt areas (Nearmap, 2016)

Plate 2: Burnt Central Section of the Foreshore Reserve (January 2016)

2.4 Native Fauna

The Foreshore Reserve at Golden Bay contains a population of Quenda (*Isoodon fusciventer*). The size and health of the Quenda population has been monitored by the developers for six years. The number of Quenda recorded during surveys in the foreshore reserve declined in 2016 after much of the bushland was burnt which resulted in reduced habitat and an increased exposure of Quenda to predators. Since 2016, the number of bandicoots has increased. This is partially a result of ten additional individuals being relocated into the Foreshore Reserve from other sites in East Rockingham, Florida and Madora Bay, but also post-fire recovery of the habitat. The Quenda population now has Sarcoptic Mange.

The Foreshore Reserve contains a population of Western Grey Kangaroos (*Macropus fuliginosus*). The condition of the wetland vegetation is being adversely impacted by kangaroos moving through or resting in the dense sedgelands. It is anticipated there will be a progressive increase in the kangaroo population.

2.5 Pest Fauna

The Foreshore Reserve contains an abundance of rabbits as evidenced by the quantity and distribution of scats and diggings. Foxes and cats are also common in the Foreshore Reserve.

Fox and cat trapping were undertaken post the 2016 fire event and additional cat trapping is undertaken during the biannual Quenda monitoring surveys. The number of foxes has increased, and it is likely that the Sarcoptic Mange, which can be carried by foxes, has infected some of the Quenda. This disease can kill foxes within 2-4 months if left untreated and it is thought to be the same for Quenda (Terrestrial Ecosystems, 2018). Fox management is best done in cooperation with surrounding landholders as foxes move freely through the remnant vegetation.

The City of Rockingham undertakes annual fox trapping in the region, but no foxes were caught at Golden Bay between Autumn 2018 and Autumn 2019. It is unknown if trapping for foxes is proposed in proximity to the Peet landholdings in the near future.

3 MONITORING RESULTS

3.1 Monitoring Plot Establishment

A total of nine 10m x 10m monitoring plots was established in the burnt areas of the Foreshore Reserve on 27 July 2016 by Dr Paul van der Moezel of PGV Environmental.

The plots were chosen to be representative of the variety of vegetation types burnt.

The plots were aligned on northings and eastings with the corners of each plot pegged with small steel pegs. The co-ordinates of the plot were taken using a hand-held GPS from the centre of the plot. A photo was taken from the south-east corner of each plot looking towards the north-west corner.

The pre-fire vegetation type was assessed for each plot using the burnt vegetation as a guide.

Six of the nine monitoring plots were located on low sand dunes while three were in flat swales containing wetland TEC vegetation. Plot GBF6 was transitional between the dryland and wetland vegetation types while plot GBF7 contained slightly raised areas on the edge of the wetland swale.

The pre-fire vegetation in the monitoring plots was assessed as being the following:

Dunes

Plot GBF1 *Acacia rostellifera/Spyridium globulosum* Open Heath over *Lepidosperma gladiatum* Open Sedgeland

Plot GBF 3 *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (3.5-4m, >70%) over *Lepidosperma gladiatum* Sedgeland (30%)

Plot GBF4 *Acacia rostellifera/Spyridium globulosum* Shrubland (1.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (60%)

Plot GBF6 *Spyridium globulosum/Exocarpos sparteus* Open Heath (1.5m, 50-70%) over *Lepidosperma gladiatum/Baumea juncea* Open Sedgeland (20-30%)

Plot GBF8 *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (4m, 70-80%) over *Lepidosperma gladiatum* Sedgeland

Plot GBF9 *Spyridium globulosum* Tall Shrubland (3.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (50%)

Wetlands/TEC

Plot GBF2 *Baumea juncea/Ficinia nodosa* Closed Sedgeland (90%) over *Centella asiatica* Herbland

Plot GBF5 *Baumea juncea* Sedgeland (90%) over *Centella asiatica* Herbland

Plot GBF7 *Baumea juncea* Closed Sedgeland (80-90%) over *Centella asiatica* Herbland

Within each plot the percentage cover and average height of all species were recorded. Where possible, the post-fire recovery mechanism was assessed for each species.

A follow-up assessment of the plots on 11 October 2016 was made to record any new emergence of ephemeral species in spring.

The plots were assessed in 18 April and 24 October 2017 and on 5 April and 9 October 2018. This report presents the results of the 2018 monitoring.

3.2 Monitoring Plot Results

The monitoring plot data are provided in Appendix 1 and summarised in Tables 1 and 2. Photos of each monitoring plot from all monitoring events are provided in Appendix 2. A comparison of each plot 6 months after the fire in July 2016 and the last monitoring in October 2018 are shown in Plates 5-12.

3.2.1 Growth

Dryland Plots

The growth of *Acacia rostellifera* in the two dunal plots (GB3 and GB8) that had a tall and dense cover of *A. rostellifera* pre-fire continued to grow in 2018 with *Acacia* plants growing up to 2m in October 2018 (Table 1). It will still take at least 2 years for the *Acacia* canopy to reach the pre-fire height of 3.5-4m in these areas.

Plots that were assessed as having *Spyridium globulosum* as a dominant pre-fire shrub are recovering at a much slower rate due to the post-fire recovery mechanism of growing from seed for *S. globulosum* rather than sprouting.

Sword Sedge (*Lepidosperma gladiatum*) recovered quickly in all plots, either as an understorey species or dominant as a Sedgeland with an open Shrubland overstorey. The Sword Sedge plants attained their pre-fire height (0.7-1m) and percentage cover by April 2017 and retained the height and cover through to October 2018.

Wetland Plots

The dense sedge cover in the three wetland plots was well advanced in October 2016 and had fully recovered by April 2017 with the height of the dominant species *Baumea juncea* and *Ficinia nodosa* up to 1.2m tall (Table 1). The wetland vegetation retained its dense Sedgeland structure through to October 2018.

The phenomenon of mass germination of *Melaleuca preissiana* seedlings from one parent tree observed in 2017 in the wetland in which monitoring plot GB 7 is located was still evident in October 2018. The dense mass of seedlings was up to 1m high in October 2018.

Table 1: Height and Cover of Monitoring Plot Vegetation

Plot	Vegetation (Pre-fire)	Pre-fire		Post-fire (July 2016)			Post Fire (October 2017)			Post Fire (October 2018)		
	Dune Vegetation	Height (m)	% Cover[1]	Height (m)	% Cover dominant stratum	Overall cover (%)	Height (m)	% Cover dominant stratum	Overall cover (%)	Height (m)	% Cover dominant stratum	Overall cover (%)
GBF1	*Acacia rostellifera/ Spyridium globulosum* Open Heath over *Lepidosperma gladiatum* Open Sedgeland (10-20%)	1.5	20-30	<0.1	<1 (1*)	1-2	0.5	12 (15)	30	1.5-2	50 (20)	50
GBF3	*Acacia rostellifera/ Spyridium globulosum* Closed Tall Scrub over *Lepidosperma gladiatum* Sedgeland (30%)	3.5-4	>70	0.6	20 (10)	30-40	1.5	40	70 (25)	1.8	50	75 (30)
GBF4	*Acacia rostellifera/ Spyridium globulosum* Shrubland over *Lepidosperma gladiatum/ Trachyandra divaricata* Sedgeland (60%)	1.5	10	0.3	1 (20)	40-50	0.7	2 (20)	65	1.3	4	65 (40)
GBF6	*Spyridium globulosum/Exocarpos sparteus* Open Heath over *Lepidosperma gladiatum/Baumea juncea* Open Sedgeland (20-30%)	1.5	50-70	<0.1	<1 (2)	5	0.5-1	2 (25)	60	1.7 - 2	25 (20)	90
GBF8	*Acacia rostellifera/ Spyridium globulosum* Closed Tall Scrub over *Lepidosperma gladiatum* Sedgeland (20-30%)	4	70-80	0.4	15 (10)	25-30	1.5	50 (15)	70	2.5	75 (15)	80

Plot	Vegetation (Pre-fire)	Pre-fire		Post-fire (July 2016)			Post Fire (October 2017)			Post Fire (October 2018)		
GBF9	*Spyridium globulosum* Tall Shrubland over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (50%)	3.5	10	<0.1	<1 (10)	30-40	0.3	<1 (25)	50	0.5	<1 (30)	50
	Wetland/TEC Vegetation											
GBF2	*Baumea juncea/Ficinia nodosa* Closed Sedgeland (90%) over *Centella asiatica* Herbland	1	90	0.5	70	70-75	0.8	100	100	0.8	100	100
GBF5	*Baumea juncea* Sedgeland (90%) over *Centella asiatica* Herbland	1	90	0.5	80	75-80	0.8	95	100	1 – 1.2	100	100
GBF7	*Baumea juncea* Closed Sedgeland (80-90%) with occasional *Acacia saligna* shrubs over *Centella asiatica* Herbland	1	80-90	0.4	60	60-70	0.7	80	90	0.8 - 1.2	90	100

1 – estimate based on burnt vegetation

* - % cover *Lepidosperma gladiatum* Sedgeland

Table 2: Number of Species in Monitoring Plots

Plot	Vegetation (Pre-fire)	No. Species - July 2016			No. Species - October 2016			No. Species – October 2017			No. Species – October 2018		
	Dune Vegetation	**Native**	**Non-native**	**Total**	**native**	**Non-native**	**Total**	**native**	**Non-native**	**Total**	**Native**	**Non-native**	**Total**
GBF1	*Acacia rostellifera/ Spyridium globulosum* Open Heath over *Lepidosperma gladiatum* Open Sedgeland (10-20%)	7	4	**11**	9	12	**21**	12	8	**20**	13	7	**20**
GBF3	*Acacia rostellifera/ Spyridium globulosum* Closed Tall Scrub over *Lepidosperma gladiatum* Sedgeland (30%)	7	7	**14**	10	10	**20**	7	6	**13**	10	5	**15**
GBF4	*Acacia rostellifera/ Spyridium globulosum* Shrubland over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (60%)	6	7	**13**	10	14	**24**	5	12	**17**	8	10	**18**
GBF6	*Spyridium globulosum/ Exocarpos sparteus* Open Heath over *Lepidosperma gladiatum/ Baumea juncea* Open Sedgeland (20-30%)	7	5	**12**	10	11	**21**	14	10	**24**	14	6	**20**
GBF8	*Acacia rostellifera/ Spyridium globulosum* Closed Tall Scrub over	5	4	**9**	7	10	**17**	11	9	**20**	9	5	**14**

Plot	Vegetation (Pre-fire)	No. Species - July 2016			No. Species - October 2016			No. Species – October 2017			No. Species – October 2018		
	Lepidosperma gladiatum Sedgeland (20-30%)												
GBF9	*Spyridium globulosum* Tall Shrubland over *Lepidosperma gladiatum/ Trachyandra divaricata* Sedgeland (50%)	6	7	**13**	9	13	**22**	9	10	**19**	11	8	**19**
	Wetland Vegetation												
GBF2	*Baumea juncea/Ficinia nodosa* Closed Sedgeland (90%) over *Centella asiatica* Herbland	8	4	**12**	8	5	**13**	7	1	**8**	8	0	**8**
GBF5	*Baumea juncea* Sedgeland (90%) over *Centella asiatica* Herbland	6	2	**8**	8	5	**13**	10	0	**10**	9	0	**9**
GBF7	*Baumea juncea* Closed Sedgeland (80-90%) with occasional *Acacia saligna* shrubs over *Centella asiatica* Herbland	9	11	**20**	13	16	**29**	13	6	**19**	13	1	**14**

Plate 3a: GBF Plot 1 July 2016

Plate 3b: GBF Plot 1 October 2018

Plate 4a: GBF Plot 2 July 2016

Plate 4b: GBF Plot 2 October 2018

Plate 5a: GBF Plot 3 July 2016

Plate 5b: GBF Plot 3 October 2018

Plate 6a: GBF Plot 4 July 2016

Plate 6b: GBF Plot 4 October 2018

Plate 7a: GBF Plot 5 July 2016

Plate 7b: GBF Plot 5 October 2018

Plate 8a: GBF Plot 6 July 2016

Plate 8b: GBF Plot 6 October 2018

Plate 9a: GBF Plot 7 July 2016

Plate 9b: GBF Plot 7 October 2018

Plate 10a: GBF Plot 8 July 2016

Plate 10b: GBF Plot 8 October 2018

Plate 11a: GBF Plot 9 July 2016

Plate 11b: GBF Plot 9 October 2018

3.2.2 Species Richness

Dryland Plots

The average species richness in the six dryland plots in October 2018 was 17.7 (range 14-20) compared to 20.8 (range 17-24) in October 2016 (Table 2). The average for native species in October 2018 was similar in October 2018 with 10.8 species (8-14) compared to 9.2 (7-10) in October 2016. Seedlings of *Olearia axillaris* were recorded in three plots in 2018 for the first time. New occurrences were also recorded in October 2017 in other plots indicating that *Olearia axillaris* can take up to 2 years to re-colonise an area from seed after a fire.

Wetland Plots

Native species richness in the three wetland plots in October 2018 averaged 10.0 (range 8-13) which was similar to the species richness of 9.7 (8-13) in October 2016 (Table 2).

The water levels in the wetlands in 2018 were significantly higher than 2016 due to the amount and pattern of rainfall throughout the year. As a result of the higher groundwater levels all wetland contained above ground water, up to 0.4m deep in October 2018.

3.3 Weeds

Introduced species that were most commonly recorded in the monitoring plots are shown in Table 3.

Rose Pelargonium (*Pelargonium capitatum*) which was present in all plots in October 2016 was recorded in fewer plots in October 2017 mostly due to the impact of higher water levels in the wetlands. The reduction in Rose Pelargonium in wetland plots persisted in the October 2018 monitoring. Rose Pelargonium continued to spread in GBF 6 with an increase in percentage cover from 5 – 15% from October 2017 to October 2018. Blackberry Nightshade (*Solanum nigrum*) was not recorded in any plots in October 2018.

Other species that are considered to be potential invasive weeds in the foreshore reserve, Pigface (*Carpobrotus edulis*) and Onion Weed (*Trachyandra divaricata*), were recorded in similar density from 2016 to 2018. Several weed species such as *Oenothera* and Geraldton Carnation Weed (*Euphorbia terracina*) were only recorded in isolated areas and were not considered to be spreading during the monitoring period.

The monitoring of weed species since the January 2016 fire indicates that the fire has not caused the proliferation of invasive weeds post-fire.

The almost complete absence of introduced species in the wetland areas is highly likely due to the rapid and dense regeneration of native sedge and rush species after the fire.

Table 3: Introduced Species Recorded in more than three Monitoring Plots

Species	Common Name	October 2016			October 2017			October 2018		
		Dryland	Wetland	Total	Dryland	Wetland	Total	Dryland	Wetland	Total
Pelargonium capitatum	Rose Pelargonium	6	3	9	5	1	6	6	1	7
Oenothera species	Evening Primrose	5	2	7	4	0	4	2	0	2
Lolium perenne	Rye Grass	4	3	7	2	0	2	0	0	0
Dischisma arenarium		6	1	7	6	0	6	2	0	0
Carpobrotus edulis	Pigface	4	2	6	5	1	6	5	0	5
Crassula glomerata		4	1	5	6	1	7	6	0	6
Trachyandra divaricata	False Onion Weed	4	1	5	4	0	4	4	0	4
Lysimachia arvensis	Pimpernel	4	1	5	3	1	4	1	0	1
Solanum nigrum	Blackberry Nightshade	4	1	5	3	0	3	0	0	0
Hypochaeris species	Flatweed	3	1	4	1	0	1	0	0	0
Conyza bonariensis	Fleabane	4	0	4	0	0	0	1	0	1
Cerastium glomeratum	Chickweed	4	0	4	0	0	0	0	0	0
Sonchus oleraceus	Sow Thistle	3	1	4	3	1	4	3	0	3
Ehrharta longiflora	Annual Veltdgrass	2	0	2	3	0	3	3	0	3

3.4 Post-Fire Regeneration Mechanisms

A total of 76 plant species have been recorded in the nine monitoring plots in 2016 and 2017 (Appendix 2). Of these, 44 are native and 32 introduced.

Appendix 2 lists the post-fire regeneration mechanism of the species recorded where it was able to be observed. Plant species generally have two mechanisms of regeneration after fire. The first mechanism is for the burnt plant to resprout either from underground stems or bulbs/corms etc. The second mechanism is regeneration from seed, usually after the parent plant has been completely killed by the fire. Some species are able to regenerate by both sprouting and seeding. The heat of the fire can also influence the mechanism of regeneration for some species. For example, a plant may be able to recover by sprouting after a relatively cool burn but regenerates from seed after a hot burn that kills the entire plant.

The majority of native plants in the foreshore reserve were recorded as regenerating after fire by seeding. The two dominant shrub species on the dunal areas, *Acacia rostellifera* and *Spyridium globulosum* both regenerate by seed, however *Acacia rostellifera* also resprouts from the base of burnt shrubs.

The difference in early growth for *Acacia rostellifera* from sprouting (up to 2m tall in October 2018) compared to the growth of *Spyridium globulosum* seedlings (up to 0.4m tall) shows the competitive advantage of the sprouting mechanism, at least in the early stages.

The wetland sedge species all regenerate by sprouting from the underground stems which is the reason for the rapid regeneration of these areas soon after the fire.

3.5 Grazing

A small mob of kangaroos is present in the foreshore reserve at Golden Bay and freely roam into adjacent areas of Secret Harbour to the north and Singleton to the south. Some grazing by rabbits, and possibly kangaroos, was observed in the foreshore reserve in 2016, however no grazing was observed in the monitoring plots in 2018. The impact of kangaroos traversing through and lying in parts of the wetland sedges is evident. However, apart from flattening the sedges, the impact is negligible.

4 CONCLUSIONS AND RECOMMENDATIONS

The results of the post-fire vegetation monitoring of the Golden Bay Foreshore Reserve following the 1 January 2016 fire are as follows:

- Nine 10m x 10m permanent monitoring plots were established in the burnt areas of the Foreshore Reserve. Six plots were on dryland sand dunes and three in flat swales containing wetlands and Threatened Ecological Community 19;
- The plots were monitored for species presence, height and cover twice a year in 2016, 2017 and 2018;
- The growth of *Acacia rostellifera* in the dryland plots has progressed rapidly with plants up to 2m tall in October 2018. The other dominant pre-fire shrub species, *Spyridium globulosum* which regenerates from seed, was much smaller at around 0.4m tall;
- The growth of sedges in the three wetland plots reached pre-fire levels very quickly with all wetlands at pre-fire height and density by April 2017;
- Water levels in the wetlands and some of the lower-lying dunal plots was significantly higher in 2017 compared to 2016 resulting in wetlands being inundated and the low-lying dunal plots being waterlogged more than usual. As a result, several species not tolerant of waterlogging or inundation died in 2017, including *Olearia axillaris, Spyridium globulosum* and *Exocarpos sparteus*. The impact of the high 2017 water levels on the regeneration of the low-lying dunal plots persisted in 2018 when the groundwater levels were also high;
- Invasive weed species do not appear to be spreading in the foreshore reserve as a result of the fire. The weeds appear to have stabilised, probably at their pre-fire coverage, with the exception of Rose Pelargonium (*Pelargonium capitatum*) in one plot;
- A total of 76 species has been recorded in the monitoring plots. The majority of native species in the Foreshore Reserve were recorded as regenerating after fire by seeding. The remainder regenerated by sprouting from underground stems and roots and bulbs/corms etc. *Acacia rostellifera* regenerated by both seeding and sprouting;
- No grazing by rabbits or kangaroos was observed in the monitoring plots. Some grazing has been observed in the foreshore reserve as well as trampling of wetland sedges, however this is not having a detrimental impact on the recovery of the vegetation after the fire;
- The burnt areas are expected to retain their pre-fire cover within around 5 years after the fire without any necessary intervention with regards to revegetation or weeding. As a result, no in-fill planting or weeding is considered necessary in response to the 2016 fire.

5 REFERENCES

Alan Tingay and Associates (1992) *Amendment to the Metropolitan Region Scheme Public Environmental Review.* Prepared for H & B Developments Pty Ltd. Perth, Western Australia.

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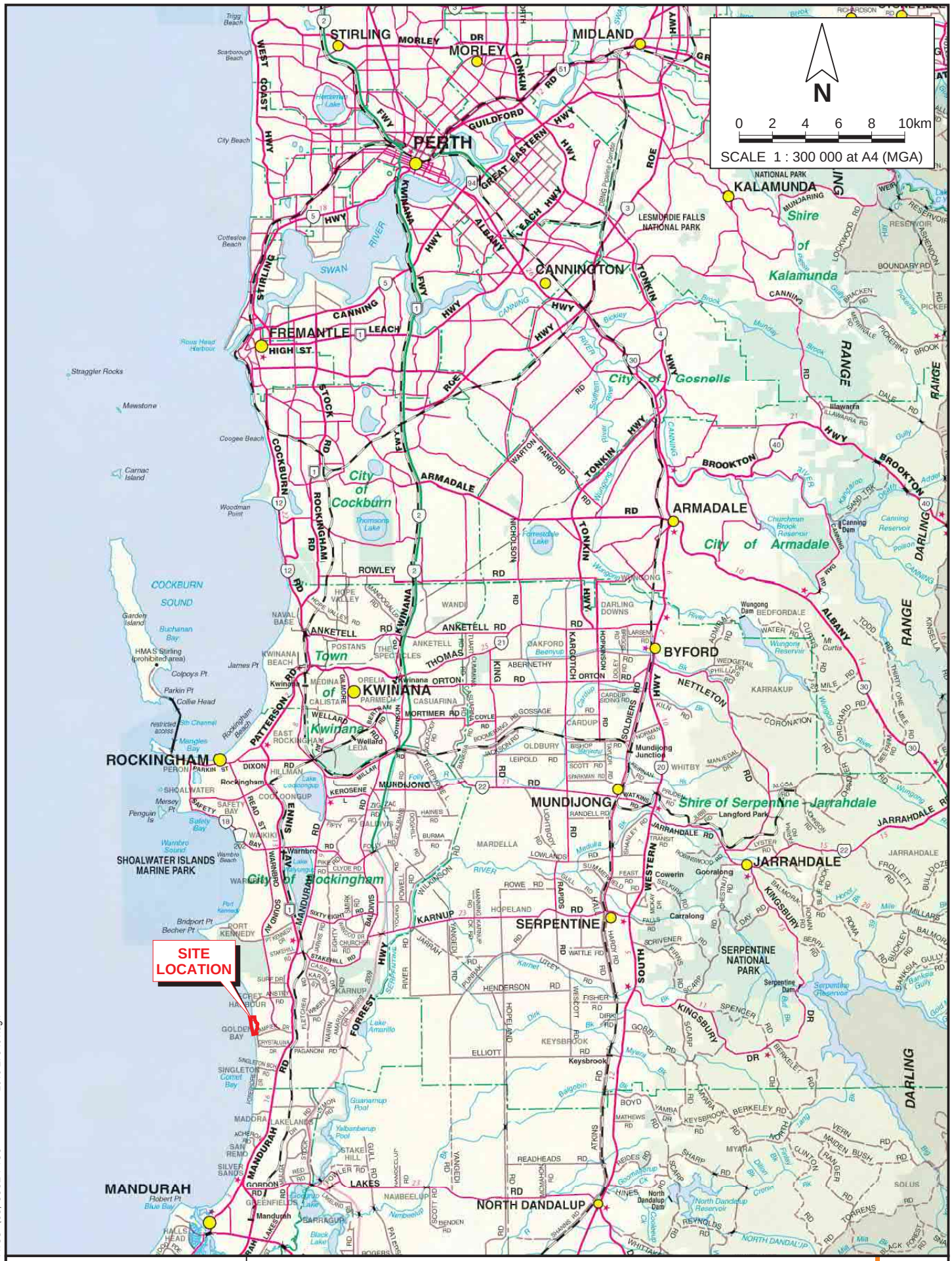
PGV Environmental (2016) *Lot 2 Warnbro Sound Avenue and Lot 3 Dampier Drive Golden Bay Foreshore Rehabilitation Plan*. Prepared for Department of Housing and Peet Golden Bay Pty Ltd. Perth, Western Australia. Report 2015-207.

PGV Environmental (2016) *Lot 2 Warnbro Sound Avenue, Golden Bay Foreshore Reserve Post-Fire Vegetation Monitoring Baseline Survey*. Prepared for the Housing Authority and Peet Golden Bay Pty Ltd. Perth, Western Australia. Report 2016-275.

FIGURES



PINPOINT CARTOGRAPHICS (08) 9562 7136 2016-275-f01.dgn

pgv ENVIRONMENTAL

The Housing Authority and Peet Golden Bay Pty Ltd
POST-FIRE VEGETATION MONITORING SURVEY
LOT 2 WARNBRO SOUND AVENUE, GOLDEN BAY FORESHORE RESERVE

Drawn: P. van der Moezel	Date: 11 Aug 2016
Job: 10004 Rpt: 2018-416	Revision: A

SITE LOCATION

Figure 1

PINPOINT CARTOGRAPHICS (08) 9562 7136 2016-275-f02.dgn

382 250mE

382 500mE

382 750mE

6 412 500mN

6 412 250mN

6 412 000mN

GBF9

GBF8

GBF7

GBF5

GBF6

GBF4

GBF1

GBF3

GBF2

N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

Legend

- Foreshore Reserve Boundary
- Cadastral Boundary
- Topographic Contour (m AHD)
- Coffey Environments and DEC Approved TEC19a Boundary October 2010
- Monitoring Plot Location

CADASTRAL SOURCE: Landgate, May 2015.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown January 2016.

pgv ENVIRONMENTAL

The Housing Authority and Peet Golden Bay Pty Ltd
POST-FIRE VEGETATION MONITORING SURVEY
LOT 2 WARNBRO SOUND AVENUE, GOLDEN BAY FORESHORE RESERVE

Drawn: P. van der Moezel | Date: 11 Aug 2016

Job: 10004 Rpt: 2018-416 | Revision: A

MONITORING PLOT LOCATIONS

Figure 3

APPENDIX 1

Monitoring Plot Data

QUADRAT GBF1

50 382543 E 6412176 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Open Heath (1.5m, 20-30%) over *Lepidosperma gladiatum* Open Sedgeland (10-20%)

Landform: Flat, low-lying, not wetland

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	0.8	15
Ficinia nodosa	0.8	5
Acacia rostellifera	1.4	2
Baumea juncea	0.7	1
Juncus kraussii	0.8	1
Acacia saligna	1.5	30
**Symphyotrichum squamatum*	to 1.5m	<1
**Lythrum hyssopifolia*	0.4	<1
Scaevola crassifolia		
Olearia axillaris	0.3 seedling	<1
**Sonchus sp*		
**Lysimachia arvensis*		
**Dischisma arenarium*		
Crassula colorata		
**Conyza bonariensis*	To 1.2	1
Senecio pinnatifolius	0.3	<1
**Carpobrotus edulis*		

SPECIES	HEIGHT (m)	COVER (%)
**Lolium perenne*		
**Brassicaceae sp*		
Spyridium globulosum	0.5	1
Calandrinia sp.		
**Crassula glomerata*		
**Pelargonium capitatum*	0.4	1
Acanthocarpus preissii		
Isolepis marginata		
**Solanum nigrum*	0.2	<1
Lobelia anceps	0.1	<1
Caladenia latifolia		
**Hypochaeris radicata*		
**Taraxacum officinale*		
**Oenothera drummondii*	0.4	<1
Hardenbergia comptoniana	Climber	<1
Cassytha racemosa	climber	<1
TOTAL COVER		**50**

* introduced species

Red = newly recorded species

QUADRAT GBF2

50 382501 E 6412149 N

Pre-fire Vegetation: *Baumea juncea/Ficinia nodosa* Closed Sedgeland (90%) over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Baumea juncea	0.8	70
Ficinia nodosa	0.8	50
Samolus repens		
Acacia saligna		
**Lolium perenne*		
Juncus kraussii	0.6	2
Lepidosperma gladiatum	0.6	<1
Sporobolus virginicus		
Apium prostratum	0.5	1
Spyridium globulosum		
Lobelia anceps	0.4	<1
Centella asiatica	0.4	20
Sphaerolobium ?calcicola		
**Sonchus oleraceus*		
**Carpobrotus edulis*		
**Pelargonium capitatum*		
**Trifolium campestre*		

SPECIES	HEIGHT (m)	COVER (%)
Epilobium billardiereanum		
TOTAL COVER		**100**

* introduced species

Red = newly recorded species

QUADRAT GBF3

50 382461 E 6412160 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (3.5-4m, >70%) over *Lepidosperma gladiatum* Sedgeland (30%)

Landform: Top of low rise, dry sandy soils

QUADRAT (10 x 10m) – 5 April 2018

Pegs in SW (tall peg) and SE corners (small peg)

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	1.7	50
Lepidosperma gladiatum	0.7-1	30
**Trachyandra divaricata*	0.4	<1
**Lolium perenne*		
**Lagurus ovatus*		
Calandrinia liniflora		
**Hypochaeris radicata*		
Parietaria debilis		
**Dischisma arenarium*		
Scaevola crassifolia	0.6	2
**Bromus diandrus*		
**Crassula glomerata*		
**Cerastium glomeratum*		
Isolepis marginata		
**Pelargonium capitatum*	0.3	<1
Spyridium globulosum	0.4	<1
Acanthocarpus preissii	0.3	<1
**Conyza bonariensis*		
Thysanotus patersonii		

SPECIES	HEIGHT (m)	COVER (%)
Clematis linearifolia	climber	<1 sick
Hardenbergia comptoniana		
Rhagodia baccata	1	5
**Ehrharta calycina*		
**Carpobrotus edulis*		
TOTAL COVER		**75**

* introduced species

Red = newly recorded species

QUADRAT GBF4

50 382427 E 6412262 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Shrubland (1.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (60%)

Landform: Upper slopes of low rise, dry sandy soil

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	1.7	3
Lepidosperma gladiatum	0.5	40
**Trachyandra divaricata*	0.4	20
**Podotheca angustifolia*		
**Solanum nigrum*		
**Sonchus ?oleraceus*		
Conostylis candicans		
**Lolium perenne*		
Calandrinia liniflora		
**Crassula glomerata*		
Parietaria debilis		
**Cynodon dactylon*		
**Ehrharta calycina*		
Isolepis marginata		
**Dischisma arenarium*		
**Euphorbia terracina*		

SPECIES	HEIGHT (m)	COVER (%)
**Conyza bonariensis*		
Crassula colorata		
**Cerastium glomeratum*		
**Lagurus ovatus*		
Scaevola thesioides		
**Vulpia myuros*		
**Romulea rosea*		
Spyridium globulosum	0.1-0.3	<1 several seedlings
Scaevola crassifolia	0.2-0.5	<1 many seedlings
**Carpobrotus edulis*	0.2	<1
**Pelargonium capitatum*	0.3	3
**Oenothera drummondii*	0.4	<1
**Cuscuta epithymum*		
Hardenbergia comptoniana		
Cassytha racemosa		
TOTAL COVER		**65**

* introduced species

Red = newly recorded species

QUADRAT GBF5

50 382466 E 6412278 N

Pre-fire Vegetation: *Baumea juncea* Sedgeland (90%) over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE and NE corner

SPECIES	HEIGHT (m)	COVER (%)
Baumea juncea	0.8	90
Ficinia nodosa	To 1.1	5
Juncus kraussii	0.7	<1
Acacia cyclops	1	<1
Centella asiatica	0.3	40
Acacia saligna	1	1
Samolus junceus		
Samolus repens		
Apium prostratum	1	1
**Symphyotrichum squamatum*	0.7	<1
Spyridium globulosum		
Lobelia anceps	0.6	5
Sporobolus virginicus		
Sphaerolobium ?calcicola		
**Lolium perenne*		
**Lysimachia arvensis*		
**Romulea rosea*		

SPECIES	HEIGHT (m)	COVER (%)
Atriplex sp.		
**Pelargonium capitatum*		
**Arctotheca calendula*		
TOTAL COVER		**100**

* introduced species

Red = newly recorded species

QUADRAT GBF6

50 382527 E 6412277 N

Pre-fire Vegetation: *Spyridium globulosum/Exocarpos sparteus* Open Heath (1.5m, 50-70%) over *Lepidosperma gladiatum/Baumea juncea* Open Sedgeland (20-30%)

Landform: Flat, low-lying, not wetland

QUADRAT (10 x 10m) – 5 April 2018

Pegs in SE and NE corners

SE tall green peg co-ordinate is 382533 6412271

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	0.8	20
Acacia cyclops	1.2	<1
**Symphyotrichum squamatum*	1.2	1
**Conyza bonariensis*	1	10
Juncus kraussii	0.6	<1
Ficinia nodosa	0.8	1
Baumea juncea	0.7	20
**Aira sp*	0.6	<1
Leucopogon parviflorus		
Rhagodia baccata	0.4	5
**Solanum nigrum*	0.8	<1
**Lythrum hyssopifolia*	0.4	<1
Scaevola crassifolia		
Exocarpos sparteus		
Lobelia anceps	0.3	<1

SPECIES	HEIGHT (m)	COVER (%)
**Lolium perenne*		
Parietaria debilis		
**Crassula glomerata*		
Calandrinia liniflora		
**Dischisma arenarium*		
Olearia axillaris	0.3	<1
Senecio pinnatifolius	0.2	1
**Lysimachia arvensis*		
Isolepis marginata		
**Carpobrotus edulis*	0.1	1
**Cerastium glomeratum*		
**Pelargonium capitatum*	0.5	5
Spyridium globulosum	0.7	1
Acacia saligna	To 1.5	25
**Hypochaeris glabra*		
**Conyza bonariensis*		
**Oenothera drummondii*	0.3	<1
Myoporum caprarioides	0.6	<1
**Lagurus ovatus*		
**Ehrharta calycina*		
**Arctotheca calendula*		
Hardenbergia comptoniana	climber	<1
Cassytha racemosa		
TOTAL COVER		**70**

* introduced species

Red = newly recorded species

QUADRAT GBF7

50 382459 E 6412348 N

Pre-fire Vegetation: *Baumea juncea* Closed Sedgeland (80-90%) with occasional *Acacia saligna* shrubs over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland, some water in north-east corner

QUADRAT (10 x 10m) – 5 April 2018

NE small peg and SE tall peg

SPECIES	HEIGHT (m)	COVER (%)
Juncus kraussii	0.8	1
Baumea juncea	0.6	70
**Cyperus tenuiflorus*		
Ficinia nodosa	0.8	10
Schoenoplectus validus	1.1	1
Lepidosperma gladiatum	0.4	<1
**Symphyotrichum squamatum*	1	10
Apium prostratum	0.6	10
Melaleuca preissiana	0.4-1	10
Lobelia anceps	0.4	2
Acacia rostellifera	0.6	<1
Samolus repens	0.4	<1
Rhagodia baccata	0.4	<1
**Trachyandra divaricata*		
**Lolium perenne*		
**Lagurus ovatus*		

SPECIES	HEIGHT (m)	COVER (%)
**Sonchus oleraceus*		
**Romulea rosea*		
Olearia axillaris		
Centella asiatica	0.4	20
**Dischisma arenarium*		
**Oenothera drummondii*		
Trachymene pilosa		
Eryngium pinnatifidum		
Acacia cyclops	1	1
Spyridium globulosum		
**Solanum nigrum*		
**Trifolium sp.*	0.1	<1
**Cynodon dactylon*		
Acacia saligna	0.5-1	25
**Pelargonium capitatum*	0.4	1
**Lysimachia arvensis*		
**Carpobrotus edulis*		
**Oenothera stricta*		
**Crassula glomerata*		
**Hypochaeris glabra*		
Hardenbergia comptoniana		
TOTAL COVER		**95**

* introduced species

Red = newly recorded species

QUADRAT GBF8

50 382413 E 6412428 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (4m, 70-80%) over *Lepidosperma gladiatum* Sedgeland (20-30%)

Landform: Upper slopes of dune

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	2-2.5	70
Lepidosperma gladiatum	1.2	15
**Podotheca angustifolia*		
**Trachyandra divaricata*	0.4	1
**Lysimachia arvensis*		
**Oenothera drummondii*	0.2	<1
Rhagodia baccata	0.5	10
**Solanum nigrum*		
Scaevola crassifolia	0.5	1
Olearia axillaris	1.1	<1
**Ehrharta calycina*		
Exocarpos sparteus		
Acanthocarpus preissii	0.5	1
Spyridium globulosum	0.6	<1
**Bromus diandrus*		
Conostylis candicans		

SPECIES	HEIGHT (m)	COVER (%)
Calandrinia liniflora		
**Dischisma arenarium*		
Isolepis marginata		
**Pelargonium capitatum*	0.4	1
Parietaria debilis		
**Crassula glomerata*		
Calandrinia brevipedata		
**Conyza bonariensis*		
**Carpobrotus edulis*	0.4	3
**Arctotheca calendula*		
Hardenbergia comptoniana	climber	<1
Cassytha racemosa		
TOTAL COVER		**80**

* introduced species

Red = newly recorded species

QUADRAT GBF9

50 382410 E 6412509 N

Pre-fire Vegetation: *Spyridium globulosum* Tall Shrubland (3.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (50%)

Landform: Mid-slope of dune

QUADRAT (10 x 10m) – 5 April 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	0.5	30
**Trachyandra divaricata*	0.3	20
Hibbertia cuneiformis	0.8	1
**Conyza bonariensis*		
Scaevola crassifolia	0.5	2
**Lolium perenne*		
Rhagodia baccata	0.4	<1
**Vulpia myuros*		
**Crassula glomerata*		
**Solanum nigrum*		
**Sonchus oleraceus*		
**Lysimachia arvensis*		
Parietaria debilis		
**Dischisma arenarium*		
Isolepis marginata		
Crassula colorata		
**Carpobrotus edulis*	0.2	2

SPECIES	HEIGHT (m)	COVER (%)
Conostylis candicans		
Acanthocarpus preissii		
**Cerastium glomeratum*		
**Brassicaceae sp.*		
Calandrinia liniflora		
Calandrinia brevipedata		
**Pelargonium capitatum*	0.3	2
Spyridium globulosum	0.4	<1
**Oenothera drummondii*	0.4	2
**Oenothera stricta*		
Hardenbergia comptoniana	Climber	3
Cassytha racemosa	climber	1
**Cuscuta epithymum*		
TOTAL COVER		**50**

* introduced species

Red = newly recorded species

QUADRAT GBF1

50 382543 E 6412176 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Open Heath (1.5m, 20-30%) over *Lepidosperma gladiatum* Open Sedgeland (10-20%)

Landform: Flat, low-lying, not wetland (damp in Oct 2018)

QUADRAT (10 x 10m) – 9 October 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	1	20
Ficinia nodosa	1.3	5
Acacia rostellifera	1.5	2
Baumea juncea	1	1
Juncus kraussii	1.2	2
Acacia saligna	2	50
**Symphyotrichum squamatum*	1	<1
**Lythrum hyssopifolia*	0.1	<1
Scaevola crassifolia		
Olearia axillaris	0.8	<1
**Sonchus oleraceus*	0.1	<1
**Lysimachia arvensis*		
**Dischisma arenarium*		
Crassula colorata		
**Conyza bonariensis*	0.4	<1
Senecio pinnatifolius	0.4	<1
**Carpobrotus edulis*		
**Lolium perenne*		

SPECIES	HEIGHT (m)	COVER (%)
**Brassicaceae sp*		
Spyridium globulosum	1	<1
Calandrinia sp.		
**Crassula glomerata*	0.1	1
**Pelargonium capitatum*	0.7	1
Acanthocarpus preissii		
Isolepis marginata	<0.1	1
**Solanum nigrum*		
Lobelia anceps	0.2	<1
Caladenia latifolia		
**Hypochaeris radicata*		
**Taraxacum officinale*		
**Oenothera drummondii*		
**Arctotheca calendula*	0.1	<1
Hardenbergia comptoniana	Climber	<1
Cassytha racemosa	climber	1
TOTAL COVER		**60**

* introduced species

Red = newly recorded species

QUADRAT GBF2

50 382501 E 6412149 N

Pre-fire Vegetation: *Baumea juncea/Ficinia nodosa* Closed Sedgeland (90%) over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland (inundated up to 0.4m)

QUADRAT (10 x 10m) – 9 October 2018

Small peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Baumea juncea	0.8	40
Ficinia nodosa	1	50
Samolus repens		
Acacia saligna		
**Lolium perenne*		
Juncus kraussii	1	5
Lepidosperma gladiatum	0.8	1
Sporobolus virginicus		
Apium prostratum	0.4	1
Spyridium globulosum		
Lobelia anceps	0.3	<1
Centella asiatica	0.3	20
Sphaerolobium ?calcicola	0.8	<1
**Sonchus oleraceus*		
**Carpobrotus edulis*		
**Pelargonium capitatum*		
**Trifolium campestre*		
Epilobium billardiereanum		

SPECIES	HEIGHT (m)	COVER (%)
TOTAL COVER		**100**

* introduced species

Red = newly recorded species

QUADRAT GBF3

50 382461 E 6412160 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (3.5-4m, >70%) over *Lepidosperma gladiatum* Sedgeland (30%)

Landform: Top of low rise, dry sandy soils

QUADRAT (10 x 10m) – 9 October 2018

Pegs in SW (tall peg) and SE corners (tall peg)

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	1.8	50
Lepidosperma gladiatum	0.8	30
**Trachyandra divaricata*	0.5	<1
**Lolium perenne*		
**Lagurus ovatus*		
Calandrinia liniflora		
**Hypochaeris radicata*		
Parietaria debilis	0.2	<1
**Dischisma arenarium*		
Scaevola crassifolia	1.2	5
Olearia axillaris	1.2	<1
**Bromus diandrus*		
**Crassula glomerata*	<0.1	5
**Cerastium glomeratum*		
Isolepis marginata	<0.1	2
**Pelargonium capitatum*	1	1
Spyridium globulosum	1.1	1
Acanthocarpus preissii	1	<1
**Conyza bonariensis*		

SPECIES	HEIGHT (m)	COVER (%)
Thysanotus patersonii		
Clematis linearifolia	climber	<1
Hardenbergia comptoniana		
Rhagodia baccata	1.2	5
**Ehrharta longiflora*	0.1	1
**Carpobrotus edulis*	0.1	<1
TOTAL COVER		**75**

* introduced species

Red = newly recorded species

QUADRAT GBF4

50 382427 E 6412262 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Shrubland (1.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (60%)

Landform: Upper slopes of low rise, dry sandy soil

QUADRAT (10 x 10m) – 9 October 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	1.3	4
Lepidosperma gladiatum	0.5	40
**Trachyandra divaricata*	0.4	20
**Podotheca angustifolia*		
Olearia axillaris	0.4	<1
Senecio pinnatifolius	0.4	<1
**Euphorbia terracina*	0.3	<1
**Solanum nigrum*		
**Sonchus ?oleraceus*	0.3	<1
Conostylis candicans	0.2	<1
**Lolium perenne*		
**Arctotheca calendula*	0.1	<1
Calandrinia liniflora		
**Crassula glomerata*	<0.1	1
Parietaria debilis		
**Cynodon dactylon*		

SPECIES	HEIGHT (m)	COVER (%)
**Ehrharta calycina*		
Isolepis marginata	<0.1	<1
**Dischisma arenarium*	<0.1	<1
**Euphorbia terracina*		
**Conyza bonariensis*		
Crassula colorata		
**Cerastium glomeratum*		
**Lagurus ovatus*		
Scaevola thesioides		
**Vulpia myuros*		
**Romulea rosea*	0.2	1
Spyridium globulosum	0.4	<1
Scaevola crassifolia	0.4	<1
**Carpobrotus edulis*	0.1	<1
**Pelargonium capitatum*	0.4	5
**Oenothera drummondii*	0.4	<1
**Cuscuta epithymum*		
Hardenbergia comptoniana		
Cassytha racemosa		
TOTAL COVER		**65**

* introduced species

Red = newly recorded species

QUADRAT GBF5

50 382466 E 6412278 N

Pre-fire Vegetation: *Baumea juncea* Sedgeland (90%) over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland (inundated to 0.2m)

QUADRAT (10 x 10m) – 9 October 2018

Peg in SE and NE corner

SPECIES	HEIGHT (m)	COVER (%)
Baumea juncea	1	95
Ficinia nodosa	to 1.2	5
Juncus kraussii	0.7	<1
Acacia cyclops	1	<1
Centella asiatica	0.3	10
Acacia saligna	1	2
Samolus junceus	0.8	<1
Samolus repens		
Apium prostratum	0.5	<1
**Symphyotrichum squamatum*		
Spyridium globulosum		
Lobelia anceps	0.5	5
Sporobolus virginicus		
Sphaerolobium ?calcicola		
**Lolium perenne*		
**Lysimachia arvensis*		
**Romulea rosea*		
Atriplex sp.		

SPECIES	HEIGHT (m)	COVER (%)
**Pelargonium capitatum*		
**Arctotheca calendula*		
TOTAL COVER		**100**

* introduced species

Red = newly recorded species

QUADRAT GBF6

50 382527 E 6412277 N

Pre-fire Vegetation: *Spyridium globulosum/Exocarpos sparteus* Open Heath (1.5m, 50-70%) over *Lepidosperma gladiatum/Baumea juncea* Open Sedgeland (20-30%)

Landform: Flat, low-lying, not wetland

QUADRAT (10 x 10m) – 9 October 2018

Pegs in SE and NE corners

SE tall green peg co-ordinate is 382533 6412271

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	0.8	20
Acacia cyclops	1.7	1
**Symphyotrichum squamatum*	0.5	<1
**Conyza bonariensis*		
Juncus kraussii	0.7	<1
Ficinia nodosa	0.8	1
Baumea juncea	0.7	25
**Aira sp*		
Leucopogon parviflorus		
Rhagodia baccata	0.5	2
**Solanum nigrum*		
**Lythrum hyssopifolia*	0.1	<1
Scaevola crassifolia		
Exocarpos sparteus		
Lobelia anceps	0.2	1

SPECIES	HEIGHT (m)	COVER (%)
**Lolium perenne*		
Parietaria debilis		
**Crassula glomerata*	<0.1	<1
Calandrinia liniflora		
**Dischisma arenarium*		
Olearia axillaris	1	1
Senecio pinnatifolius	0.6	1
**Lysimachia arvensis*		
Isolepis marginata		
**Carpobrotus edulis*	0.2	1
**Cerastium glomeratum*		
**Pelargonium capitatum*	1.1	15
Spyridium globulosum	1.3	<1
Acacia saligna	to 2.0	25
**Hypochaeris glabra*		
**Sonchus oleraceus*	0.1	<1
**Conyza bonariensis*		
**Oenothera drummondii*		
Myoporum caprarioides	0.6	<1
**Lagurus ovatus*		
**Ehrharta longiflora*	0.2	<1
**Arctotheca calendula*		
Hardenbergia comptoniana	climber	<1
Cassytha racemosa		
TOTAL COVER		**90**

* introduced species

Red = newly recorded species

QUADRAT GBF7

50 382459 E 6412348 N

Pre-fire Vegetation: *Baumea juncea* Closed Sedgeland (80-90%) with occasional *Acacia saligna* shrubs over *Centella asiatica* Herbland

Landform: Swale, damp peaty soil, wetland, some water in north-east corner (0.3m)

QUADRAT (10 x 10m) – 9 October 2018

NE small peg and SE tall peg

SPECIES	HEIGHT (m)	COVER (%)
Juncus kraussii	1	2
Baumea juncea	0.8	70
**Cyperus tenuiflorus*		
Ficinia nodosa	1.2	10
Schoenoplectus validus	to 1.5	10
Lepidosperma gladiatum	0.4	<1
**Symphyotrichum squamatum*		
Apium prostratum	0.5	5
Melaleuca preissiana	0.5-1	10
Lobelia anceps	0.5	2
Acacia rostellifera		
Samolus repens		
Rhagodia baccata	0.4	<1
**Trachyandra divaricata*		
**Lolium perenne*		
**Lagurus ovatus*		

SPECIES	HEIGHT (m)	COVER (%)
**Sonchus oleraceus*		
**Romulea rosea*		
Olearia axillaris		
Centella asiatica	0.2	20
**Dischisma arenarium*		
**Oenothera drummondii*		
Trachymene pilosa		
Eryngium pinnatifidum		
Acacia cyclops	1.2	1
Spyridium globulosum	1	<1
**Solanum nigrum*		
**Trifolium sp.*		
**Cynodon dactylon*		
Acacia saligna	1.2	30
**Pelargonium capitatum*	0.6	1
**Lysimachia arvensis*		
**Carpobrotus edulis*		
**Oenothera stricta*		
**Crassula glomerata*		
**Hypochaeris glabra*		
Hardenbergia comptoniana		
TOTAL COVER		**100**

* introduced species

Red = newly recorded species

QUADRAT GBF8

50 382413 E 6412428 N

Pre-fire Vegetation: *Acacia rostellifera/Spyridium globulosum* Closed Tall Scrub (4m, 70-80%) over *Lepidosperma gladiatum* Sedgeland (20-30%)

Landform: Upper slopes of dune

QUADRAT (10 x 10m) – 9 October 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Acacia rostellifera	2.5	75
Lepidosperma gladiatum	1.2	15
**Podotheca angustifolia*		
**Trachyandra divaricata*	0.4	1
**Lysimachia arvensis*		
**Oenothera drummondii*		
Rhagodia baccata	0.7	10
**Solanum nigrum*		
Scaevola crassifolia	0.8	5
Olearia axillaris	1.1	<1
**Ehrharta longiflora*	0.2	1
Exocarpos sparteus		
Acanthocarpus preissii	0.7	1
Spyridium globulosum	0.5	<1
**Bromus diandrus*		
Conostylis candicans		
Calandrinia liniflora		

SPECIES	HEIGHT (m)	COVER (%)
**Dischisma arenarium*		
Isolepis marginata	<0.1	<1
**Pelargonium capitatum*	0.8	10
Parietaria debilis		
**Crassula glomerata*	<0.1	5
Calandrinia brevipedata		
**Conyza bonariensis*		
**Carpobrotus edulis*	0.2	3
**Arctotheca calendula*		
Hardenbergia comptoniana	climber	<1
Cassytha racemosa		
TOTAL COVER		**80**

* introduced species

Red = newly recorded species

QUADRAT GBF9

50 382410 E 6412509 N

Pre-fire Vegetation: *Spyridium globulosum* Tall Shrubland (3.5m, 10%) over *Lepidosperma gladiatum/Trachyandra divaricata* Sedgeland (50%)

Landform: Mid-slope of dune

QUADRAT (10 x 10m) – 9 October 2018

Peg in SE corner only

SPECIES	HEIGHT (m)	COVER (%)
Lepidosperma gladiatum	0.6	30
**Trachyandra divaricata*	0.3	20
Hibbertia cuneiformis	1	1
**Conyza bonariensis*		
Scaevola crassifolia	0.5	2
**Lolium perenne*		
Rhagodia baccata	0.4	<1
Olearia axillaris	0.4	<1
Senecio pinnatifolius	0.4	<1
**Vulpia myuros*		
**Crassula glomerata*		
**Solanum nigrum*		
**Sonchus oleraceus*	0.1	<1
**Lysimachia arvensis*	0.1	<1
Parietaria debilis		
**Dischisma arenarium*	<0.1	1
Isolepis marginata	<0.1	<1
**Crassula glomerata*	<0.1	<1

SPECIES	HEIGHT (m)	COVER (%)
Crassula colorata		
**Carpobrotus edulis*	0.1	2
Conostylis candicans	0.2	<1
Acanthocarpus preissii		
**Cerastium glomeratum*		
**Brassicaceae sp.*		
Calandrinia liniflora		
Calandrinia brevipedata		
**Pelargonium capitatum*	0.4	3
Spyridium globulosum	0.5	<1
**Oenothera drummondii*	0.4	2
**Oenothera stricta*		
Hardenbergia comptoniana	Climber	3
Cassytha racemosa	climber	1
**Cuscuta epithymum*		
TOTAL COVER		**50**

* introduced species

Red = newly recorded species

APPENDIX 2

Monitoring Plot Photos

GBF 1

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 2

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 3

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 4

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 5

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 6

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 7

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 8

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

GBF 9

27 July 2016

11 October 2016

18 April 2017

24 October 2017

5 April 2018

October 2018

APPENDIX 3

Species List

Species List - Golden Bay Foreshore Reserve Post-Fire Monitoring Plots

Species	Regeneration Mechanism	
	Seed	Sprout/Bulb
MONOCOTYLEDONS		
Acanthocarpus preissii	+	
**Aira sp.*	+	
Baumea juncea		+
**Bromus diandrus*	+	
Caladenia latifolia	ND	ND
Conostylis candicans	?	?
Cynodon dactylon		+
**Cyperus tenuiflorus*		+
**Ehrharta calycina*	+	
Ficinia nodosa		+
Isolepis cernua		+
Isolepis marginata	+	
Juncus kraussii		+
Juncus pallidus		+
**Lagurus ovatus*	+	
Lepidosperma gladiatum		+
**Lolium perenne*	+	
**Poa annua*	+	
**Romulea rosea*		+
Schoenoplectus validus		+
Sporobolus virginicus		+
Thysanotus patersonii		+
**Trachyandra divaricata*	?	?
**Vulpia myuros*	+	
DICOTYLEDONS		
Acacia cyclops	+	
Acacia rostellifera	+	+
Acacia saligna	+	
Alyxia buxifolia	+	
Apium prostratum	+	
**Arctotheca calendula*	+	
Atriplex sp.	+	
**Bartsia trixago*	+	
Brassicaceae sp.	+	
Calandrinia liniflora	+	
Calandrinia brevipedata	+	
**Carpobrotus edulis*	+	
Cassytha racemosa		+

Species	Regeneration Mechanism	
	Seed	Sprout/Bulb
Centella asiatica		+
**Cerastium glomeratum*	+	
Clematis linearifolia		+
**Conyza bonariensis*	+	
Crassula colorata	+	
**Crassula glomerata*	+	
**Cuscuta epithymum*	+	
**Dischisma arenarium*	+	
Epilobium billardiereanum	+	
**Euphorbia terracina*	+	
Exocarpos sparteus	+	
Hardenbergia comptoniana	+	+
Hibbertia cuneiformis		+
**Hypochaeris glabra*	+	
**Hypochaeris radicata*	+	
Leucopogon parviflorus		+
Lobelia anceps	+	
**Lysimachia arvensis*	+	
**Lythrum hyssopifolia*	+	
Melaleuca preissiana	+	+
Myoporum caprarioides	+	
**Oenothera drummondii*	+	
**Oenothera stricta*	+	
Olearia axillaris	+	
**Parietaria debilis*	+	
**Pelargonium capitatum*	+	
**Podotheca angustifolia*	+	
Rhagodia baccata	+	
Samolus junceus	+	
Samolus repens	+	
Scaevola crassifolia	+	
Senecio pinnatifolius	+	
**Solanum nigrum*	+	
**Sonchus oleraceus*	+	
**Sonchus sp*	+	
Sphaerolobium ?calcicola	+	
Spyridium globulosum	+	
**Symphyotrichum squamatum*	+	
**Taraxacum officinale*	+	
Trachymene pilosa	+	
**Trifolium campestre*	+	

* introduced species

APPENDIX 6

SOUTHERN BROWN BANDICOOT MONITORING SURVEY REPORTS

Southern Brown Bandicoot Monitoring
Golden Bay
Autumn 2017

Version 1. April 2017

Prepared for:

Peet Ltd
Level 7
200 St Georges Terrace
Perth WA 6000

By:

Terrestrial Ecosystems
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Record of Distribution

No. of copies	Report File Name	Report Status	Date	Prepared for:	Initials
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Disclaimer

Front Cover: Southern Brown Bandicoot tracks in the sand

Contents

1 INTRODUCTION

Peet Ltd, on behalf of the Peet Ltd and the Department of Housing, requested a follow up monitoring survey of the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) population in the Foreshore Reserve adjacent to Lot 2, Warnbro Sound Ave, Golden Bay (i.e. 'project area'). This follows on from an initial survey in spring 2012 and monitoring surveys in autumn and winter/spring of 2013, 2014, 2015 and 2016. Southern Brown Bandicoot monitoring is a requirement under the Ministerial Statement 150 and compliance reports are provided to the Office of the Environmental Protection Authority on an annual basis.

The Foreshore Reserve includes the fore dune and swale, and the hinterland vegetation inland for about 400m from the ocean (Figure 1). The Foreshore Reserve includes a Conservation Category Wetland and a Threatened Ecological Community (TEC) that supported dense vegetation before it was burnt. There project area was extensively burnt in January 2016 and the only continuous unburnt habitat remains at the southern end of the foreshore reserve. There are patches of unburnt habitat spread throughout the burnt area, however, none of these are substantial enough to maintain resident Southern Brown Bandicoots. Vegetation clearing is now within 10m of the Foreshore Reserve in the central and northern sections.

There is a sand track that runs the length of the Reserve east of the fore dune and along the fence line, with numerous tracks running at right angles to the beach in the southern section. Closer to the beach is a sand track used by walkers that runs parallel to the beach. In July 2013, a firebreak was cleared near the eastern boundary of the Foreshore Reserve, but this has now mostly disappeared and is part of the cleared area.

Peet in conjunction with the Department of Housing, is clearing the vegetation and developing residential lots to the east of the Foreshore Reserve. Past monitoring indicated that Southern Brown Bandicoots in the Foreshore Reserve were moving freely between the remaining areas to be cleared and the Foreshore Reserve. The majority of the vegetation clearing was completed in July 2016 and only a small patch of habitat remains in the south-west corner (Figure 1).

1.1 Scope of this Southern Brown Bandicoot survey for long-term monitoring

The Foreshore Reserve will remain public open space and the developer has made a commitment to monitor the health of the Southern Brown Bandicoot population on a twice yearly basis during the construction and development stages (PGV Environmental 2011).

Coffey Environments recorded eight Southern Brown Bandicoots in the Reserve during its survey in mid-February 2010 (PGV Environmental 2011). It was reported that Southern Brown Bandicoots preferred scrubby, often swampy vegetation with a dense understorey of cover up to one metre high. The TEC and wetland areas within the Foreshore Reserve were considered suitable habitat to sustain a bandicoot population in the long-term (PGV Environmental 2011).

A Southern Brown Bandicoot relocation program has being undertaken for each stage of development prior to vegetation clearing from Lot 2, Warnbro Sound Ave and Lot 3, Dampier Drive as required under Ministerial Statement 150. This program was implemented to minimise the impact of vegetation clearing on bandicoots residing in these lots. All bandicoots caught prior to the last vegetation clearing program in July 2016 were relocated out of the area as there would have been insufficient habitat remaining to sustain this population given the area that had been burnt in January 2016.

The results of nine previous monitoring surveys are shown in Table 1. This report provides the outcomes of the tenth monitoring survey of Southern Brown Bandicoots in the Foreshore Reserve.

Table 1. Number of Southern Brown Bandicoots in the previous monitoring programs

	Spring 2012	Winter 2013	Spring 2013	Winter 2014	Spring 2014	Autumn 2015	Spring 2015	Autumn 2016	Spring 2016
# of indiv. captured	31	30	28	39	48	53	36	26	12
# of males	13	10	7	12	10	16	14	8	3
# of females	15	20	21	27	25	34	22	18	3
# of juveniles	3	-	-	1	12	3	6	-	6

2 BIOLOGY AND ECOLOGY OF SOUTHERN BROWN BANDICOOTS

The Southern Brown Bandicoot (*I. obesulus*) is a medium-sized, ground-dwelling marsupial that belongs to the Peramelidae family (Van Dyck and Strahan 2008). Populations of Southern Brown Bandicoots occur widely throughout southern Australia (Rees and Paull 2000, Van Dyck and Strahan 2008).

Isoodon obesulus fusciventer is the Western Australian subspecies and it was listed as a Schedule 1 species (Fauna that is rare or likely to become extinct) under the Western Australian *Wildlife Conservation Act 1950* until 1998. An increase in the population, which was attributed to the implementation of fox baiting throughout the state, meant that in 1998 the Southern Brown Bandicoot was removed from the threatened species list. The Southern Brown Bandicoot is now listed as a Priority 4 species ('Taxa in need of monitoring') on the Department of Parks and Wildlife's (DPaWs) Priority Fauna List.

Southern Brown Bandicoots are found in the wetter sections of the south-west of Western Australia, mostly along the Swan Coastal Plain from the Moore River to Walpole and the Fitzgerald River area. Populations of Southern Brown Bandicoots are found in a variety of habitats in this region, and appear to be able to survive a level of habitat destruction and live in close proximity to urban and industrial developments. The Southern Brown Bandicoot prefers habitats with a dense shrub understorey up to one metre high, but they are found in a variety of habitats including Banksia, Eucalypt and Melaleuca woodlands, but most often in close proximity to a wetland where the vegetation is often more dense (Stoddard and Braithwaiter 1979, Ramalho et al. 2013). In areas of thick undergrowth, Southern Brown Bandicoots are able to establish runways that are difficult to detect beneath the interlocking vegetation (Craven 1981). They are vulnerable to cat, fox and dog predation and are occasionally seen dead on the roads in urban environments, with the result that they are increasingly under threat due to the clearing of bushland leading to habitat fragmentation, bushland degradation and predation by introduced predators including foxes, cats and dogs (Friend 1991).

The Southern Brown Bandicoot is both nocturnal and diurnal, but are mostly active during the day early in the morning or late afternoon (Van Dyck and Strahan 2008). Individuals are mostly solitary, but with overlapping home ranges. The home range size of Southern Brown Bandicoots decreases with increasing population size (Broughton and Dickman 1991). The smallest home range estimates of 2.1ha for males and 1.4ha for females were recorded for a high density population (1.3 – 1.4 animals ha^{-1}) on Franklin Island, South Australia (Copley et al. 1990). The largest home range estimates of 5.3ha for males and 2.3ha for females and were calculated for a low density population (0.07 – 0.2 animals ha^{-1}) in Tasmania (Heinsohn 1966). A recent study of Southern Brown Bandicoots in the Perth metropolitan area found that the animals' increased their home range size and grazed in more open habitats in areas when predator control was implemented, compared to areas where there was no predator control (Gardner 2004).

Southern Brown Bandicoots are omnivorous, feeding on invertebrates (including earthworms, beetles and larvae), underground fungi, subterranean plant material, and occasionally small vertebrates such as lizards (Broughton and Dickman 1991). Southern Brown Bandicoots build a nest consisting of a heap of ground litter over a shallow depression providing an internal chamber with loose regions at both ends for entry and exit. The dense vegetation probably protects the nest from extremes in temperature and wind, rain and predators.

Heinsohn (1966) reported Southern Brown Bandicoots reach sexual maturity at five to six months of age when they weigh approximately 600g. As males produce sperm throughout the year, it is the reproductive activity of the female that determines the beginning and length of the breeding season (Heinsohn 1966). Breeding peaks in spring (Thomas 1987, Mallick et al. 1998) and females have a gestation period of 12 to 13 days and litters of one to six young are produced, although litters of two to four are most common. Two or three litters may be reared during a single breeding season, although this is dependent upon the availability of food resources (Friend 1991, Mallick et al. 1998) and rainfall (Barnes and Gemmell 1984).

Studies have reported the sex ratio of Southern Brown Bandicoot populations to be from 1.7 males to one female to 0.33 males to one female (Craven 1981, Thomas 1987, Mallick et al. 1998). The lifespan of the Southern Brown Bandicoot in the wild is estimated to be two to three years (Craven 1981).

3 METHODOLOGY

Sixty-eight baited wire cage traps were set in locations shown in Figure 1 (Appendix A). Cage traps were baited with a peanut butter sandwich and were set for five nights between 2-7 April 2017. Traps were located in the vegetated areas that were likely to support Southern Brown Bandicoots. The layout of traps was similar to spring 2016, but different to earlier surveys due to the fire in January 2016 and vegetation clearing in July 2016. Traps were baited when they were opened, when they had no bait and on every other day if they had bait. All traps had a hessian cover and were placed under vegetation. Traps were cleared from first light each morning. Staff in the Department of Parks and Wildlife (DPaW) requested that tissue samples were taken from caught bandicoots, which was done and the tissue samples will be given to DPaW at a later date.

Trapping was conducted under License SF010966. All Southern Brown Bandicoots that had not previously been caught had a microchip inserted on the dorsal surface near the shoulder blades. Captured bandicoots were identified and released near their site of capture.

3.1 Data analysis

Trap success rate was determined by dividing the trapping effort by the number of bandicoots caught per trap-night. There were 68 cage traps targeting Southern Brown Bandicoots and the trapping effort was 340 trap nights. Trapping data are compared with previous survey data.

3.2 Signs

As recommended in the winter 2014 monitoring report (Terrestrial Ecosystems 2014) signs (Plate 1) were prepared by Peet and placed on each track leading into the survey area. These signs were designed to reduce the number of people and dogs interfering with traps and captured bandicoots.

Plate 1. Sign placed near the end of an access track

4 RESULTS AND DISCUSSION

4.1 Survey monitoring

The Southern Brown Bandicoot trapping results are shown in Table 2. Fifteen individual bandicoots were caught with five adult females, nine adult males and one juvenile (<200g) male. Three of the females were carrying pouch young. Including non-target captures the trapping success was 13.5% and for bandicoots only it was 10.8%.

Nine of the 15 bandicoots caught during this survey were new to the monitoring program. This is a high percentage particularly as 11 of 12 captures in spring 2016 were also new to the area. This shows that there is a very high turnover of animals in the area and the population is relying on juvenile recruitment to maintain the low density of bandicoots in the area.

In most cases, once a Southern Brown Bandicoot had been caught it was caught multiple times during the survey, indicating it had become accustomed to the bait and is not afraid of the traps.

In addition to the Southern Brown Bandicoots, rats (*Rattus rattus*), bobtails (*Tiliqua rugosa*), house mice (*Mus musculus*) and a Western blue-tongued lizard (*Tiliqua occipitalis*) were caught in the traps.

Based on an assessment of the tracks in the area, there is at least once fox active in the coastal dunes and project area and multiple cats. Removal of cats and foxes from the area would significantly improve the chances of the Southern Brown Bandicoot population remaining viable while the burnt bushland rehabilitates.

The rabbit population is more abundant than in spring 2016, with new tracks present everyday. Without control programs to manage numbers the rabbit population is expected to increase as the new vegetation emerges in the foreshore during winter. Maintaining a low rabbit population in the short-term may be beneficial in taking the predation pressure off the Southern Brown Bandicoots (Pedler et al. 2016).

Kangaroos were seen on multiple occasions, and move through the burnt and unburnt areas. They are also seen feeding in the nearby residential areas. The movement of kangaroos into the residential area may be due to a lack of sufficient foraging areas.

Impacts on the trapping program

Trap baits taken by House Mice (*M. musculus*), rats (*R. rattus*) and bobtails reduced the number of Southern Brown Bandicoots caught as these animals take the bait and cause traps to be closed stopping the capture of bandicoots. This is an unavoidable aspect of using bait that attracts multiple species. All non-native species were euthanased.

There was limited disturbance by residents, and none that would have significantly impacted on the results of this survey.

Status of the population

The total number of Southern Brown Bandicoots caught during this monitoring program (15) was slightly more than spring 2016 (12), but substantially less than during autumn 2016 (26), spring 2015 (36) and autumn 2015 (56 bandicoots; see Table 1). This low number was expected after the low captures in spring 2016 and the January 2016 fire. Until the vegetation in the burnt area has regenerated resident Southern Brown Bandicoots will be subject to increased predation by cats and foxes.

As a result of the limited available habitat, any bandicoots that remain in the foreshore reserve will be concentrated into one small area until the vegetation in the burnt area can re-establish. As all of the traps were also confined to this same area Terrestrial Ecosystems are confident that most of the bandicoots were caught.

Three females had pouched young which is promising for the establishment of a bandicoot population, however, the high turnover of animals and high number of new animals indicates that the population is not stable. Mortality

of young is high, and surveys in the past three years have indicated that only a small proportion of juveniles in the size range of 100-300g survive to adulthood.

Undertaking a management program for foxes and cats in cooperation with the City of Rockingham for the coastal duen system is critical to maintaining a viable population of Southern Brown Bandicoots in the Foreshore Reserve. This program should be discussed with the City of Rockingham and implemented during winter 2017 while the vegetation is recovering from the January 2016 fire.

Western Grey Kangaroos

There are about 11 Western Grey Kangaroos in the Foreshore Reserve and surrounds. With the growth on new vegetation after the fire it is likely that this population will increase by 25-30% each year. If Peet or the City of Rockingham wanted these kangaroos relocated, then now is the time for this to happen as their habitat has been significantly reduced. These kangaroos are particularly wary, as they have almost certainly been chased by people and local dogs, so any removal program will be difficult. However, a relocation program involving darting and sedating each kangaroo is probably the most effective option.

Rabbits

The population of rabbits in the Foreshore reserve and the adjacent beach dunes is increasing and is likely to continue to increase as the vegetation regrows. Rabbits move along and through the vegetation on the coastal dunes, but the higher density populations are in the remnant native vegetation like the Foreshore Reserve. A recent paper by Pedler et al. (2016) demonstrated the importance of rabbit control in maintaining populations of native mammals. Rabbits are likely to significantly impact on the regenerating native vegetation, by eating the emerging vegetation. If a rabbit control program was envisaged by Peet or the City of Rockingham, then this autumn and winter 2017 would be a good time. The use of the biological control agent - rabbit hemorrhagic disease virus (RHDV) and fumigating and closing warrens can most effectively be done when the regenerated vegetation is in an early stage and there is good access to most of the area.

4.2 Conclusion

Based on the results of this trapping program, there has been a significant reduction in the population of Southern Brown Bandicoots in the Foreshore Reserve since early 2016, however, the population is similar to spring 2016. This is likely to be the result of reduced habitat availability after the January 2016 fire, the relocation of bandicoots prior to the July 2016 vegetation clearing program, and increased predation pressure from cats and foxes. The capture data also indicates that there is a high turnover of individuals which indicates the population is under stress and not stable. Although in low density, the small remaining population of Southern Brown Bandicoots should be sufficient to recolonise the area as the vegetation regrows post-fire presuming that predation pressures are maintained at low levels. If predation pressures are not managed the population could be removed quickly.

Given the reduced quantity of native vegetation, it is very important that feral predators remain at a very low level until the bandicoot population has recovered. It is therefore recommended that a fox and cat management program is repeated in 2017 to allow any young bandicoots a chance of survival during 2017. This program should be discussed with the City of Rockingahm to see if they will financially contribute to a broader program across the coastal dune system. Consideration should also be given to a rabbit reduction program, as this will assist the regeneration of vegetation and also reduce competition for foraging opportunities for bandicoots.

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Table 2. Southern Brown Bandicoot trapping results

							Trapping days and trap number					
Sex	**Mass**	**HL**	**HW**	**Pes**	**Testes**	**Chip No**	**03-04-17**	**04-04-17**	**05-04-17**	**06-04-17**	**07-04-17**	**No. times caught**
m	1100	79	35	63	23	6B35490					1	1
f	590	71	30	25		6B3C3B8	1		1		1	3
m	980	80	42	58	35	6B3CE74				1		1
f	720	67	31	53		6E1E2E5					1	1
m	660	68	28	49	23	6E20137	1	1	1	1	1	5
m	1300	80	3	63	30	6E21B2C				1	1	2
m	760	80	38	62	30	6E21F96	1	1	1	1		4
m	1250	85	36	55	30	6E22596		1	1		1	3
f	720	68	37	51		6E22B20	1	1	1	1	1	5
m	1080	75	36	61	28	6E22CF6			1			1
m	540	63	30	53	23	6E2304C			1			1
f	540	64	30	53		6E2364A	1	1				2
f	400	65	29	51		6E2491B		1		1	1	3
m	120	49	24	42	8	6E252D7		1		1		2
m	990	73	36	61	30	6E2536A		1	1	1		2

Appendix A. Trapping site locations (GDA94; Zone 50)

Site	Easting	Northing
1	382510	6411865
2	382515	6411879
3	382515	6411895
4	382519	6411903
5	382521	6411910
6	382517	6411911
7	382524	6411921
8	382528	6411923
9	382532	6411926
10	382537	6411929
11	382541	6411931
12	382547	6411935
13	382555	6411938
14	382563	6411943
15	382569	6411948
16	382574	6411952
17	382583	6411956
18	382587	6411963
19	382592	6411966
20	382595	6411972
21	382595	6411975
22	382594	6411981
23	382591	6411987
24	382590	6411993
25	382587	6412007
26	382585	6412011
27	382585	6412023
28	382582	6412029
29	382580	6412032
30	382573	6412043
31	382567	6412047
32	382563	6412046
33	382556	6412051
34	382547	6412048

Site	Easting	Northing
35	382543	6412048
36	382528	6412025
37	382525	6412021
38	382524	6412016
39	382515	6412005
40	382512	6412001
42	382510	6411996
43	382508	6411992
44	382505	6411989
45	382500	6411982
46	382501	6411976
47	382498	6411972
48	382500	6411960
49	382502	6411947
50	382505	6411945
51	382510	6411932
52	382513	6411926
53	382519	6411924
54	382485	6411931
55	382476	6411935
56	382459	6411938
57	382441	6411943
58	382436	6411945
59	382429	6411980
60	382439	6411976
61	382444	6411970
62	382454	6411963
63	382468	6411956
64	382475	6411956
65	382480	6411958
66	382488	6411972
67	382505	6411917
68	382500	6411927

PINPOINT CARTOGRAPHICS (08) 9562 7136 2017-0013-f01.dgn

N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

LEGEND

- Foreshore Reserve Boundary
- Reserve Boundary
- Cadastral Boundary
- Trapping Site - Bandicoot

382 250mE

382 500mE

6 412 500mN

6 412 250mN

6 412 000mN

6 411 750mN

R 47199 4779

R 34664 2486

R 27066 2030

R 52131 8009

R 35364

9020

AUREA BOULEVARD

WOODLANDS ROAD

IVANHOE STREET

MARILLANA DRIVE

TANGADEE ROAD

CADASTRAL SOURCE: Landgate, April 2017.
AERIAL PHOTOGRPAH SOURCE: NearMap, flown February 2017.

TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson

Date: 20 Apr 2017

Peet Ltd and Department of Housing
BANDICOOT MONITORING
GOLDEN BAY - AUTUMN 2017

TRAPPING SITES

Figure 1

Job: 2017-0013

Southern Brown Bandicoot Monitoring
Golden Bay
Spring 2017

Version 1. October 2017

Prepared for:

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Record of Distribution

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Disclaimer

Front Cover: Regeneration of the burnt vegetation in the Foreshore Reserve

Contents

1 INTRODUCTION

Peet Ltd, on behalf of the Peet Ltd and the Department of Housing, requested a follow up monitoring survey of the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) population in the Foreshore Reserve adjacent to Lot 2, Warnbro Sound Ave, Golden Bay (i.e. 'project area'). This follows on from an initial survey in spring 2012 and monitoring surveys in autumn and winter/spring of 2013, 2014, 2015, 2016 and autumn 2017. Southern Brown Bandicoot monitoring is a requirement under the Ministerial Statement 150 and compliance reports are provided to the Office of the Environmental Protection Authority on an annual basis.

The Foreshore Reserve includes the fore dune and swale, and the hinterland vegetation inland for about 400m from the ocean (Figure 1). The Foreshore Reserve includes a Conservation Category Wetland and a Threatened Ecological Community (TEC) that supported dense vegetation before it was burnt. There project area was extensively burnt in January 2016 and the only continuous unburnt habitat remains at the southern end of the foreshore reserve. There are patches of unburnt habitat spread throughout the burnt area, which are in the progress of regenerating. Some of the regeneration is substantial enough to maintain resident Southern Brown Bandicoots but most is still growing. The regrowth in the burnt area has benefitted from winter rains. Vegetation clearing is now along the edge of the Foreshore Reserve in the central and southern sections.

There is a sand track that runs the length of the Reserve east of the fore dune and along the fence line, with numerous tracks running at right angles to the beach in the southern section. Closer to the beach is a sand track used by walkers that runs parallel to the beach. In July 2013, a firebreak was cleared near the eastern boundary of the Foreshore Reserve, but this has now mostly disappeared and is part of the cleared area.

1.1 Scope of this Southern Brown Bandicoot survey for long-term monitoring

The Foreshore Reserve will remain public open space and the developer has made a commitment to monitor the health of the Southern Brown Bandicoot population on a twice yearly basis during the construction and development stages (PGV Environmental 2011).

Coffey Environments recorded eight Southern Brown Bandicoots in the Reserve during its survey in mid-February 2010 (PGV Environmental 2011). It was reported that Southern Brown Bandicoots preferred scrubby, often swampy vegetation with a dense understorey of cover up to one metre high. The TEC and wetland areas within the Foreshore Reserve were considered suitable habitat to sustain a bandicoot population in the long-term (PGV Environmental 2011).

A Southern Brown Bandicoot relocation program has being undertaken for each stage of development prior to vegetation clearing from Lot 2, Warnbro Sound Ave and Lot 3, Dampier Drive as required under Ministerial Statement 150. This program was implemented to minimise the impact of vegetation clearing on bandicoots residing in these lots. All bandicoots caught prior to the last vegetation clearing program in July 2016 were relocated out of the area as there would have been insufficient habitat remaining to sustain this population given the area that had been burnt in January 2016.

The results of 10 previous monitoring surveys are shown in Table 1. This report provides the outcomes of the eleventh monitoring survey of Southern Brown Bandicoots in the Foreshore Reserve.

Table 1. Number of Southern Brown Bandicoots in the previous monitoring programs

	Spring 2012	Winter 2013	Spring 2013	Winter 2014	Spring 2014	Autumn 2015	Spring 2015	Autumn 2016	Spring 2016	Autumn 2017
# of indiv. captured	31	30	28	39	48	53	36	26	12	15
# of males	13	10	7	12	10	16	14	8	3	9
# of females	15	20	21	27	25	34	22	18	3	5
# of juveniles	3	-	-	1	12	3	6	-	6	1

2 BIOLOGY AND ECOLOGY OF SOUTHERN BROWN BANDICOOTS

The Southern Brown Bandicoot (*I. obesulus*) is a medium-sized, ground-dwelling marsupial that belongs to the Peramelidae family (Van Dyck and Strahan 2008). Populations of Southern Brown Bandicoots occur widely throughout southern Australia (Rees and Paull 2000, Van Dyck and Strahan 2008).

Isoodon obesulus fusciventer is the Western Australian subspecies and it was listed as a Schedule 1 species (Fauna that is rare or likely to become extinct) under the Western Australian *Wildlife Conservation Act 1950* until 1998. An increase in the population, which was attributed to the implementation of fox baiting throughout the state, meant that in 1998 the Southern Brown Bandicoot was removed from the threatened species list. The Southern Brown Bandicoot is now listed as a Priority 4 species ('Taxa in need of monitoring') on the Department of Biodiversity, Conservation and Attractions' (DBCAs) Priority Fauna List.

Southern Brown Bandicoots are found in the wetter sections of the south-west of Western Australia, mostly along the Swan Coastal Plain from the Moore River to Walpole and the Fitzgerald River area. Populations of Southern Brown Bandicoots are found in a variety of habitats in this region, and appear to be able to survive a level of habitat destruction and live in close proximity to urban and industrial developments. The Southern Brown Bandicoot prefers habitats with a dense shrub understorey up to one metre high, but they are found in a variety of habitats including Banksia, Eucalypt and Melaleuca woodlands, but most often in close proximity to a wetland where the vegetation is often more dense (Stoddard and Braithwaiter 1979, Ramalho et al. 2013). In areas of thick undergrowth, Southern Brown Bandicoots are able to establish runways that are difficult to detect beneath the interlocking vegetation (Craven 1981). They are vulnerable to cat, fox and dog predation and are occasionally seen dead on the roads in urban environments, with the result that they are increasingly under threat due to the clearing of bushland leading to habitat fragmentation, bushland degradation and predation by introduced predators including foxes, cats and dogs (Friend 1991).

The Southern Brown Bandicoot is both nocturnal and diurnal, but are mostly active during the day early in the morning or late afternoon (Van Dyck and Strahan 2008). Individuals are mostly solitary, but with overlapping home ranges. The home range size of Southern Brown Bandicoots decreases with increasing population size (Broughton and Dickman 1991). The smallest home range estimates of 2.1ha for males and 1.4ha for females were recorded for a high density population (1.3 – 1.4 animals ha^{-1}) on Franklin Island, South Australia (Copley et al. 1990). The largest home range estimates of 5.3ha for males and 2.3ha for females and were calculated for a low density population (0.07 – 0.2 animals ha^{-1}) in Tasmania (Heinsohn 1966). A recent study of Southern Brown Bandicoots in the Perth metropolitan area found that the animals' increased their home range size and grazed in more open habitats in areas when predator control was implemented, compared to areas where there was no predator control (Gardner 2004).

Southern Brown Bandicoots are omnivorous, feeding on invertebrates (including earthworms, beetles and larvae), underground fungi, subterranean plant material, and occasionally small vertebrates such as lizards (Broughton and Dickman 1991). Southern Brown Bandicoots build a nest consisting of a heap of ground litter over a shallow depression providing an internal chamber with loose regions at both ends for entry and exit. The dense vegetation probably protects the nest from extremes in temperature and wind, rain and predators.

Heinsohn (1966) reported Southern Brown Bandicoots reach sexual maturity at five to six months of age when they weigh approximately 600g. As males produce sperm throughout the year, it is the reproductive activity of the female that determines the beginning and length of the breeding season (Heinsohn 1966). Breeding peaks in spring (Thomas 1987, Mallick et al. 1998) and females have a gestation period of 12 to 13 days and litters of one to six young are produced, although litters of two to four are most common. Two or three litters may be reared during a single breeding season, although this is dependent upon the availability of food resources (Friend 1991, Mallick et al. 1998) and rainfall (Barnes and Gemmell 1984).

Studies have reported the sex ratio of Southern Brown Bandicoot populations to be from 1.7 males to one female to 0.33 males to one female (Craven 1981, Thomas 1987, Mallick et al. 1998). The lifespan of the Southern Brown Bandicoot in the wild is estimated to be two to three years (Craven 1981).

3 METHODOLOGY

Sixty-eight baited wire cage traps were set in locations shown in Figure 1 (Appendix A). Cage traps were baited with a peanut butter sandwich and were set for five nights between 28 September and 3 October 2017. Traps were located in the vegetated areas that were likely to support Southern Brown Bandicoots. The layout of traps was similar to that in spring 2016 and autumn 2017, but different to earlier surveys due to the fire in January 2016 and vegetation clearing before July 2016. Traps were baited when they were opened, when they had no bait and on every other day if they had bait. All traps had a hessian cover and were placed under vegetation. Traps were cleared from first light each morning. Staff in the Department of Biodiversity, Conservation and Attractions (DBCA) requested that tissue samples were taken from caught bandicoots, which was done and the tissue samples will be given to DBCA at a later date.

Trapping was conducted under License 11-000925-1. All Southern Brown Bandicoots that had not previously been caught had a microchip inserted on the dorsal surface near the shoulder blades. Captured bandicoots were identified and released near their site of capture.

3.1 Data analysis

Trap success rate was determined by dividing the trapping effort by the number of bandicoots caught per trap-night. There were 68 cage traps targeting Southern Brown Bandicoots and the trapping effort was 340 trap nights. Trapping data are compared with previous survey data.

3.2 Signs

As recommended in the winter 2014 monitoring report (Terrestrial Ecosystems 2014) signs (Plate 1) were prepared by Peet and placed on each track leading into the survey area. These signs were designed to reduce the number of people and dogs interfering with traps and captured bandicoots.

Plate 1. Sign placed near the end of an access track

4 RESULTS AND DISCUSSION

4.1 Survey monitoring

The Southern Brown Bandicoot trapping results are shown in Table 2. Fifteen individual bandicoots were caught with five adult females, nine adult males and one juvenile (<200g) male. All of the females were carrying pouch young. Including non-target captures the trapping success was 15.3% and for bandicoots only it was 9.1%. which is similar to last years rates of 13.5% and 10.8% respectively.

Only four of the 15 bandicoots caught during this survey were caught in the autumn 2017 monitoring program. This is a particularly disappointing result, as 12 of the 15 bandicoots caught in the autumn survey had been previously caught. This shows that there is a very high turnover of animals in the area and the population is relying on recruitment to maintain the low density of bandicoots in the area. It is hoped that many of the pouch young survive this spring and enter the population as breeding adults.

Six of the 15 bandicoots were caught once and the remainder on two or more occasions. In addition to the Southern Brown Bandicoots, four rats (*Rattus rattus*), 17 bobtails (*Tiliqua rugosa*) and five house mice (*Mus musculus*) were caught in the traps.

We recorded no fox tracks but observed cat tracks on most days (Plate 2). These feral cats would be predating on young Southern Brown Bandicoots and other small vertebrate fauna in the Reserve.

Plate 2. Feral cat tracks along the edge of the sand dune

We indicated in the spring of 2016 and the autumn of 2017 that the rabbit population was on the increase. Without an active management program, the rabbit population is expected to increase as the new vegetation becomes established and provides a significantly greater area of vegetation cover. Maintaining a low rabbit population in the short-term may be beneficial in taking the predation pressure off the Southern Brown Bandicoots (Pedler et al. 2016).

Kangaroos were not seen during the survey, but their tracks were observed on most days.

Status of the population

The total number of Southern Brown Bandicoots caught during this monitoring program (15), is the same as autumn 2017 and slightly more than spring 2016 (12), but substantially less than during autumn 2016 (26), spring 2015 (36) and autumn 2015 (56 bandicoots; see Table 1). This low number was expected after the burning of a substantial quantity of the bushland in January 2016, however, we had expected an increase as the adjacent vegetation was regenerating.

All five females had pouched young which is promising for the establishment of a bandicoot population, however, the high turnover of individuals and high number of new animals indicates that the population is not stable. Mortality of young has been very high, and surveys in the past three years have indicated that only a small proportion of juveniles in the size range of 100-300g survive to adulthood. If the population is to return to pre-fire levels, then a significant increase should be expected in the autumn 2018 survey, as the bandicoots will be able to live in some of the adjacent regrowth by then.

Undertaking a management program for rabbits, foxes and cats in cooperation with the City of Rockingham for the coastal dune system is critical to maintaining a viable population of Southern Brown Bandicoots in the Foreshore Reserve. This program should be discussed with the City of Rockingham and implemented during winter/spring of 2018. It is more effective to target foxes during the breeding season than after young are mobile in late spring and early summer. Fox trapping in late spring and summer results in captures of young foxes and leaves the adult foxes. Vixens also teach their offspring to avoid traps. Cat control is most effective in late autumn and early winter when food resources are limited. *Western Grey Kangaroos*

We saw no Western Grey Kangaroos in the Foreshore Reserve and surrounds, however, based on the numbers seen in the autumn survey and number of fresh tracks each morning it could be anticipated there are 15-20 individuals living in the area. This population will increase by 25-30% each year.

Rabbits

The population of rabbits in the Foreshore Reserve and the adjacent beach dunes has increased and will continue to increase as the vegetation regrows (see diggings in Plate 3). Rabbits move along and through the vegetation on the coastal dunes, but the higher density populations are in the remnant native vegetation like the Foreshore Reserve. A recent paper by Pedler et al. (2016) demonstrated the importance of rabbit control in maintaining populations of native mammals.

Rabbits are likely to significantly impact on the regenerating native vegetation, by eating the emerging vegetation. If a rabbit control program was planned by Peet or the City of Rockingham, then autumn of 2018 would be a good time. The use of the biological control agent (i.e. rabbit hemorrhagic disease virus - RHDV), is very effective, particular when the majority of rabbits are still confined to the dense unburnt vegetation on the southern end of the Reserve. Rabbit control should be undertaken in spring or autumn to coincide with the optimum delivery period for RHDV (i.e. maximum abundance of dispersal vectors). Use of Pindone to control rabbits should be avoided in all areas which contain Western Grey Kangaroos and Southern Brown Bandicoots, as it is a non-discriminating bait and will impact on the native species.

Plate 3. Rabbit diggings along one of the sand tracks

4.2 Conclusion

Based on the results of this trapping program, there has been a significant reduction in the population of Southern Brown Bandicoots in the Foreshore Reserve since early 2016, however, the population is similar to that recorded in the spring 2016 and autumn 2017 monitoring programs. This is likely to be the result of reduced habitat availability after the January 2016 fire, the relocation of bandicoots prior to the July 2016 vegetation clearing program, and increased predation pressure from cats and foxes in 2016 and 2017. The capture data also indicates that there is a very high turnover of individuals which indicates the population is under stress and not stable. Although in low density, the small remaining population of Southern Brown Bandicoots should be sufficient to recolonise the entire Foreshore Reserve as the vegetation regrows. If predation pressures are not managed the population could be removed quickly.

Given the reduced quantity of native vegetation, it is very important that feral predators remain at a very low level until the bandicoot population has recovered. It is therefore recommended that a fox and cat management program is implemented and the rabbit hemorrhagic disease virus (RHDV K5) is released to reduce the current abundance of rabbits in autumn of 2018. This program should be coordinated with the City of Rockingham.

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Table 2. Southern Brown Bandicoot trapping results

						Trapping days and number of trapped individuals					
Sex	**Mass (g)**	**HL (mm)**	**HW (mm)**	**Pes (mm)**	**Chip N°**	**29/09/2017**	**30/09/2017**	**1/10/2017**	**2/10/2017**	**3/10/2017**	**Grand Total**
M	980	75	34	64	0006B3CE74				1		1
F	720	75	30	63	0006B3D38E				1		1
M	1820	92	40	72	0006B3DA6C		1	1	1	1	4
M	1250	83	36	66	0006B3E664		1		1	1	3
M	1240	86	37	56	0006E21B2C	1	1				2
M	1110	79	37	71	0006E21F96	1	1			1	3
M	110	53	27	42	0006E24A16					1	1
M	990	87	36	70	0006E2536A	1					1
F	720	76	31	61	000783BFC5			1			1
F	470	68	27	51	00079D5624		1		1		2
M	670	79	30	60	00079D575C				1	1	2
F	610	72	30	59	00079D58F7			1			1
F	620	73	32	54	0007ABBD1F	1		1	1	1	4
M	800	81	31	67	0007AC2A59		1	1		1	3
M	970	82	34	64	0007AFEB1D				1	1	2

PINPOINT CARTOGRAPHICS (08) 9562 7136 2017-0042-f01.dgn

N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

LEGEND

- Foreshore Reserve Boundary
- Reserve Boundary
- Cadastral Boundary
- Trapping Site - Bandicoot

6 412 500mN

6 412 250mN

6 412 000mN

6 411 750mN

382 250mE

382 500mE

R 47199 4779

R 34664 2486

9020

R 27066 2030

R 52131 8009

R 35364

AUREA BOULEVARD

WOODLANDS ROAD

IVANHOE STREET

MARILLANA DRIVE

TANGADEE ROAD

CADASTRAL SOURCE: Landgate, April 2017.
AERIAL PHOTOGRPAH SOURCE: NearMap, flown August 2017.

TERRESTRIAL ECOSYSTEMS

Drawn: G. Thompson | Date: 16 Oct 2017

Peet Ltd and Department of Housing
BANDICOOT TRAPPING SITES
GOLDEN BAY - SPRING 2017

TRAPPING SITES

Figure 1

Job: 2017-0042

Appendix A. Trapping site locations (GDA94; Zone 50)

Site	Easting	Northing
1	382550	6412046
2	382542	6412042
3	382539	6412040
4	382536	6412038
5	382533	6412033
6	382530	6412027
7	382527	6412023
8	382525	6412019
9	382521	6412012
10	382518	6412009
11	382515	6412005
12	382506	6411998
13	382511	6412000
14	382507	6411992
15	382505	6411989
16	382500	6411985
17	382499	6411977
18	382498	6411971
19	382498	6411960
20	382502	6411950
21	382508	6411942
22	382511	6411935
23	382513	6411932
24	382497	6411916
25	382488	6411922
26	382480	6411923
27	382468	6411931
28	382456	6411932
29	382446	6411935
30	382438	6411936
31	382427	6411940
32	382423	6411973
33	382429	6411970
34	382437	6411965

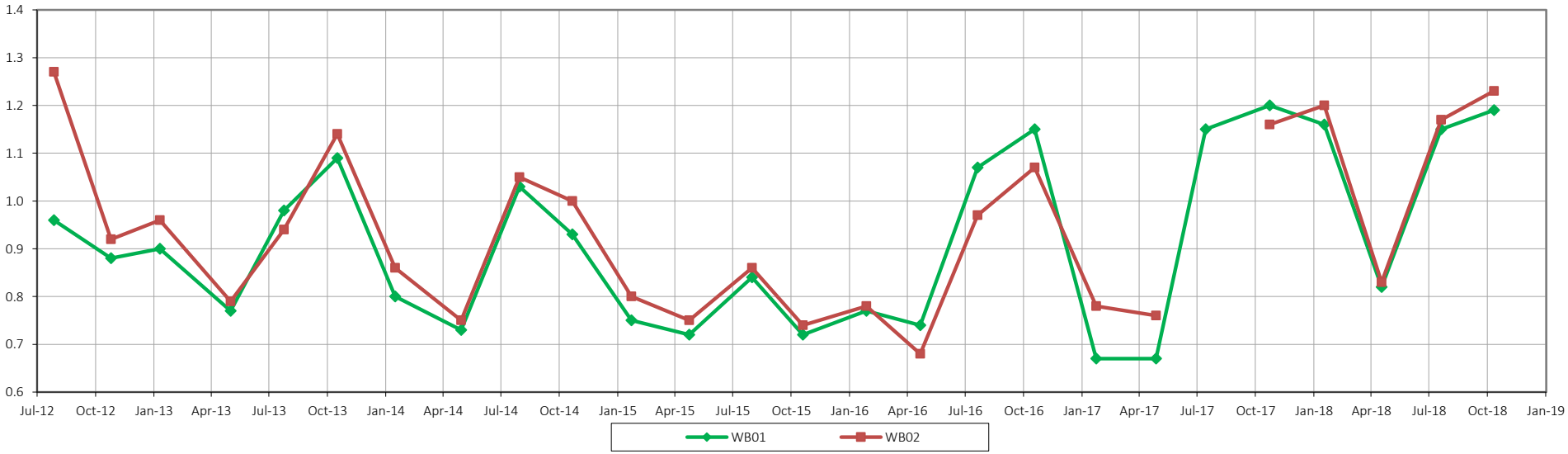
Site	Easting	Northing
35	382446	6411959
36	382457	6411951
37	382474	6411953
38	382478	6411959
39	382482	6411963
40	382516	6411921
42	382526	6411924
43	382536	6411930
44	382544	6411938
45	382555	6411939
46	382512	6411926
47	382562	6411942
48	382570	6411949
49	382576	6411954
50	382583	6411956
51	382586	6411960
52	382590	6411961
53	382590	6411965
54	382589	6411967
55	382590	6411973
56	382589	6411978
57	382589	6411987
58	382584	6411994
59	382582	6412002
60	382579	6412007
61	382577	6412012
62	382575	6412018
63	382574	6412025
64	382571	6412029
65	382569	6412033
66	382565	6412036
67	382560	6412039
68	382555	6412043

APPENDIX 7

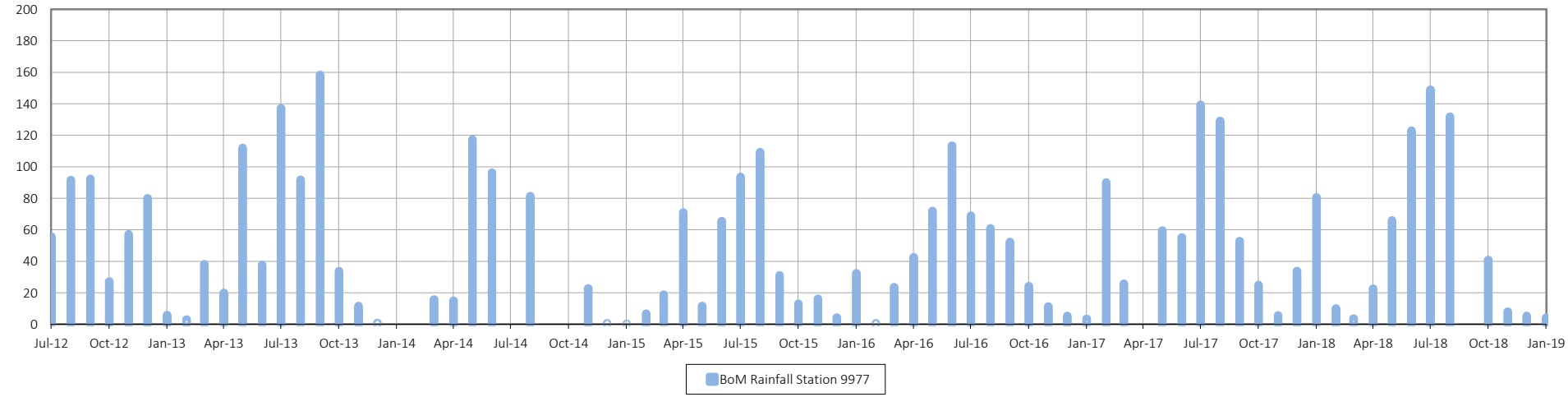
FORESHORE RESERVE GROUNDWATER LEVELS

Wetland Bores - Groundwater Levels 2018

Groundwater Levels (mAHD)



Rainfall (mm)



Job No. J6798

PEET / Dept of Housing

Golden Bay Groundwater Monitoring

Figure 1: Groundwater Levels in Wetland Bores 2012 - 2018

APPENDIX 8

EPA SERVICES CORRESPONDENCE CONDITION 297-M4-1

Phone: + 61 8 6500 8801
Mob: +61 0 427 005 228
Email: paul@pgv.net.au
Unit 1, 61 Guthrie Street
Osborne Park WA 6017
ABN 44 083 725 488
Knightside Nominees Pty Ltd

17 April 2019

Tim Francis

Manager Compliance Branch
EPA Services
Department of Water and Environmental Regulation
Locked Bag 10
Joondalup DC
Joondalup WA 6027

Dear Tim,

RE: Ministerial Statement 297 Golden Bay - Condition 297-M4-1

PGV Environmental on behalf of our client Peet Golden Bay Pty Ltd and the Department of Communities are writing to inform the Environmental Protection Services - Compliance Branch that the detailed planning and engineering for the development interface with the northern end of the Landscape Protection Area on Lot 3 Dampier Drive has been completed.

1 Background

Development of Lot 3 Dampier Drive has environmental approval through Ministerial Statement 297. Condition 297-M4-1 of MS 297 states the following:

> 4. *Landscape Protection*
>
> *The landscape value of the parabolic dune ridge on the eastern edge of Golden Bay should be recognised.*
>
> *4-1 Prior to subdivision approval, the Proponent shall liaise with the Department of Planning and Urban Development and the City of Rockingham to incorporate planning measures which recognise and protect the landscape value of the parabolic dune ridge on the eastern edge of Golden Bay, to the requirements of the Minister for the Environment and the Minister for planning on advice of the Department of Planning and Urban Development, the City of Rockingham and the Environmental Protection Authority.*

A Landscape Protection Area (LPA) was agreed to by all parties and the condition was cleared by the Minister for the Environment on 25 November 1993 (Attachment 1).

Subsequent to the identification and approval of LPAs on Lot 3 a Comprehensive Development Plan was prepared for the site and was endorsed by the City of Rockingham on 25 August 1994. Adoption of the CDP was subject to Condition 7 which states:

> *The preparation and implementation of a Management Plan for the Landscape Protection Area and the Foreshore Reserve.*

A Landscape Protection Management Plan was prepared by Michell Goff & Associates (November 1994) and was endorsed by the City of Rockingham pursuant to TPS Amendment No. 248. The Landscape Protection Management Plan includes landscape treatments and management of levels / interface.

2 Landscape Protection Area and Development Interface

The detailed engineering for the interface between the development and the northern LPA has been undertaken by the project engineers in consultation with the City of Rockingham officers. Early planning for the site as far back as 1994 recognised that retention of the tall dunes on Lot 3 would require some earthworks in the dune area to enable roads and houses to be constructed along the interface of the dunes.

Under the 1994 endorsed Management Plan the interface was to include batters and a series of tiered walls. The project engineers and City of Rockingham officers have discussed the use of tiered walls to stabilise the dune and determined that pitched rocks at the base of the slope and a vegetated batter upslope will provide a better outcome. The reasons for the change are that the batter slope is easier to revegetate and look after in the long term and will blend back into the natural dune vegetation providing better view amenity than a set of tiered walls.

The Project engineers have completed the earthworks plan for the development interface with the northern portion of the LPA (Attachment 2). Some clearing of native vegetation will be required in the LPA to allow for the pitch rocks to stabilise the base of the dunes and to allow for the 1:3 batter that will be revegetated to blend back into the natural dunal environment. The clearing and revegetation within the LPA to accommodate engineering requirements was envisaged and approved in the 1994 Landscape Protection Management Plan.

The City of Rockingham have approved the earthworks plan (Attachment 3).

This letter is to provide the EPA Services unit of DWER an update on the change from a stepped wall approach to the engineering works in sections of the LPA to a rock-pitch and 1:3 batter slope arrangement.

Peet has communicated with approximately 2000 local residents through the March 2019 letter box drop that informed them about the Stage 5B earthworks and in the Golden Bay Newsletter March 2019 that is on the Peet website.

The approach to the development interface with the LPA continues to protect the dunal landform in accordance with MS297 4-1 and will provide a more aesthetically and better environmental outcome than that original proposal to include tiered walls.

If you have any queries, please contact the undersigned.

Yours sincerely

Belinda Heath
Senior Environmental Consultant
CC Gemma Davis (Peet)
Aaron Pereria (C&W)

Attachment 1: EPA Clearance of MS297 4-1

Attachment 2: Earthworks Plan for development Interface and northern section of LPA

Attachment 3: City of Rockingham Support

Attachment 1

6

WESTERN AUSTRALIA

MINISTER FOR THE ENVIRONMENT

Our Ref: ENV934818

Town Clerk
City of Rockingham
PO Box 42
ROCKINGHAM WA

25 NOV 1993

CLEARANCE OF ENVIRONMENTAL CONDITION 4-1 PERTAINING TO THE URBAN DEVELOPMENT OF PART LOT 12 AND RESERVE 34664, GOLDEN BAY

Having examined the matter carefully and assessed the arguments put forward by the Consultative Committee which consisted of representatives of the Department of Planning and Urban Development, the City of Rockingham, the Environmental Protection Authority and the Golden Bay Progress Association, the Minister for Planning and myself are in agreement on the requirements to clear Condition 4-1 as outlined below.

The area presented for protection of the landscape features, identified on Plan 2 as the "Area of Agreement" is acceptable and the land identified on Plan 2 as the "Area of disagreement" is suitable for residential development and need not be protected for landscape features.

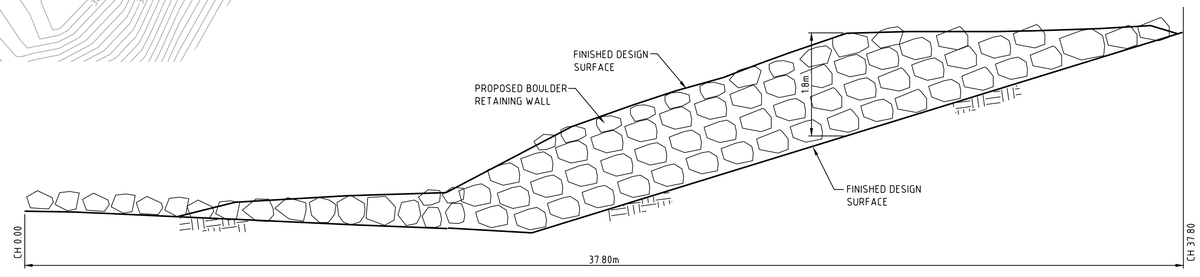
These requirements should now be implemented through the final stages of zoning, subdivision and design.

Kevin Minson MLA
MINISTER FOR THE ENVIRONMENT

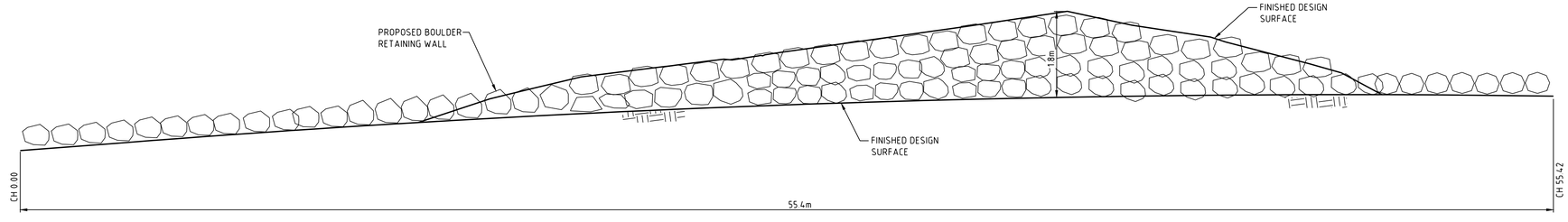
12th FLOOR, DUMAS HOUSE, 2 HAVELOCK STREET, WEST PERTH, 6005 TELEPHONE (09) 321 2222 FAX (09) 322 5149

Attachment 2

PLAN
1:500



ELEVATION A
SCALE: 1:100 H
1:50 V



ELEVATION B
SCALE: 1:100 H
1:50 V

1:500 0m 10 20 30m
1:100 0m 2 4 6m
1:50 0m 1.0 2.0 3.0m

REV	DATE	DRN	CKD	APP	AMENDMENT
0	04.04.19	WBR	AJP	A. THOMSON	ISSUED FOR CONSTRUCTION
C	27.03.19	WBR	AJP	A. THOMSON	AMENDMENTS AS PER COUNCIL COMMENTS
B	21.03.19	WBR	AJP	A. THOMSON	ISSUED FOR FINAL APPROVAL
A	19.12.18	WBR	AJP	A. THOMSON	ISSUED FOR APPROVAL

Cossill & Webley CONSULTING ENGINEERS
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Street Address: B12 (Level 2) 431 Roberts Road, Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: THE DEPARTMENT OF COMMUNITIES & PEET GOLDEN BAY PTY LTD
PROJECT: GOLDEN BAY - STAGE 5B
TITLE: EARTHWORKS AND RETAINING WALL PLAN WITHIN POS
APPROVED: A Thomson
DESIGNED: WBR
SCALE: 1:500 1:100 1:50
WAPC No.: 154533, 156181
DRAWING No.: 5453-5B-103
REVISION: 0
ORIGINAL SIZE: A1

Attachment 3

Our Ref: LUP/1469 - D19/50693

Your Ref: 5453-5B

Enquiries to: Mr Matthew Crutchett - 9528 0337

city of Rockingham
where the coast comes to life

2nd April 2019

Mr Aaron Pereira
Cossill & Webley Consulting Engineers
PO Box 680
SUBIACO WA 6904

Dear Mr Pereira

Re: Golden Bay – Stage 5B
Engineering Approval

Under the requirements of Section 170(3)a of the Planning and Development Act 2005, the plans and specifications submitted for the proposed earthworks, road and drainage construction in the above subdivision have been approved, subject to the following conditions:

1. A Dust, Noise and Vibration Management Plan is to be submitted and approved by the City's Land and Development Infrastructure Department prior to the commencement of works. Dust management is to be in accordance with the Department of Environment and Conservation Guideline: *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.*

2. A soil stabilisation bond is to be provided as per the Institute of Public Works Engineering Australia (WA Division) Sub divisional Guidelines Edition 2.2. The bond is to be lodged with the City prior to commencement of works and may be used if any sand-drift occurs and action is not immediately taken by the Developers to control such nuisance when requested to do so by the City. The bond less any expenses, to be returned to the Developers when the area has been successfully re-vegetated and stabilised.

3. Disposal of any cleared vegetation is to be in accordance with the Institute of Public Works Engineering Australia (WA Division) Subdivisional Guidelines Edition 2.1 Section 2.2.1.5.6.

4. Traffic Management Plan is to be submitted to the City's Traffic Services Department for consideration and approval prior to the commencement of works. Adequate temporary warning signs being provided where the proposed works abut existing roads in accordance with Australian Standards 1742.3-2009 Part 3 Traffic Control Devices for Works on Roads and Main Roads WA Drawing 7020-264-3.

5. Line Marking and Signage of completed roads is to be arranged with Main Roads WA. Should the required line marking and signage not be installed at the time of submission of plans or diagrams of survey for clearance, the City will require evidence of payment to Main Roads WA for the provision of the subject line marking and signage.

6. Street name signs to be provided as per the design shown on City Drawing No SFSS.

7. Street lighting design to be in accordance with AS1158.1 and Section 13 - Developer Provided Street Lighting using Western Power Equipment - of the City of Rockingham Street Lighting Handbook.

8. A Building License is required for retaining wall construction, which is to be certified by a Practising Structural Engineer, prior to the commencement of works. Please liaise with the City's Building Department for lodgement and approval.

9. Engineering Supervision Fees are required in accordance with Section 295(6)(b)(ii) of the Local Government (Miscellaneous Provisions) Act 1960. The contract price appertaining to this approval is to be advised to the City so that the fee can be calculated. Payment of these fees is a prerequisite to clearance of Local Authority conditions on plans or diagrams of survey for the works.

10. Defect Liability Bond is required in accordance with Section 1.21 of the IPWEA Guidelines for Subdivisional Development Edition 2.2. The contract price appertaining to this approval is to be advised to the City so that the Defect Liability Bond can be calculated. Payment of the bond is a prerequisite to clearance of Local Authority conditions on plans or diagrams of survey for the works. The bond is to be held for 12 months from the start of the Defect Period. An inspection will be required of the works prior to the City releasing the bond.

11. Prior to the defect liability inspection all roads are to be swept and eduction carried out on all drainage infrastructure. An inspection will not be undertaken until these works are completed.

12. Bonding of outstanding works is to be in accordance with Section 1.20 of the IPWEA Guidelines for Subdivisional Development Edition 2.2. The City will give consideration to the granting of clearance prior to the completion of works subject to lodgement of a bank guarantee or cash bond equal to the City's estimate of the value of outstanding works plus a 25% contingency. Such bond less expenses will be returned to the Developer when requested after completion of all outstanding work.

13. Prior to the commencement of works a Pre Works Geotechnical Report is required certifying that that the land is physically capable of development or advising how the land is to be remediated and compacted to ensure it is capable of development; and in the event that remediation works are required, the landowner/applicant is to provide a post geotechnical report certifying that all subdivisional works have been carried out in accordance with the pre-works geotechnical report.

    The post geotechnical report is also to confirm that all fill material is clean and non-cohesive. Sand should be free draining and free of all silty, organic, waste, contaminants or other deleterious materials, and which contains no more than five percent by weight of soil fractions finer than 0.075 millimetres, with a zero plasticity index (i.e. non-plastic);

    Sampling methodology must be in accordance with relevant Australian Standards; and include a summary of laboratory test results certified by the National Association of Testing Authority which confirms the suitability of the fill material and that it has not been subject to contaminated land uses including industrial, commercial, mining or agricultural activities.

14. Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to the commencement of subdivisional works.

15. All water from de-watering works must be contained within the subdivision. The contractor will ensure that de-watering works do not cause flooding to adjacent property. If City's drains are to be used for the disposal of water, prior approval must be obtained from the Director Engineering & Parks Services.

16. An inspection of the existing infrastructure surrounding the proposed area of works needs to be identified and documented prior to works commencing. Particular interest is to be paid to the state of the existing road pavements.

17. An as-constructed plan for roads (including traffic calming), paths, drainage (including subsoil & rain gardens) and fire hydrant locations are to be provided in both a hardcopy format as-well as electronic formats compatible with the City's AutoCAD (DWG) and Geographic Information Systems (D-spec & R-Spec).

18. Written confirmation is required from the Consulting Engineer that civil works pertaining to this approval have been completed in accordance with the approved plans and specifications. Provision of this correspondence is a prerequisite to clearance of Local Authority conditions on plans or diagrams of survey for the works.

19. Test results are required to ensure that the material supplied and the work carried out conforms to the approved specifications. Testing shall be carried out by a laboratory approved by the National Association of Testing Authorities (NATA). Quality Assurance documentation and certification is a prerequisite to clearance of Local Authority conditions on plans or diagrams of survey for the works.

20. PDF copies of the Approved Construction Drawings and subsequent amendments are to be forwarded to the City's for our records.

21. All service covers in verge areas to be heavy duty trafficable. Particular attention to Sewer, Telstra and Reticulation lids.

22. Prior to commencement of on-ground works the applicant must forward the successful contractors certificates of currency for Public Liability. Alternatively, the City will accept confirmation that all relevant information has been received in accordance with the contractual requirements. Copies of the documents must be made available to the City should they be required during the course of the project construction.

23. Substantial development must commence within a period of 2 years from the date of this letter. In the event that substantial works have not commenced, the approval shall have no further effect. Where the approval has lapsed, no development shall be carried out without subsequent approval being granted.

FOOTNOTE:

1. All road connections are required to match into the adjoining road levels and widths of adjacent sub-divisional developments. Please liaise with the engineers and designers involved with the neighbouring sub-divisions to ensure continuity.

2. All necessary approvals and management plans related to these works must be obtained from the relevant agencies and authorities prior to the commencement of works. Any operations undertaken without approvals are done so at the developers/contractors risk.

3. The City's Building Department will only approve the Retaining Wall Building License once the Engineering Drawings have been approved.

4. In regards to Condition 9, the Local Government Miscellaneous Provisions Act 1960, Section 295(6)(b) reads as follows:

Where the person does not make the arrangement with Council, he shall pay to it, on demand, an amount to cover the reasonable costs of the Council in supervising the construction and drainage which amount shall be reckoned as follows:-

i) where the person has not engaged a consulting engineer and clerk of works to design and supervise the construction and drainage the amount shall be three percentum (3%) of the cost of the construction and drainage as estimated by the Council; and

ii) where the person has employed a consulting engineer and clerk of works to design and supervise the construction and drainage the amount shall be one and one half percentum (1½%) of the cost of the construction and drainage as estimated by the Council.

5. In regards to Condition 12, Compliance with Section 1.20 of the IPWEA the guideline does not imply acceptance of the bonding proposal and each request shall be subject to approval by the Manager Land & Development Infrastructure.

6. An Early Clearance proposal will only be assessed once the drainage system has been completed and the road pavements are up to the primer seal stage. As per the IPWEA Guidelines for Subdivisional Development Section 1.20 and the City's Fees and Charges a non-refundable fee of $1,100 inc GST for administration of bond is applicable.

7. Landscaping plans are to be forwarded for engineering comment as soon as possible. The City should be contacted prior to the laying of any path works within a POS and agreement on the location and set-up confirmed.

Design Drawings Associated With Approval:

- 5453-5B-100 Rev 0
- 5453-5B-103 Rev C
- 5453-5B-110 Rev D
- 5453-5B-201 Rev 1
- 5453-5B-301 Rev B
- 5453-5B-311 Rev B
- 5453-5B-320 Rev C
- 5453-5B-322 Rev B
- 5453-5B-324 Rev B
- 5453-5B-400 Rev B
- 5453-5B-401 Rev B
- 5453-5B-102 Rev C
- 5453-5B-104 Rev B
- 5453-5B-111 Rev D
- 5453-5B-300 Rev B
- 5453-5B-310 Rev B
- 5453-5B-312 Rev B
- 5453-5B-321 Rev B
- 5453-5B-323 Rev B
- 5453-5B-700 Rev 1
- 5453-5B-701

Should the Engineering Drawings be amended during construction, please forward revised drawings to the City for approval.

Should you be aggrieved by any of the above requirements, under Section 170(5) of the Planning and Development Act 2005, you are able to apply to the State Administrative Tribunal for Review, in accordance with Part 14 of the Act.

If you have any further enquiries with respect to this advice, please do not hesitate to contact Mr Matthew Crutchett, Development Assessment Officer on 9528 0337.

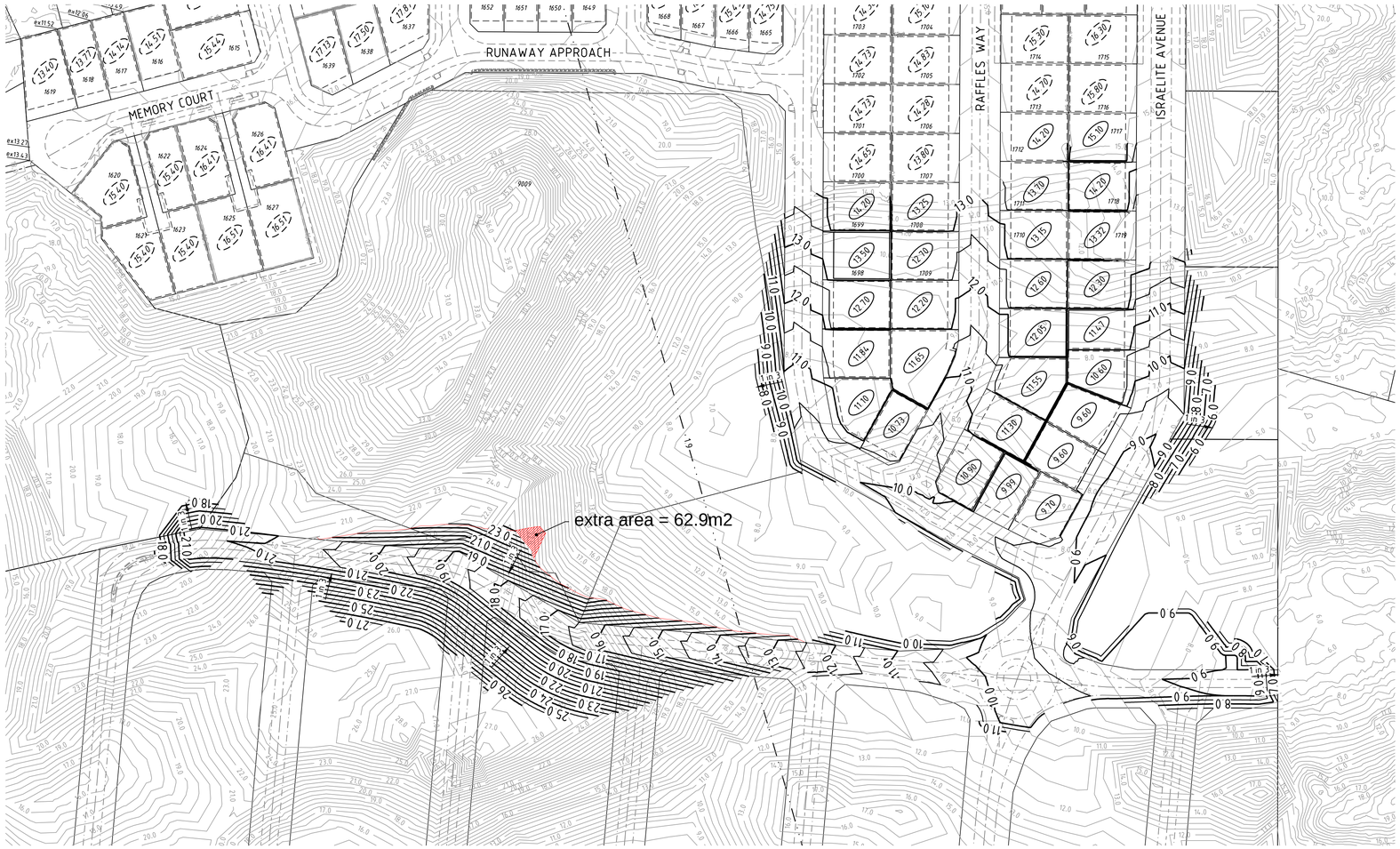
Yours faithfully

JAMES HENSON
MANAGER LAND & DEVELOPMENT INFRASTRUCTURE

APPENDIX 9

LOT 3 STAGE 5

REVISED EARTHWORKS PLAN



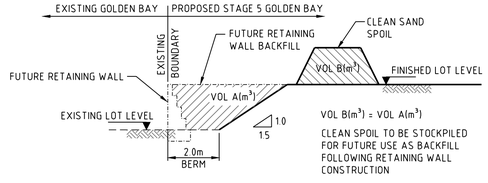
GENERAL NOTES

1. ALL LEVELS IN METRES TO AHD. EXISTING SURVEY BY MNG.
2. BATTERS TO EXISTING SURFACE AT 1:3 (CUT) 1:3 (FILL) UNLESS NOTED OTHERWISE.
3. BATTER POSITION FOR FUTURE WALLS TO ENSURE CUT TO FILL EARTHWORKS BALANCE.
4. ALL UNSUITABLE MATERIAL TO BE REMOVED BY THE CONTRACTOR TO APPROVED TIPPING SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL FEES TO BE PAID BY CONTRACTOR.
5. EXTENT OF EARTHWORKS TO BE LIMITED TO THE EARTHWORKS STAGE BOUNDARY UNLESS AGREED WITH THE SUPERINTENDENT.
6. ALL CLEARED MATERIAL TO BE MULCHED AND STOCKPILED ON SITE WHERE INDICATED.
7. CONTRACTOR TO LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS ON SITE.
8. CONTRACTOR TO GRADE EVENLY BETWEEN DESIGN CONTOURS AND MATCH INTO EXISTING SURFACE AT LIMIT OF EARTHWORKS BOUNDARY WHERE APPROPRIATE.
9. EXCESS CUT FROM EARTHWORKS SHALL BE PLACED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
10. WHERE LIMESTONE IS WITHIN 600mm OF THE FINAL SURFACE LEVEL THE CONTRACTOR SHALL TREAT THE SITE IN ACCORDANCE WITH THE SPECIFICATION.
11. DESIGN LEVELS SHOWN SHALL BE ON THE FINISHED SURFACE INCLUDING TOPSOIL WHERE SPECIFIED.
12. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND PERSONELL TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION AND EXISTING SERVICES ON SITE.

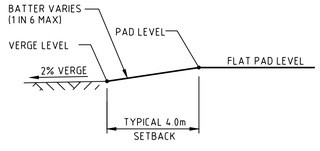
LEGEND

- EXISTING CONTOUR (0.5m)
- DESIGN CONTOUR (0.5m)
- EXISTING LOT PAD LEVEL
- DESIGN LOT PAD LEVEL
- EXISTING NATURAL SURFACE LEVEL
- AAMGL
- EARTHWORKS BOUNDARY

DIAL BEFORE YOU DIG www.1100.com.au



TYP. BATTER AT FUTURE WALL LOCATION TO EXISTING LOTS
N.T.S



TYPICAL BATTER TO FRONT OF TRADITIONAL LOTS
N.T.S

WARNING TO CONTRACTOR

1. IT IS THE CONTRACTORS RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTORS LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM. DURING CONSTRUCTION WORKS THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.
2. THE SITE IS IDENTIFIED AS POTENTIALLY HAVING UNEXPLODED ORDNANCE. (NO EXCAVATION OR OTHER DISTURBANCE TO THE SOIL ON THIS SITE SHOULD BE CARRIED OUT WITHOUT FIRST OBTAINING CLEARANCE FROM THE UNEXPLODED ORDNANCE BRANCH OF THE W.A. POLICE DEPARTMENT)

1:1000 0m 20 40 60m

REV	DATE	DRN	CKD	APP	AMENDMENT
0	04.06.19	WBR		-	ISSUED FOR CONSTRUCTION
A	29.03.19	WBR	AJP	A. THOMSON	ISSUED FOR APPROVAL

Cossill & Webley CONSULTING ENGINEERS
Mailing Address: PO Box 680, Subiaco WA 6904
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CLIENT: THE DEPARTMENT OF COMMUNITIES & PEET GOLDEN BAY PTY LTD

APPROVED | DESIGNED: WBR | SCALE: 1:1000

PROJECT: GOLDEN BAY - STAGE 5C

TITLE: BULK EARTHWORKS PLAN STAGE 5C

WAPC No. 154533, 156181 | DRAWING No. 5453-5C-SK3 | REVISION 0

ORIGINAL SIZE A1

P:\5453 Golden Bay\5453-LOT3\Stage 5C\Acad\sketches\5453-5C-SK3.dwg, 22/08/2019 4:31:59 PM, weyner, Digital Signing PDF.pc3, 1:1, - CW Reference