Chevron

Gorgon Gas Development
Fourth Train Expansion Proposal
Response to Submissions / Final Environmental Impact Statement

EPA Assessment No. 1889
EPBC Referral 2011/5942
December 2014

Table of Contents

Terms, Definitions, and Abbreviations

The following terms, acronyms, and abbreviations are used in this document.

Chevron Australia	Chevron Australia Pty Ltd
CO_2	Carbon dioxide
DotE	Commonwealth Department of the Environment
EIS	Environmental Impact Statement
EP Act	Western Australian *Environmental Protection Act 1986*
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Foundation Project	Gorgon Gas Development Foundation Project, which consists of the initial Gorgon Gas Development, Revised and Expanded Gorgon Gas Development, Jansz–Io Development Project and Feed Gas Pipeline, all of which are approved, and , Gorgon Gas Development Additional Construction, Laydown and Operations Support Area
Fourth Train Proposal	Gorgon Gas Development Fourth Train Expansion Proposal
GJVs	Gorgon Joint Venturers
LNG	Liquefied natural gas
OEPA	Western Australian Office of the Environmental Protection Authority
PER	Public Environmental Review
SEWPaC	Former Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now the Department of the Environment)
WA	Western Australia

1. Proposal Overview

Chevron Australia, on behalf the Gorgon Joint Venturers (GJVs), is progressing approval for the development of the Gorgon Gas Development Fourth Train Expansion Proposal (Fourth Train Proposal) to gain approval for future development phases and to provide certainty on future conditions that would apply. In addition to the expansion of the Gorgon Gas Development from the approved 15 million tonnes per annum (MTPA) to 20 MTPA, the Public Environmental Review / Draft Environmental Impact Statement (PER/Draft EIS) covers the development of additional fields, utilising existing Project infrastructure to maintain gas supply as well as a third trunkline.

The approved Foundation Project is currently under construction; it comprises three LNG trains on Barrow Island, processing gas gathered from the Gorgon and Jansz–Io fields. The Environmental Impact Statement/Environmental Review and Management Programme prepared for the approved Foundation Project included information relating to the intent to further develop gas in the Greater Gorgon Area through future capacity increases of the processing facilities on Barrow Island. However, approval was not sought at that time as these reserves had not been found or, if found, had not been confirmed.

The opportunity for progressing a fourth LNG train for the Gorgon Gas Development was identified in 2010 to develop gas resources in fields in the Greater Gorgon Area additional to the gas fields associated with the Foundation Project. Further appraisal of these gas fields determined that the commercialisation of these additional resources would be optimised by adding a fourth LNG train to the Gas Treatment Plant on Barrow Island, rather than processing the gas at a later date through the three-train Foundation Project infrastructure or by transferring the gas to another existing or planned processing facility in the Pilbara.

The Fourth Train Proposal will involve drilling new production wells and installing subsea infrastructure, constructing a new Feed Gas Pipeline System, and adding a fourth LNG train and associated infrastructure at the Gas Treatment Plant on Barrow Island. The fourth LNG train will be designed to integrate with the three LNG trains already approved under the Foundation Project. Existing LNG and condensate export facilities (constructed as part of the approved Foundation Project) will be used to export products generated by the Fourth Train Proposal.

The Public Environmental Review / Draft Environmental Impact Statement (PER/Draft EIS) (Chevron Australia 2014) covers the construction, commissioning, and operation of:

- offshore production facilities, including wells, subsea installations, and intrafield pipelines in the Greater Gorgon Area
- a Feed Gas Pipeline System transporting unprocessed hydrocarbons from the offshore production facilities to the Foundation Project's Gas Treatment Plant on Barrow Island
- a fourth 5 million tonnes per annum (nominal) LNG processing train and associated infrastructure at the Foundation Project's Gas Treatment Plant on Barrow Island
- shared use of infrastructure and utilities with the Foundation Project, including the Foundation Project's product export facilities, Materials Offloading Facility, and carbon dioxide (CO_2) and wastewater injection wells.

1.1 Environmental Assessment Process

The Fourth Train Proposal is subject to environmental approval requirements under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Environmental Protection Act 1986* (EP Act) (Figure 1-1).

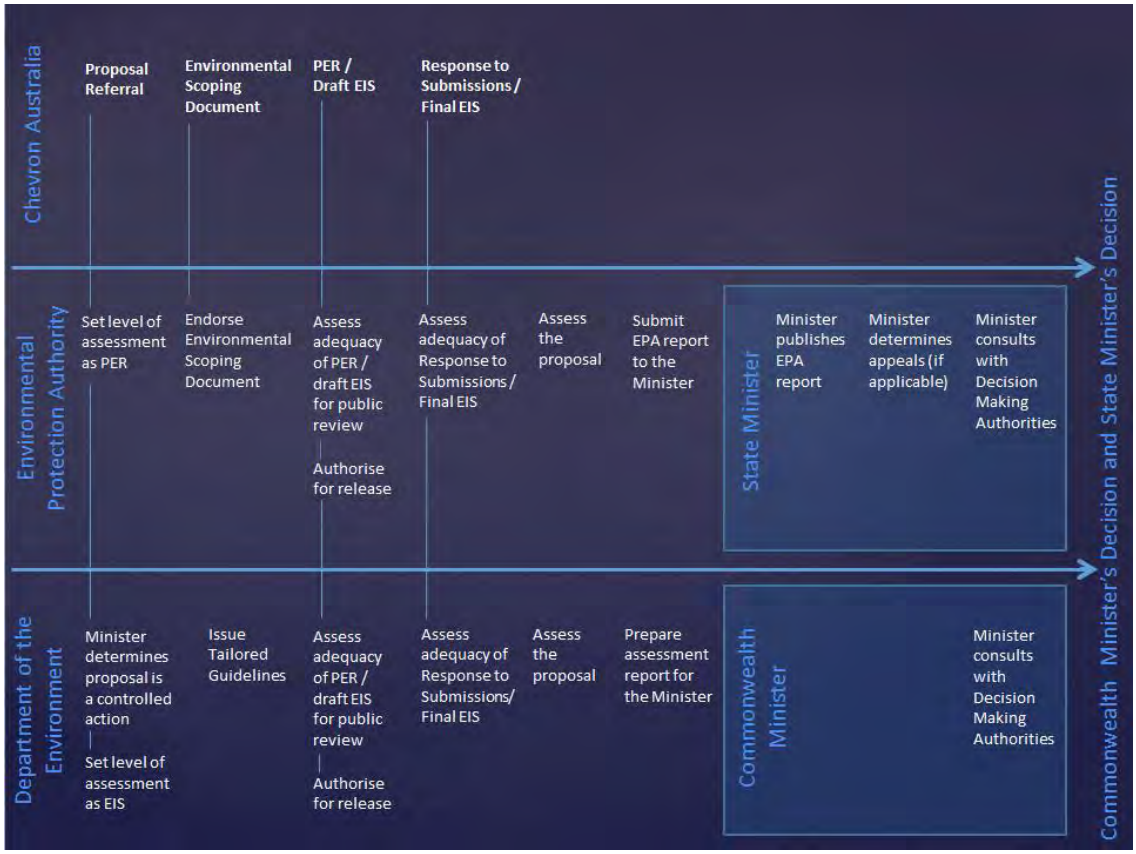


Figure 1-1: Gorgon Fourth Train Proposal Expansion Project Environmental Assessment Process

The Fourth Train Proposal was referred to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities under the EPBC Act on 27 April 2011 (Chevron Australia 2011). On 3 June 2011, the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (now the Department of the Environment) deemed that the Fourth Train Proposal was a 'controlled action' under the EPBC Act, based on these controlling provisions:

- national heritage places (Sections 15B and 15C)
- listed threatened species and communities (Sections 18 and 18A)
- listed migratory species (Sections 20 and 20A)
- Commonwealth Marine Areas (Sections 23 and 24A).

SEWPaC set the level of assessment as an Environmental Impact Statement (EIS; EPBC Reference: 2011/5942) and subsequently issued a set of Tailored Guidelines for the Preparation of a Draft Environmental Impact Statement of the Fourth Train Proposal to Chevron Australia (SEWPaC 2011).

The Fourth Train Proposal was referred to the Western Australian Environmental Protection Authority (EPA) on 27 April 2011 (Chevron Australia 2011a). On 23 May 2011, the EPA determined that the Fourth Train Proposal required assessment at the level of a PER with an eight-week public review period (EPA Assessment No. 1889; EPA 2011).

In accordance with the level of assessment set, the GJVs prepared and issued an Environmental Scoping Document (Chevron Australia 2012) to seek EPA endorsement of the scope of the assessment of the Fourth Train Proposal. The Final Environmental Scoping Document was endorsed by the EPA on 30 May 2012.

The Fourth Train Proposal PER/Draft EIS was prepared to address both the EPBC Act and the EP Act requirements. The PER/Draft EIS described the elements of the Fourth Train Proposal,

the potential impacts from the Fourth Train Proposal, the mitigation and management measures that the GJVs propose to implement, and concluded with an assessment of environmental acceptability of the Fourth Train Proposal.

The PER/Draft EIS was endorsed for release for public review by the EPA and the Department of the Environment (DotE), and was subsequently released on 7 July 2014, with the comment period concluding on 1 September 2014.

1.2 Purpose and Scope of this Document

The purpose of this Response to Submissions/Final EIS is to provide Chevron Australia's response to issues raised in the submissions received during the public review period. Following the close of the public review period the Office of the EPA (OEPA) provided a Summary of Public Submissions to Chevron Australia containing the pertinent issues raised in the submissions for the PER/Draft EIS. Under the EP Act, the GJVs are required to respond to the Summary of Public Submissions and under the EPBC Act the GJVs are required to address any public submissions that relate to the controlling provisions. The controlling provisions, under the EPBC Act, relevant to the Fourth Train Proposal are provided in Section 1.1.

As there were no public submissions that related to the controlling provisions that were not included in the Summary of Public Submission, the controlling provisions have been discussed in the responses to the Summary of Public Submissions (Attachment 3), thereby meeting the EPBC Act requirements. A separate section outlining responses relevant to the matters of national environmental significance has not been included.

This Response to Submissions/Final EIS will be considered by the EPA and the DotE during their assessments of the proposal, when deciding on whether to recommend approval and any associated conditions. The OEPA has also provided some additional comments regarding the Fourth Train Proposal as a Summary of Matters to be Addressed. Responses to this summary have also been provided in this Response to Submissions/Final EIS.

1.3 Public Comments

Ten submissions were received during the public comment period on the Fourth Train Proposal PER/Draft EIS:

- Department of Aboriginal Affairs (WA)
- Department of Mines and Petroleum (WA)
- Department of Fisheries (WA)
- Department of Transport (WA)
- Department of Parks and Wildlife (WA)
- Department of State Development (WA)
- Public submitter (anonymous)
- State Heritage Office (WA)
- Western Australian Museum
- Department of Environmental Regulation (WA)

1.4 Format of this Document

This document comprises four parts:

1. This introductory document.
2. Attachment 1 – the raw comments as received by the OEPA during the public submission period for the PER/Draft EIS.
3. Attachment 2 – a summary of the matters raised by the OEPA (as provided by the OEPA), and GJV's response to those matters.

4. Attachment 3 – a summary of the matters raised by other parties (as provided by the OEPA), and GJV's response to those matters.

1.5 Correction

The link included to the Foundation Project Air Quality Management Plan in Table 3-1 of the PER/Draft EIS is incorrect. The link to the Air Quality Management Plan directs the reader to the Foundation Project Best Practice Pollution Control Design Report. The correct link for the Air Quality Management Plan is http://www.chevronaustralia.com/docs/default-source/default-document-library/gorgon-emp-air-quality-management-plan.pdf?sfvrsn=2.

2. References Cited

Chevron Australia. 2011. *Referral of Proposed Action (under the* Environmental Protection and Biodiversity Conservation Act 1999*) – Gorgon Gas Development Fourth Train Expansion Proposal*. 27 April 2011. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2011a. *Referral of a proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the* Environmental Protection Act – *Gorgon Gas Development Fourth Train Expansion Proposal*. 27 April 2011. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2012. *Gorgon Gas Development Fourth Train Proposal: Environmental Scoping Document*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014. *Gorgon Gas Development Fourth Train Expansion Proposal: Public Environmental Review / Draft Environmental Impact Statement.* Chevron Australia, Perth, Western Australia.

Department of Sustainability, Environment, Water, Population and Communities. 2011. *Tailored Guidelines for the preparation of a Draft Environmental Impact Statement: Chevron Australia Pty Ltd – Gorgon Fourth Train Expansion Proposal (EPBC 2011/5942)*. Commonwealth Government of Australia, Canberra, Australian Capital Territory. Available from: http://www.environment.gov.au/epbc/notices/assessments/2011/5942/2011-5942-eis.pdf [Accessed 15 January 2012].

Environmental Protection Authority. 2011. *Notice under Section 39A(3) of the* Environmental Protection Act 1986 o*n the EPA's Decision on the Referral of the Gorgon Gas Development Fourth Train Expansion Proposal; EPA Assessment No. 1889*. Letter from the EPA to Chevron Australia dated 23 May 2011.

Attachment 1 – Raw Comments

Government of **Western Australia**
Department of **Aboriginal Affairs**

ENQUIRIES : - Ph 6551 8075

OUR REF: 11/0946

YOUR REF: EA02-2013-0001; 2014-0000853283

Mr Anthony Sutton
Director, Assessment and Compliance Division
Office of the Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Dear Mr Sutton

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL - ASSESSMENT NO. 1889 - PUBLIC ENVIRONMENTAL REVIEW

Thank you for your letter dated 27 June 2014 regarding the Gorgon Gas Development Fourth Train Expansion Proposal (the Proposal).

The Department of Aboriginal Affairs (DAA) has reviewed the document and I have no concerns regarding the implementation of the Proposal. I note that surveys have been conducted within the Proposal area and that no Aboriginal heritage sites of significance have been identified. I also note that you have consulted with the Thalanyji People, the Kuruma Marthudunera People and the Yaburara Mardudhunera People.

It would be useful if the report of the Aboriginal Heritage investigation conducted in the Proposal area were provided to DAA if this has not already been done. Should you require any assistance in regards to this, please contact Mr Cesar Rodriguez on (08) 6551 8092 or Cesar.Rodriguez@daa.wa.gov.au .

Yours sincerely

Kathryn Przywolnik
CHIEF HERITAGE OFFICER

23 July 2014

Ground Floor, 151 Royal Street, East Perth, Western Australia, 6004
PO Box 3153, East Perth, Western Australia, 6892
Telephone 1300 651 077 Facsimile (08) 6551 8088
www.daa.wa.gov.au

Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

Office of the Environmental Protection Authority
File: .....
13 AUG 2014

A:	☐ For Information
fa:	☐ For Discussion
Officer:	☐ For Action
☐ Dir.AC	Response please:
☐ Dir. Bus Ops	☐ GM Signature
☐ Dir. SPPD	☐ Dir for GM (copy to GM)
☐ Dir. Strat Sup	☐ Dir Signature (copy to GM)
☐	☐ Mgr Direct (copy to GM)

Your ref: EA02-2013-0001: 2014-0000853393
Our ref: X0089/201004
Enquiries: Shane Daniel Ph 93588195
Email: shane.daniel@dmp.wa.gov.au

Mr Anthony Sutton
Director - Assessment and Compliance Division
Environment Protection Authority
The Atrium Level 8
168 St Georges Terrace
PERTH WA 6000

Attention: Mr John Guld

Dear Mr Sutton

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL - ASSESSMENT NO. 1889 - PUBLIC ENVIRONMENTAL REVIEW

I refer to your letter of 27 June 2014 seeking comment from this agency on the Public Environmental Review for the above project.

I provide the following comments relating to our licensing and safety regulations for this project:

- The additional ***sub-sea pipeline*** will need to meet the requirements of the '*Petroleum (Submerged Lands) Act (1982)*' and the associated 'Petroleum (Submerged Lands) (Pipelines) Regulations 2007.'

- The additional ***on-shore pipeline*** will need to meet the requirements of the '*Petroleum Pipelines Act 1969*' and the associated 'Petroleum Pipelines (Management of Safety of Pipeline Operations) Regulations 2010.'

- The additional ***LNG train*** will need to meet the requirements of the '*Dangerous Goods Safety Act 2004*' and the associated 'Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007' and 'Dangerous Goods Safety (Major Hazard Facilities) Regulations 2007.' Please note that Worksafe is the agency responsible for regulating the occupational health and safety activities during construction and operation of the LNG train under the '*Occupational Safety and Health Act 1984*' and the associated 'Safety and Health Regulations 1996.'

- Careful consideration of the impact of the simultaneous management of operations (SIMOP) for both construction and operational activities' should be undertaken for all the aforementioned additional operations.

Mineral House 100 Plain Street East Perth Western Australia 6004
Telephone +61 8 9222 3333 Facsimile +61 8 9222 3862
ResourcesSafety@dmp.wa.gov.au www.dmp.wa.gov.au
www.wa.gov.au

Further, the 'Barrow Island Act 2003' should be reviewed to reflect the proposed changes, in particular Part 4 – Conveyance and underground disposal of carbon dioxide.

Yours sincerely

Ross Stidolph
Director
DANGEROUS GOODS AND PETROLEUM SAFETY BRANCH

6 August 2014

Government of **Western Australia**
Department of **Fisheries**

Fish for the future

Our ref: 522/12
Enquiries: Fiona Rowland (08) 9482 7200

Chairman
Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Dear Chairman

Chevron Australia Pty Ltd – Gorgon Gas Development Fourth Train Expansion Proposal Public Environmental Review/Draft Environmental Impact Statement

Thank you for the opportunity to comment on the Gorgon Gas Development Fourth Train Expansion Proposal Public Environmental Review/Draft Environmental Impact Statement (the Expansion Proposal) document. The Department of Fisheries (the Department) understands that this document has been prepared with the intention of satisfying requirements under both the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Environmental Protection Act 1986* (EP Act). The Department therefore provides the following comment:

1. General Comments

Baseline data
The Department understands that most of the environmental baselines for the Expansion Proposal have been drawn from the 2005 Draft Environmental Impact Statement. There has, however, been significant environmental change in the project area resulting from extreme events (e.g. marine heat wave/coral bleaching) and Chevron operations (e.g. dredging) since 2005. The Department therefore thinks it is appropriate that some new baseline data be collected to assess the impacts of the Expansion Proposal.

Subsea structures and moorings
The installation of subsea structures (and associated exclusion zones) or moorings during construction and operation of the Expansion Proposal may result in the temporary or permanent displacement of fishing activities. Any loss of access to fishing grounds may require an adjustment to management arrangements to ensure fishery sustainability. To address this, we request that Chevron Australia Pty Ltd and their contractors undertake a detailed consultation process with fishers such that any potential impacts are appropriately managed.

Access to ports
Increased demand on existing ports due to vessel movements has the potential to restrict fishing vessel access to these ports. The Department requests that fishers are explicitly considered in the development of management and port access plans.

3rd Floor, The Atrium 168 St Georges Terrace Perth Western Australia 6000
Telephone +61 8 9482 7333 Facsimile +61 8 9482 7389
Email: headoffice@fish.wa.gov.au Website: http://www.fish.wa.gov.au
wa.gov.au
ABN 55 689 794 771

2. Biosecurity

In accordance with the *Fish Resources Management Regulations 1995* (reg. 176(1)), the Department requires that all vessel managers and operators of immersible equipment minimise the risk of translocating pests and diseases into or within WA waters. Vessel hulls, sea chests and niche areas must be 'clean' before each voyage.

To help minimise this risk, the Department's preferred position is that Chevron Australia Pty Ltd develop an overarching Invasive Marine Species (IMS) plan for its operations in Australia. Such a plan would put them on par with other companies that have looked to best practice standards to ensure that structures and vessels in Australian waters are effectively managed for IMS.

In the absence of an overarching IMS plan, Chevron Australia Pty Ltd will need to work with the Department of Fisheries to develop an effective project specific IMS strategy that is compliant with the *Fish Resources Management Act 1994.*

3. Fishing activities in the area

The Department notes that Chevron Australia Pty Ltd has already identified some potentially affected commercial fisheries. We provide the list below for cross-referencing:

Permit Area	Bioregion and Province	Commercial Fishing Interests
Greater Gorgon	North Coast; Northwest Shelf and Northwest Province	Mackerel Managed Fishery; Pearl Oyster Fishery; Specimen Shell Managed Fishery; Marine Aquarium Fish Managed Fishery; Onslow Prawn Interim Managed Fishery; Pilbara Trap Managed Fishery; Pilbara Trawl Managed Fishery; Pilbara Line Fishery

The Department requests that all stakeholder engagement include consultation with the Western Australian Fishing Industry Council, Recfishwest and individual fishers in potentially affected fisheries. Importantly, the Department does not recognise the 'active' or 'non-active' fishery status described in the project proposal. Instead, we request that all fishers with a legitimate right to operate in the affected area are consulted, irrespective of their current fishing status. It is also important that fishers be consulted regarding the positioning of any moorings associated with this project.

4. Spawning periods

Spawning grounds and nursery areas for key fish species are particularly vulnerable to the impacts of spills, discharges and other marine development activities. Our data indicates that the following key fish species may be spawning within the proposed area of activities. These times should be taken into consideration in the event of a spill and when planning any activities associated with the project:

Bioregion	Key Fish Species within zone	Spawning / Aggregation times
North Coast	Blacktip shark *(Carcharhinus tilstoni & C. limbatus)*	Nov - Dec
	Goldband snapper *(Pristipomoides multidens)*	Jan - April
	Rankin Cod (*Epinephelus multiinotatus*)	Aug - Oct
	Red Emperor *(Lutjanus sebae)*	Jan, Mar
	Pink Snapper (*Pagrus auratus*) (rare)	May – Jul
	Sandbar shark *(Carcharhinus plumbeus)*	Oct - Jan
	Spanish mackerel *(Scomberomorus commerson)*	Aug - Nov

5. Expectation and Implementation

The Department requests that all potential impacts to fisheries, fish and fish habitat described in this letter are specifically identified in all Environment Plans associated with the Expansion Project. Should any objections or claims be raised during the consultation process, we request that these are resolved to the satisfaction of the regulator prior to commencement of activities.

The Department's advice is valid for six months. For any activities commencing after this period, we ask that you re-consult with us a minimum of three months prior to initiating any on ground work. Given the potential duration of this project, and the overarching nature of this document, we also request that Chevron Australia Pty Ltd provide regular updates to the Department on activities that have the potential to affect the aquatic environment.

The Department looks forward to continued correspondence with Chevron Australia Pty Ltd on the Gorgon Gas Development Fourth Train Expansion Project. Please contact Fiona Rowland on 9482 7200 should you have any queries regarding the above advice.

Yours sincerely

Brett Harrison
General Manager, Aquatic Environment

1st September 2014

Government of **Western Australia**
Department of **Transport**
Coastal Infrastructure Business Unit

Your ref: EA02-2013-0001: 2014-0000853538
Our ref: DT/14/01900
Enquiries: Fangjun Li (9435 7545)

Chairman
Environmental Protection Authority
Locked Bag 10, EAST PERTH
WA 6892
Attention: John Guld

Dear Chairman,

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL - ASSESSMENT NO. 1889 - PUBLIC ENVIRONMENTAL REVIEW

Thank you for your letter dated 27 June 2014 to Mr Reece Waldock, Director General, Department of Transport. As requested we have reviewed coastal engineering aspects of the Public Environmental Review (PER) document for the above project dated June 2014, Revision 0, and its relevant supporting technical reports. Our comments on horizontal directional drilling and coastal processes are:

Horizontal Directional Drilling (HDD) Marine Monitoring

- The proposed management measures outlined in this document and the previous Gorgon Gas Development and Jansz Feed Gas Pipeline: Horizontal Directional Drilling Management and Monitoring Plan (Chevron Australia, 2011f) appear reasonable. And it is necessary to conservatively estimate the potential maximum impact of the development. However, it is suggested that consideration should also be given to determining a 'best estimate' which may allow more efficient management of the environmental impacts during and following the HDD and pipeline installation. Over estimation of the potential impacts can have the flow on effect of placing monitoring sites in ineffective locations or result in ineffective selection of management options.

- There is high uncertainty remaining in the drilling fluid and cutting dispersion modelling with regards to the likely extent of environmental impact originating from the HDD and well drilling. Where possible initial modelling results and predictions of impacts should be validated following the commencement of construction. Where predictions significantly differ from those actually monitored, management plans should be revised accordingly.

- Model predictions should be validated against post-construction monitoring data. It is recommended that a statement or commitment to this be included within the main report, along with an indicative post-construction monitoring plan.

- The impact assessment and monitoring of the 1200 tonnes of material to be discharged to the marine environment (mainly cuttings) should be expanded to:
    a) Provide supporting information for the assumptions on the release rates of cuttings and turbidity generation from drilling;
    b) Clarify if allowance for downtime due to environmental stoppages has been considered in determining the drilling durations;
    c) Consider the impact of those shallow water cutting mounds on coastal sediment transport in both short-term cyclone events and long-term average metocean (winds, waves, currents) climate at Barrow Island.

- It does not appear that the latest local metocean conditions (winds, waves, currents) have been incorporated into this new proposal. The sea level rise projections quoted in this proposal are out of date (Section 6.4.10.3) and contradictions exist between Section 4.9 and Section 6.4 of this proposal.

- If undertaken, no details are provided of any recent model calibration. It is recommended that the impact prediction models be checked for its accuracy by calibration of results against the background conditions both prior to commencement of drilling, against background conditions, and soon after commencement of drilling, against construction conditions. Calibration should be against the local metocean conditions (waves, currents), water quality (turbidity) and sedimentation. It is recommended that the monitoring requirements of waves and currents be included within the project's environmental conditions.

Coastal Processes

- Consideration should be given to the impact of the cutting mounds from the HDD on the nearby beaches. It is acknowledged that the coastal studies have shown that the sediment transport rates along the foreshore are likely to be relatively low. However consideration should be given to identifying the gross sediment transport rates (i.e. the sediment transport rates in each direction parallel to the shoreline) when considering the impact of the cutting mounds on the shoreline, and not just the net movement.

Research and Development

- It is suggested that the Proponent be required to contribute to scientific research, to improve our general understanding of temporary and long-term impacts of HDD cuttings on seabed and coastal environments.

It is considered essential that all collected data and data analysis be made publicly available to aid in the assessment and management of future projects.

Government of **Western Australia**
Department of **Transport**
Coastal Infrastructure Business Unit

Regards,

Yours sincerely

Fangjun Li
Manager Coastal Management
29/08/2014

cc. John Guld
Carmel Critchley

Department of Transport, GPO Box C102, Perth WA 6839
Telephone (08) 9435 7500 Facsimile (08) 94357812
www.transport.wa.gov.au ABN 27 285 643 255

Government of **Western Australia**
Department of **Parks and Wildlife**

Your ref: EA02-2013-0001; 2014-0000854498
Our ref: CEO887/14; 2008/003662-3
Enquiries: Stuart Field
Phone: 9219 8785
Fax: 9334 0327
Email: stuart.field@dpaw.wa.gov.au

Dr Paul Vogel
Chairman
Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Dear Dr Paul Vogel

I refer to the letter dated 27 June 2014 received from Anthony Sutton, Director Assessment and Compliance Division to Stuart Field, Gorgon Project Coordinator, Department of Parks and Wildlife, regarding the Gorgon Gas Development Fourth Train Expansion Proposal – Assessment No. 1889 – Public Environmental Review.

The proposal is of interest to Parks and Wildlife as it directly affects Barrow Island Nature Reserve (class A), and Barrow Island Marine Management Area (class A). The proposal also has potential to lead to an increase in the cumulative impacts of the Foundation Gorgon project on flatback turtle *Natator depressus* (threatened, ranked vulnerable) and terrestrial fauna. As such, Parks and Wildlife recommends that additional environmental offset provisions (or extensions to the existing additional undertakings) are considered. It is also noted that Clause 11 of the *Gorgon Gas Processing and Infrastructure Project Agreement* (Schedule 1 to the *Barrow Island Act 2003*) requires 'proportionate, additional funding' for Net Conservation Benefits to be agreed between the Joint Venturers and the State.

Advice regarding specific matters relevant to Parks and Wildlife's *Wildlife Conservation Act 1950* and *Conservation and Land Management Act 1986* related responsibilities, is provided in the attached table.

Should you wish to discuss this advice, please contact Dr Stuart Field on 9219 8785 or stuart.field@dpaw.wa.gov.au.

Yours sincerely

Jim Sharp
DIRECTOR GENERAL

1 September 2014

Att

Department of Parks and Wildlife

Document Review Comments Sheet

Document Title:	Public Environmental Review - Gorgon Gas Development Fourth Train Expansion Proposal	**EPA Assessment Number: 1889**
Revision:	Final for public review	
Date of Review:	August 2014	

Item	Section / Issue	Reviewer Comment / Recommendations	Proponent Response
1	Cumulative impacts and Management	***Recommendation 1: That the cumulative impacts of the Foundation Project and the Fourth Train Proposal be combined in the assessment of likely impacts.*** **Discussion:** The Public Environmental Review (PER) document indicates that there are no additional emissions/impacts associated with the development of the Fourth Train. While it is acknowledged that the activities that will occur during the Fourth Train Proposal are not different from the Foundation Project, the quantum (extent and duration) of those activities will change. For example, there will be increased light and noise emissions and a substantial increase in shipping movements due to the development of the Fourth Train Proposal. In addition, Table 4.3 (page 173) includes another five gas fields identified for future development, but no detail is given in the document on the potential cumulative impacts of further developments utilising the additional infrastructure from this proposal. Parks and Wildlife recommends that the assessment of potential impacts from the Fourth Train Proposal on the environmental values of Barrow Island Nature Reserve needs to consider the cumulative and indirect pressures on those values, with particular reference to marine turtles and terrestrial fauna. <u>Marine turtles</u> It is noted that there have been physical changes recorded on turtle nesting beaches for	

Item	Section / Issue	Reviewer Comment / Recommendations	Proponent Response
		the threatened flatback turtle species adjacent to the plant site (i.e. sand loss at Terminal and Bivalve beaches), and that these changes could have a negative impact on nesting success of turtles on those beaches. It is also noted that that the PER indicates that the lighting associated with the Fourth Train Proposal will be within management guidelines during construction and operation of the completed Train. Given that the flatback turtle population may already have been impacted by the physical changes to the above nesting beaches, which was not specifically identified when the environmental impacts of the Foundation Project were assessed, Parks and Wildlife recommends an assessment is conducted of the likely impacts of the existing pressure from these physical changes combined with potential additional lighting pressure. Additional management or mitigation measures could be considered via this assessment. <u>Shipping</u> It is noted that there will be a substantial increase in shipping movements as a result of the Fourth Train Proposal. While the potential impact of this factor has been assessed, it has not been considered in combination with other potential impacts on marine fauna, particularly marine turtles, such as lighting, noise and spills. While the potential for use of a grounded condensate vessel and resultant risk of loss of heavy fuel oil (HFO) is mentioned, there is no comment on a full bunker load or single bunker tank release or the increase of the level of risk from the Foundation Project. With the exception of condensate vessels, it is stated that all other spills from marine vessels will involve diesel. However, during the Foundation Project, offshore pipe and rock laying vessels were HFO powered. If HFO powered vessels are used in the Fourth Train construction, Parks and Wildlife recommends that the impacts of a potential spill need to be properly considered in spill scenarios on the east and west coasts of Barrow Island. <u>Quarantine</u> Parks and Wildlife supports the proponent's continuing strong commitment to quarantine standards on Barrow Island. However, given the extended duration of the construction phase coupled with an increased workforce, Parks and Wildlife considers there is likely to be some degree of increase in quarantine risk. Parks and Wildlife recommends the quarantine risk is reassessed to take into account the increase in construction workforce over the extended period of construction associated with the Fourth Train Proposal to determine if the cumulative risk remains low or if additional risk mitigation measures are required. Parks and Wildlife recommends that the potentially increased quarantine risk is acknowledged and considered when continuing to implement the Quarantine	

Item	Section / Issue	Reviewer Comment / Recommendations	Proponent Response
		Management System. Terrestrial fauna The increased construction duration of the combined Foundation Project and Fourth Train Proposal has the potential to further impact on terrestrial fauna through an increase in road kills. The PER states that the additional impact of this factor from the Fourth Train Proposal will not occur across a greater area than the Foundation Project. However, it does not seem to consider the greater numbers of animals likely to be impacted and the potential effects this could have on populations of conservation significant fauna on Barrow Island Nature Reserve. ***Recommendation 2: That hydrocarbon spill modelling is developed for an additional proposed gas field close to the continental shelf to complement the modelling completed for the proposal.*** **Discussion:** Spill modelling was conducted for what is considered a worst-case scenario involving a well blowout at the Chandon Gas Field, due to it being considered to have the highest potential for environmental impact as a result of the gas-to-oil-ratio compared to the other gas fields. Chandon is approximately 70km away from and further offshore from the nearest other Fourth Train Proposal gas field. The other gas fields are located close to the edge of the continental shelf and are likely to be subject to significantly different ocean currents resulting in spill scenarios that are not comparable to the Foundation Project and Chandon modelled oil spill. Parks and Wildlife recommends that additional modelling of a well blowout on a gas field in closer proximity to Barrow Island (near to the continental shelf) be completed to indicate the likely impact of an oil spill. Maps showing spatial modelling of a spill should also be provided. ***Recommendation 3: That further detail is provided on the proportion of Barrow Island vegetation associations likely to be impacted in the 20ha footprint of the horizontal directional drill (HDD) area.*** **Discussion:** Table 9.9 includes quantitative information on the proportions of the known areas of affected vegetation associations on Barrow Island Nature Reserve, for each of the vegetation associations occurring within the 20ha footprint for the HDD area. However, without knowing what proportions the affected areas of these vegetation associations represent of the total area on Barrow Island Nature Reserve, it is unclear how significant any additional loss may be, particularly given that the data provided in the PER is based a survey area that covers only 11% of Barrow Island Nature Reserve.	

Item	Section / Issue	Reviewer Comment / Recommendations	Proponent Response
		There are substantial increases in areas cleared for some of the vegetation associations between the Foundation Project and the Fourth Train Proposal, and three of these are in vegetation associations identified as conservation significant due to their restricted distribution. While only 11% of Barrow Island Nature Reserve has been mapped under Astron classification, the combined Astron and Mattiske surveys are likely to provide sufficient information to indicate whether these associations are restricted. Parks and Wildlife recommends that the information from both surveys is used to provide further detail on the proportions of vegetation associations likely to be impacted by the Fourth Train Proposal in relation to their distribution across the entire island. ***Recommendation 4: That consideration be given to environmental offsets or extensions to the existing additional undertakings.*** **Discussion:** No environmental offsets (or extensions to the existing additional undertakings) are presently proposed to balance the cumulative pressures that may result from the Fourth Train Proposal. Parks and Wildlife recommends that additional offsets (or extensions to the existing additional undertakings) be considered, particularly in relation to impacts on marine turtles and terrestrial fauna. It is also noted that Clause 11 of the *Gorgon Gas Processing and Infrastructure Project Agreement* (Schedule 1 to the *Barrow Island Act 2003*) requires proportionate, additional funding for Net Conservation Benefits to be agreed between the Joint Venturers and the State, and that the Joint Venture partners have agreed to negotiate the quantum of this proportionate increase in NCB funds with the State Government.	

End of Document Review Sheet

Government of Western Australia
Department of State Development

Your ref: EA02-2013-0001: 2014-0000853603
Our ref: S0352/201101
Enquiries: Ian Allison, Project Manager - Ph 9222 0595 Fax 9222 0505
Email: ian.allison@dsd.wa.gov.au

Chairman
Environmental Protection Authority,
Locked Bag 10,
EAST PERTH WA 6892

Attention: John Guild

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL - ASSESSMENT NO. 1889 - PUBLIC ENVIRONMENTAL REVIEW

Thank you for your letter of 27 June 2014 and the opportunity to comment on the Public Environmental Review for the Gorgon Gas Development Project Fourth Train Expansion Proposal.

Two issues relevant to the Department are the management of uncleared land as provided for under section 9 of the *Barrow Island Act 2003* (BIA), and clause 11(6) of the *Gorgon Gas Processing and Infrastructure Project Agreement* (Agreement) regarding the Net Conservational Benefit (NCB) that would be payable to the State subject to the implementation of the proposal.

1. The PER in numerous instances indicates that up to 10 hectares of land will be cleared at the horizontal directional drill site at North Whites Beach (p 33, 45, 46, 47, 60, 182, 196 – and others). Please note that the land available for clearing is limited to 332 hectares under section 9 of the BIA, and that 330 hectares has already been used, or allocated, subject to current approved proposals.

2. The NCB payable for the fourth train - at the nameplate capacity of 5Mt of LNG per year, the NCB payable subject to clause 11(6) of the Agreement would be $20 million which would need to be paid together with a lump sum payment of $5M on approval of the additional proposals. Additionally, the Department understands from Chevron's press release of 5 December 2012 that the nameplate capacity of each LNG train has been revised and increased by 4% from 5Mtpa to 5.2Mtpa. Clarification on this point by the proponent would be appreciated as the PER consistently states that the "nominal" capacity of the 4th train is 5Mtpa, rather than a "nameplate" capacity of 5.2Mtpa.

Stephen Wood
DIRECTOR GENERAL
1 ~~August~~ September 2014

From:
Sent: Wednesday, 13 August 2014 9:09 PM
To: ATRI-656-INFO
Subject: Gorgon fourth train expansion - comment on PER

Hello

I recognise this 'lip service to public consultation' is a bureaucratic process with a pre-determined outcome that will only collate responses into themes, waste public officers time and inevitably be futile.

However, in an effort to increase your statistics I provide the following:

* Gorgon should of course, never have been approved on Barrow Island (gas pipelines now criss cross to Onslow and it was only approved for the profit margins of Chevron rather than strategic purpose).

* Climate change impacts should be considered and mitigated if this thing is going to be expanded - it can no longer be said that this is being delivered on by the Feds, we all know direct action is a joke.

* Management plans bore everyone, no one reads them, or follows up on them, including surely your staff. Why not consider setting targets in a one page summary people can actually see are / are not achieved? No one has time for the door stop volume. Except perhaps, consultants.

Regards

GOVERNMENT OF WESTERN AUSTRALIA

STATE HERITAGE OFFICE

Working on behalf of the Heritage Council to recognise, conserve, adapt and celebrate our State's unique cultural heritage

16 July 2014

YOUR REF EX02-2013-0001
OUR REF P14365/32070
ENQUIRIES Susan Barratt (08) 6552 4000

Chief Executive Officer
Office of the Environmental Protection Authority
Locked Bag 10
EAST PERTH, WA 6892

Attention: John Guld

Dear Sir

Barrow Island Marine Area - part
Proposed Gorgon Gas Development Fourth Train Expansion Proposal - Assessment No. 1889 - Public Environmental Review - Public Environmental Review

Thank you for your letter of 7 July 2014 regarding the proposed Gorgon Gas Development Fourth Train Expansion Proposal. *Barrow Island Marine Area - part* is not on the State Register of Heritage Places, or in our current assessment program.

We thank you for the opportunity to provide a submission on the proposed development. However, the Heritage Council has made no assessment of the significance of the place. Therefore, it is unable to provide comment.

Should you have any queries regarding this matter, please contact Susan Barratt at susan.barratt@stateheritage.wa.gov.au or on 6552 4000.

Yours sincerely

K Jackson

Karen Jackson
A/DEVELOPMENT AND INCENTIVES MANAGER

www.stateheritage.wa.gov.au
info@stateheritage.wa.gov.au

Bairds Building 491 Wellington Street Perth PO Box 7479 Cloisters Square PO WA 6850 P: (08) 6552 4000 F: (08) 6552 4001 FREECALL (regional): 1800 524 000

WESTERN AUSTRALIAN museum

29 August 2014

Mr Anthony Sutton
Director Assessment and Compliance Division
Office of the Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Dear Mr Sutton

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL - ASSESSMENT NO. 1889 - PUBLIC ENVIRONMENTAL REVIEW

The Western Australian Museum welcomes the opportunity to view the environmental review draft for the Gorgon Gas Development Fourth Train Expansion Proposal.

We have no specific comments or points to raise in relation to this document.

As requested, the contact details for further communication are:
Mr Alec Coles
Chief Executive Officer
Western Australian Museum
Locked Bag 49
WELSHPOOL DC 6986

Kind regards

ALEC COLES
CHIEF EXECUTIVE OFFICER

Government of **Western Australia**
Department of **Environment Regulation**

Your ref: EA02-2013-0001; 2014-0000854664
Our ref: CEO1014/14
Enquiries: Tom Rose
Phone: 6467 5287
Fax: 6467 5562
Email: tom.rose@der.wa.gov.au

Mr Kim Taylor
General Manager
Office of the Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Attention: John Güld

Dear Mr Taylor Kim

GORGON GAS DEVELOPMENT FOURTH TRAIN EXPANSION PROPOSAL – ASSESSMENT NO. 1889 – PUBLIC ENVIRONMENTAL REVIEW

I refer to the letter dated 27 June 2014 from Mr Anthony Sutton, Director Assessment and Compliance Division, informing the Department of Environment Regulation (DER) of the opportunity to provide public comment on the Gorgon Gas Development Fourth Train Expansion Public Environmental Review (PER).

Please find attached DER's comments and recommendations made in relation to issues identified in the PER.

Comments are provided on the basis of DER's responsibilities under the *Environmental Protection Act 1986* (EP Act), *Environmental Protection Regulations 1987*, *Environmental Protection (Noise) Regulations 1997* and *Contaminated Sites Act 2003*.

Should the Office of the Environmental Protection Authority find the proposed PER acceptable, there will be a number of requirements under Part V of the EP Act that require the proponent to seek a works approval, and that may be needed to address licensing aspects. For example, any modification to existing approved infrastructure may trigger the need for a works approval and if the temporary power station remains in use for construction at the same time as the operational phase of the Foundation Project, then the combined impact may need to be assessed by DER's North West Region Office.

Yours sincerely

Jason Banks
DIRECTOR GENERAL

1 October 2014

Att.

Department of Environment Regulation

Document Review Comments Sheet

Reviewer: Department of Environment Regulation	EPA Assessment Number: 1889
Document Title: Gorgon Gas Development Fourth Train Expansion PER	
Document Revision: 1	
Date of Review: 26 August 2014	

Item No.	Section No.	Recommendations and Discussion	Proponent Response
Information, studies or commitments to be included in the Public Environmental Review document (with priorities):			
1	App D1, 3.5.7 and 5.2.3	**Recommendation 1: That the proponent be requested to include some upset conditions/scenarios or otherwise provide explanation as to why these scenarios are no longer assessed or being considered for assessment.** **Discussion:** The modelling configuration and results have been modified a number of times since the first assessment was submitted in 2008 (see tables in Attachment 1). For example, the one-hour NO_2 concentration for the cold-start scenario was predicted to be 139% of National Environment Protection Measure criteria in 2008, while this value was predicted to be 65% of criteria (48.8% of criteria for regional modelling results) in the latest assessment. Similar patterns were also observed for ozone. The proponent is requested to detail why some of the upset conditions are no longer being included in the modelled scenarios.	

Item No.	Section No.	Recommendations and Discussion	Proponent Response
2	App D1 and 5.2.3	**Recommendation 2: That the proponent be requested to provide and assess emission scenarios with significant ground level concentrations or explain why they were removed from the PER.** **Discussion:** In the Draft PER, worst case scenarios (non-routine) were discussed. In the final PER, they have been omitted without explanation. Because the management of risk is central to much of DER's regulatory functions, it is considered that an explanation needs to be provided in the PER. As examples, the PER states that "*The black start scenario was predicted to be the worst case of the non-routine scenarios modelled; therefore, no results relating to the other modelled scenarios are presented in this PER/Draft EIS*". DER also notes that Table 7-1 suggests that the "*pigging*" case appears to be the worst case scenario (scenario 3) for non-routine operations. In addition, the scenario 2c (routine operation of the Fourth Train Proposal with Regenerative Thermal Oxidiser [RTO]) and the scenario 2a (routine operation of the Fourth Train Proposal with AGRUs Venting) were also predicted to be the worst case routine scenarios. It appears all abovementioned scenarios were also removed from the final PER report without explanation (see Attachment two).	
3	General	**Recommendation 3: The proponent be requested to provide an explanation for removing the Regenerative Thermal Oxidiser (RTO) assessment from the PER and/or clarify whether the RTO will be still be used in the Fourth Train Proposal.** **Discussion:** The RTO was claimed to be the largest source of SO_2 in the Fourth Train Project as it oxidises the H_2S in the acid gas recovery unit gas stream to SO_2. The modelling assessment of the RTO has been dropped from the PER, without explanation. DER recommends the proponent review the emissions file provided to DER in the PER review and qualifies why this has been omitted when it was the most significant source of SO_2 in previous draft PER versions.	
4	General	**Recommendation 4: The proponent design and undertake a comprehensive ambient air quality monitoring program to validate the source and estimates of emissions.** **Discussion:** DER recognises the utility and power of previous modelling related to the operation of petro-chemical facilities. However, DER considers it is appropriate to validate estimates of emissions from real-time local data to improve and strengthen the large number of model based assumptions and projections associated with this project. This would help strengthen confidence in any management and regulatory requirements and better inform pollution issues associated with this project as well as other related projects in the area. It would also provide contemporary information rather than relying solely on modelling assessments using older data.	

Item No.	Section No.	Recommendations and Discussion	Proponent Response
5	5	**Recommendation 5: The proponent be advised that issues of sewage and other contaminants that may be discharged from offshore vessels moored in shallow waters needs further explanation in the PER.** **Discussion:** The PER states offshore vessels will comply with the Regulations for the Prevention of Air Pollution from Ships contained in Annex VI of the International Convention (International Maritime Organization 1997), where relevant. The proponent needs to provide more information on where this is considered relevant. When the "Marine Vessels" component of the Solid and Liquid Waste Management Plan was developed, its intent was to cover general work vessels that were under power and moving. The proposal to manage discharges in accordance with MARPOL is neither relevant nor appropriate. MARPOL was designed to minimise pollution of the seas, primarily from the international movement of vessels. It was not designed to manage activities, for example, from stationary accommodation vessels in shallow nearshore waters. The proponent is requested to demonstrate how it intends to manage emissions or discharges from stationary vessels at or near Barrow Island such that unacceptable impacts from emissions are prevented.	
6	General	**Recommendation 6: That the proponent include in the PER, management and assessment of acid sulfate soils associated with cuttings at horizontal drilling access points for the installation of pipelines in the nearshore environment.** **Discussion:** The use of the horizontal drilling to install infrastructure across mangroves and tidal flats is supported as disturbance of surface sediments are generally reduced, limiting the potential for oxidation and the formation of acid sulfate soils. However, drilling is likely to generate cuttings from below the water table when horizontal drilling emerges above the land surface at pipeline beachheads. The disposal of cuttings in shallow water will need to be carefully managed because of large tidal variation and wave action that has the potential to cause this material to oxidise and release metals into the water column. DER considers an explanation on how this will be managed when the fourth train is developed, to be relevant to the PER.	

Modelling Results 2004 (Table 8.2-8.5) [1]

- **Table 8-2 Maximum predicted future ground level concentration on the modelled grid under routine operating conditions**

Pollutant	TAPM Grid	Averaging Period	Maximum on Grid ($\mu g/m^3$)	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria
NO_2	1 km	1-hour	42.6	246	17.3
		Annual	0.7	62	1.2
O_3	10 km	1-hour	131.9	214	61.6
		4-hour	109.6	171	64.1
SO_2	1 km	1-hour	14.6	571	2.6
		24-hour	2.6	229	1.2
		Annual	0.2	57	0.3
PM_{10}	1 km	24-hour	0.9	50	1.8

- **Table 8-3 Maximum predicted future ground level concentration on the modelled grid during start-up**

Pollutant	TAPM Grid	Averaging Period	Maximum on Grid ($\mu g/m^3$)	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria
NO_2	1 km	1-hour	341	246	139
O_3	10 km	1-hour	132.2	214	61.8
SO_2	1 km	1-hour	14.8	571	2.6
PM_{10}	1 km	24-hour	1	50	2

- **Table 8-5 Maximum predicted future ground level concentration on modelled grids during CO_2 venting**

Pollutant	TAPM Grid	Averaging Period	Maximum on Grid ($\mu g/m^3$)	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria
NO_2	1 km	1-hour	42.6	246	17.3
O_3	10 km	1-hour	272	214	127
SO_2	1 km	1-hour	14.9	571	2.6
PM_{10}	1 km	24-hour	2.3	50	4.7

[1] Note: Blue and Red rectangle on one-hour predicted NO_2 and O_3 concentrations for the routine, venting and cold-start scenarios between 2008 and 2014

Revised version of Modelling Results of 2008 (Table 9.2-9.3)[1]

Table 9.2: Maximum Predicted Percentages of Assessment Criteria at Existing Chevron Camp

Air Emission	Assessment Criteria ($\mu g/m^3$) (NEPC 2003; 2004)	Averaging Period	Percentage of Assessment Criteria				
			Existing and Approved	Revised Proposal			
				Routine	Cold Start	Emergency Shutdown	CO_2 Venting
NO_2	246	1-hour	6.1	8.1	33.3	6.5	7.7
O_3	214	1-hour	35.5	37.9	46.7	37.9	93.5
SO_2	571	1-hour	0.1	0.9	0.7	0.5	0.9
PM_{10}	50	24-hour	n/a	0.6	0.6	0.6	1.6

Table 9.3: Maximum Predicted Percentages of Assessment Criteria at Proposed Gorgon Construction Village

Air Emissions	Assessment Criteria ($\mu g/m^3$) (NEPC 2003; 2004)	Averaging Period	Percentage of Assessment Criteria				
			Existing and Approved	Revised Proposal			
				Routine	Cold Start	Emergency Shutdown	CO_2 Venting
NO_2	246	1-hour	7.3	8.5	33.3	8.5	8.5
O_3	214	1-hour	35.5	37.9	46.7	37.9	93.5
SO_2	571	1-hour	0.1	1.1	1.1	0.5	1.1
PM_{10}	50	24-hour	n/a	0.6	0.7	0.6	1.6

[1]Note: Blue and Red rectangle on one-hour predicted NO_2 and O_3 concentrations for the routine, venting and cold-start scenarios between 2008 and 2014

Modelling Results 2013 (Table 6.3 & 7.1)[1]

Table 6-3 Predicted Maximum Concentrations from the Fourth Train Proposal and Existing Sources

Pollutant	Ave. Period	Conc. Statistic	Criteria Value	Units	Back-ground	Existing and Bckgnd	Existing and Bckgnd with Foundation Project (S. 1)	Existing and Bckgnd. with Fourth Train Proposal		
								Routine no RTO (S. 2a/2b)	Routine with RTO (S. 2c)	Plant Restart (S. 4)
CO	8-hour	Max	9000	ppb	100	466	467	467	467	466
NO_2	1-hour	Max	120	ppb	2	65	65	65	65	65
	1-year	Ave	30	ppb	1	27	27	27	27	27
SO_2	1-hour	Max	200	ppb	0	0	24	24	74	24
	1-day	Max	80	ppb	0	0	4.2	4.2	16	4.2
	1-year	Ave	20	ppb	0	0	0.13	0.13	1.8	NA
PM_{10}	1-day	Max	50	$\mu g/m^3$	27	32.3	32.4	32.4	32.4	32.4
$PM_{2.5}$	1-day	Max	25	$\mu g/m^3$	6	11.3	11.4	11.4	11.4	11.4
	1-year	Ave	8	$\mu g/m^3$	5	6.8	6.9	6.9	6.9	6.9

Table 7-1 Predicted Maximum Concentrations (ppb) of Ozone and NO_2 Anywhere on the Model Grid

Pollutant	Ave. Period	Statistic Used	Criteria Value	Predicted Concentration (ppb)							
				Natural	Existing 2009	Future with GFP (S. 1)	Future with FTP and Train 4 AGRU Venting (S.2a)	Future with FTP and Train 4 AGRU Injected (S.2b)	Future with FTP and Train 4 AGRU to RTO (S.2c)	Future with FTP Non Routine Pigging (S.3)	Future with FTP Non Routine Black Start (S.4)
Nitrogen Dioxide	1-hour	Max	120[1]	42	47	48.5	50.6	49.6	51	48.7	48.8
	1-hour	2nd	120	39	45	47	47	47	47	47	47
	1-year	Ave	30	0.5	8.9	9.5	9.8	9.8	9.8	9.8	9.8
Ozone	1-hour	Max	100[1]	70	71	84	101	81	82	93	75
	1-hour	2nd	100	70	70.5	73	73	69	68	76.5	68
	4-hour	Max	80[1]	70	70	70	70.5	69	73	69	70
	4-hour	2nd	80	69	69.6	69	67	68	67	68.4	67

Notes:

1) NEPM 1-hour values actually allow for not more than one exceedance per year.
2) "Existing 2009" is all natural and anthropogenic sources at 2009. "Future" is existing and all approved and proposed projects as defined in **Section 2**. GFP is Gorgon Foundation Project and FTP is the Fourth Train Proposal.

[1]Note: Blue and Red rectangle on one-hour predicted NO_2 and O_3 concentrations for the routine, venting and cold-start scenarios between 2008 and 2014

Modelling results 2014, presented in the PER (Table 8.2-8.5)[1]

Table 5-8: Predicted Maximum Ground-level Concentrations for the Fourth Train Proposal and their Comparison to the Ambient Air NEPM

Pollutant	Averaging Period	Units	Ambient Air NEPM Criteria	Baseline (including Foundation Project)	Fourth Train Proposal (including Baseline)		
					Routine Operations	Difference in Fourth Train Proposal and Foundation Project Routine Operations	Black Start
Local Scale Modelling							
CO	8-hour	ppb	9000	467	467	0	466[1]
NO_2	1-hour	ppb	120	65	65	0	65
	1-year	ppb	30	27	27	0	27
SO_2	1-hour	ppb	200	24	24	0	24
	24-hour	ppb	80	4.2	4.2	0	4.2
	1-year	ppb	20	0.13	0.13	0	NA
PM_{10}	1-day	$\mu g/m^3$	50	32.4	32.4	0	32.4
$PM_{2.5}$	1-day	$\mu g/m^3$	25	11.4	11.4	0	11.4
	1-year	$\mu g/m^3$	8	6.9	6.9		6.9
Regional Scale Modelling							
NO_2	1-hour	ppb	120	48.5	49.6	1.1	48.8
	1-year	ppb	30	9.5	9.8	0.3	9.8
O_3	1-hour	ppb	100	84	81	-3[2]	75
	4-hours	ppb	80	70	69	-1[2]	70

Note:

1. *This improvement in air quality occurs as the black start case makes a smaller contribution to the air emissions than the normal Fourth Train Proposal scenarios.*
2. *This improvement (reduction in ground-level concentration) is due to the additional NO_x from the Fourth Train contributing to increase the NO_2 concentrations, but decreasing the O_3 concentrations as there are no additional VOCs emitted (i.e. the formation of O_3 as a secondary pollutant depends on the availability of both NO_x and VOCs).*
3. *The predicted maximum local concentration of pollutants is dominated by existing/background sources, with both the Foundation Project and the Fourth Train Proposal emissions being only minor contributors on the local scale; hence the difference in predicted pollutant levels between the Baseline (including the Foundation Project) and the Fourth Train Proposal can only be gauged at a regional scale.*
4. *The black start emissions are dominated by flaring. Flaring produces a very buoyant plume that has no impact on the local scale modelling, but is measurable at the regional scale.*

[1]Note: Blue and Red rectangle on one-hour predicted NO_2 and O_3 concentrations for the routine, venting and cold-start scenarios between 2008 and 2014

Table 2-1 Gorgon Gas Development Atmospheric Emissions – Scenario Definitions

Scenario Definition	Anticipated Frequency of Operations	Local Modelling Run [2]	Regional Modelling Run [2]
Scenario 1 **Foundation Project - Routine Operations with 1 AGRU Venting** • Three trains operating • All five GE Frame 9 Gas Turbine Generators operating for a 410 MW plant load • All six GE Frame 7 Process Gas Turbines operating • Two heating medium heaters on hot standby • Wet and Dry Gas flares operated on pilot and flare enrichment gas, no non-routine flaring • BOG flares operated on pilot and purge fuel gas only, no non-routine flaring • One AGRU venting; acid gas from two trains injected • Concurrent condensate loading operations	Up to 20% of the Gas Treatment Plant uptime	Local Case 1	Regional Case 2 [1]
Scenario 2a **FTP - Routine Operations and 2 AGRUs Venting** • Four trains operating • All six GE Frame 9 Gas Turbine Generators operating for a 547 MW plant load • All eight GE Frame 7 Process Gas Turbines operating • Two heating medium heaters on hot standby • Wet and Dry Gas flares operated on pilot and flare enrichment gas, no non-routine flaring • BOG flares operated on pilot and purge fuel gas only, no non-routine flaring • Two AGRU venting including the AGRU emissions from Train 4 • Concurrent condensate loading operations	Up to 20% of the Gas Treatment Plant uptime	Local Case 2	Regional Case 3
Scenario 2b **FTP - Routine Operations and 1 AGRU Venting** • As per Scenario 2a but with • One AGRU venting; with AGRU emissions from three trains including Train 4 injected	Up to 20% of the Gas Treatment Plant uptime	The same as Local Case 2	Regional Case 4
Scenario 2c **FTP - Routine Operations and 1 AGRU Venting and 1 AGRU vent gas incinerated in RTO** • As per Scenario 2a but with • One AGRU from trains 1 to 3 venting, with the AGRU emissions from the proposed Train 4 incinerated in an RTO	Up to 20% of the Gas Treatment Plant uptime	Local Case 3	Regional Case 5
Scenario 3 – "Pigging" **FTP - Non-Routine Operations: 3 Trains and 3 AGRUs Venting (during CO_2 Injection Pipeline Pigging Operations)** • Three trains operating with one train in maintenance • Five GE Frame 9 Gas Turbine Generators online (1 GTG shutdown) • Six GE Frame 7 Process Gas Turbines online (2 GTs tripped) • Two heating medium heaters on hot standby • Wet and Dry Gas flares flaring at routine flaring rates • BOG flares operated on pilot and purge fuel gas only, no non-routine flaring • Three AGRUs venting, no acid gas injected • Concurrent condensate loading operations	1 in a 5 year event (CO_2 pipeline pigging operations conducted during a train shutdown for maintenance)	The same as Local Case 1	Regional Case 6 (increase in VOC emissions)
Scenario 4 "Black Start" **FTP - Non-Routine Operations: Full Plant Restart** • First train of the four in start up • One GE Frame 9 Gas Turbine Generator at spinning reserve (40% load, outside DLN regime) • Two GE Frame 9 Gas Turbine Generator at routine conditions • Two Heating Medium Heaters at 100% load conditions • Non-Routine flaring at 490 tonnes/hr • One AGRU venting • Two GE Frame 7 Gas Turbines – operated under low load (outside DLN regime)	1 in a 5 year event (complete plant restart. I.e. black restart due to total loss of power).	Local Case 4	Regional Case 7

Notes:

1) Regional Case 1 is a case that includes background or natural sources only, including emissions from bush fires.

Attachment 2 – OEPA Summary of Matters to be Addressed

Gorgon Gas Development Fourth Train Expansion Proposal

PUBLIC ENVIRONMENTAL REVIEW
ASSESSMENT NO. 1889

SUMMARY OF MATTERS TO BE ADDRESSED

This document forms a summary of matters raised by the Office of the Environmental Protection Authority (OEPA).

Table of Contents

1. General Comments

Issue number	Matters to be addressed	Response
1	It is proposed that the principal mechanism for addressing additional impacts from this proposal on top of those associated with the Foundation Project is through minor amendments to the existing EMPs. To ensure that any additional impacts from this proposal are managed to meet the EPA's objectives the OEPA should be consulted during the preparation of the following amended EMPs relating to marine impacts: • Coastal and Marine Baseline State and Environmental Impact Report: Feed Gas Pipeline and the Marine Component of the Shore Crossing; • Coastal and Marine Baseline State and Environmental Impact Report; • Long-term Marine Turtle Management Plan; • Horizontal Directional Drilling Management and Monitoring Plan; • Offshore Feed Gas Pipeline Installation Management Plan; and • Marine Environmental Quality Management Plan.	It is the OEPA's responsibility to review and approve/endorse Foundation Project Environment Management Plans (EMPs). It is expected that the Ministerial Conditions applied to the Fourth Train Proposal will require this process to be extended, i.e. the OEPA will be consulted about (and will approve or endorse) new EMPs for the Fourth Train Proposal and the minor amendments which will be required to be made to the listed Foundation Project EMPs.

2. Benthic Communities and Habitat

Issue number	Matters to be addressed	Response
2	It is noted that the base case pipeline installation methodology, which "represents the most likely scenario and therefore represents the basis for environmental assessment and associated management", is to not use trenching to stabilise the Feed Gas Pipeline within State Waters, similar to the approved Foundation Project. The proponent acknowledges that "as a contingency, trenching may be required, in which case the excavated material will be placed adjacent to the trench to allow for natural dispersal. This has been included in the calculation for the total area of seabed disturbance." It is also noted that other decisions relating to the final installation methodology are yet to be made (for example stabilisation method, Northern vs Southern Pipeline Route or anchoring vs dynamic positioning system). There is some inconsistencies within the PER document in relation to predicted seabed disturbance for the two pipeline options. On page 538 the proponent states that if trenching is required it will affect "between 0.23 and 0.27 km^2 (approximately) of seabed depending on the final pipeline route chosen." However, Table 4.6 suggests that this should be between 0.27 and 0.32 km^2 (approximately). To enable the OEPA to fully assess the impacts from this proposal, in the Response to Submissions the proponent should provide the OEPA with clear predictions of seabed disturbance/impact in table format for both the north and south pipeline route options for both trenching and non-trenching scenarios showing direct (permanent) impacts and indirect (recoverable) impacts. The predictions of direct and indirect impacts should also include any proposed secondary stabilisation methods such as rock stabilisation or anchors.	The sections below discuss the quantification of the potential direct and indirect impacts from trenching and rock stabilisation methods of installation of the Offshore Feed Gas Pipeline in state waters. The areas of direct and indirect impacts combined make up the marine disturbance footprint (MDF) for the Offshore Feed Gas Pipeline: • **Direct impacts**: the direct placement of the Offshore Feed Gas Pipeline System on the seabed, or the installation of a trench, is predicted to affect benthic ecological elements, with recovery to the original state not possible, and • **Indirect impacts**: surrounding areas of direct impact, the installation of the Offshore Feed Gas Pipeline System is likely to cause sublethal impacts that may remove or reduce the existing ecological elements, but will recover within five years. • **Temporary impacts**: changes in water quality due to sediment suspension following installation activities that are expected to last for less than a day. However, it should be noted that surveys of non-coral benthic macroinvertebrates, macroalgae, and seagrass following the installation of the Gorgon Foundation Project Feed Gas Pipeline System detected no change at MDF and Reference Sites from before to after offshore pipelay, while an increase in the abundance of some species of demersal fish was observed following offshore pipelay (Chevron Australia 2014a). As such, the sections below constitute a conservative assessment of potential impacts. **5.1.1 Direct and Indirect Impacts from Rock Stabilisation** The Foundation Project Offshore Feed Gas Pipeline System was installed using rock stabilisation within State waters. The infrastructure footprint is approximately 0.26 km^2 from the horizontal directional drilling exit point to the edge of State waters (Chevron Australia 2014), including the area occupied by the pipelines, umbilicals, and rock berms. This is an appropriate approximation of the area of direct and indirect impacts from the construction of the Fourth Train Proposal Offshore Feed Gas Pipeline System along the Northern route. The area of direct and indirect impacts predicted for the

Issue number	Matters to be addressed	Response
	In Section 10.5.2.2 - Seabed Disturbance the proponent states that "Experienced gained from the Wheatstone Project, which modelled the potential sediment plume generated from trenching activities in a similar sediment type (i.e. soft sediment) in State Waters off Onslow, found the Zone of High Impact to extend 525 m either side of the centre of the trunkline." This information is inconsistent with other predictions of seabed disturbance in the PER document such as in Table 4.6. The Zone of High Impact, or direct/permanent impacts, as shown in Table 4.6 would only be about 25 m either side of the trunkline rather than 525 m as suggested above using Wheatstone modelling. Clearly permanent impacts would not be expected 525 m either side of the trunkline regardless of installation methodology, and considering no trenching in State waters is proposed for this proposal the OEPA would expect to see a much smaller Zone of High Impact or seabed disturbance area from trunkline installation. This should be reflected in the Response to Submissions. This information is also misleading as the sediment type found at Wheatstone (coastal inshore environment adjacent to Ashburton River Delta) is not that similar to the sediment type found off the west coast of Barrow Island. This statement needs to be reviewed or explained further in the Response to Submissions. The final seabed disturbance area and marine disturbance footprint for the feed gas pipeline system and shore crossing within State waters (that should be presented in the amended Offshore Feed Gas Pipeline Installation Management Plan or any other amended EMPs where relevant) should represent the final installation methodology as far as practicable to ensure impacts are predicted, monitored and managed appropriately. How the proponent calculates the final seabed disturbance area should also be presented.	Southern Route was based on the rock stabilisation method causing approximately the same area of disturbance per kilometre length along both routes. **5.1.2 Temporary Impacts of Rock Stabilisation** The installation of rock stabilisation has the potential to resuspend and spread sediments, which will increase the suspended sediment load in the water column. As most of the material used for rock installation is very coarse, it is anticipated that sediment spill from rock installation activities will primarily relate to suspension of the local sediment caused by the momentum of the rock materials as they are placed on the seabed. Modelling undertaken during the construction of the Nord Stream twin pipelines (gas pipelines that link Russia and the European Union via the Baltic Sea) in an area of sandy sediments overlaying hard basement geology found that sedimentation as a result of rock installation ranged from 0.1 to 1.0 kg/m^2 within 500 m of the source and from 0.01 to 0.1 kg/m^2 at 1.5 km distant (Nord Stream AG 2009). A sedimentation rate of up to 1.0 kg/m^2, which is equivalent to 1 mm of sediment over a square metre, is not expected to be significant in the high-energy waters around the west coast of Barrow Island where wave activities frequently contribute to local resuspension and deposition of sediments. Therefore, temporary impacts would only be expected within 500 m of the central line. **5.1.3 Direct and Indirect Impacts from Trenching** Trenching in State waters is not the base case for installation of the Offshore Feed Gas Pipeline System. However, should trenching be required, the area of direct and indirect impacts predicted is approximately 30 m from the Feed Gas Pipeline System centre line (this width varies along the route in response to the local conditions and requirements). Calculations give an indicative direct disturbance area of between approximately 0.27 km^2 and 0.32 km^2 within State Waters for the Northern and Southern routes respectively (Table 1). **5.1.4 Temporary Impacts of Trenching** The marine sediments of the Pilbara mainly comprise silt and sand sheets of varying thickness overlaying limestone. Both the Fourth Train Proposal pipeline route and the Wheatstone pipeline route (beyond the alluvial deposits from the Ashburton delta) consist of areas of soft sands over harder Pleistocene calcarenite (limestone). Due to the similarities in the regional sediments and geology, the Fourth Train Proposal impact assessment used information from the Wheatstone

<table>
<tr><th>Issue number</th><th>Matters to be addressed</th><th>Response</th></tr>
<tr><td></td><td></td><td>
trenching modelling to provide an estimate of the area likely to be affected by temporary increases in sediment load from trenching (if required) within State Waters for the Fourth Train Proposal Feed Gas Pipeline System. These temporary increases in sediment load would only be expected within 525 m of the central line.

5.1.5 Table of Areas of Direct and Indirect Impact, and Temporary Impacts

Table 1 contains an indicative assessment of the direct, indirect and temporary impacts associated with the route and method options for the installation of the Fourth Train Proposal Offshore Feed Gas Pipeline System. The areas of direct impacts (where the components of the Offshore Feed Gas Pipeline System contact the seabed) and indirect impacts (from installation of the components of the Offshore Feed Gas Pipeline System) have been calculated together as fine level detail of the two different areas is not currently available. As the area of combined direct and indirect impact is so minor, the separation of these two areas is not considered necessary in order to manage project impacts.

Table 1: Indicative Areas of Direct and Indirect Impacts, and Temporary Impacts for the Feed Gas Pipeline System Options

<table>
<tr><th></th><th colspan="2">Non-trenching Option</th><th colspan="2">Trenching Option</th></tr>
<tr><th></th><th>Direct and Indirect Impacts</th><th>Temporary Impacts</th><th>Direct and Indirect Impacts</th><th>Temporary Impacts</th></tr>
<tr><td>Northern Route (approx. 5 km in State Waters)</td><td>0.26 km^2</td><td>5 km^2</td><td>0.27 km^2</td><td>5.2 km^2</td></tr>
<tr><td>Southern Route (approx.. 6 km in State Waters)</td><td>0.31 km^2</td><td>6 km^2</td><td>0.32 km^2</td><td>6.3 km^2</td></tr>
</table>

5.1.6 Offshore Feed Gas Pipeline Installation Management Plan

An Offshore Feed Gas Pipeline Installation Management Plan or an equivalent Environment Plan will provide a greater level of detail on predicted impacts, installation methodology, calculation of areas of direct and indirect impact based on that methodology, monitoring design, and management approach for the installation of the Feed Gas Pipeline System to ensure that the offshore pipeline installation meets the existing objectives and requirements of the Plan.
</td></tr>
</table>

Issue number	Matters to be addressed	Response
	Anchor Management Plan Anchoring is required to undertake the feed gas pipelay. The proponent proposes to undertake management measures to minimise impacts to benthic communities and advises that the construction contractor will develop an anchoring management plan. This plan should be included as part of the amended Offshore Feed Gas Pipeline Installation Management Plan. The plan should include contemporary best practice management for pipelay such as predetermined anchor drops to avoid sensitive areas and relocating anchors into existing disturbed areas to minimise the overall footprint. Given that such techniques have been successfully executed in other projects in Western Australia, it is appropriate that they are applied for this project.	Anchor Management Plan It is likely that dynamically positioned vessels would be used for the Fourth Train Proposal offshore pipelay, so impacts from anchoring would not be expected. However, if anchoring is required, it is likely to be restricted to the MDF in State Waters (where the benthic environment is predominantly soft sediments with sparse sessile taxa, and no coral assemblages), and to the construction corridor in Commonwealth Waters, and vessel anchoring will be managed in accordance with maritime industry standard watchkeeping practices. Illustrative management measures presented in the PER/Draft EIS included the development of a specific Anchor Management Plan by the Construction Contractor (if required) for the Fourth Train Proposal, which would require approval by Engineering Procurement Construction Management and/or Chevron Australia. The Anchor Management Plan would be expected to cover, aspects such as: required anchor spreads, the management of chain/wire drag and anchor movements, and the procedures for the deployment and retrieval of anchors. Seabed disturbance due to anchoring for the Fourth Train Proposal is not predicted to compromise the integrity, ecological functions, or environmental values of the seabed. The GJVs consider that the stressors to seabed, including from anchoring, will be able to be adequately managed by existing measures such that the impacts are environmentally acceptable and the environmental objective is met.

3. Marine Environmental Quality

Issue number	Matters to be addressed	Response
3	The submission from the Department of State Development (DSD) stated that a press release from Chevron Australia Pty Ltd on 5 December 2012 indicated that the nameplate capacity of each LNG train had been revised and increased by 4% from 5.0 Mtpa to 5.2 Mtpa. It is not clear from the information provided in Section 10.5.2.1.3 in the PER document whether the increase in nameplate capacity has been taken into account in determining the quantity of reject brine wastewater that would be	The Reverse Osmosis facilities were designed to meet the water demand of the Foundation Project, which allows for capacity of approximately 5.2 million tonnes per annum (MTPA) per liquefied natural gas (LNG) train. Dilution modelling studies completed for the reverse osmosis brine discharge from the approved Foundation Project temporary and permanent Reverse Osmosis facilities modelled maximum and minimum potential flow rates based on the design of the facilities. The modelling concluded that under both these conditions the required dilution could be achieved.

Issue number	Matters to be addressed	Response
	generated by the reverse osmosis facilities and disposed of into the marine environment, as well as its impact on dispersion and marine environmental quality.	The capacity of the LNG trains was taken into account when determining whether the Reverse Osmosis facilities could meet the requirements of the Fourth Train Proposal. The approved Foundation Project temporary and permanent reverse osmosis facilities have been assessed to provide sufficient fresh water to meet the requirements of both the Fourth Train Proposal and the approved Foundation Project.

4. Marine Fauna

Issue number	Matters to be addressed	Response
4	Noting the proponent's predictions, it would not be unreasonable to conclude that this proposal presents a risk of additional residual impacts from light emissions on turtles.	The impact assessment undertaken in the PER/Draft EIS does not support the conclusion that the proposal presents a risk of additional residual impacts from light emissions on turtles.
	Flatback turtles (listed as 'fauna that is rare or likely to become extinct' under the *Wildlife Conservation Act 1950*) were a key environmental factor for the EPA's assessment of the Gorgon Gas Development Project on Barrow Island. The nesting population on Barrow Island is a major part of the Northwest Shelf genetic stock (~20%) and approximately 30% of all flatback turtles nesting at Barrow Island nest on Terminal Beach and Bivalve Beach.	As part of the Long Term Marine Turtle Management Plan, a number of monitoring programs have been implemented by the Gorgon Foundation Project that provide an understanding of the effects of light sources on hatchling turtles. Chevron Australia monitors the fan angles of hatchlings leaving the beach in the Hatchling Orientation (fan) on Beaches Monitoring Program. Modelling of survey data combined with additional environmental covariates concluded that there has been no adverse effect from Foundation Project construction activities to date on orientation of Flatback Turtle hatchlings on Barrow Island across the eight sampled beaches.
	Given the uncertainty associated with the potential short and long-term impacts of increased light emissions on turtles, particularly from the LNG jetty as a result of more ship loading events, it is recommended that additional effort and resources be committed through the Long-Term Marine Turtle Management Plan (LTMTMP) to the existing Flatback Turtle Hatchling Dispersal and Survivorship Program in order to gain a better understanding of whether turtle hatchlings can successfully disperse away from the project area once they have left the beach, and to facilitate the mitigation of any impacts.	In addition to this program, the Gorgon Foundation Project has undertaken three years of monitoring under the Flatback Turtle Hatchling Dispersal and Survivorship Program. This monitoring covers the operation of the Materials Offloading Facility, including its night-time operations. Monitoring during the operation of this offshore light source provides meaningful data that hatchling turtles are more influenced by other environmental cues (such as currents and wave fronts) after leaving the beach, than attraction to light sources. The Flatback Turtle Hatchling Dispersal and Survivorship Monitoring Program will be continued under the Long Term Marine Turtle Management Plan for the Fourth Train Proposal, if required, to better understand the attraction of hatchling turtles to artificial light sources, based on the risk of impact to hatchlings from the Fourth Train Proposal LNG Jetty.
	<u>Coastal Stability Management and Monitoring Plan</u> As the PER document points out, one of the objectives of the Coastal Stability Management and Monitoring Plan (CSMMP) is to establish a program to detect and manage adverse changes to the beach structure and beach sediments that could have implications for marine turtles nesting on the beaches adjacent to the marine facilities. Given this and previously reported significant beach profile changes, exceedances of management trigger levels and	<u>Coastal Stability Management and Monitoring Plan</u> The Coastal Stability Management and Monitoring Plan is a Gorgon Foundation Project document. None of the activities proposed by the Fourth Train Proposal are expected to impact coastal stability, and as such the Coastal Stability Management and Monitoring Plan is not relevant to the Fourth Train Proposal. Monitoring of impacts to turtle nesting habitat as a result of changes to beach profiles is included in the approved Gorgon Foundation Project Coastal Stability Management and Monitoring Plan. The Marine Turtle Expert Panel is consulted during proposed changes and updates to the Gorgon Foundation Project Coastal Stability Management

Issue number	Matters to be addressed	Response
	declines in turtle nesting on Terminal Beach and Bivalve Beach the OEPA recommends that you consider bringing the CSMMP implementation under the oversight of the Marine Turtle Expert Panel (MTEP).	and Monitoring Plan, as required by the Ministerial Conditions.

5. Air Quality (Including Greenhouse Gas Emissions)

Issue number	Matters to be addressed	Response
5	The submission from the DSD stated that a press release from Chevron Australia Pty Ltd on 5 December 2012 indicated that the nameplate capacity of each LNG train had been revised and increased by 4% from 5.0 Mtpa to 5.2 Mtpa. It is not clear from the information provided in Section 2.2.5 in the Air Quality Assessment in Appendix D1 and the Phase 2 Acid Gas Vent Dispersion Modelling report in Appendix D2 in the PER document whether the increase in nameplate capacity has been taken into account in the relevant stack emission rates that were used in the air quality modelling that was undertaken. If the increase in nameplate capacity was not taken into account, then revised information on the predicted ground level concentrations for all relevant atmospheric emissions needs to be provided. In addition, it is also unclear from the information provided in Section 11.2.2 in the PER document whether the increase in nameplate capacity has been taken into account in determining the total quantity of greenhouse gas emissions that would be generated during operation of all four LNG trains. This needs to be clarified. Chevron Australia Pty Ltd also needs to clarify whether the increase in nameplate capacity has been taken into account in determining the total quantity of carbon dioxide that would be re-injected into the Dupuy Formation, and when assessing the ability of the Dupuy Formation to accommodate the additional emissions.	The Public Environmental Review / Draft Environmental Impact Statement (PER/Draft EIS), including the appendices, refers to LNG trains with a nominal capacity of 5 MTPA, which aligns with the terminology used in Schedule 1 of Ministerial Statement No. 800. However, the air quality assessment (Appendix D1), acid gas vent dispersion modelling (Appendix D2), greenhouse gas emissions estimation and Dupuy Formation reservoir carbon dioxide injection studies (Section 11 of the PER/Draft EIS) were based on an annual average LNG production of approximately 5.2 MTPA per train. However, the greenhouse gas emissions intensity provided in Section 11.4.1.1 of the PER/Draft EIS, which is calculated based on tonnes of greenhouse gas emissions per tonnes of LNG produced, considered the LNG train producing 5 MTPA of LNG. Accounting for a production of 5.2 MTPA, the Fourth Train Proposal is predicted to have an emissions intensity of 0.31 tonnes of carbon dioxide equivalent/tonne of LNG produced. This does not change the position of the Fourth Train Proposal in relation to the other projects in Figure 11-3 of the PER/Draft EIS.

6. References Cited in Attachment 2

Chevron Australia. 2011. *Wheatstone Project: Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report – Feed Gas Pipeline and the Marine Component of the Shore Crossing*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2013. *Wheatstone Project: Trunkline Installation Environmental Monitoring and Management Plan*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Offshore Feed Gas Pipeline Installation Management Plan.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014a. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Offshore Feed Gas Pipeline Post-development Coastal and Marine State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing, Year 1: 2013.* Chevron Australia, Perth, Western Australia.

Nord Stream AG. 2009. *Nord Stream Espoo Report: Chapter 9 Impact Assessment and Mitigation Measures*. Available from: http://www.envir.ee/orb.aw/class=file/action=preview/id=1093994/Chapter+9+Impact+assessment+and+mitigation+measures.pdf [Accessed September 2010].

7. Terms and Acronyms in Attachment 2

BPPH	Benthic primary producer habitat
CSMMP	Coastal Stability Management and Monitoring Plan
DSD	Western Australian Department of State Development
EMP	Environmental Management Plan
EPA	Western Australian Environmental Protection Authority
Foundation Project	Gorgon Gas Development Foundation Project, which consists of the initial Gorgon Gas Development, Revised and Expanded Gorgon Gas Development, Jansz–Io Development Project and Feed Gas Pipeline, all of which are approved, and , Gorgon Gas Development Additional Construction, Laydown and Operations Support Area
Fourth Train Proposal	Gorgon Gas Development Fourth Train Expansion Proposal
km	Kilometre
LNG	Liquefied Natural Gas
LTMTMP	Long-term Marine Turtle Management Plan
MDF	Marine Disturbance Footprint
MTEP	Marine Turtle Expert Panel
MTPA	Million tonnes per annum
OEPA	Western Australian Office of the Environmental Protection Authority
PER	Public Environmental Review
PER/Draft EIS	Public Environmental Review / Draft Environmental Impact Statement
ZoHI	Zone of high impact

Attachment 3 –Summary of Public Submissions

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

Gorgon Gas Development Fourth Train Expansion Proposal

PUBLIC ENVIRONMENTAL REVIEW
ASSESSMENT NO. 1889

SUMMARY OF PUBLIC SUBMISSIONS

This document forms a summary of public submissions and advice received on the Public Environmental Review (PER) document for the Gorgon Gas Development Fourth Train Expansion Proposal proposed by Chevron Australia Pty Ltd, on behalf of the Gorgon Joint Venturers.

The public review period for the proposal commenced on 7 July 2014 for a period of 8 weeks, ending on 1 September 2014. A total of 10 submissions were received, of which one objected to the proposal.

The principle issues raised in the submissions and advice received included environmental and social issues as well as issues focussed on questions of fact and technical aspects of the proposal. Although not all of the issues raised in the submissions are environmental, the proponent is asked to address all issues, comments and questions, as they are relevant to the proposal.

Table of Contents

1. The Proposal – General Comments

Issue number	Submitter	Submission and/or issue	Response to comment
1	Department of Mines and Petroleum	The additional **sub-sea pipeline** will need to meet the requirements of the 'Petroleum (Submerged Lands) Act (1982)' and the associated 'Petroleum (Submerged Lands) (Pipelines) Regulations 2007.' The additional **on-shore pipeline** will need to meet the requirements of the 'Petroleum Pipelines Act 1969' and the associated 'Petroleum Pipelines (Management of Safety of Pipeline Operations) Regulations 2010.' The additional **LNG train** will need to meet the requirements of the 'Dangerous Goods Safety Act 2004' and the associated 'Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007' and 'Dangerous Goods Safety (Major Hazard Facilities) Regulations 2007.' Please note that Worksafe is the agency responsible for regulating the occupational health and safety activities during construction and operation of the LNG train under the 'Occupational Safety and Health Act 1984' and the associated 'Safety and Health Regulations 1996.' Careful consideration of the impact of the simultaneous management of operations (SIMOP) for both construction and operational activities' should be undertaken for all the aforementioned additional operations. Further, the 'Barrow Island Act 2003' should be reviewed to reflect the proposed changes, in particular Part 4 - Conveyance and underground disposal of carbon dioxide.	The Public Environment Review/Draft Environmental Impact Statement (PER/Draft EIS; Chevron Australia 2014) has been prepared to address requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and the *Environmental Protection Act 1986* (WA) (EP Act). Documentation for the Fourth Train Proposal will be developed, and activities undertaken, as necessary, to satisfy additional legal requirements. The Gorgon Joint Venture (GJVs) will have regard to the relevant agencies and any further legal requirements under relevant acts and regulations, including those referred to here by the Western Australian Department of Mines and Petroleum, prior to commencing the associated activities for the Fourth Train Proposal. Any potential future updates to the *Barrow Island Act 2003* (WA) are beyond the scope of this environmental approval. Any amendments that may be made to the *Barrow Island Act 2003* (WA) will follow the Western Australia (WA) legislative process. Risks associated with simultaneous operations (SIMOPS) are managed and mitigated to account for the increased risk of incidents and accidents occurring during the SIMOPS period. The SIMOPS management process is designed to identify, plan, and prioritise SIMOPS activities and situations, and to provide a proactive approach to management. The approved Foundation Project is required to manage SIMOPS risks, as Liquefied Natural Gas (LNG) Train 1 will be operational when LNG Trains 2 and 3 are under construction. The Fourth Train Proposal can leverage experience gained from the increased operational and SIMOPS knowledge from the approved Foundation Project prior to construction of the Fourth Train Proposal commencing.
2	Department of Parks and Wildlife	***Recommendation 1: That the cumulative impacts of the Foundation Project and the Fourth Train Proposal be combined in the assessment of likely impacts.*** **Discussion:** The Public Environmental Review (PER) document indicates that there are no additional emissions/impacts associated with the development of the Fourth Train. While it is acknowledged	In the PER/ Draft EIS: • 'additional impact' refers to the total emissions, discharges, wastes, impacts, likelihood, or risk due to the Fourth Train Proposal when added to that of the approved Foundation Project.

Issue number	Submitter	Submission and/or issue	Response to comment
		that the activities that will occur during the Fourth Train Proposal are not different from the Foundation Project, the quantum (extent and duration) of those activities will change. For example, there will be increased light and noise emissions and a substantial increase in shipping movements due to the development of the Fourth Train Proposal. In addition, Table 4.3 (page 173) includes another five gas fields identified for future development, but no detail is given in the document on the potential cumulative impacts of further developments utilising the additional infrastructure from this proposal. Parks and Wildlife recommends that the assessment of potential impacts from the Fourth train Proposal on the environmental values of Barrow Island Nature Reserve needs to consider the cumulative and indirect pressures on those values, with particular reference to marine turtles *and* terrestrial fauna.	• 'additive impact' refers to a situation in which a particular factor is affected by more than one stressor from the Fourth Train Proposal or Foundation Project or both. • 'cumulative impacts' refers to the potential incremental impacts of the Fourth Train Proposal when combined with the approved Foundation Project and other present and reasonably foreseeable future actions. Figure 1 in Appendix 1 provides a diagrammatical overview of these impact assessment terms. Additional impacts (including potential direct, indirect, and facilitated impacts) and additive impacts from the Fourth Train Proposal and the Foundation Project are assessed in these sections of the PER/Draft EIS: • Section 5 (*Emissions, Discharges, and Wastes*) • Section 9 (*Terrestrial Environment – Impacts and Management*) • Section 10 (*Coastal and Nearshore Environment – Potential Impacts and Management*) • Section 11 (*Greenhouse Gas Emissions and Energy Management*) • Section 12 (*Quarantine Management*) • Section 13 (*Matters of National Environmental Significance – Impacts and Management*) • Section 14 (*Social, Cultural, and Economic Impacts and Management*). Section 15 of the PER/Draft EIS (*Cumulative Impacts*) describes the potential incremental impacts of the Fourth Train Proposal when combined with the approved Foundation Project and other present and reasonably foreseeable future actions. Potential additional impacts on marine turtles are discussed throughout Section 10 (*Coastal and Nearshore Environment – Impacts and Management*) of the PER/Draft EIS. Potential additional impacts on terrestrial fauna are discussed throughout

Issue number	Submitter	Submission and/or issue	Response to comment
			Section 9 (*Terrestrial Environment – Impacts and Management*) of the PER/Draft EIS. Both marine turtles and terrestrial fauna, as they relate to matters of national environmental significance, are discussed in Section 13 (*Matters of National Environmental Significance – Impacts and Management*). The cumulative impact assessment undertaken in Section 15 (*Cumulative Impacts*) of the PER/Draft EIS addresses the incremental impacts of the Fourth Train Proposal when combined with the approved Foundation Project and other present and reasonably foreseeable future actions (termed 'considered actions'). The additional five gas fields identified in Table 4-3 (*Gas Fields Proposed to be Developed as Part of the Phased Development of the Combined Gorgon Gas Development, and Future Developments*) of the PER/Draft EIS are considered actions, which may have the potential to impact cumulatively on the marine environment with the Fourth Train Proposal, as described in Section 15.3.2.9 (*Future Gas Fields Developed as Part of the Gorgon Project*) and Table 15-3 (*Stressors Associated with the Considered Actions included in the Cumulative Impact Assessment*) of the PER/Draft EIS. The impact of stressors from these additional five gas fields acting cumulatively with the Fourth Train Proposal is assessed throughout Section 15 (*Cumulative Impacts*) of the PER/Draft EIS.
3	Department of Parks and Wildlife	Quarantine[1] Parks and Wildlife supports the proponent's continuing strong commitment to quarantine standards on Barrow Island. However, given the extended duration of the construction phase coupled with an increased workforce, Parks and Wildlife considers there is likely to be some degree of increase in quarantine risk. Parks and Wildlife recommends the quarantine risk is reassessed to take into account the increase in construction workforce over the extended period of construction associated with the Fourth Train Proposal to determine if the cumulative risk remains low or if additional risk mitigation	To manage the potential for the Foundation Project to affect the conservation values of Barrow Island through the introduction of Non-indigenous Terrestrial Species and/or Marine Pests to Barrow Island and its surrounding waters, Chevron Australia (on behalf of the GJVs) has developed and is implementing the Quarantine Management System (QMS; Chevron Australia 2014a). The QMS is based on 13 material pathways, which were identified in consultation with community stakeholders and independent experts. These material pathways and the proposed quarantine barriers associated with each material pathway underwent a comprehensive risk analysis, which again involved independent experts. The risk

[1] Although this discussion point falls under the Western Australian Department of Parks and Wildlife (DPaW's) Recommendation 1 on cumulative impacts, it addresses additional impacts rather than cumulative impacts. Refer to the response to Issue Number 2 for a detailed explanation of the impact assessment terms.

Issue number	Submitter	Submission and/or issue	Response to comment
		measures are required. Parks and Wildlife recommends that the potentially increased quarantine risk is acknowledged and considered when continuing to implement the Quarantine Management System.	analysis process did not look at volume of cargo, numbers of personnel or frequency of delivery to Barrow Island, as the material pathways are independent of, and not affected by these factors. The process focused on quarantine barrier analysis (e.g. contractor engagement, pre-border processes, inspection, chemical treatments, on-island surveillance). The quarantine barriers that were assessed, which Chevron Australia is now implementing, and the resultant risk level remain the same regardless of the workforce numbers or the duration of construction. Data collected from construction of the Foundation Project has shown the number of quarantine incidents is independent of the amount of freight transported to Barrow Island and the size of the construction workforce. The two material pathways associated with an increase in construction workforce over an extended period are: 1. Food and Perishables 2. Personnel and Luggage. The Food and Perishables pathway already has strong controls in place, which include: • Ongoing training and awareness • Pre-processing of food (e.g. peeling, chopping, washing) • Quarantine Management Plan that includes pest control and housekeeping measures are in place at Contractor (and subcontractor) facilities • Compliance visits to Contractor (and subcontractor) facilities • Food Consolidation Centre • Inspection by Contractor and Chevron Australia prior to mobilisation to Barrow Island, and again on arrival • 'Closed' facility at Barrow Island (e.g. sealed receival dock, air curtains on entry and exits, air filtration system, waste management) • Ongoing pest control and housekeeping measures • Ongoing monitoring and surveillance. The Personnel and Luggage pathway already has strong controls in place, which include: • Ongoing training and awareness

Issue number	Submitter	Submission and/or issue	Response to comment
			• Passenger declaration card, which was recently revised to include greater detail with respect to penalties if a passenger is non-compliant • Inspection • X-ray, including ongoing competency training and review for Contractor and Chevron Australia personnel • Detector dogs, which have recently undergone additional scent training for cockroaches and millipede recognition. The Western Australian Environmental Protection Authority (EPA) stated in Report 1323 for the Gorgon Gas Development Revised and Expanded Proposal, that the Quarantine Management System 'subject to it being implemented as proposed, is likely to be world's best practice and therefore it is unlikely to be possible to recommend additional practical controls beyond that system' (EPA 2009). As such, no measures or controls or monitoring programs additional or different to those required for the Foundation Project have been assessed as being necessary to manage the potential incremental or additional impacts from Fourth Train Proposal quarantine management. The QMS implementation by the Foundation Project has been found to be effective at managing the quarantine risks associated with the Foundation Project. No introduced Non-indigenous Terrestrial Species or Marine Pests and no proliferations of existing weeds or new weed establishment ('infestation') as a result of the Foundation Project have occurred on Barrow Island (Chevron Australia 2013). The GJVs consider that the approved Foundation Project QMS, as amended from time to time, is suitable to effectively manage the quarantine risks from the Fourth Train Proposal such that risks are environmentally acceptable and the environmental objective is met.
4	Department of Fisheries	<u>Baseline data</u> The Department understands that most of the environmental baselines for the Expansion Proposal have been drawn from the 2005 Draft Environmental Impact Statement. There has, however, been significant environmental change in the project area resulting from extreme events (e.g. marine heat wave/coral bleaching) and Chevron operations (e.g. dredging) since 2005. The Department	Fourth Train Proposal marine activities are primarily to be conducted off the west coast of Barrow Island, and are therefore unlikely to interact with Foundation Project dredging impacts off the east coast of Barrow Island. The baseline for the Fourth Train Proposal was established using a number of sources from the Foundation Project including the 2005 Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Gorgon Gas

Issue number	Submitter	Submission and/or issue	Response to comment
		therefore thinks it is appropriate that some new baseline data be collected to assess the impacts of the Expansion Proposal.	Development (Chevron Australia 2005) and the Gorgon Gas Development Revised and Expanded Proposal Public Environmental Review (Chevron Australia 2008). The Fourth Train Proposal PER/Draft EIS also used a number of other more recent sources that incorporate monitoring data and post-development survey results available from the Foundation Project at the time of writing. The baseline for the Fourth Train Proposal was established in accordance with the approved Environmental Scoping Document. Such sources including: • Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (Chevron Australia 2011) • Gorgon Gas Development and Jansz Feed Gas Pipeline: Horizontal Directional Drilling Management and Monitoring Plan (Chevron Australia 2011a) • Gorgon Gas Development and Jansz Feed Gas Pipeline Upstream Facilities – Horizontal Directional Drilling Marine Monitoring. Technical Report – Marine Monitoring Survey 3 (Chevron Australia 2012) • Gorgon Gas Development and Jansz Feed Gas Pipeline: Reverse Osmosis Brine Disposal via Ocean Outfall Environmental Management and Monitoring Plan Temporary and Permanent Reverse Osmosis Facilities (Chevron Australia 2013a) • Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report – WAPET Landing, Dredge Spoil Disposal Ground, MOF, and LNG Jetty (Chevron Australia 2014b) • Gorgon Gas Development and Jansz Feed Gas Pipeline: Terrestrial and Subterranean Baseline State and Environmental Impact Report (Chevron Australia 2014c) • Gorgon Gas Development and Jansz Feed Gas Pipeline: Short Range Endemics and Subterranean Fauna Monitoring Plan (Chevron Australia 2014d) • Gorgon Post-Development Coastal and Marine State and Environmental Impact Survey Report, Year 1: 2011–2012 (Chevron Australia 2012a)

Issue number	Submitter	Submission and/or issue	Response to comment
			• Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environmental Impact Survey Report (Chevron Australia 2013b). Baseline data reported in these documents, including ecological information, monitoring data, survey results, lessons learnt, and/or ecological changes, were considered for, and included in, the Fourth Train Proposal baseline. Such information included ecological changes resulting from the Foundation Project (e.g. dredging) and/or resulting from natural occurrences (e.g. thermal coral bleaching).
5	Department of Fisheries	<u>Subsea structures and moorings</u> The installation of subsea structures (and associated exclusion zones) or moorings during construction and operation of the Expansion Proposal may result in the temporary or permanent displacement of fishing activities. Any loss of access to fishing grounds may require an adjustment to management arrangements to ensure fishery sustainability. To address this, we request that Chevron Australia Pty Ltd and their contractors undertake a detailed consultation process with fishers such that any potential impacts are appropriately managed.	The establishment of petroleum safety zones and moorings is discussed in Sections 14.5.2.2 (*Physical Presence of Infrastructure*), 10.4.2.2 (*Seabed Disturbance*), and 10.7.2.2 (*Seabed Disturbance*) of the PER/Draft EIS, respectively. Petroleum safety zones are regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) via the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) and the Petroleum Safety Zone Assessments Policy. Prior to the establishment of a petroleum safety zone, as required by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) and the Petroleum Safety Zone Assessments Policy, consultation will be undertaken with the relevant government agencies and other users likely to be especially affected by the establishment of the petroleum safety zone NOPSEMA 2014). Under the Petroleum Safety Zone Assessments Policy, for an application to establish a petroleum safety zone to be accepted by NOPSEMA, it must contain a consultation report which demonstrates there has been an appropriate level of consultation (NOPSEMA 2014). The consultation report should describe the consultation undertaken with the relevant agencies and any other users of the oceans commons likely to be especially affected by the establishment of the petroleum safety zone, a summary of each response that arose, an assessment of the legitimacy of any objection or claim of adverse impact, and a statement of the manner (if any) in which the applicant has responded or proposes to respond to each objection or claim (NOPSEMA 2014). Other ocean users expected to be relevant to the Fourth Train Proposal include

Issue number	Submitter	Submission and/or issue	Response to comment
			commercial fisheries. In addition to the consultation undertaken as part of the establishment of a petroleum safety zone, consultation will also be undertaken under the Environment Plan regime, as discussed in the response to Issue Number 36. Prior to the installation of moorings the appropriate regulatory agencies will be consulted. Depending on the location of a mooring and the potential interaction with other ocean users consultation may be undertaken with the relevant other ocean users prior to installation of the mooring.
6	Department of Fisheries	<u>Access to ports</u> Increased demand on existing ports due to vessel movements has the potential to restrict fishing vessel access to these ports. The Department requests that fishers are explicitly considered in the development of management and port access plans.	The Fourth Train Proposal will result in additional marine vessels in the vicinity of the Fourth Train Proposal Area during construction activities, and additional LNG, condensate, and logistics vessels during the operations phase, as discussed in Sections 4.5.4 (*Logistics*) and 4.7.3 (*Logistics*) of the PER/Draft EIS. Impacts on other ocean users, including fisheries, as a result of vessel movements from the Fourth Train Proposal are discussed in Section 14.5.2 (*Assessment and Mitigation of Potential Impacts*) of the PER/Draft EIS. The Fourth Train Proposal is expected to use Henderson, Barrow Island and Dampier ports for the majority of marine, LNG, condensate and logistic vessels. These ports are not currently used by commercial fisheries. The *Shipping and Pilotage Act 1967* (WA) governs shipping and pilotage in and about ports, boat harbours, and mooring control areas of the State. The *Port Authorities Act 1999* (WA) governs Western Australia's port authorities, covering their functions, responsibilities, concept of operations, and related matters. Under the *Port Authorities Act 1999* (WA), the port authorities, including the Pilbara Ports Authority, are accountable to the State Government. As part of their management function, port authorities facilitate fair and equitable access to port services and facilities. The Fourth Train Proposal will comply with the relevant requirements of each port and port authority, including those associated with accessing the ports.

<table>
<tr><th>Issue number</th><th>Submitter</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td>7</td><td>Department of Fisheries</td><td><u>Fishing activities in the area</u>

The Department notes that Chevron Australia Pty Ltd has already identified some potentially affected commercial fisheries. We provide the list below for cross-referencing:

<table>
<tr><th>Permit Area</th><th>Bioregion and Province</th><th>Commercial Fishing Interests</th></tr>
<tr><td rowspan="8">Greater Gorgon</td><td rowspan="8">North Coast; Northwest Shelf and Northwest Province</td><td>Mackerel Managed Fishery;</td></tr>
<tr><td>Pearl Oyster Fishery; Specimen</td></tr>
<tr><td>Shell Managed Fishery; Marine</td></tr>
<tr><td>Aquarium Fish Managed</td></tr>
<tr><td>Fishery; Onslow Prawn Interim</td></tr>
<tr><td>Managed Fishery; Pilbara Trap</td></tr>
<tr><td>Managed Fishery; Pilbara Trawl</td></tr>
<tr><td>Managed Fishery; Pilbara Line Fishery</td></tr>
</table>

The Department requests that all stakeholder engagement include consultation with the Western Australian Fishing Industry Council, Recfishwest and individual fishers in potentially affected fisheries. Importantly, the Department does not recognise the 'active' or 'non-active' fishery status described in the project proposal. Instead, we request that all fishers with a legitimate right to operate in the affected area are consulted, irrespective of their current fishing status. It is also important that fishers be consulted regarding the positioning of any moorings associated with this project.</td><td>These fisheries are all included in Section 6.8.4.4.2 (Fisheries)[2] of the PER/Draft EIS, and the potential impacts to these fisheries from the Fourth Train Proposal are assessed in Section 14.5 (Land and Sea Use) of the PER/Draft EIS.

Chevron Australia has previously consulted directly with the Western Australian Fishing Industry Council (WAFIC), RecFishWest, and individual fishery licence holders (including fisheries that are currently not active in the relevant areas) for the Foundation Project, with agreed engagement arrangements in place. Relevant stakeholders, including the relevant fishery licence holders and relevant fishing representative bodies, will be informed throughout the planning of the Fourth Train Proposal and during construction and operation. Ongoing stakeholder engagement activities will be aligned and coordinated with those of the approved Foundation Project. Consultation is also undertaken through the Environment Plan regime. See the response to Issue Number 36 for ongoing consultation requirements under the Fourth Train Proposal Environment Plans.

Prior to the installation of moorings the appropriate regulatory agencies will be consulted. Depending on the location of a mooring and the potential interaction with other ocean users consultation may be undertaken with the relevant other ocean users prior to installation of the mooring.</td></tr>
<tr><td>8</td><td>Public Submitter No. 1</td><td>Gorgon should of course, never have been approved on Barrow Island (gas pipelines now criss cross to Onslow and it was only approved for the profit margins of Chevron rather than strategic purpose).</td><td>The PER/Draft EIS was prepared to describe and assess the potential impacts from the Fourth Train Proposal. Section 4.2 (Alternatives to the Proposed Development) of the PER/Draft EIS outlines the selection process for locating the Fourth Train Proposal on Barrow Island as the preferred alternative for development.

The PER/Draft EIS is not required to reassess the impacts from the approved Foundation Project, or provide justification for Foundation Project approvals.</td></tr>
</table>

[2] The fishery provided by the Western Australian Department of Fisheries as the Pilbara Trawl Managed Fishery is referred to in the PER/Draft EIS as the Pilbara Fish Trawl (Interim) Managed Fishery.

Issue number	Submitter	Submission and/or issue	Response to comment
9	Public Submitter No. 1	Management plans bore everyone, no one reads them, or follows up on them, including surely your staff. Why not consider setting targets in a one page summary people can actually see are / are not achieved?	It is not possible to reduce the detail contained in the Environment Management Plans (EMPs) into a one-page summary due to the level of detail required to satisfy the Ministerial Conditions. For Gorgon Environmental Performance Reports, refer to the 'Reports' tab on this website http://www.chevronaustralia.com/our-businesses/gorgon/environmental-responsibility/environmental-approvals

2. Benthic Communities and Habitats

Issue number	Submitter	Submission and/or issue	Response to comment
10	Department of Transport	It is suggested that the proponent be required to contribute to scientific research, to improve our general understanding of temporary and long-term impacts of HDD cuttings on seabed and coastal environments.	The impact of the horizontal directional drilling /shore crossing cuttings on seabed and coastal environments is detailed in Sections 4.5.2 *(Shore Crossing)*, 5.5.3.2.2 *(Horizontal Directional Drilling)*, and Section 10.4.2.1 (*Seabed [Intertidal and Subtidal] - Discharges to Sea*) of the PER/Draft EIS. Drilling cuttings generated from drilling the pilot hole (prior to breaking through the seabed) are intended to be collected for possible re-use or disposal. In addition, drilling fluids used for the Fourth Train Proposal are expected to be low-toxicity and water-based, similar to those used by the approved Foundation Project. A modelling study has been conducted by the Foundation Project for the dispersion of horizontal directional drilling fluids and cuttings following seabed breakthrough. The study found that the impact of horizontal directional drilling cutting mounds on coastal sediment transport and nearby beaches is predicted to be negligible. Monitoring during both the Marine Baseline Program and the Post Horizontal Directional Drilling Construction Survey found no substantial differences in the characteristics of surficial sediments among sites in the Marine Disturbance Footprint, Potential Impact Sites outside the Marine Disturbance Footprint and Reference Sites (Oceanica 2013), confirming modelling predictions. Similarly, the volume of drilling fluids and cuttings discharged by the Foundation Project was found to have little to no detectable impact on the receiving environment (Asia Pacific Applied Science Associates [APASA] 2008)). Therefore, the impacts for the Fourth Train Proposal are considered to be effectively managed by the mitigation and management measures included in the Horizontal Directional Drilling Management and Monitoring Plan and no additional measures required.
		It is considered essential that all collected data and data analysis be made publicly available to aid in the assessment and management of future projects.	The GJVs have committed to contribute to scientific research through 'a series of initiatives to conserve the Flatback Turtle population and protect other endangered species' described in Ministerial Statement No. 800 as 'Additional Gorgon Joint Venture Undertakings'. The GJVs are not proposing to contribute to further scientific research for the temporary and long-term impacts of horizontal directional drilling cuttings on seabed and coastal environments.

Issue number	Submitter	Submission and/or issue	Response to comment
			As little to no detectable impact to the receiving has been found due to the Foundation Project horizontal directional drilling, it is not considered necessary to make all data and data analysis publically available. Furthermore, environmental offsets and additional undertakings are not deemed to be required, as outlined in the response to Submission Number 27.

3. Coastal Processes

Issue number	Submitter	Submission and/or issue	Response to comment
11	Department of Transport	Consideration should be given to the impact of the cutting mounds from the HDD on nearby beaches. It is acknowledged that the coastal studies have shown that the sediment transport rates along the foreshore are likely to be relatively low. However consideration should be given to identifying the gross sediment transport rates (i.e. the sediment transport rates in each direction parallel to the shoreline) when considering the impact of the cutting mounds on the shoreline, and not just the net environment.	See response to Issue Number 15.

4. Marine Environmental Quality

Issue number	Submitter	Submission and/or issue	Response to comment
12	Department of Transport	The proposed management measures outlined in this document and the previous Gorgon Gas Development and Jansz Feed Gas Pipeline: Horizontal Directional Drilling Management and Monitoring Plan (Chevron Australia, 2011f) appear reasonable. And it is necessary to conservatively estimate the potential maximum impact of the development. However, it is suggested that consideration should also be given to determining a 'best estimate' which may allow more efficient management of the environmental impacts during and following the HDD and pipeline installation. Over estimation of the potential impacts can have a flow on effect on placing monitoring sites in in effective locations or result in ineffective selection of management options.	The Foundation Project horizontal directional drilling marine monitoring program did not detect any project-attributable change in the horizontal directional drilling marine disturbance footprint as result of drilling fluid and cutting dispersion undertaken for the Foundation Project. Observational monitoring of turbidity levels during the discharge of drilling cuttings from Foundation Project horizontal directional drilling activities found the spatial area impacted, appeared to be smaller than that predicted by the sediment dispersion modelling and was related to weather rather than drilling activities (Oceanica 2011; Asia Pacific Applied Science Associates [APASA] 2008). Any dispersion noted was gone within one tide cycle, and the marine monitoring program did not detect any project-attributable change within or outside the horizontal directional drilling marine disturbance footprint. As the scale of the Fourth Train Proposal horizontal directional drilling campaign is smaller (fewer drilled holes compared to the Foundation Project), it will result in less material being discharged to the marine environment. The volume discharged by the Foundation Project was found to have little to no detectable impacts on the receiving environment; therefore the environmental impacts from drilling fluid and cuttings is considered to be effectively managed to be environmentally acceptable by the mitigation and management measures included in the Horizontal Directional Drilling Management and Monitoring Plan. No measures or controls additional to those required for the Foundation Project were assessed as being necessary to manage the potential incremental or additional impacts from the Fourth Train Proposal horizontal directional drilling. The GJVs anticipate that the mitigation and management measures included in the existing Foundation Project EMPs and Subsidiary Documents for offshore drilling and completion and pipeline installation will also apply to the Fourth Train Proposal. As such, the potential impacts from these activities are considered to be appropriately managed to be environmentally acceptable.

Issue number	Submitter	Submission and/or issue	Response to comment
			Determination of a 'best estimate' is not necessary in order to manage the impacts from Fourth Train Proposal horizontal directional drilling.
13	Department of Transport	There is high uncertainty remaining in the drilling fluid and cutting dispersion modelling with regards to the likely extent of environmental impact originating from the HDD and well drilling. Where possible initial modelling results and predictions of impacts should be validated following commencement of construction. Where predictions significantly differ from those actually monitored, management plans should be revised accordingly.	The Fourth Train Proposal horizontal directional drilling campaign is of a smaller size than the Gorgon Foundation Project campaign. As the Foundation Project horizontal directional drilling marine monitoring program did not detect any project-attributable change in the horizontal directional drilling marine disturbance footprint as a result of drilling fluid and cuttings, model validation for the Fourth Train Proposal campaign is not considered necessary in order to manage potential project impacts. Monitoring of the extent of drilling fluid and cuttings dispersion during well drilling is not considered necessary due to the deep offshore location, dispersive environment, and distance from coastal environmental sensitivities. Modelling is not necessary in order to manage the impacts from Fourth Train Proposal well drilling, and therefore isn't included in the PER/Draft EIS.
14	Department of Transport	Model predictions should be validated against post-construction monitoring data. It is recommended that a statement or commitment to this be included within the main report, along with an indicative post-construction monitoring plan.	See response to Issue Number 13.
15	Department of Transport	The impact assessment and monitoring of 1200 tonnes of material to be discharged to the marine environment (mainly cuttings) should be expected to: a) provide supporting information for the assumptions on the release rates of cuttings and turbidity generation from drilling; b) clarify if allowance for downtime due to environmental stoppages has been considered in determining the drilling durations; and c) consider the impact of those shallow water cutting mounds on coastal sediment transport in both sort-term cyclone vents and long-term average metocean (winds, waves, currents) climate at Barrow Island.	**Use of Foundation Project Modelling** A modelling study conducted for the approved Foundation Project Horizontal Directional Drilling Management and Monitoring Plan (Chevron Australia 2011a) predicted that approximately 1200 tonnes of material would be discharged to the marine environment from Foundation Project horizontal directional drilling activities. The Fourth Train Proposal is not predicted to result in a discharge of this size. The decreased scope of the Fourth Train Proposal horizontal directional drilling campaign (fewer drilled holes compared to the Foundation Project) is expected to result in less material being discharged to the marine environment, although the type of material is expected to be similar. As such, this modelling provides a conservative estimate of the impacts from HDD activities associated with the Fourth Train Proposal, and is appropriate to use in the impact assessment.

Issue number	Submitter	Submission and/or issue	Response to comment
			The following subsections address the Foundation Project modelling. **Release Rates of Cuttings and Turbidity from Drilling** The Foundation Project horizontal directional drilling fluid and cutting dispersion modelling study classified discharges according to whether they were produced from reaming stages, hole cleaning, or pipeline installation. Each of these discharge types is characterised by a different size distribution of drilling cuttings and muds, considered to be representative of the drilling process that produced them. **Environmental Stoppages** The Foundation Project horizontal directional drilling fluid and cutting dispersion modelling study did not include environmental stoppages as there were no down-time periods included other than off-shift time. **Impact of Cutting Mounds – Sediment Transport and Foreshore** The horizontal directional drilling exit point is likely to be in an area of unconsolidated sediment beyond the limestone pavement off the west coast of Barrow Island. It is expected to be approximately 400 to 500 m from the low water mark, in approximately 15 m water depth, which is comparable to the Foundation Project horizontal directional drilling. The Foundation Project horizontal directional drilling fluid and cutting dispersion modelling study predicted the Foundation Project sediment plume to be low concentration (>1 mg/L), and generally advected northward by the prevailing currents (APASA 2008). The modelling indicated some sediment would migrate around the northern end of Barrow Island and down the Barrow Island channel on a flooding tide, and move back westward around the northern end of Barrow Island on an ebbing tide (APASA 2008). The ebbing tide is then likely to carry the sediment off the shelf rather than back down the west coast of Barrow Island. The Foundation Project horizontal directional drilling fluid and cutting dispersion modelling study predicted that most of the breakout

Issue number	Submitter	Submission and/or issue	Response to comment
			material was predicted to settle within 25 m of the exit points, and that nearly 90% would settle into mounds within 50 m. The final footprint of the mound is predicted to be 15 cm high at its peak, and it is only likely to be slowly reworked by major wind and wave events (APASA 2008). Given the distance of the exit point from shore, and the results of the Foundation Project modelling, coupled with the smaller scale of the Fourth Train Proposal horizontal directional drilling campaign, the impact of horizontal directional drilling cutting mounds on coastal sediment transport and nearby beaches is assessed to be negligible. These aspects of the modelling do not alter the conclusions of the assessment outlined in the PER/Draft EIS that the potential impacts from horizontal directional drilling are environmentally acceptable and the environmental objectives are met.

Issue number	Submitter	Submission and/or issue	Response to comment
16	Department of Transport	It does not appear that the latest local metocean conditions (winds, waves, currents) have been incorporated into this new proposal. The sea level rise projections quoted in this proposal are out of date (Section 6.4.10.3) and contradictions exist between Section 4.9 and Section 6.4 of this proposal.	To produce an appropriate range of results, a five-year sample of metocean conditions was selected for the modelling, encompassing likely climatic variability experienced at Barrow Island. Those conditions were then checked against long-term averages and likely annual and inter-annual variability to ensure their appropriateness. Section 4.9.1 (*Sea Level Rise*) of the PER/Draft EIS describes Western Australian Planning Commission (WAPC) State Planning Policy 2.6: State Coastal Planning Policy (WAPC 2013), which provides guidance for coastal hazard risk management and adaptation. The Policy recognises that climate change will cause a variation in mean sea level, and recommends that coastal developments should allow a vertical sea level rise of 0.9 m to 2110. Section 6.10.3 (*Sea Level Rise and Storm Surge*) in the PER/Draft EIS used a projected figure from the Intergovernmental Panel on Climate Change (IPCC) for sea level rise of between 18 and 59 cm by 2100 (IPCC 2007), with a possible additional contribution from ice sheets of 10 to 20 cm (Commonwealth Scientific and Industrial Research Organisation [CSIRO] and Bureau of Meteorology [BOM] 2007). The IPCC now projects a range of possible sea level rises between 26 cm and 98 cm by 2100 (IPCC 2013), which is slightly higher than the figure used in the PER/Draft EIS. This minor change does not materially affect the impact assessment undertaken in the PER/Draft EIS. The Fourth Train Proposal Gas Treatment Plant is set above 12 m Australian Height Datum and is not expected to be affected by a projected sea level rise of 0.98 m. Areas within the onshore component of the Fourth Train Proposal Feed Gas Pipeline System Footprint may be inundated during a high tide if sea levels rose by 0.98 m. However, the onshore Feed Gas Pipeline System will be trenched and stabilised, and is not expected to be affected by inundation. A comparison of Sections 4.9.1 (*Sea Level Change*) and 6.4.10.3 (*Sea Level Rise and Storm Surge*) found no contradictions. A comparison of Sections 4.9.2 (*Extreme Weather Events*), 6.4.10.5 (*High Intensity Rainfall Events and Cyclones*), and 6.4.10.2 (*Precipitation Changes*) found no contradictions.

Issue number	Submitter	Submission and/or issue	Response to comment
17	Department of Transport	If undertaken, no details are provided of any recent model calibration. It is recommended that the impact prediction models be checked for accuracy by calibration of results against the background conditions, as soon after commencement of drilling, against construction conditions. Calibration should be against the local metocean conditions (waves, currents), water quality (turbidity) and sedimentation. It is recommended that the monitoring of requirements of waves and currents be included within the project's environmental conditions.	The horizontal directional drilling marine monitoring program, conducted under the Horizontal Directional Drilling Monitoring and Management Program did not detect any project-attributable change in the horizontal directional drilling marine disturbance footprint as result of drilling fluid and cutting dispersion undertaken for the Foundation Project. Actual dispersion did not exceed the dispersion modelled, and impacts were within the worst-case prediction. Given that the Fourth Train Proposal horizontal directional drilling campaign has a smaller scope, and that project-attributable change was not detected, calibration of the model is not necessary in order to manage the project impacts.
18	Department of Parks and Wildlife	<u>Shipping</u> While the potential for use of a grounded condensate vessel and resultant risk of loss of heavy fuel oil (HFO) is mentioned, there is no comment on a full bunker load or single bunker tank release or the increase of the level of risk from the Foundation Project. With the exception of condensate vessels, it is stated that all other spills from marine vessels will involve diesel. However, during the Foundation Project, offshore pipe and rock laying vessels were HFO powered. If HFO powered vessels are used in the Fourth Train construction, Parks and Wildlife recommends that the impacts of a potential spill need to be properly considered in spill scenarios on the east and west coasts of Barrow Island.	Assessment of the potential impacts of a bunker fuel spill off the east coast of Barrow Island is undertaken throughout Section 10*(Coastal and Nearshore Environment – Impacts and Management)* (see particularly Section 10.3.2.1.2 *(Accidental or Unplanned Releases – Hydrocarbons*) and Section 13 (*Matters of National Environmental Significance – Impacts and Management*). An impact assessment of a potential HFO spill as a result of Fourth Train Proposal activities is included in Appendix 2 to this document.
19	Department of Parks and Wildlife	***Recommendation 2: That hydrocarbon spill modelling is developed for an additional proposed gas field close to the continental shelf to complement the modelling completed for the proposal.*** **Discussion:** Spill modelling was conducted for what is considered a worst-case scenario involving a well blowout at the Chandon Gas Field, due to it being considered to have the highest potential for environmental impact as a result of the gas-to-oil-ratio compared to the other gas fields. Chandon is approximately 70 km away from and further offshore from the nearest other Fourth Train Proposal gas field. The other gas fields are located close to the edge of the continental shelf and are likely to be subject to significantly different ocean currents resulting in spill scenarios that are not comparable to the Foundation Project and Chandon modelled oil spill. Parks and	The geographic area impacted in the event of a well blowout is highly dependent on the direction and speed of ocean currents and wind in the area at the time of the blowout, and the volume of liquid released. Ocean currents are variable throughout the year, and will affect the transportation and fate of the release according to the prevailing conditions at the time. This can result in different spatial distributions from releases at different times of the year as well as interannual variations and different release locations. Stochastic modelling was conducted, which considered the spill scenarios using different samples of current and wind data (from a spatially variable data set that spans five years). This accounted for temporal and spatial variations in large-scale drift currents, which have largest magnitudes over the outer shelf waters (typically >200 m depth) together with tidal and wind-driven currents. While

Issue number	Submitter	Submission and/or issue	Response to comment
		Wildlife recommends that additional modelling of a well blowout on a gas field in closer proximity to Barrow Island (near to the continental shelf) be completed to indicate the likely impact of an oil spill. Maps showing spatial modelling of a spill should also be provided.	stochastic modelling does not provide an absolute measure of the likely extent of any one slick, it does provide an indication of likely patterns of slick movement, areas most likely to be affected, and areas unlikely to be exposed to the spilled hydrocarbons. In order to determine the worst case modelling scenario, as required by the Tailored Guidelines, the highest liquid release volume from any well was determined. An analysis of the combination of maximum flow rates per well (which are similar amongst the Fourth Train Proposal gas fields) and the condensate-to-gas-ratio (Chandon has a ratio approximately twice that of the other Fourth Train Proposal gas fields), results in Chandon having a substantially higher potential liquid release than the other gas fields. As Orthrus, Maenad and Geryon have condensate-to-gas ratios approximately half that of Chandon, a well blow out from these gas fields would result in approximately twice as much gas per volume being released through to the atmosphere than from a Chandon well blowout. This released gas would dissipate into the atmosphere with less impact to marine receptors than condensate. This difference in condensate-to-gas ratios also means that a well blow-out at Orthrus, Maenad or Geryon would release only approximately half the amount of condensate compared to a well blowout at Chandon (assuming same duration of blowout before the well was brought under control), substantially reducing the impacts in comparison to Chandon. Therefore the Chandon Gas Field was selected as the worst-case gas field for use in the hydrocarbon spill study despite its location further offshore compared to the other Fourth Train Proposal Gas Fields. As the Chandon Gas Field is representative of the worst case, no releases from other Fourth Train Proposal gas fields were modelled for the PER/Draft EIS. However, predictions about the effects of a well blowout at these other fields can be made on the basis of their flow-rates and condensate-to-gas ratios. The behaviour and fate of condensate released at the seafloor, and the resulting potential impacts are discussed in: • Section 10.5.2.3 (Marine Water Quality – Spills and Leaks) • Section 10.6.2.8 (Marine Fauna – Spills and Leaks)

Issue number	Submitter	Submission and/or issue	Response to comment
			• Section 10.6.3 (Marine fauna – Conservation-Significant Species) • Section 10.7.2.4 (Benthic Primary Producer Habitat – Spills and Leaks) Additionally, the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) require an operator to have an accepted Environment Plan in place for petroleum activities in Commonwealth Waters, and that this Environment Plan contain an Oil Pollution Emergency Plan (OPEP). NOPSEMA guidance states that oil spill trajectory modelling assists in decision making and development of the OPEP (NOPSEMA 2014a). Drilling and installation of subsea infrastructure at any of the Fourth Train Proposal gas fields will require an accepted Environment Plan and OPEP, which will provide additional detail on potential impacts in the event of a well blow-out at the relevant gas fields. Detailed modelling of well blowout scenarios at these gas field will be undertaken during this process, if required.
20	Department of Environment Regulation	**Recommendation 5: The proponent be advised that issues of sewage and other contaminants that may be discharged from offshore vessels moored in shallow waters needs further explanation in the PER.** **Discussion:** The PER states that offshore vessels will comply with the Regulations for the Prevention of Air Pollution from Ships contained in Annex VI of the International Convention (International Maritime Organization 1997), where relevant. The proponent needs to provide more information on where this is considered relevant. When the "Marine Vessels" component of the Solid and Liquid Waste Management Plan was developed, its intent was to cover general work vessels that were under power and moving. The proposal to manage discharges in accordance with MARPOL is neither relevant nor appropriate. MARPOL was designed to minimise pollution of the seas, primarily from the international; movement of vessels. It was not designed to manage activities, for example, from stationary accommodation vessels in shallow nearshore waters. The proponent is requested to demonstrate how it intends to manage emissions or discharges from stationary vessels at or near Barrow Island such that unacceptable impacts	As stated in Section 5.5.3.1, the Fourth Train Proposal may house some of the workforce on an offshore accommodation vessel as the last contingency. However, as the construction program for the Fourth Train Proposal is substantially less than the approved Foundation Project, an additional offshore accommodation vessel is unlikely to be required. The existing Barrow Island accommodation (e.g. the Construction Village [Butler Park]) is expected to house the Fourth Train Proposal workforce. In the unlikely event that an additional offshore accommodation is required, the vessel selection process and choice of location will be determined with considerations that include potential environmental impacts, e.g. distance from sensitive environmental receptors. The Prevention of Air Pollution from Ships contained in Annex VI of the International Convention (International Maritime Organization 1997) may become relevant if the vessel requires an onboard incinerator or power plant. Should this be required, any relevant licenses and/or works approvals required under Part V of the EP Act would be sought. An accommodation vessel may require discharging waste streams

Issue number	Submitter	Submission and/or issue	Response to comment
		from emissions are prevented.	to the marine environment. These may include reverse osmosis brine, treated wastewater output from a sewage treatment plant or wastewater treatment plant, greywater, and macerated food waste. In the unlikely event that an additional accommodation vessel is required at or near Barrow Island, the GJV's propose to manage waste discharges in line with the Solid and Liquid Waste Management Plan. The objectives of the Solid and Liquid Waste Management Plan are included in Table 3-1 of the PER/Draft EIS. The Solid and Liquid Waste Management Plan specifies that any discharge from a marine vessel directly to the marine environment shall be managed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL). MARPOL identifies waste streams that may be discharged into the marine environment from both stationary and transiting vessels. Of these waste streams, MARPOL requires some waste streams to be discharged from a vessel on-route only, including food waste (including macerated food waste), oily water, and untreated sewage. These waste streams would be removed from the stationary accommodation vessel and transferred to an appropriately licensed facility. Additionally, the discharge of sewage will not occur from the vessel unless the sewage has first been treated in a sewage treatment plant of a type approved by the national Administration of the vessel. Chevron notes that the standards applied in MARPOL provide an indication of what has been internationally agreed as acceptable for the prevention of impacts on the marine environment from vessel discharges and is therefore both relevant and appropriate for the management of potential environmental impacts resulting from discharges to the marine environment, including in Barrow Island Port. Note also that the Solid and Liquid Waste Management Plan has recently been amended and approved to allow for the possibility of sea disposal of greywater and treated wastewater from accommodation vessels. The text relating to sea dumping states '*Following an assessment of potential disposal options, Chevron will consult with the Commonwealth Department of the Environment (DotE) regarding sea disposal options and permitting requirements. If granted, sea dumping will then be undertaken in accordance with*

Issue number	Submitter	Submission and/or issue	Response to comment
			the conditions specified in a Sea Dumping Permit.' Should a Reverse Osmosis Plant be required, the discharges may be required to be managed through the Reverse Osmosis Brine Disposal via Ocean Outfall Environmental Management and Monitoring Plan (Temporary and Permanent Reverse Osmosis Facilities). In addition to the Solid and Liquid Waste Management Plan and Reverse Osmosis Brine Disposal via Ocean Outfall Environmental Management and Monitoring Plan (Temporary and Permanent Reverse Osmosis Facilities), the GJV's intend to manage emissions and/or discharges from stationary vessels – such as an accommodation vessel – at or near Barrow Island through Sea Dumping Permits, Works Approvals and Licences where required. The conclusions of the assessment outlined in the PER/Draft EIS, that the potential impacts from stationary vessels are environmentally acceptable and the environmental objectives are met, are not altered.
21	Department of Environment Regulation	**Recommendation 6: That the proponent include in the PER, management and assessment of acid sulfate soils associated with cuttings at horizontal drilling access points for the installation of pipelines in the nearshore environment.** **Discussion:** The use of horizontal drilling to install infrastructure across mangroves and tidal flats is supported as disturbance of surface sediments are generally reduced, limiting the potential for oxidation and the formations of acid sulfate soils. However, drilling is likely to generate cuttings from below the water table when horizontal drilling emerges above the land surface at pipeline beachheads. The disposal of cuttings in shallow water will need to be carefully managed because of large tidal variation and wave action that has the potential to cause this material to oxidise and release metals into the water column. DER considers an explanation on how this will be managed when the fourth train is developed, to be relevant to the PER.	Potential acid sulphate soils have not been identified on Barrow Island, including below the water table. The shore crossing environment is described in Section 6.4.6 as: *…comprises coastal sands overlaying shoreline limestone platforms. An outcrop of limestone forms an extensive rock platform between the water and the sand, and runs parallel to the sandy beach.* Therefore no acid sulphate soils are predicted.

5. Marine Fauna

Issue number	Submitter	Submission and/or issue	Response to comment
22	Department of Parks and Wildlife	Marine Turtles It is noted that there have been physical changes recorded on turtle nesting beaches for the threatened flatback turtle species adjacent to the plant site (i.e. sand loss at Terminal and Bivalve beaches), and that these changes could have a negative impact on nesting success of turtles on those beaches. It is also noted that that the PER indicates that the lighting associated with the Fourth Train Proposal will be within management guidelines during construction and operation of the completed Train. Given that the flatback turtle population may already have been impacted by the physical changes to the above nesting beaches, which was not specifically identified when the environmental impacts of the Foundation Project were assessed, Parks and Wildlife recommends an assessment is conducted of the likely impacts of the existing pressure from these physical changes combined with potential additional lighting pressure. Additional management or mitigation measures could be considered via this assessment.	**Marine Turtles** The potential impact of the materials offloading facility and the LNG jetty on nearby beaches was considered as part of the Gorgon Foundation Project. As a result, a Coastal Stability Management and Monitoring Plan with the objective of establishing "a monitoring programme to detect adverse changes to the beach structure and beach sediments that could have implications for marine turtles nesting on the beaches adjacent to the marine facilities" is required under the Gorgon Foundation Project Ministerial Conditions. It should be noted that there is no evidence of sand loss at Terminal and Bivalve beaches; rather the sand there has been redistributed. Potential impacts to marine turtles are managed under both the Coastal Stability Management and Monitoring Plan and the Long Term Marine Turtle Management Plan. The Long Term Marine Turtle Management Plan includes a number of monitoring programs, including programs focussed on Flatback Turtles on the east cost of Barrow Island. The Flatback Turtle Tagging Program did not detect any impacts to Flatback Turtle nesting rookery size, demographics, survivorship, recruitment, and abundance during the 2013–2014 reporting period as a result of Gorgon Foundation Project activities. Population estimates during the 2012–2013 and 2013–2014 seasons were the highest since monitoring commenced. There were changes to the localised beach usage and the spatial distribution of nesting Flatback Turtles at both Terminal and Bivalve beaches. These changes reflect the sediment redistribution along those beaches, however the changes are localised and data indicates that the nesting success of Flatback Turtles at Bivalve and Terminal beaches was not adversely affected by Gorgon Foundation Project activities. The Fourth Train Proposal is not proposing any additional infrastructure on the west coast of Barrow Island that could affect sand distribution. The Fourth Train Proposal is not anticipated to affect the abundance, diversity, or geographic distribution of marine fauna, including marine turtles, found within or adjacent to the Fourth

Issue number	Submitter	Submission and/or issue	Response to comment
			Train Proposal Area. The GJVs consider that the stressors to marine fauna will be able to be adequately managed such that the impacts are environmentally acceptable and the environmental objective is met. Under Condition 5.3 of MIS 800 (and equivalent Commonwealth conditions) Chevron is required to submit a Five Year Environmental Performance Report in 2015. This will involve analysis and reporting of five years' worth of data, as well as proposed management improvements (Condition 5.3(iv), MIS 800) and review of lighting measures and controls (Condition 5.3 (v), MIS 800).
		Shipping It is noted that there will be a substantial increase in shipping movements as a result of the Fourth Train Proposal. While the potential impact of this factor has been assessed, it has not been considered in combination with other potential impacts on marine fauna, particularly marine turtles, such as lighting, noise and spills.	**Shipping** Stressors identified to have the potential to impact marine fauna in the coastal and nearshore environment are: • artificial light (Section 10.6.2.2 [*Artificial Light*]) • discharges to sea (Sections 10.5.2.1 [*Discharges to Sea*] and 10.6.2.3 [*Discharges to Sea*]) • noise and vibration (Section 10.6.2.4 [*Noise and Vibration*]) • seabed disturbance (Sections 10.5.2.2 [*Seabed Disturbance*] and 10.6.2.5 [*Seabed Disturbance*]) • physical interaction (Section 10.6.2.6 [*Physical Interaction*]) • spills and leaks (Sections 10.5.2.3 [*Spills and Leaks*] and 10.6.2.8 [*Spills and Leaks*]). • Section 13.4 (*Listed Threatened and Migratory Species and Communities – Marine Species, and Their Habitats*) Key marine fauna of concern for the impact assessment of the Fourth Train Proposal include marine turtles and marine mammals. Potential additive impacts on marine mammals are discussed in Section 10.6.3.2.1 (*Cetaceans – Blue Whales, Humpback Whales, Sperm Whales, Australian Snubfin Dolphin, and Indo-Pacific Humpback Dolphin – Cetaceans Summary*), and Section 10.6.3.2.2 (*Dugongs– Dugongs Summary*) of the PER/Draft EIS. Light, including light from shipping, is not expected to impact marine mammals, and the probability of a major spill occurring (and thereby contributing to additive impacts) is considered low. Key interactions

Issue number	Submitter	Submission and/or issue	Response to comment
			of the identified stressors that could result in an additive impact to marine mammals are noise and physical interaction, both of which are stressors potentially associated with shipping. This additive impact has the greatest potential to affect migrating Humpback Whales. However, physical interaction risks posed by shipping are highly localised and short term, and noise from construction activities will be intermittent. Potential impacts identified from the marine fauna assessment that may interfere with breeding, feeding, migration, or resting behaviours are unlikely at a population level. Key marine reptile species identified for the impact assessment of the Fourth Train Proposal include Flatback Turtles and Green Turtles. Potential additive impacts on Flatback Turtles on the east coast of Barrow Island and Green Turtles at Whites Beach on the west coast of Barrow Island are discussed in Section 10.6.3.1 (*Green Turtles, Flatback Turtles, and Hawksbill Turtles – Marine Reptiles Summary*) of the PER/Draft EIS. Noise, including noise from shipping, is not expected to impact marine turtles, and the probability of a major spill occurring (and thereby contributing to additive impacts) is considered low. Key interactions of the identified stressors that could result in an additive impact to marine turtles on the east coast of Barrow Island are artificial light and physical interaction, both of which are stressors potentially associated with shipping. This additive impact has the potential to affect nesting turtles and hatchling orientation, as well as foraging turtles. However, as the Long-term Marine Turtle Management Plan (Chevron Australia 2014e) has shown no statistically significant change in turtle sightings off the east coast as a result of Foundation Project construction, the Fourth Train Proposal is not anticipated to increase the consequence of impact from that assessed for the Foundation Project. Additive impacts are not expected off the west coast of Barrow Island, as North Whites Beach is not heavily used as a natal beach by Green Turtles and suitable foraging and courting areas over the limestone platform exist elsewhere. The short-term displacement of any foraging/courting animals in the nearshore area may reduce their exposure to stressors associated with localised seabed disturbance, discharges to sea, and physical interaction, which could otherwise result in additive stress/impacts to the species.

Issue number	Submitter	Submission and/or issue	Response to comment
			Assessment of potential additive impacts on marine fauna from a potential HFO spill as a result of Fourth Train Proposal activities is included in Appendix 2 to this document.
		While the potential for use of a grounded condensate vessel and resultant risk of loss of heavy fuel oil (HFO) is mentioned, there is no comment on a full bunker load or single bunker tank release or the increase of the level of risk from the Foundation Project. With the exception of condensate vessels, it is stated that all other spills from marine vessels will involve diesel. However, during the Foundation Project, offshore pipe and rock laying vessels were HFO powered. If HFO powered vessels are used in the Fourth Train construction, Parks and Wildlife recommends that the impacts of a potential spill need to be properly considered in spill scenarios on the east and west coasts of Barrow Island.	Assessment of the potential impacts of a bunker fuel spill off the east coast of Barrow Island is undertaken throughout *Section 10: Coastal and Nearshore Environment – Impacts and Management* (see particularly *Section 10.3.2.1.2: Accidental or Unplanned Releases – Hydrocarbons*) and Section 13 (*Matters of National Environmental Significance – Impacts and Management*). An impact assessment of a potential HFO spill as a result of Fourth Train Proposal activities is included in Appendix 2 to this document.

Issue number	Submitter	Submission and/or issue	Response to comment
23	Department of Fisheries	<u>Biosecurity</u> *In accordance with the Fish Resources Management Regulations 1995* (reg. 176(1)), the Department requires that all vessel managers and operators of immersible equipment minimise the risk of translocating pests and diseases into or within WA waters. Vessel hulls, sea chests and niche areas must be 'clean' before each voyage. To help minimise this risk, the Department's preferred position is that Chevron Australia Pty Ltd develop an overarching Invasive Marine Species (IMS) plan for its operations in Australia. Such a plan would put them on par with other companies that have looked to best practice standards to ensure that structures and vessels in Australian waters are effectively managed for IMS. In the absence of an overarching IMS plan, Chevron Australia Pty Ltd will need to work with the Department of Fisheries to develop an effective project specific IMS strategy that is compliant with the *Fish Resources Management Act 1994* (WA).	The QMS details quarantine barriers for 13 material pathways. One of the identified pathways is marine vessels (topsides and wetsides). The Marine Vessel pathway and the proposed quarantine barriers associated with this pathway underwent a comprehensive risk analysis, which involved independent experts. The Marine Vessels pathway already has strong controls in place, which include: • Vessels must be free from secondary fouling prior to the initial mobilisation to the Barrow Island Marine Quarantine Limited Access and Controlled Access zones • Vessels must meet Commonwealth Department of Agriculture, Fisheries and Forestry Biosecurity ballast water requirements and must not discharge high-risk ballast water • Vessels entering the Barrow Island Marine Quarantine Controlled Access Zone must have quarantine compliant ballast tanks • Wetside commissioning inspection must be undertaken by a Chevron Australia approved marine biologist prior to the initial mobilisation to the Barrow Island Marine Quarantine Limited Access and Controlled Access Zones • Contractor engagement • Ongoing training and awareness • Vessel Quarantine Management Plan that includes topside compliance, wetside compliance, ballast water management, ongoing pest control, vessel housekeeping, vessel provisioning, and quarantine event response • Ongoing monitoring and surveillance. During the Foundation Project, Chevron Australia has mobilised more than 300 marine vessels without introducing any marine pests. The quarantine barriers in place have led to the detection of four marine pests on marine vessels during the mobilisation process, but prior to wetside commissioning and prior to Chevron Australia approval to enter the Barrow Island Marine Quarantine Limited Access and Controlled Access Zones. The intercept of these marine pests were actioned accordingly and in consultation with the Western Australian Department of Fisheries, where required. The GJVs consider that the quarantine barriers under the QMS are

<table>
<tr><th>Issue number</th><th>Submitter</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td></td><td></td><td></td><td>sufficient and adequately address the requirements within both the Fish Resources Management Act 1994 (WA) and the Fish Resources Management Regulations 1995 (WA), and is suitable to effectively manage the quarantine risks from the Fourth Train Proposal such that risks are environmentally acceptable and the environmental objective is met. The QMS also meets the objectives of MIS 800. Chevron Australia would welcome examples of other IMS plans or best practices undertaken by other companies provided by the Department of Fisheries for review with continual improvement in mind.</td></tr>
<tr><td>24</td><td>Department of Fisheries</td><td><u>Spawning periods</u>

Spawning grounds and nursery areas for key fish species are particularly vulnerable to the impacts of spills, discharges and other marine development activities. Our data indicates that the following key fish species may be spawning within the proposed area of activities. These times should be taken into consideration in the event of a spill and when planning any activities associated with the project:

<table>
<tr><th>Bioregion</th><th>Key Fish Species within zone</th><th>Spawning / Aggregation times</th></tr>
<tr><td>North Coast</td><td>Blacktip shark (Carcharhinus tilstoni & C. limbatus)</td><td>Nov - Dec</td></tr>
<tr><td></td><td>Gold band snapper Pristipomoides multidens)</td><td>Jan - April</td></tr>
<tr><td></td><td>Rankin Cod (Epinephelus multiinotatus)</td><td>Aug - Oct</td></tr>
<tr><td></td><td>Red Emperor (Lutjanus sebae)</td><td>Jan - Mar</td></tr>
<tr><td></td><td>Pink Snapper (Pagrus auratus) (rare)</td><td>May - July</td></tr>
<tr><td></td><td>Sandbar shark (Carcharhinus plumbeus)</td><td>Oct - Jan</td></tr>
<tr><td></td><td>Spanish mackerel (Scomberomorus commerson)</td><td>Aug - Nov</td></tr>
</table></td><td>Of the fisheries operating in the Fourth Train Proposal area, few target the key fish species listed in the Department of Fisheries' comments (shown on the left) as spawning in the area (Department of Fisheries 2013). The fisheries that do target these species are the Pilbara Demersal Scalefish Fisheries (Pilbara Trap Managed Fishery and Pilbara Line Fishery – the Fourth Train Proposal area is closed to trawl fishing) and the Mackerel Managed Fishery. The WA North Coast Shark Fishery has targeted Blacktip shark and Sandbar shark in the past, however, there has been no reported fishing activity since 2008/09 (Department of Fisheries 2013).

The Pilbara Trap Managed Fishery targets include only two of the key species listed: Red Emperor Lutjanus sebae (14.9% of catch) and Rankin Cod Epinephelus multinotatus (15.4% of catch) (Department of Fisheries 2013). The Pilbara Line Fishery catches a much smaller number of scalefish than the trap fishery, and this catch is dominated by Ruby Snapper and Goldband Snapper (Department of Fisheries 2013), of which only Goldband Snapper is considered key fish species.

Spanish Mackerel are found throughout the Indo-West Pacific region (Table 1). The Western Australian Mackerel Managed Fishery primarily targets two species of mackerel, one of which is the Spanish Mackerel (Scomberomorus commerson) (Department of Fisheries 2013). This Fishery is divided into three areas extending from Cape Leeuwin in the south-west through to the Northern Territory border. Most of the catch is taken in the Kimberley area reflecting the tropical distribution of mackerel species.

In addition, the key species of fish listed by the Department of</td></tr>
</table>

<table>
<tr><th>Issue number</th><th>Submitter</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td></td><td></td><td></td><td>
Fisheries have extensive distributions, ranging far beyond Australian waters (Table 1). The only exception is C. tilstoni, which is only known from the continental shelf of Australia (Froese and Pauly 2014).

Table 1: Distribution of Department of Fisheries Key Fish Species
<table>
<tr><th>Key Fish Species Spawning within zone</th><th>Distribution</th></tr>
<tr><td>Blacktip shark (C. limbatus)</td><td>Western Atlantic: Nova Scotia, Canada to Brazil. Eastern Atlantic: Senegal to Democratic Republic of the Congo, Madeira, the Canary Islands, and Mediterranean. Indo-Pacific: Red Sea, Madagascar, and South Africa to China, Australia, Tahiti, Marquesas, and Hawaii. Eastern Pacific: Baja California, Mexico to Peru, including the Galapagos Islands.</td></tr>
<tr><td>Blacktip shark (C. tilstoni)</td><td>Indo-West Pacific: currently known only from the continental shelf of tropical Australia.</td></tr>
<tr><td>Goldband snapper (P. multidens)</td><td>Indo-Pacific: Red Sea, Arabian Sea, and East Africa to Samoa, north to southern Japan, south to Australia.</td></tr>
<tr><td>Rankin Cod (E. multiinotatus)</td><td>Indian Ocean: Persian Gulf to southern Mozambique and eastward to Western Australia. Not known from the Red Sea.</td></tr>
<tr><td>Red Emperor (L. sebae)</td><td>Indo-West Pacific: southern Red Sea and East Africa to New Caledonia, north to southern Japan, south to Australia.</td></tr>
<tr><td>Pink Snapper (P. auratus)</td><td>Indo-Pacific: widely occurring off New Zealand, Australia, Philippines, Indonesia, China, Taiwan, and Japan.</td></tr>
<tr><td>Sandbar shark (C. plumbeus)</td><td>Western Atlantic: southern Massachusetts, USA to Argentina; also Gulf of Mexico, Bahamas, Cuba, and south and west Caribbean. Eastern Atlantic: Portugal to Democratic Republic of the Congo, including the</td></tr>
</table>
</td></tr>
</table>

Issue number	Submitter	Submission and/or issue	Response to comment

	Mediterranean. Indo-Pacific: scattered records ranging from the Red Sea, Persian Gulf, and East Africa to the Hawaiian Islands. Eastern Pacific: Revillagigedo and Galapagos Islands
Spanish mackerel (*S. commerson*)	Indo-West Pacific: Red Sea and South Africa to Southeast Asia, north to China and Japan, and south to south-eastern Australia, and to Fiji. Immigrant to the eastern Mediterranean Sea by way of the Suez Canal. Southeast Atlantic: St. Helena.

Source: Froese and Pauly 2014

Although the individual species listed in Table 1 have identified aggregation times (listed in the Department of Fisheries' comments), the combined duration of these encompasses all the months of the year. Additionally, there is a lack of known and defined geographic aggregation areas for these species. This prevents scheduling planned project activities to take these aggregation times into account.

Given the localised nature of planned activities during the construction and operation of the Fourth Train Proposal and the wide distribution of the key species provided, the impacts to these species during those activities is considered to be negligible. Any potential spill, discharge, or marine construction activity in the Fourth Train Proposal Area would only affect a small proportion of the fish population or fishery for a relatively short duration. Potential impacts to fisheries are considered to be able to be managed to acceptable levels. The GJVs consider that the stressors to other ocean users will be adequately managed such that the potential impacts are socially acceptable and the social objective is met.

6. Flora and Vegetation

Issue number	Submitter	Submission and/or issue	Response to comment
25	Department of Parks and Wildlife	***Recommendation 3: That further detail is provided on the proportion of Barrow Island vegetation associations likely to be impacted in the 20 ha footprint of the horizontal directional drill (HDD) area.*** **Discussion:** Table 9.9 includes quantitative information on the proportions of the known areas of affected vegetation associations on Barrow Island Nature Reserve, for each of the vegetation associations occurring within the 20 ha footprint for the HDD area. However, without knowing what proportions the affected areas of these vegetation associations represent of the total area on Barrow Island Nature Reserve, it is unclear how significant any additional loss may be, particularly given that the data provided in the PER is based a survey area that covers only 11% of Barrow Island Nature Reserve. There are substantial increases in areas cleared for some of the vegetation associations between the Foundation Project and the Fourth Train Proposal, and three of these are in vegetation associations identified as conservation significant due to their restricted distribution. While only 11% of Barrow Island Nature Reserve has been mapped under Astron classification, the combined Astron and Mattiske surveys are likely to provide sufficient information to indicate whether these associations are restricted. Parks and Wildlife recommends that the information from both surveys is used to provide further detail on the proportions of vegetation associations likely to be impacted by the Fourth Train Proposal in relation to their distribution across the entire island.	The Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Gorgon Gas Development (EIS/ERMP) and the Gorgon Gas Development Revised and Expanded Proposal Public Environmental Review (Chevron Australia 2005, 2008 respectively) used the 34 broadscale vegetation units identified on Barrow Island by Mattiske and Associates (1993). However, with the progression of botanical survey work on Barrow Island since the Mattiske and Associates (1993) survey, it became apparent that there are a greater number and variety of broad floristic formations (across landforms) on Barrow Island than allowed for in the original classification system (Astron Environmental Services 2009). The Mattiske and Associates classification system is difficult to extend due to the inconsistent scale of vegetation description and a number of habitat and location issues (Astron Environmental Service 2008). Therefore, Barrow Island vegetation was mapped using a system that aligns with the hierarchical structure in the National Vegetation Information System (NVIS). The vegetation associations resulting from the NVIS work (Astron Environmental Services 2011) that were used in the PER/Draft EIS do not fully align with the broadscale vegetation units identified on Barrow Island by Mattiske and Associates (1993). However, the Mattiske and Associates 1993 classification system can inform the environmental impact assessment for the Fourth Train Proposal because the resulting vegetation mapping of vegetation formations extended across all of Barrow Island. Seven of the Mattiske and Associates (1993) vegetation formations occur within the horizontal directional drilling Site Area, as well as bare sand (Table 2). The dominant vegetation formations are F5 (hummock grassland of *Triodia wiseana* with emergent *Hakea suberea* on limestone ridges) and L9 (Hummock Grassland of *Triodia wiseana – Triodia angusta* with emergent *Sarcostemma viminali* spp. *australe* and *Ficus platypoda* var. *platypoda* on coastal limestone flats and low ridges with localised pockets of *Frankenia pauciflora*), which together comprise approximately 67% of the

<table>
<tr><th>Issue number</th><th>Submitter</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td></td><td></td><td></td><td>
Horizontal Directional Drilling Site Area.

Table 2: Vegetation Formations (Mattiske and Associates 1993) within the 20 ha Horizontal Directional Drilling Site Area
<table>
<tr><th>Vegetation Formation</th><th>Total on Barrow Island (ha)*</th><th>Foundation Project (ha)</th><th>Fourth Train Proposal (ha)</th><th>Combined (ha)</th><th>Percentage remaining</th></tr>
<tr><td>BS</td><td>82</td><td>0.44</td><td>0.77</td><td>1.21</td><td>98.52</td></tr>
<tr><td>C1</td><td>256</td><td>0.25</td><td>0.35</td><td>0.60</td><td>99.77</td></tr>
<tr><td>C2</td><td>530</td><td>2.42</td><td>2.66</td><td>5.09</td><td>99.04</td></tr>
<tr><td>C3</td><td>402</td><td>1.25</td><td>1.66</td><td>2.91</td><td>99.28</td></tr>
<tr><td>F1</td><td>1511</td><td>53.95</td><td>0.08</td><td>54.03</td><td>96.42</td></tr>
<tr><td>F5</td><td>1332</td><td>3.16</td><td>6.61</td><td>9.77</td><td>99.27</td></tr>
<tr><td>L9</td><td>1691</td><td>11.65</td><td>6.74</td><td>18.39</td><td>98.91</td></tr>
<tr><td>S1</td><td>190</td><td>0</td><td>0.32</td><td>0.32</td><td>99.83</td></tr>
</table>
Prior to Foundation Project clearing

• BS = Bare sand
• C1 = Coastal complex dominated by Spinifex longifolius on white foredunes; including Coastal Complex of Ipomoea pes-caprae ssp. brasiliensis and Spinifex longifolius on strand line foredunes
• C2 = Open Shrub of Acacia coriacea – Rhagodia preissii ssp. obovata – Olearia dampieri ssp. dampieri on elevated dunes on fringes of island
• C3 = Hummock Grassland of Triodia pungens with dense shrubs including Acacia bivenosa on back-slopes of foredunes
• F1 = Hummock Grassland of Triodia angusta on red earth flats and drainage lines
• F5 = Hummock Grassland of Triodia wiseana with emergent Hakea suberea on limestone ridges
• L9 = Hummock Grassland of Triodia wiseana – Triodia angusta with emergent Sarcostemma viminali spp. australe and Ficus platypoda var. platypoda on coastal limestone flats and low ridges with localised pockets of Frankenia pauciflora
• S1 = Mixed Herbfield and Grassland of Eragrostis xerophila. Eriachne flaccida and Sporobolus virgincus on clay pans.
</td></tr>
</table>

Issue number	Submitter	Submission and/or issue	Response to comment
			Following vegetation clearing by the Foundation Project and the Fourth Train Proposal, more than 96% of each vegetation formation potentially affected by vegetation clearing for the Fourth Train Proposal will remain on Barrow Island (Table 2). Therefore, these vegetation formations are well-represented elsewhere on Barrow Island, and support the conclusion of the assessment of potential impacts to vegetation and flora, which states the impacts are environmentally acceptable and the environmental objective is met.
26	Department of State Develop-ment	The PER in numerous instances indicates that up to 10 hectares of land will be cleared at the horizontal directional drill site at North Whites Beach (p 33, 45, 46, 47, 60, 182, 196 - and others). Please note that the land available for clearing is limited to 332 hectares under section 9 of the *Barrow Island Act 2003*, and that 330 hectares has already been used, or allocated, subject to current approved proposals.	Sections 4.5.2 (*Shore Crossing*), 6.5.1.2 (*Vegetation*), and 9.5.2.1 (*Vegetation Clearing and Earthworks*) of the PER/Draft EIS state that the exact location, size, and dimensions of the horizontal directional drilling site have not yet been finalised. So as to allow flexibility in the design and location of the horizontal directional drilling site, the PER/Draft EIS assesses a horizontal directional drilling site of up to 10 ha within a defined 20 ha area. This approach allows a conservative assessment because the horizontal directional drilling site design, once finalised, is expected to be smaller than the area assessed. The PER/Draft EIS, in Section 4.5.2 (*Shore Crossing*) and elsewhere, identifies that vegetation clearing will be within the allocated uncleared land available for tenure on Barrow Island for gas processing activities under the *Barrow Island Act 2003* (WA). In addition, Section 9.5.2.1.1 (*Assessment of Additional Impacts* of the PER/Draft EIS states that the area over which vegetation clearing and earthworks activities will take place as a result of the Combined Gorgon Gas Development will be within the 332 ha of uncleared land available for tenure on Barrow Island under the *Barrow Island Act 2003* (WA).

7. Terrestrial Fauna

Issue number	Submitter	Submission and/or issue	Response to comment
27	Department of Parks and Wildlife	Terrestrial fauna[3] The increased construction duration of the combined Foundation Project and Fourth Train Proposal has the potential to further impact on terrestrial fauna through an increase in road kills. The PER states that the additional impact of this factor from the Fourth Train Proposal will not occur across a greater area than the Foundation Project. However, it does not seem to consider the greater numbers of animals likely to be impacted and the potential effects this could have on populations of conservation significant fauna on Barrow Island Nature Reserve.	The potential impacts from the Fourth Train Proposal when added to those of the approved Foundation Project are assessed throughout Section 9 (*Terrestrial Environment – Impacts and Management*) and Section 13 (*Matters of National Environmental Significance – Impacts and Management*). Terrestrial fauna 'road kills' are assessed in Section 9.6.2.5 (*Physical Interaction*) and Section 13.3 (*Mammals*) of the PER/Draft EIS, where potential impacts are identified as most likely to occur during construction due to the significantly higher numbers of vehicles used on Barrow Island at that time compared with during operations. The assessment of physical interactions concludes that the Fourth Train Proposal additional to the approved Foundation Project (i.e. considering the combined projects) is likely to impact fauna individuals but will not compromise the population viability of species on Barrow Island. Conservation-significant species (EPBC Act-listed species and species protected under Western Australian State legislation) that are identified as vulnerable to physical interaction—Barrow Island Euro, Spectacled Hare-wallaby, Golden Bandicoot, and Boodie—are further assessed in Section 9.6.2.8.1 (*Barrow Island Euro, Spectacled Hare-wallaby, Golden Bandicoot, and Boodie*) and Section 13.3.2..2.1 (*Black-flanked Rock-wallaby, Boodie, Golden Bandicoot, Spectacled Hare-wallaby, and Barrow Island Euro*)of the PER/Draft EIS. This cross-references to Section 3.5.1.3 (*Mammals*) of the PER/Draft EIS, which discusses the results of Foundation Project monitoring of the Barrow Island Euro, Spectacled Hare-wallaby, Golden Bandicoot, and Boodie in an 'At Risk' zone (which is equivalent to the Terrestrial Disturbance Footprint and includes areas adjacent to roads) and in 'Reference' zones. The discussion states that changes in abundance for each mammal species monitored were broadly similar across both zones, and therefore can be attributed to natural causes. Natural causes include rainfall fluctuations and resulting changes to food availability, which can

3 Although this discussion point falls under DPaW's Recommendation 1 on cumulative impacts, it addresses additional impacts rather than cumulative impacts, as defined for this assessment (Figure 1 in Appendix 1). Refer to the response for Issue Number 2 for a detailed explanation of the impact assessment terms.

Issue number	Submitter	Submission and/or issue	Response to comment
			affect reproduction and survival rates. Section 3.5.1.3 (*Mammals*) of the PER/Draft EIS details the conclusions made from the analysis of the Foundation Project monitoring results: i.e. that there is no evidence to suggest variations in mammal species abundance are attributable to the Foundation Project (see Chevron Australia 2013). The assessment of additional impacts from physical interaction in the PER/Draft EIS identifies that the Fourth Train Proposal extends the construction period duration on Barrow Island compared with the Foundation Project alone, but that this extended duration is not predicted to increase the total number of vehicle movements on Barrow Island at any time compared with the maximum number of vehicle movements experienced under the Foundation Project alone. Therefore, the rate at which mammals may be impacted through physical interaction is not predicted to increase compared with the Foundation Project. As a result, the PER/Draft EIS concludes that variations in species abundance due to the addition of Fourth Train Proposal vehicle movements are not predicted, based on the analysis of the prior Foundation Project monitoring. The Fourth Train Proposal concludes that, although additional fauna individuals are likely to be impacted over time, impacts to population viability are not predicted. Analysis of data from the mammal monitoring programs on Barrow Island for 2012–2013 was ongoing as the PER/Draft EIS was finalised and therefore was not included. This data analysis is now complete and the results are included in the 2014 Environmental Performance Report (Chevron Australia 2014f), which was released at the end of October 2014. The results of the 2013-2014 mammal distance sampling program demonstrated that Barrow Island population and density estimates for the Spectacled Hare-wallaby and the Euro were the highest recorded since the commencement of monitoring in 2010, and have not been adversely affected by the Foundation Project. In addition, the results of the 2013-2014 mammal trapping programs on Barrow Island demonstrated that abundances of Burrowing Bettongs and Golden Bandicoots have not been adversely affected by Foundation Project activities. Table 3 contains further information on the mammal monitoring. Note that, the results show a decline in abundance of Golden Bandicoots for both ‘At Risk’ and ‘Reference’ zones due to natural population

<table>
<tr><th>Issue number</th><th>Submitter</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td></td><td></td><td></td><td>
fluctuations, but these fluctuations in abundance did not exceed lower control limits[4] and therefore no additional mitigation or management measures are triggered.

The results of the 2012–2013 mammal monitoring programs provide further indication that variations in abundance of mammal species on Barrow Island are not attributable to the construction of the Foundation Project, but likely due to annual fluctuations in environmental conditions. These results further support the conclusions of the PER/Draft EIS.

Table 3: Summary of 2013 Mammal Monitoring Program Findings
<table>
<tr><th>Mammal</th><th>Mammal Trapping</th><th>Distance Sampling</th></tr>
<tr><td>Boodie</td><td>On average, Boodie captures increased in both the ‘At Risk’ and ‘Reference’ zones, and stayed within the control limits.</td><td>N/A</td></tr>
<tr><td>Golden Bandicoot</td><td>There was an overall island-wide decline in the abundance of Golden Bandicoots. The overall assemblages within the ‘At Risk’ and ‘Reference’ zones were within the control limits.</td><td>N/A</td></tr>
<tr><td>Spectacled Hare-wallaby</td><td>The trend in abundance of Spectacled Hare-wallabies in the ‘At Risk’ zone exceeded the upper control limit in 2013, a trend continued since 2011 (i.e. the population is substantially increasing).</td><td>The estimated density of Spectacled Hare-wallabies increased in both zones from 2012 to 2013. The 2013 population and density estimates for the Spectacled Hare-wallaby population on Barrow Island were the highest recorded since the mammal monitoring program began in 2010.</td></tr>
<tr><td>Barrow</td><td>N/A</td><td>The population estimates were</td></tr>
</table>
</td></tr>
</table>

[4] Control charts use a power analysis approach for interpreting change to abundance, as abundance data on their own can be misleading when interpreting trends over time. The control charts approach may be used to monitor key parameters or indicators for significant ecological elements that may be at risk from Foundation Project-related stressors on Barrow Island. By calculating the error and control limits for baseline data it is poss ble to identify if future years’ data fall within or beyond the control limits. These control limits serve as the trigger points for action.

Issue number	Submitter	Submission and/or issue	Response to comment

Island Euro		higher in the 'Reference' zone than in the 'At Risk' zone for the first time since monitoring began in 2010. The population of Euros on Barrow Island is estimated to have increased to the highest levels since monitoring began.

As stated in Section 9.6.2.5 (*Physical Interaction*) of the PER/Draft EIS, the Foundation Project undertakes regular review of management measures to facilitate continuous improvement of environmental performance. Management measures that have been introduced by the Foundation Project to reduce physical interaction on roads include:

- Digital traffic signage placed alongside roads at vehicle fauna strike 'hotspots'
- Extended reduced speed time frames (20 minutes before dusk and after sunrise)
- In-vehicle Monitoring System
- Driver awareness annual refresher training provided on site
- Restricting light vehicle use between construction sites and Butler Park (Construction Village)
- Awareness campaigns
- Sealing (bitumen) of main roads.

As a result of the adaptive management used by the Foundation Project, the rate of physical interaction with fauna from vehicle strikes on the Foundation Project has steadily decreased. This rate, measured in fauna strikes per 1000 km of night driving, has declined from its highest level of 4.1 per 1000 km of night driving in February 2012, to a year-to-date rate of 0.277 per 1000 km of night driving for 2014. Management measures continue to be reviewed regularly to facilitate continuous environmental performance improvements. The Environmental Management Framework implemented for Foundation Project will be adopted for the Fourth Train Proposal, thus the GJVs are confident of the conclusion (as stated in the PER/Draft EIS) that the Fourth Train Proposal additional to the Foundation Project will not impact the population viability of terrestrial fauna.

8. Air Quality (Including Greenhouse Gas Emissions)

Issue number	Submitter	Submission and/or issue	Response to comment
28	Department of Environment Regulation	**Recommendation 1: That the proponent be requested to include some upset conditions/scenarios or otherwise provide explanation as to why these scenarios are no longer assessed or being considered for assessment.** **Discussion:** The modelling configuration and results have been modified a number of times since the first assessment was submitted in 2008. For example, the one-hour NO_2 concentration for the cold-start scenario was predicted to be 139% of the National Environment Protection Measure criteria in 2008, while this value was predicted to be 65% of the criteria (48.8% of criteria for regional modelling results) in the latest assessment. Similar patterns were also observed for ozone. The proponent is requested to detail why some of the upset conditions are no longer being included in the modelled scenarios.	Upset conditions are included in the PER/Draft EIS assessment, including black start and pigging; however, changes in the model set up and the model used since 2008 have produced different results as quoted. Changes to the model set up included changing the acid gas vent height from 15 m to 56 m, reducing the vent diameter, increasing the vent exit velocity, increasing the gas turbine and gas turbine generator exhaust stack height from 40 m to 45 m and altering the exhaust volume flow rates. These changes reflect design refinements and development of detailed design that have occurred since 2008. The 2008 Foundation Project modelling study also used different flare emissions characteristics compared to the recent studies, resulting in an increased buoyancy of the flare exhaust plume due to the effect of a large area point source release used in the recent study. This large area point source release is representative of the actual flare design. The 2008 Foundation Project modelling study used an older version of The Air Pollution Model with a Generalised Reaction Set (TAPM-GRS) photochemistry scheme, which is optimised for fast processing. This model represented all volatile organic compounds (VOCs) as one species (using smog reactivity [Rsmog]) with their competing reactions. This simplification in TAPM-GRS is known to produce an over-prediction in nitrogen dioxide (NO_2) concentrations and subsequently ozone (O_3) concentrations (O_3 is created by oxides of nitrogen reacting with VOCs in the presence of sunlight), hence the higher results quoted. The more recent and sophisticated TAPM with a Chemical Transport Model (TAPM-CTM) was used in the regional air quality assessment in the PER/Draft EIS. This uses actual VOC concentrations and emissions, therefore provides a far more accurate prediction of contaminants than TAPM-GRS, which at the present time is used only as a screening model due to its processing speed. The air quality modelling included in the PER/Draft EIS also includes carbon monoxide emissions, which are important when considering chemistry modelling.

Issue number	Submitter	Submission and/or issue	Response to comment
			NB: a comparison with approved Foundation Project modelling studies is outside of the scope of the Fourth Train Proposal assessment, as defined in the Environmental Scoping Document (Chevron Australia 2012b).
29	Department of Environment Regulation	**Recommendation 2: That the proponent be requested to provide and assess emission scenarios with significant ground level concentrations or explain why they were removed from the PER.** **Discussion:** In the draft PER, worst case scenarios (non-routine) were discussed. In the final PER, they have been omitted without explanation. Because the management of risk is central to much of DER's regulatory functions, it is considered that an explanation needs to be provided in the PER. As examples, the PER states that "*The black start scenario was predicted to be the worst case of the non-routine scenarios modelled; therefore, no results relating to the other modelled scenarios are presented in the PER/draft EIS*". DER also notes that Table 7-1 suggests that the "*pigging*" case appears to be the worst case scenario (scenario 3) for non-routine operations. In addition, the scenario 2c (routine operation of the Fourth Train Proposal with Regenerative Thermal Oxidiser [RTO]) and the scenario 2a (routine operation of the Fourth Train Proposal with AGRUs Venting) were also predicted to be the worst case routine scenarios. It appears all abovementioned scenarios were also removed from the final PER report without explanation.	During the early project design phases a number of options for the management of reservoir carbon dioxide (CO_2) during routine operations were explored, including injection (represented by scenario 2b), venting of all reservoir CO_2 from the Fourth Train Proposal (represented by scenario 2a) and regenerative thermal oxidisation (RTO; represented by scenario 2c). However, the venting and RTO scenarios were not developed any further during the engineering design phase and therefore will not be implemented. Accordingly, the only routine operating scenario presented in the Emissions and Discharges Section of the PER/Draft EIS is where the reservoir CO_2 is injected (scenario 2b). The pigging scenario produces significantly less NO_2, carbon monoxide and VOC emissions in comparison to the black start scenario; this is due to increased flaring during a black start. However, higher levels of benzene, toluene and xylene are emitted whilst pigging, as venting from the Acid Gas Removal Unit Vents is increased. During pigging the resultant maximum ground level concentrations for O_3 were predicted to be below the National Environment Protection (Ambient Air Quality) Measure (NEPM) (Ambient Air NEPM; National Environment Protection Council [NEPC] 2003) criteria, with a maximum of 93% (76.5% for the second highest concentration) of the 1-hour average and 69% of the 4-hour average criteria. However, these maximums are very unlikely to occur as they would require three Acid Gas Removal Units to be venting at the same time during the worst case dispersive conditions. These ground level concentrations are predicted to be a minor impact on the baseline air quality, considering the approved Foundation Project and other regional sources, and are within regulatory criteria and therefore acceptable.
30	Department of Environment	**Recommendation 3: The proponent be requested to provide an explanation for removing the Regenerative Thermal Oxidiser (RTO) assessment from the PER and/or clarify whether the RTO**	The Regenerative Thermal Oxidiser was an early design option for the plant (therefore it was included in the modelling as Scenario 2c),

Issue number	Submitter	Submission and/or issue	Response to comment
	Regulation	**will still be used in the Fourth Train Proposal.** **Discussion:** The RTO was claimed to be the largest source of SO_2 in the Fourth Train Project as it oxidises the H_2S in the acid gas recovery unit gas stream to SO_2. The modelling assessment of the RTO has been dropped from the PER without explanation. DER recommends the proponent review the emissions file provided to DER in the PER review and qualifies why this has been omitted when it was the most significant source of SO_2 in previous draft PER versions.	however, it has been discarded at the later stage of the design and will not be installed as part of the Fourth Train Proposal, hence it was not discussed in the PER/Draft EIS.
31	Department of Environment Regulation	**Recommendation 4: The proponent design and undertake a comprehensive ambient air quality monitoring program to validate the source and estimates of emissions.** **Discussion:** DER recognises the utility and power of previous modelling related to the operation of petro-chemical facilities. However, DER considers it is appropriate to validate estimates of emissions from real-time local data to improve and strengthen the large number of model based assumptions and projections associated with this project. This would help strengthen confidence in any management and regulatory requirements and better inform pollution issues associated with this project as well as other related projects in the area. It would also provide contemporary information rather than relying solely on modelling assessments using older data.	The approved Foundation Project Air Quality Management Plan (Chevron Australia 2014) describes the ambient monitoring program that is used to determine the performance of the environmental protection measures in comparison to the applicable assessment criteria. The Air Quality Management Plan also outlines how ongoing monitoring is to be assessed on a routine basis to ensure the program meets the air quality-related objectives outlined in Ministerial Statement No. 800. This assessment is based on actual monitoring results, not a comparison against predicted (modelled) ambient concentrations.
32	Public Submitter No. 1	Climate change impacts should be considered and mitigated if this thing is going to be expanded - it can no longer be said that this is being delivered on by the Feds, we all know direct action is a joke.	Greenhouse gas emissions from the implementation of the Fourth Train Proposal are considered and mitigated as outlined in Section 11 (*Greenhouse Gas Emissions and Energy Management*) of the PER/Draft EIS. The assessment of the greenhouse gas emissions from the Fourth Train Proposal has been conducted consistent with Commonwealth and State Government policy.

9. Offsets – Integrating Factor

Issue number	Submitter	Submission and/or issue	Response to comment
33	Department of Parks and Wildlife	***Recommendation 4: That consideration be given to environmental offsets or extensions to the existing additional undertakings.*** **Discussion:** No environmental offsets (or extensions to the existing additional undertakings) are presently proposed to balance the cumulative pressures that may result from the Fourth Train Proposal. Parks and Wildlife recommends that additional offsets (or extensions to the existing additional undertakings) be considered, particularly in relation to impacts on marine turtles and terrestrial fauna. It is also noted that Clause 11 of the *Gorgon Gas Processing and Infrastructure Project Agreement* (Schedule 1 to the *Barrow Island Act 2003*) requires proportionate, additional funding for Net Conservation Benefits to be agreed between the Joint Venturers and the State, and that the Joint Venture partners have agreed to negotiate the quantum of this proportionate increase in NCB funds with the State Government.	The WA Environmental Offsets Guidelines (EPA 2014) states "Environmental offsets will only be applied where the residual impacts of a project are determined to be significant, after avoidance, minimisation and rehabilitation have been pursued…Environmental offsets will only be considered after strategies to avoid and mitigate significant environmental impacts have been applied". Similarly, the Commonwealth Environmental Offsets Policy (COA 2012) states "For assessments under the EPBC Act, offsets are only required if residual impacts are significant[5]". The GJVs have demonstrated in the PER/Draft EIS that the Fourth Train Proposal has no 'significant residual environmental impacts' and that the mitigation and management measures have followed the 'hierarchy of control'. The Fourth Train Proposal has been designed to avoid, prevent, or reduce the potential for unacceptable adverse impacts. The GJVs are confident that residual incremental, additional, additive and cumulative impacts can be acceptably managed within the context of the existing Foundation Project environmental management framework such that they are acceptable and the objectives established for this assessment are met. The Fourth Train Proposal has been assessed to have no unacceptable or significant residual impacts and therefore, in accordance with the policy, environmental offsets are not required or appropriate for the Fourth Train Proposal [Section 16.3 (*Environmental Offsets*) of the PER/Draft EIS]. **Additional Undertakings** Additional undertakings were negotiated between the GJVs and the Minister for State Development during the initial environmental impact considerations of the Foundation Project and subsequently included in a tabled variation to the State Agreement in 2009. The

[5] *Significant as defined in Significant impact guidelines 1.1 – matters of national environmental significance and Significant impact guidelines 1.2 – actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies (Commonwealth of Australia 2012).*

Issue number	Submitter	Submission and/or issue	Response to comment
			GJVs are not proposing to extend or provide additional undertakings based on the assessment and conclusions of the PER/Draft EIS. The Fourth Train Proposal combined with the approved Foundation Project and WA Oil operations are not expected to create any substantial cumulative impacts to terrestrial flora, vegetation, marine fauna (turtles), terrestrial and subterranean fauna, and habitats on Barrow Island [Section 15 (*Cumulative Impacts*) of the PER/Draft EIS]. Refer to the responses to Issue Number 27 and Issue Number 22 for additional detail related to potential residual impacts on terrestrial fauna and marine turtles, respectively. **Net Conservation Benefits** The GJVs understand that the Fourth Train Proposal would result in 'proportionate' funding and the amount is to be agreed between the GJVs and the State. The quantum of this proportionate increase in net conservation benefit (NCB) funds specified in the State Agreement will be discussed and agreed with the State.
34	Department of State Develop-ment	The Net Conservational Benefit (NCB) payable for the fourth train - at the nameplate capacity of 5 million tonnes of LNG per year, the NCB payable subject to clause *11(6)* of the *Gorgon Gas Processing and Infrastructure Project Agreement* would be $20 million which would need to be paid together with a lump sum payment of $5 million on approval of the additional proposals. Additionally, the Department understands from Chevron's press release of 5 December 2012 that the nameplate capacity of each LNG train has been revised and increased by 4% from 5 Mtpa to 5.2 Mtpa. Clarification on this point by the proponent would be appreciated as the PER consistently states that the "nominal" capacity of the 4th train is 5 Mtpa, rather than a "nameplate" capacity of 5.2 Mtpa.	Clause 11 (6) of the State Agreement (as amended in 2009) states that if any expansion of the Project is undertaken beyond the nameplate capacity of 15 million tonnes per annum (MTPA), proportionate funding additional to the $60 million will be required. As mentioned in the response to Issue Number 33, the GJVs understand that the Fourth Train Proposal would result in 'proportionate' funding and the amount is to be agreed between the GJVs and the State. The quantum of this proportionate increase in NCB funds specified in the State Agreement will be discussed and agreed with the State. The nominal capacity for the three Foundation Project trains, and the train proposed in the Fourth Train Proposal, remains unchanged at 5 MTPA. As highlighted in the 5 December 2012 Chevron Media Statement, there is confidence the capacity of the three Foundation Project trains will exceed 5 MPTA, to at least 5.2 MTPA. However, as previously advised in discussions with the Department of State Development, the ultimate capacity will only be known when the Gas Treatment Plant has been operating for some time. The GJVs acknowledges that any change to the nameplate capacity for additional proposals will require further engagement with the

Issue number	Submitter	Submission and/or issue	Response to comment
			Department as per Clause 11 (6) of the Agreement.

10. Consultation

Issue number	Submitter	Submission and/or issue	Response to comment
35	Public Submitter No. 1	I recognise this 'lip service to public consultation' is a bureaucratic process with a pre-determined outcome that will only collate responses into themes, waste public officers time and inevitably be futile.	In preparation of the PER/Draft EIS, consultation was undertaken with various stakeholders, including government, community groups, environmental non-government organisations, industry groups and representatives, Aboriginal groups, and internal stakeholders. Key issues raised through this engagement and previous consultation undertaken as part of the Foundation Project were considered in preparation of the PER/Draft EIS. The public review process is a legislative requirement of the EPBC Act and the EP Act.
36	Department of Fisheries	Expectation and Implementation The Department requests that all potential impacts to fisheries, fish and fish habitat described in this letter are specifically identified in all Environment Plans associated with the Expansion Project. Should any objections or claims be raised during the consultation process, we request that these are resolved to the satisfaction of the regulator prior to commencement of activities. The Department's advice is valid for six months. For any activities commencing after this period, we ask that you re-consult with us a minimum of three months prior to initiating any on ground work. Given the potential duration of this project, and the overarching nature of this document, we also request that Chevron Australia Pty Ltd provide regular updates to the Department on activities that have the potential to affect the aquatic environment.	The comment from the Department of Fisheries' that their advice is valid for six months is noted. Accepted State and Commonwealth Environment Plans are required to be in place for petroleum activities under the Environment Plan regime and associated Commonwealth and Western Australian legislation. Consultation will be undertaken as part of the development of these Environment Plans in compliance with the relevant regulations to ensure relevant stakeholders, including the Department of Fisheries, are engaged at the appropriate time for the appropriate activities. The impacts and risks associated with petroleum activities, including the social, economic and heritage features of the environment, which encompasses commercial fisheries, fish species and habitats where relevant, require consideration under the Environment Plan regime. An Environment Plan must describe the existing environment that may be affected by the activity and include details of the particular relevant sensitivities of that environment. Various stakeholder consultation and reporting requirements must be met during the development of Commonwealth and State Environment Plans, including the development of implementation strategies that provide for appropriate consultation with relevant authorities and other relevant interested persons or organisations. Commonwealth Environment Plans are to include an assessment of the merits of any objection or claim about the adverse impact of each activity to which the Environment Plan relates; and a statement of the titleholder's response, or proposed response, if any, to each

Issue number	Submitter	Submission and/or issue	Response to comment
			objection or claim. The Western Australian Department of Mines and Petroleum (2012) Guidelines for the Preparation and Submission of an Environment Plan provides guidance regarding the resolution of issues and concerns raised during stakeholder consultation. Chevon Australia will consult with the Department of Fisheries as required under the relevant Environment Plans.

11. References Cited in Attachment 3

Asia Pacific Applied Science Associates. 2008. *Gorgon Upstream JV – Horizontal Drilling Simulation Study*. Prepared for Chevron Australia Pty Ltd by Asia Pacific Applied Science Associates, Perth, Western Australia.

Astron Environmental Services. 2008. *Letter Report Regarding Outstanding Queries on Barrow Island Vegetation – June 2008*. Unpublished report prepared for Chevron Australia Pty Ltd, June 2008

Astron Environmental Services. 2009. *Barrow Island Flora and Vegetation Review*. Unpublished report prepared for Chevron Australia, Perth, Western Australia.

Astron Environmental Services. 2011. *Barrow Island Flora and Vegetation Review: January 2011*. Unpublished report prepared for Chevron Australia, Perth, Western Australia.

Australian Transport Safety Bureau. 2013. *Australian Shipping Occurrence Statistics 2005 to 2012*. Australian Transport Safety Bureau, Canberra, Australian Capital Territory.

Australian Maritime Safety Authority. 2012. *Interim Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities*. Australian Maritime Safety Authority, Canberra, Australian Capital Territory.

Australian Maritime Safety Authority. 2013. *The Effects of Maritime Oil Spills on Wildlife including Non-Avian Marine Life*. Available from: http://www.amsa.gov.au/marine_environment_protection/national_plan/
general_information/oiled_wildlife/oil_spill_effects_on_wildlife_and_non-avian_marine_life.asp [Accessed 3 April 2013].

Chevron Australia. 2005. *Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Gorgon Development*. Available from: http://www.chevronaustralia.com/ourbusinesses/gorgon/environmental responsibility/environmentalapprovals.aspx [Accessed 6 January 2012].

Chevron Australia. 2008. *Gorgon Gas Development Revised and Expanded Proposal Public Environmental Review*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2011. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2011a. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Horizontal Directional Drilling Management and Monitoring Plan*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2012. *Gorgon Gas Development and Jansz Feed Gas Pipeline Upstream Facilities – Horizontal Directional Drilling Marine Monitoring. Technical Report – Marine Monitoring Survey 3*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2012a. *Gorgon Post-Development Coastal and Marine State and Environmental Impact Survey Report, Year 1: 2011–2012*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2012b. *Gorgon Gas Development Fourth Train Proposal: Public Environmental Review – Environmental Scoping Document*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2013. *Gorgon Gas Development: Ministerial Implementation Statement No. 800, Ministerial Implementation Statement No. 769, EPBC Reference: 2003/1294 (as amended) and EPBC Reference: 2008/4178 Environmental Performance Report 2013*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2013a. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Reverse Osmosis Brine Disposal via Ocean Outfall Environmental Management and Monitoring Plan Temporary and Permanent Reverse Osmosis Facilities*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2013b. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environmental Impact Survey Report.* Chevron Australia, Perth, Western Australia

Chevron Australia. 2014. *Gorgon Gas Development Fourth Train Expansion Proposal: Public Environmental Review / Draft Environmental Impact Statement.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014a. *Barrow Island Quarantine: Terrestrial and Marine Quarantine Management System*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014b. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report – WAPET Landing, Dredge Spoil Disposal Ground, MOF, and LNG Jetty.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014c. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Terrestrial and Subterranean Baseline State and Environmental Impact Report.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014d. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Short Range Endemics and Subterranean Fauna Monitoring Plan*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014e. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Long-term Marine Turtle Management Plan*. Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014f. *Gorgon Gas Development: Ministerial Implementation Statement No. 800, EPBC Reference: 2003/1294 (as amended) and EPBC Reference: 2008/4178 Environmental Performance Report 2014.* Chevron Australia, Perth, Western Australia.

Chevron Australia. 2014g. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Offshore Feed Gas Pipeline Installation Management Plan*. Chevron Australia, Perth, Western Australia.

Clarke, R.H. 2010. *The Status of Seabirds and Shorebirds at Ashmore Reef and Cartier and Browse Islands: Monitoring program for the Montara Well release – Pre-impact Assessment and First Post-impact Field Survey*. Prepared on behalf of PTTEP Australasia and the Department of the Environment, Water, Heritage and the Arts, Canberra, Australia.

Commonwealth of Australia. 2012. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.* Commonwealth of Australia 2012, Public Affairs, Canberra ACT. Available from: http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf [Accessed 09 December 2014]

Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology. 2007. *Climate Change in Australia: Technical Report 2007*. CSIRO and Bureau of Meteorology, Melbourne, Victoria.

Concawe Petroleum Produces and Heath Manage Group. 1998. *Heavy Fuel Oils*. Product Dossier no. 98/109. Brussels, Belguim

Department of Fisheries. 2013. *Status Reports of the Fisheries and Aquatic Resources of Western Australia 2012/13: The State of the Fisheries*. Eds. W.J. Fletcher and K. Santoro, Department of Fisheries, Perth, Western Australia, pp193–211.

Department of Mines and Petroleum. 2012. *Guidelines for the Preparation and Submission of an Environment Plan*. Department of Mines and Petroleum, Perth, Western Australia.

Environmental Protection Authority. 2009. *Gorgon Gas Development Revised and Expanded Proposal: Barrow Island Nature Reserve*. Available from: http://epa.wa.gov.au/epadoclib/2937_rep1323gorgonrevper30409.pdf [Accessed 02 March

2013]

Environmental Protection Authority. 2014. *WA Environmental Offsets Guidelines*. Available from: http://www.epa.wa.gov.au/SearchCentre/results.aspx?k=%20WA%20Environmental%20Offsets%20Guideline [Accessed 15 October 2014)

Froese, R. and D. Pauly. (eds). 2014. *FishBase.* Available from: http://www.fishbase.org, version 08/2014. [Accessed 11 September 2014]

Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Working Group I: The Physical Science Basis.* http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspm-projections-of.html [Accessed 16 September 2014]

Intergovernmental Panel on Climate Change. 2013. *Climate Change 2013: The Physical Science Basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* T.F. Stocker, D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

International Maritime Organization. 1997. *International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 relating thereto (MARPOL)*. International Maritime Organization, London, United Kingdom.

International Tanker Owners Pollution Federation. 2001. *A Review of the Problems Posed by Spill of Heavy Fuel Oils*. Paper presented at: 2001 International Oil Spill Conference, March 26–29 2001, Tampa Florida.

Mattiske, E.M. and Associates. 1993. *Flora and Vegetation, Barrow Island*. Unpublished report prepared for West Australian Petroleum Pty Limited, Perth, Western Australia.

National Environment Protection Council. 2003. *Variation to the National Environment Protection (Ambient Air Quality) Measure, as amended*. National Environment Protection Council, Canberra, Australian Capital Territory.

National Offshore Petroleum Safety and Environmental Management Authority. 2014. *Policy – Petroleum Safety Zone Assessments*. National Offshore Petroleum Safety and Environmental Management Authority, Perth, Western Australia.

National Offshore Petroleum Safety and Environmental Management Authority. 2014a. *Oil Spill Contingency Planning. Guidance Note N-04750-GN1394. Rev 0.* NOPSEMA, Perth, Western Australia.

Oceanica. 2011. *Barrow Island HDD Thrust Block Study Beach and Back Beach Assessment*. Unpublished report to Chevron Australia, Oceanica, Perth, Western Australia.

Oceanica. 2013. *Gorgon Gas Development and Jansz Feed Gas Pipeline Upstream Facilities – HDD Marine Monitoring Technical Report Surficial Sediments Survey – Post HDD Construction, March 2013*. Unpublished report to Chevron Australia, Oceanica, Perth, Western Australia.

Rainer Engelhardt, F. 1983. *Petroleum Effects on Marine Mammals*. Aquatic Toxicology, 4(3): 199–217.

RPS. 2012. *Assessment of Environmental Risk – Hydrocarbon spill. Gorgon Development Fourth Train Proposal*. Unpublished report for Chevron Australia, RPS, Perth, Western Australia.

St. Aubin, D.J., and Lounsbury, V. 1990. *Chapter 11 – Oil Effects on Manatees: Evaluating the Risks. In: G. Joseph (ed) Sea Mammals and Oil: Confronting the Risks*. Academic Press. Pp. 241–251

Western Australian Planning Commission. 2013. *State Planning Policy 2.6: State Coastal Planning Policy*. Western Australian Planning Commission, Perth, Western Australia.

12. Terms and Acronyms in Attachment 3

AMSA	Australian Maritime Safety Authority
APASA	Asia Pacific Applied Science Associates
BOM	Bureau of Meteorology
BPPH	Benthic primary producer habitat
CO_2	Carbon dioxide
COA	Commonwealth of Australia
Considered action	Present, and reasonably foreseeable future actions that have the potential to impact the environment in a similar manner to the Fourth Train Proposal
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth of Australia
DER	Western Australian Department of Environment Regulation
DotE	Department of the Environment
DPaW	Western Australian Department of Parks and Wildlife
EIS/ERMP	The Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Gorgon Gas Development dated September 2005 as amended or supplemented from time to time
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Western Australian Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
Foundation Project	Gorgon Gas Development and Jansz Feed Gas Pipeline
Fourth Train Proposal	Gorgon Gas Development Fourth Train Expansion Proposal
GJV	Gorgon Joint Venturer
g/m^2	Grams per square metre
ha	Hectare
HDD	Horizontal Directional Drilling
HFO	Heavy Fuel Oil
IMS	Invasive Marine Species
IPCC	Intergovernmental Panel on Climate Change
km	Kilometre
LNG	Liquefied Natural Gas
m	Metre
m^3	Cubic metres
mg/L	Milligrams per litre
MTPA	Million tonnes per annum
NCB	Net Conservation Benefit

NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NO_2	Nitrogen dioxide
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NVIS	National Vegetation Information System
O_3	Ozone
OPEP	Oil Pollution Emergency Plan
ppb	Parts per billion
PER	Public Environmental Review
PER/Draft EIS	Public Environmental Review / Draft Environmental Impact Statement
QMS	Quarantine Management System
Rsmog	Smog reactivity
RTO	Regenerative thermal oxidisation
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
TAPM-CTM	The Air Pollution Model – Chemical Transport Model
TAPM-GRS	The Air Pollution Model – Generalised Reaction Set
VOC	Volatile organic compounds
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAPC	Western Australian Planning Commission
WC Act	*Wildlife Conservation Act 1950* (WA)

13. Appendix 1

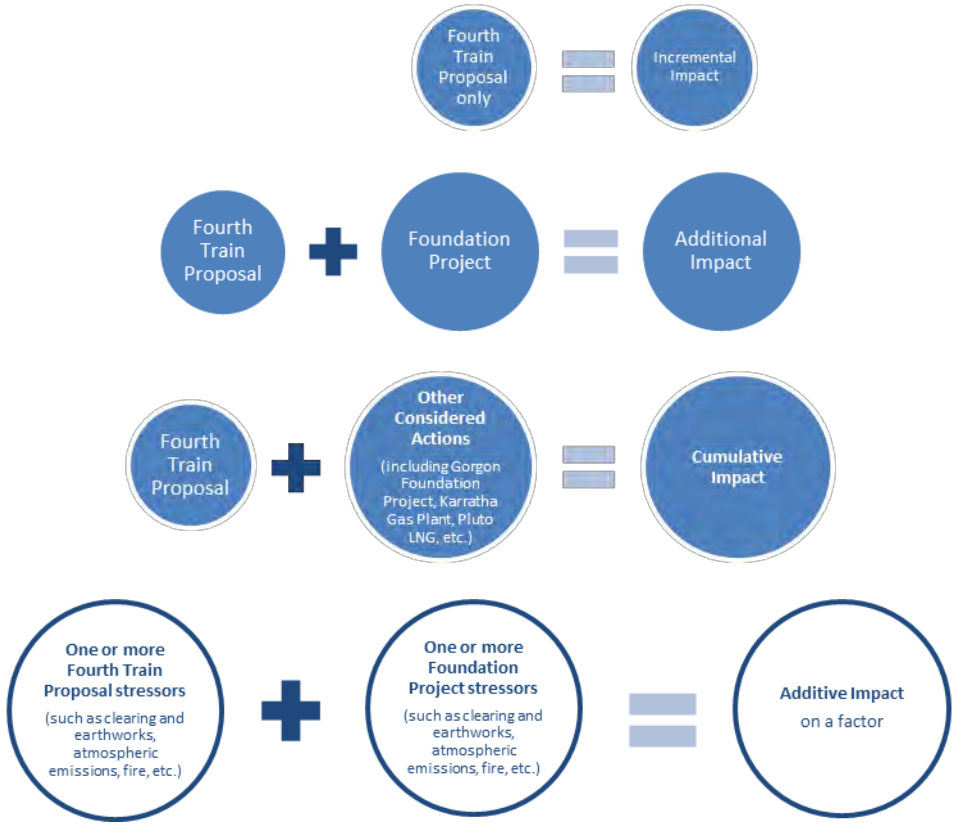


Figure 1: Impact Terms Diagram

14. Appendix 2 Spills and Leaks – Heavy Fuel Oil

The Fourth Train Proposal may require the use of heavy fuel oil (HFO) to power marine vessels. Major marine oil spills predominantly occur from the accidental damage of vessels, such as from vessel grounding or collision. A grounding or collision close to the coast would be likely to have the most significant impact on Barrow Island.

The worst case spill of HFO is predicted to be from the largest pipelay vessel during the construction of the Offshore Feed Gas Pipeline System. This pipelay vessel is expected to be a Class 3 dynamically positioned vessel with a high level of positioning redundancy, which reduces the potential for uncontrolled drift. The pipelay vessel will also spend the majority of the time offshore, only coming close to shore to pick up pipe on a few occasions[6]. The pipelay vessel will move at approximately 2 km/day while laying pipe, and be piloted by experienced operators. All these factors reduce the chance of an uncontrolled drift that could result in a grounding.

Pre-installation surveys for the Foundation Project indicate that the pipeline route in the nearshore area has a relatively flat sandy seabed with no emergent features. At the lowest tide, there is approximately 2 m clearance to the seabed, which is in line with the safe operating clearance of the HFO-powered pipelay vessels used by the Foundation Project. Vessel grounding would require failure of the dynamic positioning system and an uncontrolled drift of up to 1 km before the positioning thrusters of the vessel contacted the seabed, and the hull would require a further 500 m drift before it came in contact with the seabed. The time taken for this uncontrolled drift distance to occur is significantly greater than the time taken to implement response measures to minimise this distance, such as:

- Deploying anchors in shallow waters
- Attaching towlines and / or mooring lines to the vessel to hold in place or tow to deeper water
- Restoring power to thrusters.

Although the proposed pipeline route traverses the shipping route between the WA coast and Asia, the main shipping routes to and from Port Hedland and the Port of Dampier are located further to the east. A review of Australian Ship Reporting (Australian Transport Safety Bureau 2013), a ship reporting system operated by the Australian Maritime Safety Authority (AMSA), estimated that 1200 ships a year travelled through the vicinity of the pipeline route in 2008. This equates to fewer than four per day, and provides few potential collision opportunities. The potential also exists for collision between the pipelay vessel and other vessels involved in the Fourth Train Proposal construction activities (including supply, pipe supply, crew transfer, and survey vessels) which may be required to operate close to the pipelay vessel. However, the pipelay vessel will move at approximately 2 km/day while laying pipe, and all vessels will be piloted by experienced operators, reducing the likelihood of a collision.

The *Solitaire* has completed pipelay on both the Gorgon and Wheatstone pipelines without an incidence of grounding or collision. A major marine spill as a result of vessel collision or grounding would only be possible under exceptional circumstances. Therefore, the likelihood of a major HFO spill resulting from vessel grounding or collision is assessed as remote.

[6] The *Solitaire* came in to shore to pick up pipe twice during the laying of the Gorgon Feed Gas Pipeline System.

14.1 Characteristics of Heavy Fuel Oil

Once released HFO is not likely to entrain into the water column and very little of the oil will be lost to evaporation, due to the high content of heavy hydrocarbons. The high water content (up to 30%) of HFO will cause it to emulsify. As a result of the emulsification processes, the surface oil is unlikely to thin out, but rather travel on the sea surface for an extended time while undergoing degradation processes.

The density of some HFOs means that they may also sink on their release into water. This heavy fraction will assume a tar-like consistency and stick to exposed substrates or become adsorbed to suspended particulates (Concawe Petroleum Producers and Heath Manage Group 1998). In the open sea where the concentrations of suspended material are low, this effect may be less important, but in the surf zone, grains of sand become mixed into the oil. The longer term fate of oil sunk is likely to be burial under fresh sediment in nearshore waters or stranding by waves casting the oil onto shore (International Tanker Owners Pollution Federation 2001). HFO can also solidify into tar balls, which can widely disperse.

14.2 Foundation Project Modelling of a Potential Heavy Fuel Oil Spill

The pipelay vessel expected to be used for Fourth Train Proposal construction activities is a Class 3 dynamically positioned vessel similar to the *Solitaire* which was used for Gorgon Foundation Project construction (it may even be the *Solitaire* itself). As such, the HFO spill modelling undertaken for the Gorgon Foundation Project is considered an appropriate basis for an assessment of the impacts of a potential HFO spill off the west coast of Barrow Island during Fourth Train Proposal construction activities.

AMSA (2012) suggests the maximum credible spill volume from the collision or grounding of an installation vessel is the total volume of fuel from one tank. The Offshore Feed Gas Pipeline Installation Management Plan (Chevron Australia 2014g) for the Gorgon Foundation Project modelled a number of scenarios including a worst case potential release of 800 m^3 of HFO due to collision or grounding of a HFO-powered vessel near the shore of Barrow Island. This maximum credible volume of 800 m^3 is based on the complete instantaneous loss of the largest HFO tank capacity of the pipelay vessel (*Solitaire*) which operated close to Barrow Island. Modelling was undertaken of a release from a nearshore site 2 km from the Barrow Island shoreline in order to assess the potential for environmental impacts[7], as this is the closest approach to the shoreline made by the large HFO-powered vessels during construction activities.

Foundation Project HFO spill modelling results are presented in Table 14-1, showing all seasons. For the worst-case season (winter), the maximum distance from the release point (at the 99th percentile) is 232.1 km at the moderate threshold and 572.9 km at the low threshold. The modelled spill has a high probability of contacting the west coast of Barrow Island, and potentially the Montebello Islands.

[7] Oil spill modelling was carried out using a three-dimensional oil spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program), which is designed to simulate the transport, spreading, and weathering of specific oil types under the influence of changing meteorological and oceanographic (metocean) forces. This is the same program that was used for the modelling of the Fourth Train Proposal spill scenarios.
Stochastic modelling was also carried out using repeated simulations of the same spill scenario under different, randomly sampled, conditions. These modelling simulations provide insight into the probable behaviour of potential oil spills under the metocean conditions expected to occur in the Gorgon Project area. They predict the most probable path and transport rates for released oil using historical wind and ocean current data. Stochastic modelling provides three types of information:

- sea surface areas that might be oiled and the associated probability of oiling
- the shortest period of time the oil takes to reach beaches
- the beaches that are predicted to become potentially oiled.

For heavy hydrocarbons, the surface slick thickness can be used to determine the likely risk of physical oiling of marine fauna at the water surface; this predominantly affects avifauna at risk of hypothermia from oiling of feathers, and surface-breathing marine mammals and reptiles. Exceedance of 1 g/m^2 is considered to give a 'perception' of environmental harm due to visibility, but is unlikely to result in an observable effect on marine organisms. Surface slick hydrocarbon concentrations above 10 g/m^2 are used as an indicator for moderate oiling, as these concentration levels have the potential to impact marine fauna and coat emergent habitat. Foundation Project modelling predicted there was a potential for high surface exposure levels (>25 g/m^2) along the west coast of Barrow Island, and around the northern tip (Figure 14-1). High surface exposure levels are also predicted for the west coast of the Montebello and Varanus Islands. The remainder of the Barrow and Montebello Islands Area is predicted to reach moderate (10–25 g/m^2) and low (1–10 g/m^2) surface levels.

Few studies have been undertaken to assess the impact of entrained oil, and thus the threshold values selected are nominal and used to reflect increasing potential impact to marine life (RPS 2012). Entrained modelling predicts some zones of moderate exposure (hours in the range of 9600–48 000 ppb hydrocarbon concentrations) around the west, southern, and south-east coasts of Barrow Island, and along the west coast of the Montebello Islands. Some zones of moderate exposure are also predicted to occur offshore. Low exposure (hours in the range of 960- 9600 ppb hydrocarbon concentrations) is predicted across much of the remainder of the Montebello/Lowendal/Barrow Island region.

Modelling predicted the highest likelihood of shoreline contact to Barrow Island in the summer season (51%), and the maximum volume of hydrocarbons coming ashore on Barrow Island in the transitional season (202.8 m^3) (Table 14-1). In addition, the modelling predicts the HFO level may drop below threshold levels for surface thickness, but then re-accumulate on distant shorelines due to the tendency of HFO to emulsify.

Table 14-1: HFO Modelling Results for Shoreline Contact on Barrow Island from Nearshore Release 2 km from North White's Beach

Parameter	Summer	Transitional period (Spring and Autumn)	Winter
Absolute shortest time to shore (hours)	2	2	2
Maximum shoreline probability (%) > 1 g/m^2	51	42	25
Maximum shoreline probability (%) > 10 g/m^2	48	42	22
Maximum load of oil ashore (g/m^3)	18 875	17 630	17 695
Average load of oil ashore (m^3)	93	1 494	1 117
Maximum volume of oil ashore (m^3)	180.9	202.8	172.5
Average volume of oil ashore (m^3)	88.2	68.6	43.2
Maximum length of shoreline contacted (km)	35	42	43

Note: this table contains details for Barrow Island shoreline contact only. For further details of contact with other shorelines, please refer to Table 6-21 (Evaluation of Severity of Modelled Oil Spills to Values, for each EMBA area) of the Offshore Feed Gas Pipeline Installation Management Plan (Chevron Australia 2014g).

Potential receptor pathways and significant environmental impacts from the modelled spill in the Barrow Island area are discussed below.

14.3 Potential Impacts to Marine Fauna

Spills of HFO have the potential to directly impact habitat, environmental media, or marine fauna. Marine fauna can be directly impacted by hydrocarbon spills and leaks through inhalation, ingestion, or physical contact. For heavier hydrocarbons, the surface slick thickness can be used to determine the likely risk of physical oiling of marine fauna at the water surface; surface slick hydrocarbon concentrations above 10 g/m^2 are used as an indicator for moderate oiling, as these concentration levels have the potential to impact marine fauna and coat emergent habitat. Marine mammals are particularly sensitive to surface slicks as they are surface-breathers. Entrained hydrocarbons are likely to affect fauna that lives below the ocean surface, such as fish, while shoreline accumulations of hydrocarbons are likely to affect fauna that uses the shoreline such as turtle hatchlings and shorebirds.

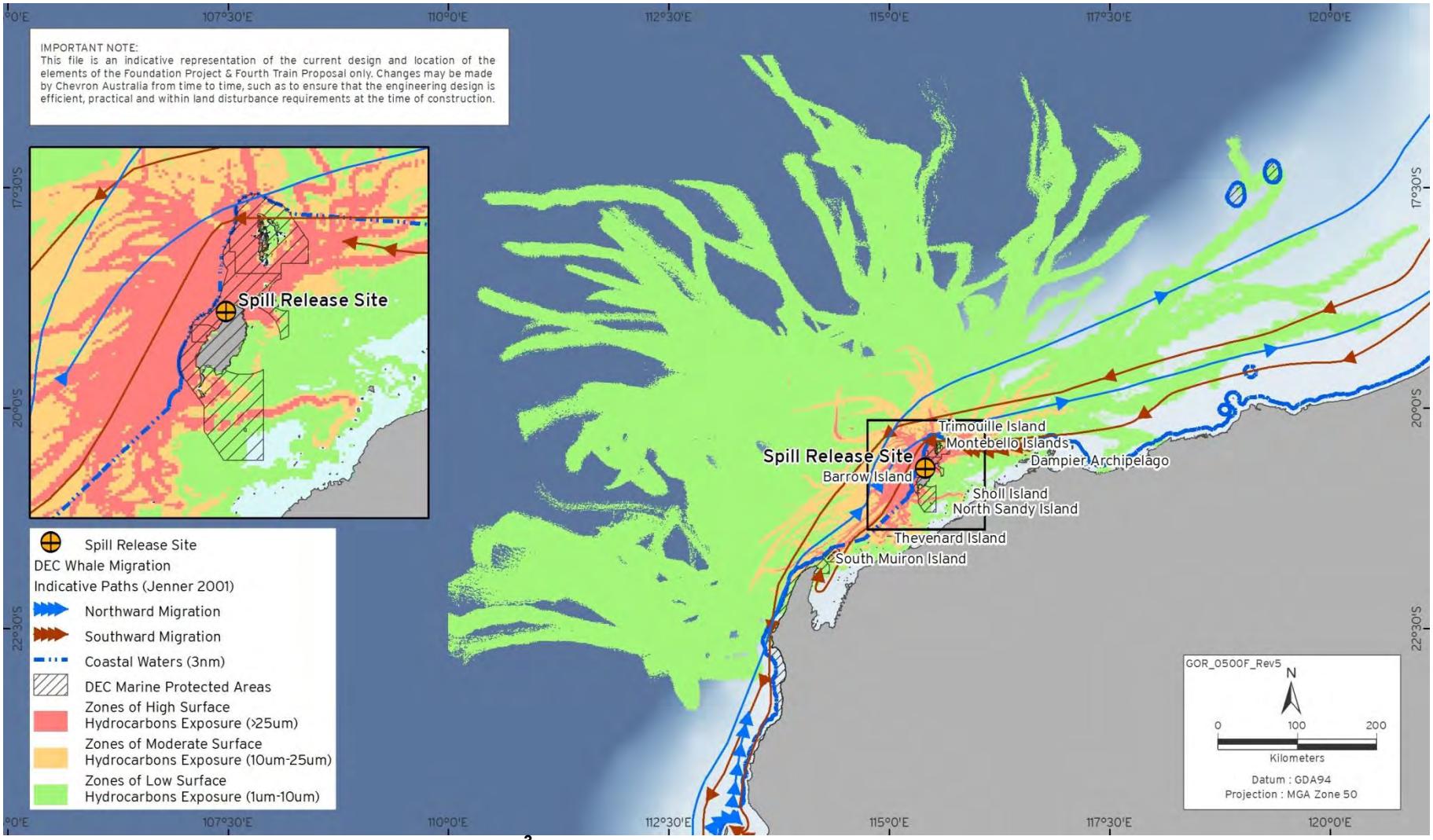


Figure 14-1: Modelling of 800m^3 Surface Release of HFO Near the West Coast of Barrow Island

Fish[8]

Entrained hydrocarbons are likely to affect fish present in the water column. Modelling of entrained hydrocarbons predicts moderate exposure focused around the west coasts of Barrow Island and the Montebello Islands, and widespread low exposure through the remainder of the area. Low entrained thresholds are indicative of chronic exposure, and moderate thresholds may also lead to acute toxicity, particularly for juvenile fish as they are more prone to stay within the entrained plume.

Whale Shark aggregation occurs during March to July in the Ningaloo Marine Park. The tendency of Whale Sharks to feed close to surface waters will increase the likelihood of exposure to surface slicks and elevated hydrocarbon concentrations beneath slicks. Modelling predicts surface hydrocarbon exposure would be predominantly low, with limited moderate exposure, of which weathered tar balls may be ingested by Whale Sharks during feeding. The risk to the Whale Shark aggregation is considered acceptable given the remote likelihood of such an event occurring, the seasonality of the aggregation, the low exposure reaching the marine park should a spill occur, and the response mechanisms in place in the event of a spill.

Population-level impacts to fish are not expected as most species have relatively wide distributions, and the likelihood of a HFO spill event is remote. Additive impacts are not predicted.

Marine Mammals[9]

As air breathers, marine mammals are vulnerable to exposure to hydrocarbon spill impacts through the inhalation of evaporated volatiles if they surface in the slick. Marine mammals may also directly ingest hydrocarbons when feeding (e.g. consumption of tar balls by dugong) or through the ingestion of prey species that have accumulated hydrocarbons (Varanasi and Malins 1977 and Neff 1979 in Rainer Engelhardt 1983; St Aubin and Lounsbury 1990).

Humpback Whales are at greatest risk of exposure during their migration season, and have the potential to be impacted if a spill coincides with their annual migration north or south. Modelling of HFO spills predict high surface thresholds around the west coast of the Montebello and Trimouille Islands and intersecting identified Humpback Whale migration routes. Modelling also predicts entrained hydrocarbon exposure of a moderate level could intersect a small portion of the Humpback Whale migratory route. Some moderate, and more widely, low, entrained exposure is predicted west of Trimouille Island, in the Humpback Whale resting area, and there is potential for resting juveniles to be affected. However, the Humpback Whales are able to move out of the plume, and the impact would likely be limited to a portion of their migration route, with only one migration period likely to be affected.

Dugongs migrate between areas of seagrass meadows. Only small, sparse, fluctuating patches of seagrass occur at a few locations in shallow waters off the west coast of Barrow Island, however the Ningaloo Coast and Exmouth Gulf contain foraging and nursing habitat for Dugongs. Modelling suggests there is the potential for limited moderate (10–25 g/m^2) exposure focused around the north-western extent of the peninsula, and low threshold exposure (1–10 g/m^2) is predicted to extend down the coast. Although there is potential for individual Dugongs to be effected by spills and leaks, it is considered unlikely that individuals or areas of habitat would be impacted enough to result in adverse effects at population level.

Additive impacts are not anticipated to occur on marine mammals within coastal and nearshore waters due to the remote likelihood of a HFO spill, and the absence of observable impacts from other

[8] See Table 6.8 *Protected Fish that may occur in the Vicinity of the Fourth Train Proposal* of the PER/Draft EIS for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Wildlife Conservation Act 1950* (WC Act)-listed fish species, and Department of Parks and Wildlife (DPaW) Current Threatened and Priority rankings.

[9] See Table 6.9 *Protected Marine Mammals that may occur in the Vicinity of the Fourth Train Proposal* of the PER/Draft EIS for EPBC Act- and WC Act-listed marine mammal species, and DPaW Current Threatened and Priority rankings.

stressors. Potential impacts identified from the marine fauna assessment that may interfere with breeding, feeding, migration, or resting behaviours are unlikely at a population level.

Marine Reptiles[10]

Marine turtles are vulnerable to the effects of oil at all life stages—eggs, post-hatchlings, juveniles, and adults in nearshore waters. The heavy and persistent nature of HFO has the potential to result in heavy oiling of intertidal areas and beach habitats, affecting the nesting and reproductive success of turtles through the oiling of eggs, which may inhibit development, and the reduced survival of hatchlings. The likelihood of such consequences occurring depends on the timing of the spill relative to the breeding and nesting season.

Modelling of HFO spills undertaken for the Gorgon Foundation Project predicts high surface thresholds in the water around many important islands in the area, with the exception of the east coast of Barrow Island, which is predicted to be exposed to low thresholds. In summer, the turtle nesting season, HFO modelling predicts maximum loads ashore of 18 875 and 8787 g/m^2 at Barrow Island and Varanus Island, respectively. This is substantially greater than the 1000 g/m^2 load categorised as 'oil cover'. In the absence of known threshold data, it is assumed that this level may impact turtles directly by smothering, and may cause egg mortality.

Springtime spills and leaks could coincide with the nesting season for Green Turtles and the emergence of Hawksbill Turtle hatchlings in the area. As Flatback, Green, and Hawksbill Turtles all exhibit cyclical nesting patterns, only a portion of a nesting population would be exposed in the event of a hydrocarbon spill or leak. Population-level impacts to marine turtles would not be expected, and the likelihood of a HFO spill event is remote.

Additive impacts to marine reptiles are not expected off the west coast of Barrow Island due to the very low probability of a HFO spill, and the absence of observable impacts from other stressors. The short-term displacement of any foraging/courting animals in the nearshore area may reduce their exposure to stressors associated with localised seabed disturbance, discharges to sea, and physical interaction, which could otherwise result in additive stress/impacts to the species.

Marine Avifauna[11]

Birds foraging at sea have the potential to directly interact with oil on the sea surface some considerable distance from breeding sites in the course of normal foraging activities. Direct contact with hydrocarbons is likely to foul feathers, which may result in hypothermia due to a reduction in the ability of the bird to thermoregulate and impaired waterproofing. Direct contact with surface hydrocarbons may also result in dehydration, drowning, and starvation (AMSA 2013). Shorebird species foraging for invertebrates on exposed sand flats at lower tides will be at potential risk of both direct impacts through contamination of individual birds (ingestion or soiling of feathers) and indirect impacts through the contamination of foraging areas that may result in a reduction in available prey items (Clarke 2010).

Modelling predicts high surface thresholds through much of the area, particularly along the west coast of Barrow and Montebello Islands. HFO modelling of maximum loads ashore for the Montebello and Double Islands are predicted to be above an 'oil cover' of >1000 g/m^2 in all seasons, which may indicate this load can cause smothering of feathers and eggs. Should shoreline accumulations impact on the main foraging and breeding grounds, there is the potential for large quantities of oiled wildlife, and if not cleaned up these accumulations may result in longer term impacts through reduction in successful breeding and impact to bird eggs. Population-level impacts to marine avifauna from a HFO spill off the west coast is remote, however there is the potential for localised impacts to occur.

---

[10] See Table 6.10 *Protected Marine Reptiles that may occur in the Vicinity of the Fourth Train Proposal* of the PER/Draft EIS for EPBC Act- and WC Act-listed marine reptile species, and DPaW Current Threatened and Priority rankings.

[11] See Table 6.11 *Protected Marine Avifauna that may occur in the Vicinity of the Fourth Train Proposal* of the PER/Draft EIS for EPBC Act- and WC Act-listed marine avifauna species, and DPaW Current Threatened and Priority rankings.

The potential additive impacts on conservation-significant marine avifauna as a result of the Fourth Train Proposal are not predicted to change from that assessed and approved for the Foundation Project. The Fourth Train Proposal is unlikely to increase the potential impact to either marine avifauna species.

Marine Fauna - Spills and Leaks Summary

The potential incremental impact to marine fauna from the Fourth Train Proposal due to spills and leaks (including a HFO spill) is assessed as 'Medium', which is the same as a diesel fuel spill in the same area. The potential impact in addition to the approved Foundation Project is also assessed as 'Medium'. The likelihood of a major spill event is very low, an assessment of the potential severity of its consequences brings the incremental and additional impact level to 'Medium'.

14.4 Potential Impacts to Environmental Media (Marine Water Quality, Foreshore and Seabed)

A spill or leak of HFO has the potential to impact marine water quality, particularly through formation of surface sheens or slicks, and cause reduced integrity of sediment due to contamination. The potential for a HFO spill to impact areas above the high water mark and affect the foreshore area is expected to be worsened if a spill coincides with unusually high tides and/or storm surge, which are more likely during the cyclone season (November to April), and may result in stranding by waves casting the oil onto shore. The impact to water quality parameters of the receiving marine environment is highly dependent on a range of factors including prevailing conditions, the proximity of discharge from the waters being assessed, and the discharge volume.

The potential incremental impact to the foreshore and seabed from the Fourth Train Proposal due to spills and leaks (including a HFO spill) is assessed as 'Low', and the potential impact in addition to the approved Foundation Project is assessed as 'Low'. Although the severity of the consequence of a spill or leak can be severe, the likelihood of a spill or leak (including a HFO spill) occurring is low, and the likelihood of that spill or leak then impacting the foreshore area is also low.

14.5 Potential Impacts to Benthic Primary Producer Habitat

A spill or leak of hydrocarbon or hazardous material has the potential to expose BPPH to toxic compounds. Heavy hydrocarbons can smother benthic primary producer habitat (BPPH) in the intertidal zone, interfering with its capacity to produce energy, impact health and potentially result in mortality. The level of impact depends on the magnitude of the spill, metocean conditions, timing in relation to biological events, and species composition.

The potential incremental impact to BPPH from the Fourth Train Proposal due to spills and leaks (including a HFO spill) is assessed as 'Low', and the potential impact in addition to the approved Foundation Project is assessed as 'Low'. Potential additive impacts on BPPH are not anticipated given the low probability of a HFO spill, the absence of observable impacts from other stressors, and the localised nature of those other stressors.

14.6 Potential Impacts to Conservation Areas

The Montebello/Barrow Islands Marine Conservation Reserves includes the Montebello Islands Marine Park, Barrow Island Marine Park, and Barrow Island Marine Management Area. These marine and coastal environments are protected in recognition of their importance to marine biodiversity. A HFO spill from the Fourth Train Proposal could extend throughout the Barrow Island Marine Management Area, affecting the Reserves and the Bandicoot Bay Conservation Area. Descriptions of the potential impacts of an HFO spill on the environmental factors that are also relevant to the ecological values of Montebello/Barrow Islands Marine Conservation Reserves are discussed in Sections 14.3 to 14.5.

The closest boundary of the Ningaloo Marine Park is approximately 130 km south-west of Barrow Island. HFO spill modelling suggests there is the potential for limited moderate (10–25 g/m^2) exposure focused around the north-western extent of the Cape Range peninsula, with low threshold exposure (1–10 g/m^2) predicted to extend further down the coast. Nearshore modelling predicts a small exposure area of high threshold >25 mg/m^2 at the north corner of Cape Range. The risk to these conservation areas, including the Ningaloo Marine Park is considered acceptable given the remote likelihood of such an event occurring and the response mechanisms (Section 5.7.3 (*Accidental Releases (Spills and Leaks) to the Marine Environment)* of the PER/Draft EIS) in place in the event of a spill.

Potential incremental impacts of the Fourth Train Proposal are largely predicted to be localised or short term, and are not predicted to compromise the ecological values established for the Reserves. Potential additional impacts are evaluated to be of no greater scale than those predicted for the Foundation Project.

The stressors that have the potential to impact the ecological values of marine and coastal environments of the Montebello/Barrow Islands Marine Conservation Reserves, when considered additively, are not expected to contradict efforts to manage the Reserves as set out in the Montebello/Barrow Conservation Reserve Management Plan and it is anticipated that ecological values will be maintained.

14.7 Potential Cumulative Impact

Potential cumulative impacts to marine fauna, including species and their habitats protected under Commonwealth and/or State legislation may result when stressors from the Fourth Train Proposal are combined with the Foundation Project and other considered actions. However, spills and leaks were not identified as key stressors likely to contribute to cumulative impacts to marine fauna.

14.8 Proposed Management

The following EMPs address the potential impacts of spills and leaks to the marine environment and the control and response measures planned to minimise the respective risks and impacts relevant to HFO-powered vessels:

- Offshore Feed Gas Pipeline Installation Management Plan (or equivalent Environment Plan)
- Environment Plan for the drilling and completion of production wells in the Commonwealth Marine Area
- Long-term Marine Turtle Management Plan
- Marine Facilities Construction Environmental Management Plan

Subsidiary Documents that are relevant to spills and leaks to the marine environment include:

- Commonwealth Environment Plans (and Oil Pollution Emergency Plans)
- State Environment Plans (and Oil Spill Contingency Plans).

These Environment Plans are required to assess and address environmental risks from operations, accidents, and other emergency conditions, and to include measurements of whether specific environmental objectives and performance standards are met. These Environment Plans are also required to include a plan for oil spill response that is kept up to date throughout operations, and to include a description of emergency response arrangements that are regularly tested.

The GJV consider that the risks and the potential impacts of the Fourth Train Proposal can be effectively managed under the EMPs and Subsidiary Documents for the Foundation Project. This conclusion is supported by the Foundation and Wheatstone Projects' successful completion of the

pipelay works using HFO-powered vessels. No measures or controls additional to those required for the Foundation Project have been assessed as being necessary to manage the potential of a spill of HFO to the marine environment associated with the Fourth Train Proposal. Therefore, the GJVs propose that minor changes are included in the relevant Foundation Project EMPs and Subsidiary Documents (e.g. Environment Plans and Oil Pollution Emergency Plans) to ensure that those documents also apply to the Fourth Train Proposal.

14.9 Predicted Environmental Outcome

A HFO spill from the Fourth Train Proposal could result in severe impacts to marine fauna; however, there are mitigation and management measures in place to prevent and respond to spills, and the likelihood of such a spill is considered to be remote.

The GJVs consider that spill or leak (including a HFO spill from marine vessels) will be able to be adequately managed such that the impacts are environmentally acceptable and the environmental objectives (described throughout Section 10 (*Coastal and Nearshore Environment – Potential Impacts and Management*) of the PER/Draft EIS) and Section 13 (Matters of National Environmental Significance – Impacts and Management) are met.

The Fourth Train Proposal has the potential to increase the likelihood of a spill or leak (including a HFO spill from marine vessels). However, although the consequence may be greater from a HFO spill than from a diesel spill, the likelihood of such an event occurring is remote. The consideration of the likelihood and potential impacts from a HFO spill does not change the impact level assessed in the PER/Draft EIS. When combined with the mitigation and management measures that are to be put in place for the Fourth Train Proposal, the incremental, additional and additive impacts are considered to be acceptable and meet the relevant environmental objectives presented in the PER/Draft EIS.

REPORT

Southern Seawater Desalination Project: Commonwealth Public Environment Report

Prepared for

Water Corporation

629 Newcastle Street
Leederville
WA 6007

8 May 2009

42906896 : R1370 AQUA Doc #1572647

URS

Project Manager:

FOR John Polglaze
Senior Principal
Environmental Scientist

Project Director:

Ian Baxter
Senior Principal
Environmental Scientist

URS Australia Pty Ltd

Level 3, 20 Terrace Road
East Perth WA 6004
Australia
T: 61 8 9326 0100
F: 61 8 9326 0296

Date: 8 May 2009
Reference: 42906896 : R1370
DK:M&C3107/PER
Status: Final

Table of Contents

Table of Contents

Table of Contents

Tables, Figures, Drawings, Appendices

Tables

Figures

Tables, Figures, Drawings, Appendices

Appendices

Tables, Figures, Drawings, Appendices

Executive Summary

This Commonwealth Public Environment Report (cPER) has been prepared for the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) for the assessment and approval of actions that may have an impact upon Matters of National Environmental Significance (NES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proponent for the Southern Seawater Desalination Plant (SSDP) is the Water Corporation of Western Australia (the Corporation), established under the *Water Corporation Act* 1995. The Corporation manages Western Australia's water supply catchments, removes and treats wastewater, manages drainage networks and irrigation and supplies drinking water to communities spread across 2.5 million km^2 of one of the driest provinces on Earth. The Corporation owns and operates 1,521 water and wastewater pump stations, 254 water treatment plants and 113 dams and weirs.

Declining rainfall has reduced stream flow into public water supply dams by two thirds over the past 30 years. Consequently, in planning for WA's water future, the Corporation has adopted the *Security through Diversity* strategy. This involves developing a broad range of innovative water sources to secure WA's water supplies and reduce water demand, even in times of drought. Seawater desalination is a climate independent, proven technology capable of delivering large quantities of potable water. With current uncertainty regarding future climate, desalination provides a robust source option for the Integrated Water Supply Scheme (IWSS).

The seawater desalination plant will produce potable water by the seawater reverse osmosis (RO) process. The RO process involves gravitating seawater in through the seawater intake structure to the seawater pump station, pre-treating it (using filtration and/or coagulation) and then pressurising it over a membrane so that freshwater is driven through and higher salinity seawater (brine) is left behind. The brine, which is approximately twice as saline as seawater, passes through energy recovery devices before being discharged via the brine discharge pipeline and diffuser at high velocity and rapidly mixes with the surrounding seawater. The potable water will be transferred through the Water Transfer Pipeline to the summit tank(s). A pipeline, in the same easement as the water transfer pipeline, will transfer potable water from the summit tank(s) into the Stirling-Harvey Trunk main which forms part of the IWSS. This infrastructure will be located between Binningup and Harvey.

Key infrastructure elements of the proposal are:

- a seawater intake structure (for an ultimate plant capacity of 100 GL/year);
- a seawater supply pipeline, which feeds into an onshore seawater pump station (both for an ultimate plant capacity of 100 GL/year);
- a minimum 50 GL/year, maximum 100 GL/year potable water production RO desalination plant (including pre-treatment and post-treatment facilities) powered by renewable energy;
- a brine discharge pipeline(s) and diffuser array in the ocean (for an ultimate plant capacity of 100 GL/year);
- approximately 28.5 km of 1400 mm diameter buried Water Transfer Pipeline (this is sufficient for the ultimate 100 GL/year plant capacity) from the plant to a summit tank (minimum 1 x 32 ML, ultimately 4 x 32 ML) and sump (2 ML, upgradable to 5 ML) 3.5 km north east of Harvey;
- approximately 1.5 km of 1400 mm diameter buried pipeline to deliver the water from the summit tank in Harvey into the Stirling-Harvey Trunk main; and

Executive Summary

- a regulating valve on the delivery main.

Subject to further evaluation, DEWHA has deemed that the SSDP has the potential to impact upon matters protected by the EPBC Act, with particular reference to:

- listed threatened species and ecological communities - notably the Western ringtail possum (*Pseudocherius occidentalis* - which is a transient visitor to the site), Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), and the Chuditch (*Dasyurus geoffroil*), due to vegetation clearing;
- listed migratory species (Rainbow bee-eater [*Merops ornatus*]) due to disturbance of nesting sites; and
- other threatened and listed migratory species likely to occur in the Project Area. These include the humpback whale (*Megaptera novaeangliae*), southern right whale (*Eubalaena australis*) and blue whale (*Balaenoptera musculus*), the Australian sea-lion (*Neophoca cinerea*), grey nurse shark (west coast population) (*Carcharias taurus*), great white shark (*Carcharodon carcharias*), and whale shark (*Rhincodon typus*), due to increased turbidity, blasting or seismic work.

Preliminary discussions (including a site visit) have been held with DEWHA and the cPER has been requested by DEWHA for full assessment under the EPBC Act.

On balance, and taking into account the impact avoidance, reduction and mitigation measures to be implemented by the Corporation, it may be concluded that the proposed SSDP is not likely to have a significant impact on the environment in general, nor upon specific matters afforded protection by the EPBC Act. This assessment is based upon an evaluation within the framework of DEWHA significance criteria for Matters of NES, as per *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (DEWHA 2006) for the Matters of NES applicable to the SSDP. From a comparison with the criteria that apply to the relevant Matters of NES identified as being likely to be present, it was assessed that the Project would not have significant adverse impacts upon:

- threatened or migratory terrestrial fauna, or their habitats.
- threatened ecological communities.
- threatened flora species.
- threatened, migratory or listed marine species of avian fauna.
- any wetlands of international significance.
- threatened, migratory or listed marine species, including cetaceans.

Owing to their presence on the SSDP site, some temporary disturbance of Western ringtail possums will most likely occur, but given the extent of that disturbance, the non-critical nature of the habitat area concerned, the risk avoidance and reduction measures to be employed by the Corporation and the intended rehabilitation of the site following construction, none of the expected impacts are likely to be significant either of themselves or in the context of EPBC Act assessment criteria.

Similarly, it is possible that some aspects of habitat linked to the Carnaby's Black Cockatoo and Baudin's Black Cockatoo will be disturbed, but such impact would be small and isolated, and of minimal significance in the context of the abundance and array of similar available habitat in the Project area.

Executive Summary

Given the complexity of natural systems and the prevalent lack of full scientific understanding, no certainty can be given that all potential environmental effects from the activities intended by the Proponent have been identified and assessed, or indeed can be identified and assessed on the basis of current knowledge. Nevertheless, the assessments and conclusions presented in this report represent the outcomes of realistic evaluation of the potential impacts of the proposed activities on the basis of available knowledge and a precautionary and conservative approach.

This Commonwealth Public Environment Report (cPER) has been prepared for the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) for the assessment and approval of actions that may have an impact upon Matters of National Environmental Significance (NES) under Chapter 4 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This cPER is based largely upon information previously presented to, and assessed by, the Western Australia (WA) Environmental Protection Authority (WA EPA, or 'EPA') in the State Public Environmental Review (sPER) for the Southern Seawater Desalination Project (SSDP) and the sPER's supporting technical reports, as well as the Construction Environmental Management Framework and the Operational Environmental Management Framework. This cPER also incorporates feedback from the EPA and relevant public submissions received during the sPER review process, and is supplemented by additional studies focused upon specific matters of interest to DEWHA. Readers of the cPER are directed to the sPER and it's supporting technical reports (accessible via the Water Corporation website, www.watercorporation.com.au) for background information.

1.1 Identification of the Proponent

The proponent for the SSDP is the Water Corporation of Western Australia (the Corporation), established under the *Water Corporation Act* (1995). The magnitude of scale of the Corporation's operations across the vastly diverse environment of Western Australia cannot be understated. The Corporation manages Western Australia's water supply catchments, removes and treats wastewater, manages drainage networks and irrigation and supplies drinking water to communities spread across 2.5 million square kilometres (km^2) of one of the driest provinces on Earth. This consists of managing and operating water services to and from in excess of 1 million properties, managing in excess of 60 recycled water schemes, supplying 355,468 megalitres of water (2006-07) and collecting and treating 140,542 megalitres of wastewater (2006-07) through 32,270 kilometres (km) of water mains and 14,261 km of wastewater mains. It provides drainage services across the state, maintaining 2,838 km of drains. The Corporation owns and operates 1,521 water and wastewater pump stations, 254 water treatment plants and 113 dams and weirs.

The Corporation's focus is on balancing environmental, social and economic outcomes to 'sustainably manage water services to make Western Australia a great place to live and invest', and maintain legal compliance with relevant legislation including environmental licenses and conditions. When considered against the magnitude of scale of its operations, and the diversity of the natural environment within which it operates, the Corporation's environmental performance is considered by many observers to be very good. As evidence of its excellence in environmental performance, the Water Corporation has won the Prime Minister's Award (2004) for environmental excellence in Public Sector Management, the WA Premiers Award (2004), the 2003 AGO Gold Award, and the United Nations Association of Australia World Environment Day Award 2004 for excellence in Marine and Coastal Management to name a few. The Water Corporation has had no actions brought against it in relation to its environmental performance under Commonwealth legislation, but has received two modified penalty notices from WA State authorities. Note that under the applicable WA legislation modified penalty notices do not represent an admission for the purposes of criminal or civil proceedings.

The Corporation provides world-class water, wastewater, drainage and irrigation services to the city of Perth and hundreds of WA towns and communities spread over 2.5 million km^2. The Corporation is committed to supplying West Australians with water that is safe to drink and that complies with directions on drinking water quality made by the Minister for Health. These directions are based on the guidelines of the National Health and Medical Research Council, which reviews public health issues within Australia. The Corporation continuously

Section 1 0BGeneral Information

monitors and assesses the quality of drinking water supplied and makes improvements as required to meet these health guidelines.

Proponent Details

Company:	Water Corporation (ABN: 28 003 434 917)
Contact Person:	Suzanne Brown
Position:	Project Environmental Manager
Office Address:	629 Newcastle Street, Leederville WA 6007
Postal Address:	PO Box 100, Leederville WA 6902
Phone:	+61 (08) 9420 2894
Fax:	+61 (08) 9420 2775
Email:	suzanne.brown@watercorporation.com.au

1.2 Outline of the Proposal

Key infrastructure elements of the proposal are:

- a seawater intake structure (for an ultimate plant capacity of 100 GL/year);
- a seawater supply pipeline, which feeds into an onshore seawater pump station (both for an ultimate plant capacity of 100 GL/year);
- a minimum 50 GL/year, maximum 100 GL/year potable water production reverse osmosis (RO) desalination plant (including pre-treatment and post-treatment facilities) powered by renewable energy;
- a brine discharge pipeline and diffuser array in the ocean (for an ultimate plant capacity of 100 GL/year);
- approximately 28.5 km of 1400 mm diameter buried Water Transfer Pipeline (this is sufficient for the ultimate 100 GL/year plant capacity) from the plant to a summit tank (minimum 1 x 32 ML, ultimately 4 x 32 ML) and sump (2 ML, upgradable to 5 ML) 3.5 km north east of Harvey;
- approximately 1.5 km of 1400 mm diameter buried pipeline to deliver the water from the summit tank in Harvey into the Stirling-Harvey Trunk main; and
- a regulating valve on the delivery main.

The seawater desalination plant will produce potable water by the seawater RO process. The RO process involves gravitating seawater in through the seawater intake structure to the seawater pump station, pre-treating it (using microfiltration) and then pressurising it over a membrane so that freshwater is driven through and higher salinity seawater (brine) is left behind. The brine, which is approximately twice as saline as seawater, passes through energy recovery devices before being discharged via the brine discharge pipeline and diffuser at high velocity and rapidly mixes with the surrounding seawater. The product water from this process will be treated with lime as necessary to provide potable water in accordance with the requirements of the relevant drinking water guidelines. The potable water will be transferred through the Water Transfer Pipeline to the summit tank(s). A pipeline, in the same easement as the water transfer pipeline, will transfer potable water from the summit tank(s) into the Stirling-Harvey Trunk main which forms part of the Integrated Water Supply Scheme (IWSS).

Solid waste associated with backwashing the media filters will be thickened to facilitate transport for disposal at a Class III landfill pursuant to the *Landfill Waste Classification and Waste Definition* (DEC, 2005); licensed under the *Environmental Protection Regulations 1987* (WA)

The key project characteristics are summarised in Table 1-1. Figures 1-1 to 1-3 show the general location of the proposed plant and pipelines, depicts the proposed site boundaries and pipeline route and shows a detailed site map for the proposed plant. A conceptual representation of the desalination process is shown in Figure 1-4.

The proposed project schedule is summarised in Table 1-2. Note that consequent to the development of the SSDP, Western Power, another WA State Government agency, will be extending the current electricity distribution grid in the area to service the SSDP. This will be achieved via a 7 km to 10 km single 132 kV transmission line from the nearby Kemerton Terminal Sub-station. As with all Western Power projects, this extension will be conducted in accordance with applicable Western Power environmental management processes including referral to the WA EPA and to the DEWHA. Western Power have referred their powerline proposal to the DEWHA and this constitutes a separate action to this proposal, and as such, will not be referred to again within this document (Appendix A).

Section 1 0BGeneral Information

Table 1-1 Project characteristics

Characteristic	Details[1]	
SEAWATER DESALINATION PLANT	50 GL/year	100 GL/year
Location	Lots 32 & 33 and Part Lot 8 Taranto Road, Binningup, Shire of Harvey (Figures 1-1 and 1-2).	
Treatment Process	RO with pre-treatment, potabilisation and disinfection.	
Design Capacity	Up to 100 GL per year[2] (stage 1 = 50 GL/year).	
Power requirement		50 MW annual average.
Net greenhouse gas emissions of purchased energy	0 tpa CO_2-equivalent.	
Clearing of native vegetation	Maximum of 15 ha to be cleared, depending on the final optimisation of the site.	
SEAWATER INTAKE		
Intake volume		Average 722 ML/d.
Inlet pipelines	Two pipes of 2.4 m diameter, extending 500 m offshore.	
Location (indicative)	As per Figure 1-3.	
BRINE DISCHARGE		
Brine discharge volume		Average 418 ML/d.
Salinity		Up to 65,000 mg/L.
Temperature	Not more than 2 °C above ambient seawater.	
Outlet pipelines including diffuser	One pipe of 2 m diameter, extending 950 m offshore.	
Diffuser	Located between 600 m and 950 m offshore. Up to 350 m in total length.	
Location (indicative)	As per Figure 1-3.	
Sludge production		Approximately 30 tonnes/d (disposal to Class III landfill)
WATER TRANSFER PIPELINE		
Pipeline length	Approximately 30 km.	
Pipeline diameter	1400 mm.	
Clearing of native vegetation	Approximately 5-7 ha.	
Location	As per Figure 1-2.	
HARVEY SUMMIT TANK		
Storage volume	Up to 130 ML.	
Number Tanks		Up to four.
Maintenance sump	2 ML	5 ML
Clearing of native vegetation	< 0.1 ha.	
Location	As per Figure 1-2.	

1 All pipeline dimensions and distances are nominal.

2 Actual production can be up to 15% greater than the design production.

3 All flow rates are design flow rates based upon 100 GL being produced in 330 days. Actual flow rates at any given time can be up to 15% greater than design values.

Section 1 0BGeneral Information

Figure 1-1 Regional location of SSDP

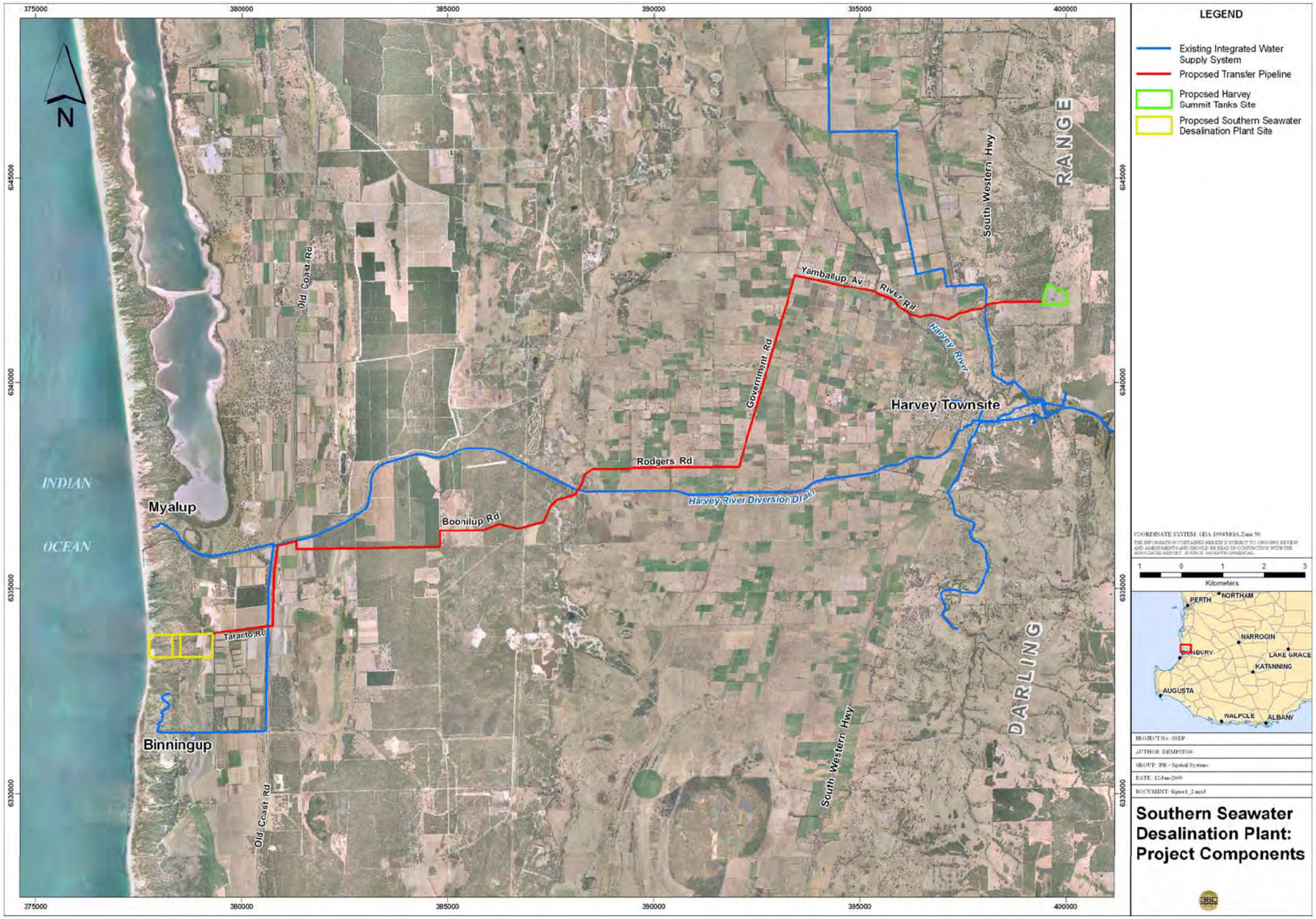


Figure 1-2 SSDP plant site and potable water pipeline route to Harvey summit tanks

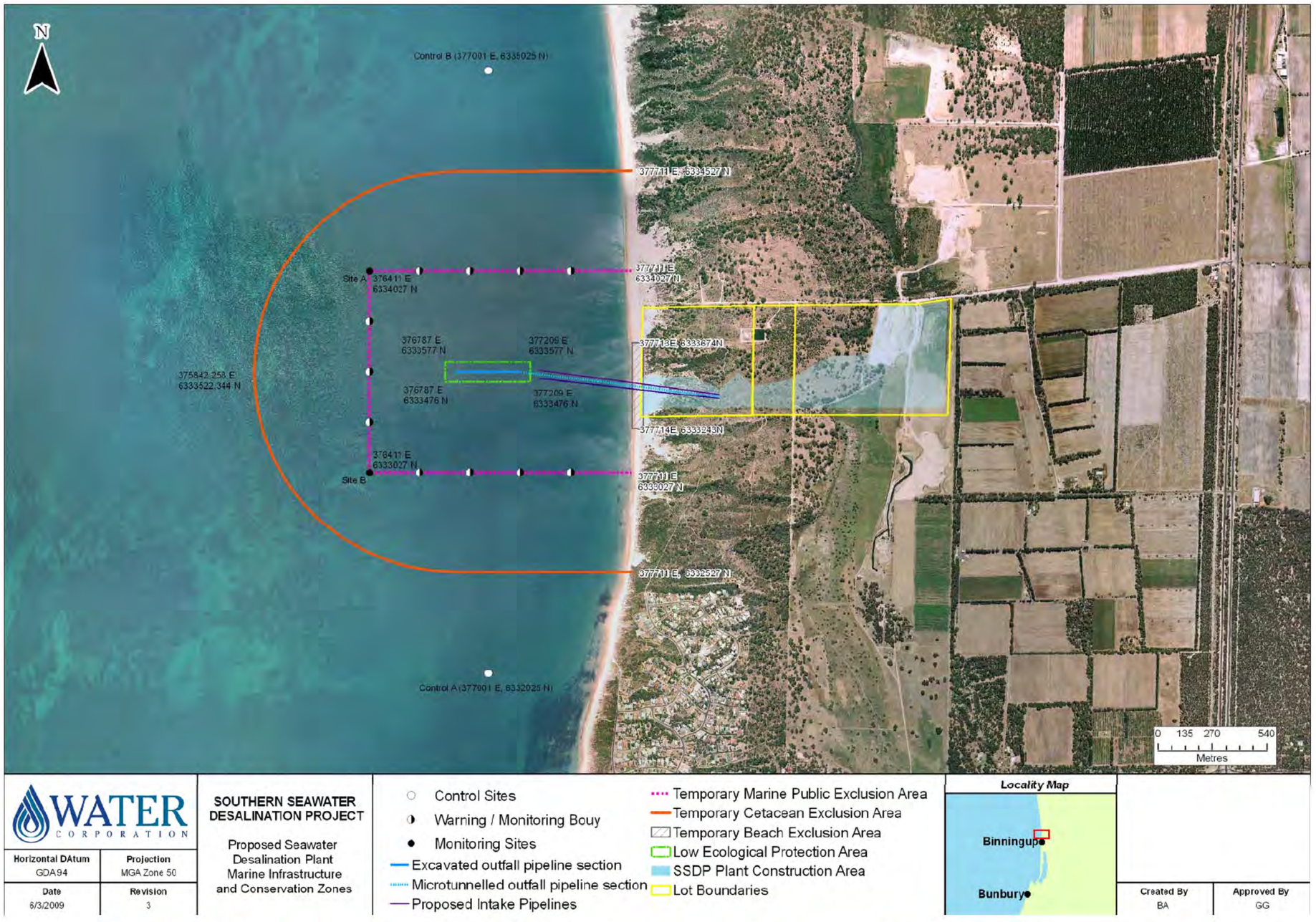


Figure 1-3 SSDP plant site and marine inlet/outlet pipe nominal locations, including proposed Low Ecological Protection Area (LEPA)

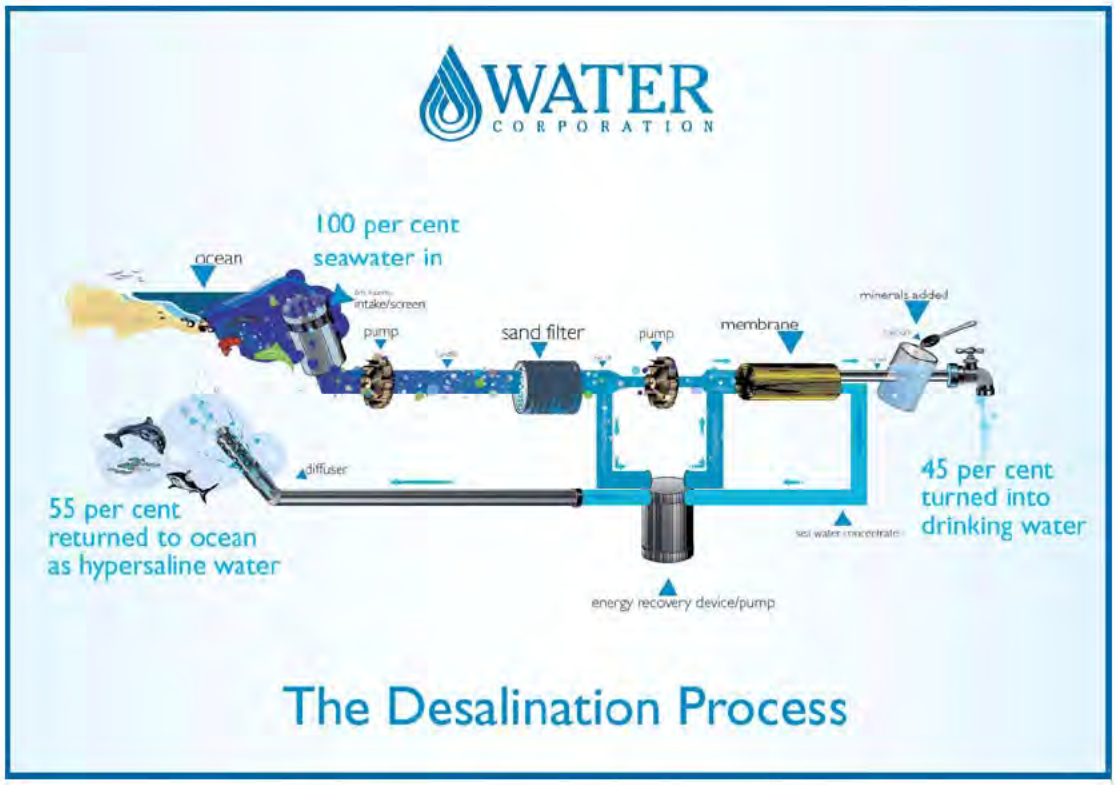


Figure 1-4 Desalination process diagram

Table 1-2 Proposed schedule (indicative dates) to meet December 2011 deadline for 50 GL/year (Stage 1) water to the IWSS

Event	Date
WA State Government announcement that the next water source is the desalination plant at Binningup	May 2007
Referral of proposal to WA EPA and setting of level of assessment	July 2007
Resolution of appeals on level of assessment	October 2007
Draft Environmental Scoping Document to the WA EPA	October 2007
Scoping document released for public comment (two weeks)	November 2007
Scoping Document endorsed by WA EPA	February 2008
Draft sPER document to the WA EPA	February 2008
EPBC Act formal Referral submitted to DEWHA	April 2008
Environmental Impact Assessment (EIA) document released for public comment (eight weeks)	April 2008
WA EPA Bulletin released for public comment (two weeks)*	October 2008
First Draft cPER to DEWHA	October 2008
WA Environment Minister's Statement released*	November 2008
Revised Draft cPER to DEWHA	end November 2008

Section 1 0BGeneral Information

Event	Date
cPER finalised and released for public comment*	December 2008
Commonwealth Environment Minister's decision released*	early 2009
Construction commences*	early 2009

* Indicative timing

1.3 Structure of the cPER

The cPER structure is as follows:

Chapter 1: General Information

Chapter 2: Legal Framework

Chapter 3: Description of Action

Chapter 4: Feasible Alternatives

Chapter 5: Description of the Environment (local and regional context)

Chapter 6: Potential Impacts and Their Management

Chapter 7: Environmental Impact Evaluation

Chapter 8: Socio-Economic Factors

Chapter 9: Conclusions

Chapter 10: References and Bibliography

Chapter 11: Glossary

Chapter 12: Limitations

Appendices

A Western Power Letter of 15 July

B External Approvals Manual (Water Corporation 2008)

C Other Approvals

D Interim Report/Advice Declared Rare Flora Survey

E Review of Literature on EPBC Avifauna Issues

F Southern Seawater Desalination Project Mitigation and Offset Strategy

G Supporting Documentation, on CD and including;

- Supporting technical reports (consultants): Flora, Fauna and Wetlands studies
- Supporting technical reports (consultants): Marine studies

- Construction Environmental Management Framework (containing management plans)
- Operational Environmental Management Framework (containing management plans)
- Supporting documents (general)

H Review of Literature on Sound in the Ocean and Effects of Noise and Blast on Marine Fauna

I Review of Literature on the Effects of Desalination Plant Brine Discharge Upon Cetaceans

J Social Impact Assessment

K Public Consultation

L Project Implementation

M Rehabilitation Plan

Section 2 1BLegal Framework

2.1 Background

The Corporation (the proponent) referred the proposed SSDP at Taranto Road, Binningup to the EPA for assessment under Section 38 of the WA *Environmental Protection Act 1986* (EP Act) in July 2007. The level of assessment was set as a sPER, with a six week public comment period. This was increased after appeals (on the level of assessment) to eight weeks.

The proposal to construct the SSDP is subject to the provisions and constraints of a number of State and Commonwealth Acts, in particular the EP Act and the Commonwealth EPBC Act.

2.2 WA State Legislation and Assessment Process

2.2.1 Relevant State Legislation and Policies

State legislation relevant to the SSDP Project, that must be complied with through approvals, design, construction and operation is presented in Table 2-1.

Table 2-1 State Government legislation applicable to the SSDP proposal

Legislation	Brief description	Administering Agency
Aboriginal Heritage Act 1972	The Act provides for the preservation and protection of places or objects of historical significance to, or of traditional or customary use by the original inhabitants of Australia or their descents.	Department of Indigenous Affairs (DIA)
Biosecurity and Agriculture Management Act 2007	The purpose of this Act is to prevent new animal and plant pests (weeds and vermin) and diseases from entering WA and becoming established, to manage the impact and limit the spread of those already present in the State, and to safely manage the use of agriculture and veterinary chemicals and ensure agricultural products are not contaminated with chemical residues.	Department of Agriculture and Food
Bush Fires Act 1954	This Act contains provisions for diminishing the dangers resulting from bush fires, for the prevention, control and extinguishment of bush fires.	Fire and Emergency Services Authority
Conservation and Land Management Act 1984	This Act establishes a comprehensive set of legislative provisions dealing with state conservation and land management matters. The Act provides for the use, protection and management of certain public lands, waters and flora and fauna, and establishes a number of responsible statutory bodies.	Department of Environment and Conservation (DEC)
Contaminated Sites Act 2003	The Act regulates matters relating to the identification, assessment, recording, management and clean up of contaminated land.	DEC
Dampier to Bunbury Pipeline Act 1997	This Act defines the requirements for the management of the Dampier to Bunbury Natural Gas pipeline (DBNGP) corridor and creates the role and function of the DBNGP Land Access Minister.	Department for Planning and Infrastructure (DPI)
Dangerous Goods	This Act relates to the safe storage, handling and transport of	Department of

Legislation	Brief description	Administering Agency
Safety Act 2004	dangerous goods and for related purposes.	Consumer and Employment Protection
Environmental Protection Act 1986 and its Regulations	The Act makes provision for the establishment of the EPA, for the prevention, control and abatement of pollution and for the conservation, preservation, protection, enhancement and management of the environment. The Act also provides for the control and licensing of potentially polluting activities, land clearing and is the Act under which the State environmental approvals process operates.	DEC
Explosives and Dangerous Goods Act 1961	This Act relates regulates the manufacture, importation and use of explosives, and the classification, marking, storage, carriage, and sale of explosives and dangerous goods.	Department of Consumer and Employment Protection
Heritage of Western Australia Act 1990	The Act provides for and encourages the conservation of places (natural or constructed) which have significance to the cultural heritage of the State.	Heritage Council of Western Australia
Land Administration Act 1997	The Act relates to Crown land surveys, reservation of Crown land for specific purposes, and the sale or transfer of Crown land.	DPI
Local Government Act 1995	The Act vests local authorities with the responsibility for waste management, sewage disposal and protection of water supplies within their jurisdiction.	Local Government
Maritime Archaeology Act 1973	This Act protects shipwrecks from disturbance.	Western Australian Maritime Museum
Rights in Water and Irrigation Act 1914	This Act makes provision for the regulation, management, use and protection of water resources, to provide for irrigation schemes, and for related purposes.	Department of Water (DoW)
Soil and Land Conservation Act 1988	The Act deals with the conservation of soil and land resources and with the mitigation of the effects of erosion, salinity and flooding.	DEC
Town Planning and Development Act 1928	An Act relating to the planning and development of land for urban, suburban, and rural purposes.	Western Australian Planning Commission
Wildlife Conservation Act 1950	The Act provides for the conservation and protection of wildlife (flora and fauna). Special provisions and schedules cover protection and management of gazetted rare flora and fauna.	DEC

The proposal is also subject to the direction provided by the following key State Government Policy documents:

EPA Position Statements:

- No. 2 – Environmental Protection of Native Vegetation in Western Australia.
- No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.

- No. 4 – Environmental Protection of Wetlands.
- No. 6 – Towards Sustainability.
- No. 7 – Principles of Environmental Protection.
- No. 9 – Environmental Offsets.

EPA Guidance Statements:

- No. 6 – Rehabilitation of Terrestrial Ecosystems.
- No. 8 – Environmental Noise (Draft).
- No. 10 – Level of Assessment for Proposals affecting natural areas within the System 6 Region and Swan coastal Plain Portion of the System 1 Region.
- No. 12– Minimising Greenhouse Gas Emissions.
- No. 19 – Environmental Offsets (Draft).
- No. 29 – Benthic Primary Producer Habitat Protection for WA's Marine Environment.
- No. 33 – Draft Environmental Guidance for planning and development.
- No. 51 – Terrestrial Flora and Vegetation Surveys for EIA in WA.
- No. 55 – Implementing Best Practice in Proposals submitted to the EIA process.
- No. 56 – Terrestrial Fauna Surveys for EIA in WA.

Other documents:

- Environmental Protection (Swan Coastal Plain Lakes) Policy 1992.
- Environmental Protection (Noise) Regulations 1997.
- Perth Coastal Waters Environmental Values and Objectives.
- WAPC Statement of Planning Policy No. 2.6 State Coastal Planning Policy.

2.2.2 Western Australian Assessment Process

The public review period for the sPER has been completed and the Corporation has summarised and responded to issues raised in submissions by the public and decision-making authorities (DMAs). The EPA is now assessing the proposal and will release its report and recommendations to the WA Minister for the Environment. Consultation will also occur between the State and Commonwealth Ministers. The Minister for the Environment will then issue a Statement (provided approval for the Project is given) which legally binds the Corporation to implement the proposal as documented and described, subject to the EPA's conditions and procedures and proponent commitments. The Ministerial Conditions and commitments will also be

communicated through contract documentation and any management plans prepared for the project. Where possible, management plans were developed and publicly reviewed. Any future management plans will require approval at the State level.

The project will be subject to the WA DEC Works Approval and Licensing process under Part V of the EP Act, following completion of the environmental impact assessment process and issuing of Ministerial Conditions. The Corporations External Approvals Manual is provided as Appendix B, with a summary of the main additional specific approvals to be gained by the Corporation for the SSDP presented in Appendix C.

2.2.3 Key Decision-making Authorities

The key DMAs involved in the State environmental impact assessment of the SSDP proposal are the EPA and the DEC.

Other DMAs that are considering the same proposal or have already done so under their relevant legislation include:

- DIA (sites of significance for Aboriginal people)
- DPI
- DoW
- Shire of Harvey.

2.3 Commonwealth Legislation and Assessment Process

2.3.1 Introduction

Commonwealth legislation relevant to the SSDP project, that must be complied with through approvals, design, construction and operation is presented in Table 2-2.

Table 2-2 Commonwealth Government legislation applicable to the SSDP proposal

Legislation	Brief description	Administering Agency
Environment Protection and Biodiversity Conservation Act 1999	The Act protects the environment, particularly matters of National Environmental Significance.	DEWHA
Freedom of Information Act 1992	The Act requires the release of information relating to decisions made by public bodies	Office of the Information Commissioner
Native Title Act 1993	The Act provides for the protection and recognition of native title to unalienated Crown land, providing that a continuous connection with that land can be established.	Native Title Tribunal

The EPBC Act, administered by DEWHA, is the main item of Commonwealth legislation relevant to the proposed SSDP.

2.3.2 EPBC Act

2.3.2.1 Overview

Under the environmental assessment provisions of the EPBC Act, actions that are likely to have a significant impact on Matters of NES are subject to an assessment and approval process. An action includes a project, development, undertaking, activity, or series of activities.

The EPBC Act identifies seven Matters of NES:

- World Heritage
- National heritage properties
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions (including uranium mining).

In addition to Matters of NES, the EPBC Act also provides for protection of the environment in Commonwealth areas and for cetaceans and other specific listed marine species.

DEWHA has developed and promulgated defined criteria for assessing whether a proposed action is likely to have a significant impact upon any matter protected by the EPBC Act.

2.3.2.2 Conservation Management of Threatened Species and Ecological Communities

The EPBC Act allows for the identification of processes that endanger the survival of species and ecological communities, and the development and implementation of measures designed to assist recovery and reduce threats to their survival. These individual measures are (Environment Australia 2003c):

- Key Threatening Processes
- Action Plans
- Conservation Overviews
- Recovery Plans
- Declared Critical Habitat
- Threat Abatement Plans

These conservation measures are expanded upon below. The specific measures for threatened species are in addition to the general protection afforded by the EPBC Act for migratory species, cetaceans and listed marine species.

Key Threatening Processes

A Key Threatening Process is one that threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. A process can be listed as a key threatening process if it could:

- cause a native species or ecological community to become eligible for adding to a threatened list (other than conservation dependent);
- cause an already listed threatened species or threatened ecological community to become more endangered; or
- adversely affect two or more listed threatened species or threatened ecological communities.

Once a threatening process is listed under the EPBC Act a Threat Abatement Plan can be put into place if it is proven to be "a feasible, effective and efficient way" to abate the threatening process.

Of the 17 Key Threatening Processes currently established under the EPBC Act, only two, land clearance and dieback caused by the root-rot fungus (*Phytophthora cinnamomi*) have a link with the proposed SSDP.

Action Plans

Action plans are management plans that have been produced by DEWHA since the commencement of the Endangered Species Program in 1989. Action plans are strategic documents intended to arrest the decline of, or stabilise and promote the recovery of, populations of a defined group of related organisms. They review the conservation status of major Australian taxonomic groups against IUCN categories, identify threats and recommend actions to minimise those threats. Action plans assist in the establishment of national priorities for threatened species conservation. A total of 11 action plans are currently in place.

Conservation Overviews

Conservation overviews are more general reviews of conservation issues for taxa where not enough is known to review the status of all individual species within that taxon. Four conservation overviews have been prepared to date (notwithstanding the combined Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Estuarine Fishes – 2002).

Recovery Plans

The Commonwealth Minister for the Environment may make or adopt and implement recovery plans for threatened species (other than conservation dependent species) and threatened ecological communities listed under the EPBC Act.

Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community.

Recovery plans state what must be done to protect and restore important populations of threatened species and habitat, as well as how to manage and reduce threatening processes. Recovery plans achieve this aim by providing a framework for key interest groups and responsible government agencies to coordinate their work to improve the plight of threatened species and/or ecological communities.

Section 2 1BLegal Framework

As of July 2008, 399 recovery plans had been established, with more in preparation. A number of these have varying degrees of relevance to the SSDP

Declared Critical Habitat

The Commonwealth Environment Minister may identify and list habitat critical to the survival of a listed threatened species or ecological community. Details of such identified habitat are recorded in a Register of Critical Habitat maintained by DEWHA.

Declaration of habitat critical to the survival of a species or ecological community depends largely on the particular requirements of the threatened species or ecological community concerned. For example, areas only incidentally used by a threatened species, and which the species is unlikely to be dependent upon for its survival or recovery, may not be areas of habitat critical to the survival of that particular species.

Identification of Critical Habitat takes into account the following matters:

- whether the habitat is used during periods of stress (e.g. flood, drought, fire);
- whether the habitat is used to meet essential life cycle requirements (e.g. foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes);
- the extent to which the habitat is used by important populations;
- whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development;
- whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements;
- whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation; and
- any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.

Information on the Register of Critical Habitat is publicly available unless determined by DEWHA that it is necessary to keep the information out of the public domain in order to protect the species, community or the habitat, and/or to protect the interests of relevant landholders.

Under the EPBC Act, it is an offence to take an action that will significantly damage the Critical Habitat of a listed threatened species (except a species in the conservation dependent category), or a listed threatened ecological community, if the Critical Habitat is in a Commonwealth area.

No currently declared (publicly listed) Critical Habitat exists which has any linkage with the proposed SSDP.

Threat Abatement Plans

Threat Abatement Plans provide for the research, management, and any other actions necessary to reduce the impact of a listed Key Threatening Process to a threatened species or ecological community. Implementing the plan is intended to assist the long term survival in the wild of the threatened species or ecological community.

Within 90 days of listing a Key Threatening Process the Minister for the Environment must decide if a Threat Abatement Plan should be made or adopted for the species or ecological community concerned. This decision

is based on whether having and implementing a plan is the most "feasible, effective and efficient way to abate the process".

Ten Threat Abatement Plans have been approved to date. Only one of these, concerning dieback caused by the root-rot fungus (*Phytophthora cinnamomi*), has relevance to the proposed SSDP.

2.3.2.3 Commonwealth Assessment Process

The SSDP proposal has been referred to DEWHA for assessment under the EPBC Act. Subject to further evaluation, DEWHA has deemed that the SSDP has the potential to impact upon matters protected by the EPBC Act, with particular reference to:

- listed threatened species and ecological communities - notably the Western ringtail possum (*Pseudocherius occidentalis* - which is a transient visitor to the site), Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), and the Chuditch (*Dasyurus geoffroil*), due to vegetation clearing;
- listed migratory species (Rainbow bee-eater [*Merops ornatus*]) due to disturbance of nesting sites; and
- other threatened and listed migratory species likely to occur in the Project Area. These include the humpback whale (*Megaptera novaeangliae*), southern right whale (*Eubalaena australis*) and blue whale (*Balaenoptera musculus*), the Australian sea-lion (*Neophoca cinerea*), grey nurse shark (west coast population) (*Carcharias taurus*), great white shark (*Carcharodon carcharias*), and whale shark (*Rhincodon typus*), due to increased turbidity, blasting or seismic work.

Preliminary discussions (including a site visit) have been held with DEWHA and the cPER has been requested by DEWHA for full assessment under the EPBC Act.

Section 3 2BDescription of Action

3.1 Need for the Proposal

Declining rainfall has reduced stream flow into public water supply dams by two thirds over the past 30 years. Consequently, in planning for WA's water future, the Corporation has adopted the *Security through Diversity* strategy. This involves developing a broad range of innovative water sources to secure WA's water supplies and reduce water demand, even in times of drought. These strategies will be supported by a strong focus on efficient water consumption programs, which have already delivered a saving of approximately 18% since 2001 (i.e. 185 to 151 kL per person per year). This represents around 45 GL/year saved in the IWSS. To put this into perspective, the following table (Table 3-1) shows the average inflow into the metropolitan dams since 1911:

Table 3-1 Average metropolitan dam inflows, 1911 – 2006

Years	Average inflows (GL/year)
1911 - 1974	338
1975 - 1996	177
1997 - 2005	114
2001 - 2006	81.8

Seawater desalination is a climate independent, proven technology capable of delivering large quantities of potable water. With current uncertainty regarding future climate, desalination provides a robust source option for the IWSS.

3.2 Location

The SSDP consists of a seawater desalination plant site (and associated coastal works), a Water Transfer Pipeline from the plant heading inland to connect to the IWSS and (up to) four summit tanks to facilitate the connection to the IWSS. This infrastructure will be located between Binningup and Harvey, as shown in Figure 1-2.

Key infrastructure elements of the proposal are:

- a seawater intake structure (for an ultimate plant capacity of 100 GL/year);
- a seawater supply pipeline, which feeds into an onshore seawater pump station (both for an ultimate plant capacity of 100 GL/year);
- a minimum 50 GL/year, maximum 100 GL/year potable water production RO desalination plant (including pre-treatment and post-treatment facilities) powered by renewable energy;
- a brine discharge pipeline(s) and diffuser array in the ocean (for an ultimate plant capacity of 100 GL/year);
- approximately 28.5 km of 1400 mm diameter buried Water Transfer Pipeline (this is sufficient for the ultimate 100 GL/year plant capacity) from the plant to a summit tank (minimum 1 x 32 ML, ultimately 4 x 32 ML) and sump (2 ML, upgradable to 5 ML) 3.5 km north east of Harvey;

- approximately 1.5 km of 1400 mm diameter buried pipeline, in the same easement as the plant to tank pipeline, to deliver the water from the summit tank in Harvey into the Stirling-Harvey Trunk main; and
- a regulating valve on the delivery main.

3.2.1 Plant Site

The plant will be located at Lots 32, 33 and part Lot 8 Taranto Road, Binningup, 130 km south of Perth and 66 km south of Mandurah (Figure 1-3).

Comprising some 41 ha, Lots 32 and 33 and ~40 ha, part Lot 8 Taranto Road, Binningup form the site for the Corporation's existing Binningup Waste Water Treatment Plant (WWTP), which treats wastewater from the greater Binningup area. There is sufficient space on the site (total approx 80 ha) to accommodate both operations.

Similarly comprising some 40 ha, Part Lot 8 Taranto Road, Binningup is proposed for the location of the majority of water treatment infrastructure as this site has already been partially cleared of native vegetation due to quarrying activities in the past. Part Lot 8 was purchased by the Corporation in order to minimise environmental impact to vegetation on Lots 32 and 33 and to reduce the visual amenity impact of the proposed infrastructure from the nearby beach.

Key components of the plant are:

- the seawater intake structure;
- the seawater supply pipeline;
- an onshore seawater pump station;
- a minimum 50 GL/year, maximum 100 GL/year potable water production RO desalination plant (including pre-treatment and post-treatment facilities) powered by renewable energy; and
- a brine discharge pipeline and diffuser array in the ocean.

The design and construction of the plant will be confined to areas of low ecological value, the footprint of which is delineated as the SSDP Plant construction area in Figure 1-3.

The desalination plant will produce potable water by the seawater RO process (Figure 1-4), involves gravitating seawater in though the intake structure to the pump station, pre-treating it (using microfiltration) and then pressurising it over a membrane so that freshwater is driven through and higher salinity seawater (brine) is left behind. The brine, which is approximately twice as saline as seawater, passes through energy recovery devices before being discharged via the brine discharge pipeline and diffuser at high velocity and rapidly mixes with the surrounding seawater. The product water from this process will be treated with lime as necessary to provide potable water in accordance with the requirements of the relevant drinking water guidelines. The potable water will be transferred through the Water Transfer Pipeline to the summit tank(s). A pipeline will transfer potable water from the summit tank(s) into the Stirling-Harvey Trunk main which forms part of the IWSS.

At full production, approximately 30 tonnes per day (approximately 25 cubic metres) of solid filter backwash material will be recovered from the dual media filters which are used to filter solid materials (such as marine algae and silts) from the intake seawater prior to the water being desalinated. The dual media filters must be

periodically backwashed to keep them operational. The backwash water containing the solid material is thickened (which may involve the addition of coagulants) with the resulting sludge collected and the liquid portion added to the brine discharge. The sludge is predominantly comprises naturally occurring marine components (water, salt, calcium carbonate, silts and sands) and can be safely disposed of to landfill classified to accept Class 3 wastes in accordance with the *Landfill Waste Classification and Waste Definitions 1966* (DEC, 2005) and licensed under the *Environmental Protection Regulations 1987* (WA).

The intake and outlet pipelines will be tunnelled underground from the seawater pump station to intake structures located approximately 500 m offshore. As a result the dunes and beach will not be disturbed from this work. Pipelines beyond the intake structure would be fabricated on the shore and towed into position. Shallow trenches would be excavated to provide a base for the pipes and to limit the protrusion of the pipes above the seafloor.

Excavation of the seabed floor is required for the installation of the seawater pipelines. Material will be excavated using a grab dredge, such as a clam shell bucket or a backhoe or similar, working from a barge. The maximum width of the excavated trench offshore will be 50 m. Sand removed during excavation will be dropped beside the trenches where ocean currents will redistribute it back to the original profile. Rock removed from the trenches will be dropped beside the exposed pipelines further offshore to anchor them in place. No rock will be left on the beach or near shore zone closer to shore than the 5 m depth contour, except when it can be placed at the same depth from which it was removed. Limited blasting of rock may be required in very short sections where there is very hard rock.

Thrust boring, sub-sea tunnelling or directional drilling may be used for pipeline installation, with the launch pit to be land based and the reception pits ocean based. Water-based drilling fluids will be used for boring, tunnelling and drilling. Sheet piles, rock or concrete may be used in the construction of the reception pits. Excavated material from the trench is likely to be side cast to either side of the trench, from where it will be redistributed by wave and tidal action.

3.2.2 Water Transfer Pipeline

A buried Water Transfer Pipeline will connect the seawater desalination plant to a Summit Tank site (approximately 28.5 km length), and from the Harvey Summit Tank site to the existing Stirling Trunkmain (approximately 1.5 km length and within the same alignment). The Water Transfer Pipeline will be located within a combination of roads and road reserves (16 km), agricultural land (9 km with nine private landowners), State Forest (2.3 km) and recreation reserves (1.2 km). Total clearing of native vegetation is estimated at approximately 5 to 7 ha. The Water Transfer Pipeline route (shown in Figure 1-2) was selected from a range of potential routes based on an assessment considering environmental, social and economic considerations.

3.2.3 Harvey Summit Tank Site

A summit tank facility, comprising of up to 130 ML water storage (in up to four tanks) and up to a 5 ML maintenance sump, will be constructed on agricultural land approximately 3 km north-east of the Harvey town site. The Harvey Summit Tanks will allow for gradual feed of water from the plant into the IWSS. Initially, only one 32 ML storage tank and one 2 ML sump will be constructed, with upgrade to occur in accordance with increases in water demand and supply. The most likely Water Storage Facility site was selected from a range of

potential sites based on an assessment considering environmental, social and economic considerations. Negotiations with the owners of the preferred sites are ongoing at the time of publication of the cPER.

4.1 Alternatives Considered

Data obtained from the Bureau of Meteorology (BOM) 2007 show that in the past seven years, Perth has experienced 21% less rainfall than the long-term average, resulting in 64% less runoff into dams and similarly placing groundwater sources under threat (Figures 4-1 and 4-2). Under the eight year climate and stream flow regime, the average yield of existing sources of supply to the IWSS was estimated at 256 GL/year. This comprises 136 GL/year from surface water sources and 120 GL/year from groundwater sources. The theoretical, unrestricted demand for 2004/5 was estimated at 289 GL/year. To continue to supply a similar demand at the planned level of reliability (1 in-200 year probability of total sprinkler ban), 318 GL/year of source capacity is required.

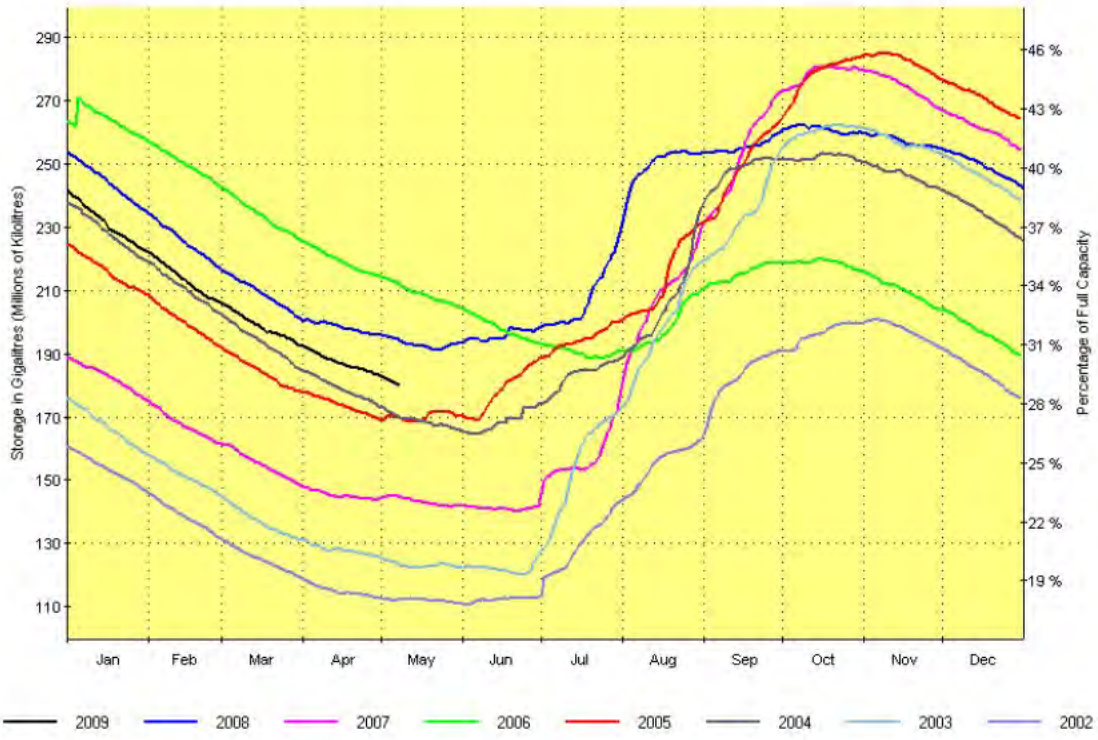


Figure 4-1 Total volume of water stored in the dams supplying water to the Integrated Water Supply System

Note: From 02 July 2007 the increase in the Water Corporation's dam storage is the result of available water traded from Harvey Water in the Stirling and Samson Dams.

Section 4 3BFeasible Alternatives

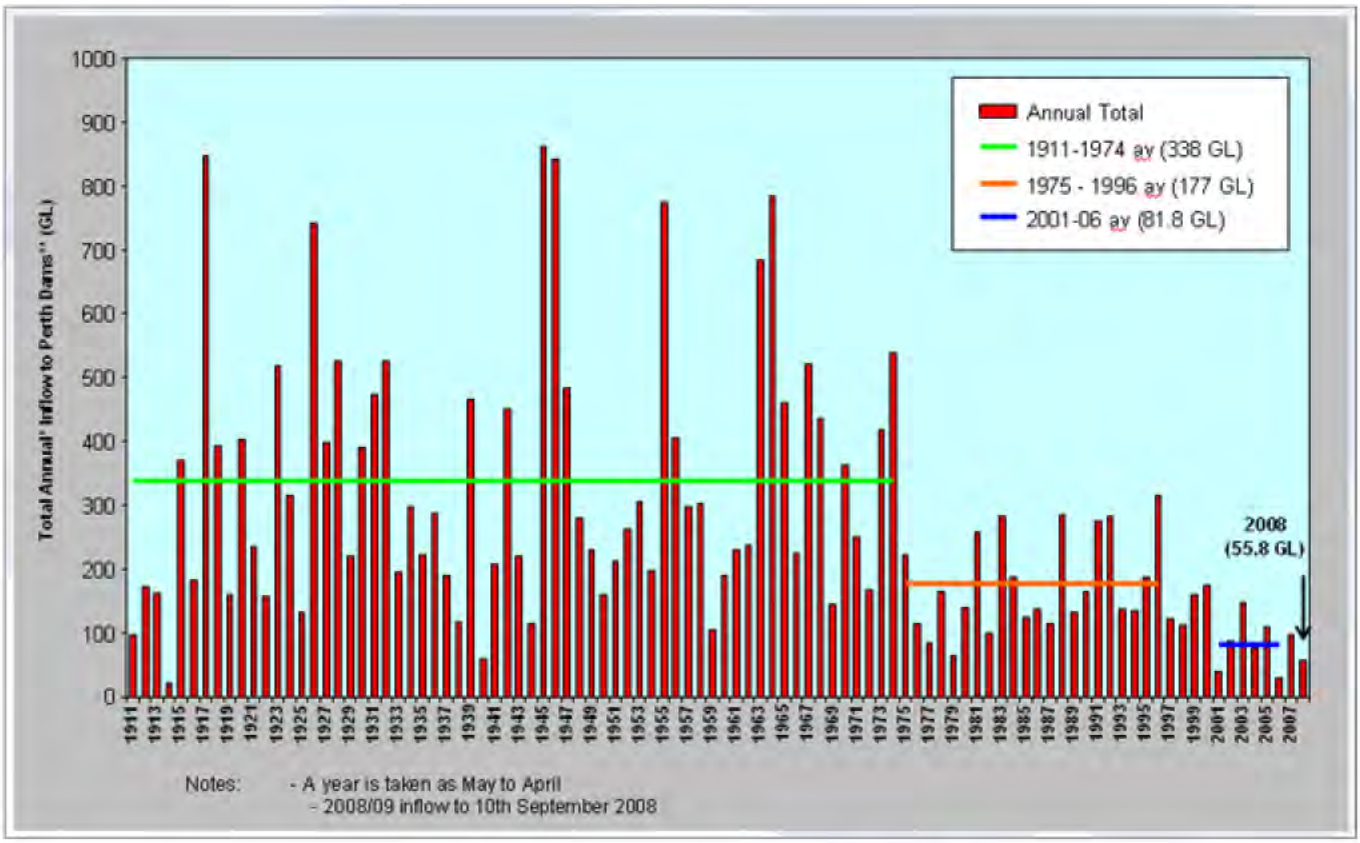


Figure 4-2 Total annual inflow to Perth dams

Current sources of supply to the IWSS fall approximately 60 GL/year short of this requirement. The shortfall in source capacity is currently being met by additional abstraction from the Gnangara groundwater source. Significant water savings have also been achieved through the implementation of two sprinkler days per week, which have assisted in the management of the water supply situation over the period since 2001. However, an additional 50 GL/year (approximately) of source capacity will be required to reinstate the demand/supply balance, and provide for projected growth in demand until 2014/15.

The Corporation's approach to meet future water supplies is to adopt a secure and diverse range of sources. *Security through Diversity* is the Corporation's multi-faceted strategy for water supply and demand management into the future.

The Corporation is actively pursuing the following initiatives to augment the current water supply:

- new groundwater sources;
- seawater desalination;
- new surface water sources;
- water trading (with other water providers/Harvey Water);

- catchment management (Wungong Dam catchment thinning trials);
- water recycling and reclamation (including groundwater replenishment with highly treated wastewater); and
- demand management.

The proposed SSDP is one component of the *Security through Diversity* strategy currently being implemented. Seawater desalination is a proven technology, capable of delivering large quantities of water, independent of climate. With uncertainty regarding future climate and stream flows, seawater desalination provides a reliable source option.

4.2 Alternative Water Sources Considered

4.2.1 South West Yarragadee

The South West Yarragadee groundwater aquifer is a significant water resource in the south-west region of the State. As such it has been the subject of a detailed investigation by the Corporation which commenced in 2002. Investigation and regulatory approval processes associated with the Corporation's proposal to abstract 45 GL/year from the South West Yarragadee aquifer were shelved by the WA State Government in 2007, in favour of the development of a new desalination source.

4.2.2 Water Trading

A significant share of surface water resources are allocated to the irrigation industry. The Corporation estimates that by piping water that currently flows in open channels in the Harvey and Waroona Irrigation network, therefore preventing seepage and evaporation losses, 17 GL/year of water has been made available for trade.

4.2.3 Kimberley Water

In December 2004 the WA State Government established a panel of experts to assess and examine proposals to bring water from the Kimberley to Perth (Department of Premier and Cabinet, 2006). The panel reviewed various proposals and the main finding was that transporting water from the Kimberley to Perth was not efficient as:

- The cost of Kimberley water is not currently competitive with other potential sources;
- Transporting water by canal would have the greatest environmental impacts and hold the greatest risks for providing a reliable water supply; and
- Transporting the water to Perth using super tankers would cost on average $6.70/kL and transport via canal equates to $20.50/kL. Current water sources' costs are between 80c and $1.20/kL.

4.2.4 Catchment Management

Catchment management aims at increasing runoff into dams through decreasing the density of previously logged and subsequently replanted catchment vegetation. The Corporation's Wungong catchment trial

commenced in late 2005 for a period of 12 years, and is predicted to increase runoff into the dam by 25%. The outcomes of this analysis will guide the extension of the catchment management program into other public drinking water supply catchments.

4.2.5 Eglinton, Yanchep and Gingin Groundwater

Eglinton, Gingin and Yanchep groundwater sources are located within the Northern Perth Basin in the Gingin Groundwater area. The Northern Perth Basin contains significant, mainly fresh to brackish, groundwater resources currently used for a variety of horticultural and mining purposes. Land use in these areas is highly diverse but has recently come under considerable pressure from sprawling urban residential developments, placing uncertainty on development of this resource.

4.2.6 Wellington Dam

The use of water from Wellington Dam is currently constrained by catchment salinisation. The Collie River Salinity Recovery Project (first phase) was launched on 3 August 2005. The project is designed to reduce salinity levels, with a long-term goal of making the water suitable for drinking by 2015 (Gallop 2005). The Corporation's ability to access a larger share of this resource for the IWSS will be linked closely to management of this, and allocation issues.

4.2.7 Esperance to Goldfields Pipeline

A report that reviewed the cost of supplying bulk drinking water to the Goldfields was released on 30 June 2005 (ERA 2005). The report indicates that supplying water to Kalgoorlie via desalination and delivery by pipeline from Esperance is not the most appropriate method of supply, in terms of economic costing. Despite this, the Corporation will continue to assess the role of the Esperance to Goldfields Pipeline in source development planning.

4.2.8 Water Recycling

While water recycling has been undertaken in regional areas of WA for many years, large scale use of recycled water in the metropolitan area has been limited due to ongoing health and environmental investigations.

The State Water Strategy has set a target of reusing 20% of treated waste water sources by 2012. To achieve this the Corporation has developed a number of recycling projects, including:

- The Groundwater Replenishment Trial project, which is a trial of adding recycled treated wastewater to underground aquifers under controlled conditions. The water can be withdrawn at a later date, or used as a barrier to reduce water table decline and prevent saltwater or other contaminants from entering the aquifer;
- The Kwinana Water Reclamation Plant, which treats about 24 million litres a day of secondary treated wastewater from the Woodman Point Wastewater Treatment Plant. The resulting high quality industrial grade water is then supplied to industry in place of scheme and bore water; and

- The McGillivray Oval Irrigation Project, where secondary treated wastewater from the Subiaco Wastewater Treatment Plant is used to water sports ovals. In many regional areas this is also common.

4.3 Alternative Sites and Pipeline Routes Considered

A new desalination plant cannot be developed on the site of the recently constructed Perth Seawater Desalination Plant (in Kwinana) due to limited land area. There are no other potentially suitable sites in the vicinity of the metropolitan area which meet the requirement of access to the coast within close proximity to the IWSS.

In 2005 the Corporation referred a proposal for a seawater desalination plant containing three potential sites (two at East Rockingham and one at Port Kennedy) to the WA EPA. The Port Kennedy site is a Corporation owned Wastewater Treatment Plant site. The proposal for a desalination plant at Port Kennedy included a number of potential intake and outlet points located at Secret Harbour Bay, Golden Bay, Bridport Point and Becher Bay. These, on average, are approximately 7 km from the proposed plant site.

The two potential plant sites identified in East Rockingham are owned by the Corporation. The proposed outlet point would be located at Point Peron and two potential intake points were identified on Cockburn Sound in Rockingham. Pump stations would be required on the beach at the intake point to draw in seawater and send it to the plant.

The East Rockingham/Port Kennedy proposal was given a sPER level of assessment which was raised on appeal to an Environmental Review and Management Program (ERMP). At the same time as the appeal was determined, the then State Minister for the Environment announced that for environmental and social reasons, the proposed plant would not be located at Port Kennedy. The Corporation has withdrawn this proposal from the WA EPA assessment process.

Investigations of the coastal strip from Jurien Bay to Bunbury to identify potential desalination plant sites began in 2006 (Water Corporation, 2007a). Desktop studies were undertaken to identify possible locations, with further engineering and environmental assessments carried out on some of the potentially feasible options. Initial studies included environmental constraints assessments, as well as consideration of social and technical factors. The requirement of the investigation was to identify potential locations that could sustain the intake and brine discharge from a 50 GL/year desalination plant with potential to increase to 100 GL/year in the future. Potential desalination plant sites were identified on the basis of the following characteristics:

- close to the ocean;
- easy integration into the IWSS;
- access to a suitable power source;
- environmentally compatible, with minimal environmentally sensitive areas;
- at least 10 ha (for the first 50 GL/year component) in size to accommodate plant components;
- available buffers required for chlorination facilities;
- compatible surrounding land uses (industrial, rural, park and recreation); and
- ideally, be owned by the Corporation.

Section 4 3BFeasible Alternatives

Environmental considerations (taken into account in the selection of potential sites) included:

- Land immediately adjacent to Marine Conservation Reserves;
- Land immediately adjacent to estuarine environments;
- Land immediately adjacent to river mouth environments;
- Land immediately adjacent to Fish Habitat Protection Areas (FHPAs);
- Land immediately adjacent to waters with potential for fouling;
- Land immediately adjacent to marine areas of Aboriginal significance;
- Land immediately adjacent to known and protected shipwrecks;
- Land included in a reserved National Park, Nature Reserve, Conservation Park, State Forest or Regional Park (collectively referred to within this document as 'Reserves');
- Land and waters declared to be protected under the Ramsar Convention;
- Land declared to be protected under the Environment Protection (Swan Coastal Plains Lakes) Policy 1992;
- Land declared as a Conservation Category Wetland (CCW);
- Land declared in the Directory of Important Wetlands;
- Land declared as the location and buffer of Threatened Ecological Communities (TECs);
- Land known to include Declared Rare Flora (DRF) or be known to support Threatened or Endangered Fauna;
- Land declared for protection under Bush Forever;
- Land declared for conservation under the Systems Conservation Reservations, namely Systems 5 and 6;
- Land recognised by the WA DEC as an Environmentally Sensitive Area (ESA);
- Land identified as being of World, National or Commonwealth Heritage value;
- Protected sites on the Register of the National Estate;
- Land identified as a Registered Site on the Aboriginal Site Register under the *Aboriginal Heritage Act 1972*;
- Land zoned 'Urban' or 'Urban Deferred' under a Region or Town Planning Scheme; and
- Land used for military training.

The selection of the pipeline route up to the storage tanks north of Harvey was based on an initial desktop constraints mapping exercise which included environmental, soils and heritage issues. A landowner workshop was held in September 2007 to determine the social impacts of the potential pipeline route and consultation with the Shire of Harvey on the pipeline route options has been ongoing. As a result of all these inputs a preferred pipeline route has been selected, based on environmental and social impact minimisation. A significant reduction in impacts on native vegetation and landowners has been achieved via this process. Further impact assessment (flora, fauna, soils and social) studies along the proposed pipeline route will be presented and discussed in Section 6 of this PER.

Site selection for the summit tank(s) north of Harvey was based on the requirement for a site height of 145 m AHD to provide the gravity feed to the system, and to minimise environmental and social impacts. This was undertaken in consultation with local landowners and the Shire of Harvey. Consultation with the owner of the preferred site is continuing and the majority of the site is cleared agricultural land.

Section 5 4BDescription of the Environment

5.1 Introduction

This Section presents an overview of the environment in the SSDP Project area, with a particular focus upon aspects pertinent to those issues protected by the EPBC Act and Commonwealth requirements as articulated by DEWHA.

5.2 Surrounding Land Use

The proposed location for the SSDP is partially within the existing Binningup Wastewater Treatment Plant site at Lots 32, 33 and part Lot 8 Taranto Road Binningup. The 41 ha Lots 32 and 33 site is reserved for 'Public Utilities' under the Greater Bunbury Regional Scheme (WAPC 2007). The WWTP onsite is a 'pond' type treatment plant and treats only wastewater from the Binningup town-site. Part Lot 8 Taranto Road, Binningup is a cleared, disused limestone quarry and will also be owned by the Corporation at the time of commencement of construction, and will be zoned appropriately (currently rural).

There are two town sites located near the proposed plant site: Binningup and Myalup. Binningup has a population of approximately 900 and Myalup has a population of approximately 190 (Shire of Harvey 2006).

There are a number of land uses in the region. Inland areas consist of largely agricultural land use and coastal areas are largely residential. A chain of limestone quarries runs parallel to the coast between the ocean and the agricultural zones and a large pine plantation operated by the DEC is nearby to the east.

According to the Greater Bunbury Regional Scheme and the Shire of Harvey Town Planning Scheme the land use zones that will be intersected by the implementation of the proposal are rural, public purposes and state forest (WAPC 2007) (Figure 5-1).

Recreational facilities are available at the three major recreation nodes along the study coastal area, Myalup, Binningup and Buffalo Beach. Myalup Beach and Binningup Beach have areas specifically designated for swimming. Binningup beach has an occasional surf break, attracting surfers to the area when the conditions are suitable.

A recent survey published in the Shire of Harvey Coastal Management Plan indicates that the main recreational activities in Binningup are swimming, fishing and walking (Shire of Harvey 2006).

The use of four-wheel-drive vehicles, off-road vehicles, trail bikes and quad bikes on the local beaches and sand dunes is a popular activity, although this practice is illegal with vehicles not lawfully permitted in the dunes. Despite this, the Shire of Harvey has provided vehicle access points to the beach at Binningup. Vehicles are generally encouraged to drive along the beach between the high and low water marks and avoid the dunes (Shire of Harvey 2006). Once vehicles are on the beach they generally travel unimpeded, with the only restrictions being at the main beaches at Myalup and Binningup and where occasionally the Harvey Diversion Drain breaks through to the beach (Shire of Harvey 2006). Access to the beach and dunes for these vehicles is essentially unfettered, with significant areas of erosion and vegetation damage evident from uncontrolled vehicle access in the area proposed for the SSDP.

5.3 Climate

Binningup is located in south-western WA, which experiences Mediterranean climate patterns. The climate of the south-west coastal region is summarised in Table 5-1.

Table 5-1 Climate of Binningup, Western Australia

Climate of Binningup, Western Australia	
Climate	Temperate, distinctly dry and hot summer, marked wet winter
Temperature	Mean Maximum: 22.9 °C - Mean Minimum: 11.0 °C
Dominant Rainfall Season	Winter
Average Annual Rainfall	736.6 mm
Average Annual Evaporation	1400–2000 mm
Predominant wind direction	East south-east in the morning - westerly in the afternoon

Source: BOM 2008b

5.4 Terrestrial Environment

5.4.1 Flora and Vegetation

The majority of the region's coastal areas have been cleared of remnant vegetation in the past, mainly for rural land uses, but also for urban development. Narrow strips of coastal dune vegetation remain along most of the coast. In certain areas the condition of the vegetation has been degraded as a result of uncontrolled access and dune blowouts.

Although no Commonwealth listed vegetation communities exist in the Project area, the WA EPA has identified seven ecological linkages in the greater Bunbury region. These linkages are presented in Figure 5-2.

Level 1 field investigations were undertaken in spring 2006 (360 Environmental 2007). This study covered the Corporation owned Lots 32 and 33, Taranto Road, Binningup and a selected pipeline corridor. Negotiations with the owners of Lot 8 had not yet commenced so this Lot was not surveyed at that time. The pipeline corridor surveyed was based on a desktop analysis of likely environmental and social constraints and has since been re-aligned to better address landowner concerns.

Section 5

4BDescription of the Environment

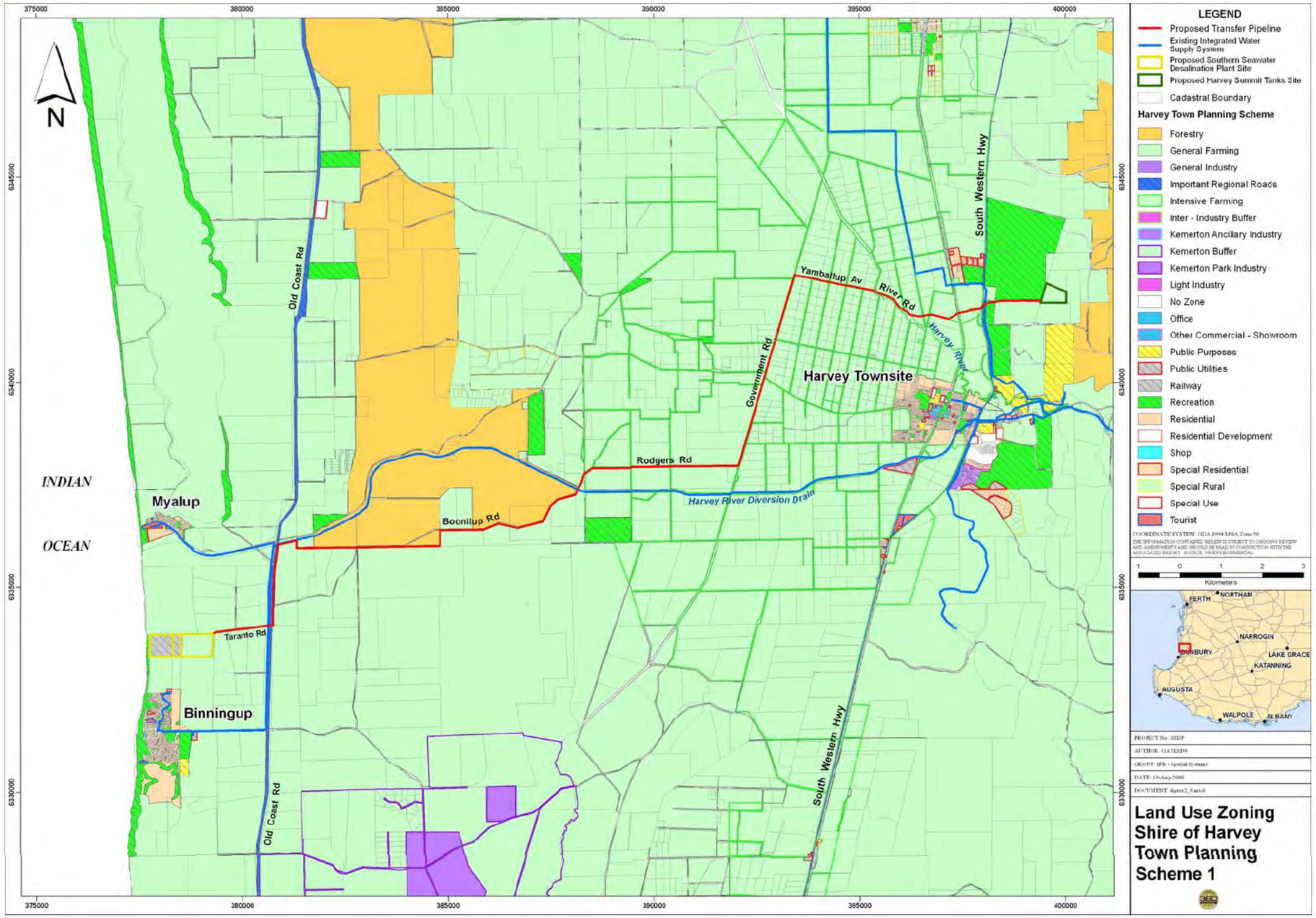


Figure 5-1 Land Use Zones within proximity to SSDP

Section 5 4BDescription of the Environment

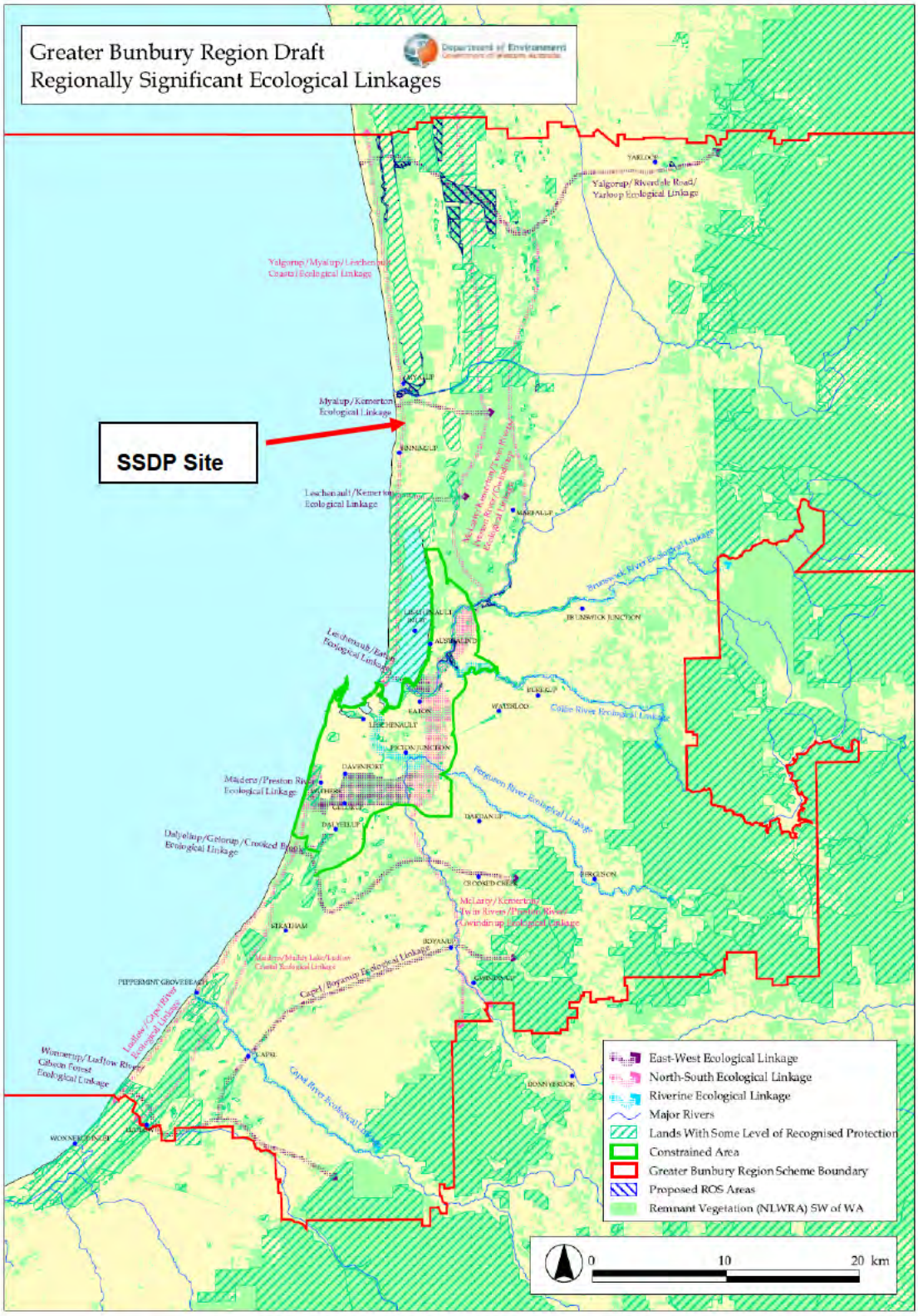


Figure 5-2 Regionally significant ecological linkages

Section 5 4BDescription of the Environment

Once the pipeline corridor route had been finalised, and the Corporation had confirmed agreement with the owners of Lot 8 to progress with the purchase of part Lot 8, a Level 2 Flora Study was commissioned. This study was conducted in spring 2007 (360 Environmental 2008a).

The combined terrestrial flora and vegetation studies found:

- One species listed as both (WA) Declared Rare Flora and EPBC Act listed Vulnerable flora, Dwarf Hammer-orchid (*Drakaea micrantha*).
- Important vegetation values recorded in the survey area included *Eucalyptus gomphocephala* woodlands (in good condition), *Agonis flexuosa* low open forests, *Banksia attenuata- Agonis flexuosa* low woodlands and conservation wetlands.
- The condition of the vegetation in the bushland areas was mostly good to very good.
- The pipeline corridor east of the Harvey diversion drain and the tank sites were mostly completely degraded road verges and paddocks.
- The plant site and bushland between the Old Coast Road and Harvey River diversion drain were part of north-south ecological linkages.
- Linkage values exist in an east-west direction along the pipeline corridor.

The major findings of the vegetation surveys are further discussed in Section 6.2. Although not listed in the results of the EPBC Act search of the Project site, DEWHA has requested that the Corporation consider the impact of the Project upon two threatened flora species. Accordingly, an additional survey was conducted by Maunsell Australia Pty Ltd in October 2008. The Maunsell study found a totoal of 866 individual plants of three species of Priority Flora within the proposed pipeline corricors including 843 plants of *Acacia semitrullata* (P3), 22 plants of *Caladenia speciosa* subsp. *speciosa* (P4) and one mature tree, *Eucalyptus rudis* subsp. *cratyantha* (P4) (which was identified and vouchered during 360 Environmental's 2007 assessment). The study did not record any populations of DRF species within the specified project area nor were any DRF or Priority flora populations recorded at the PSDP plant site. The Maunsell report is included as Appendix D of this cPER. In regards to the two threatened species identified by DEWHA, details are listed in Table 5-2 and further information is provided below.

Table 5-2 EPBC Act Protected Flora Species that may occur in the Project area

Species	Common Name	Status	Threatened Species
Drakaea elastica	Glossy-leaved hammer-orchid	Endangered	Yes
Drakaea micrantha	Dwarf hammer-orchid	Vulnerable	Yes

Glossy-leaved Hammer-orchid

The Glossy-leaved hammer-orchid (*Drakaea elastica*) is a tuberous, perennial, herb, 0.12–0.3 m high with red, light green with slightly darker venation above, and yellow flowers. Flowering occurs late September to early November (Hopper & Brown 2007).

D. elastica is listed as Endangered under the EPBC Act. Urban development and agricultural clearing have removed much of the habitat of this species. The remaining fragmented remnants of native vegetation are mostly small and degraded through weed invasion, recurrent fire, dieback disease, rubbish dumping and illegal vehicle usage. Half the historically known populations are now extinct and only two of the remainder are in good condition (Hopper & Brown 2007).

D. elastica is endemic to WA and is found between Cataby and Ruabon on the Swan Coastal Plain. *D. elastica* occurs in white or grey deep sandy soil in Banksia woodland, often in association with tall *Kunzea* spp. (Hopper & Brown 2007). The species has been previously recorded in the Binningup region but was not recorded in the 2007 (360 Environmental 2008) or 2008 surveys (Maunsell 2008, Appendix D).

Dwarf Hammer-orchid

The dwarf hammer-orchid *(Drakaea micrantha)* is a tuberous perennial herb, 0.12 m to 0.3 m high, with dull, blue grey and dark green flowers. Flowering occurs September to early November (Hopper & Brown 2007). *D. micrantha* is listed as Vulnerable under the EPBC Act due to its abundance with very few individuals recorded even though the species is widespread in many disjunct populations (Hopper & Brown 2007).

D. micrantha is endemic to WA and occurs in small disjunct populations between Perth, Augusta and the Porongurups. It is usually found in open sandy patches in Banksia and Jarrah woodland where it grows under thickets of *Kunzea glabrescens* with the Flying Duck orchid (*Paracaleana nigrita*) and other *Drakaea* species (Hopper & Brown 2007, Water Corporation 2008). Although suitable habitat for *D. micrantha* exists in wetlands areas of the Survey Area, only one plant was recorded. This species was recorded about 45 m north of the corridor centre line in a seasonal dampland area. *D. micrantha* was not recorded within the Project Area during the 2008 threatened flora survey (Maunsell 2008, Appendix D)

5.4.2 Dieback

The 2007 Flora and Fauna survey (360 Environmental 2008a) scope was widened to include a hygiene survey, namely *Phytophthora cinnamomi* (dieback) at the Plant Site, Pipeline Corridor and Tank Sites. The results have indicated that the plant pathogen *Phytophthora cinnamomi* is found within the Survey Area (360 Environmental 2008a). Of the total area surveyed for dieback, 460.8 ha was classified as uninterpretable (highly disturbed areas such as paddocks), 14.1 ha are infested and 10.0 ha are uninfested. The entire plant site and some areas of the pipeline corridor are free of *P. cinnamomi* (or were uninterpretable). These areas will be protected to prevent the spread of the pathogen during the installation and operational phases of the SSDP as described in Section 6.2.4, and as consistent with the *Threat Abatement plan for Dieback caused by the root-rot fungus Phytophthora cinnamomi Department of Environment and Heritage* (DEH, 2002).

5.4.3 Terrestrial Fauna

Terrestrial fauna occurring, or potentially occurring, in the SSDP region and listed under the EPBC Act, were identified using the search tool on the DEWHA website. This search identified two species listed as Vulnerable under the EPBC Act: the Chuditch (*Dasyurus geoffroii*) and the Quokka (*Setonix brachyurus*).

Section 5 4BDescription of the Environment

Although not listed in the results of the EPBC Act search of the Project site, DEWHA has requested that the Corporation also consider the impact of the Project upon the Western Ringtail Possum (*Pseudocheirus occidentalis*). This species is listed as Vulnerable under the EPBC Act.

It should be noted that fauna are mobile and the database information provided should therefore be regarded as indicative only. Detailed field investigations of the Plant Site and an indicative pipeline corridor were undertaken in spring 2006 and 2007 by suitably qualified zoologists (360 Environmental 2007, 2008a). An outline of the survey findings are presented below.

The field studies (360 Environmental 2007, 2008a) found:

- The Plant Site plays a part in the Yalgorup/Myalup/Leschenault Coastal Ecological Linkage but does not appear to form a part of any east-west linkage because of the large distance between this remnant and bushland to the east. More mobile species such as some species of bird, larger mammals and reptiles may be able to move between the Plant Site and other areas of feeding and/or breeding importance;
- Regional surveys for the Western Ringtail Possum were conducted in three study areas from Myalup to the Leschenault Peninsula using three stages of fieldwork to assess the significance of the Plant Site to the local ringtail possum population. Surveys in the study area surrounding the Plant Site found evidence of a ringtail possum population that inhabits two main areas of habitat – the area around the Binningup town site and Taranto Road (includes the Plant Site, Figure 5-3 and 5-4). This population is small (approximately 50 individuals) and persists at low density, particularly on the Plant Site (360 Environmental 2008a). The Western Ringtail Possums use the vegetation on the Plant Site as shown in Figure 5-5. The majority of this vegetation will be retained as discussed in Section 6.2.

All Protected Fauna species that may reside within the Project Area and are listed as Threatened under the EPBC Act are documented in Table 5-3 and further information is provided below.

Table 5-3 EPBC Act Protected Fauna Species that may occur in the project area

Species	Common Name	EPBC Act Status
Dasyurus geoffroii	Chuditch	Vulnerable
Setonix brachyurus	Quokka	Vulnerable
Pseudocheirus occidentalis	Western ringtail possum	Vulnerable

Chuditch

The Chuditch (*D. geoffroii*), also known as the Western Quoll, is the largest carnivorous marsupial in WA. The species has a soft, white spotted, brown pelage, large rounded ears, pointed muzzle, large dark eyes and a non-hopping gait. The tail is about three quarters of the head and body length, and has a black brush over the distal portion. Its granulated footpads readily distinguishes *D. geoffroii* from its more arboreal relative, the Northern Quoll (*D. hallucatus*), which has striated footpads. It is usually active from dusk to dawn (DEC 2006).

D. geoffroii formerly occurred over nearly 70% of the Australian continent from WA across to Queensland, New South Wales and Victoria. *D. geoffroii* now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA (DEC 2006). Habitat alteration and removal of suitable den logs and den sites following land clearing, grazing and frequent wildfire have contributed to a decline in *D. geoffroii* numbers. Competition for food and predation by foxes (*Vulpes vulpes*) and cats (*Felis catus*), hunting and poisoning have also contributed to its decline (DEC 2006). *D. geoffroii* is listed as Vulnerable by the EPBC Act.

The species was not recorded during the 2006 or 2007 surveys by Ninox Wildlife Consulting (360 Environmental 2007, 2008a). This marsupial has been frequently captured in the Darling Range, although there are very few records from the southern Swan Coastal Plain. However, *D. geoffroii* have been captured at Gwindinup, south of Boyanup in recent years. While it is possible that *D. geoffroii* may be present within the general area, it is unlikely that many of the small native mammals remain due to the level of disturbance and long-term fragmentation of the remnant vegetation in the general area (360 Environmental 2007, 2008a).

Quokka

Setinox brachyurus is a small to medium sized macropodid marsupial endemic to south-west WA and currently known to inhabit Rottnest Island, Bald Islands, and 25 sites on the mainland, including swamp areas through the south-west forests from Jarrahdale to Walpole (www.naturebase.net, accessed July 2008). Compared to the contiguous Rottnest Island population, those on the mainland occur at low density and in widely separated sites (Hayward et al. 2007). These remnant local populations are restricted to discrete and scattered, swampy habitat patches which are dominated by the tall shrub *Agonis linearifolia* (Hayward et al. 2003). The continued low abundance of *S. brachyurus* in the northern jarrah forest is likely to be a combination of continuing predation pressure from foxes and the absence of sufficient suitable swamp habitat to provide food and predation refuge (Hayward et al. 2007).

Recent publications have confirmed that no populations of *S. brachyurus* exist within 30 km of the coast between Perth and Bunbury (Haywood et al. 2007). Therefore, there is no indication that the species occurs in the vicinity of the Project area.

Western Ringtail Possum

Pseudocheirus occidentalis (Western Ringtail Possum) is commonly described as very dark brown above, occasionally dark grey, with cream or grey fur below. *P. occidentalis* has ears that are short and rounded and a slender, strongly prehensile tail with a terminal white tip of variable length (Nevill 2005, DEC 2006).

P. occidentalis is endemic to south-western Australia and is a specialised arboreal herbivore that feeds predominantly on leaves of a few select species (Wayne et al. 2005). Only three large populations remain, with the densest population located around Bunbury and Busselton. This location is in the southern extremity of the Swan Coastal Plain where the peppermint tree (*Agonis flexuosa*) constitutes 95% of the species' diet (Wayne et al. 2005). This coastal population differs from the inland population in diet and nests (dreys). Inland species feed on jarrah foliage as *A. flexuosa* is naturally absent, and use tree hollows and *Xanthorrhoea preissii* for shelter rather than build dreys, as in the coastal population (Wayne et al. 2005). *P. occidentalis* is listed as Vulnerable under the EPBC Act.

The major factors thought to be contributing to the decline of *P. occidentalis* include habitat loss and/or modification, predation by introduced predators, and changing fire regimes. In most coastal populations the fox is the main predator of *P. occidentalis* as shown by monitoring of re-introduced populations. Clearing of coastal

Section 5 4BDescription of the Environment

Peppermint in the Bunbury- Augusta and Albany areas is contributing to habitat fragmentation while prescribed burning of these areas needs to be managed to maximise population survival and enhancement (DEC 2006).

A regional survey for *P. occidentalis* was conducted by Barbara Jones (360 Environmental 2007) in the area from Myalup to the Leschenault Peninsula to assess the significance of the Plant Site to the local *P. occidentalis* population (Figures 5-3 to 5-5). The survey identified that *P. occidentalis* occurs on the Plant Site within the Tuart (*Eucalyptus gomphocephala*) and peppermint vegetation associations, and the Banksia (*Banksia attenuata*) and peppermint vegetation associations. This population is small (approximately 50 individuals) and persists at low density, particularly on the Plant Site. The 2007 survey also identified *P. occidentalis* within the Binningup townsite, within privately owned native vegetation to the east of the Binningup townsite (Binningup Road), and within privately owned native vegetation north and east of the Plant Site (Water Corporation 2008a).

Potential *P. occidentalis* movement corridors from north to south and from east to west were identified within the Survey Area. These corridors may allow the movement of *P. occidentalis* through the Plant Site to other habitat areas (Water Corporation 2008a).

Section 5 4BDescription of the Environment

Figure 5-3 Western ringtail possum dreys and scats

Section 5 4BDescription of the Environment

Figure 5-4 Western ringtail possum nocturnal sightings

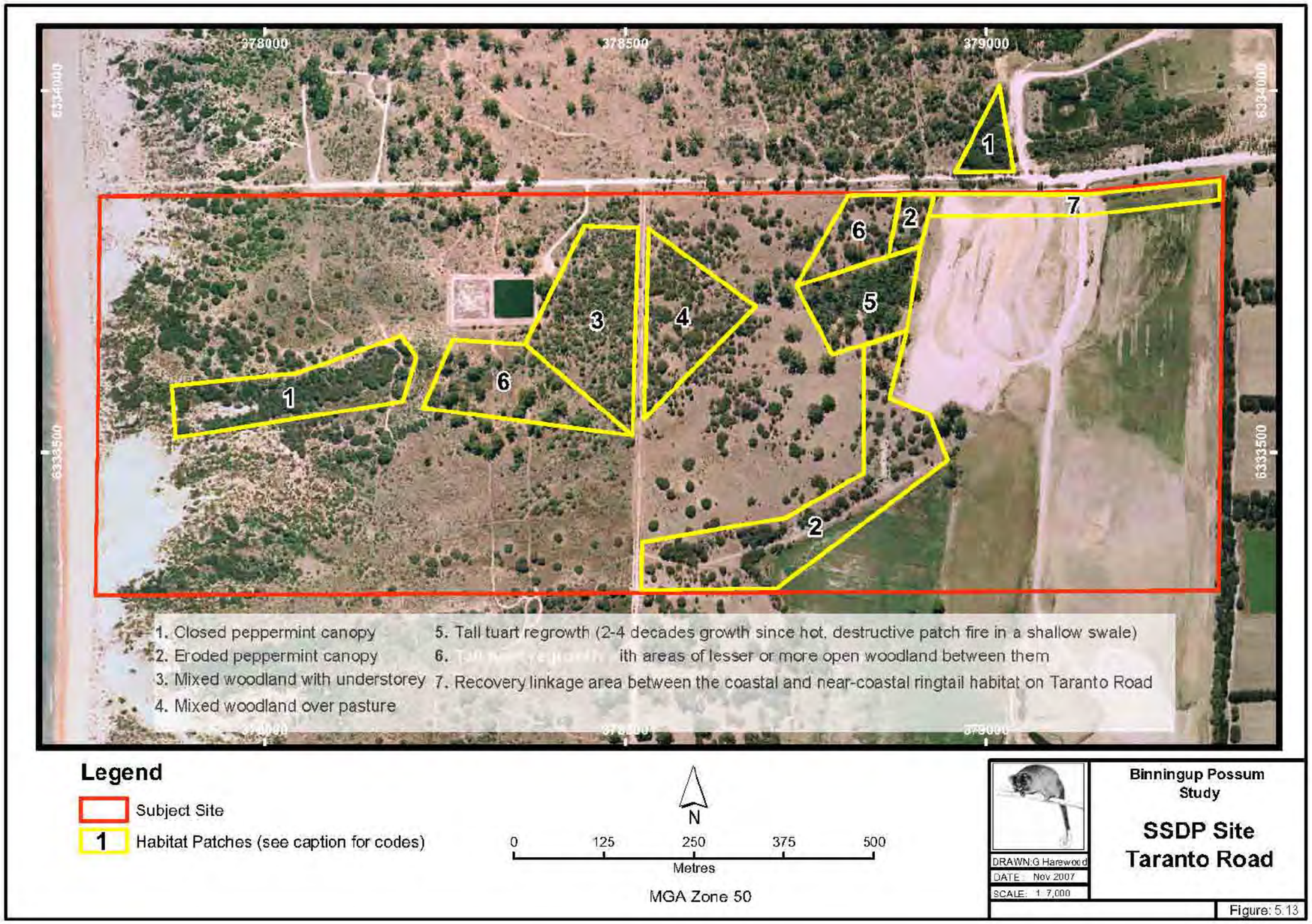


Figure 5-5 Western ringtail possum habitat – SSDP site

5.4.4 Avifauna

Avifauna occurring, or potentially occurring, in the SSDP region that are listed on the Commonwealth threatened species list under the EPBC Act, or that are listed as protected migratory species under international agreements, were identified using the search tool on the DEWHA website. This search identified a total of 52 bird species (see Table 5-4).

A literature review was also conducted to determine the likelihood of a species occurrence within the SSDP site (Appendix E). The review placed emphasis on the distribution and range of applicable EPBC Act and species listed under the Japan – Australia, China – Australia and Republic of Korea – Australia Migratory Bird Agreements (JAMBA/CAMBA/ROKAMBA), taking into account factors such as:

- seasonal variation (or migratory behaviour) of the presence (or otherwise) of these species
- habitats and life cycle requirements of listed species
- habitats potentially affected by the proposed SSDP
- known significant sites for migratory species in the region (e.g. Peel-Yalgorup system, Vasse-Wonnerup wetland system).

Detailed field investigations of Lot 32, 33 and an indicative pipeline corridor were undertaken in spring 2006 and 2007 by an suitably qualified zoologists (360 Environmental 2007, 2008a). A survey was also conducted for threatened Cockatoos on the Plant Site, Pipeline Corridor and Tank Sites. An outline of the findings from these surveys and the literature review is presented below.

Table 5-4 EPBC Listed Marine Birds and Migratory Bird Agreement listed species that may occur in the Project area

Species (common name)	EPBC Status	Migratory Bird Agreement			Likelihood of occurrence
		ROKAMBA	CAMBA	JAMBA	
SEABIRDS					
Southern Giant -Petrel	Endangered				Unlikely – oceanic distribution
Northern Giant-Petrel	Vulnerable				Unlikely – oceanic distribution
Shy Albatross	Vulnerable				Unlikely – oceanic distribution
Gibson's Albatross	Vulnerable				Unlikely – oceanic distribution
Flesh-footed Shearwater		X		X	Unlikely – oceanic distribution
Short-tailed Shearwater		X			Unlikely – oceanic distribution
Wedge-tailed Shearwater				X	Unlikely – oceanic distribution
Pomarine Skua			X	X	Unlikely – oceanic distribution
South Polar Skua				X	Unlikely – oceanic distribution
Arctic Jaeger		X			Unlikely – oceanic distribution
Caspian Tern			X	X	Possible temporary occurrence on beach and nearshore waters
Crested Tern				X	Possible temporary occurrence

Species (common name)	EPBC Status	Migratory Bird Agreement			Likelihood of occurrence
					on beach and nearshore waters
Common Tern		X	X	X	Unlikely
Bridled Tern			X		Unlikely
White-winged Black Tern		X		X	Unlikely
MIGRATORY SHOREBIRDS					
Black-tailed Godwit		X	X	X	Unlikely
Bar-tailed Godwit		X	X	X	Unlikely
Little Curlew		X	X	X	Unlikely
Whimbrel		X	X	X	Unlikely
Eastern Curlew		X	X	X	Unlikely
Marsh Sandpiper		X	X	X	Unlikely
Common Greenshank		X	X	X	Unlikely
Wood Sandpiper		X	X	X	Unlikely
Terek Sandpiper		X	X	X	Unlikely
Common Sandpiper		X	X	X	Unlikely
Grey-tailed Tattler		X	X	X	Unlikely
Ruddy Turnstone		X	X	X	Unlikely
Great Knot		X	X	X	Unlikely
Red Knot		X	X	X	Unlikely
Sanderling		X	X	X	Unlikely
Red-necked Stint		X	X	X	Unlikely
Long-toed Stint		X	X	X	Unlikely
Pectoral Sandpiper		X		X	Unlikely
Sharp-tailed Sandpiper		X	X	X	Unlikely
Curlew Sandpiper		X	X	X	Unlikely
Broad-billed Sandpiper		X	X	X	Unlikely
Ruff		X	X	X	Unlikely
Red-necked Phalarope		X	X	X	Unlikely
Pacific Golden Plover		X	X	X	Unlikely
Grey Plover		X	X	X	Unlikely
Lesser Sand Plover		X	X	X	Unlikely
Greater Sand Plover		X	X	X	Unlikely
Oriental Pratincole		X		X	Unlikely
TERRESTRIAL BIRDS					
Carnaby's Black Cockatoo	Endangered				Yes
Baudin's Black Cockatoo	Vulnerable				Likely: March - September
Great Egret	Migratory		X	X	Possible occurrence in nearby wetlands

Species (common name)	EPBC Status	Migratory Bird Agreement			Likelihood of occurrence
Cattle Egret	Migratory		X	X	Possible occurrence in nearby wetlands
Glossy Ibis			X		Possible occurrence in nearby wetlands
Eastern Reef Egret			X		Unlikely
White-bellied Sea Eagle	Migratory	X	X		Unlikely
Fork-tailed Swift	Migratory	X	X	X	Unlikely
Rainbow Bee-eater	Migratory			X	Likely occurrence during September to April

Seabirds

The term 'Seabirds' is generally used to collectively describe those bird species which spend a substantial part of their life foraging and breeding in marine environments. Birds considered to be seabirds include gulls, terns, albatrosses, petrels, shearwaters, cormorants, gannets and boobies. The majority of these birds feed in coastal and oceanic waters and many migrate beyond Australian waters to feed and breed. Most species tend to forage on their own, though large feeding flocks will gather at rich or passing food sources. Squid, fish and krill are common food sources. Seabirds breed in colonies on remote islands and the WA DEC database on seabird breeding locations has not identified any breeding sites in the vicinity of the Binningup area.

Fifteen species of seabirds were identified as possibly occurring in the area (see Table 5-4). These were composed of 10 species of oceanic seabirds and five species of seabirds (terns) that may also feed in nearshore coastal waters and possibly make temporary landfall on the shoreline for resting/roosting purposes.

The oceanic seabirds (Giant Petrels, Albatross, Shearwaters, Skuas) range from rare to common visitors to waters off the south-west WA coast and usually only beach washed dead specimens of these species are recorded as reaching the shoreline (typically after winter storms). Breeding sites for the Petrel and Albatross species are mostly in remote subantarctic and Antarctic islands (e.g. Falklands east to Macquarie Island) as well as a few islands off Tasmania (Ross et al. 1993). Recovery of birds (mostly beach washed) along the WA coastline have included birds banded as nestlings from many distant locations such as the Orkney and Shetland Islands, Crozet Islands and South Georgia (Storr & Johnstone 1988).

The Shearwater species are known to breed on some islands along the south-west and southern coast of WA and the breeding locations for these species are provided below:

- Wedge-tailed Shearwater: mostly breeds in tropical and subtropical islands with Rottnest and Carnac Islands being the southern-most localities.
- Fleshy-footed Shearwater: breeds in temperate islands in the southern Indian Ocean and the south-west Pacific. In WA it breeds on at least 40 islands along the south coast from Cape Leeuwin to east of Esperance (Daw Island).
- Short-tailed Shearwater: Breeds on temperate islands off the south coast of Australia. In WA breeding occurs on six islands in the Recherche Archipelago, east of Esperance.

Section 5 4BDescription of the Environment

The Wedge-tailed and Fleshy-footed shearwaters are also long-distance migrants out of WA in their non-breeding season and the local breeding populations of these species make trans-equatorial migrations into the northern Indian Ocean during winter months (Johnstone & Storr 1998).

Five species of tern may occur along the coast adjacent to the Project site. Caspian and Crested Terns are the most common of the tern species in the south-west and it is expected they would be present in nearshore marine waters and estuaries in the area. There is the potential for these species to use the sandy beaches between Bunbury and Mandurah (including the Binningup area) as a temporary resting/roosting site. The terns listed in Table 5-4 all have extensive distribution ranges including the north and east Indian Ocean and western Pacific Ocean. Breeding localities for the three tern species (Crested, Caspian, and Bridled Tern) known to regularly breed along the south-west WA coast include offshore islands such as those in the Lancelin area, the Rottnest Island to Safety Bay area and near Cape Leeuwin.

The White-winged Black Tern is an irregular visitor (September to May) to south-west WA where it may occur in large flocks. Its habitat preference in the Swan Coastal Plain is mainly freshwater lakes and swamps, occasionally estuaries, samphire and short-grass flats and lucerne fields (attracted to emerging dragonflies and swarming grasshoppers). It breeds in east Europe and north and central Asia (Johnstone & Storr 1998).

The Common Tern (*Sterna hirundo hirundo*) breeds in North America, Europe, North Africa and western Asia and is only a very rare visitor to the lower west coast of WA. It is moderately common to common along the northern WA coast (north of Carnarvon).

Migratory Shorebirds

Each year millions of shorebirds migrate between their northern hemisphere breeding areas in the Russian Far East, northern China and Alaska to as far south as Australia and New Zealand. The birds breed during the northern hemisphere summer and then move to the southern hemisphere localities during the non-breeding season. In Australia, large flocks of shorebirds arrive in October and feed mainly on small invertebrate fauna such as polychaete worms and small bivalves living in tidal mudflats and sandflats. In WA, the Kimberley-Pilbara coast represents a major wintering area for shorebirds and it is estimated that for some species (e.g. Great Knot), up to 70-80% of the total world population spends its non-breeding season on that section of coast, hence the region is of worldwide importance (Johnstone & Storr 1998). In April, shorebirds fly from their Australian feeding grounds and return to breeding grounds in the northern hemisphere tundra. Some species of shorebird weighing as little as 30 g may migrate 25,000 km annually and some species may fly more than 6,000 km non-stop.

Table 5-4 lists 28 species of migratory shorebirds that may potentially occur in the local region (Swan Coastal Plain). Recorded occurrence of these species on the Swan Coastal Plain varies from being rarely recorded (vagrants such as the Long-toed Stint) to regular seasonal visitors (e.g. Bar-tailed Godwit, Common Greenshank and Red-necked Stint). Important migratory shorebird sites on the Swan Coastal Plain in the south-west of WA include the Peel-Yalgorup and Vasse-Wonnerup wetland systems which have extensive areas of feeding habitat for shorebirds (i.e. invertebrate rich sandflats/mudflats, estuarine and freshwater wetlands).

A few species of shorebirds (Little Whimbrel and Oriental Practincole) are considered to be aberrant 'grassland' waders that prefer dry grasslands and floodplains in northern WA coastal areas. These species usually stay within the tropical zone and are highly nomadic, responding to local thunderstorms and cylconic rains. Both these species are vagrant or scarce visitors to south-west WA.

Terrestrial Birds

A few other species not included in the above seabird or migratory shorebird groupings may potentially occur in the area - these consist of two species of Cockatoo, four species of waterbirds (egrets/ibis), one species of raptor (White-bellied Sea Eagle), the Rainbow Bee-eater and the Fork-tailed Swift.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is a large black bird with distinctive white tail feathers, and white cheek feathers more conspicuous in the male. In males, the bill is black and the eye-ring dark pink. Females have a light grey bill, grey eye-ring, and the cheek patch is less distinctive (Nevill 2005).

C. latirostris is endemic to the south-west of WA extending from the lower Murchison River to Esperance, and inland to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noogar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Coondingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998). This species tends to move from inland areas in wheatbelt west after breeding into higher rainfall zones especially on the Swan Coastal Plain. Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah – Marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury. There are small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008). *C. latirostris* is listed as Endangered under the EPBC Act.

The 2007 survey by 360 Environmental identified a flock of 50 *C. latirostris* feeding in the pine plantation of the State Forest, and a flock of 60 *C. latirostris* feeding on pine plantation along Taranto Road near the SSDP site. An additional flock of 10 *C. latirostris* was observed feeding on *Hakea prostrata* vegetation on the SSDP site near the existing wastewater treatment ponds. Three potential hollows/nests and 89 potential feeding trees suitable for *C. latirostris* were identified within the Project area (Figure 5-6).

Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) is similar in appearance to *C. latirostris,* but can be distinguished from *C. latirostris* by its longer and narrower bill. The distribution and behaviour of *C. baudinii* is well known and restricted to the south-west Jarrah and Marri forests. The species is endemic to the south-west of Australia (Nevill 2005). *C. baudinii* is listed as Vulnerable under the EPBC Act.

On the southern Swan Coastal Plain this cockatoo is in some areas resident but mainly a migrant moving from the deep south-west to the central and northern Darling Range. Between March and September most flocks move north and are concentrated in the northern parts of the Darling Range. During this period birds forage well out onto the southern Swan Coastal Plain to areas such as Harvey, Myalup, Bunbury, Capel, Dunsborough and Meelup (Johnstone 2008).

While generally more common in the Darling Range this species can also be common on parts of the southern Swan Coastal Plain especially in mid-August – September when flocks begin to return to their breeding quarters (Johnstone 2008). Evidence of where Baudin's Cockatoos had been feeding was found in six areas on eastern section of pipeline and at the Harvey Summit Tank area. Although there were no sightings in 2006 or 2007 of *C. baudinii* during the environmental surveys within the Project area (Water Corporation 2008), this species is expected to utilise the Marri vegetation occurring along the pipeline corridor occasionally during March – September (Johnstone 2008).

Section 5 4BDescription of the Environment

The 2007 survey noted that the potential hollows/nests feeding trees identified for *C. latirostris* are all capable of utilisation by *C. baudinii.*

Four waterbird species are birds listed on the JAMBA could occur in the survey area: Great Egret, Cattle Egret, Glossy Ibis and Eastern Reef Egret. The Great Egret is common and widespread throughout Australia (except deserts) where it forages in aquatic habitats for fish, amphibians and invertebrates. The Cattle Egret is considered an irregular, mainly autumn visitor to the south-west and may be observed mainly in wet pasture in the company of livestock (Johnstone & Storr 1998). The Glossy Ibis is increasing on the Swan Coastal Plain and may be observed in and adjacent to freshwater lakes and other wetland areas. Based on the 360 Environmental (2008a) wetland survey, the wetland portion of the SSDP site does not "possess a high degree of naturalness" or "support a high level of ecological attributes and functions" that define a 'conservation category' wetland. Given the degraded nature of the wetland portion of the SSDP site, it is unlikely that the site contains important habitat for the above waterbird species or supports breeding sites (e.g. tall *Melaleuca* trees above water).

The Eastern Reef Egret is unlikely to occur in the vicinity of the Project area. It is uncommon in the south-west where it is mostly confined to islands (e.g. Rottnest, Carnac, Garden, Penguin) and rocky parts of the mainland coast opposite them and is scarce or absent elsewhere (Johnstone & Storr 1998). In addition, its preferred habitat (tidal reef, mudflats, rocky shores) does not occur in the vicinity of the SSDP site.

The White-bellied Sea Eagle was identified by the EPBC database 2 km radius search, however, it is noted in Johnstone and Storr (1998) that while this species has been recorded from most of the WA coastline it does not occur on the lower west and south-west, between Peel Inlet and Wilson Inlet (this includes the Binningup area).

The Fork-tailed Swift (*Micropus pacificus*), is listed in the migratory bird agreements and may be observed flying overhead, often ahead of storm fronts. However, this bird rarely lands in Australia. This species is migrant from Asia with arrival and departure times that are similar to the migratory shorebirds.

The Rainbow Bee-eater is a breeding migrant to the south-west during the September to April period when it is scarce to very common in the Darling Range and heavily wooded parts of the south-west (Johnstone & Storr 1998). During winter months it occurs in northern Australia (north of Gascoyne River in WA) and Indonesia. This species is likely to be in the local area during the spring and summer and was recorded from within the Banksia and Tuart vegetation types on the SSDP site (360 Environmental 2008). The Rainbow Bee-eater is often seen perching on telephone wires, fences and dead trees from where it makes short dashes to catch passing insects. It burrows into sand to form a nest, often at the margins of roads and tracks.

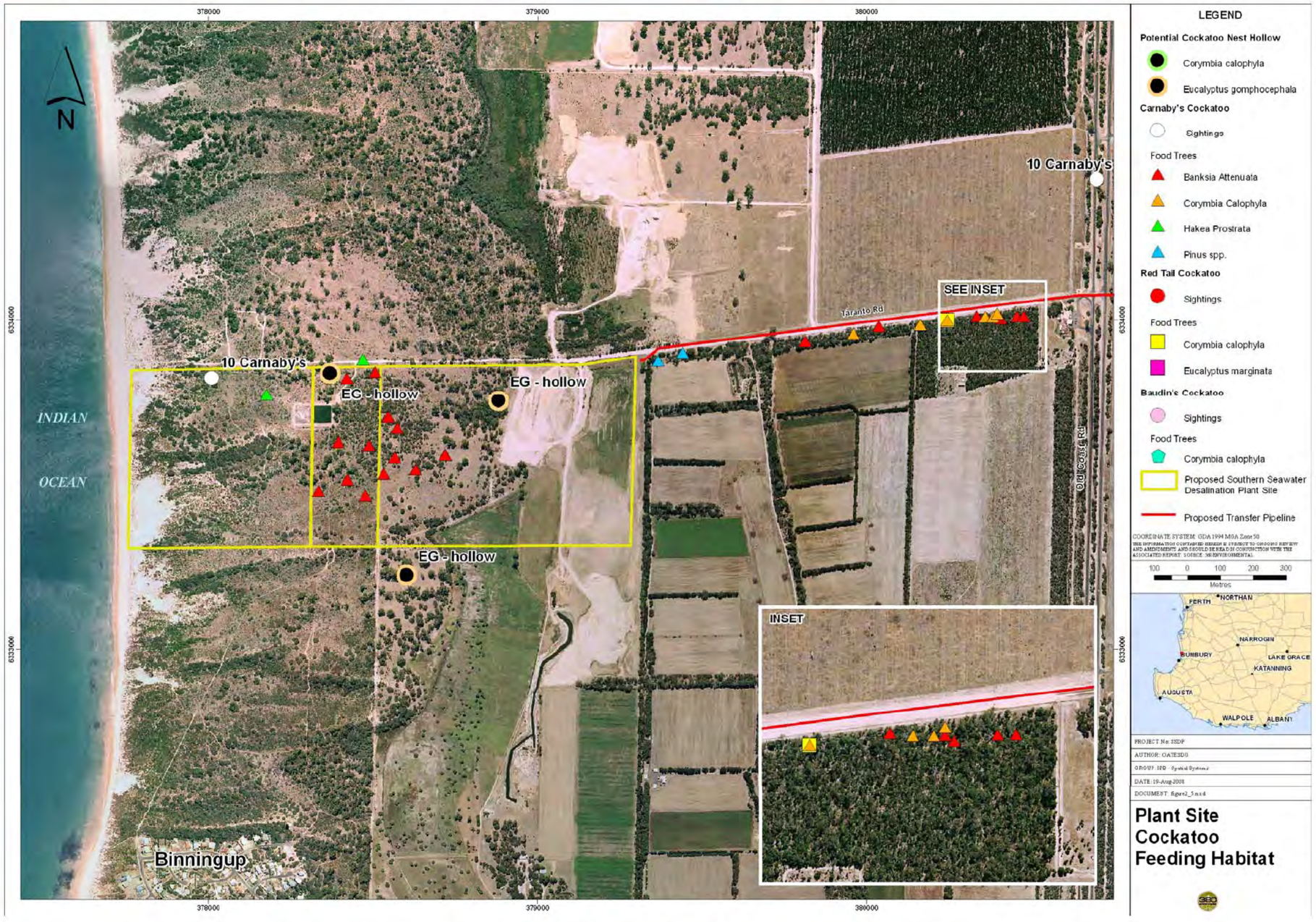


Figure 5-6 SSDP Cockatoo Feeding Habitat

Section 5 4BDescription of the Environment

5.5 Marine Environment

5.5.1 General oceanography

Bathymetry and water movement patterns are important factors in the siting of desalination plant outfalls as still conditions, deep holes or an unfavourable slope of the seafloor could potentially result in the brine discharge from the desalination plant not adequately mixing with the surrounding ocean. The Binningup area is characterised by simple offshore bathymetry (Figure 5-7). This area is favourable in that the shore is oriented approximately north–south, with the distinct absence of well-developed offshore limestone ridges. Thus the west-facing shores are fully exposed to the wind, wave, and current regime of the Rottnest Shelf (Commonwealth of Australia 2005). These conditions support the choice of the Taranto Road site for the SSDP plant.

A detailed bathymetric study was conducted by Fugro Survey Pty. Ltd. between 20 September and 3 October 2007 (Fugro 2008a) using a multibeam echo sounder, side scan sonar and sub bottom profiler (boomer) over a 4 km x 2 km area (Figure 5-7). No significant bathymetric features were found, confirming the suitability of the offshore environment for the mixing of the brine discharge.

Water column temperature data in the Project area were gathered via Conductivity Temperature Depth (CTD) profilers (UWA 2008d; KBR 2008b), a Seaglider (GHD 2007d; 2008c) and thermistors at fixed heights (RTMS and UWA 2008d, see Water Corporation 2008 for a compilation of all temperature data). Temperature varies on a seasonal basis with a peak of around 24 ºC in summer-autumn and a minimum of around 15 ºC in winter-spring. Analysis of temperature data (see UWA 2008d) shows that the site experiences well mixed conditions the majority of the time. A regular diurnal stratification-de-stratification cycle was observed where solar heating stratified the water column in temperature, which was then well-mixed by wind and over-night cooling.

5.5.2 Regional marine ecology

A larval fish literature review of the regional marine environment (Maunsell 2008) of makes reference to research conducted by Ayvazian & Hyndes (1995). Results of this study indicate that the surf zone and nearshore environments can be considered as important nursery habitats for fish larvae.

Detached macrophytes (commonly referred to as wrack) are transported from offshore environments (seagrass beds) to the surf zone, where they accumulate. Accumulation is usually greater during the winter. The total abundance of fish fauna and fish biomass increased as the volume of wrack in the surf zone increased. Furthermore, the fish fauna that used the macrophytes in the surf zone was dominated by juveniles. It is suggested that some species of fish are directly dependant on the wrack for shelter from predators and indirectly dependant by feeding on invertebrates associated with the wrack.

When the species composition of the nearshore environment is compared with that found in habitats adjacent to the nearshore, 38% and 42% of the species in the nearshore environment were also found with reefs and within seagrass beds respectively, and 22% were present in all three habitats. This indicates that although the nearshore habitats do not support as rich species diversity as limestone reefs or seagrass beds they are still fundamental in supporting fish fauna.

Section 5 4BDescription of the Environment

The regional marine environment is dominated by warm-temperate marine fauna (76%), with several sub-tropical species (19%) and a few tropical species (5%) also present. A large portion of the temperate species occurring are whiting and herring with juveniles of these species likely to inhabit the nearshore and surf zone environments.

Maunsell (2008) concluded that the species that occur at Binningup are likely to occur regionally. They also noted that the work of Ayvazian & Hyndes (1995) was particularly relevant due to the presence of a number of study sites close to Binningup.

5.5.3 Binningup marine ecology

Offshore from the proposed plant site, areas of limestone protrude through the sandy veneer in several places but are not considered sufficiently prominent to influence sedimentation. Accordingly, the benthic environment provides a poor habitat for flora and fauna, and results in relatively low species diversity and abundance (WAPC 1999; UWA 2008a).

A benthic habitat mapping study (UWA 2008a) also found that the marine fauna occurring in proximity to the marine infrastructure location comprises sponges, ascidians, bryozoa, hydroids, and hard corals (shown as sessile invertebrates in Figure 5-8).

It was found (UWA 2008a) that the marine flora within proximity to the proposed location for the intake and outlet marine infrastructure consisted of macroalgae (*Ecklonia, Sargassum, Caulerpa, Scytothalia,* epiphytes and *Codium*) and seagrass (*Amphibolis, Zostera/Heterozostera, Halophila, Posidonia,* and *Thalassodendron*). Seagrasses in the study area were described as having sparse beds appearing around 1.2 km offshore along the alignment of offshore works (Figure 5-9). These seagrasses consisted of 98.7% *Posidonia angustifolia* and 1.3% *Posidonia coriacea* and would form the majority of the benthic primary producer habitat (BPPH) in the area.

The marine waters offshore of Binningup do not have any marine conservation reserves within 8 km and would be classified as BPPH Category D under EPA (2004b) as it is a “non-designated area”. EPA (2004b) specifies a maximum cumulative loss of 5% of the original BPPH for this category. It is considered that there is no risk of any tangible BPPH loss as a result of its development and operation of the SSDP.

Maunsell (2008) concluded that the Binningup region supports marine fish fauna, particularly larvae. However, the habitats at Binningup are well represented throughout the south-west and are unlikely to support unique communities of marine organisms. Both Maunsell (2008) and UWA (2008a) determined that the Binningup area is physically disturbed (due to natural wind-dominated processes) and as such, contains less rich and less abundant marine flora and fauna than other south-west marine waters.

Section 5 4BDescription of the Environment

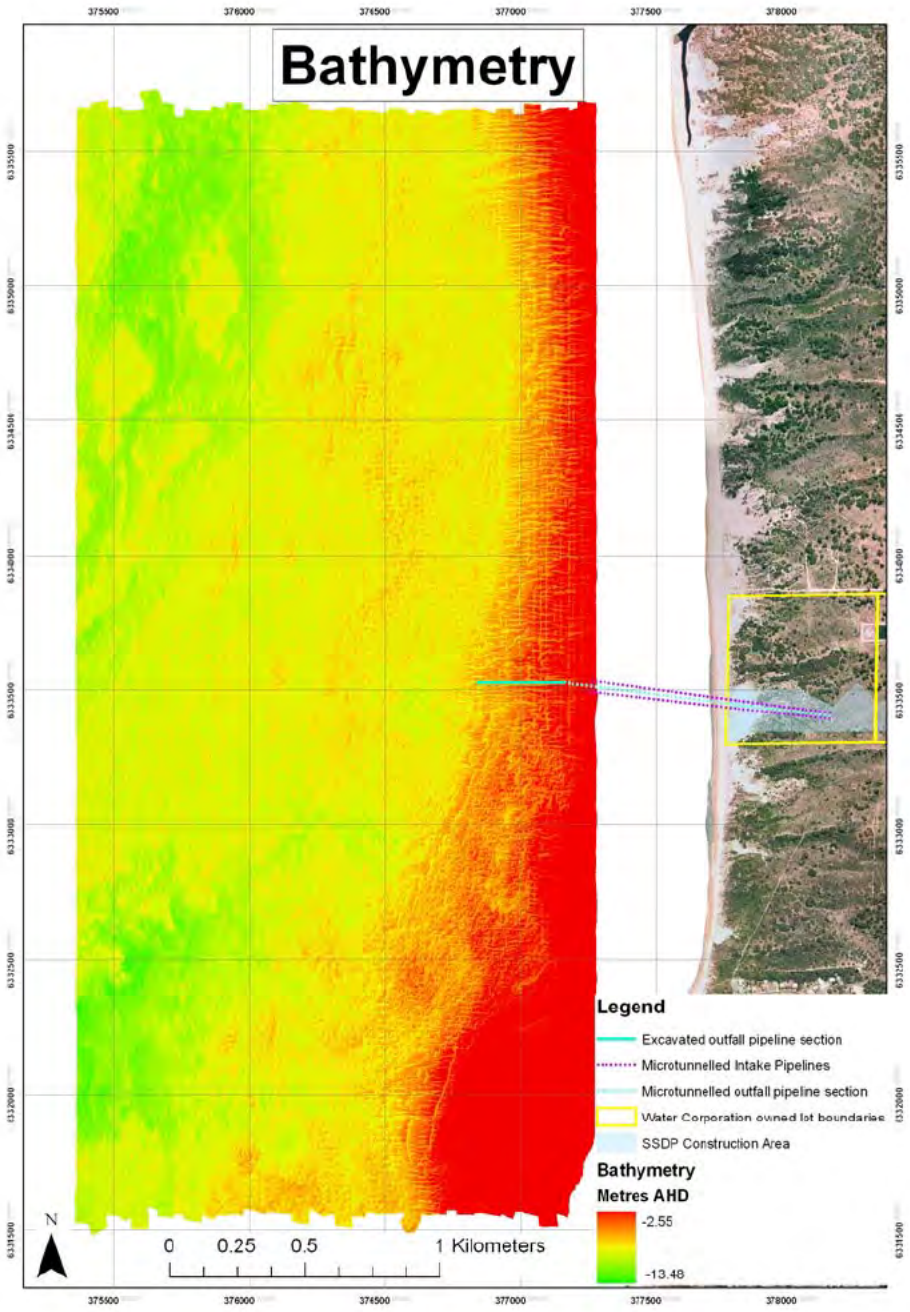


Figure 5-7 Marine bathymetry

(Fugro 2008a)

Section 5 4BDescription of the Environment

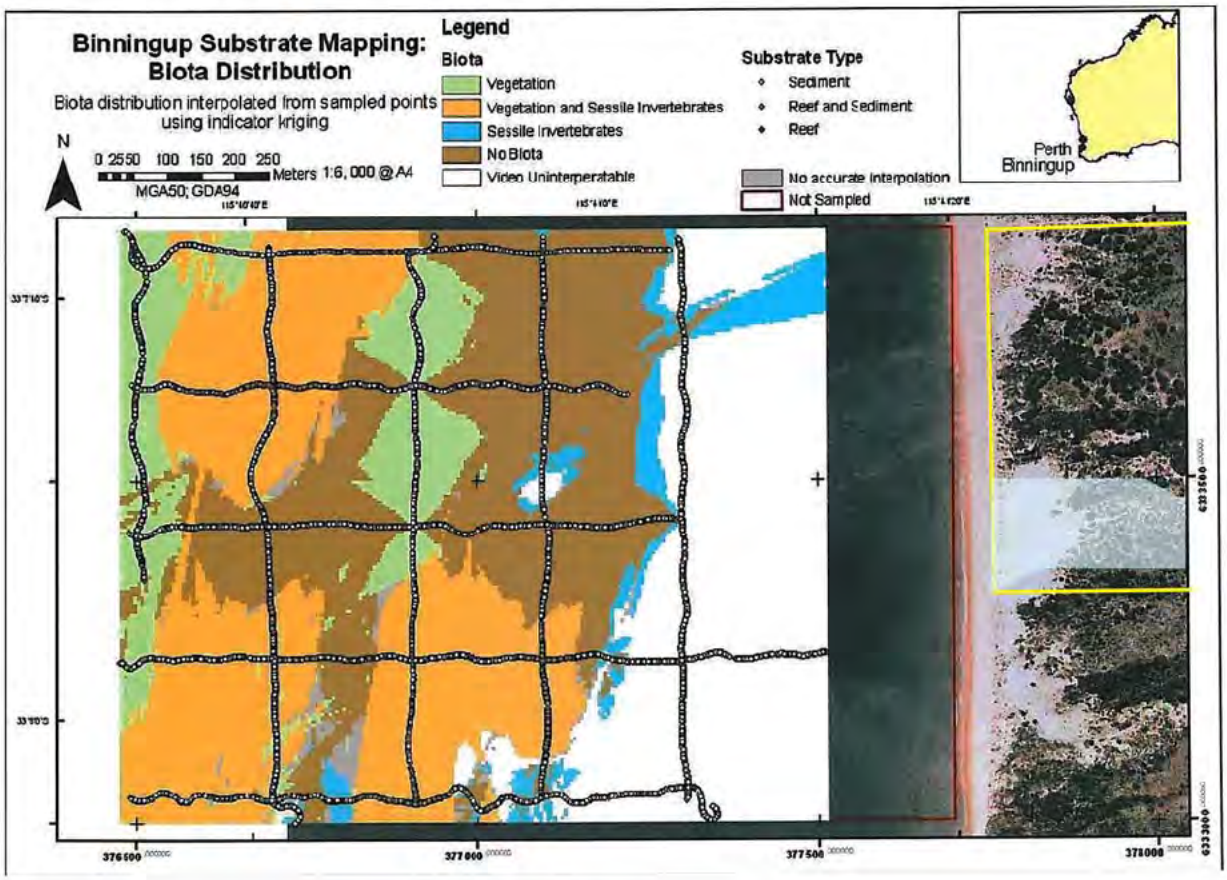


Figure 5-8 Benthic habitat map

Section 5 4BDescription of the Environment

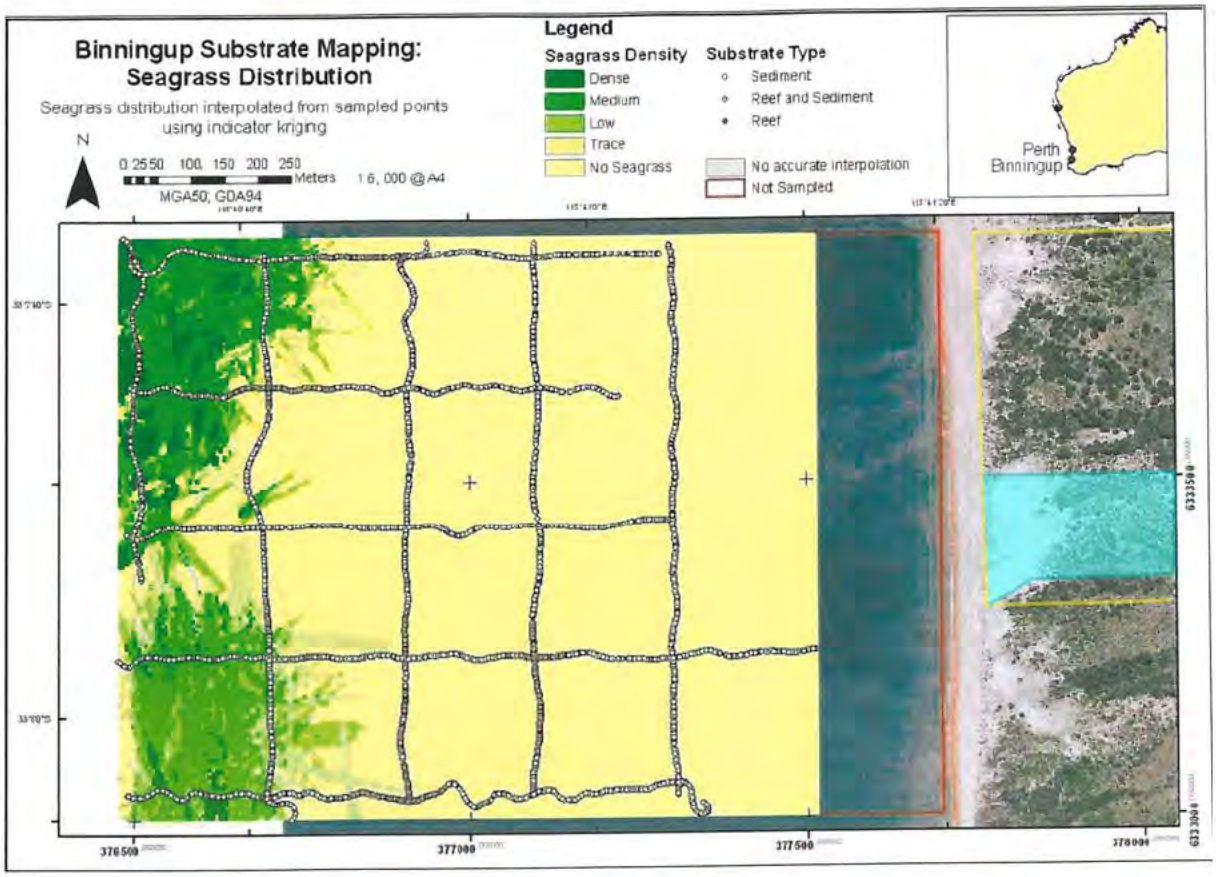


Figure 5-9 Seagrass habitat map

Section 5 4BDescription of the Environment

5.5.4 EPBC Act protected marine species

Table 5-5 lists marine the species considered by DEWHA as likely to occur within 1 km of the Project area according to the EPBC Act Protected Matters Report, and details the aspect/s of specific protection afforded to them by that Act. Note that in addition to any other layers of protection, dolphins and whales are also afforded protection by the EPBC Act as they are cetaceans.

Table 5-5 EPBC Act Protected Marine Species that may occur in the project area

Species	Common Name	Status	Threatened Species	Migratory Species
MAMMALS				
Megaptera novaeangliae	Humpback whale	Vulnerable	Yes	Yes
Eubalaena australis	Southern right whale	Endangered	Yes	Yes
Balaenoptera musculus	Blue whale	Endangered	Yes	Yes
Balaenoptera edeni	Bryde's whale	Migratory	No	Yes
Caperea marginata	Pygmy Right whale	Migratory	No	Yes
Lagenorhynchus obscurus	Dusky dolphin	Migratory	No	Yes
Orcinus orca	Orca	Migratory	No	Yes
Neophoca cinerea	Australian sea-lion	Vulnerable	Yes	No
Arctocephalus forsteri	New Zealand fur-Seal	Listed Marine Species	No	No
Balaenoptera acutorostrata	Minke whale	Cetacean	No	No
Delphinus delphis	Common dolphin	Cetacean	No	No
Grampus griseus	Risso's dolphin	Cetacean	No	No
Stenella attenuata	Spotted dolphin	Cetacean	No	No
Tursiops aduncus	Indian Ocean bottlenose dolphin	Cetacean	No	No
Tursiops truncatus s. str.	Bottlenose dolphin	Cetacean	No	No
SHARKS				
Carcharias taurus	Grey Nurse shark	Vulnerable	Yes	No
Carcharias caraharias	Great white shark	Vulnerable	Yes	Yes
Rhincodon typus	Whale shark	Vulnerable	Yes	Yes
REPTILES				
Caretta caretta	Loggerhead Turtle	Endangered	Yes	Yes
RAY-FINNED FISHES				
Acentronura australe	Southern pygmy pipehorse	Listed Marine Species	No	No
Campichthys galei	Gale's pipefish	Listed Marine Species	No	No

Section 5 4BDescription of the Environment

Species	Common Name	Status	Threatened Species	Migratory Species
Heraldia nocturna	Upside-down pipefish	Listed Marine Species	No	No
Hippocampus angustus	Western spiny seahorse	Listed Marine Species	No	No
Hippocampus brevceps	Short-head seahorse	Listed Marine Species	No	No
Hippocampus subelongatus	West Australian seahorse	Listed Marine Species	No	No
Histiogamphelus cristatus	Rhino pipefish	Listed Marine Species	No	No
Lissocampus caudalis	Australian Smooth pipefish	Listed Marine Species	No	No
Lissocampus fatiloquus	Prophet's pipefish	Listed Marine Species	No	No
Lissocampus runa	Javelin pipefish	Listed Marine Species	No	No
Maroubra perserrata	Sawtooth pipefish	Listed Marine Species	No	No
Mitotichthys meraculus	Western Crested pipefish	Listed Marine Species	No	No
Nannocampus subosseus	Bony-headed pipefish	Listed Marine Species	No	No
Phycodrus eques	Leafy seadragon	Listed Marine Species	No	No
Phyllopteryx taeniolatus	Weedy seadragon	Listed Marine Species	No	No
Pugnaso curtirostris	Pug-nosed pipefish	Listed Marine Species	No	No
Solegnathus lettiensis	Indonesian pipefish	Listed Marine Species	No	No
Stigmatopora argus	Spotted pipefish	Listed Marine Species	No	No
Stigmatopora nigra	Wide-bodied pipefish	Listed Marine Species	No	No
Urocampus carinirostris	Hairy pipefish	Listed Marine Species	No	No
Vanacampus margaritifer	Mother-of-pearl pipefish	Listed Marine Species	No	No
Vanacampus phillipi	Port Phillip pipefish	Listed Marine Species	No	No
Vanacampus poecilolaemus	Australian long-snout pipefish	Listed Marine Species	No	No

Whales, dolphins and sharks are regularly sighted along the coastline of WA and may also be infrequent visitors near the proposed SSDP at Binningup. Anecdotal reports indicate that little penguins (*Eudyptula minor*), a listed marine species under the EPBC Act, also occur periodically in the Binningup area. This presence is likely to be associated with long range foraging activities as no breeding sites are known to occur in the area.

Information available on the occurrence, species diversity, abundance, distribution and movements of marine mammals and sharks at or near the proposed SSDP is extremely limited. There have been no direct studies on marine mammals in the Binningup area therefore any information on local distribution is gained from local knowledge, literature and experience working with marine mammals (Western Whale Research 2008). Note that few, if any, of the species listed in Table 5-5 are known or likely to be resident in the area, with many of the above named species no more than occasional migratory visitors or vagrant wanderers. Further salient information on the more pertinent species is presented below.

Humpback Whale

The humpback whale is a moderately large baleen whale with a maximum weight of about 45 tonnes. Australia has two recognised migratory populations of humpback whales: a west coast population and an east coast population, which are currently considered genetically distinct. Baseline surveys have not located humpback whales at Binningup, but this species may utilise the area at various times for different purposes including resting, socialising, feeding, migrating, calving and nursing of young (Western Whale Research 2008).

Australia's west coast population of humpback whales migrates from Antarctic waters during the summer where they feed (Bannister & Hedley 2001) to breeding grounds along the west coast of Australia in winter. During the southern migration a large number of whales use Exmouth Gulf and Shark Bay as resting areas (Jenner et al. 2001).

In WA, this species is mainly encountered within the area between the coast and the 200 m bathymetric contour. The northward migration is concentrated from June to August and southward from September to November. The southern migration usually occurs closer to the coast. A feature of the southern migration is the passage of cow/calf pairs, particularly in the latter stages. Cow-calf pairs are the slowest class of whales to migrate, with pods containing calves significantly slower than pods without calves (Noad 2002). Cow-calf pairs are often found close to shore especially during the southern migration and appear to use sheltered bays to opportunistically rest during their migration to the feeding grounds. Humpbacks do not feed during the migration period and their presence in the waters around Binningup would normally be associated with migratory transit.

Southern Right Whale

Southern right whales are large baleen whales. They grow to a maximum length of 17.5 m and a weight of 80 tonnes, with mature females often slightly larger than males (Bannister et al. 1996). Southern right whales have been recorded in the coastal waters of all Australian states, with the exception of the Northern Territory, from mid-May to mid-November. This species is often encountered close to the coast in sheltered embayments, where whales may come to give birth and/or nurse their young. They are principally found around the southern coastline off southern WA and far west South Australia, but may occur anywhere between Sydney and Perth.

While most southern right whales venture no further north than WA's south coast, a small number migrate through the region around Binningup from around mid-May to October (in October 2007 a female and calf were observed resting approximately 200 m off the shoreline in the Binningup area). This number may be expected to increase over time as the population recovers from the decimation of earlier commercial whaling. While the southern right whale may use the marine environment of the local area on occasions, it is not known to be a biologically important habitat (i.e. a defined breeding, calving, feeding, or resting area, or a confined migratory route).

Based upon incidents with the closely related northern right whale, this species is considered especially vulnerable to ship strikes.

Blue Whale

Blue whales are the largest living animals. They can grow to a length of over 30 m and weigh up to 180 tonnes. Blue whales have been seen from the northern tip of WA, down the west coast. Temperate feeding areas off Rottnest Island and in the Bonney Coast upwelling region off Victoria are the only areas identified off the Australian coast where blue whales aggregate with some predictability.

Section 5 4BDescription of the Environment

Blue whales generally exhibit a preference for deeper waters of at least 500 m. From early November to mid-May both pygmy blue whale (*Balaenoptera musculus brevicauda*) and the true blue whale (*Balaenoptera musculus intermedia*) are known to congregate over the head of the Rottnest Trench (Perth Canyon), some 130 km or more from the Project area. Blue whales are also infrequently sighted, typically from October to December, over the continental shelf between Rottnest Island and Cape Naturaliste (i.e. about 100 km from Binningup), and have been periodically observed to come close in-shore in the Cape Naturaliste area, about 70 km from Binningup. It is likely that these Australian records, almost entirely in summer, are mainly of pygmy blue whales.

No blue whale breeding grounds have been identified in the Southern Hemisphere. While mother-calf pairs have been seen in the Bonney Coast upwelling feeding area and off Rottnest Island and Dunsborough, WA, the location of mating and calving areas in the southern hemisphere generally are unknown. Blue whales have not been confirmed in the Binningup area.

Bryde's Whale

The Bryde's whale is listed as migratory under the EPBC Act. Bryde's whales are found in waters throughout Australia and are known to venture as far as 35° South, but are more common in warmer sea areas between 30° North and 30° South (URS 2008a). Bryde's whales have not been confirmed to exist in the waters around Binningup (33° South), but may nevertheless occur periodically in the area.

Pygmy Right Whale

Little is known about the pygmy right whale's exact distribution, but sightings and strandings around Australian and South African coasts in the spring and summer suggest that this small cetacean moves into inshore waters during this time of year. Pygmy right whales seem to be located in most waters of the Southern Hemisphere and travel either alone or in pairs. It is virtually impossible to tell this species from the minke whale, unless the head is visible. The smallest of the baleen whales, pygmy right whales have been found through waters in the southern half of Australia. Reeves et al. (2002) and Carwardine (1995) both note that the pygmy right whale is the least known and most rarely sighted of all the baleen whales. Bannister et al. (1996) report that pygmy right whales have been periodically sighted feeding in the Fremantle area. As pygmy right whales have been rarely observed at sea, information about their behaviour and habitat is limited. Notwithstanding this, there is potential for this species to occur in the general area of the proposal.

Dusky Dolphin

Duskies are a southern hemisphere dolphin usually found in temperate waters and often seen in large groups of hundreds. They use their bodies to herd fish, in a variety of leaps and water slaps. Although they have been recorded in waters in the southern half of Australia, populations are thought mostly to exist off Tasmania and New South Wales and several small islands in the South Atlantic and Indian Oceans. Dolphins have been sighted and are know to inhabit the waters around the Binningup Project area; however they are most likely bottlenose dolphins (Western Whale Research 2008).

Orca

At a length of 9 m and weight of over 5 tonnes, the orca is the largest member of the dolphin family. Orcas are found in most habitat types from coastal areas to the deep ocean waters, from the tropics to polar regions, of all states and territories of Australia. These animals are carnivores and one of the most efficient large predators of

the ocean. A cooperative hunter, they often work in packs, and will take a broad range of vertebrates including whales, seals, penguins, fish, sea otters, and turtles. Orcas have marked territorial behaviour and home ranges. Their prey is determined by what is available in their home range but they also seek out areas of seasonal abundance such as seal pupping sites. Orcas are a highly social species whose group size and composition is based on the dominance of a female line. The gestation period is thought to be about 15 months after which a single young is born. Group cooperation extends to care of the young, which will continue to suckle from the mother for an extended period of up to two years. The breeding season is variable, as is the interval between births. This latter period can be as little as three years or as long as eight (The Ecology Lab 2005).

Baseline surveys have not located orcas in waters around Binningup, but this species may use the area at various times (Western Whale Research 2008).

Other cetaceans

Other cetaceans which could conceivably occur in the Project area are:

- minke whale (*Balaenoptera acutorostrata*)
- common dolphin (*Delphinus delphis*)
- Risso's dolphin (*Grampus griseus*)
- pan-tropical spotted dolphin (*Stenella attenuata*)
- Indian Ocean bottlenose dolphin (*Tursiops aduncus*)
- bottlenose dolphin (*Tursiops truncatus s. str.*)

Confirmed sightings of cetaceans around Binningup are predominantly of dolphins, most likely the bottlenose dolphin.

Australian Sea-lion

The Australian sea-lion is a bottom foraging species which generally favours reef areas as sources of prey. It has been observed to forage out as far as the 200 m bathymetric contour, although juveniles and lactating females remain in shallower waters (Costa & Gales 2003). Although within the range distribution of the species, neither Shaungnessey (1999) in the Action Plan for Australian Seals, nor the WA Department of Fisheries (Campbell 2005) identified any particular habitat area for the Australian sea lion in the vicinity of Binningup (URS 2008a). The nearest breeding sites were located some 300 km north of the Project area at Butler Island, near Cervantes, and the nearest haul-out sites (i.e. non-breeding resting sites) are at Penguin and Seal Islands, Shoalwater, some 90 km distant. It is possible that sea lions migrating between south coast and mid-west coast breeding sites may move through the Binningup area.

New Zealand Fur Seal

New Zealand fur seals are coastal mammals that occur in Australian and New Zealand waters. In Australian waters, New Zealand fur seals have been recorded in all of the southern states as well as in Queensland (south of Fraser Island). They eat fish and cephalopods and to a lesser extent birds such as penguins, both in shallow waters and around the margins of the continental shelf. In Australia, breeding colonies are known from islands off southern WA, South Australia and Tasmania, including Macquarie Island (The Ecology Lab 2008). No New

Section 5 4BDescription of the Environment

Zealand fur seal colonies exist near Binningup, so any animals of this species in the Project area are likely to be vagrants.

Grey Nurse Shark

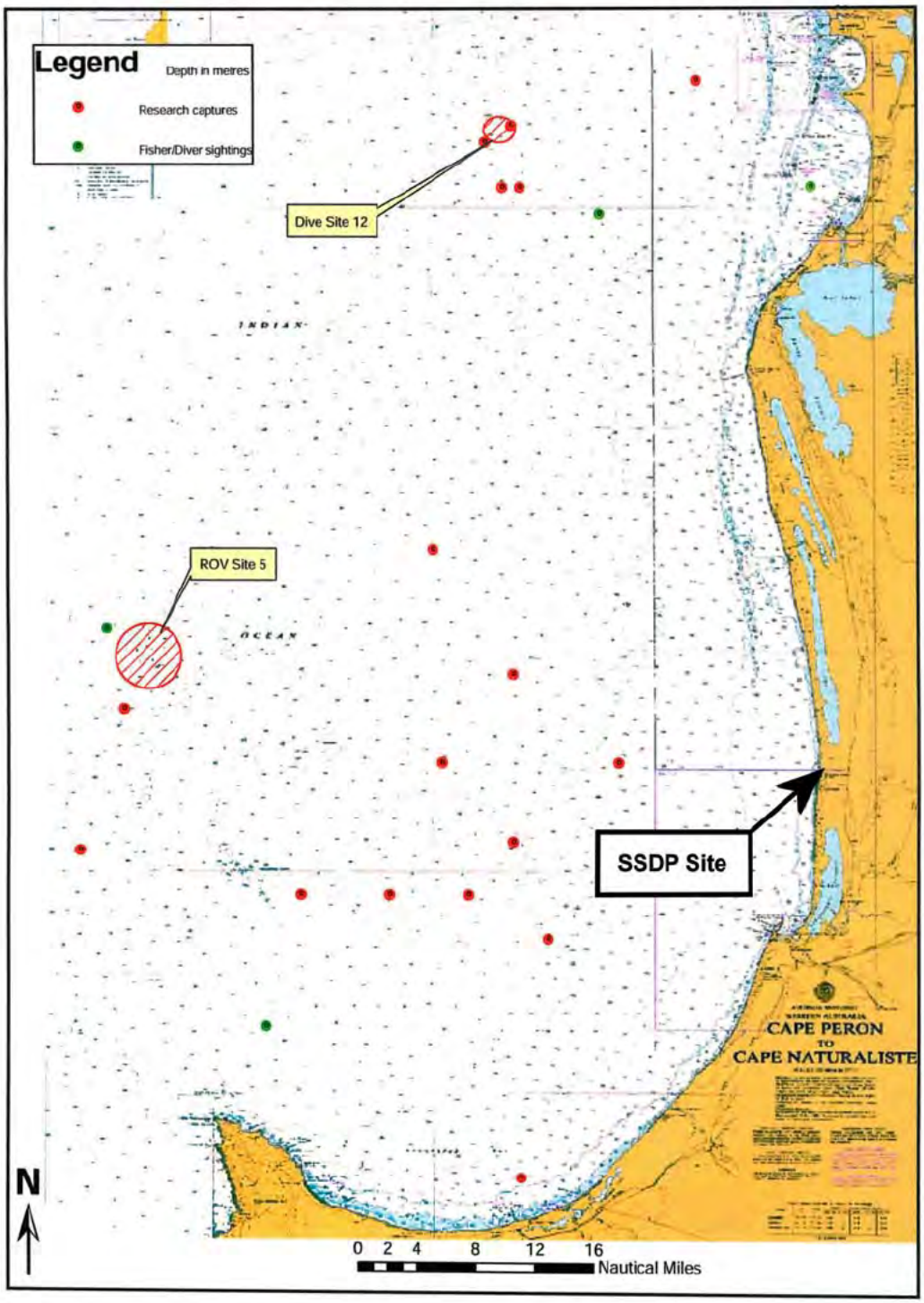
The grey nurse shark is listed as two separate populations under the EPBC Act. The east coast population is listed as critically endangered and the west coast population is listed as vulnerable. The west coast grey nurse shark has a broad inshore distribution, primarily in sub-tropical to cool temperate waters. In Australia, grey nurse sharks have been regularly reported around most of the southern half of the continent (excluding the Great Australian Bight), and northward to Shark Bay in WA (Environment Australia 2002). Grey nurse sharks are often observed just above the seabed in or near deep sandy-bottomed gutters or rocky caves in the vicinity of inshore rocky reefs and islands (Environment Australia 2002).

Unlike the east coast population, there are no confirmed aggregation sites off WA. In an assessment for the WA Department of Fisheries, Chidlow et al. (2006) identified 34 potential areas of interest based on anecdotal observations by commercial fishers, divers and others. The potential grey nurse aggregation site nearest to the proposed SSDP was at Naturaliste Reef; around 70 km almost directly out to sea from the Project area (Figure 5-10) (URS 2008a). Catch and catch rate data from the demersal gillnet fishery, prior to 1997, indicates that grey nurse sharks were relatively abundant in temperate WA waters in the mid-late 1990s and that the population was stable (Cavanagh et al. 2003). The west coast grey nurse shark population has therefore been assessed as near threatened by the IUCN Red List but as vulnerable under the EPBC Act (Childlow et al. 2005).

Great White Shark

The great white shark is potentially present all year round in WA coastal waters. It is generally more common in south-west coastal waters during the humpback whale migration period, particularly the latter part of the southern migration as it preys on humpback calves. DEWHA (2007) notes that juvenile great white sharks are commonly encountered in inshore areas, often in the vicinity of the open coast beaches. These are more usually associated however, with great white shark pupping grounds. The Australian White Shark (*Carcharodon carcharias*) Recovery Plan (Environment Australia 2002a) identified no areas in WA that are seasonally important for juvenile white sharks or as possible pupping grounds, although the Plan concedes that more research is required.

Section 5 4BDescription of the Environment



(Chidlow et al. 2005)

Figure 5-10 Grey nurse shark sightings and potential aggregation sites in the wider south-west region of WA

Section 5 4BDescription of the Environment

Whale Shark

Whale sharks have a broad distribution in tropical and warm temperate seas, including shallow coastal waters, usually between latitudes 30° North and 35° South (DEWHA 2007). Although most common in tropical areas, confirmed sightings have been made further south than Kalbarri, WA These sharks are thought to prefer sea surface temperatures of 21°C to 25°C, so if it is to occur near Binningup, this would most likely be a rare sighting during the warmer summer months (URS 2008a).

Turtles

The loggerhead turtle (*Caretta caretta*) has a global distribution throughout tropical, sub-tropical and temperate waters (Marquez 1990). It occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. The species forages over the extensive soft-bottomed habitats at less than 40 m depth throughout the coastal waters of the inner continental shelf (Poiner and Harris 1996). Resident sub-adult and adult turtles are known from waters between Rottnest Island and Geographe Bay (DEWHA 2008a). The loggerhead turtle may use habitat within the vicinity of the SSDP for foraging, given that it is the most commonly, albeit infrequently, sighted turtle species in the area.

Note that other turtles may occur in Binningup. Three other species of marine turtle are known to infrequently visit the waters south of Perth and juveniles may be encountered on or near local beaches after winter storms and the Leeuwin Current have driven them south. Leatherback turtles (*Dermochelys coriacea*) are occasionally seen in these waters although this species is usually a non-nesting migrant visitor to WA. Based on records of stranded dead turtles, it is probable that at least some green turtles (*Chelonia mydas*) stray into the region seasonally, possibly brought southward by the warmer Leeuwin Current in winter. The hawksbill turtle (*Eretmochelys imbricata*) is also an infrequent visitor. There are no turtle breeding or nesting sites near Binningup and none in WA south of the area of Ningaloo Reef (Marsh et al. 1995). Turtles in the Project area are described further in Pendoley (2008) and URS (2008a).

Ray-finned fishes

The EPBC Act protects all syngnathids found in Commonwealth waters, making it an offence to kill or injure any members of the family without a Commonwealth approval permit. The syngnathids include seahorses, pipefishes and pipehorses. Pipefishes are generally long and pencil-like in shape, with a straight, tapering tail. Seahorses have a prehensile tail and a thickened body. Pipehorses are so-named because they have a typical pipefish-shaped head and body, along with the prehensile tail of a seahorse.

It is considered possible that 23 individual species of syngnathids may occur in the Binningup locality. Most pipefishes, seahorses and pipehorses live in shallow bays and coastal waters, especially amongst weed-covered reefs or in seagrass meadows, while some species prefer soft bottoms near reefs or rubble in shallow to very deep waters.

Section 5 4BDescription of the Environment

5.6 Reserves and Conservation Areas

5.6.1 Terrestrial Conservation Areas

The State's main conservation reserves are National Parks, Conservation Parks, Nature Reserves and State Forests. These are vested with the Conservation Commission of WA, and managed by the DEC. The Terrestrial Conservation Areas within the vicinity of Binningup are shown in Figure 5-11.

5.6.2 Wetlands

Vegetation mapping was undertaken (360 Environmental 2008a) for wetlands of conservation significance on the Plant Site and along the pipeline corridor on Boonilup Road (Figure 5-12). The results suggest some minor discrepancies between the current wetland boundaries mapped by the DEC and the actual wetland areas. The proposed pipeline will intersect or run adjacent to wetlands, or their associated buffer areas. Wherever possible, disturbance will be limited to already cleared areas of sandy tracks and firebreaks that pass through the wetland area on Boonilup Road. Further assessment of the impacts upon these wetlands is provided in Section 6.

A wetland is present on the proposed plant site. The wetland portion on the southern boundary of the SSDP site was classified by the WA DEC in 1996 as a 'conservation category' wetland. The wetland has a total area of 481.5 ha, of which approximately 2.06 ha occurs within the SSDP site. From the southern boundary of the SSDP site the wetland extends southwards for a distance of approximately 7.5 km, where it connects with the Leschenault Estuary, which is a further 2,642 ha in area (DEC 2006). The portion of the wetland on Part Lot 8 is unlikely to meet the criteria of a conservation category wetland, the investigative assessment in 2007 (360 Environmental 2008a) confirmed that the wetland vegetation is 'completely degraded' (Figure 5-13), contained no rare or priority flora, and that the current wetland classification as 'conservation category' is inconsistent with its ecological value.

EPA Bulletin 686 defines 'conservation category' as "*wetlands* (that) *possess a high degree of naturalness*". Further, the DoW (formerly the Water and Rivers Commission) position statement on wetlands provides a general description of 'conservation category' wetlands as "*support*(ing) *a high level of ecological attributes and functions*". The DoW has a no development policy position on 'conservation category' wetlands (Water and Rivers Commission 2001).

For all other wetlands of conservation significance within the Wetland Corridor, the vegetation condition is of a quality in line with their category. Although some areas exhibited a Poor vegetation rating, in both a local and regional context this is likely to have flora and fauna values. The presence of Priority Flora and DRF indicate conservation significance in the absence of Good vegetation condition. One area mapped as wetland vegetation but not currently within DEC wetland mapping (West of UFI 1919) has vegetation of high quality and supports DRF (360 Environmental 2008a).

The Peel-Yalgorup wetland Ramsar site is ~2.5km distant, but is not linked in any way with any of the proposed activities.

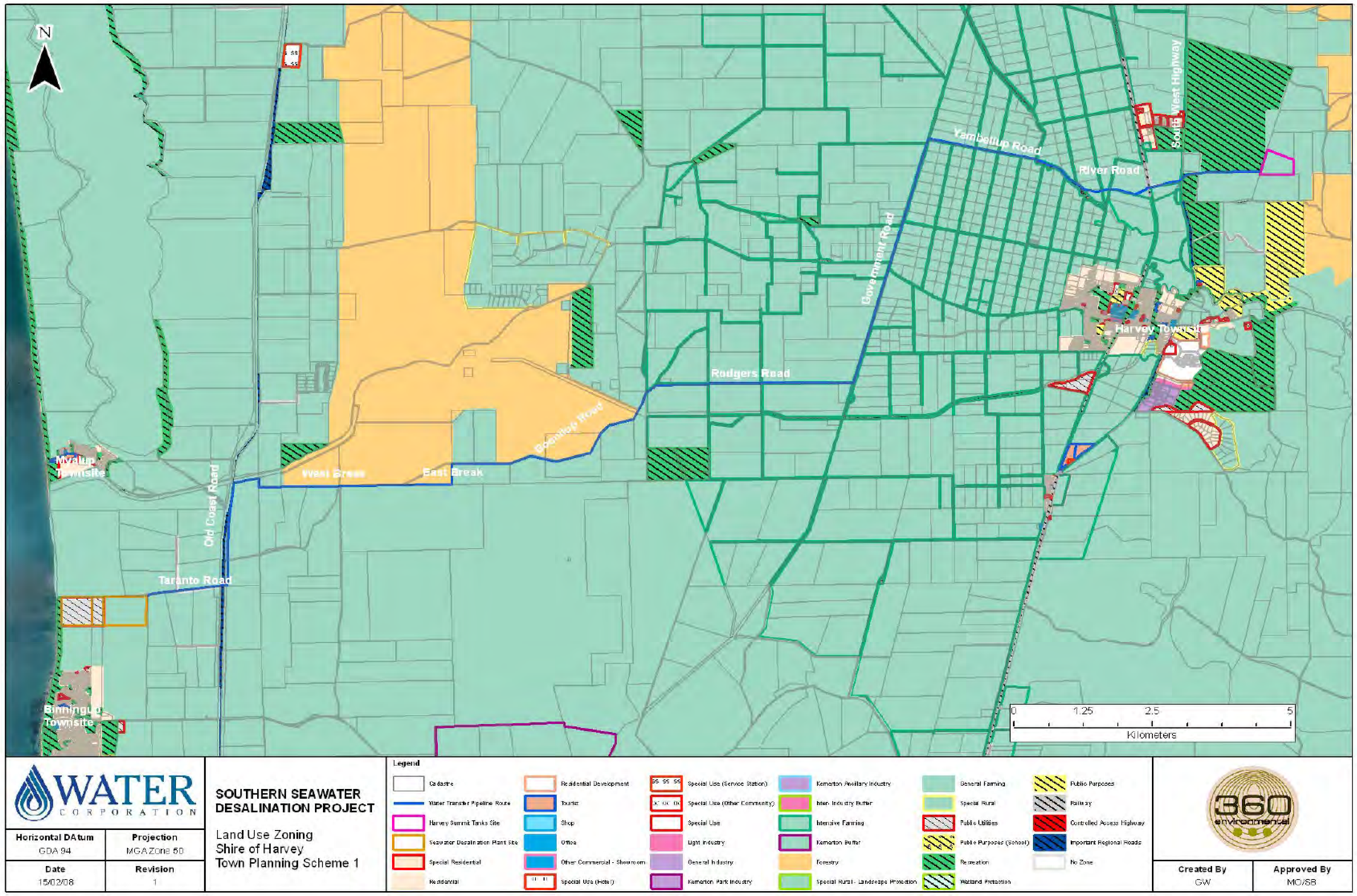


Figure 5-11 Main Conservation Reserves, Parks, Conservation Parks, Nature Reserves and State Forests (WA)

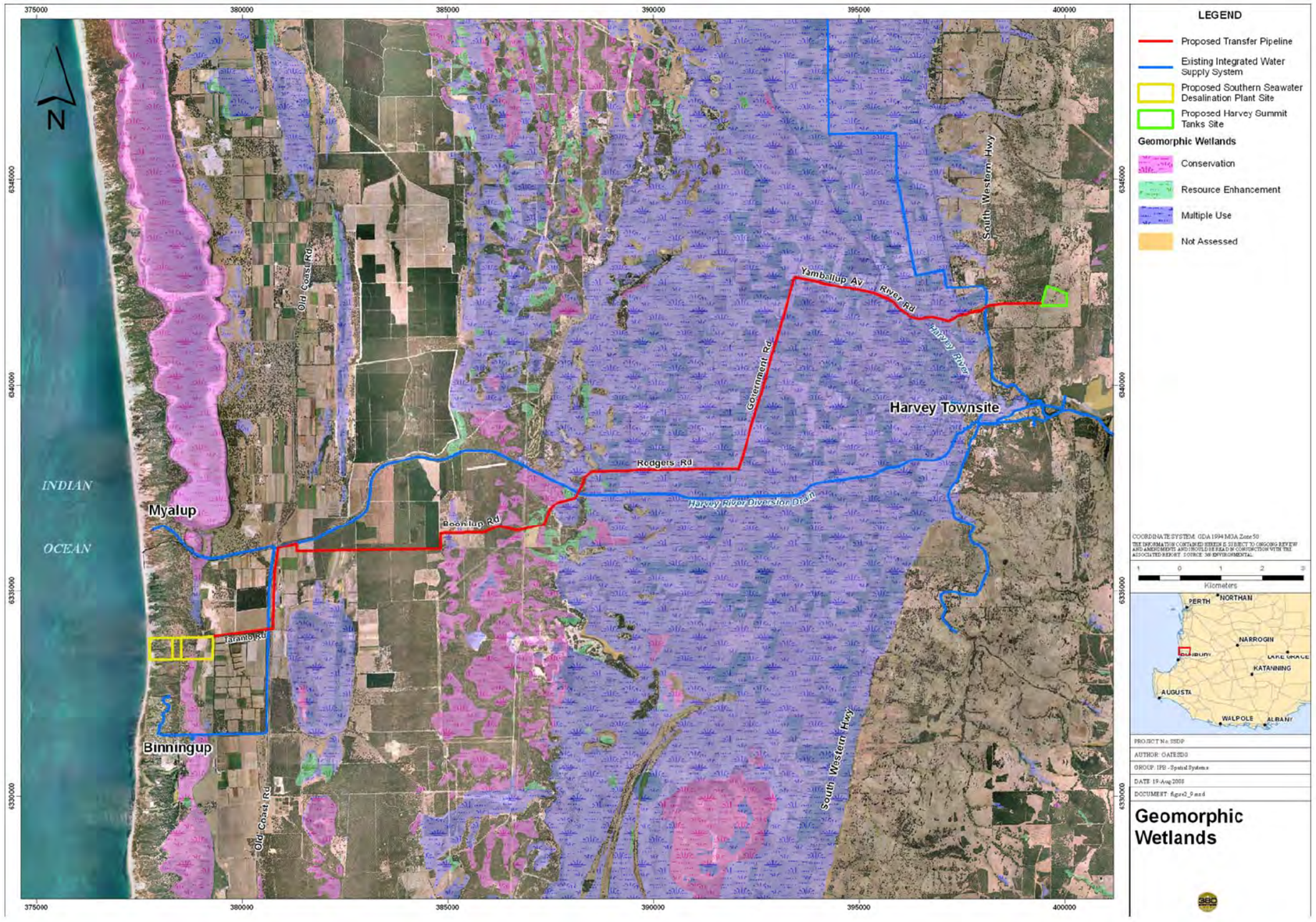


Figure 5-12 Conservation Significant Wetland locations

(360 Environmental 2008a)

Section 5

4BDescription of the Environment

Figure 5-13 The vegetation on Wetland 13239 (Part Lot 8 Taranto Road) showing the degraded section affected by the proposal

5.6.3 Marine Conservation Areas

Marine conservation reserve is the term used in WA to describe areas of the marine and estuarine environment of the State that have been legally established to help conserve biodiversity. There are three types of reserve category: Marine Nature Reserves, Marine Parks and Marine Management Areas.

There are no Marine Nature Reserves, Marine Parks or Marine Management Areas in the proposal area. There is one Marine Conservation Area earmarked for protection as a Marine Conservation Reserve, at the northern extent of the Leschenault Estuary, 8 km south of the proposal area.

5.7 Aboriginal Heritage

Objects and places hold special significance to Aboriginal people, reflecting a deep and lasting relationship with the land. Traces of the past - former camp sites, rock paintings, initiation grounds, burial or massacre sites and artefacts all retain deep meaning to Aboriginal people who guard and protect them to maintain their links with their ancestors.

The *Aboriginal Heritage Act 1972*, administered by the DIA, has provisions to protect objects and places of Aboriginal significance. The DIA maintains a database of previously recognised places and objects that are of Aboriginal significance.

Disturbance to objects and places of Aboriginal significance requires prior approval from the Minister for Aboriginal Affairs, under Section 18 of the *Aboriginal Heritage Act 1972*.

No objects or places of Aboriginal significance were identified during site investigations (which included ethnographic and archaeological surveys). Therefore, there is no basis upon which to anticipate that there will be any impact upon sites or items of Aboriginal significance as a result of construction (and operation) of the SSDP. If any objects of likely Aboriginal significance are discovered during construction, consultation will be initiated with the Gnaala Karla Booja Native Title Claimant Group and the South West Aboriginal Land and Sea Council to determine the appropriate course of action.

5.8 Native Title

The SSDP area is subject to a registered native title claim by the Gnaala Karla Booja Native Title Claimant Group under the Commonwealth *Native Title Act 1993*. The *Native Title Act 1993* is managed by the Commonwealth Attorney-General's Department and supported by the National Native Title Tribunal (NNTT). The Gnaala Karla Booja claim applies to approximately 30 000 km^2 of the south-west of WA, incorporating 31 local government areas including the Shire of Harvey (NNTT 2007). Native title for the Gnaala Karla Booja Native Title Claimant Group was yet to be determined by the NNTT at the time of preparation of this report.

Section 5 4BDescription of the Environment

5.9 Non-indigenous Heritage

5.9.1 Shipwrecks

Under the WA *Maritime Archaeology Act 1973* it is an offence to in any way alter, remove, destroy, damage, or in any way deal with, or assume the possession, custody or control of, any maritime archaeological site, ship or relic without the consent of the Western Australian Museum.

There are a number of shipwrecks off the Bunbury coast (Figure 5-14), none of which are recorded in the Binningup area (M. McCarthy [WA Maritime Museum] 2006 pers. comm. 25 August 2006).

5.9.2 Structures

The only structure of heritage value in the project study area is Pead's Cottage, a corrugated iron roofed, weatherboard cottage, built in 1848. This is located approximately 1 km from the potable water pipeline route. This cottage was used by early settlers during farming purposes such as grazing, pastoralism and dairying. Given that the cottage is approximately 1 km from the Water Transfer Pipeline route, the heritage values will not be affected.

5.9.3 World Heritage places

There are no World Heritage places within the vicinity of the SSDP site, pipeline or Harvey Summit Tanks area, and no World Heritage values of any kind at risk from the proposed activities.

Section 5 4BDescription of the Environment

Figure 5-14 Shipwrecks within proximity of SSDP

Section 6 5BPotential Impacts and Their Management

6.1 Introduction

This Section presents a discussion and evaluation of the potential environmental effects from the proposed SSDP Project. Both terrestrial and marine environmental issues are considered. Taking account of the range and complexity of the terrestrial environmental issues of concern, these are each dealt with discretely within Section 6.2 whereby the risks and their mitigation are presented separately for each aspect of the terrestrial environment considered. By comparison, the marine environment issues of concern display a greater inter-connectedness and homogeneity, which lends itself to a more consolidated dissertation of these risks and their management. Accordingly, Section 6.3 presents aggregated potential environmental risks, their mitigation and an evaluation of their significance in a sequential format. In general, the management measures to be applied by the Corporation, in conjunction with the mitigation measures identified below, are expected to be effective in minimising any impact upon the surrounding environment.

A consolidated list of safeguards and mitigation measures has been provided as Appendix F. This strategy has been designed to provide information on proposed mitigation and offset measures that are aimed at reducing the impact of the SSDP on species listed under the EPBC Act.

6.2 Terrestrial Environment Risks and Their Management

6.2.1 Threatened Flora

The infrastructure areas for the SSDP are located in the Harvey region, which is a mosaic of agricultural land and remnant native vegetation. The areas of remnant native vegetation contain a range of native flora species and native flora communities in a range of vegetation health conditions.

The proposed construction footprint for the infrastructure for the SSDP have been selected and designed to minimise the total area of remnant native vegetation cleared. Revegetation of cleared areas following construction will ensure that this objective is maintained following construction and during operation of the Project.

It is not considered that any planned clearing of agricultural land (pasture and crops) compromises EPBC Act objectives and therefore will not be assessed in detail in this cPER. Despite not being assessed in this cPER, the clearing of agricultural land has been considered in the Project design and management actions for the protection of agricultural land are included in the Construction Environmental Management Framework (Appendix G). The assessment outlined below concentrates on the impacts and management of the construction and operation of the SSDP on the two *Drakaea* species listed under the EPBC Act and documented in Section 5.4.1.

Impacts to Threatened Flora

The Project areas were surveyed for terrestrial flora in spring 2006 and 2007 to identify the flora species within the preferred infrastructure locations (360 Environmental 2007, 2008a).

The 2006 and 2007 surveys identified that within the survey area there were 370 native flora species, including the EPBC Act threatened (Vulnerable) species *Drakaea micrantha*. No Threatened Ecological Communities or critical habitats, as defined under the EPBC Act, were located within the Project area.

D. micrantha was identified (360 Environmental 2008a) in State Forest approximately 50m north of the Water Transfer Pipeline on Boonilup Road. The construction working width will be reduced to 20m to minimise vegetation clearing in this area. Construction works will not directly affect *D. micrantha* as it occurs outside of the 20m pipeline construction corridor width and indirect impacts on *D. micrantha*, from temporary dewatering, are unlikely due to the dewatering cone of depression being less than 30m and limited to approximately seven days duration. Further investigation on construction impacts for this flora species was undertaken in Spring 2008, during which no *Drakea* species were located (Maunsell 2008, Appendix D).

Vegetation Clearing and Rehabilitation

The selection of infrastructure sites, consisting of the SSDP site, the Water Transfer Pipeline and the Harvey Summit Tank Site was based on an assessment using environmental and social criteria (GHD 2007a, b). A primary criterion of this assessment was to avoid and minimise areas of terrestrial native flora that would be cleared during construction.

The preferred locations of the infrastructure have resulted in a total of up to approximately 22 ha of native vegetation, depending on plant layout, that could be cleared during construction, with approximately 28.9 ha to be revegetated following construction (including revegetation of agricultural land with native species) because the infrastructure is buried. The 22 ha of clearing is within an infrastructure area of more than 185 ha (80 ha SSDP site; 28.5km long, 30m wide Water Transfer Pipeline Corridor; 21 ha Harvey Summit Tanks Site). This avoidance and minimisation of terrestrial flora clearing will be achieved by using existing areas of cleared land (including agricultural land and roads) and then minimising construction clearing widths. The extent of the construction and post construction vehicle movements along Taranto Road will be limited to the section already at full width and, as such, no clearing for widening of this road will be required. The estimated areas of terrestrial native flora that will be cleared and revegetated for each component of the project are presented in Table 6-1. The Revegetation Management Plan for the project site, including additional offset rehabilitation undertaken outside of the construction footprint, is outlined in Figure 6-1 and provided in Appendix G.

Table 6-1 Estimated clearing for native vegetation and agricultural land for the SSDP

	Area to be cleared	Area to be revegetated[1] and rehabilitated[2]
SSDP site	Native vegetation[3]: 7.6 ha low quality native vegetation. Agricultural land[4]: 7.7 ha (includes approximately 2 ha of nationally environmentally significant fauna habitat).	Native vegetation: 4.35 ha of revegetation and 4.3 ha of rehabilitation Agricultural land: 14.0 ha of revegetation (includes 7.7 ha of berm) and 6.2 ha of rehabilitation
Water Transfer Pipeline (Buried)	Native vegetation: 7 ha Agricultural land: 36 ha (repeatedly grazed and contains no native vegetation)	Native vegetation: 7 ha of revegetation
Harvey Summit Tanks	Agricultural land: 5.05 ha (includes 0.05 ha of isolated native trees).	Agricultural land: 3.5 ha of revegetation
Total	63.2 ha (includes 22 ha of native vegetation and 41 ha of agricultural land that has been repeatedly grazed and contains no native vegetation)	28.9 ha of revegetation and 10.5 ha of rehabilitation

Section 6 5BPotential Impacts and Their Management

Notes:

[1]Revegetation: establishment of new plantings to create natural vegetation for National Environmental Significance Species habitat and corridor linkage

[2]Rehabilitation: botanical enhancement of degraded natural vegetation for National Environmental Significance Species habitat and corridor linkage

[3]Native vegetation: naturally vegetated land not recently disturbed by exploitative land use

[4]Agricultural land: previously grazed land that may contain natural vegetation of varying condition

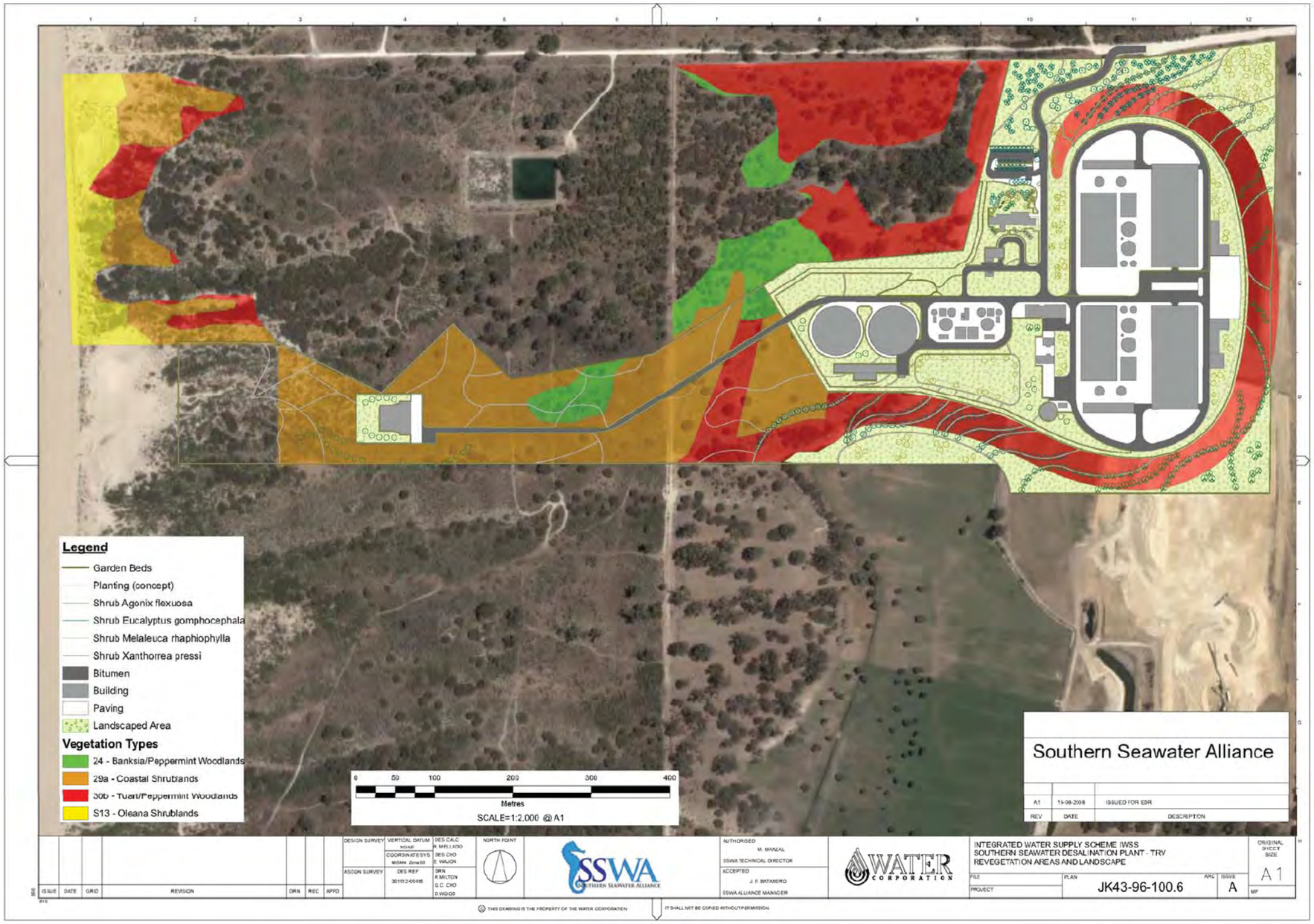


Figure 6-1 SSDP Site Revegetation Plan

Section 6 5BPotential Impacts and Their Management

As identified in Table 6-1, most of the areas to be cleared for the project will be revegetated following construction. Revegetation of the areas of native vegetation cleared during construction will assist in restoring the long-term ecological function temporarily lost by the clearing. Areas cleared for buried pipeline installation will be revegetated with low growing shrubs following construction. This includes the Water Transfer Pipeline and the pipelines connecting the main buildings of the Seawater Desalination Plant to the Seawater Pumping Station.

All cleared construction areas not required for infrastructure will be revegetated. This includes 4.35 ha in Lots 32 and 33 and 6.35 ha in Lot 8 which will be replanted with local endemic species including tuarts, peppermints and banksias to enhance ecological corridors and fauna habitat. Additionally, 7.7 ha within Lot 8 will be replanted with peppermints, tuarts, banksias and *Melaleucas* to create a visual/noise berm that will also act as an east-west and north-south ecological corridor for Western Ringtail Possum.

Screening planting of 3.5 ha around the Harvey Summit water storage facility tanks will also be undertaken. The species selected will be Marri and other local endemic species, which are Carnaby's black cockatoo foraging habitat. Areas cleared for the Seawater Desalination Plant and Harvey Summit Tanks infrastructure are unable to be revegetated due to the building of above ground infrastructure.

Revegetation will be undertaken using plants from the species list in Attachment 1 of the Revegetation Management Plan (see Appendix G). Seed will be collected within a nominal 50 km radius of the infrastructure areas to ensure that the seed collected is provenance correct. The 50 km radius is required given the limited areas of native vegetation in the region from which seed could be sourced. No seeding of the two threatened *Drakaea* species is anticipated. Seeding will undertaken by an experienced and suitably qualified contractor.

The planting of large tree species during revegetation along pipelines will be avoided for the long-term protection of the pipelines. The steel pipelines will be joined by rubber rings (except bends, which will be welded) and tree roots can interfere with these joints. Tree roots can also interfere with pipeline maintenance works that will require access to the pipeline. Consequently, large tree species are excluded nominally 7.5 m either side of installed pipelines during revegetation. The vegetation structure of revegetated areas along installed pipelines will be different to the pre-construction vegetation structure as a result of this exclusion; however the changed vegetation structure will still assist in restoring flora biodiversity and as habitat for native fauna. This exclusion applies to approximately 10 ha of the approximately 29 ha of revegetation to be undertaken for the project.

Agricultural land along the pipeline route will be revegetated to an equal condition following construction. Roads affected by construction works (approximately 17 km of the Water Transfer Pipeline is within road reserves) will be restored to an equal or better condition than that existing pre-construction and in accordance with the appropriate engineering standards.

Revegetation works for both native vegetation and agricultural land will include respreading of stockpiled topsoil, seeding, fertilising, irrigation and weed management in consultation with the landowner(s) of each property affected.

In addition to revegetation of the areas cleared for construction, the Corporation is committing to the rehabilitation of an additional 10.5 ha on the SSDP site. This rehabilitation work will involve planting Tuart (*Eucalyptus gomphocephala*), Banksia (*Banksia attenuata*) and Peppermint (*Agonis flexuosa*) species, along with typical understorey species relevant to the areas identified in the 2006 and 2007 spring surveys (360 Environmental 2007, 2008a). The rehabilitation works will be undertaken in areas degraded by previous land

uses (agriculture and mining) in order to improve the flora and fauna linkages across the SSDP site. The rehabilitated areas will provide improved fauna habitat, particularly for the Western ringtail possum (*P. occidentalis*) and Carnaby's black cockatoo (*Calyptorhynchus latirostris*), and will also provide potential habitat for the establishment of the two threatened *Drakaea* species. Figure 6-1 shows the extent of potential rehabilitation for the plant site.

Management of Impacts

The management actions, responsibilities, timing and auditable outcomes for the management of terrestrial flora are contained in the following management plans forming the Construction Environmental Management Framework:

1) Land Clearing and Trench Management Plan.
2) Rehabilitation Management Plan.
3) Hygiene Management Plan.

The management actions identified in those plans for the protection of terrestrial flora include:

1) Defining maximum clearing widths for the Water Transfer Pipeline to the Harvey Summit Tanks of 15-20 m in native vegetation and 30 m within agricultural land. Clearing will be demarcated at the SSDP site with stock fencing. Clearing will be demarcated on the Water Transfer Pipeline by field markers (given the temporary nature of works at these locations).
2) Creating an 8 m high boundary berm, to be curved along the southern and eastern SSDP site boundary, to better match the existing landscape. The berm will be rehabilitated with tuarts and peppermints.
3) Collecting, storing and propagating provenance seed for use in rehabilitation activities.
4) Stockpiling and later re-use of cleared vegetation for revegetation works.
5) Marking and retaining habitat trees where possible.
6) Stockpiling of topsoil for use during rehabilitation.
7) Ripping, grading, seeding, fertilising and irrigating of construction areas following construction works.
8) Monitored post-construction revegetation works to confirm revegetation success, with supplementary seeding, fertilising or direct planting where initial revegetation is not successful.
9) Prohibiting burning cleared vegetation to prevent fires that could affect adjoining vegetation.
10) Spraying of weed infestations pre- and post-construction.
11) Installing and implementing hygiene procedures and inspection points to prevent the spread of weeds and plant pathogens between construction areas.

A consolidated list of safeguards and mitigation measures has been provided as Appendix F. This strategy has been designed to provide information on proposed mitigation and offset measures that are aimed at reducing the impact of the SSDP on *Drakaea* species.

Predicted Outcome

It is considered that the construction and operation of the SSDP will not pose any significant risk to the populations of EPBC listed flora in the region.

6.2.2 Peel-Yalgorup Ramsar wetland

The Peel-Yalgorup wetland, which is listed under the Ramsar Convention, is ~2.5 km distant (at its closest point) from the SSDP site and the pipeline corridor. No effects at all are anticipated upon this wetland, either upon the surface or groundwater hydrology regimes of the wetland, nor upon the species, particularly migratory bird species, which occur there.

6.2.3 Threatened Terrestrial Fauna

The mosaic of agricultural land and remnant native vegetation in the Harvey region provides habitat for a range of native fauna species. The primary impacts to native fauna relate to vegetation clearing, which corresponds to a direct loss of fauna habitat. Secondary impacts relate to native fauna becoming trapped and/or injured within construction excavations.

The design and management of the construction works will aid in minimising the total area of native vegetation cleared (loss of fauna habitat), avoiding known fauna habitats, rehabilitating cleared areas post-construction (habitat rehabilitation) and rehabilitation of other existing habitats. The assessment outlined below will concentrate on the impacts and management of the construction and operation of the SSDP on the three terrestrial fauna species listed under the EPBC Act and documented in Section 5.4.2.

Impacts to Threatened Fauna

The infrastructure areas were surveyed for vertebrate and invertebrate fauna during spring 2006 and 2007 (360 Environmental 2007, 2008a). These surveys identified the Western Ringtail Possum (*P. occidentalis*) which is listed as Vulnerable under the EPBC Act.

The primary impact to threatened fauna at the SSDP site is expected to come from vegetation clearing required for construction of the infrastructure. The selection of infrastructure sites and routes was based on an assessment using social and environmental constraints, including community input (GHD 2007a,b). A primary focus of the assessments was to avoid and minimise the clearing of terrestrial native flora during construction, thereby minimising the loss of fauna habitat. The assessment of native vegetation clearing is addressed in the section on Terrestrial Flora (Section 6.2.1). As most areas to be cleared are connected to larger stands of native vegetation, combined with the revegetation initiatives following construction works, the overall impact of the Project upon native fauna is expected to be minimal.

Fauna identified for specific consideration in the DEWHA Guidelines for the cPER, and/or by virtue of their listing under the EPBC Act and known or potential presence in the Project area, are considered below:

Chuditch

Dasyurus geoffroii was not recorded during the 2006 or 2007 fauna surveys (360 Environmental 2007, 2008a). This marsupial has been frequently captured in the Darling Range, although there are very few records from the southern Swan Coastal Plain. However, *D. geoffroii* have been captured at Gwindinup (approximately 50 km south of the SSDP site), in recent years. While it is possible that *D. geoffroii* may be present within the general area, it is unlikely that many of the small native mammals remain due to the level of disturbance and long-term fragmentation of the remnant vegetation in the general area (360 Environmental 2008a).

Given the unlikely presence of *D. geoffroii* in the Project area, no specific management measures will be required for this species. However, many of the management measures to be implemented for other fauna species are consistent with those recommended in the Chuditch Recovery Plan (Orell & Morris 1994).

Quokka

Recent publications have confirmed that no populations of *Setinox brachyurus* exist within 30 km of the coast between Perth and Bunbury (Haywood et al. 2007, see Section 5.4.3). Therefore, there is no indication that the species occurs in the vicinity of the Project area. Given the unlikely presence of *S. brachyurus* in the Project area, no specific management measures will be implemented for this species. However, many of the management measures outlined below are expected to benefit the species should a population be surviving near the SSDP site.

Western Ringtail Possum

A regional survey for *Pseudocherius occidentalis* was conducted in 2007 in the area from Myalup to the Leschenault Peninsula to assess the significance of the SSDP site to the local *P. occidentalis* population. The survey located a population of approximately 50 animals that may occasionally access the site, with approximately four ringtail possums regularly using the SSDP site. The survey identified potential *P. occidentalis* movement corridors from north to south and from east to west were identified within the SSDP site. These corridors may allow the movement of *P. occidentalis* through the site to other habitat areas. The east-west corridor consists of vegetation associations of Tuart (*E. gomphocephala*), peppermint (*A. flexuosa*) and *Banksia* (*B. attenuata*). The vegetation condition of the Survey Area ranges from very poor to excellent. This east-west corridor vegetation represents the most favourable *P. occidentalis* habitat on the SSDP site due to its vegetation type and the intact vegetation structure. As this area will be avoided by the construction works to conserve this vegetation, it is not considered that the proposed works compromise the EPBC Act objectives and thus the east-west corridor will not be assessed further in this cPER.

The Project will require the installation of buried seawater pipelines from the ocean (west) towards the eastern boundary of the SSDP site. The vegetation towards the southern boundary of the SSDP site ranges in condition from completely degraded to very good to excellent and is largely not suitable as habitat for *P. occidentalis* (or Cockatoos). The only area suitable as habitat for *P. occidentalis* is a narrow north-south peppermint corridor, approximately 2 ha in size, of a poor to very poor vegetation condition. This corridor may assist with movement of *P. occidentalis* through the SSDP site. The survey results identified that this corridor did not contain stick nests (dreys) for *P. occidentalis* and they were not sighted actively using this area. Despite the above, scats (faeces) were identified which indicate previous use of this area.

This north-south peppermint corridor may be cleared during construction for the installation of plant infrastructure (buildings and pipelines). The corridor will be revegetated with peppermint and tuart vegetation (and relevant understorey species) following construction to upgrade the vegetation condition to better than its current poor to very poor condition (areas immediately over buried infrastructure will be planted with understorey species only). Following revegetation, it is expected that the corridor will likely be suitable for north-south movement of the *P. occidentalis* within a period of approximately five years of vegetation re-growth. This vegetation expected to be a suitable habitat for nesting and feeding within approximately 10-20 years of vegetation re-growth (Water Corporation 2008). This revegetation is expected to provide significantly better *P. occidentalis* habitat than the existing poor quality vegetation that does not provide viable long term habitat for the local ringtail possum population.

It is anticipated that the temporary removal of the north-south corridor will limit (depending on layout) the north-south movement of *P. occidentalis* through the site. This temporary removal is not expected to have any long-term impact on the population as a whole, however it is expected that the range of a number of individuals of the population will be affected, being restricted in their movement. No direct *P. occidentalis* mortalities are expected. Any *P. occidentalis* that previously moved through the plant site from the north or south are unlikely to move through the construction area until the corridor is revegetated and safe passage from predators is ensured (Water Corporation 2008).

A mitigation strategy (including management of impacts upon the Western Ringtail Possum during construction) has been developed and is provided as Appendix F.

In addition to revegetation of the areas cleared for construction, the Corporation has committed to rehabilitating an additional 10.5 ha on the SSDP site. The rehabilitation will involve planting of tuarts, peppermints and banksias. The rehabilitation works will be undertaken in areas degraded by previous land uses in order to improve the flora and fauna habitat linkages on and around the SSDP site. The rehabilitated areas may provide better fauna habitat for *P. occidentalis* than that which currently exists (Water Corporation 2008).

Management of Impacts

The management actions, responsibilities, timing and auditable outcomes for the management of terrestrial fauna are contained in the following management plans forming the Construction and Operations Environmental Management Frameworks:

1) Land Clearing and Trench Management Plan.
2) Rehabilitation Management Plan.

The management actions identified for the protection of native terrestrial fauna include:

1) ensuring a maximum open excavation length before pipelaying of 1000 m for each construction area to minimise the opportunity for fauna to enter the trenches;
2) grading the ends of open excavations at the end of each day to allow easy exit of fauna from the excavations;
3) installing fencing with ground level shrouding around open trenches to reduced the potential for fauna to enter the trenches;
4) maintaining a 450 m wide terrestrial corridor between the pump station and the ocean at all times during construction;
5) allowing fauna movement throughout areas with open trenches by always keeping open at least one corridor between the pump station works and the plant;
6) inspecting plant site and pipeline excavations prior to construction on each day to determine the presence of fauna within the trenches and other construction areas. Fauna found within excavated trenches and other construction areas will be removed and relocated without harm;
7) treating injured fauna by a veterinary doctor;
8) removing any dead fauna from the construction sites to discourage predation;
9) preventing predation and spread of disease by excluding domestic animals from the construction areas;
10) fencing agricultural land (electric where appropriate) to prevent livestock entering excavations and becoming injured;

11) marking and retaining habitat trees wherever possible during construction: and

12) revegetating cleared areas post-construction to re-establish fauna habitat, including enhancement plantings of Tuarts and Peppermints.

A consolidated list of safeguards and mitigation measures proposed for threatened terrestrial fauna has been provided as Appendix F.

Predicted Outcome

It is considered that the construction and operation of the SSDP will not pose any significant risk to the populations of EPBC listed terrestrial fauna in the region.

6.2.4 Threatened and Migratory Avifauna

Mosaic of agricultural land and remnant native vegetation in the Harvey Region provides habitat for a range of avifauna species. The primary impacts to avifauna relate to vegetation clearing, which corresponds to a direct loss of potential feeding and breeding habitat. Secondary impacts relate to avifauna being disturbed by construction activities.

The design and management of the construction works will aid in minimising the total area of native vegetation cleared (loss of avifauna habitat), avoiding known avifauna habitats, rehabilitating cleared areas post-construction (habitat rehabilitation), rehabilitation of other existing habitats (biodiversity offset), and managing temporary groundwater reductions on wetland habitats. The assessment outlined below will concentrate on the impacts and management of the construction and operation of the SSDP on avifauna species listed under the EPBC Act and international migratory bird species agreements and documented in Section 5.4.4.

Impacts to Threatened and Migratory Avifauna

The infrastructure areas were surveyed for avifauna during spring 2006 and 2007 (360 Environmental 2007, 2008a). 40 species of birds occur within the Project area, including the Carnaby's Black Cockatoo (*C. latirostris*) which is listed as Endangered under the EPBC Act.

The primary impact to threatened and migratory avifauna at the SSDP site is expected to come from vegetation clearing required for construction of the infrastructure. The selection of infrastructure sites and routes was based on an assessment using social and environmental constraints, including community input (GHD 2007a, b). A primary focus of the assessments was to avoid and minimise the clearing of terrestrial native flora during construction, thereby minimising the loss of avifauna habitat. The assessment of native vegetation clearing is addressed in the section on Terrestrial Flora (Section 6.2.1). As most areas to be cleared are connected to larger stands of native vegetation, combined with the revegetation initiatives following construction works (Section 6.2.1) the overall impact of the Project upon avifauna is expected to be minimal.

Avifauna identified by the 2006 and 2007 surveys that are listed under the EPBC Act are considered below:

Seabirds

Fifteen species of seabirds were identified as possibly occurring in the area (see Section 5.4.4). These were composed of 10 species of oceanic seabirds and five species of seabirds (terns) that may also feed in nearshore coastal waters and possibly make temporary landfall on the shoreline for resting/roosting purposes. Due to the vast feeding ranges of oceanic seabird species and remote breeding locations it is extremely unlikely

that the SSDP will result in any impact to those species. The terns listed in Table 5-4 all have extensive distribution ranges including the north and east Indian Ocean and western Pacific Ocean. Breeding localities for the three tern species (Crested, Caspian, Bridled Tern) known to regularly breed along the south-west WA coast include offshore islands such as those in the Lancelin area, the Rottnest Island to Safety Bay area and near Cape Leeuwin which are well beyond any potential zone of influence from the SSDP. The limited extent of disturbance to beach habitat from the SSDP is unlikely to cause any significant disruption to the terns temporary use of the beach, particularly when considering the extent of similar habitat available along this section of coast and current recreational use of the beach and associated disturbance from these activities..

Migratory Shorebirds

Table 5-4 lists 28 species of migratory shorebirds that may potentially occur in the local region (Swan Coastal Plain). Recorded occurrence of these species on the Swan Coastal Plain varies from being rarely recorded to regular seasonal visitors. Important migratory shorebird sites on the Swan Coastal Plain in the south-west of WA include the Peel-Yalgorup and Vasse-Wonnerup wetland systems which have extensive areas of feeding habitat for shorebirds (i.e. invertebrate rich sandflats/mudflats, estuarine and freshwater wetlands).

The habitats that occur within the SSDP site (narrow sandy beach, dunes, coastal woodland and a degraded wetland or seasonally wet paddock) are unlikely to support significant shorebird populations or be considered as an important site within the network of wetland sites within the Swan Coastal Plain.

Terrestrial Birds

A few other species not included in the above seabird or migratory shorebird groupings may potentially occur in the area - these consist of two species of Cockatoo, four species of waterbirds, one species of raptor, the Rainbow Bee-eater and the Fork-tailed Swift. These species are classified as threatened or “migratory” under the EPBC Act and/or are listed under the international migratory bird agreements.

The 2007 survey (360 Environmental, 2008a) identified a flock of 50 *C. latirostris* feeding in the pine plantation of the State Forest, and a flock of 60 *C. latirostris* feeding on pine plantation along Taranto Road near the SSDP site. Further, a flock of 10 *C. latirostris* was observed feeding on *Hakea prostrata* vegetation on the SSDP site near the existing wastewater treatment ponds. There were no sightings in 2006 or 2007 of *C. baudinii* during the environmental surveys.

Feeding trees (14) suitable for *C. latirostris* and *C. baudinii* were identified on the SSDP site, of which four occur within areas identified for construction works and are likely to be removed. The remaining 10 trees are located within areas that will not be impacted by construction works. An estimated 17 of the 74 feeding trees identified on, or adjacent to, the Water Transfer Pipeline may be cleared during construction of the pipeline sections along the Boonilup Road, Government Road, South West Highway and the agricultural land east of the South West Highway. It may be possible to retain some or all of the feeding trees on Government Road, however this will largely depend on the location of existing infrastructure (which create construction constraints) in this area. One feeding tree was identified near the Harvey Summit Tanks. This tree was outside of the construction areas and therefore will not be impacted by the construction works (Water Corporation 2008).

Despite the percentage of feeding trees that will be cleared during construction (24% of the feeding trees identified), the Project area is connected to, or surrounded by, larger stands of native vegetation. There is greater than 10,000 ha of native vegetation in the immediate Project area (not including coastal vegetation and plantations) in a combination of State Forest, State Nature Reserves or in private ownership that contains large tracts of feeding habitat than was identified by the limited survey area. Accordingly, the 21 feeding trees that

may be cleared during construction are insignificant in the total distribution of feeding habitat within the project region (Water Corporation 2008).

On the SSDP site, two potential nests/hollow sites were identified within areas that will not be impacted by construction works. Three potential hollows/nests were identified on, or adjacent to, the Water Transfer Pipeline. All three of the potential nests/hollows will be retained, with construction works occurring adjacent to these trees.

Based on the above assessment, the Project will not significantly impact hollows/nests for Cockatoos. The Project will have a limited impact on potential food sources for Cockatoos, however that impact is considered insignificant when considered in context of the distribution of feeding habitat that exists in the more than 10,000 ha of native vegetation in the surrounding region (Water Corporation 2008). In addition, the management measures identified below are consistent with those recommended in the *C. latirostris* Recovery Plan (Cale 2003), and are likely to further reduce the impact of the Project upon both species.

Four waterbird species listed on the JAMBA agreement could occur in the Project area: Great Egret, Cattle Egret, Glossy Ibis and Eastern Reef Egret. However, given the degraded nature of the wetland within the wetland portion of the SSDP site (refer Section 5.4.4 of the cPER) it is unlikely that the site contains important habitat for the above waterbird species or supports breeding sites (e.g. tall *Melaleuca* trees above water). These species are highly mobile, that, if disturbed, are capable of finding other sites unassisted. There is sufficient suitable habitat present outside the development area and it ism unlikely that the project will have any significant impact on these species.

Eastern Reef Egret is unlikely to occur in the vicinity of the Project area. It is uncommon in the south-west where it mostly confined to islands (e.g. Rottnest, Carnac, Garden, Penguin) and rocky parts of mainland coast opposite them and is scarce or absent elsewhere (Johnstone & Storr 1998). In addition, its preferred habitat (tidal reef, mudflats, rocky shores) does not occur in the vicinity of the SSDP site. There is no reef habitat in the area in which marine structures associated SSDP will be built and therefore no potential for the project to affect these species.

The Rainbow Bee-eater is a breeding migrant to the south-west during the September to April period. This species is likely to be in the local area during the spring and summer and was recorded from within the Banksia and Tuart vegetation types on the SSDP site (360 Environmental 2008) (see Section 5.4.4). However, sufficient suitable habitat is present outside the development area to support displaced animals and it is unlikely that the proposed development will significantly impact on this species.

Management of Impacts

The management actions, responsibilities, timing and auditable outcomes for the management of threatened and migratory avifauna are contained in the following management plans forming the Construction and Operations Environmental Management Frameworks:

1) Land Clearing and Trench Management Plan.
2) Rehabilitation Management Plan.
3) Hygiene Management Plan.

The management actions identified in those plans for the protection of threatened and migratory avifauna include:

1) defining maximum clearing widths for the Water Transfer Pipeline to the Harvey Summit Tanks of 20 m in native vegetation and 30 m within agricultural land. Clearing will be demarcated at the SSDP site with stock

fencing. Clearing will be demarcated on the Water Transfer Pipeline by field markers (given the temporary nature of works at these locations).

2) treating injured fauna by a veterinary doctor;
3) removing any dead fauna from the construction sites to discourage predation;
4) preventing predation and spread of disease by excluding domestic avifauna from the construction areas;
5) marking and retaining habitat trees where possible.
6) revegetating cleared areas post-construction to re-establish avifauna habitat.
7) collecting, storing and propagating provenance seed for use in rehabilitation activities.
8) stockpiling and later re-use of cleared vegetation for revegetation works.
9) stockpiling of topsoil for use during rehabilitation of avifauna habitat.
10) ripping, grading, seeding, fertilising and irrigating of construction areas following construction works.
11) monitored post-construction revegetation works to confirm revegetation success, with supplementary seeding, fertilising or direct planting where initial revegetation is not successful.
12) prohibiting burning cleared vegetation to prevent fires that could affect adjoining avifauna habitat.
13) spraying of weed infestations pre- and post-construction.
14) installing and implementing hygiene procedures and inspection points to prevent the spread of weeds and plant pathogens between construction areas.

A consolidated list of safeguards and mitigation measures has been provided as Appendix F. This strategy has been designed to provide information on proposed mitigation and offset measures that are aimed at reducing the impact of the SSDP on threatened and migratory avifauna.

Predicted Outcome

It is considered that the construction and operation of the SSDP will not pose any significant risk to the populations of EPBC listed avifauna in the region.

6.2.5 Feral and domestic animals

Introduced species including dogs (*Canis familiaris*), foxes, rabbits (*Oryctolagus cuniculus*) and house mice (*Mus musculus*) were identified in Project area in the 2006 and 2007 surveys (360 Environmental 2007, 2008a). Additionally, cats would normally be expected to occur in the area due to the proximity of residential areas. Of these species, dogs, foxes and cats are considered to have the greatest potential predation impact on native fauna within the SSDP site, with the Western Ringtail Possum, birds and lizards most at risk.

The Corporation has commenced dialogue with the WA DEC to incorporate the SSDP site into the areas where predator control baiting is undertaken by that Department. Initial discussions have identified that the site meets the separation distance from residential premises required for such a predator baiting program to proceed. A baiting program has the potential to reduce predator numbers within the area, thereby improving the long-term survival of terrestrial native fauna and resulting in a net environmental improvement for the status of native fauna in the area.

A predator baiting program on the SSDP site in isolation would have limited benefit given the hunting ranges for dogs, foxes and cats likely extend beyond the boundaries of the site unless it was fenced. In implementing a predator baiting program, the Corporation will consult adjacent landowners to determine the possibility of extending the program to include there lots to achieve improved predator control. If a predator baiting program is considered appropriate by the DEC, consultation with the WA Department of Health, the Shire of Harvey and adjacent landowners will be undertaken prior to construction to identify how that action may best be implemented, thereby limiting predation and spread of disease by excluding domestic animals from the construction areas. Furthermore, no dogs or cats will be allowed in project construction areas or the SSDP when completed, and the site is unlikely to attract scavenging species.

6.2.6 Dieback

As noted in Section 5.4.3, the construction areas may contain infestations of the plant pathogens that cause Phytophthora Dieback (*Phytophthora cinnamomi*) as well as Armillaria Root Disease (*Armillaria luteobubalina*). Plant pathogens, as well as weeds, can be spread through the movement of soil from infected areas to uninfected areas. The construction areas will be surveyed prior to construction for evidence of plant pathogens and significant weed infestations. These areas will be marked on the infrastructure maps used for site works and construction. The project will also establish and implement a Hygiene Management Plan, which will outline management actions necessary to minimise the spread of the plant pathogens and weeds from infested to uninfested land. Actions to be taken will be as follow:

- Identified infestations of declared weeds and Watsonia (*Watsonia bulbillifera*) will be sprayed to minimise weed spread during construction.
- Vehicles and machinery (including wheels, racks, undercarriage and inside cabins), construction plant and footwear will be inspected and cleaned of sods of dirt and slurry prior to entry to all construction areas.
- Construction materials (e.g. soil, revegetation material) will not be sourced from areas known to contain forest diseases or high weed infestations.
- Topsoil, overburden and vegetation from dieback infected areas will not be transported to uninfected ‘protectable’ areas.
- Excess overburden from dieback infected areas on-site will be disposed of within the dieback infected construction corridor by evenly spreading over the construction area prior to spreading the infected topsoil. This may result in a raised land level. Where disposal of overburden by this manner is not practicable due to excessive mounding, an alternative disposal location will be sought.
- Hygiene Inspection Points will be established at appropriate sites as indicated by a pre-construction dieback survey to prevent soil transfer from infected areas to uninfected ‘protectable’ areas. All vehicles, footwear and equipment entering the Hygiene Inspection Points will be cleaned to remove attached sods of dirt (including the tyres, undercarriage and inside cabin of vehicles and plant). Vehicles, footwear and equipment will be cleaned by:
  - air hosing and brushing during dry conditions.
  - low volume, high pressure water hosing during wet/boggy conditions.

- Construction vehicles will be restricted to within the clearing corridor (nominally 20 m in native vegetation areas and 30 m in agricultural land).
- Cleared vegetation will not be removed from determined dieback infected areas. All cleared vegetation from dieback infected areas will be retained within the dieback infected areas.
- Topsoil from agricultural areas will not be respread in areas of native vegetation in order to minimise the spread of pasture species.

Hygiene Inspection Points will be designed such that:

a) There is physical separation between the object being cleaned and the effluent produced (i.e. grate over a sump).

b) Cleaning wastewater is infiltrated on-site within already infested areas.

c) The object being cleaned does not become re-contaminated by the wastewater.

It is considered that these actions will be appropriate to manage the *Phytophthora* risks that do exist and are consistent with the requirements of the *Threat Abatement plan for Dieback caused by the root-rot fungus Phytophthora cinnamomi Department of Environment and Heritage* (DEH, 2002).

6.2.7 Hydrology

SSDP and Harvey sites

The SSDP is to be sited on porous coastal soils where there are no existing surface drainage channels or permanent standing water bodies (other than the evaporation ponds of the existing WWTP). The small ephemeral wetlands which occur on the SSDP site will be filled-in which, although resulting in a slight loss of non-permanent standing waterbodies, is not anticipated to result in any significant, long-term alteration to the hydrology regime of the site.

With the exception of site works for the onshore pump station, there will be minimal excavation on the site for the construction of the SSDP, thus the desalination plant itself is not expected to have any tangible effect upon either surface or groundwater hydrology at the site. Similarly, the Harvey Summit tanks, to be constructed at surface level in an existing farming area, are unlikely to have any hydrological impacts.

Construction of the onshore pump station at the Binningup site will involve excavation of a pit and minor dewatering. The Seawater Pumping Station will be located at the western end of the SSDP site behind the primary dune, 450 m from the beach. The Seawater Pumping Station will be installed to a depth of approximately RL -15 m, which is approximately 15 m below the summer groundwater level (Golder Associates 2008). The Water Corporation is proposing to construct diaphragm walls for the seawater pump station. Diaphragm walls are concrete walls that are constructed in trenches prior to dewatering. The walls will extend to the Leederville formation and will therefore provide a barrier to prevent water entering into the seawater pump station construction area. The diaphragm walls also form the walls for the completed pump station. Once the walls are complete the soil inside the walls can be removed and groundwater pumped out from inside the structure without reducing groundwater levels in the vicinity of the structure (as opposed to a previously predicted drawdown cone extending 600-800 m in the sPER, when it was not proposed to use diaphragm walls). Surrounding dewatering impact will be minimal (and therefore modelling is not required) and will be effectively restricted to seepage under the diaphragm wall. The drawdown (lowering of groundwater levels) will

be confined around the seawater pump station excavation and should be less than the natural variability in groundwater levels. Diaphragm walls were successfully constructed at Perth Seawater Desalination Plant.

Because of the use of diaphragm walls, there should not be any significant impacts on ground water dependent ecosystems such as peppermints, tuarts and banksias on the site, the adjacent landowners nor on the salinity of the aquifer associated with dewatering for the pump station construction.

Pipeline

The risk of causing adverse effects to surface and groundwater drainage will be minimised during laying of the water pipeline by the construction and laying methods which will be employed. Construction of the Water Transfer Pipeline will be undertaken in the dry months (nominally summer and autumn) and the management of Acid Sulphate Soils (ASS) dewatering water will be conducted in accordance with the Dewatering and ASS Management Plan (described in the proceeding section) that has been prepared in accordance with the Water Corporation's ASS and Dewatering Strategy (Water Corporation 2007d). As a result of minimal dewatering and the short period during which dewatering will be undertaken, it is likely that the dewatering works will have negligible impact on vegetation or water levels associated with wetlands and watercourses along the Water Transfer Pipeline.

Additionally, only trench sections of around 100 m will be open and being worked on at any one time, and any water pumped from the trench sections for dewatering purposes will be returned to groundwater in the same location via re-infiltration. Thus, there is not expected to be any tangible effect on surface or groundwater during the laying of the pipeline. The limited vegetation clearing to be conducted along the pipeline route (around 4 ha in total along its 38 km length) is similarly expected to have no tangible affect upon surface or groundwater flows or abstraction along the pipeline route.

The pipeline will be buried in a relatively shallow trench, thus addressing any further risk to surface hydrology or to most aspects of groundwater flows. It is recognised that the pipeline trench itself could act as a conduit for groundwater flow in areas of impervious material owing to the pervious backfill material (sand) creating a preferential path for the water. Accordingly, where necessary, i.e. on the edge of wetlands or in impermeable soils, clay barriers will be sited approximately every 500m within the backfill material to arrest longitudinal groundwater flow. In areas of pervious material (sand), the backfill material (sand) will not create a preferential path thus clay barriers will not be necessary.

6.2.8 Dewatering and Acid Sulphate Soils Management

Dewatering by spears and pumps will be required for excavations and installation of infrastructure in areas where the watertable is above the installation depth. Pipeline installation will occur during dry periods to reduce the need for dewatering with the temporal extent of dewatering limited by the pipeline installation rate (at approximately 100m per day), with dewatering in any one area being completed within approximately 7 days.

The eastern third of the SSDP site and approximately 70% of the length of the Water Transfer Pipeline will cross areas understood to be at risk of having ASS, which are naturally occurring soils and sediments containing sulphide minerals that react with oxygen to form sulphuric acid when exposed. Sulphuric acid has the potential to contaminate groundwater and cause the release of metals bound in the soil (such as aluminium, arsenic and iron). ASS excavated and exposed during construction must be treated to achieve an appropriate pH prior to disposal, and the dewatering water from ASS areas must be monitored and pH treated prior to discharge to the environment.

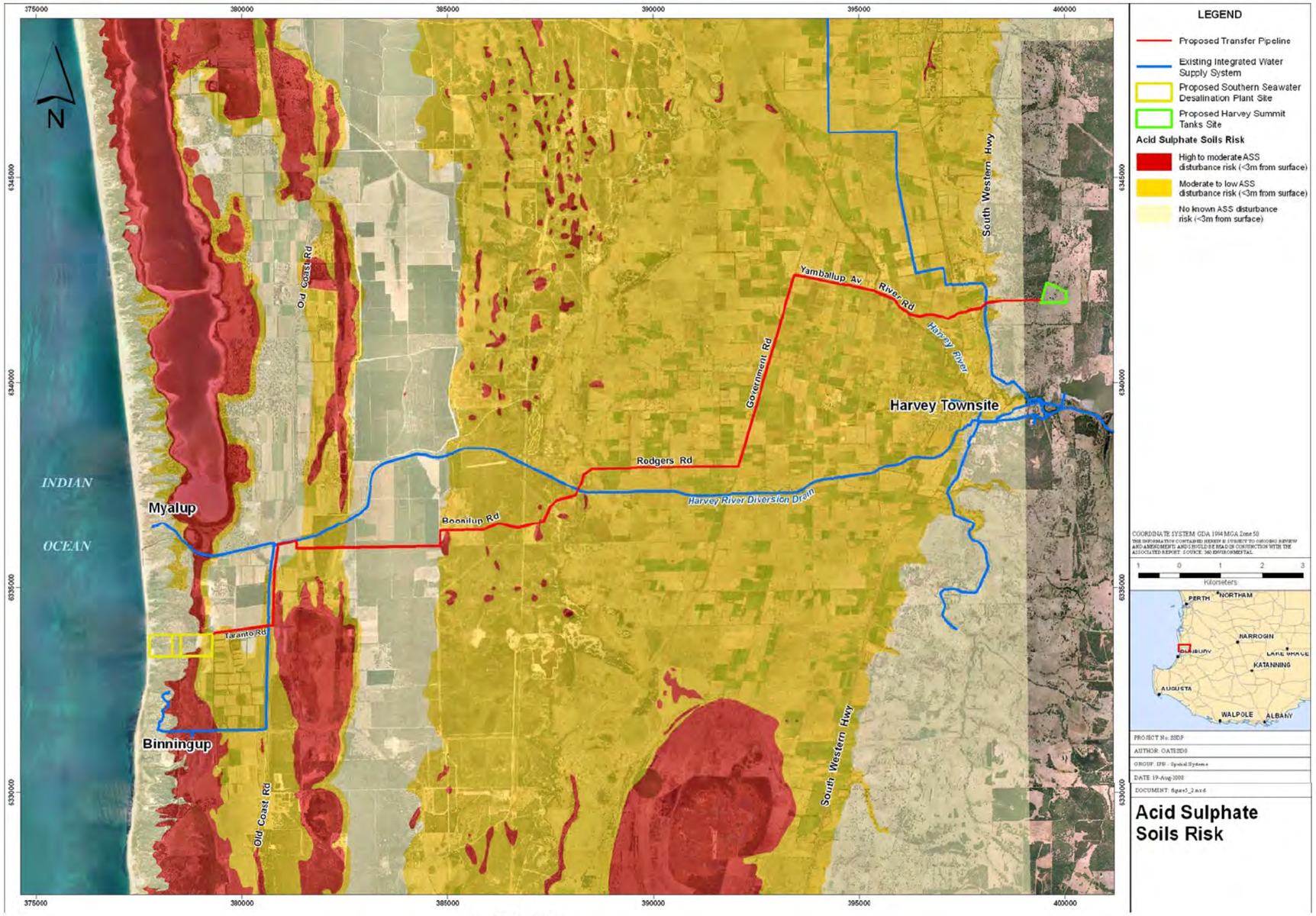
Section 6 5BPotential Impacts and Their Management

Mapping completed by the WAPC in May 2007 (see figure 6-2) provided a coarse indication of the ASS risk for the Project areas. From that mapping, it is estimated that approximately 30% of the SSDP site and approximately 70% of the Water Transfer Pipeline may have soils containing ASS (Table 6-2. The marine areas for the seawater pipeline installation were not mapped for ASS risk as ASS are not expected due to the high carbonate content of the marine sediments. Similarly, the Harvey Summit Tanks site was not been mapped as ASS is not expected at that elevation (approximately 150 m AHD above the Swan Coastal Plain), soil type and groundwater level.

Table 6-2 ASS risk of the project area

ASS Risk (for excavations up to 3 m depth)	
Seawater Desalination Plant Site:	2 ha of "high to moderate risk" (degraded remnant wetland) 18 ha of "moderate to low risk" 61 ha of "no known risk" (Note: Marine areas have not been mapped by WAPC, however ASS is not expected due to the high carbonate content of the marine sediments).
Water Transfer Pipeline:	0.5 km of "high to moderate risk" 22 km of "moderate to low risk"
Harvey Summit Tanks:	No data recorded (Note: ASS is not expected due to land elevation of approximately 150 m AHD, soil type and groundwater levels)

(WAPC 2007)



(WAPC 2007)

Figure 6-2 SSDP Infrastructure and Acid Sulphate Soil (ASS) Risk Areas

Section 6 5BPotential Impacts and Their Management

Preliminary ASS investigations have confirmed that the wetland is the only portion of the SSDP site containing ASS (Golder Associates 2008). The two wetland sites tested confirmed that the wetland soils were a medium ASS risk. This ASS identified at the SSDP site is not anticipated to be of concern as those areas will be filled to achieve the necessary height for infrastructure installation, and therefore will not be exposed. In the event that the construction works require excavation of this area, the ASS will be appropriately neutralised. Construction of the Water Transfer Pipeline will require the excavation and stockpiling of soils considered an ASS risk. The excavation and stockpiling undertaken during pipeline installation could result in exposure to oxygen and the resultant oxidation of ASS. The potential exposure of ASS will occur in both the stockpiled soils and soils within, and adjacent to, the excavated trench (within the dewatering cone of depression). The exposure to oxygen of potential ASS material in these areas of the pipeline will be limited due to construction works being undertaken during dry months (construction equipment will be unable to operate during wet periods) when groundwater tables are lowest, thereby increasing the speed of installation, reducing the total volume and depth of dewatering required, while minimising the potential environmental impacts on flora and fauna and production of ASS. Dewatering will be further minimised by limiting the dewatering rate to the minimum required for safe construction. Excessive dewatering will be avoided as part of normal construction works as excessive dewatering increases the construction cost and increases the volume of dewatering water requiring management and infiltration.

The dewatering water produced will be infiltrated near the dewatering site. In addition, the duration of exposure will be limited as construction works in any one area will be limited to approximately seven days (except at the Harvey-Myalup Main Drain where construction works may take approximately four weeks). The Corporation will verify the presence of ASS along the pipeline corridor by undertaking a risk based field investigation for ASS in accordance with the Corporation's ASS and Dewatering Management Strategy (Water Corporation 2007d). The risk based approach will involve field soil sampling and laboratory testing of soil samples collected. Areas identified as containing ASS will have soil and groundwater treated to ensure that the risk to the environment is minimised in accordance with the EPA objective. The particulars of the Dewatering and Acid Sulphate Soils Management Plan are as follow

Purpose

The purpose of the Dewatering and Acid Sulphate Soils Management Plan is to outline management actions to:

1. minimise the environmental impacts of dewatering.
2. identify and manage areas of ASS.

Performance Indicators

Performance will be demonstrated by compliance with the prescribed management actions.

Management Actions

Prior to Construction

1. The presence of ASS and the depth to groundwater will be determined as described below:

a. Sample sites will be located at 500m intervals along the pipeline routes, except for the Boonilup Road section where the sampling distance will be 100m. At the Seawater Desalination Plant site the degraded remnant wetland will be sampled (minimum 2 sample sites).

b. At each sample site, one 500 gram sample will be taken from the centre of each soil layer (horizon) to a depth of approximately 4.0 metres. The sample will be collected and placed in a sealed plastic bag, excluding air. Shell material, if present, will be removed from the sample in the field. Samples will be placed in a field freezer or esky containing ice, then frozen within 24 hours of collection (i.e. on return from field sampling).

c. Each soil sample will be tested by the Suspension Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) suite method by a laboratory accredited by NATA for analysis by SPOCAS.

d. For each soil profile, the following will be recorded:

    i. Location (geo-referenced to eastings and northings) of the sample site.

    ii. Depth from which the soil sample was taken.

    iii. Description of thickness, soil texture and grain size for each layer.

    iv. Description of colour using a Munsell colour chart for each layer.

    v. Description of soil mottling, organic matter, moisture content, and presence of shell material for each layer.

    vi. Estimation of the water table depth below ground level.

    vii. Photograph of the soil profile with a field marking indicating the sample collection points.

e. Reporting of the results will include:

    i. Description of the equipment and methods used for sample collection.

    ii. Maps with geo-referenced coordinates of each sampling site.

    iii. Results of SPOCAS tests (includes Titratable Actual Acidity, Titratable Peroxide Acidity, Acid Neutralising Capacity, Titratable Sulfidic Acidity).

    iv. Recorded matters listed in part '1d' (above).

    v. NATA endorsed laboratory report for the laboratory results.

    vi. Description of Chain of Custody for samples collected for laboratory analysis.

    vii. Discussion of laboratory analysis.

Construction

Dewatering General

2. Excessive dewatering will be avoided. The rate of dewatering will be limited to the minimum rate required for the infrastructure to be installed within the trench.

Dewatering to Ocean

3. Dewatering water maybe discharged to the ocean from the Seawater Desalination Plant site. It will be ensured that the dewatering water is discharged within the surf zone (nominally within 0m to 25m of the shoreline) where the dewatering water will be rapidly mixed by wave action.

4. Dewatering discharge will not create a visible plume greater than 100m from the discharge location.

Dewatering to Land

5. Dewatering water will be infiltrated on-site within cleared or agricultural areas. Infiltration of dewatering water will be within a defined area (may require earth bunding).

6. Dewatering to native vegetation will only occur where no other practicable disposal option exists.

7. Dewatering water maybe used for dust suppression if monitoring confirms that the discharge water meets the following water quality criteria for discharge to land (below).

Dewatering to a Watercourse

8. Dewatering water may be discharged to a watercourse if monitoring confirms that the water meets the water quality criteria for discharge to a watercourse (Table 6-3).

9. Dewatering water will be discharged to a watercourse via a settling tank/bund to remove suspended sediments. The size of the settling tank/bund will be designed (subject to land availability) to allow for sufficient retention time to remove visible suspended solids.

10. The dewatering water will be discharged from the settling tank/bund onto a hard surface (such as a rocky ledge), or via a diffuser, to minimise flow velocity that could erode the watercourse bed, banks or vegetation of the watercourse, and to aerate the discharge.

11. A continuous row(s) of sterile hay bales or geofabric will be installed, through which the discharge will pass prior to entering the watercourse if the settling tank/bund does not sufficiently remove suspended sediments (i.e. the watercourse is visibly turbid). The bales/geofabric will be fixed using stakes to the base of the watercourse. The bales/geofabric and stakes will be removed following the completion of discharge.

12. If required, the dewatering discharge will be dosed with Alum (aluminium sulphate, $Al_2(SO_4)^{3-}$) to remove sediments from suspension within the settling tank/bund or on the discharge side of the bales/geofabric. The concentration of alum required will be dependent on the level of sedimentation of the water. Soda Ash (sodium carbonate, Na_2CO_3) will also be applied during Alum dosing at a rate of 2 parts Alum: 1 part Soda Ash for pH correction.

Monitoring of Dewatering Discharge to a Watercourse or Land

13. The discharge water will be monitored at the discharge point once per day for pH and temperature using a calibrated multimeter probe(s).

14. The water within a watercourse to which dewatering water is discharged will be monitored at 100m upstream and 100m downstream of the discharge point for pH and temperature using a calibrated multimeter probe(s). The results of discharge will be compared to the upstream water quality.

15. The discharge will be managed such that the following water quality objectives are achieved:

Table 6-3 Dewatering Discharge Objectives

	Temperature	pH
Discharge to Watercourse	Within ± 2 degrees Celsius in watercourse (100m downstream v. 100m upstream)	6.0-8.5 for discharge water *or* within ± 2 pH units in watercourse (100m downstream v. 100m upstream)
Discharge to Land	Not applicable	4-10 for discharge water
Discharge to Ocean	Not applicable	4-10 for discharge water

16. A visual turbidity assessment will be taken of the discharge and of the watercourse at 100m upstream and downstream of the discharge.

17. Sterile hay bales and/or a geofabric will be installed within the watercourse downstream of the discharge to reduce turbidity if the watercourse is identified as visibly turbid.

18. The watercourse will be dosed on the discharge side of the bales/geofabric with Alum (aluminium sulphate, $Al_2(SO_4)^{3-}$) to reduce turbidity if the installation of bales/geofabric does not sufficiently reduce turbidity. The concentration of alum required will be dependent on the level of turbidity of the water. Soda Ash (sodium carbonate - Na_2CO_3) will also be applied during Alum dosing at a rate of 2 parts Alum: 1 part Soda Ash for pH correction.

19. The results of monitoring for pH, temperature and turbidity will be recorded on the Water Discharge Monitoring Log.

20. The pH of the dewatering waters will be neutralised with liquid lime if the dewatering discharge water quality does not meet the discharge objectives for pH. The rate of neutralisation will be based on achieving a neutralised discharge quality to within the pH discharge water objective of pH 6.0-8.5 for a watercourse or pH 4.0-10.0 for discharge to land or ocean.

21. The rate of dewatering will be adjusted, or location of dewatering changed, if the dewatering discharge to a watercourse does not meet the temperature discharge objectives.

Dewatering on Boonilup Road Wetland (Watercourse) Area

22. A fixed water level indicator will be installed with 1cm increments into the open water area of each wetland containing open water within 100m of the Water Transfer Pipeline on Boonilup Road (excluding the Harvey-Myalup Drain).

23. The wetland water levels will be monitored and recorded on the Wetland Water Level Monitoring Log to 1cm accuracy in all wetlands within 100m of the Water Transfer Pipeline on Boonilup Road on each day during construction.

24. Dewatering water may be temporarily discharged to any wetland that records a reduction in water level greater than 10cm (and accounting for any natural reduction in water levels recorded in wetlands beyond the immediate construction area). Discharge will continue until the natural water level is restored to within 1cm. Discharge will be monitored and recorded on the Water Discharge Monitoring Log.

ASS Soil Management

25. The ASS risk (based on preconstruction investigations) will be marked on the infrastructure maps for the Water Transfer Pipeline (Appendix 2). The maps will identify a 500m/100m buffer on pipeline areas identified as having ASS given the investigation confidence (sampling) interval was 500m/100m for preconstruction investigations.

26. Field sampling and field analysis will be conducted for pHF and pHFOX at 50m intervals within the 500m/100m buffer during construction to determine the starting location of ASS where present. The field sampling and analysis will be conducted in accordance with Appendix 1 of *Performing and Interpreting Soil Field pH of Draft Identification and Investigation of Acid Sulfate Soils* (DEC, May 2006).

27. ASS material will be stockpiled separately from non-ASS material. Stockpiles of ASS material will be placed on a pad of Aglime (pulverised limestone) of no less than 100mm depth.

28. Stockpiles of ASS material will be neutralised by thorough mixing with the following ratios of aglime (pulverised limestone) based on the ASS risk, i.e.

Table 6-4 Aglime Dosing Rates for ASS

	ASS Assessment			
	Nil	**Low** (S% 0.03-0.4)	**Medium** (S% 0.5 -1.9)	**High** (S% 2.0-5.0)
Rate of Aglime dosing (tonne of lime : tonne soil excavated)	No treatment required	2:100	8:100	19:100

Notes:

1. Ratios are based on tonnage, not volume. Estimation of the bulk density of the ASS material is required prior to neutralisation.
2. Aglime dosing rates are for pure fine Aglime (100% CaCO3) using a safety factor of 1.5. If commercial grade lime is used the rates must be proportionally emended to account for change in purity.
3. Aglime dosing rate includes the weight of Aglime pad on which ASS material is placed.
4. Limestone has not been recommended given low surface (reaction) area and high volume requirements for neutralisation.

29. Neutralised ASS material maybe disposed of to:

    a. the excavated trench.

    b. a suitable location agreed with the Landowner (the Landowner has first preference to retain excess overburden from their own property).

    c. a suitable location agreed with adjacent Landowners (with preference to Landowners on the pipeline route) or other nearby Landowners.

    d. local landfill as inert waste.

Reporting

30. The following details will be recorded and reported weekly:

    a) volume of dewatering.

    b) locations of dewatering discharge.

    c) volume of ASS material excavated and neutralised.

    d) disposal locations of neutralised ASS material.

Additional Information

ASS Sampling

1. Draft Identification and Investigation of Acid Sulfate Soils (DoE, May 2006) recommends an ASS linear sampling interval of 50m. The preconstruction sampling interval to be undertaken for the pipeline will be at 500m intervals (which is predominantly "moderate to low risk"), with 100m intervals for the Boonilup Road section (which is mostly "moderate to low risk" with sections of "high to moderate risk"). The recommended interval of 50 metres for investigative sampling is not practicable (would equate to approximately 800 sites), consequently, a conservative linear interval buffer of 500m/100m will be added to the results of investigation sampling from the ASS delineation mapping, with field testing at 50m intervals conducted during construction for field delineation.

2. Draft Identification and Investigation of Acid Sulfate Soils (DoE, May 2006) recommends an ASS vertical sampling interval of 0.25 metres, or greater where soil layers are less. The recommended interval for investigative sampling is not considered necessary as the material will not be returned in layers (excepting topsoil). One sample from each soil layer will be sufficient to determine the overall ASS risk and allow ASS, if present, to be quantified by volume and concentration for effective management during construction.

3. Four metres is the approximate maximum reach of the machinery which will be used for geotechnical excavations and construction. Sampling beyond this depth is not practicable.

4. SPOCAS tests are being conducted on all soil samples collected. Tests for pHF and pHFOX will not be conducted for pre-construction delineation of ASS as the DEC (formerly as the WA Department of Environment, May 2006) identifies that tests for pHF and pHFOX have a 20-40% error (false positives and false negatives). Consequently, tests for pHF and pHFOX (as a precursor for determining the need for SPOCAS testing) are not considered by the Principal to be reliable for preconstruction delineation of ASS.

Dewatering Discharge

1. pH 6.5 is the lower guideline value for South-western freshwater river ecosystems by ANZECC (2000). pH 6.0 is the guideline action trigger level recommended by DoW (2006).

2. pH range of 4-10 is consistent with the *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA).

3. Aglime dosing rate is based on Appendix 1 of *Acid Sulfate Soils Guideline Series – Treatment and Management of disturbed acid sulfate soils* (DEC, October 2004).

Dewatering Licence

A licence from the DoW to conduct dewatering activities is not required as a result of powers contained in s83(2)(b)(i) of the *Water Agencies (Powers) Act 1984* (WA).

6.3 Marine Environment Risks and Their Management

6.3.1 Sources of environmental risk

The construction and operation of the SSDP will generate in-water noise, which has the potential to lead to adverse impacts upon marine fauna in the vicinity of the development site. Potential sources of noise during construction include dredging activities, pile driving (e.g. during the laying of the pipe), rock armour dumping, sand/sludge dumping and general vessel traffic, as well as that arising from any in-water blasting. Potential noise sources during operations include the movement of water through the outfall as well as vessel traffic associated with periodic maintenance and inspection (URS 2008a), although, any noise that is generated during operation would be minimal and inconsequential in comparison with the ambient noise environment of the nearshore zone where the pipelines will be located (Appendix I).

Vessel collisions, or 'boat strikes' are also possible if any of the vessels engaged in SSDP construction impact significant marine fauna, such as cetaceans or turtles. For example, as described in Pendoley (2008) turtles are at risk from boat strike when they rise to the surface to breathe or when they surface as a 'startle' response to some situation such as dredging noise, explosions or visual cues.

The construction of the intake and outlet infrastructure will also cause some physical disturbance to the seabed during site preparation and the construction of marine pipelines and structures. Physical disturbance of benthic habitats and increased turbidity due to dredge plumes may impact habitats of marine fauna protected by the EPBC Act.

During operations, water intake and brine discharge will be the two sources of potential environmental effect upon the marine environment. Pendoley (2008) noted that marine organisms are at risk from entrainment and entrapment in ocean intakes such as those used for cooling water and desalination, usually via one of two processes:

- entrapment which is the trapping of organisms on screens placed near the entrance to the intake pipe; and
- entrainment which is the transport of organisms small enough to pass through the screens and into the pre-treatment systems.

Principal determinants of the extent of any entrapment or entrainment are:

- the size of the organism/s, and their abundance/density in the affected part of the water column;
- the habitat in which the intake is located;
- the velocity at which water is drawn into the intake;
- the design, size and shape of screens; and
- the frequency and means by which screens are cleaned.

When operating, the SSDP will produce brine with approximately twice the salinity of seawater. The brine will pass through energy recovery devices before being discharged via the brine discharge pipeline and diffuser (URS 2008b). The ocean outfall diffuser(s) will be located between 600 m and 950 m offshore with a total diffuser length of up to 350 m. The brine will be discharged at high velocity through angled nozzles and will mix rapidly with the surrounding seawater. Based on measurements of the analogous Perth Seawater Desalination Plant diffuser discharge and the extensive modelling undertaken by the Corporation for the SSDP, the nearfield (i.e. the designated mixing zone) is expected to extend for no more than around 50 m either side of the diffuser.

For this reason the mixing zone is proposed to be a rectangular zone that extends 50 m in all directions around the diffuser with an area of approximately 4.5 ha. For this reason, the seagrass beds are not expected to be impacted as they are located approximately 1300 m offshore.

Salinity of the brine at the discharge point of the diffuser will be up to 65 parts per thousand (ppt). The brine will rapidly mix with the surrounding seawater due to turbulence caused by the velocity of the output. The Corporation has committed to the SSDP desalination discharge not causing an increase in salinity at the boundary of the mixing zone that is:

1. greater than 1 ppt 95% of the time
2. greater than 1.3 ppt at any time.

The brine is heavier than the surrounding seawater due to its higher salinity. The region where the brine settles to the seafloor is termed the nearfield and is predicted to be fully contained within the mixing zone. Once the diluted brine reaches the seabed it will continue to dilute due to natural mixing processes. It will also be affected by currents and move down slope (i.e. offshore) due to being slightly denser than the surrounding seawater (Water Corporation 2008).

There is no potential for long-term build-up of salinity due to the discharge being sited on an open coastline. The brine discharge is predicted to increase the average density stratification by no more than 0.1 kg/m^3 at 500 m from the diffuser. This stratification reduces with distance away from the diffuser and there is only a minor change to the duration of stratification 2 km and more from the diffuser (Water Corporation 2008). Given the rapid mixing and the relatively constrained scale of the mixing zone and the location of the diffuser in close proximity to the surf zone, variations in oceanic currents are unlikely to have any discernible impact upon mixing conditions, although the orientation of the mixing plume will be influenced to some extent in the near field.

The brine discharge will also include a number of chemical additives, at low concentrations, to promote the efficient operation of the plant and RO process. These may include sulphuric acid, polyelectrolyte, anti-scalants, sodium hypochlorite and sodium bisulphate. The actual chemical dosing regimes for the SSDP will be determined following pilot testing and will be refined during commissioning. Table 6-3 presents an estimate of chemical additives to be discharged in trace amounts via the brine outfall. All of the treatment chemicals to be used are either non-hazardous, form harmless by-products or biodegrade relatively rapidly (Water Corporation 2008).

Table 6-5 Estimated chemical additives to be discharged via the brine outfall

Chemical	Application	Frequency of use	Anticipated average fortnightly chemical use	Units
Anti-scalant	RO system	Continuous	5155	L
Sulphuric Acid	MF cleaning	Intermittent	804	L
Sodium Hypochlorite	MF cleaning and intake shock dosing	Intermittent	6896	L
Citric Acid	MF and RO cleaning	Intermittent	1968	kg
Caustic Soda	RO cleaning	Intermittent	154	L
Detergent	RO cleaning	Intermittent	5.8	L
Biocide	RO cleaning	Intermittent	14.5	L

RO = Reverse Osmosis, MF = Microfiltration. Total Plant Output per fortnight = 2.184×10^9 litres

The brine discharge will also have a slightly elevated temperature (2 °C) and reduced dissolved oxygen (DO) levels compared with ambient water into which it will be mixed. The Water Corporation (2008) reported, as a worst case estimate, the brine from the SSDP could be up to 2 to 2.5 mg/L lower in DO than the ambient seawater. Following dilution with seawater, the largest decreases in DO that could occur are 0.09 mg/L (1.3% sat) and 0.14 mg/L (2% sat) at the boundary of the mixing zone considered by the WA EPA and within the mixing zone respectively.

6.3.2 Mitigation measures

Construction Phase

Potential disturbance arising from the SSDP marine construction activities will be mitigated via a number of mechanisms related to site selection, construction processes and management measures. These include:

- Marine construction works will only be undertaken in a relatively small area close to the shore. The area of marine benthic habitat disturbed from construction will be limited to a 500 m long by 50 m wide area (2.5 ha).
- Work will only be undertaken for a period of up to 18 months, and will generally only be conducted during normal working hours on normal working days.
- The site has been selected in an area generally devoid of habitat features such as reefs, sponge gardens or algal beds and has only limited seagrass coverage which does not commence until about 1000 m from the shoreline (Fugro 2008; UWA 2008).

- The total number of days on which excavation occurs offshore of the nominal 6 m depth contour or where rock is encountered, whichever is further offshore, shall not exceed 122 days. This is considered the threshold below which no adverse effects arising from the influence of turbidity are likely to be encountered (see Oceanica 2008a).
- Monitoring of turbidity levels and photosynthetically active radiation (PAR) will be conducted during activities that are likely to generate turbidity, such as dredging/excavation and backfilling, and construction of reception pits for tunnelling and drilling.
- Only water-based drilling fluids will be used.
- Vessel crews engaged in marine construction activities will undertake site induction by the Environmental Officer so that they are aware of the potential impacts to significant marine fauna and appropriate risk avoidance and mitigation measures.
- The beach will be closed for public safety reasons for 2-3 weeks at a time when tunnelling machinery is directly below the beach.
- A temporary marine exclusion area will be established around the construction activity. This will be marked with marine warning buoys at, nominally, 300 m, 550 m, 800 m, 1050 m and 1300 m from the beach and 500 m south from the marine pipeline alignment.
- If necessary to use explosives, only small charges will be used.
- A 1 km marine fauna/safety exclusion zone will be established around the construction activity. The Corporation intends that an ocean watch vessel, with a suitably qualified observer onboard, will be deployed before any pile driving activities to observe for significant marine fauna such as cetaceans, turtles, pinnipeds and protected shark species. In the case of any explosive blasting, an exclusion zone of 2 km radius will be established around detonation sites. From 1 hour before the planned time of detonation this zone will be checked to be clear of large marine fauna such as whales, dolphins, sharks and turtles. If any are observed to be within the zone then detonation will be delayed until such time as the observed fauna are outside the zone. To enhance the effectiveness of surveillance, detonations will only be conducted in daylight conditions and with benign sea conditions (e.g. sea state 3 or below) so that boat (and land-based observers if used) have a reasonable probability of sighting any marine fauna incursion into the safety zone.
- As far as practicable and although not considered critical, any underwater blasting will be conducted outside of the recognised migration periods in that area for southern right whales (May to October) and humpback whales (May to November).

Operational Phase

The risk of entrainment of marine fauna will be minimised by design and operational safeguards. The intakes will comprise a large cylinder or similar with a perimeter screen to prevent medium to large fish, seaweed, marine mammals, seabirds (such as penguins), and turtles (as well as divers) from being drawn in. The risk of entrapment will be minimised by drawing in water at an intake velocity less than the higher water velocities that naturally occur in the Binningup area and to which 'swimming' organisms have habituated. UWA (2008b) measured velocities of up to 0.3 $m.s^{-1}$, however, velocities only exceed 0.15 $m.s^{-1}$ around 5% of the time. As reported in Pendoley (2008), the US EPA has determined that an intake velocity of 0.15 $m.s^{-1}$ provides an

adequate safety factor for 96% of fish species, which compares favourably with the intended SSDP peak intake velocity of around 0.1 $m.s^{-1}$.

To ensure rapid mixing, brine will be discharge through the ocean outfall diffuser(s) located between 600 m and 950 m offshore. The brine will be discharged at high velocity through angled nozzles and will thus mix rapidly with the surrounding seawater (URS 2008b). The rapid mixing and employment of multiple, high velocity nozzles in the diffuser will also limit the likelihood of the diffuser array acting as a fish aggregation device; this is often observed at other industrial ocean outfalls, most likely as a result of more favourable thermal conditions compared with ambient waters.

Furthermore, following commissioning of the SSDP, the Corporation intends that:

- Brine discharge will be monitored for levels of nutrients, toxicants and process additive chemicals as part of the Discharge Water Quality Monitoring Plan.
- Whole Effluent Toxicity (WET) monitoring will be conducted to measure the potential biological impacts of the brine discharge on the surrounding environment.
- Benthic habitat monitoring will be conducted between 18 and 30 months of the initiation of brine discharge.
- Regular cleaning of the intake screens will be conducted and live biota entrapped on the screens will be released in the area away from the intake pipelines.

6.3.3 Marine environmental risk evaluation

Literature reviews (URS 2008a,b, Appendices H and I) and a specific assessment of marine turtle risks (Pendoley 2008) have been conducted to assess the potential environmental impact of construction and operation of the SSDP on cetaceans and other conservation significant marine fauna. These studies generally concluded that the SSDP presents minimal risks to these fauna, and what risks that do exist can be reduced via the application of additional controls, mainly related to monitoring for and surveillance of the species of concern during key phases of the SSDP construction. These conclusions are consistent with the environmental assessment undertaken for a similar desalination plant proposed for the Sydney area (The Ecology Lab 2005).

The risk of boat strike on marine fauna by vessels engaged in SSDP construction activities is minimal, particularly noting that for a significant proportion of the time the vessels involved will be stationary or operating at slow speeds. When placed in context, there is a greater risk arising from ship and boating activity around nearby Bunbury.

Noise generated from this project would be audible to cetaceans, particularly baleen whales in the near field, but would be mainly at frequencies below the optimal hearing ranges of toothed whales, such as dolphins. Low frequency noises are also likely to be audible to any marine turtles in the vicinity. By comparison, seals and sea lions have fairly poor hearing at low frequency and, therefore, can approach low frequency noise sources, such as seismic survey vessels, without suffering adverse effects. Potential noise, and shock effects in the event of any explosives use, on significant marine fauna as a result of SSDP construction and operation are intrinsically low and will be further attenuated by the intended risk mitigation measures. It is possible that the proposed activities, particularly the pile driving, may elicit some short-term behavioural changes on some cetaceans and possibly turtles in the immediate area and only for the duration of the time that the noise source is active. If any effects do occur, however, these are likely to be confined to startle responses, changes to feeding patterns and temporary avoidance of the Project area. None of these are considered likely to result in long-term harm to

either individuals or populations. The risk of adverse noise effects would be further ameliorated by the high ambient broadband noise levels existing at the site by dint of its location within and immediately behind the surf zone of an open ocean beach, further alleviated by the poor acoustic propagation characteristics of shallow coastal waters. Taking these factors into account, it is unlikely that the construction and operation of the proposed SSDP would occasion any significant noise or shock-related impact upon any individual animals, with population level effects even less likely (URS 2008a).

Pinnipeds have been widely observed to develop habituation to explosive detonations, as 'seal bombs', used to keep seals and sea lions away from fishing vessels and aquaculture pens, have been found to have limited long-term effect (Lewis 1996). On this basis, it is conceivable that seals may be attracted to explosions causing fish kills and may then be caught in the next explosion if these were to be conducted with any regularity and repetition. This risk can be mitigated by application of an exclusion zone around blast sites and the employment of a suitable interval between detonations (URS 2008b).

Grey nurse and great white sharks that may enter the Project area will be able to detect the low frequency noises generated by the construction activities, particularly the pile driving. However, no critical habitat or aggregation areas for either species are known to occur within the vicinity of the project site, so any acoustic-induced impact is likely to be short-term and non-persistent. Compared with most fish, sharks may be less susceptible to blast and impulse effects. This is due to the absence of a swim bladder, their physical size and arguably also due to their general morphology (see URS 2008a). Any potential effects from the use of explosives will be mitigated by application of the intended exclusion zone around blast sites.

It is considered unlikely that the hyper-saline brine discharge will impact on large marine species, either at the individual or population levels as these animals are presumably able to sense changes in water salinity and density and avoid if necessary (Western Whale Research 2008). The 50 km distance from the project site to the nearest whale aggregation area at Geographe Bay mitigates against the existence of any credible risk to cetaceans from the brine discharge. Further, any exposure of large marine fauna to negative environmental impacts related to the operation of the SSDP, particularly the brine discharge, would be unlikely due to their size and highly mobile nature. This conclusion takes into account possible effects as a result of the salinity of the discharge effluent, as well as potential effects from changes in temperature and DO levels, and chemical additives in the discharge stream. Hence it is considered a remote possibility that there will be adverse impacts on conservation significant marine fauna due to the operation of the SSDP (URS 2008b). Furthermore, the cetaceans, pinnipeds, sharks and turtles of concern are highly mobile organisms in relation to the size of the brine mixing zone proposed at the SSDP. Owing to their mobility, it is expected that exposure to environmental conditions within the mixing zone, even if they were to be adverse, will be minimal. While a wide range of the potential environmental impacts of discharge from desalination plants has been identified, few studies have been published in the scientific literature that examined the actual effects of discharge from desalination plants on large marine fauna (URS 2008b). Nevertheless, all of these studies have essentially concluded that brine discharge from desalination plants, including treatment additives at low concentrations, is not expected to significantly impact upon the local marine environment.

Although there is potential for the prey species of significant marine fauna to be affected by the outlet plume, this affect would be localised and unlikely to effect the general abundance or availability of prey species.

The most likely impacts, if any, upon ray-finned fishes that may be in the area is temporary loss of habitat due to preparation of the seabed for pipeline laying and associated activities. Possible temporary short-term impacts on habitat health may also occur due to turbidity generated during construction. Oceanica (2008a) considered the likely impacts upon marine invertebrates from construction activities such as dredging. It was found that natural levels of turbidity in bottom waters in the Binningup region encompass the range of turbidity likely to be

generated by dredging. Invertebrates in the region are therefore likely to be able to cope with periodic elevations in turbidity. Furthermore, the intake and outlet structures and pipe routes will avoid sensitive marine habitat and communities, including seagrass meadows.

In summary, disturbance arising from the marine construction aspects and operation of the SSDP is unlikely to have a significant effect on marine habitat in the Project area for a number of intrinsic reasons related to the site proposed for the SSDP and inherent risk mitigation factors related to habitat and species which may otherwise be considered likely to be subject to risks from the SSDP. These may be summarised as follow:

- Marine construction works will be localised and temporary, and work will generally only be conducted during normal working hours on normal working days, thus indicating any sources of impact would be not be persistent in character and be limited in both the spatial and temporal domains.
- The site has been selected in an area generally devoid of habitat features such as reefs, sponge gardens or algal beds and has only limited seagrass coverage which does not commence until about 1000 m from the shoreline (Fugro 2008; UWA 2008).
- The intake and outfall pipelines will be tunnelled from the seawater pump station under the beach to the intake structures (500 m offshore). They will not emerge from the seabed into the water column until past the 6 m depth contour.
- The marine species considered likely to be resident in the immediate area of the proposed marine construction area are well represented in surrounding regions.
- Other marine species of specific conservation significance are not resident in the area, and the Binningup area does not represent important or significant habitat for any of these species.
- The Corporation will establish a marine exclusion area and safety zones around the site during construction. These will be monitored during noise intensive activities such as pile-driving and blasting to ensure they are clear of any conservation significant marine fauna.
- Any temporarily displaced sessile invertebrate fauna are considered likely to have the ability to readily recolonise areas from which they may have been displaced.
- The intakes will be designed and operated to minimise the likelihood of the entrainment or entrapment of marine fauna.
- Mobile marine vertebrate fauna such as whales, dolphins and pelagic and demersal fish are generally likely to avoid construction activities and equipment and are unlikely to be affected by brine discharges.

On balance, it may be anticipated that any disturbance or perturbation arising from the construction and operation of the SSDP is unlikely to have a significant effect on marine habitat or any marine species. The potential significance of whatever minimal risks that may exist will be further ameliorated by the mitigation measures intended to be employed by the Corporation. None of the activities associated with the proposed SSDP is considered likely to be incompatible with the aims and objectives of the various recovery plans currently in place regarding marine species.

Section 7 6BEnvironmental Impact Evaluation

7.1 Introduction

The objective of this Section is to assess the potential for construction and operation of the SSDP to significantly affect Matters of NES and other pertinent environmental matters, as described in the EPBC Act, EPBC Regulations and EPBC Act Significant Impact Guidelines (DEWHA 2006) and the Commonwealth SSDP PER Guidelines.

DEWHA has published Significant Impact Guidelines to assist prospective proponents of an action to determine whether or not their proposed action will have, or is likely to have, a significant impact on Matters of NES. These official guidelines provide a useful benchmark against which to measure the likely environmental impact, and the significance or otherwise of any impact, within the context of matters protected by the EPBC Act. The DEWHA EPBC Act Significant Impact Guidelines applicable to the proposed SSDP are detailed in Section 7.2.

This Section assesses the potential for the SSDP to cause adverse environmental effects as addressed by the EPBC Act, as per DEWHA Guidelines. This assessment is based on the description of known and potential impacts of the activities presented in this PER. As a component of this evaluation, the likelihood of occurrence of impacts deemed to be of significance under the terms of the EPBC Act have been considered. The assessment itself is presented in a series of tables (Tables 7-1 to 7-8) that list the relevant criteria for each identified matter and evaluate the likelihood of the activity triggering any of the individual criteria.

7.2 EPBC Act Impact Significance Criteria Applicable to the SSDP

The impact assessment criteria promulgated by DEWHA for assessing the impact significance of the four Matters of NES that are relevant to the proposed SSDP are presented below.

When assessing whether an action is likely to have a significant impact, it is necessary to take into account the nature and magnitude of potential impacts, and to take account of aspects such as:

- all on-site and off-site impacts
- all direct and indirect impacts
- the frequency and duration of the action
- the total impact which can be attributed to that action over the entire geographical area affected, and over time
- the sensitivity of the receiving environment
- the degree of confidence with which the impacts of the action are known and understood.

7.2.1 Listed threatened species and ecological communities

An action will require approval from the Commonwealth Minister for the Environment if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild;
- critically endangered;

- endangered; or
- vulnerable.

An action will also require approval from the Commonwealth Minister for the Environment if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- critically endangered; or
- endangered.

Some of the significance criteria below refer to the concept of "habitat critical to the survival of a species or ecological community". Habitat critical to the survival of a species or ecological community may include areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community;
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species / community.

Habitat critical to the survival of a species or ecological community will depend largely on the particular requirements of the species/community in question.

The criteria for critically endangered and endangered species only are presented here as an example, noting that these are similar to, but more stringent than, those applying to vulnerable species.

It is considered that an action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- *lead to a long-term decrease in the size of a population;*
- *reduce the area of occupancy of the species;*
- *fragment an existing population into two or more populations;*
- *adversely affect habitat critical to the survival of a species;*
- *disrupt the breeding cycle of a population;*
- *modify, destroy, remove, isolate or decrease the availability or quality of a habitat to the extent that the species is likely to decline;*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat ;*
- *introduce disease that may cause the species to decline; or*
- *interfere with the recovery of the species.*

7.2.2 Listed migratory species

An action has, will have, or is likely to have a significant impact on migratory species if it does, will, or is likely to:

- *substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or*
- *result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species; or*
- *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.*

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- habitat that is of critical importance to the species at particular life-cycle stages;
- habitat utilised by a migratory species which is at the limit of the species range; or
- habitat within an area where the species is declining.

7.2.3 Listed marine species

There are six criteria for significant impact pertaining to the Commonwealth marine environment, as follow.

An action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will:

- *result in a known or potential pest species becoming established in the Commonwealth marine area;*
- *modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results;*
- *have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (e.g. breeding, feeding, migration behaviour, life expectancy) and spatial distribution;*
- *result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health;*
- *result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected; or*
- *have a substantial adverse impact on heritage values of the Commonwealth marine area, including damage or destruction of an historic shipwreck.*

Note that the waters off Binningup which may be affected by the proposed SSDP are not within a Commonwealth marine area. Therefore, by definition of the DEWHA significance criteria, only one of these has direct possible relevance to listed marine species not necessarily within a Commonwealth marine area, as is the

case with the proposed SSDP. Within this context, it is considered that the SSDP could only have a significant impact on a listed marine species if there is a real chance or possibility that the action will have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (e.g. breeding, feeding, migration behaviour, life expectancy) and spatial distribution.

Although arguably not within the ambit of the protections afforded by the EPBC Act to the marine environment in the circumstances of the SSDP, in the interests of being comprehensive this report also considers whether the proposed action will:

- result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health;
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

7.2.4 Wetlands of international importance

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- *areas of the wetland being destroyed or substantially modified;*
- *a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland;*
- *the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected;*
- *a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health; or*
- *an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.*

7.3 EPBC Act Significance Evaluations

7.3.1 Threatened Species

Table 7-1 defines significance criteria for the Matters of NES for Listed Threatened Species and Ecological Communities. Table 7-2 summarises an assessment of the potential for the development and operation of the SSDP, pipeline and Harvey Summit tanks to cause impacts that trigger these criteria.

Table 7-1 Significance criteria for Listed Threatened Species

Criteria	Description
I	Lead to a long-term decrease in the size of a population
II	Reduce the area of occupancy of the species
III	Fragment an existing population into two or more populations
IV	Adversely affect habitat critical to the survival of a species
V	Disrupt the breeding cycle of a population
VI	Modify, destroy, remove, isolate or decrease the availability or quality of a habitat to the extent that the species is likely to decline
VII	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
VIII	Introduce disease that may cause the species to decline
IX	Interfere with the recovery of the species

Table 7-2 Potential for impacts that trigger Significance Criteria

Receptor of Potential Concern	Criteria								
	I	II	III	IV	V	VI	VII	VIII	IX
Glossy-leaved hammer-orchid	UL	UL	UL	UL	UL	UL	UL	UL	UL
Dwarf hammer-orchid	UL	UL	UL	UL	UL	UL	UL	UL	UL
Chuditch	UL	UL	UL	UL	UL	UL	UL	UL	UL
Quokka	UL	UL	UL	UL	UL	UL	UL	UL	UL
Western ringtail possum	UL	T	T	UL	T	UL	UL	UL	UL
Carnaby's Black Cockatoo	UL	UL	UL	P/UL	UL	P/UL	UL	UL	UL
Baudin's Black Cockatoo	UL	UL	UL	P/UL	UL	P/UL	UL	UL	UL
Rainbow bee-eater	UL	UL	UL	UL	UL	UL	UL	UL	UL
Humpback whale	UL	UL	UL	UL	UL	UL	UL	UL	UL
Southern right whale	UL	UL	UL	UL	UL	UL	UL	UL	UL
Blue whale	UL	UL	UL	UL	UL	UL	UL	UL	UL
Australian sea lion	UL	UL	UL	UL	UL	UL	UL	UL	UL
Grey nurse shark	UL	UL	UL	UL	UL	UL	UL	UL	UL
Great white shark	UL	UL	UL	UL	UL	UL	UL	UL	UL
Whale shark	UL	UL	UL	UL	UL	UL	UL	UL	UL
Loggerhead turtle	UL	UL	UL	UL	UL	UL	UL	UL	UL
Other marine turtles	UL	UL	UL	UL	UL	UL	UL	UL	UL
Southern Giant Petrel	UL	UL	UL	UL	UL	UL	UL	UL	UL
Northern Giant Petrel	UL	UL	UL	UL	UL	UL	UL	UL	UL
Shy albatross	UL	UL	UL	UL	UL	UL	UL	UL	UL
Gibson's albatross	UL	UL	UL	UL	UL	UL	UL	UL	UL

UL = Unlikely; P = Possible; T = Transitory

Owing to their presence on the SSDP site, some temporary disturbance of Western ringtail possums will most likely occur, but given the extent of that disturbance, the non-critical nature of the habitat area concerned, the risk avoidance and reduction measures to be employed by the Corporation and the intended rehabilitation of the site following construction, none of the expected impacts are likely to be significant either of themselves or in the context of EPBC Act assessment criteria.

Similarly, it is possible that some aspects of habitat linked to the Carnaby's Black Cockatoo and Baudin's Black Cockatoo will be disturbed. Although no breeding has been confirmed for this area and the six trees with 'possible' nest hollows will remain; it is possible (but unlikely) that the clearing of feeding areas could adversely affect habitat critical to the survival of breeding birds. For example, breeding birds generally feed within 6-10 km of the breeding site, however, the nearest confirmed breeding sites are about 30 km to north in the Lake Clifton region. As such, under Significance Criteria IV and VI, the potential impact has been listed as "Possible" and "Unlikely" as it has been deemed possible, but unlikely, that the clearing of feeding areas could adversely affect habitat critical to the survival of breeding birds (Johnstone 2008). In general, the impact to these species is expected to be small and isolated, and of minimal significance in the context of the abundance and array of similar available habitat in the Project area.

7.3.2 Migratory Species

Table 7-3 defines significance criteria for the Matters of NES for Listed Migratory Species. Table 7-4 summarises an assessment of the potential for the development and operation of the SSDP, pipeline and Harvey Summit tanks to cause impacts that trigger these criteria.

Table 7-3 Significance criteria for Listed Migratory Species

Criteria	Description
I	Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species
II	Result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species
III	Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species

Table 7-4 Potential for impacts that trigger significance criteria for Listed Migratory Species

Receptor of Potential Concern	Criteria		
	I	II	III
Migratory cetaceans	UL	UL	UL
Migratory sharks	UL	UL	UL
Migratory turtles	UL	UL	UL
Migratory avian species (terrestrial)	UL	UL	UL
Migratory avian species (marine)	UL	UL	UL

UL = Unlikely

7.3.3 Listed Marine Species

Table 7-5 defines significance criteria for the Matters of NES for Listed Marine Species. Table 7-6 summarises an assessment of the potential for the development and operation of the SSDP, pipeline and Harvey Summit tanks to cause impacts that trigger these criteria.

Table 7-5 Significance criteria for Listed Marine Species

Criteria	Description
I	Have a substantial adverse effect on a population of a marine species (or cetacean) including its life cycle (e.g. breeding, feeding, migration behaviour, life expectancy) and spatial distribution
II	Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health
III	Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected

Table 7-6 Potential for impacts that trigger significance criteria for Listed Marine Species

Receptor of Potential Concern	Criteria		
	I	II	III
Humpback whale	UL	UL	UL
Southern right whale	UL	UL	UL
Blue whale	UL	UL	UL
Bottlenose dolphin	UL	UL	UL
Other cetacean species	UL	UL	UL
Loggerhead turtle	UL	UL	UL
Other marine turtle species	UL	UL	UL
Grey nurse shark	UL	UL	UL
Great white shark	UL	UL	UL
Whale shark	UL	UL	UL
Australian sea lion	UL	UL	UL
New Zealand fur seal	UL	UL	UL
Listed syngnathids	UL	UL	UL
Listed avifauna	UL	UL	UL

7.3.4 Wetlands of International Importance

Table 7-7 defines significance criteria for the Matters of NES for Wetlands of International Importance. Table 7-8 summarises an assessment of the potential for the development and operation of the SSDP, pipeline and Harvey Summit tanks to cause impacts that trigger these criteria.

Table 7-7 Significance criteria for Wetlands of International Importance

Criteria	Description
I	Areas of the wetland being destroyed or substantially modified
II	A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland
III	The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected
IV	A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human
V	An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland

Table 7-8 Potential for impacts that trigger significance criteria for Wetlands of International Importance

Source of Disturbance	Criteria				
	I	II	III	IV	V
Construction and operation of the SSDP	UL	UL	UL	UL	UL
Construction of pipeline	UL	UL	UL	UL	UL

UL = Unlikely

Section 1 Socio-Economic Factors

The Water Corporation has undertaken an assessment of social factors related to the proposed development and operation of the SSDP. Apart from the obvious benefit of providing a reliable source of potable water, free from the vagaries of seasonal and cyclical factors associated with water drawn from surface and groundwater catchments, the SSDP also offers a variety of positive outcomes for both the local Binningup area and the wider south-west portion of WA.

The socio-economic evaluation of the proposed SSDP is expanded upon in Appendix J, with a summary of the public consultation program presented in Appendix K.

Section 9 7BConclusions

On balance, and taking into account the impact avoidance, reduction and mitigation measures to be implemented by the Corporation, it may be concluded that the proposed SSDP is not likely to have a significant impact on the environment in general, nor upon specific matters afforded protection by the EPBC Act. This assessment is based upon an evaluation within the framework of DEWHA significance criteria for Matters of NES, as per *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (DEWHA 2006) for the Matters of NES applicable to the SSDP. From a comparison with the criteria that apply to the relevant Matters of NES identified as being likely to be present, it was assessed that the Project would not:

- Adversely impact threatened or migratory terrestrial fauna, or their habitats.
- Adversely impact threatened ecological communities.
- Adversely impact threatened flora species.
- Adversely impact upon threatened, migratory or listed marine species of avian fauna.
- Adversely impact any wetland of international significance.
- Adversely impact upon threatened, migratory or listed marine species, including cetaceans.

Owing to their presence on the SSDP site, some temporary disturbance of Western Ringtail Possums will most likely occur, but given the extent of that disturbance, the non-critical nature of the habitat area concerned, the risk avoidance and reduction measures to be employed by the Corporation and the intended rehabilitation of the site following construction, none of the expected impacts are likely to be significant either of themselves or in the context of EPBC Act assessment criteria.

Similarly, it is possible that some aspects of habitat linked to the Carnaby's Black Cockatoo and Baudin's Black Cockatoo will be disturbed, but such impact would be small and isolated, and of minimal significance in the context of the abundance and array of similar available habitat in the Project area.

Given the complexity of natural systems and the prevalent lack of full scientific understanding, no certainty can be given that all potential environmental effects from the activities intended by the Proponent have been identified and assessed, or indeed can be identified and assessed on the basis of current knowledge. Nevertheless, the assessments and conclusions presented in this report represent the outcomes of realistic evaluation of the potential impacts of the proposed activities on the basis of available knowledge and a precautionary and conservative approach.

Prior to the completion of this cPER, the Corporation selected a preferred design for the SSDP. Details of the preferred design are presented in Appendix L, and associated details of the Corporations proposed mitigation and offset strategy, and rehabilitation plans are presented in Appendices F and M respectively.

Section 10 8BReferences and Bibliography

360 Environmental 2006. Binningup baseline water quality.

360 Environmental 2007. Binningup water treatment facility and pipeline corridor: due diligence flora and fauna investigation.

360 Environmental 2008a. Southern Seawater Desalination Project 2007 Terrestrial Flora and Fauna Survey.

360 Environmental 2008b. Southern Seawater Desalination Plant Contamination Assessment.

ANZECC/ARMCANZ 2000a. *Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting*, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand. National Water Quality Management Strategy No. 4.

ANZECC/ARMCANZ 2000b. *Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting*. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, National Water Quality Management Strategy No. 7

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000. National Water Quality Management Strategy - Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Australian and New Zealand Environment and Conservation Council 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Chapter 3.

Australian Wildlife Conservancy 2008. *Wildlife Profiles: Quenda (Southern Brown Bandicoot) (Isoodon obesulus fusciventer)*. Available at: http://www.australianwildlife.org/wildlifeprofiles.asp?WID=598. Accessed 23 January 2008.

Ayvazian, S.G. & Hyndes, G.A. 1995. Surf-zone fish assemblages in south-western Australia: do adjacent nearshore habitats and the warm Leeuwin Current influence the characteristics of the fish fauna, *Marine Biology* 122: 527-536.

Bannister J.L., Kemper C.M., & Warneke R.M. 1996. *The Action Plan for Australian Cetaceans*. Australian Nature Conservation Agency, Canberra.

Bannister JL, & SL Hedley. 2001. *Southern Hemisphere Group IV humpback whales: their status from recent aerial survey*. Memoirs of the Queensland Museum. 47:587-598.

Barber P.A., Archibald R., Drake P., Edwards T., Eslick H., Legault A., Moore N., Scott P., Taylor K., Bowen B., Calver M., Colquhoun I., Dell B., Harvdy G., Haswell D., McCaw L., McGrath J. & Froend R. 2004. *Investigating the Cause(s) of the Eucalyptus gomphocephala (Tuart) Decline Epidemic in Western Australian Native Forest*.

Bowden, K.F. 1983. Physical Oceanography of Coastal Waters. Ellis Harwood, pp. 302.

Bureau of Meteorology (BoM) 2008. Viewed 31 January 2008, <http://www.bom.gov.au/climate/averages/tables/cw_009965.shtm>.

Cale, B. 2003. Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan 2002-2012. WA Department of Conservation and Land Management.

Campbell, R. 2005. Historical distribution and abundance of the Australian sea lion (*Neophoca cinerea*) on the west coast of Western Australia. WA Department of Fisheries, Perth.

Section 10 8BReferences and Bibliography

Carwardine M 1995, Whales, Dolphins and Porpoises –The visual guide to all the world's cetaceans. Dorling Kindersley Ltd, London.

Cavanagh R.D, Kyne, P.M, Fowler, S.L, Musick, J.A, Bennett, M.B. 2003. The Conservation Status of Australian Chondrichthyans: Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia. x + 170pp.

Centre for Water Research (CWR) 2006. Hydrodynamic Modelling of the Impact of the Perth Seawater Desalination Plant Discharge on Cockburn Sound. University of Western Australia. Prepared for the Water Corporation of Western Australia. June. Okely, P., Antenucci, J.P., Imberger, J., and Marti, C.L. November.

Centre for Water Research (CWR) 2006a. Modelling of the Impact of the Perth Seawater Desalination Plant Discharge on Dissolved Oxygen in Cockburn Sound. University of Western Australia. Prepared for the Water Corporation of Western Australia. June. Okely, P., Antenucci, J.P., Imberger, J., and Marti, C.L. November.

Centre for Water Research (CWR) 2007. The Near-Field Characteristics of the Perth Seawater desalination Plant Discharge, December, Report WP2175PO.

Centre for Water Research (CWR) 2007a. Field Investigations into the Impact of the Perth Seawater Desalination Plant Discharge on Cockburn Sound. University of Western Australia. Prepared for the Water Corporation of Western Australia. Okely, P., Antenucci, J.P., Imberger, J., and Marti, C.L. June.

Centre for Water Research (CWR) 2007b. Summary of Investigations into the Impact of the Perth Seawater Desalination Plant Discharge on Cockburn Sound. University of Western Australia. Prepared for the Water Corporation of Western Australia. June. Okely, P., Antenucci, J.P., Imberger, J., and Marti, C.L. August.

Centre for Water Research (CWR) 2007c. Horizontal Mixing and dispersion at the Proposed Outfall Site for the Southern Seawater Desalination Plant, Binningup. Report WP2174CM. Centre for Water Research. University of Western Australia.

Chidlow. J, Gaughan. D, McAuley. R. 2005. Identification of Western Australian Grey Nurse Shark aggregation sites. Final Report to the Australian Government, Department of the Environment and Heritage.

Collier, C.J., 2006. *Characterising responses of the seagrass Posidonia sinuosa to changes in light availability*. Ph.D. thesis, Faculty of Computing, Health and Science. Perth, Edith Cowan University

Commonwealth of Australia 2005. Natural Hazard Risk in Perth Western Australia. Compiled by T. Jones, M. Middelmann and N. Corby for Geoscience Australia

Crawley, K.R., Hyndes, G.A., Ayvazian, S.G. 2006. Influence of different volumes and types of detached macrophytes on fish community structure in surf zones of sandy beaches. Marine Ecology Progress Series 307: 233-246.

D.A. Lord and Associates (DAL) 2005. Ecological assessment of the effects of discharge of seawater concentrate from the Perth Seawater Desalination Plant on Cockburn Sound. A report prepared for the Water Corporation.

DALSE 2002. Independent Turbidity Monitoring Consultant Quarterly Report #3. Jervoise Bay Southern Harbour Turbidity Monitoring Programme and Southern and Northern Harbour Water and Sediment Quality Monitoring, Prepared for Department of Industry and Technology by DAL Science & Engineering Pty Ltd, Report no. 02/207/3, Perth, Western Australia, May 2002.

Section 10 8BReferences and Bibliography

Deeney, A.C. 1989. Geology and groundwater resources of the superficial formations between Pinjarra and Bunbury, Perth Basin. Geological Survey of Western Australia. Report 26 p31-57

Department of Environment 2005. Stormwater Management Manual for Western Australia.

Department of Environment and Conservation 2005. *Landfill Waste Classification and Waste Definitions 1996* (as amended).

Department of Environment and Conservation 2006. *Geomorphic Wetlands of the Swan Coastal Plan Dataset*. Available from the Department of Environment and Conservation, Perth, Western Australia.

Department of Environment and Conservation 2006a. Fauna Species Profile: Western Ringtail Possum (*Pseudocheirus occidentalis*). Accessed July 2008 from: http://www.naturebase.net/component/option,com_docman/task,cat_view/Itemid,1288/gid,372/orderby,dmdatecounter/ascdesc,DESC/

Department of Environment and Conservation 2006b. Fauna Species Profile: Carnaby's Black Cockatoo (*Caloptorhynchus latirostris*). Accessed July 2008 from: http://www.naturebase.net/component/option,com_docman/task,cat_view/Itemid,1288/gid,371/orderby,dmdatecounter/ascdesc,DESC/

Department of Environment and Conservation 2006c. Fauna Species Profile: Chuditch (*Dasyurus geoffroii*). Accessed July 2008 from: http://www.naturebase.net/component/option,com_docman/task,cat_view/Itemid,1288/gid,372/orderby,dmdatecounter/ascdesc,DESC/

Department of Environment and Conservation 2006d. Fauna Species Profile: Quokka (*Setonix brachyurus*). Accessed July 2008 from: http://www.naturebase.net/index2.php?option=com_docman&task=doc_view&gid=131&Itemid=807

Department of Environment and Heritage 2002. Threat Abatement plan for Dieback caused by the root-rot fungus Phytophthora cinnamomi Department of Environment and Heritage.

Department of Environmental Protection Western Australia, Water and Rivers Commission Western Australia and Department of Health Western Australia 2002. *Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products.* Available from Department of Environment and Conservation, Perth Western Australia.

Department of Health Western Australia 2004. *Sewage Pollution in Recreational Waters*. Available at www.health.wa.gov.au/envirohealth/

Department of Premier and Cabinet 2006. Options for bringing water to Perth from the Kimberley. An independent review commissioned by the Department of Premier and Cabinet, Government of Western Australia.

Department of the Environment and Water Resources 2007. F*orest Black Cockatoos - Baudin's Cockatoo (Calyptorhynchus baudinii) and Forest Red-tailed Black Cockatoo* (Calyptorhynchus banksii naso). Draft recovery plan. DEWR, Canberra.

Department of Water Western Australia 2006. Water Quality Protection Note #13 – *Dewatering of soils at Construction Sites*.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2006. EPBC Act Policy Statement 1.1: Significant Impact Guidelines - Matters of National Environmental Significance, May 2006. DEWHA, Canberra.

Section 10 8BReferences and Bibliography

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2007. Marine Species Conservation. http://www.environment.gov.au/coasts/species/index.html, 5 July 2008.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008. The Southwest Marine Bioregional Plan Bioregional Profile: A Description of the Ecosystems, Conservation Values and Uses of the South-west Marine Region. Commonwealth of Australia.

Diaz, R.J., Rosenberg, R. 1995. 'Marine benthic hypoxia: A review of its ecological effects and the behavioural responses of benthic macrofauna'. *Oceanography and Marine Biology: An Annual Review*, vol. 33, pp. 245-303.

Economic Regulation Authority 2005. Final report: Inquiry on the cost of supplying bulk potable water to Kalgoorlie-Boulder.

Environment Australia 2002, Recovery Plan for the Grey Nurse Shark (*Carcharias Taurus*) June 2002. Environment Australia, Canberra.

Environment Australia, 2002a, White Shark (*Carcharodon carcharias*) Recovery Plan, July 2002. Environment Australia, Canberra.

Environmental Protection Authority 1993. *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area*. Available at www.epa.wa.gov.au.

Environmental Protection Authority 2000. Perth's Coastal Waters: Environmental values and objectives – the position of the EPA, a working document. February 2000. Report 17. Department of Environmental Protection, Perth WA.

Environmental Protection Authority 2003. Guidance Statement number 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia. Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 2004. *EIA Principles, Factors and Objectives*: Guide to EIA Environmental Principles, Factors and Objectives Environmental Protection Authority, Perth.

Environmental Protection Authority 2004a. *Guidance for the Assessment of Environmental Factors*: Benthic primary Producer Habitat Protection for Western Australia's Marine Environment, No. 29 Environmental Protection Authority, Perth.

Environmental Protection Authority 2005. Environmental Guidance for Planning and Development (Draft).

Environmental Protection Authority 2005a. Manual of Standard Operating Procedures - For Environmental Monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004): a supporting document to the State Environmental (Cockburn Sound) Policy 2005. Report No. 21. Environmental Protection Authority, January 2005.

Environmental Protection Authority 2005b. Environmental Quality Criteria Reference Document for Cockburn Sound. A Supporting Document to the State Environmental (Cockburn Sound) Policy 2005. Environmental Protection Authority. Report 20. January 2005.

Erftemeijer P. L. A, & Robin Lewis III R.R., 2006. Environmental impacts of dredging on seagrasses: A review. *Marine Pollution Bulletin*, Vol. 52, pp. 1553-1572.

Froend R. & Zencich .2002. *Groundwater Dependent Ecosystems*. In: *Environmental Issues in Western Australia*. School of Natural Sciences, Edith Cowan University.

Section 10 8BReferences and Bibliography

Gallop G. 2005. Collie River recover project to help secure our water future. Media release from the Premier of Western Australia, Perth, 3 August 2005.

GCD Alliance 2006. Material change of use application: ERA 16, 19 and 7.

German Standard DIN 4150-3 1999. Structural vibration – effects of vibration on structures.

GHD 2007a. Report for Southern Seawater Desalination Plant Summit Tank – Preliminary Site Assessment.

GHD 2007b. Report for Southern Seawater Desalination Plant Trunk Main – Preliminary Route Assessment (Draft).

GHD 2007c. Report on the Southern Seawater Desalination Plant – Preliminary Geotechnical Investigation (Draft Revision A.)

GHD 2007d Southern Seawater Desalination Plant – Marine Investigations. Report for Oceanography of Southern Seawater Desalination Plant: Seaglider Transects (July-August 2007).

GHD 2008. Southern Seawater Desalination Project. Social impact assessment.

GHD 2008a. Southern Seawater Desalination Project. Sustainability assessment.

GHD 2008b. Southern Seawater Desalination Plant – Marine Investigations. Report for Oceanography of Southern Seawater Desalination Plant: Seaglider Transects (December 2007-January 2008).

Golder and Associates 2008. Geotechnical surveys interpretation report.

Government of Western Australia 2005, State Environmental (Cockburn Sound) Policy 2005, Western Australia State Environmental Policy Series 01.

Government of Western Australia. 2004. State Water Quality Management Strategy No. 6: Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting (Guidelines Nos. 4 & 7: National Water Quality Management Strategy). Report No. SWQ 6, Perth.

Hayward, M. W., de Tores, P. J., Dillon, M. J. & Fox, B. J. 2003. Local population structure of a naturally occurring metapopulation of the quokka (*Setonix brachyurus* Macropodidae: Marsupialia). *Biological Conservation* (110) 343–355.

Hayward, M. W., de Tores, P. J., Dillon, M. J. & Banks, P. B. 2007. Predicting the occurrence of the quokka, *Setonix brachyurus* (Macropodidae: Marsupialia), in Western Australia's northern jarrah forest. *Wildlife Research* (34) 194–199.

Herring Storer Acoustics 2007a. Baseline noise monitoring July 2007.

Herring Storer Acoustics 2007b. Baseline noise monitoring October 2007.

Herring Storer Acoustics 2008a. Noise modelling and recommendations.

Herring Storer Acoustics 2008b. Noise modelling and recommendations.

Hopper, S.D. and Brown, A.P 2007. A revision of Australia's hammer orchids (Drakaea: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators, Australian Systematic Botany **20**, 252-285.

Section 10 8BReferences and Bibliography

Jenner, K.C.S, M.N Jenner & K.A McCabe. 2001, *Geographical and temporal movements of humpback whales in Western Australian waters*. APPEA journal. Page(s) 749-765.

Johnstone, R. E. 2008. Assessment of Potential Impact to Carnaby's Cockatoo and Baudin's Cockatoo for Southern Seawater Desalination Plant Binningup to Harvey. Prepared for URS Australia Pty Ltd.

Johnstone, R.E. & G.M. Storr (1998). Handbook of Western Australian Birds. Vol. 1: Non-passerines (Emu to Dollarbird). West Australian Museum, Perth.

Kawamura, A 1980. *A review of food of balaenopterid whales*. Scientific Reports of the Whales Research Institute. 32:155-197.

KBR 2007a. Southern Seawater Desalination Plant – Marine Investigations – Water Quality Monitoring Stage 1.

KBR 2008b. Southern Seawater Desalination Plant – Marine Investigations. Oceanographic Modelling.

Lattemann, S. and Höpner, T. 2003. *Seawater Desalination: Impacts of Brines and Chemical Discharge on the Marine Environment*. Desalination Publications, L'Aquila.

Limpus, C.J. & Limpus, D.J. 2003, *Biology of the Loggerhead Turtle in Western South Pacific Ocean Foraging Areas*. Loggerhead Sea Turtles. Washington, Smithsonian Press.

Limpus, C.J. & Limpus, D.J. 2001. The loggerhead turtle, *Caretta caretta*, in Queensland: breeding migrations and fidelity to a warm temperate feeding area. Chelonian Conservation and Biology, 4, 142-153.

Lewis, J.A. 1996. *Effects of Underwater Explosions on Life in the Sea*, DSTO-GD-0080. Defence Science & Technology Organisation, Melbourne.

Mattiske & Associates 1991. *Gnangara Mound – Root Studies*. Report for the Water Authority of Western Australia.

Marquez, R 1990. FAO Species Catalogue; Sea Turtles of the World. An annotated and illustrated catalogue of the sea turtle species known to date. FAO Fisheries Synopsis. 125 (11):pp 81. Rome, Food & Agric. Org. of United Nations.

Maunsell Australia Pty Ltd 2008. Interim Report/Advice, Declared Rare Flora Survey, Binningup to Harvey Desalination Plant Project Area. A report prepared for: the Water Corporation of Western Australia.

McCauley, R.D. 1994. *The environmental implications of offshore oil and gas development in Australia – seismic surveys*. In: Swan, J.M., Neff, J.M. and Young, P.C. (eds.). Environmental Implications of Offshore Oil and Gas Development in Australia – The Findings of an Independent Scientific Review, pp19–122. Australian Petroleum Exploration Association, Sydney.

National Environment Protection Council 1999. National Environment Protection Assessment of Site Contamination) Measure 1999: Schedule B (7a) Guideline on Health-Based Investigation Levels.

National Native Title Tribunal 2007. *Claimant Application Summary: Gnaala Karla Booja*. Available at: www.nntt.gov.au/applications/claimant/WC98_58.html.

Nevill, S 2005. *Birds* In: Guide to the Wildlife of the Perth Region, Simon Nevill Publications, Perth, Western Australia.

Noad, M.J. 2002. The use of song by humpback whales (*Megaptera novaeangliae*) during migration off the east coast of Australia. Ph.D. Thesis. University of Sydney.

Section 10 8BReferences and Bibliography

Oceanica 2005. Perth Metropolitan Desalination Plant: Effect of low dissolved oxygen concentrations on marine organisms, a review. A report prepared for: the Water Corporation of Western Australia.

Oceanica 2008a. Southern Seawater Desalination Plant – marine investigations. Historical water quality review.

Oceanica 2008b. Memorandum on the Impact of Dredging on Seagrass Health. Prepared for the Water Corporation.

Oceanica 2008c, Binningup Desalination Plant Binningup Habitat Mapping, July 2008. Prepared for Water Corporation. Report No 737/001.

Orell, P. and Morris, K. 1994. Chuditch Recovery Plan 1992-2001. Western Australian Wildlife Management Program No. 13. Department of Conservation and Land Management.

Pendoley. 2008. Review of Sea Turtle Habitat Usage within the South-Western Waters of Western Australia – R-J26001 ver0.

Perth Reverse Osmosis Alliance 2008. Material Safety Data Sheet: Filter Backwash Cake.

Poiner, I.R. and Harris, A.N.M. 1996. *Incidental capture, direct mortality and delayed mortality of sea turtles in Australia's northern prawn fishery*. Marine Biology, 125, 813-825.

Reeves W.J, Greene C.R, Malme C.I & Thomson D.H. 1995. Sea Mammals of the World. A&C Black, London.

Roberts P. J. W. and G. Toms 1987. Inclined Dense Jets in Flowing Current, J. Hydraulics Div, ASCE, Vol 113, March, 323-341.

Roberts P. J. W., Ferrier, A. and G. Daviero 1997. Mixing in Inclined Dense Jets, J. Hydraulics Div, ASCE, Vol 123, August, 693-699.

Santa Barbara City College Biological Sciences Department 2006. [online] viewed 06 November 2006, <http://www.biobcc.net/ocean/marinesci/02ocean/swcomposition.htm>

Shaughnessy, P.D. 1999. The Action Plan for Australian Seals. April 1999. Prepared for Environment Australia, Canberra.

Shire of Harvey (undated) Shire of Harvey Municipal Heritage Inventory.

Shire of Harvey 2006. Website: Shire of Harvey Population Statistics. http://www.harvey.wa.gov.au/About%20Harvey/General%20Information/Population. Accessed on 21 January 2007.

Standards Australia 2002. Australian Standard 1742.3-2002: Manual of Uniform Traffic Control Devices – Part 3: Traffic control devices for works on roads.

The Ecology Lab 2005, Planning for Desalination: Marine Ecological Assessment, Preliminary Site Inspection for an Inlet and Outlet and Possible Pipeline Route for Water Distribution.

Travers, M. 2006. Review of the Nursery Role of the Deep Central Basin of Cockburn Sound and the Potential for Low Dissolved Oxygen Values to Effect Seasonally Abundant Fish and Crustaceans. Prepared for Oceanica Consulting on behalf of Water Corporation.

United States Environmental Protection Agency (US EPA) 2000. Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras, EPA-822-R-00-012.

Section 10 8BReferences and Bibliography

United States Environmental Protection Authority (USEPA) 2001. National Pollutant Discharge Elimination System: Regulations addressing cooling water intake structures for new facilities. Federal Register / Vol. 66, No. 243 / Tu.

URS 2008a. *Review of Sound in the Ocean and Effects of Noise and Blast on Marine Fauna*. Prepared for the Water Corporation. 42906896-1892: R1340.

URS 2008b. *Review of Literature on the Effects of Desalination Plant Brine upon Cetaceans*. Prepared for the Water Corporation. 42906896-1892: R1339.

UWA 2005. Sediment Oxygen Demand in the Deeper Basin of Cockburn Sound. Centre for Water Research.

UWA 2008a. Characterising the marine benthic habitats of the proposed Southern Seawater Desalination Plant (SSDP) Site: Interpretation From Underwater Towed Video and Map Interpolation. University of Western Australia, Nedlands. Report MRG 2008-1 to Kellogg Brown and Root.

UWA 2008b. Southern Seawater Desalination Plant: Oceanographic Forcing. University of Western Australia, Nedlands.

UWA 2008c. Proposed Southern Seawater desalination Plant – Sediment Oxygen Demand. University of Western Australia, Nedlands.

UWA 2008d. Southern Seawater Desalination Plant: CTD Measurements. University of Western Australia, Nedlands.

UWA 2008e. Southern Seawater Desalination Plant: Current Measurements. University of Western Australia, Nedlands.

UWA 2008f. Beach Profile Monitoring at Binningup Beach. Stage II Report. University of Western Australia, Nedlands.

Walker, D.I. 1989. Regional Studies – Seagrass in Shark Bay, the Foundations of an Ecosystem. Biology of Seagrasses – *A Treatise on the Biology of Seagrasses with Special Reference to the Australian Region.* S.A. Shepherd. Amsterdam, Elsevier: 182-210.

Water and Rivers Commission 2001. *Position Statement* on *Wetlands*. Available from the Department of Water website at www.water.wa.gov.au.

Water Consultants International 2006. An environmental literature review and position paper for reserve osmosis desalination plant discharges. Report prepared for the Water Corporation and Sydney Water.

Water Corporation (undated) *Guidelines for the Disposal of Disinfection Water.* Document No. BWW 024-2.

Water Corporation 2004. Metropolitan Desalination Proposal, Section 46 Review, Prepared for Water Corporation by Strategen, February 2004.

Water Corporation 2007a. Site alternatives and considerations.

Water Corporation 2007b. Southern Seawater Desalination Project Environmental Scoping Document.

Water Corporation 2007c. Southern Seawater Desalination Project. Response to public submissions on the Environmental Scoping Document.

Section 10 8BReferences and Bibliography

Water Corporation 2007d. Water Corporation Acid Sulphate Soil and Dewatering Management Strategy. AQUA Document No. 441876.

Water Corporation 2008. Overview of Water Quality – Physical Parameters, February 2004.

Water Corporation 2008a. Southern Seawater Desalination Project, Environmental Impact Assessment, Public Environmental Review, Prepared for the Environmental Protection Authority, April 2008.

Wayne, A.F., Rooney, J.F., Ward, C.G., Vellios, C.V. and Lindenmayer, D.B. 2005. The life history of Pseudocheirus occidentalis (Pseudocheiridae) in the jarrah forest of south-western Australia, *Australian Journal of Zoology* 55, 325-337.

Western Australian Planning Commission (WAPC) 1999. Coastal and Lakelands Planning Strategy. Dawesville – Binningup. Western Australian Planning Commission, Perth, Western Australia.

Western Australian Planning Commission (WAPC) 2007. Greater Bunbury Region Scheme. Perth, Western Australia.

Western Whale Research 2008. Preliminary Advice and Recommendations for the Minimisation of Potential Impacts of the SSDP Upon Marine Mammals Near Binningup, WA. February 2008.

Westphalen, G., Collings, G., Wear, R., Fernandes, M., Bryars, S. and Cheshire, A. 2004. *A review of seagrass loss on the Adelaide metropolitan coastline*. ACWS Technical Report No. 2 prepared for the Adelaide Coastal Waters Study Steering Committee. South Australian Research and Development Institute (Aquatic Sciences) Publication No. RD04/0073, Adelaide.

Section 11 9BAbbreviations and Glossary

Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulphate Soil
BPPH	Benthic Primary Producer Habitat
BOM	Bureau of Meteorology
CALM	Department of Conservation and Land Management (now DEC)
CCW	Conservation Category Wetland
cPER	Commonwealth Public Environment Report
CTD	Conductivity Temperature Depth
d	day
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation (formerly CALM and DoE)
DEH	(formerly) Department of Environment and Heritage (Commonwealth - now DEWHA)
DEWHA	Department of the Environment, Water, Heritage and the Arts (Commonwealth – formerly DEH)
DIA	Department of Indigenous Affairs
DMA	Decision Making Authority
DoE	(formerly) Department of Environment (now DEC)
DoW	Department of Water (formerly Water and Rivers Commission)
DO	Dissolved oxygen
DPI	Department for Planning and Infrastructure (previously MfP)
DRF	Declared Rare Flora
EIA	Environmental Impact Assessment
EPAct	*Environmental Protection* Act 1986
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999 (Commonwealth)
ERMP	Environmental Review and Management Program
ESA	Environmentally Sensitive Area
FHPA	Fish Habitat Protection Area
GL	Gigalitre (1 billion litres)
ha	Hectares
IWSS	Integrated Water Supply Scheme (Water Corporation)
km	kilometres
km^2	square kilometres
kV	kilovolt
m	metres
ML	Megalitres (one million litres)
ML/d	Megalitres per day

Section 11 9BAbbreviations and Glossary

MfP	Ministry for Planning (now Department for Planning and Infrastructure)
mm	millimetres
MW	Megawatts (of energy)
NES	National Environmental Significance
NNTT	National Native Title Tribunal
PAR	Photosynthetically Active Radiation
ppt	Parts per thousand
RO	Reverse Osmosis
SSDP	Southern Seawater Desalination Plant
sPER	State Public Environmental Review
TEC	Threatened Ecological Community
WA	Western Australia
WAPC	Western Australian Planning Commission
WET	Whole Effluent Toxicity
WWTP	Wastewater Treatment Plant (Water Corporation)

Glossary

Native Vegetation	naturally vegetated land not recently disturbed by exploitative land use
Agricultural Land	previously grazed land that may contain natural vegetation of varying condition
Rehabilitation	botanical enhancement of degraded natural vegetation for National Environmental Significance species, habitat and corridor linkage
Revegetation	establishment of new plantings to create natural vegetation for National Environmental Significance species, habitat and corridor linkage
Offset	an initiative that addresses for the impact of development activities on environmental values based on "like-for-like" or "like-for-better" outcomes
Trenchless technique (Micro tunnelling)	Below-ground boring/cutting technique used to install pipework with minimial surface disturbance

Section 12 10BLimitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of the Western Australian Water Corporation and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 30 June 2008.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between July 2008 and April 2009 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Western Power Letter of 15 July 2008

Appendix A

External Approvals Manual (Water Corporation 2008)

Appendix B

Other Approvals

Appendix C

Interim Report/Advice Declared Rare Flora Survey

Appendix D

Review of Literature on EPBC Avifauna Issues

Appendix E

Southern Seawater Desalination Project Mitigation and Offset Strategy

Appendix F

Review of Literature on Sound in the Ocean and Effects of Noise and Blast on Marine Fauna

Appendix H

Review of Literature on the Effects of Desalination Plant Brine Discharge Upon Cetaceans

Appendix I

Project Implementation

Rehabilitation Plan

westernpower

363 Wellington Street Perth WA 6000
GPO Box L921 Perth WA 6842
T: (08) 9326 4911 F: (08) 9326 4595
www.westernpower.com.au
Electricity Networks Corporation ABN 18 540 492 861

Our ref: EM/77/M38(37A)V1
Contact: Clare Game – 9425 5074

15th July 2008

Mr Nick Churchill
Project Director
Water Corporation
PO Box 100
LEEDVERVILLE WA 6902

Dear Mr Churchill

Response to Draft Public Environment Report Guidelines, Southern seawater desalination plant, supply pipelines and storage facility, Binningup, WA

The purpose of this letter is to present Western Power's position on a request from the Water Corporation for the provision of information relating to the potential impacts associated with the construction of a powerline to connect the proposed Binningup Desalination Plant to the South West Interconnect System (SWIS). The information has been requested for inclusion in the draft Public Environmental Review documentation for the Binningup Desalination Project that the Water Corporation is currently preparing for submission to the Department for Environment, Water, Heritage and the Arts.

The Electricity Networks trading corporation, trading as Western Power, is a wholly Western Australian government owned with the primary function to manage, plan, develop, expand, enhance, improve and reinforce electricity transmission and distribution systems.

The powerline for the Binningup desalination plant will be owned, operated and maintained by Western Power and will form part of the South West Interconnected System owned by the State of Western Australia. As such, Western Power is of the opinion it should be the proponent for the electricity infrastructure to service the Binningup Desalination Plant and will obtain all necessary environmental approvals.

Western Power follows a standard environmental process to assess the impact of all new capital works, as outlined below:

1. Investigate proposed area for potential environmental constraints including:
   - Rare Flora and Threatened Ecological Communities
   - Threatened Fauna and habitat
   - Wetlands and groundwater
   - DEC reserves
   - Cultural heritage
   - Visual Impact
2. Establish preliminary routes based on project requirements, stakeholder consultation and avoiding major environmental constraints, where possible.
3. Determine what potential environmental issues require detailed investigation.
4. Address stakeholder concerns regarding environmental issues.

5. Modify preliminary corridor or design corridor route to minimise impacts, if required.
6. Schedule and approve relevant surveys to address environmental and heritage issues. The surveys are usually undertaken in spring, as this is the time when most flora species are in flower making them easier to identify and annual species are flowering after winter rains.
7. Discuss any environmental issues with all relevant stakeholders and refine or design line route within the corridor to minimise impacts, if required.
8. Develop environmental referral document for the Environmental Protection Authority (EPA), if significant environmental issues have been identified. Projects are referred to the Department of Environment, Water, Heritage and the Arts if the project has the potential to impact on matters of national environmental significance.
9. If the project is determined as 'Not Assessed' or "Not a Controlled Action" by the assessing agencies, Western Power assesses vegetation clearing impacts under Western Power's permit to clear native vegetation granted under s.51E of the Environmental Protection Act 1986. This authorisation gives Western Power approval to clear, subject to certain terms, conditions or restrictions.
10. Develop Environmental Management Plan and Offsets proposal (if required) for approval of the CEO of the Department of Environment and Conservation prior to any works commencing.
11. Supervise construction to ensure compliance with environmental issues.
12. Undertake post-construction audit of any environmental conditions on project approval and remediate, if required.

Current Status of Desalination Line Route Project

Western Power has undertaken site visits and desktop analysis, as well as some stakeholder consultation to determine a preliminary line route for assessment. Regional information has been utilised to determine likely occurrence of significant environmental features. For example, Western Power is already aware of *Drakaea micrantha* (R) at the Kemerton Terminal site, and the potential occurrence of the Western Ringtail Possum and the Carnaby's and Baudin's Black Cockatoos within the proposed powerline corridor. Desktop assessment informed on locations of one Conservation Category Wetland and Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 wetlands in the study area.

A Scope of Works is in preparation to engage specialists to undertake flora, fauna and dieback surveys of proposed route/s. The surveys will specifically target *Drakaea micrantha*, Western Ringtail Possum and Carnaby's and Baudin's Black Cockatoo habitat and will provide advice on how to minimise impacts waterbirds.

Based on the standard approvals process outlined above, the next steps in the environmental assessment process are proposed:

1. Assess significance and undertake assessment of environmental impact based on results of survey reports
2. Allow opportunity for key environmental stakeholder input i.e. survey reports will be sent to Department of Environment and Conservation and the Department of Water for comment.
3. Modify line route to minimise impact, where possible.
4. Refer project to EPA and Department of Environment, Water, Heritage and the Arts, if project is likely to have a significant impact.
5. If project determined as 'Not Assessed' or "Not a Controlled Action" by the assessing agencies, assess vegetation clearing impacts under Western

Power's permit to clear native vegetation granted under s.51E of the Environmental Protection Act 1986.

6. Follow Standard Environmental Process steps 10, 11 and 12, as outlined above.

Risk Assessment

The Binningup Desalination Plant (BDP) is to be connected via a 7-10 km single circuit 132 kV transmission line to the Kemerton Terminal Substation. The first 2.2 kilometres of line from the BDP along Taranto Road will be placed underground. The line will then become overhead conductor and will be constructed using steel poles approximately 28-30 metres tall with an average span between the poles of 300 metres within a 30 metre corridor.

There will be the requirement to clear approximately 7.5 hectares of native vegetation for the proposed line, with the majority of the clearing associated with the section of the line entering the Kemerton Terminal Site (4 hectares). Preliminary discussions with a fauna expert familiar with the area have indicated that there is a very low risk of impact to Western Ringtail Possum habitat and to Carnaby's and Baudin's Black Cockatoo nesting habitat from the proposed vegetation clearing, however detailed fauna studies will be undertaken in spring 2008 to verify this advice.

Approximately 2.15 hectares of native vegetation within the Kemerton Terminal site may be impacted to facilitate the expansion of the existing 330kV switchyard and the installation of a new 132kV switchyard. The preliminary areas proposed for the new works were selected avoiding the known occurrences of the *Drakaea micrantha* recorded during the 2005 and 2006 surveys. Detailed surveys will be undertaken in spring 2008 to verify the locations of the *Drakaea micrantha* within the larger terminal site and to confirm that impacts to *Drakaea micrantha* are avoided for the proposed works.

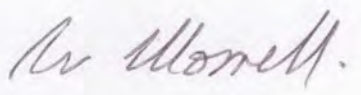
Commitment

Western Power commits to referring project to the Environmental Protection Authority and Department of Environment, Water, Heritage and the Arts, should significant impacts be identified.

If the project is determined as 'Not Assessed' or "Not a Controlled Action" by the assessing agencies, vegetation clearing impacts will be assessed under Western Power's permit to clear native vegetation granted under s.51E of the *Environmental Protection Act 1986.*

I trust that the information provided above is sufficient for the response Water Corporation is currently preparing for submission to the Department for Environment, Water, Heritage and the Arts. Please feel free to contact Clare Game on 9425 5074, should you have any queries or require further information.

Yours sincerely



John Morrell
Environmental Operations Manager
Environment and Land Management Branch

Planning and Infrastructure Division

Capital Investment Branch

External Approvals Manual

External Approvals for Engineering Infrastructure Projects

Revision Date: 23 January 2008

FOREWORD

This document is the Water Corporation's Manual for external approvals for engineering infrastructure capital projects and developer funded works. This manual includes the Preliminaries to Works process and replaces the Preliminaries to Works Manual.

The manual assists Corporation staff, consulting engineers and authorised contractors to comply with relevant legislation eg the *Water Agencies (Powers) Act 1984*, the *Environmental Protection Act*, and other statutory requirements. The manual details Corporation policy for notification of works proposals and subsequent approvals from other authorities and decision making organisations.

The manual links to a set of Guidelines for the various approvals. Because of the varied nature of the Corporation's capital projects, there may be types of works and approvals not covered by this manual. This manual, which is comprehensive for most projects, does not remove the responsibility from project managers to identify and obtain all approvals necessary for a specific project.

External users of the Manual and Guidelines without access to the Water Corporation internal Waternet should contact the Water Corporation for hyperlinked references that are not accessible.

Capital Investment Branch will update the Manual and Guidelines on the Corporation's Business Management System with input from other Branches. All suggestions for improving the content of the Manual should be sent to the Capital Investment Branch Process Improvement consultant, at John Tonkin Water Centre, Leederville using the email address CIBPA@watercorporation.com.au or telephone 9420 3059

Printed or CD ROM copies of the External Approvals Manual will not be distributed as it is available on the Water Corporation Internet site to consulting engineers and authorised contractors. Significant updates will be advised by the Infrastructure Design Branch Engineering Design Process Coordinator.

M R Taylor
Manager, Capital Investment Branch

Revision Record

Revision Number	Date	Description
1	20 Feb.2006	Revisions to Manual (20 Feb.2006) Guidelines1.2 (20 Feb.2006) and 7 (25 Jan.2006)
2	12 May 2006	Revisions to Manual, Guideline 3 re construction water licence, Guideline 9 re *Planning and Development Act 2005*, Guideline 15 re Western Power reorganisation; all 12 May 2006
3	19 July 2006	Revisions to Manual 20 Feb 2006, hyperlinks in Manual and in most Guidelines, merger of CALM and DEP, revision of Guideline 9 (24 July 2006), Guideline 19 (19 July 2006)
4	22 January 2007	Revisions to Manual, adding Department of Water and spreadsheet for tracking approvals and Preliminaries to Works. Revisions to Guidelines 1, 1.1, 2, 3, 5, 9, all dated 29 December 2006
5	5 April 2007	Revisions to Guideline 1.2 Preliminaries to Works, including updated agency contacts in separate spreadsheet.
6	27 August 2007	Revisions to Guideline 19 23 August 2007. Revisions to Guideline 1.2 23 August 2007. Revisions to Manual 27 August 2007. Example Spreadsheets 27 August 2007
7	23 January 2008	Revisions to Guideline 1.1 4 December 2007 (Swan River Trust); Guideline 1.2 3 December 2007 Letter B amended; Guideline 10 23 January 2008 Freehills advice updated; Guideline 20 3 December 2007 (Swan River Trust); Preliminaries to Works Spreadsheet 3 December 2007

CONTENTS

1. Introduction and General Matters

1.1 Purpose

There are many mandatory external approvals for engineering infrastructure projects, at various stages of the project, depending on the project scope and location.

The purpose of this Manual is to explain the various external approvals that may be needed, and to provide some advice about timing of notification of works proposals in asset creation stages.

The external approvals shall include Preliminaries to Works in accordance with the *Water Agencies (Powers) Act 1984* and may also include land, native title, aboriginal heritage, health, environmental, CALM, planning, industrial, local government, service authority and other approvals.

The preferred timing ranges from during planning through to commissioning at the end of asset creation.

1.2 Intended Audience

This Manual is intended for use by authorised persons involved in the planning, design, project management and construction of works that are to be incorporated into the Corporation's infrastructure. These include:

- Water Corporation planners, program managers, project managers, designers and contract superintendents.
- Consulting Engineers who are nominated from the Corporation's list of Panel Consultants for Design Services or otherwise specifically appointed by the Corporation.
- Design/Construction Engineers and Contractors, who have been appointed by a Developer (as defined in the Corporation's Developer Manual), for carrying out works that are to be incorporated into the Corporation's infrastructure system.

1.3 Interpretation

In this Manual, unless the contrary appears:

- "Shall", indicates a mandatory requirement, whilst the uses of adverbs such as "Will", "Should", "May" etc, indicate recommended practice.
- "Minister" means the Minister having responsibility for the *Water Agencies (Power) Act 1984.*

1.4 Community Consultation

Community consultation is not a specific external approval category, but it is an essential element of some approvals such as environmental and development applications. See IPB Work Instruction Social Issues

2. External Approvals Checklist

Commence this checklist in Planning, and use throughout the project life. To assist in interpretation of the checklist, refer to the more detailed list at Section 3 and to the accompanying Guidelines for more information.

Use of the checklist in spreadsheet format External Approvals Manual Spreadsheet is recommended. It will permit tracking of required approvals through the life of the project, including during the Preliminaries to Works process

AGENCY	APPROVAL REQUIRED	YES/NO/ UNSURE
1. Department of Water and Minister for Water Resources	• **Contract approval >$15 million.** • **Construction on land in which an interest has not been acquired.** • **Declared Areas** (to permit the Water Corporation to provide services) • **Preliminaries to Works** • **Water Allocation Licence**. Taking water from a watercourse, wetland or underground source for town water supply (Water Allocation). • **Bed and Bank Permit**. Modifications to a creek/river within proclaimed area. • **Swan River Trust** - development occurring within the Swan River Trust management area	
2. Commonwealth Dept of Environment	• Action or activities that are likely to have a significant impact on: – **World Heritage** properties. – **Matters of international importance** (e.g. RAMSAR wetlands). – **Listed threatened ecological species** and communities. – **Listed migratory species.** – **Commonwealth land**	
3. WA Department of Environment and Conservation, incorporating CALM and DEP,	• **Works Approval required for prescribed premises** e.g. sewage facility, sewage pumping station (where a discharge may enter the Swan or Canning Rivers), bulk storage of chemicals (>1000m^3), desalination plants • **A licence or registration is required following compliance with conditions in the Works Approval** and prior to commissioning of the prescribed premises. • **Land clearing. Clearing *any* area of native**	

	vegetation (no minimum area applies). • **Bush Forever sites** (approval via DPI) • **Storage of sewage sludge in an underground water pollution control area (UWPCA)** within 100m of a production well. • **Discharge into any well** or observation well of the following: chemicals, treated or untreated sewage, effluent or other matter which may pollute the underground water. • **Contaminated sites**	
4. Environment Protection Authority (EPA)	• **Environmental Assessment of Proposals**. Applicable to 'any proposal that is likely to have a significant effect on the environment'. • Proposed activities that will interfere with any of the following areas: **Gnangara Mound Crown Land.** **Swan and Canning Rivers.** **Swan Coastal Plain Lakes.** **Swan Coastal Plain Wetlands.** **Peel Inlet Harvey Estuary.** **South West Agricultural Zone Wetlands**	
5. Department of Health	• **Wastewater treatment plants** (including **biosolids**) • **Wastewater reuse.** • **Wastewater pumping stations >350l/s.** • **Public water supplies,** including **desalination.** • **Poisons Permits.**	
6. Department of Fisheries	• **Construct, alter or modify a dam, weir or reservoir** on a waterway. • **Marine environment** (wastewater outfalls, etc.).	
7. Indigenous Affairs	• **Aboriginal heritage.** • **Native Title issues.**	
8. Minister (DPI) Gas Pipelines	• **Dampier-Bunbury natural gas pipeline** reserves access. • **Dongara-Rivervale-Pinjarra** (the 'Parmelia Pipeline').	

AGENCY	APPROVAL REQUIRED	YES/NO/ UNSURE
9. WA Planning Commission (WAPC) / Local Government	• **Development Approval.** • **Building Licence.** • **Land rezoning and buffers.** • **Demolition Licence**	
10. Department of Planning and Infrastructure (DPI)	• **Works on crown land** within the Metropolitan Region Scheme.	
11. Conservation and Land Management (CALM) (Department of Environment and Conservation)	• **Removal or destruction of any produce** (e.g. trees, rocks, stone, soil, etc) from: – state forest; timber reserve, nature reserve, marine nature reserve; – national park, conservation park, marine park; and – land under the management of CALM; and crown land. • **Taking of protected flora on crown land, protected fauna or declared rare flora**. • **Taking of water from CALM managed land**.	
12. Department of Industry and Resources (DOIR)	• **Access to a Mining Tenement.** • **Extractive Industries Licence** for sand, gravel, stone, etc.	
13. Public Transport Authority (PTA)	• **Railway reserves** and corridors- access or construction	
14. Main Roads WA (MRWA)	• **Work affecting MRWA assets** • **Traffic Management Plans.**	
15. Coordinator of Energy	• **Generating station** construction. • Install any **additional main generating unit.** • Extend any **transmission works**. • **Connect generating works** to any distribution works of Western Power or Horizon Power.	
16. Service Authorities	• **Telstra, Alinta, Optus, Western Power or Horizon Power**. Works affecting Authority's assets or service corridor	
17. Heritage Councils	• **Heritage Places** (non aboriginal Register).	
18 Fire and Emergency Services Authority (FESA)	• **Unexploded ordnance**	

AGENCY	APPROVAL REQUIRED	YES/NO/ UNSURE
19. Department of Consumer and Employment Protection (DOCEP) (WorkSafe WA)	• **Demolition**. • **Storage of dangerous goods**. • **Tilt-up concrete construction** • **Plant Registration (design and/or item registration)**	
20 Economic Regulation Authority (ERA)	• **Operating Area**. Operating licence area and level of service (wastewater, water supply, irrigation) • **Controlled Area** (non-potable water, drainage)	

3. External Approval Detail List

The list describes the main approvals that may be required for projects, and directs people to the relevant legislation and to other references that contain more detailed information. For some projects, there may be other approvals required.

Note also the List of Authorities and Organisations in the Preliminaries to Works Guideline 1.2. Many authorities need to be notified, even if formal approval is not required from them.

If anyone using this list is aware of an external approval or licence requirement that is not included in the list, or any out of date links or requirements, please contact the Capital Investment Branch Process Improvement consultant.

The Relationship Managers listed below are responsible for the legislative and regulatory obligations in alignment with the Accountability Framework Other Stakeholder Managers on the Communications Division list or other contact staff below may also assist.

The Acts and Regulations in the table below may be found on the Waternet at: Legislation

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
1. Department of Water and Minister for Water Resources	**Contract approval >$15M**	Manager Procurement, Colin Orr	*Water Corporation Act 1995 (Sec. 32)*	Guideline 1.1 PCY112
	Construction on land in which an interest has not been acquired. Approval is required where Major Works are to be constructed on such land.	Manager Corporate Real Estate, Jos Mensink	*Water Agencies (Powers) Act 1984 (Sec 81.4a)* *Land Administration Act*	Guideline 1.1
	Declared Areas for country water supply and wastewater rating, and for metropolitan drainage. (See Agency group 20 for Operating and Controlled Areas)	Manager Development Services, Stephen Hiller, (Peter McGuire – LDB)	*Metropolitan Water Supply, Sewerage and Drainage Act 1909* *Country Towns Sewerage Act 1948* *Country Areas Water Supply Act 1947*	Guideline 1.1

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
	Preliminaries to Works - Authorisation of Works by Minister.	Manager Project Management, Neil La Roche Manager Development Services Branch, Stephen Hiller (John Bond – IDB)	*Water Agencies (Powers) Act 1984*	Guideline 1.2
	Water Allocation Licence Taking of water from a watercourse, wetland or underground water source for the purpose of town water supply, wastewater reuse, or for earthworks construction..	Manager Infrastructure Planning, Kevin Bradley(Kelvin Barber)	*Water and Rivers Commission Act 1995* *Rights in Water and Irrigation Act 1914*	Guideline 3
	Bed and Bank Permits - Modifications to a creek/river within proclaimed area	Manager Infrastructure Planning, Kevin Bradley(Kelvin Barber)	*Rights in Water and Irrigation Act 1914 (Section 11,17,21A of Part III)*	Guideline 3
	Swan River Trust – development occurring within the Swan River Trust management area.	Manager Environment, David Luketina (Steve Wilke)	*Swan River Trust Act 1988 (Section 49)*	Guideline 3
2. Commonwealth Department of Environment	Action or activities that are likely to have a significant impact on: • **World Heritage** properties; • **matters of international importance** (e.g. RAMSAR wetlands); • **listed threatened ecological species** and communities; and • **listed migratory species**. • **Commonwealth land**	Manager Environment, David Luketina (Steve Wilke)	*Minister for Environment and Heritage (Commonwealth)* *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).* *Environment Protection and Biodiversity Conservation Regulations 2000 (Commonwealth).*	Guideline 2

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
3. WA Dept of Environment and Conservation (incorporating CALM and DEP)	**Works Approval**. Required for **prescribed premises** as defined under the Environmental Protection Regulations 1987 e.g. • Sewage facility(including biosolids); • Sewage Pumping Station (where a discharge may enter the Swan or Canning Rivers); and • Bulk storage of chemicals (>1000m^3); • Desalination plants)	Manager Environment, David Luketina (Steve Wilke)	*Environmental Protection Act 1986 (Part V, Section 52&53).* *Environmental Protection Regulations 1987*	Guideline 3
	A licence or registration is required following compliance with conditions in the Works Approval and prior to commissioning of the prescribed premises.	Manager Environment, David Luketina (Steve Wilke)	*Environmental Protection (Controlled Waste eg sewage, chemicals) Regulations 2004* *Environmental Protection (Unauthorised Discharge eg sewage, chemicals, visible smoke) Regulations 2004*	Guideline 3
	Land clearing Clearing **any** area of native vegetation (no minimum area applies)	Manager Environment, David Luketina (Steve Wilke)	*Environmental Protection (Clearing of native Vegetation) Regulations 2004*	Guideline 3
	Bush Forever (sites approved via DPI)	Manager Environment David Luketina (Steve Wilke – Environment, David Morgan – CRE.)	*Bush Forever Policy*	Guideline 3
	Storage of sewage sludge in an underground water pollution control area (UWPCA) within 100m of a production well.	Manager Infrastructure Planning, Kevin Bradley (Peter Coghlan)	*Metropolitan Water Supply, Sewerage and Drainage By Laws 1981, Sec 5.4.2*	Guideline 3
	Discharge into any well or observation well of the following: chemicals, treated or untreated sewage, effluent or other matter which may pollute the underground water.	Manager Infrastructure Planning, Kevin Bradley (Graeme Hughes – IPB, Nick Turner, Palenque Blair – recycle project)	*Metropolitan Water Supply, Sewerage and Drainage By Laws 1981, Sec 5.4.7*	Guideline 3

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
	Contaminated Sites	Manager Environment, David Luketina (Steve Wilke)	*Contaminated Sites Bill 2003 (*not yet gazetted)	Guideline 3
4. Environment Protection Authority (EPA)	**Environmental Assessment of Proposals**: applicable to 'any proposal that is likely to have a significant effect on the environment'	Manager Environment, David Luketina (Steve Wilke)	*Environmental Protection Act 1986 (Part IV Sect 38).* *Environmental Protection (Emissions NEPM –NPI) Regulations 1998* *Environmental Protection (Noise) Regulations 1997*	Guideline 4
	Proposed activities that will interfere with any of the following areas: • **Gnangara Mound Crown Land** • **Swan and Canning Rivers** • **Swan Coastal Plain Lakes** • **Swan Coastal Plain Wetlands** • **Peel Inlet Harvey Estuary** • **South West Agricultural Zone Wetlands**	Manager Environment, David Luketina (Steve Wilke) Graeme Hughes, Peter Coghlan IPB	*Environmental Protection (Swan and Canning Rivers) Policy* *Environmental Protection (Swan Coastal Plains) Policy* *Environmental Protection (South West Agricultural Zone Wetlands) Policy*	Guideline 4
5. Dept of Health	**Wastewater treatment plants** (including biosolids disposal) **Wastewater reuse** **Wastewater pumping stations >350l/s**	Manager Wastewater Treatment, Mark Herbert (Peter Spencer)	*Health Act 1911*	Guideline 5
	Public water supplies, including desalination plants	Manager Drinking Water Quality, Richard Walker	*Health Act 1911* *Fluoridation of Public Water Supplies Act 1966* *Memorandum of Understanding DoH/WC*	Guideline 5

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
	Poisons Permits	Manager Wastewater Treatment, Mark Herbert (Peter Spencer)	*Health Act 1911*	Guideline 5
6. Department of Fisheries	Notification required for work that proposes to **construct, alter or modify a dam**, **weir or reservoir** on a waterway.	Manager Project Management, Neil La Roche	*Minister for Fisheries*	Guideline 6
	Proposed works that may affect the **marine environment** (wastewater outfalls, etc.) Also relates to Marine Branch of Dept of Environment.	Manager Environment, David Luketina (Steve Wilke)	*Fish Resource Management Act 1994 (Section 254).*	Guideline 6
7. Indigenous Affairs Aboriginal Cultural Material Committee Representative Aboriginal Body	Work that will excavate, destroy, damage, conceal, remove or in any way alter any **Aboriginal site**. Submission required to the Aboriginal Cultural Material Committee (ACMC – meets every 2 months).	Manager Corporate Real Estate, Jos Mensink (Kathy Burns)	*Minister for Indigenous Affairs* *Aboriginal Heritage Act 1972 (Section 17 & 18).* *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)*	Guideline 7
	Native Title issues Consultation process that must be undertaken to meet the requirements of the Preliminaries to Works approval.	Manager Corporate Real Estate, Jos Mensink (Lynette Lund)	*Native Title Act 1993*	Guideline 7
8. Minister (DPI) Gas Pipelines	Access into the **Dampier-Bunbury natural gas pipeline** reserves for locating infrastructure or for carrying out works. **Dongara-Rivervale-Pinjarra** (the 'Parmelia Pipeline')	Manager, Infrastructure Planning, Paul Ferguson	*Dampier-Bunbury Land Access Minister (via DPI)* *Dampier to Bunbury Pipeline Act 1997 (Section 41).*	Guideline 8

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
9. WA Planning Commission (WAPC) / Local Government	**Development Approval** • Works in the metropolitan region **may** require a Development Application for approval (via the local authority). Required prior to PTW process. • Works outside the metropolitan region may require a Development Application for approval (via the local authority). • All works – notification required.	(Brian Robertson CIB)	*Local Government Act 1995* *Planning and Development Act 2005* *Water Agencies(Powers) Act 1984*	Guideline 9
	Building Licence – current legal issue as to whether or not the Corporation is required to obtain a building licence. Proceed by consultation with the Manager, Legal Services.	Manager Legal and Risk Management, Craig Masarai (Brian Robertson CIB)		Guideline 9
	Land rezoning and buffers.	Manager Corporate Real Estate, Jos Mensink, Manager, Development Services, Stephen Hiller (Kris Kennedy Water Technologies).	*Local Government Act 1995*	Guideline 9
	Demolition Licence See also Reference 19 below	Manager OSH, Cieran MacCarron (Don Taylor)	*Local Government Act 1995*	Guideline 9
10 .Department of Planning and Infrastructure (DPI)	**Works on crown land** within the Metropolitan Region Scheme.	Manager Development Services, Stephen Hiller (John Todd)	*Planning and Development Act 2005* *DPI Bulletin 4 hyperlink*	Guideline 10

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
11. Conservation and Land Management (CALM) (Department of Environment and Conservation)	**Removal or destruction of any produce** (eg trees, rocks, stone, soil, etc) from: • state forest; • timber reserve, nature reserve, marine nature reserve; • national park, conservation park, marine park; • land reserved under the Land Act 1933 and vested in the Conservation Commission of WA or placed under the management of CALM; and • Crown land.	Manager Infrastructure Planning, Paul Ferguson.	*Conservation and Land Management Act (1984)*	Guideline 11
	Licence required for taking of: • **protected flora** on crown land • **protected fauna** Permission required for taking of any declared rare flora	Manager Environment Branch, David Luketina (Steve Wilke)	*Wildlife Conservation Act 1950 (Section 16 & 23).*	Guideline 11
	Taking of water from CALM managed land	Manager Infrastructure Planning, Kevin Bradley(Graeme Hughes)		Guideline 11
12. Department of Industry and Resources (DOIR)	**Access to a Mining Tenement.**	Manager Project Management, Neil La Roche	*Mining Act 1978 (Sec. 24)*	Guideline 12
	Extractive Industries Licence may be required for extraction of various materials (e.g. sand, gravel, stone, etc.) from a site.	Manager Project Management, Neil La Roche	*DOIR or DPI and Section 185 of Land Administration Act 1997*	Guideline 12
13. Public Transport Authority (PTA)	Access or construction in **railway reserves** and corridors.	Manager Infrastructure Planning, Paul Ferguson	Railways (Access) Act 1998 Rail Freight System Act 2000 (Section 47)	Guideline 13

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
14. Main Roads WA (MRWA)	**Works affecting MRWA assets** and within MRWA land. **Traffic Management Plans**	Manager Infrastructure Planning, Paul Ferguson Manager Project Management, Neil La Roche	Main Roads Act 1930 (Section 28B) Traffic Code 2000 Main Roads Code of Practice 2004	Guideline 14
15. Coordinator of Energy	Approval required for the following: • construct or establish any **generating station;** • install or provide any **additional main generating unit;** • extend any **transmission works;** • connect or provide any facilities to **connect any generating works** not controlled by Verve or Horizon Power, to any distribution works of Western Power or Horizon Power.	Manager Energy Management, Peter Huxtable	Electricity Act 1945 (Section 7)	Guideline 15
16. Service Authorities	Works affecting Service Authorities assets or their service corridors. (**Telstra, Alinta, Optus, Western Power or Horizon Power,** etc.)	Manager Project Management, Neil La Roche	Dial Before You Dig Utility Providers Code of Practice	Guideline 16
17. Heritage Councils	Proposed work that may affect a place that is entered in the **Register of Heritage Places**.	Manager Corporate Real Estate, Jos Mensink	Heritage of Western Australia Act 1990 Australian Heritage Council Act (Commonwealth) 2003 National Heritage Trust of Australia Act 1997	Guideline 17
18 Fire and Emergency Services Authority (FESA)	Works requiring searching of land for **unexploded ordnances**.	Manager Project Management, Neil La Roche		Guideline 18

AGENCY	APPROVAL REQUIRED	RELATIONSHIP MANAGER & CONTACT STAFF	MINISTER /ACT/REGULATION	REFERENCE
19. Department of Consumer and Employment Protection (WorkSafe WA) (DOCEP)	**WorkSafe** WA Commissioner to be notified of **demolition** work. See also Reference 9 above	Manager OSH, Ciaran MacCarron (Don Taylor)	Occupational Safety and Health Act 1984 (Part 3, Subdivision 7).	Guideline 19
	Storage of dangerous goods	Manager Infrastructure Development, Lindsay Lowes (Neil Herbert)	Explosive & Dangerous Goods Act 1961, Dangerous Goods Regulations 1992.	Guideline 19
	Tilt-up concrete construction	Manager OSH, Ciaran MacCarron (Don Taylor)	Occupational safety and Health Act 1984	Guideline 19
	Plant Registration (design and/or item registration)	Manager OSH, Ciaran MacCarron (Don Taylor	OSH Regulations 4.1 to 4.21	Guideline 19
20. Economic Regulation Authority (ERA)	• **Services outside Operating Area?** Operating licence area and level of service (wastewater, water supply, irrigation) • **Controlled Area** (non-potable water, drainage) (See Agency Group 1 for Declared Areas)	Manager Risk Management, Mandy Damant, (Stephen Hiller)	Water Services Licensing Act 1995 Water Services Licensing Act 1995	Guideline 20 SG106, PCY254 SG106

4. Responsibilities

4.1 Overall

Accountabilities are as listed for the core processes of Plan, Acquire and Manage Infrastructure Assets in the Water Corporation Accountabilities Framework - See Accountability Framework

Responsibilities for the maintenance and distribution of this manual are in the Foreword.

The Planning Director in Infrastructure Planning Branch is responsible for external approvals during planning and for handover of unresolved approval issues to the Program Manager. When the project is activated, the Program Manager shall hand over unresolved issues to the Project Manager.

Final responsibility for ensuring that all External Approvals action is taken before works proceed (contractor given possession of the site) rests with the Project Director. If the project has no Project Director, then it rests with the Regional or Branch Manager responsible for the project.

4.2 Accountability Process Manager

An Accountability Process Manager is nominated for each type of approval in the table in Section 3. They are identified from the Water Corporation Accountabilities Framework. (See hyperlink above). Process Managers provide control and expertise in dealing with approvals by the external agency. Often, but not always, the Accountability Process Manager is also the external Regulation Relationship Manager on the Risk Management Branch website. Legislation Register. If different, the Regulatory Relationship Manager may need to be consulted in some cases.

4.3 Project Manager

The Project Manager (whether employed by the Water Corporation or by an authorised consultant) shall be responsible for ensuring that the requirements of this Manual are complied with.

4.4 Subdivision Development

For subdivision development works or projects subject to the requirements in the Corporation's Developers Manual, the Developer's Design Engineer shall be responsible for meeting the requirements of this Manual and the Developers Manual, including initiating the Preliminaries to Works action.

5. Early Approvals

5.1 Recommended Strategy

Early approvals may be required from certain utilities, authorities and agencies to manage risk during all stages of project development – planning, selection, definition

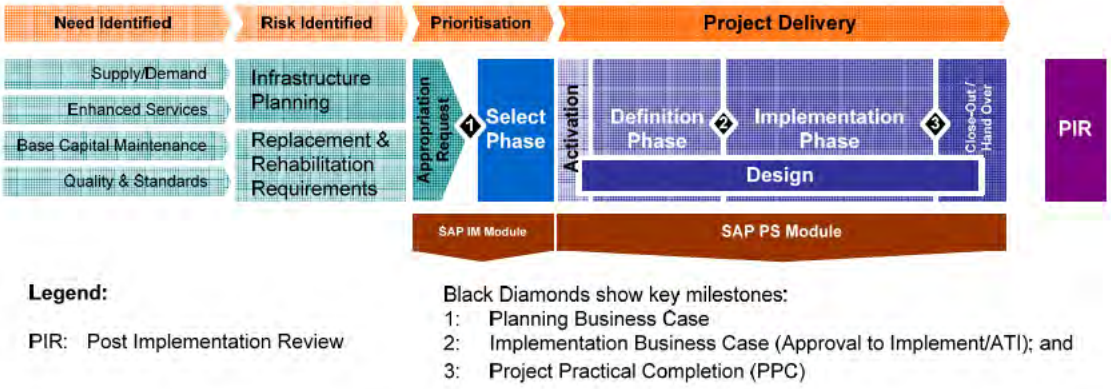
and implementation. These may be approval in principle or approval upon formal application (subject to the specific requirements of the utilities, authorities or agencies).

At the earliest stage of project development the Section 2 External Approvals list should be used as part of the planning and risk assessment. Any authority that could affect the project should be consulted until the project risk is managed. Results should be tracked during later stages.

Although prior contacts are made with these agencies in seeking approvals, during the later Preliminaries to Works process each agency shall be provided with a copy of the formal Notice of Proposal together with an appropriate covering letter.

5.2 The Asset Creation Process

The asset creation process can be illustrated as follows:



The Asset Creation Process
Need identified, project prioritisation and successful project delivery.

5.3 Timing of Environmental Approvals

The following table indicates when in the asset creation process environmental approvals should be initiated.

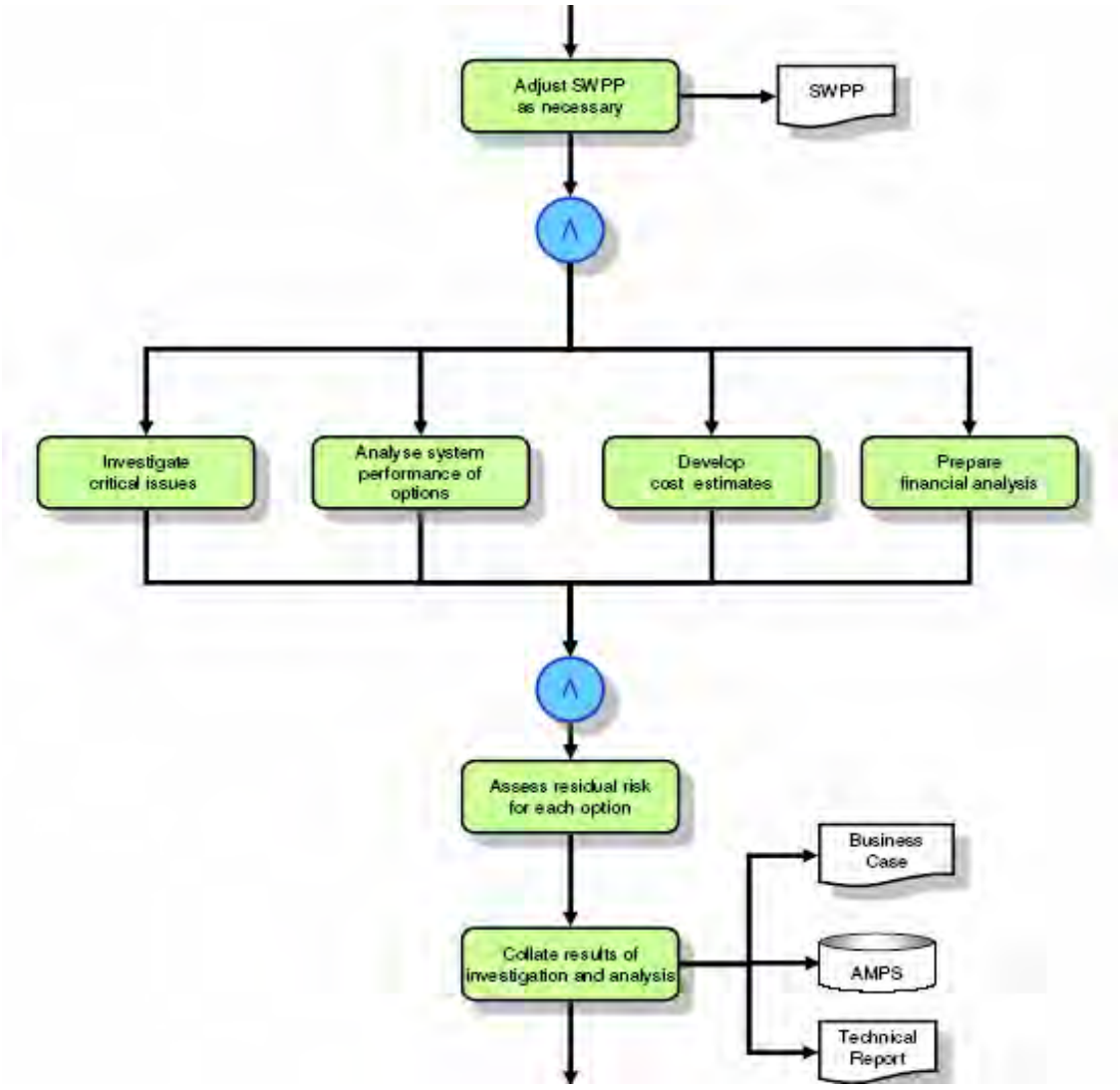
Asset Creation Standards (replaces EM003)For the Planning, Definition and Implementation Phases of Asset Creation

Corporate EMS requirement	Planning	Definition	Implementation
1. Environmental issues identified and risk management measures developed, implemented and reviewed.	Complete planner's environmental checklist, develop management or mitigation (with input from EB and/or EPA), document in planning report and pre-activation review.	Appoint a representative from EB, review planner's environmental checklist, ensure management/mitigation measures are adequate, complete environmental risk assessment package, review planner's environmental checklist for changes, develop new management/mitigation if appropriate, document in risk assessment, engineering design report and project management plan.	Appoint a representative from EB, review planner's environmental checklist, ensure management/mitigation measures are adequate, complete environmental risk assessment package, develop a project EMS and an audit table of conditions and/or commitments made to EPA (formally and informally assessed), communicate management/mitigation measures through contracts and project plans.
2. Identify likely EPA level of assessment (include Part IV and V).	Discuss results of planner's environmental checklist with EB, refer to EPA if appropriate, document in planning report and pre-activation review.	Discuss results of planner's environmental checklist with EB, refer to EPA if not already done, document in project management plan.	Discuss results of planner's environmental checklist with EB, refer to EPA if not already done.
3. Notify Manager, EB, of projects likely to require EPA approval.	Send Manager, EB, a copy of the planner's environmental checklist with rationale for referring to EPA.	If not already done, send Manager, EB, a copy of the planner's environmental checklist with rationale for referring to EPA..	If not already done, send Manager, EB, a copy of the planner's environmental checklist with rationale for referring to EPA..
4. For projects requiring EPA approval, include status of approval and plans/commitments for management of issues (with accountabilities, costs and timelines) in submissions to CIPC.	Include this information in infrastructure planning report and planning business case.	Include this information in definition report and the definition business case and project management plan.	Review the commitments made to EPA and ensure they are communicated throughout the implementation process.
5. All environmental documentation to be submitted to Manager EB for signing prior to release to EPA and/or public.	Send referral letter to Manager, EB for signing prior to release to EPA/public.	Send referral letter and any EPS/PER/ERMP documents to Manager, EB for signing prior to release to EPA/public.	Send referral letter and any EPS/PER/ERMP documents to Manager, EB for signing prior to release to EPA/public.
6. Inform Manager, EB of changes to projects undergoing the	This could include design changes, route planning changes and/or	This could include design changes, route planning changes and/or	This could include design changes, route planning changes and/or

environmental approvals process.	deferring/bringing forward a project.	deferring/bringing forward a project.	deferring/bringing forward a project.
7. Communication of management commitments and conditions made during the approvals process.	Document in the planning report and the planning business case.	Document in the definition report and the definition business case report.	Document in the relevant project plans, tenders, contracts and other project documentation as appropriate.
8. During the implementation of the project, monitor commitments and conditions and inform Manager EB if a non-compliance is likely to result in sanction from the regulator(s).			Monitor conditions and commitments through review of audit table, inform Manager EB of significant non-compliances.
9. At the conclusion of the creation of the project, assess the compliance of conditions and commitments and inform Manager, EB of this assessment.			Audit conditions and commitments, document in project close-out report and inform Manager, EB of results.
10. At the conclusion of the creation of the project, document conditions, commitments and issues requiring ongoing management by the asset owner.			Close out conditions and commitments that are no longer relevant and communicate ongoing conditions and commitments to asset owner via the handover and close-our report.

5.4 Planning Phase

The following extract from the Infrastructure Planning Branch “Planning Process Manual” shows when critical issues are identified. This should lead immediately to major approvals (final or in principle) as required.



SWPP indicates State Wide Planning Program; AMPS indicates Asset Management Planning System.

Not all projects begin in Infrastructure Planning Branch. Wherever a project begins, the External Approvals Checklist in Section 2 should be used as part of risk assessment. The Planning Business Case should show how any critical external approval risks are being managed.

5.5 Select and Definition Phases

The Program or Project Manager responsible for these phases should also use the above External Approvals Checklist in Section 2 as part of the continuing planning and risk assessment. Any authority that could affect the project should be consulted until the project risk is managed. Results should be tracked during later stages. All critical external approvals should be obtained formally or at least in principle before the implementation business case at the end of definition.

The Project Management Definition Phase Procedures on the Project Management Waternet home page deals with environmental, community consultation, aboriginal, land, health and operating area licence as specific examples of approvals needed at this stage.

5.6 Implementation Phase

The Preliminaries to Works process is an early step in the implementation phase. By then, it should be a confirmation that all external approval risks were managed during planning and definition

Also in this phase, the Project Management Implementation Phase Procedures on the Project Management Waternet home page deals with environmental and health approvals including Prescribed Premises, and WAPC or local government development applications.

The Project Management checklists and handover arrangements in this phase also deal with Operating Licence prior to commissioning, and licences or approvals from DOME, DEP and DOCEP (Worksafe).

5.7 Allowance in Project Scheduling

It is important that adequate time is allowed for external approvals when projects are being scheduled.

For example, environmental approvals may take up to two years because of required studies and consultation. Even if critical approvals have been obtained during planning and definition, for Preliminaries to Works a minimum of two months should be allowed for General Works and a minimum of three months for Major Works projects.

Consideration should also be given to potential delays to the project schedule caused by subsidiary or additional requirements not made known by the affected authority/organisation at the time of the Preliminaries to Works action being carried out.

If any contentious aspects are known, a longer period should be allowed.

5.8 Appeals Against Decisions

In exceptional circumstances, the Corporation may wish to appeal against a decision by an external agency to reject an approval application where unacceptable conditions have been imposed.

This appeal may be through the agency's internal processes or to the State Administrative Tribunal.

Advice should be sought from the Manager Legal Services before proceeding with an appeal.

6. Preliminaries to Works

Historically, this was the major external approval process. Now many other Acts exist as in Section 2, requiring extensive approval work before the Preliminaries to Works

process. The Preliminaries to Works process early in the implementation phase of projects should now be a confirmation of earlier actions.

6.1 Categories of Works

The *Water Agencies (Powers) Act 1984 (WAPA*) divides all of the Corporation's works into one of the three categories of EXEMPT WORKS, GENERAL WORKS, and MAJOR WORKS. The requirements of the Preliminaries to Works procedures differ for each category of works and care must be taken in determining the category of works that are proposed. An Extract from the *WAPA* is included in Appendix A of the Manual for reference.
Section 86 of the *WAPA* defines the categories of work as in the following clauses.

6.1.1 Exempt Works

Exempt Works means:

(a) the maintenance, repair, minor alteration, reinstatement or replacement of existing works.

(b) the construction or provision of other works:

i. not being MAJOR or GENERAL WORKS;

ii. being works in, on, under or over private land, which are constructed or provided on, and at the request of the owner of the land served or to be served by the water services in respect of which the works are required; or

iii. being works in, on, under or over Crown land or road reserves and required to link other EXEMPT WORKS to existing works.

(c) alterations to GENERAL WORKS and additions or extensions to GENERAL WORKS in, on, under or over land vested in the Commission or the Corporation:

(d) alterations, extension or additions to MAJOR WORKS where Section 91 does not apply; and

(e) such other works of the nature specified in the Order as the Governor may, from time to time by Order in Council, declare to be Exempt Works for the purposes of this Act or a relevant Act, notwithstanding that such works may form part of or be related to General Works or Major Works (see example at Clause 2.2.3).

Note: Section 91 in (d) above is particularly important in deciding the requirements of the Preliminaries to Works procedure that applies. Many extension works are exempt.

Note: Investigation bores are considered to be EXEMPT WORKS. However when they are to be subsequently converted to production bores, they shall be treated as being MAJOR WORKS.

6.1.2 General Works

General Works means:

(a) trunk and distribution water mains, pumping stations, pumping (pressure) mains, control and metering stations, main and branch sewers, main drains, irrigation channels, compensating basins and water and sewerage reticulation mains, being reticulation mains not constructed at the request of the owner of land affected;

(b) such other works of a kind similar to the works referred to in paragraph (a) of this definition as the Governor may, from time to time by Order in Council declare to be General Works for the purposes of this Act or a relevant Act; and

(c) works, in, on, under or over private land, other than EXEMPT WORKS.

6.1.3 Major Works

Major Works means:

(a) dams, service reservoirs, bulk water storage facilities, Groundwater schemes, irrigation schemes, Wastewater treatment plants or water treatment plants; and

(b) such other works as the Minister:

i. considers by virtue of their location, size or nature, to be of sufficient public interest to require public advertisement and that an opportunity to object or comment thereon should be given; and

ii. directs the Commission or the Corporation, either generally or in a specific case, to treat as MAJOR WORKS.

Note: Production bores are considered to be in the MAJOR WORKS category.

6.1.4 Preliminaries to Works Requirements

6.1.4.1. Exempt Works

Generally, Works that are categorised as EXEMPT WORKS are not required by the *WAPA* to have their provision or construction preceded by any formal preliminaries. However Exempt Works which is within group (b) of Clause 6.1.1 may be subject to development approval of the Western Australian Planning Commission via the appropriate Local Authority. (See also Guideline 9 – Development Applications).

As a condition of the Operating License (and Corporation policy), and pursuant to the provisions of the *Native Title Act 1993 (Commonwealth)* the Corporation is required to inform occupiers in advance of planned work.

See Guideline 1.2 Preliminaries to Works for further detail.

6.1.4.2. General Works

See Guideline 1.2 Preliminaries to Works for further detail.

6.1.4.3. Major Works

See Guideline 1.2 Preliminaries to Works for further detail.

6.2 Native Title Act Requirements for Exempt Works Preliminaries

The requirements of the Native Title Act shall still be observed in the case of EXEMPT WORKS.

6.3 Environmental and Other Approvals

Environmental and other approvals may still be required for EXEMPT WORKS.

Appendices

Appendix A: *Extract from Water Agencies (Powers) Act 1984*

For reference the relevant sections of the Act (S86 to S97) have been reproduced. The sections cover the responsibilities of the Water Corporation and the action and clearances that are required as a preliminary to constructing or providing any of its works.

The sections included are:

Section	Name
86	Interpretation
87	Power to carry out Major Works
88	Advertisements and notices
89	Objections and comments
90	Submission for authorisation
91	Alteration or extension of Major Works
92	Power to carry out General Works
93	Notices
94	Objections and comments
95	Authorisation for General Works
96	Commission or the Corporation to carry out Exempt Works
97	Deviation and modification
	Exempt Works (Aboriginal Communities) Order 1986

Extract from Water Agencies (Powers) Act 1984
PART VIII – WORKS
Division 2 – Preliminaries to Works
Subdivision A – Interpretations

6.3.1 Clause 86 Interpretation

In this Part and in Part VII ‘‘Exempt Works’’ means:

(a) the maintenance, repair, minor alteration, reinstatement or replacement of existing works;

(b) the construction or provision of other works:

i. not being Major or General Works;

ii. being works in, on, under or over private land, which are constructed or provided on, and at the request of the owner of, the land served or to be served by the water services in respect of which the works are required; or

iii. being works in, on, under or over Crown land or road reserves and required to link other Exempt Works to existing works.

(c) alterations to General Works and additions or extensions to General Works in, on, under or over land vested in the Commission or the Corporation;

(d) alterations, extensions or additions to Major Works where section 91 does not apply; and

(e) such other works of the nature specified in the Order as the Governor may, from time to time by Order in Council, declare to be Exempt Works for the purposes of this Act or a relevant Act, notwithstanding that such works may form part of or be related to General Works or Major Works.

''General Works'' means the construction or provision of:

(a) trunk and distribution water mains, pumping stations, pumping mains, control and metering stations, main and branch sewers, main drains, irrigation channels, compensating basins and water and sewerage reticulation mains, being reticulation mains not constructed at the request of the owner of the land affected;

(b) such other works of a kind similar to the works referred to in paragraph (a) of this definition as the Governor may, from time to time by Order in Council declare to be General Works for the purposes of this Act or a relevant Act; and

(c) works in, on, under or over private land, other than Exempt Works;

''Major Works'' means the construction or provision of:

(a) dams, service reservoirs, bulk water storage facilities, groundwater schemes, irrigation schemes, wastewater treatment plants or water treatment plants; and

(b) such other works as the Minister:

i. considers, by virtue of their location, size or nature, to be of sufficient public interest to require public advertisement and that an opportunity to object or comment thereon should be given; and

ii. directs the Commission or the Corporation, either generally or in a specific case, to treat as Major Works.

Subdivision B — Major Works

6.3.2 Clause 87 Power to Carry Out Major Works

The Commission or the Corporation may carry out, or undertake the construction or provision of, Major Works, if the Commission or the Corporation has complied with sections 88 and 89 and the Minister has thereupon authorized the carrying out of such works and a notice of such authorization has been published in the Government Gazette, but not otherwise.

6.3.3 Clause 88 Advertisements and Notices

1. The Commission or the Corporation shall, before submitting proposals to the Minister for the carrying out, construction or provision of Major Works:

(a) cause to be prepared plans of the area affected together with the current proposals for the works, and cause those plans and proposals, or certified copies to be deposited:

i. in the head office of the Commission or the Corporation; and

ii. where the proposed works are to be outside the Metropolitan Water, Sewerage, and Drainage Area, in the district office of the Commission

or the Corporation nearest to the locality which will benefit from the proposed works;

(b) cause an advertisement to be published in the Government Gazette, and in one or more newspapers generally circulating in the locality in which the proposed works are to be situate, specifying:

i. a description of the proposed works;
ii. the localities in which they will be situate;
iii. the purposes for which they are required; and
iv. the times when, and places at which, the plans and proposals may be inspected; and

(c) cause a notice specifying the details referred to in paragraph (b) to be served on:

i. the owner and occupier of any land which is to be entered for the purposes of the proposed works or which is, in the opinion of the Commission or the Corporation, likely to be affected; and
ii. any local government in the area of which the proposed works will be situate or which, in the opinion of the Commission or the Corporation, has a material interest in the proposal or the services to be provided by the works.

2. The plans and proposals referred to in subsection (1) shall be open to inspection by any person interested, at the times and places specified in the advertisement.

6.3.4 Clause 89 Objections and Comments

1. Any local government or person interested may, in writing, object to or comment on the carrying out, construction or provision of proposed Major Works.

2. Every such objection or comment shall be lodged with the Commission or the Corporation within one month from the date of the publication of the advertisement referred to in subsection (1) of section 88.

3. Where the Commission or the Corporation so determines, and whether or not by reason of objections or comments received, the Commission or the Corporation may amend the proposal by making alterations to the plans or proposals so deposited and advise the persons who are, in the opinion of the Commission or the Corporation, likely to be affected by such alterations, but when submitting the proposal to the Minister for authorization shall indicate the nature and extent of the alterations effected.

6.3.5 Clause 90 Submission for Authorisation

1. Where the Commission or the Corporation considers that the requirements of sections 88 and 89 have been complied with and that the objections or comments, if any, have been met by amendment of the proposals or are, in the general public interest, not such as to cause the proposals to be amended, the Commission or the Corporation shall submit the final proposal to the Minister and shall furnish to the Minister such plans, description, specifications, estimates or other information as the Minister may require relating thereto.

2. The Commission or the Corporation shall prepare a report to the Minister on:
   (a) the original proposal;
   (b) any amendment to that original proposal and the persons who have been advised of the amended proposal; and
   (c) the final proposal, and any interest, objection or comment not met by the final proposal, and the Minister shall have regard to that report and any recommendations contained therein and after considering the matter the Minister may:
      i. direct that any amended proposal shall be re-advertised;
      ii. direct that further or other notices be served in respect of the proposal;
      iii. authorize the carrying out, construction, or provision of the proposed Major Works; or
      iv. decline to authorize the proposed Major Works.

6.3.6 Clause 91 Alteration or Extension of Major Works

1. Where the Commission or the Corporation proposes substantially to alter or extend any Major Works it shall notify the Minister of the proposal and shall furnish to the Minister such plans, description, specifications, estimates or other information as the Minister may require relating thereto.

2. After considering the proposal the Minister may:
   (a) direct that the procedures set forth in sections 88, 89 and 90, or such procedures as are specified by the Minister, be carried out in relation to the alteration or extension as if the proposed alteration or extension were a proposal for the initial provision of Major Works;
   (b) authorize the proposed extension or alteration; or
   (c) decline to authorize the proposed extension or alteration.

3. In considering a proposal notified to him under subsection (1) the Minister may have regard to any earlier proposal relating to the same or like works and any earlier objections or comments received by the Commission or the Corporation relating to that proposal.

Subdivision C — General Works

6.3.7 Clause 92 Power to carry out General Works

The Commission or the Corporation may carry out, or undertake the construction or provision of, General Works, if the Commission or the Corporation has complied with sections 93, 94 and 95, but not otherwise.

6.3.8 Clause 93 Notices

1. The Commission or the Corporation shall:
   (a) cause to be prepared plans and a description of proposed General Works and cause those plans and that description, or certified copies, to be deposited:
      i. in the head office of the Commission or the Corporation; and

ii. where the proposed works are to be outside the Metropolitan Water, Sewerage, and Drainage Area, in the district office of the Commission or the Corporation nearest to the locality which will benefit from the proposed works; and

(b) cause a notice, and an extract or illustration of the plans and a copy of the description referred to in paragraph (a) sufficient to indicate the nature and extent of the proposed General Works, to be served on:

i. the owner and the occupier of any land which is to be entered for the purposes of the proposed works or is, or the use of which is, in the opinion of the Commission or the Corporation, likely to be adversely affected; and

ii. any local government in the area of which the proposed works will be situate or which, in the opinion of the Commission or the Corporation, has a material interest in the proposal or the services to be provided by the works, specifying the details set forth in subparagraphs (i), (ii), (iii) and (iv) of section 88 (1) (b) and nominating a date, which shall be a date not earlier than 7 days after service of the notice, by which all objections to, or comments upon, the proposal must be received by the Commission or the Corporation.

2. The plans and description referred to in subsection (1) shall be made available by the Commission or the Corporation for inspection by any person or local government upon whom or which a notice has been served pursuant to paragraph (b) of subsection (1), at the times and places specified in the notice.

6.3.9 Clause 94 Objections and Comments

1. Any person or local government upon whom or which notice has been served pursuant to section 93 may, in writing, object to or comment upon the carrying out, construction or provision of the proposed works.

2. Every such objection or comment shall be lodged with the Commission or the Corporation by the date specified in the notice.

3. Where the Commission or the Corporation so determines, and whether or not by reason of objections or comments received, the Commission or the Corporation may amend the proposal by making alterations to the plans or description so deposited, whether to meet objections or comments or otherwise, but shall advise the persons who are, in the opinion of the Commission or the Corporation, likely to be adversely affected by such alterations.

6.3.10 Clause 95 Authorisation for General Works

1. Where:

(a) the Commission or the Corporation has complied with the requirements of sections 93 and 94 and:

i. no objections or comments have been received by the time specified in the notices served pursuant to subsection (1) of section 93; or

ii. any objection or comment material to the proposal has been met; and

(b) the Commission or the Corporation does not require the authorization of the Minister to a deviation from the plan pursuant to subsection (4) of section 97,

the Commission or the Corporation is authorized to proceed to carry out, construct or provide the General Works.

2. Subject to subsection (1), where the Commission or the Corporation considers that the requirements of sections 93 and 94 have been complied with but that objections or comments material to the proposal have not been met by amendment of the proposal, the Commission or the Corporation shall submit the proposal to the Minister informing him of the original proposal and, if it has been altered, the manner in which it has been altered and shall furnish to the Minister such plans, description, specifications, estimates or other information as the Minister may require relating thereto.

3. Any question as to whether or not an interest, objection or comment is material to a proposal may be determined by the Commission or the Corporation.

4. After considering the proposal submitted to him pursuant to subsection 2. the Minister may:
   (a) authorize the carrying out, construction or provision of the proposed General Works; or
   (b) decline to authorize the proposed General Works.

Subdivision D — Exempt Works

6.3.11 Clause 96 Commission or the Corporation to carry out Exempt Works

Exempt works may be carried out, undertaken, constructed or provided by or on behalf of the Commission or the Corporation without any requirement for notification or advertisement of those works.

Subdivision E — Deviation and modification

6.3.12 Clause 97 Deviation and modification

1. Where the Commission or the Corporation is of the opinion that any deviation from the proposed line of works may be necessary, the Commission or the Corporation may, in preparing the plans of the proposed works pursuant to section 88 or section 93, show on those plans a limit within which the line of works as constructed may deviate to accommodate changes in location not inconsistent with the general proposal and any such deviation shall, if the works are authorized, be taken to be authorized.

2. Whether or not a limit within which the line of works may deviate during construction is shown on the plans of authorised works, the Commission or the Corporation in carrying out the works may deviate not more than 20 metres from the location shown on those plans if:
   (a) the change is of a nature not inconsistent with the general proposal; and
   (b) where the proposed works are to be constructed or provided on land other than
      i. unoccupied Crown land; or
      ii. a road reserve,

iii. the deviation is agreed in writing by the owner and occupier of the affected land.

3. The Commission or the Corporation may, during the carrying out, construction or provision of works, depart from any description; proposal or plans authorized, and may make such modifications as are required by the circumstances, if the departure is agreed in writing by the owner and occupier of the affected land.

4. Where the Minister is satisfied that a deviation or modification of a kind to which subsection 1. subsection 2. or subsection 3. does not apply is not inconsistent with the general proposal, is necessary in the public interest, and does not adversely affect the interest of any person who is the owner or occupier of the land where the works are to be situate, he may authorize the carrying out of the proposal as so varied notwithstanding that the provisions of :

   (a) sections 88, 89 and 90; or

   (b) sections 93, 94 and 95;

   as the case requires, have not been complied with in relation thereto.

END OF DOCUMENT

Other Approvals to be Gained by the Corporation for the SSDP

The Corporation intends to gain all necessary approvals from all applicable Commonwealth, State and local government agencies and has commenced this process. More details of relevant approvals are presented in the Construction Environmental Management Framework and the Operational Environmental Management Framework for the SSDP.

In addition, the Corporation has well established and catalogued processes for identifying and obtaining external approvals as necessary for projects, as detailed in the Corporation *Planning and Infrastructure Division - Capital Investment Branch: External Approvals Manual* (copy attached).

A summary of the main additional specific approvals to be gained by the Corporation for the SSDP is presented below.

- Protected flora and fauna will not be disturbed without approval under the WA *Wildlife Conservation Act 1950* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (as applicable)
- If Declared Rare Flora are identified within the construction area a Licence to take Declared Rare Flora will be applied for, in accordance with the *WA Wildlife Conservation Act 1950* and the WA Wildlife Conservation Regulations 1970.
- If specially protected fauna are identified within the construction area a Licence to take specially protected fauna will be applied for in accordance with the *WA Wildlife Conservation Act 1950* and the WA Wildlife Conservation Regulations 1970.
- A Licence will be required under r17 of the WA Wildlife Conservation Regulations 1970 issued by the WA Department of the Environment and Conservation (DEC) to take native fauna which may be found in trenches.
- Approval for installation of the marine warning buoys will be obtained from the WA Department for Planning and Infrastructure (DPI) under the WA *Marine Navigational Aids Act 1973* prior to installing the warning buoys.
- A permit to interfere with the beds and banks of watercourses will be obtained from the WA Department of Water (DoW) in accordance with s17 of the WA *Rights in Water and Irrigation Act 1914*.
- The WA *Aboriginal Heritage Act 1972* registers and protects sites of importance to Aboriginal persons. It is an offence to interfere with a registered site 1 without the consent of the Western Australian Minister for Indigenous Affairs. The construction works avoid all existing registered sites on the Department of Indigenous Affairs database.
- The construction area is also subject to a native title claim by the Gnaala Karla Boojah Native Title Claimant Group (NTCG) under the Commonwealth *Native Title Act 1993*. The South West Aboriginal Land and Sea Council is the representative body for the Gnaala Karla Booja NTCG. Native title has yet to be determined by the National Native Title Tribunal.
- The statutory requirements and guidelines applicable for traffic safety and management under the WA Local Government Act 1995, WA Main Roads Act 1930 and the WA *Road Traffic Act 1974*, will be complied with.

- A Licence issued by the Chief Inspector of the WA Department of Consumer and Employment Protection (DoCEP) under the WA *Dangerous Goods Safety Act 2004* will be obtained prior to any storage of dangerous goods.
- A Permit issued by the Chief Inspector of the DoCEP under the WA *Dangerous Goods Safety Act 2004* will be obtained prior to any storage or use of explosives at construction sites.

Further approvals listed in Sections 2 and 3 of the Corporation *Planning and Infrastructure Division - Capital Investment Branch: External Approvals Manual* detail what may be required for any Water Corporation project, and will be adhered to as required for the SSDP.

MAUNSELL | AECOM

Southern Seawater Desalination Project Spring Survey
Targeted Significant Flora Survey

Binningup to Harvey Southern Seawater Desalination Project

Water Corporation

17 February 2009

Targeted Significant Flora Survey

Prepared for

Water Corporation

Prepared by

Maunsell Australia Pty Ltd
3 Forrest Place, Perth WA 6000, GPO Box B59, Perth WA 6849, Australia
T +61 8 6430 2000 F +61 8 6430 2999 www.maunsell.com
ABN 20 093 846 925

17 February 2009

60047533

Quality Information

Document Targeted Significant Flora Survey

Ref 60047533

Date 17 February 2009

Prepared by Gaby Martinez and Lisa Chappell

Reviewed by Kellie Gibbs

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	06/12/2008	Draft for Internal Review	Kellie Gibbs Senior Environmental Scientist - Botanist	
B	10/12/2008	Draft for Submission	Kellie Gibbs Senior Environmental Scientist - Botanist	
0	17/02/2009	Final Submission	Kellie Gibbs Senior Environmental Scientist - Botanist	

Table of Contents

List of Figures

1.0 Introduction

1.1 Project Background

The Water Corporation is preparing to commence construction of the Southern Seawater Desalination Project (SSDP) at Binningup and associated infrastructure and pipelines to an infrastructure site at Harvey.

Previous surveys for the project and in the project area have determined the presence of Declared Rare Flora (DRF) populations. The DRF species concerned with this assessment are two species of Hammer Orchids, namely *Drakaea elastica* and *Drakaea micrantha.*

The Water Corporation is committed to conducting detailed spring surveys during optimum seasonal periods to accurately determine the location of any DRF orchids within or closely adjacent to the proposed project footprints. Maunsell | AECOM (Maunsell) was commissioned by the Water Corporation to conduct targeted DRF surveys of the proposed project area.

1.2 Scope of Works

The survey within the project area was carried out in order to locate and record populations of: the following significant flora;

- Declared Rare Flora:
  - Drakaea elastica
  - Drakaea micrantha)
- Priority Flora:
  - Acacia semitrullata (P3)
  - Caladenia speciosa subsp. speciosa (P4)
  - Eucalyptus rudis subsp cratyantha (P4)
  - Dillwynia dillwynioides (P3)
  - Lasiopetalum membranaceum (P3)

1.3 Location

The project area is located within the Shire of Harvey approximately 4.5 kilometres south of Forestry Road.

The project area is shown in Figure 1 and includes the site at Binningup which lies between the Binningup town site and Myalup Beach. The infrastructure corridor extends from the Binningup site in an easterly direction to Old Coast Road and follows this north until the Harvey River Diversion Drain. Here to corridor follows the drain to the east and traverses agricultural land in a north-easterly direction to join Rodgers Road. The project area then follows Rodgers Road in an easterly direction until to Eckersley Road and then follows north-easterly for approximately 4.8km. It then routes in an east south-easterly direction along Yambellup Avenue and crosses South Western Highway before terminating at the Harvey Infrastructure Site.

2.0 Declared Rare Flora and Priority Flora

The Department of Environment and Conservation (DEC) assigns conservation status to endemic plant species that are geographically restricted to few known populations or threatened by local processes. Allocating conservation status to plant species assists in protecting populations and conserving species from potential threats (DEC, 2008a and 2008b).

Rare Flora species are gazetted under subsection 2 of section 23F of the *Wildlife Conservation Act, 1950*. It is an offence to "take" or damage Rare Flora without Ministerial approval. Section 23F of the *Wildlife Conservation Act, 1950* defines "to take" as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Species designated as Priority Flora are under consideration for declaration as 'Rare Flora' and are in urgent need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four). Priority Flora lists is also administered by the DEC and while listed species do not have the same legal status as DRF, they are considered in approvals processes pursuant to the *Environmental Protection Act (1986).*

2.1 Drakaea elastica (DRF)

2.1.1 Conservation Significance

Drakaea elastica (Glossy-leaved Hammer Orchid or Praying Virgin) is classified by DEC as Declared Rare Flora (DRF) (and is afforded special protection under the *Wildlife Conservation Act 1950* and the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC) 1999*, under which it is listed as Endangered.

2.1.2 Ecology, Habitat and Distribution

Temperate Australian terrestrial orchids have distinctive phases within the annual growth cycle. During cooler, wet months leaves emerge, flowering occurs either prior or immediately after replacement tubers are produced, after which orchids enter dormancy as a quiescent tuber during hot summer conditions.

Drakaea elastica is described as a tuberous perennial herb that grows to 0.12 - 0.3 metres high. Plants have a single flower to 4cm across and are distinguished from the related *Drakaea concolor* by its two-toned labellum with a more prominent glandular hairy upper lobe. Flowers are red and green or yellow. Typical flowering time is October to November (Brown *et al*., 2008).

Drakaea elastica is a species endemic to Western Australia. It has been found between Cataby and Ruabon on the Swan Coastal Plain. Typically populations occur in deep sandy soil in *Banksia* Woodland, often in association with tall *Kunzea* species.

This orchid has previously been known as *Drakaea lucida and Drakaea jeanensis* (Brown *et al*., 2008).

2.2 *Drakaea micrantha* (DRF)

2.2.1 Conservation Significance

Drakaea micrantha (Dwarf Hammer Orchid) is classified by DEC as Declared Rare Flora (DRF) and is afforded special protection under the *Wildlife Conservation Act 1950* and the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC) 1999*, under which it is listed as Vulnerable.

2.2.2 Ecology, Habitat and Distribution

Drakaea micrantha is described as a tuberous, perennial herb that grows to 0.12 – 0.3m high. Flowers are red and yellow and generally flowers between September to early November. Plants have a single flower to 2.5cm across and are distinguished from the similar *Drakaea glyptodon* by its smaller size and less pouched labellum.

The species typically grows in white or grey sand. It often co-occurs with *Paracaleana nigrita* and other *Drakaea* species including *Drakaea glyptodon, D. thynniphila* and *D. livida*. *Drakaea micrantha* is so protected because very few individuals are known even though the species is widespread in many disjunct populations (Hopper and Brown, 2007).

Drakaea micrantha is a species endemic to Western Australia. It occurs in small disjunct populations between Perth, Augusta and the Porongurup Ranges. This species grows in bare sand patches in *Banksia* or Jarrah Woodland, often associated with *Kunzea glabrescens* thickets adjacent to winter-wet swamps.

2.3 *Acacia semitrullata* (P3)

2.3.1 Conservation Significance

Acacia semitrullata is classified by DEC as a Priority Three flora. The definition of a Priority Three flora under the *Wildlife Conservation Act, 1950* is as follows: *"Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey. "*

2.3.2 Ecology, Habitat and Distribution

Acacia semitrullata is described as a slender, erect, pungent shrub (0.1) 0.2 – 0.7 (-1.5) m high. Flowers are cream or white. Plants usually flower between May to October (DEC, 2008a).

This species grows in sand in Open Heath frequently fringing seasonally dry swamps and in sand over laterite in shallow depressions in Open Jarrah Forest. It is found from Yarloop to Collie and the Whicher ranges (DEC, 2008a).

2.4 *Caladenia speciosa* subsp. *speciosa* (P4)

2.4.1 Conservation Significance

Caladenia speciosa (Sandplain White Spider Orchid) is classified by DEC as a Priority Four flora. The definition of a Priority Four flora species rating under the *Wildlife Conservation Act, 1950* is as follows: "*Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years. "*

2.4.2 Ecology, Habitat and Distribution

Caladenia speciosa is described as a tuberous, perennial, herb 0.35 – 0.8m high. Plants usually have one to three flowers to 15cm across. It is distinguished from *Caladenia longicauda* by its delicate pink tinged colouration and long, often split labellum fringe (Brown *et al.,* 2008).

This orchid is largely confined to sandy *Banksia*, Jarrah Woodland on the Swan Coastal Plain from near Mundijong to Boyanup where often it is found flowering in greater profusion following summer bushfires (Hoffman and Brown, 1992).

2.5 *Dillwynia dillwynioides* (P3)

2.5.1 Conservation Significance

Dillwynia dillwynioides is classified by DEC as a Priority Three flora. The definition of a Priority Three flora under the *Wildlife Conservation Act, 1950* is as follows: *"Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey. "*

2.5.2 Ecology, Habitat and Distribution

Dillwynia dillwynioides is described as a decumbent or erect, slender shrub, 0.3–1.2 m high. Flowers are red, yellow or orange, or a combination of all colors. Flowering takes place during August to December. This species usually occurs in sandy soils in winter-wet depressions (DEC 2008a).

Species distribution is on the Swan Coastal Plain from recorded locations north to Moore River National Park and south to the Pinjarra to Capel region.

2.6 *Eucalyptus rudis* subsp. *cratyantha* (P4)

2.6.1 Conservation Significance

Eucalyptus rudis subsp. *cratyantha* is classified by the DEC as a Priority Four. The definition of a Priority Four species rating under the *Wildlife Conservation Act, 1950* is as follows: "*Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years. "*

2.6.2 Ecology, Habitat and Distribution

Eucalyptus rudis subsp. *cratyantha* is described as a tree growing up to 20m tall. It is endemic to Western Australia and occurs only in from Mandurah and Pinjarra south and south-west to Cape Naturaliste. It is confined to stream banks or floodplains on silty soils with clay subsoil (Centre for Plant Biodiversity Research, 2006).

The bark is rough in most trees but occasionally it is smooth. It differs from *Eucalyptus rudis* subsp. *rudis* in having slightly larger parts. The buds measure 1 - 1.5cm long whilst the fruit is 1.1 – 1.4cm wide and more pronouncedly campanulate (Centre for Plant Biodiversity Research, 2006).

2.7 *Lasiopetalum membranaceum* (P3)

2.7.1 Conservation Significance

Lasiopetalum membranaceum is classified by DEC as a Priority Three flora. The definition of a Priority Three flora under the *Wildlife Conservation Act, 1950* is as follows: *"Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey. "*

2.7.2 Ecology, Habitat and Distribution

Lasiopetalum membranaceum is a multi-stemmed shrub, 0.2–1m high. Flowers are pink, blue or purple. Flowering takes place from September to December. Populations occur on sand over limestone.

Distribution of the species is mostly on the Swan Coastal Plain but occasionally to the north-western Jarrah Forest and ranges from the Perth Region in the north to the Bunbury Region in the south.

3.0 Methodology

3.1.1 Desktop Assessment

Previous studies and literature relevant to this project were reviewed prior to undertaking the survey. Prior to field mobilisation, a desktop assessment of values associated with the DRF orchids, *Drakaea elastica* and *Drakaea micrantha,* was carried out. This included interrogation of the Department of Environment and Conservation's Declared Rare Flora spatial database results for the project area and surrounds. Specific habitat assessments were carried out during the desktop assessments in order to determine areas of suitable habitat for *Drakaea elastica* and *Drakaea micrantha*. These areas then became the focus of detailed ground surveys, however all areas were considered in foot searches. Additionally, relevant priority species, *Acacia semitrullata, Caladenia speciosa* subsp. *speciosa*, *Dillwynia dillwynioides* and *Eucalyptus rudis* subsp. *cratyantha* were also subject to desktop assessment, in order to maximise the efficiency and accuracy of the field surveys.

3.1.2 Field Assessment

Maunsell initially proposed to undertake field assessments during two separate site visits, in order to capture appropriate flowering times for both species of DRF orchid (*D. elastica* and *D. micrantha*). This multiple visit scenario would permit assessment of leaves only and then flowers as well for the *D.elastica* as per advice from Andrew Brown of DEC.

D. micrantha flowers from early September through to early November. Flowers are typically long lasting in comparison to most orchid species. Whilst, *D. elastica* requires identification at two separate intervals, these being at the time of leaf emergence and then again at the time of flowering. This is due to the fact that both the leaves and flowers resemble those of similar Hammer orchid species, however in combination are unique. Also, leaves are rarely in peak form at the same time, with leaves yellowing and shrivelling once flowers mature. Leaves emerge in late September and flowers follow in mid November (Brown, A., *pers.comm*).

One field survey was conducted within the Water Corporation project area, between 23rd to 26th September, 2008. During dates immediately prior to and following the assessments carried out in the Water Corporation project areas, a number of *D.elastica* and some *D.micrantha* populations were recorded in throughout adjacent areas as part of a survey conducted for Western Power, at the Kemerton Terminal and within adjacent corridors. During these surveys, DRF orchid plants located and recorded exhibited both intact leaves and flowers. Due to this, and based on knowledge and experience of Maunsell's Dr. Andrew batty, in consultation with Andrew Brown of DEC, it was determined that additional site assessments at later dates were not necessary. Additionally, the observation of both DRF species targeted in the wider project area confirms that the timing of the survey was accurately appropriate to capture both *D.elastica* and *D.micrantha*, which provides further confidence that subsequent surveys are not required.

For the purposes of locating DRF at the site, a gridding technique was used and all areas of native vegetation, or close to fringes of native vegetation, in the case of cleared or disturbed areas, were examined in detail by botanists on foot. All personnel conducting the search, including orchid specialist, Dr. Andrew Batty, were familiar with the appearance of the species surveyed and had experience in DRF recognition whilst recording the species subject to the search.

The grid sweeps utilised were between 3 to 12 metres each per sweep, depending on visibility of vegetation types in differing degrees of degradation. Navigation of the sweeps were carried out using a combination of handheld Global Positioning Systems (GPS) units, a GPS device associated with a Panasonic Toughbook (portable tablet PC) and magnetic compasses. Covered ground was indicated by tying pieces of coloured paper streamers (biodegradable) to vegetation at eye height. This "trail" was then sighted on the returning subsequent sweeps to ensure that no ground was missed or covered twice.

Where *D.elastica, D.micrantha, Caladenia speciosa, Acacia semitrullata* and *Eucalyptus rudis* subsp. *cratyantha* were located a GPS reading of the location were taken, individuals were counted and photographs were taken to confirm identifications.

4.0 Results

Maunsell recorded a total of 866 individual plants of the targeted Priority Flora species within the proposed water pipeline corridors. No individuals of any DRF species were recorded throughout the Water Corporation project area (Appendix A and Figures 2.1 – 2.10).

Previous studies conducted by 360 Environmental (2007) identified 33 plants of *Acacia semitrullata* (P3), two *Caladenia speciosa* (P4) and one *Eucalyptus rudis* subsp. *cratyantha* (P4) within the project area (Appendix B). Additionally, populations of *Dillwynia dillwynioides* (two locations) and *Lasiopetalum membranaceum* (one location) were recorded in areas near the project area, but not within current designated impact boundaries.

4.1 *Drakaea elastica* (DRF)

No flowering *D.elastica* (DRF) individuals or leaves were recorded during the survey.

4.2 *Drakaea micrantha* (DRF)

No flowering *D.micrantha* (DRF) individuals or leaves were recorded during the survey.

4.3 *Acacia semitrullata* (P3)

There were 843 *Acacia semitrullata* (P3) individuals recorded during the field survey (Figures 2.1 – 2.10). The specific locations of this species are presented in Appendix A.

4.4 *Caladenia speciosa* subsp. *speciosa* (P4)

There were 22 individuals of *Caladenia speciosa* subsp. *speciosa* (P4) recorded during the field survey (Figures 2.1 – 2.10). Specific locations of occurrences of this species area shown in Appendix A.

4.5 *Dillwyinia dillwynioides* (P3)

No flowering individuals of *Dillwynia dillwynioides* were recorded during the survey.

4.6 *Eucalyptus rudis* subsp. *cratyantha* (P4)

During the field assessment in September there was one individual of *Eucalyptus rudis* subsp. *cratyantha* (P4) found along the proposed water pipeline corridor (Figure 2.1). This species was located at 382422mE 6335994mN.

5.0 Discussion

Previous studies conducted by 360 Environmental (2007) located a total of 33 *Acacia semitrullata* (P3), two *Caladenia speciosa* subsp. *speciosa* (P4) and one *Eucalyptus rudis* subsp. *cratyantha* (P4) within the project area. Some populations of *Dillwynia dillwynioides* (P3) and *Lasiopetalum membranaceum* (P3) have also been recorded in areas near the project area and corridors.

A targeted and detailed flora survey of the project area was conducted in September 2008 by Maunsell. This survey did not record any populations of DRF species within the specified project area. The sites at Binningup (the proposed Desalination Plant site) and Harvey (infrastructure site) did not record any DRF or Priority flora populations.

A total of 866 individual plants of three species of Priority Flora were recorded within the proposed pipeline corridors. This included 843 plants of *Acacia semitrullata* (P3), 22 plants of *Caladenia speciosa* subsp. *speciosa* (P4) and one mature tree, *Eucalyptus rudis* subsp. *cratyantha* (P4). The *Eucalyptus rudis* subsp. *cratyantha* tree located by Maunsell in 2008 is the same specimen that 360 Environmental identified and vouchered during their 2007 field assessments (Appendix A and B).

Although no plants of known DRF species were recorded within the project area, it can not be ruled out that any individuals may appear in subsequent years, either arising from tuberoids that were dormant at the time of the survey or through seed dispersal from nearby populations, such as those recorded to occur within the Western Power Kemerton site.

Based on the results of the field assessment in September 2008, it is evident that the project area supports significant populations of the Priority Flora species *Acacia semitrullata* (P3). This species is classified by DEC as having a Priority Three conservation status. Maunsell recorded a total of 843 individual plants of this species and it was observed to be a dominant species in a number of vegetation types occurring in the project area. It is considered that based on the results of the survey, a review of the conservation status of this species is required. Data gathered during the survey in 2008 would provide valuable input into species reclassification. The Water Corporation is encouraged to liaise with DEC with regards to this matter.

It is a condition of DEC issued Flora Collection Permits that specimens of significant flora (i.e. DRF, Priority and range extensions) be submitted as voucher specimens for inclusion in the Western Australian Herbarium databases. Maunsell shall fulfil this requirement and proceed with submission of specimens collected during the survey.

6.0 References

Brown, A., Personal Communication (2008). Co-ordinator of (Threatened Flora) Species and Communities Branch.

Brown, A., Dundas, P., Dixon, K. and Hopper, S. (2008) *Orchids of Western Australia*. University of Western Australia Press.

Centre for Plant Biodiversity Research (2006) *EUCLID – Eucalypts of Australia Third Edition*. CSIRO Publishing.

Department of Environment and Conservation (2008a) *Florabase*. The Flora of Western Australia Online (and collections housed at the WA Herbarium). www.florabase.calm.wa.gov.au

Department of Environment and Conservation (2008b) *Declared Rare and Priority Flora List*. Publicly available list prepared by the Department of Environment and Conservation, Western Australia.

Hoffman, N. and Brown, A (1992) *Orchids of South-West Australia – Second Edition*. University of Western Australia Press.

Hopper, S.D., and Brown, A.P. (2007) *A revision of Australia's hammer orchids (Drakaea: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators.* Australian Systematic Botany 20: 252-285.

360 Environmental (2007) *Binningup Water Treatment Facility and Pipeline Corridor – Water Corporation – Due Diligence Flora and Fauna Investigation.* Report prepared for the Water Corporation.

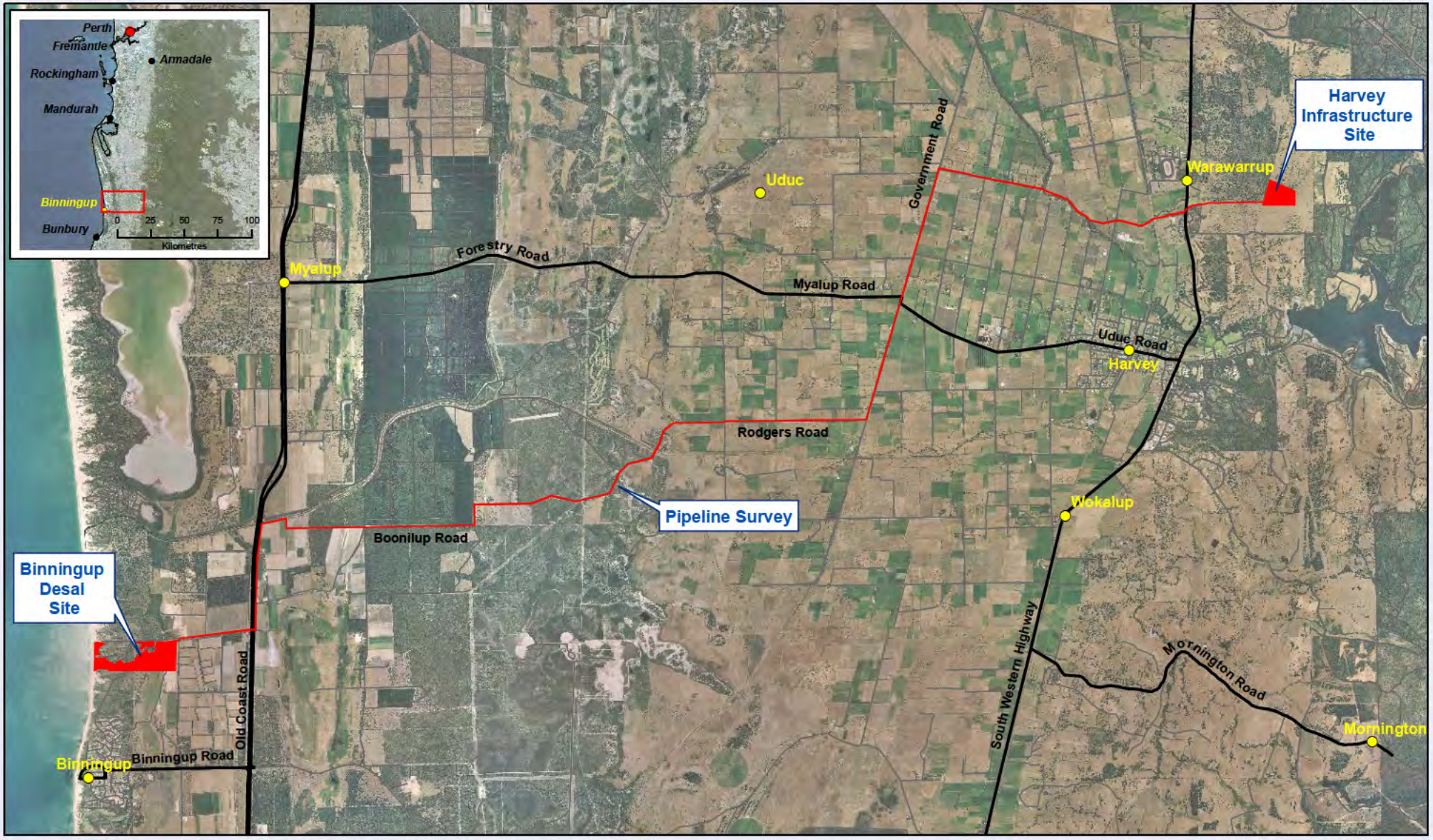


Figure 1

Locality Plan

0 1 2 3 4 5
Kilometres
1:100,000

Pipeline Survey Area

MAUNSELL | AECOM

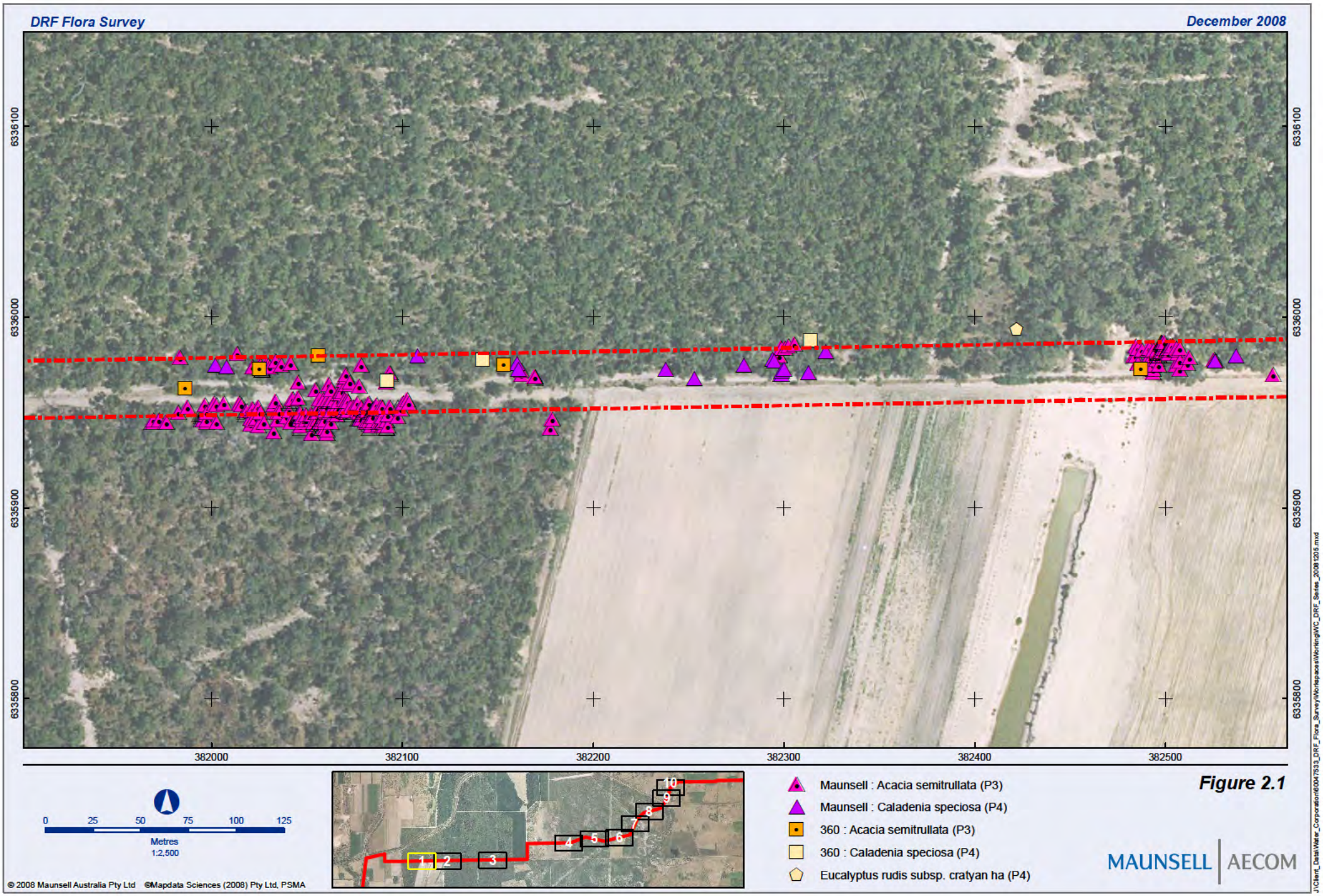

DRF Flora Survey
December 2008
6336100
6336000
6335900
6335800
382000
382100
382200
382300
382400
382500
0 25 50 75 100 125
Metres
1:2,500
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
Eucalyptus rudis subsp. cratyan ha (P4)
MAUNSELL AECOM
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Figure 2.1

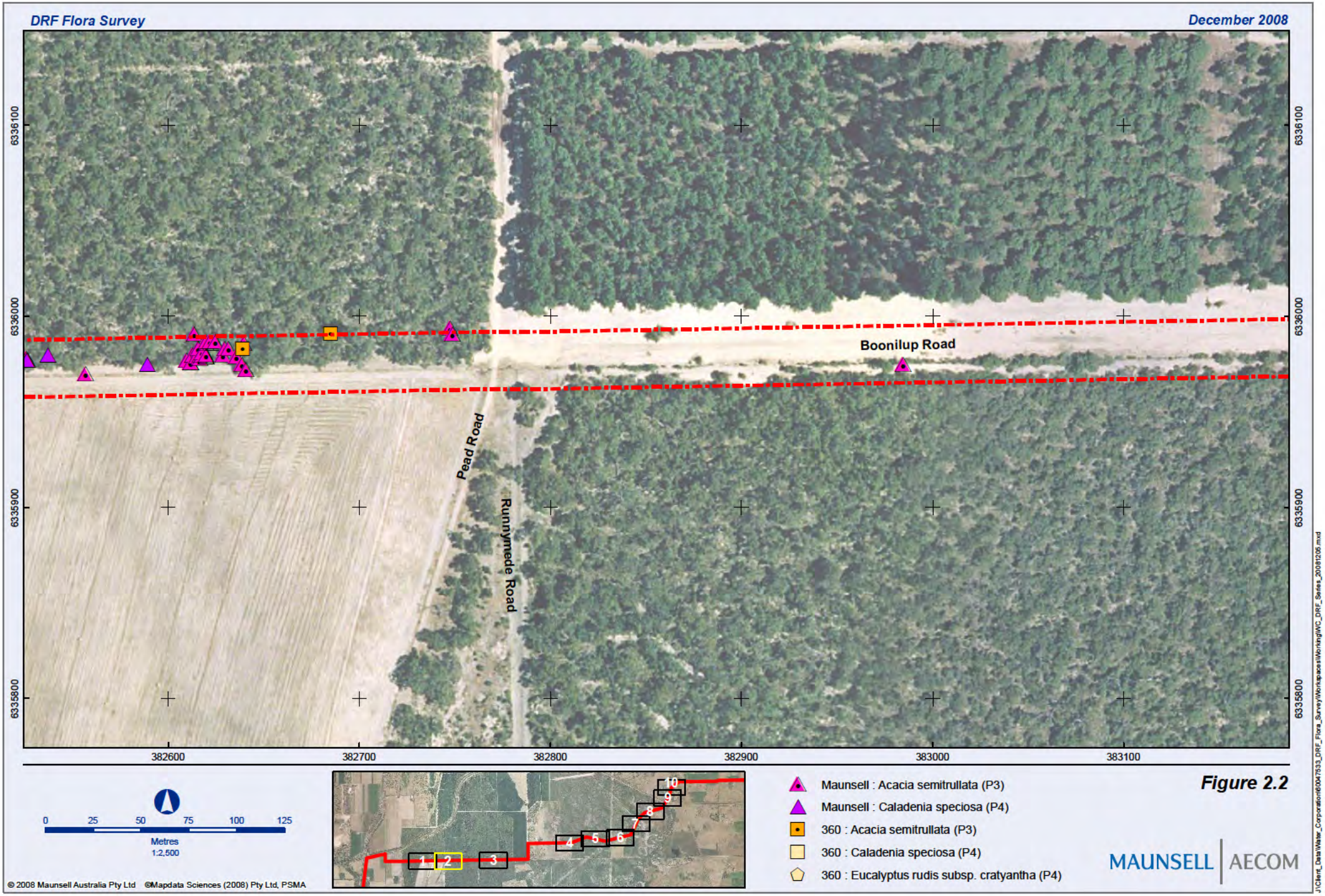


Figure 2.2

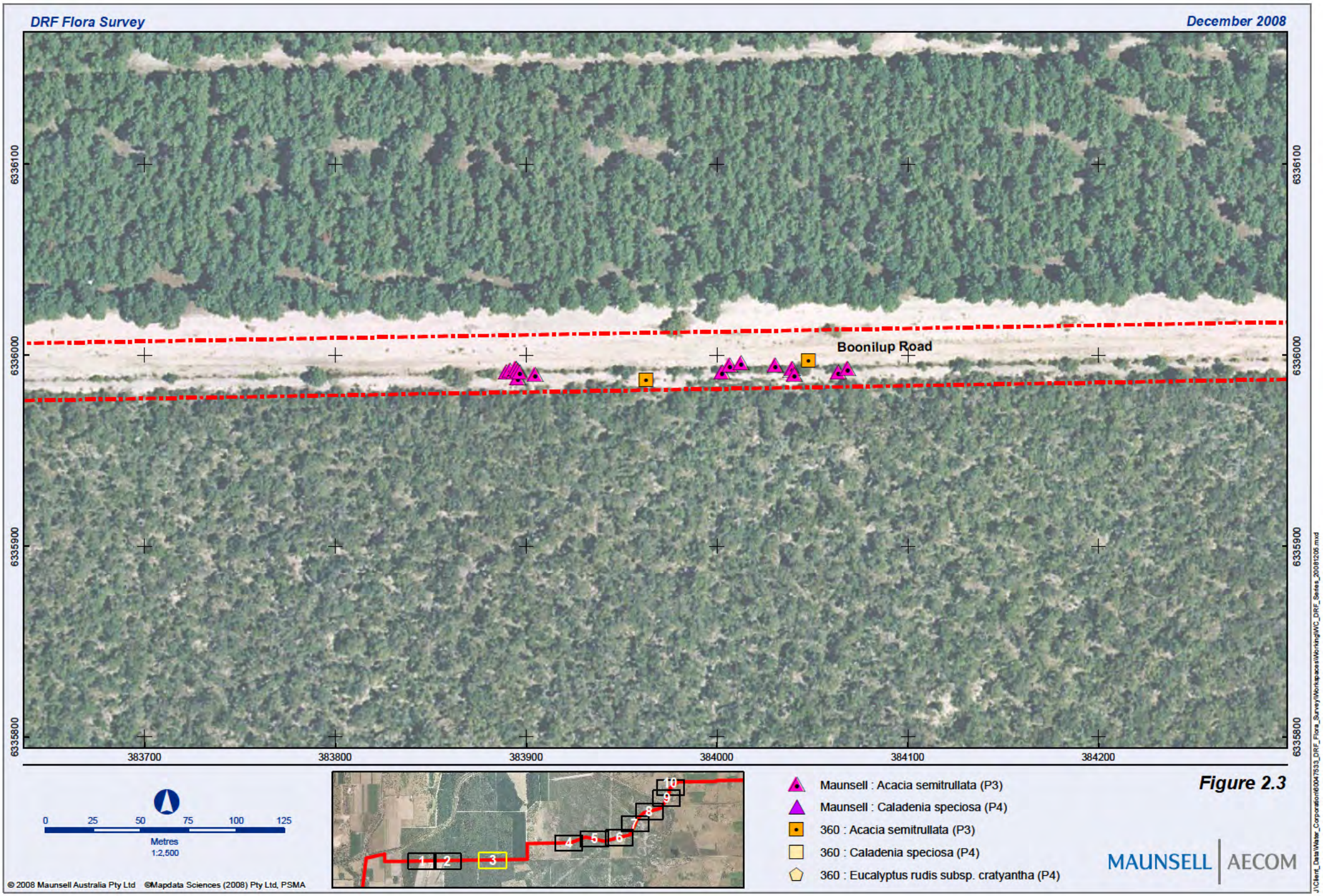

DRF Flora Survey
December 2008
Boonilup Road
6336100
6336000
6335900
6335800
383700
383800
383900
384000
384100
384200
0 25 50 75 100 125
Metres
1:2,500
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
360 : Eucalyptus rudis subsp. cratyantha (P4)
MAUNSELL AECOM
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\WorkspacesWorking\WC_DRF_Series_20081205.mxd

Figure 2.3

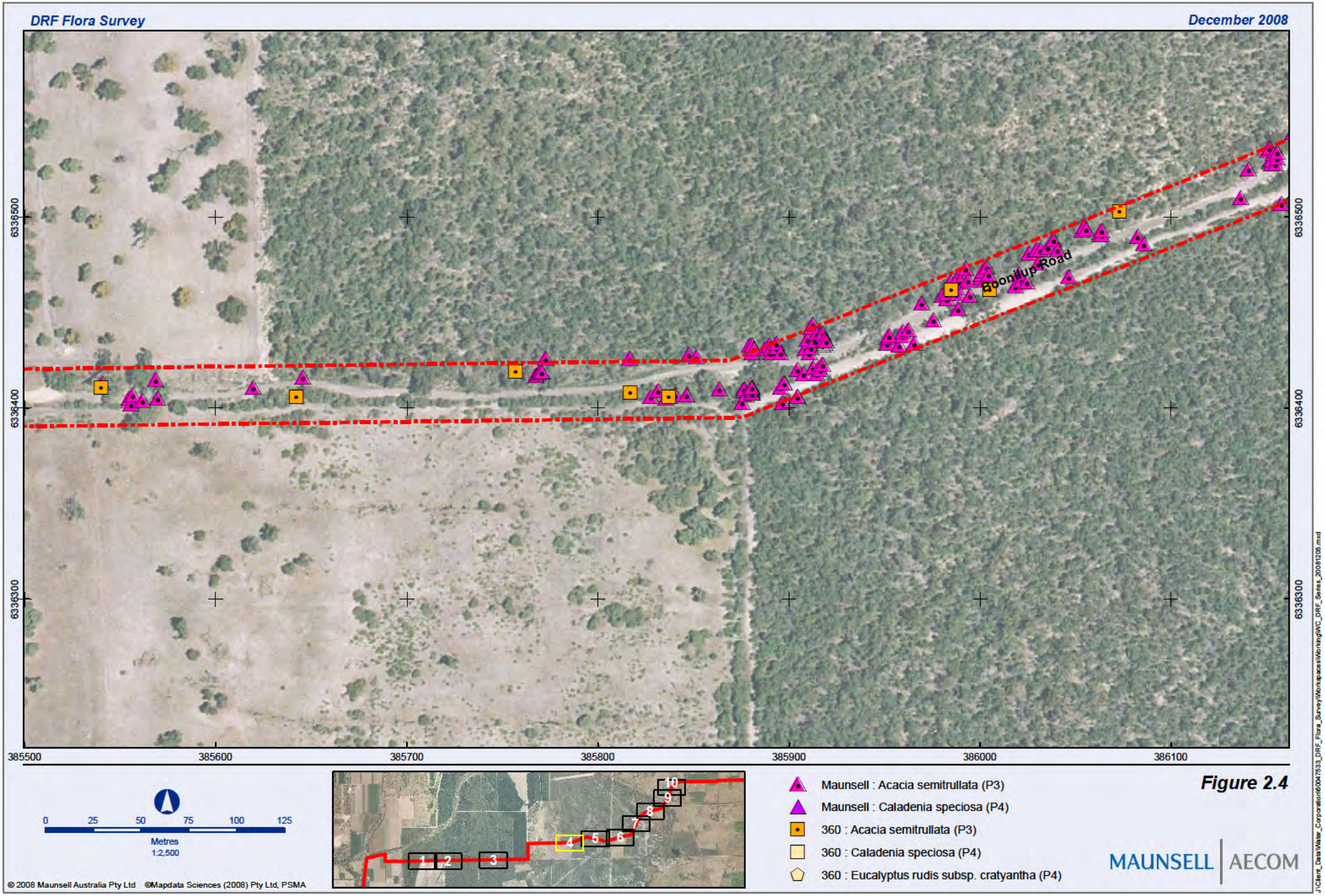
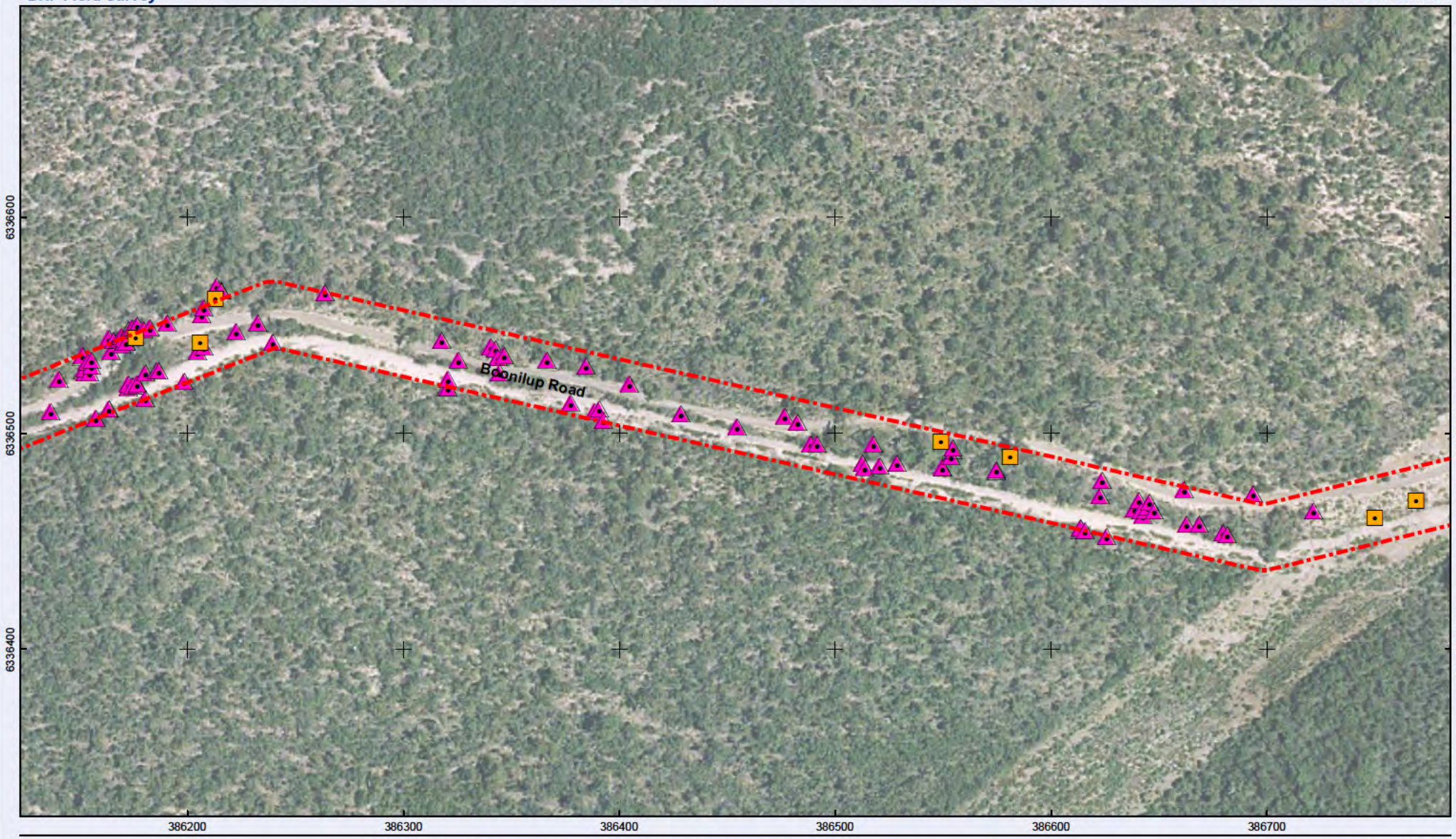

DRF Flora Survey
December 2008
Boonlup Road
6336500
6336400
6336300
385500
385600
385700
385800
385900
386000
386100
0 25 50 75 100 125
Metres
1:2,500
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
360 : Eucalyptus rudis subsp. cratyantha (P4)
MAUNSELL AECOM
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Figure 2.4

DRF Flora Survey

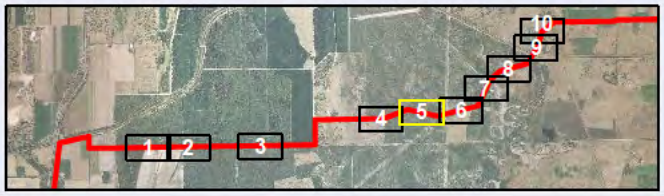
December 2008



0 25 50 75 100 125

Metres

1:2,500



- Maunsell : Acacia semitrullata (P3)
- Maunsell : Caladenia speciosa (P4)
- 360 : Acacia semitrullata (P3)
- 360 : Caladenia speciosa (P4)
- 360 : Eucalyptus rudis subsp. cratyantha (P4)

Figure 2.5

MAUNSELL | AECOM

J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

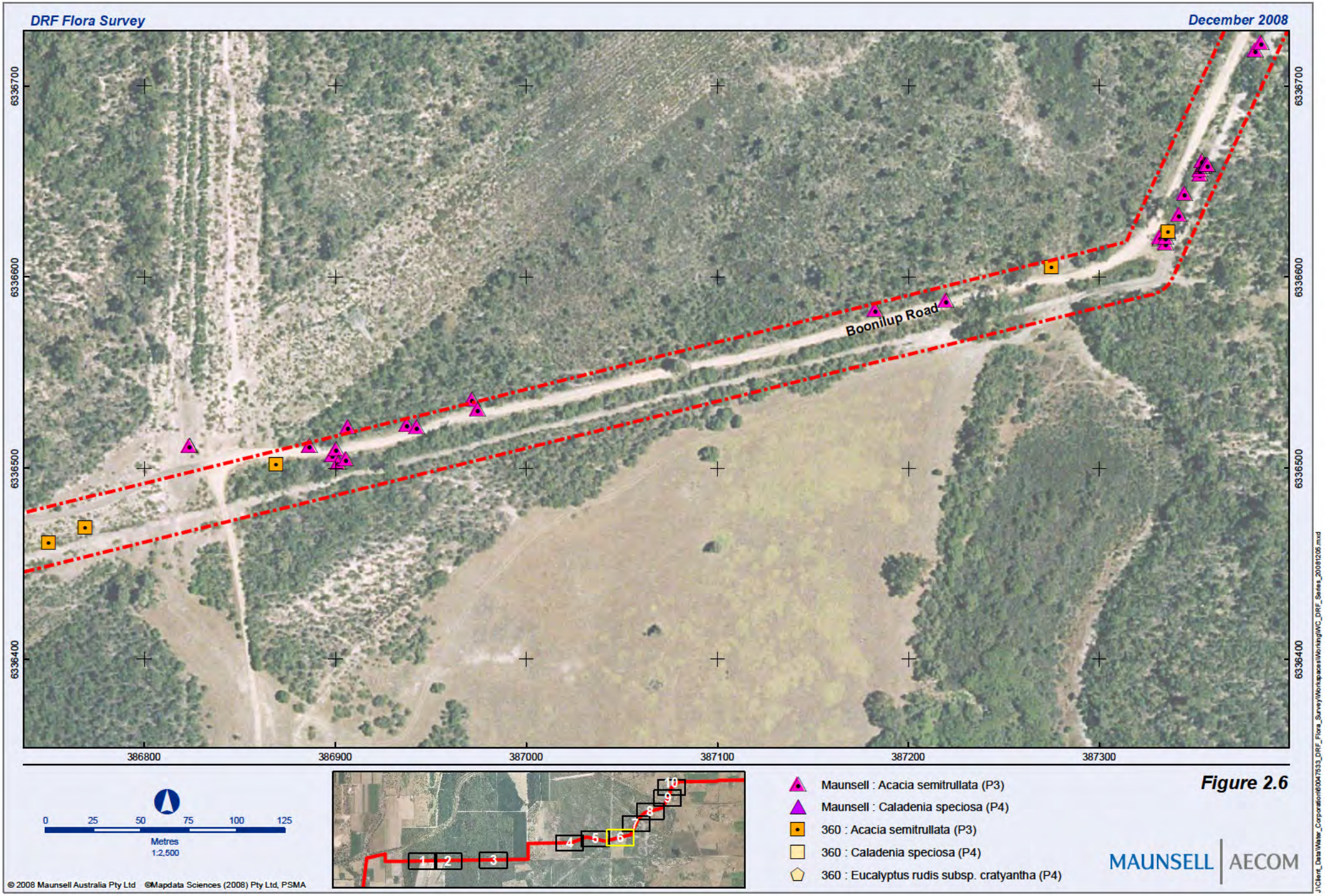

DRF Flora Survey
December 2008
Boonilup Road
6336700
6336600
6336500
6336400
386800
386900
387000
387100
387200
387300
0 25 50 75 100 125
Metres
1:2,500
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
360 : Eucalyptus rudis subsp. cratyantha (P4)
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
MAUNSELL AECOM
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Figure 2.6

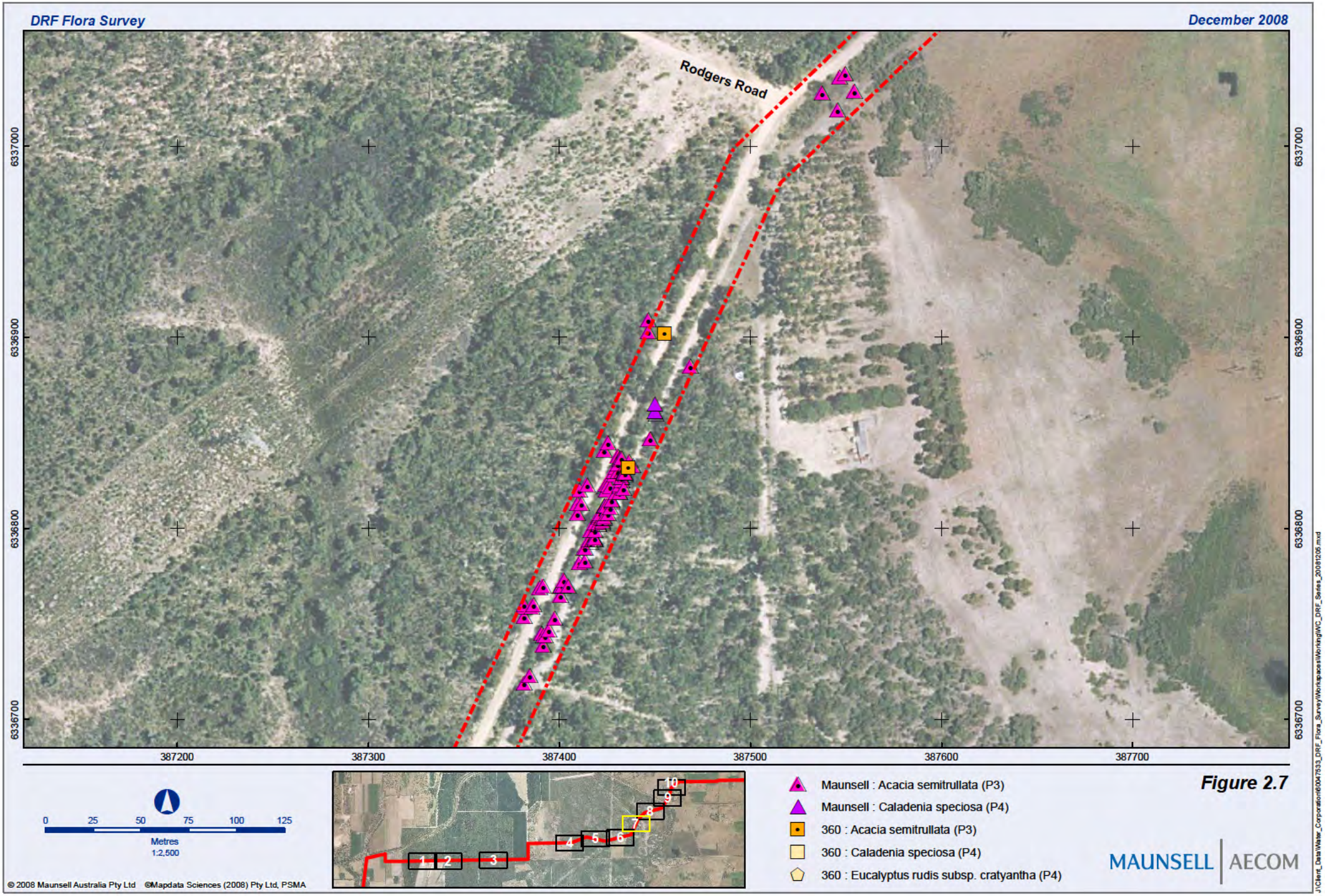

DRF Flora Survey
December 2008
Rodgers Road
6337000
6336900
6336800
6336700
387200
387300
387400
387500
387600
387700
0 25 50 75 100 125
Metres
1:2,500
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
360 : Eucalyptus rudis subsp. cratyantha (P4)
MAUNSELL AECOM
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Figure 2.7

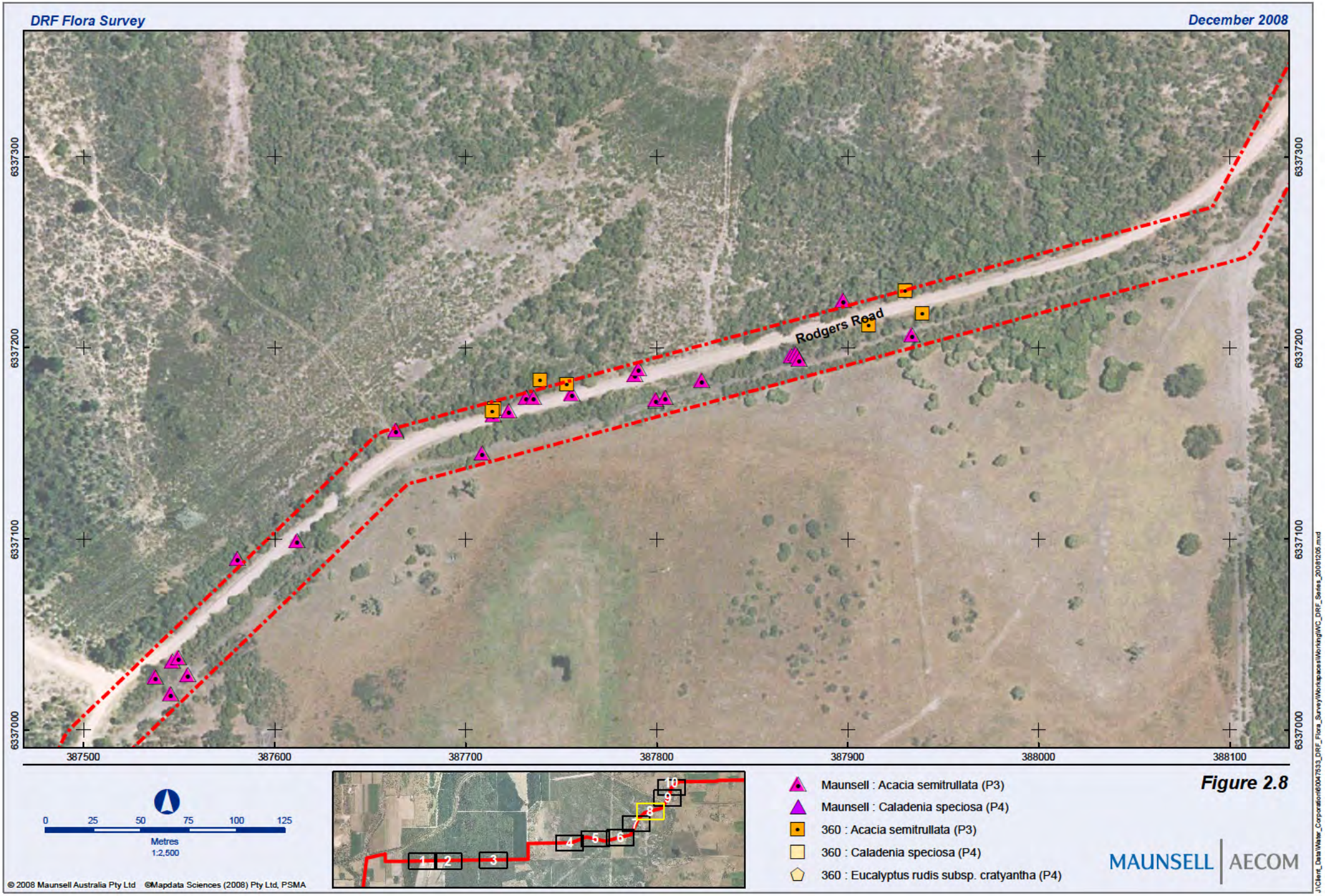

DRF Flora Survey
December 2008
Rodgers Road
6337300
6337200
6337100
6337000
387500
387600
387700
387800
387900
388000
388100
0 25 50 75 100 125
Metres
1:2,500
1 2 3 4 5 6 7 8 9 10
Maunsell : Acacia semitrullata (P3)
Maunsell : Caladenia speciosa (P4)
360 : Acacia semitrullata (P3)
360 : Caladenia speciosa (P4)
360 : Eucalyptus rudis subsp. cratyantha (P4)
© 2008 Maunsell Australia Pty Ltd ©Mapdata Sciences (2008) Pty Ltd, PSMA
MAUNSELL AECOM
J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Figure 2.8

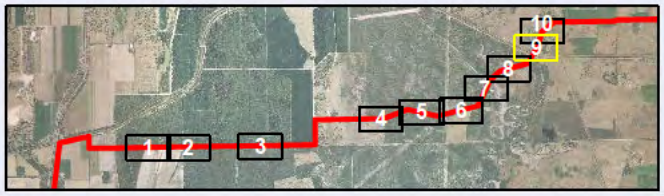
DRF Flora Survey

December 2008

0 25 50 75 100 125

Metres

1:2,500



- Maunsell : Acacia semitrullata (P3)
- Maunsell : Caladenia speciosa (P4)
- 360 : Acacia semitrullata (P3)
- 360 : Caladenia speciosa (P4)
- 360 : Eucalyptus rudis subsp. cratyantha (P4)

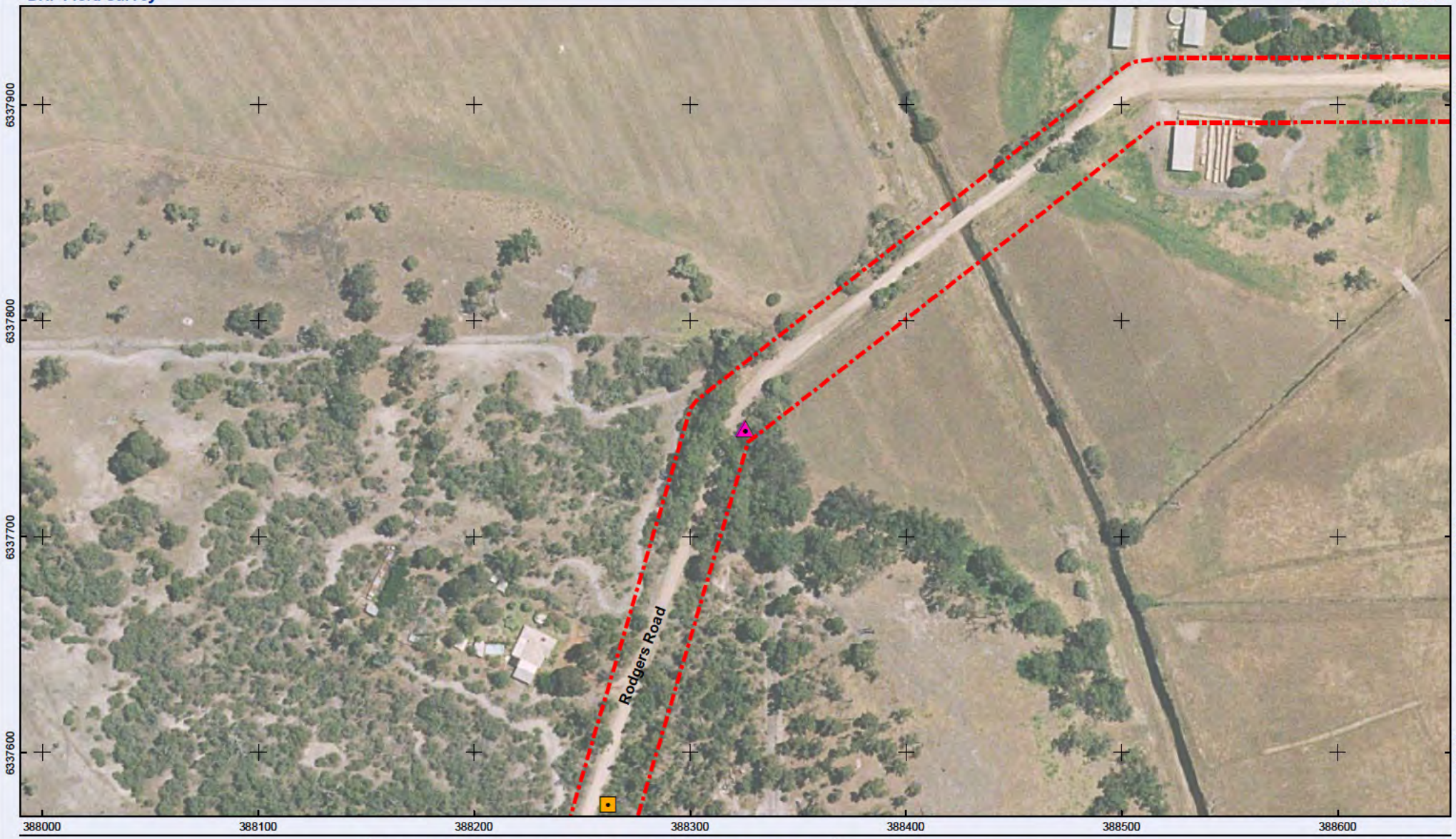
Figure 2.9

MAUNSELL | AECOM

J:\Client_Data\Water_Corporation\60047533_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

DRF Flora Survey

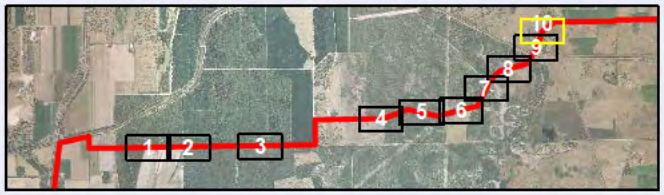
December 2008



0 25 50 75 100 125

Metres

1:2,500



Maunsell : Acacia semitrullata (P3)

Maunsell : Caladenia speciosa (P4)

360 : Acacia semitrullata (P3)

360 : Caladenia speciosa (P4)

360 : Eucalyptus rudis subsp. cratyantha (P4)

Figure 2.10

MAUNSELL | AECOM

J:\Client_Data\Water_Corporation\60047933_DRF_Flora_Survey\Workspaces\Working\WC_DRF_Series_20081205.mxd

Appendix A Recorded Locations of Significant Flora (Maunsell 2008)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
381968	6335945	*Acacia semitrullata* (P3)
381969	6335945	*Acacia semitrullata* (P3)
381969	6335946	*Acacia semitrullata* (P3)
381972	6335946	*Acacia semitrullata* (P3)
381975	6335945	*Acacia semitrullata* (P3)
381976	6335945	*Acacia semitrullata* (P3)
381982	6335950	*Acacia semitrullata* (P3)
381983	6335979	*Acacia semitrullata* (P3)
381987	6335953	*Acacia semitrullata* (P3)
381993	6335949	*Acacia semitrullata* (P3)
381994	6335946	*Acacia semitrullata* (P3)
381994	6335948	*Acacia semitrullata* (P3)
381994	6335949	*Acacia semitrullata* (P3)
381995	6335946	*Acacia semitrullata* (P3)
381995	6335946	*Acacia semitrullata* (P3)
381995	6335949	*Acacia semitrullata* (P3)
381996	6335949	*Acacia semitrullata* (P3)
381996	6335954	*Acacia semitrullata* (P3)
381997	6335945	*Acacia semitrullata* (P3)
381997	6335946	*Acacia semitrullata* (P3)
381997	6335950	*Acacia semitrullata* (P3)
382001	6335955	*Acacia semitrullata* (P3)
382002	6335945	*Acacia semitrullata* (P3)
382002	6335954	*Acacia semitrullata* (P3)
382006	6335955	*Acacia semitrullata* (P3)
382013	6335981	*Acacia semitrullata* (P3)
382014	6335955	*Acacia semitrullata* (P3)
382015	6335954	*Acacia semitrullata* (P3)
382017	6335949	*Acacia semitrullata* (P3)
382017	6335950	*Acacia semitrullata* (P3)
382017	6335951	*Acacia semitrullata* (P3)
382018	6335951	*Acacia semitrullata* (P3)
382020	6335944	*Acacia semitrullata* (P3)
382020	6335947	*Acacia semitrullata* (P3)
382020	6335951	*Acacia semitrullata* (P3)
382021	6335946	*Acacia semitrullata* (P3)
382021	6335952	*Acacia semitrullata* (P3)
382021	6335974	*Acacia semitrullata* (P3)
382023	6335947	*Acacia semitrullata* (P3)
382024	6335943	*Acacia semitrullata* (P3)
382024	6335953	*Acacia semitrullata* (P3)
382025	6335950	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382025	6335974	*Acacia semitrullata* (P3)
382025	6335975	*Acacia semitrullata* (P3)
382026	6335972	*Acacia semitrullata* (P3)
382026	6335972	*Acacia semitrullata* (P3)
382026	6335973	*Acacia semitrullata* (P3)
382027	6335945	*Acacia semitrullata* (P3)
382028	6335975	*Acacia semitrullata* (P3)
382029	6335975	*Acacia semitrullata* (P3)
382030	6335974	*Acacia semitrullata* (P3)
382032	6335940	*Acacia semitrullata* (P3)
382032	6335954	*Acacia semitrullata* (P3)
382033	6335956	*Acacia semitrullata* (P3)
382033	6335977	*Acacia semitrullata* (P3)
382034	6335946	*Acacia semitrullata* (P3)
382034	6335950	*Acacia semitrullata* (P3)
382035	6335950	*Acacia semitrullata* (P3)
382036	6335975	*Acacia semitrullata* (P3)
382039	6335948	*Acacia semitrullata* (P3)
382040	6335951	*Acacia semitrullata* (P3)
382040	6335955	*Acacia semitrullata* (P3)
382041	6335945	*Acacia semitrullata* (P3)
382041	6335956	*Acacia semitrullata* (P3)
382041	6335976	*Acacia semitrullata* (P3)
382042	6335956	*Acacia semitrullata* (P3)
382042	6335957	*Acacia semitrullata* (P3)
382042	6335957	*Acacia semitrullata* (P3)
382044	6335947	*Acacia semitrullata* (P3)
382044	6335948	*Acacia semitrullata* (P3)
382044	6335948	*Acacia semitrullata* (P3)
382045	6335946	*Acacia semitrullata* (P3)
382045	6335947	*Acacia semitrullata* (P3)
382045	6335947	*Acacia semitrullata* (P3)
382045	6335947	*Acacia semitrullata* (P3)
382045	6335948	*Acacia semitrullata* (P3)
382045	6335949	*Acacia semitrullata* (P3)
382045	6335958	*Acacia semitrullata* (P3)
382045	6335966	*Acacia semitrullata* (P3)
382046	6335942	*Acacia semitrullata* (P3)
382046	6335943	*Acacia semitrullata* (P3)
382046	6335950	*Acacia semitrullata* (P3)
382047	6335945	*Acacia semitrullata* (P3)
382047	6335946	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382047	6335948	*Acacia semitrullata* (P3)
382047	6335948	*Acacia semitrullata* (P3)
382047	6335948	*Acacia semitrullata* (P3)
382047	6335948	*Acacia semitrullata* (P3)
382049	6335946	*Acacia semitrullata* (P3)
382049	6335949	*Acacia semitrullata* (P3)
382051	6335948	*Acacia semitrullata* (P3)
382051	6335949	*Acacia semitrullata* (P3)
382052	6335939	*Acacia semitrullata* (P3)
382052	6335947	*Acacia semitrullata* (P3)
382052	6335948	*Acacia semitrullata* (P3)
382052	6335949	*Acacia semitrullata* (P3)
382053	6335944	*Acacia semitrullata* (P3)
382053	6335945	*Acacia semitrullata* (P3)
382054	6335950	*Acacia semitrullata* (P3)
382054	6335950	*Acacia semitrullata* (P3)
382054	6335962	*Acacia semitrullata* (P3)
382055	6335944	*Acacia semitrullata* (P3)
382055	6335947	*Acacia semitrullata* (P3)
382055	6335950	*Acacia semitrullata* (P3)
382055	6335952	*Acacia semitrullata* (P3)
382056	6335942	*Acacia semitrullata* (P3)
382056	6335943	*Acacia semitrullata* (P3)
382056	6335945	*Acacia semitrullata* (P3)
382056	6335945	*Acacia semitrullata* (P3)
382056	6335945	*Acacia semitrullata* (P3)
382056	6335957	*Acacia semitrullata* (P3)
382057	6335942	*Acacia semitrullata* (P3)
382057	6335942	*Acacia semitrullata* (P3)
382057	6335944	*Acacia semitrullata* (P3)
382057	6335944	*Acacia semitrullata* (P3)
382057	6335945	*Acacia semitrullata* (P3)
382057	6335945	*Acacia semitrullata* (P3)
382057	6335947	*Acacia semitrullata* (P3)
382058	6335942	*Acacia semitrullata* (P3)
382058	6335943	*Acacia semitrullata* (P3)
382058	6335945	*Acacia semitrullata* (P3)
382058	6335946	*Acacia semitrullata* (P3)
382058	6335946	*Acacia semitrullata* (P3)
382058	6335946	*Acacia semitrullata* (P3)
382058	6335948	*Acacia semitrullata* (P3)
382058	6335950	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382058	6335952	*Acacia semitrullata* (P3)
382058	6335954	*Acacia semitrullata* (P3)
382058	6335954	*Acacia semitrullata* (P3)
382058	6335957	*Acacia semitrullata* (P3)
382059	6335942	*Acacia semitrullata* (P3)
382059	6335945	*Acacia semitrullata* (P3)
382059	6335946	*Acacia semitrullata* (P3)
382059	6335951	*Acacia semitrullata* (P3)
382059	6335953	*Acacia semitrullata* (P3)
382060	6335939	*Acacia semitrullata* (P3)
382060	6335941	*Acacia semitrullata* (P3)
382060	6335953	*Acacia semitrullata* (P3)
382060	6335956	*Acacia semitrullata* (P3)
382060	6335957	*Acacia semitrullata* (P3)
382061	6335950	*Acacia semitrullata* (P3)
382061	6335956	*Acacia semitrullata* (P3)
382061	6335956	*Acacia semitrullata* (P3)
382061	6335965	*Acacia semitrullata* (P3)
382062	6335945	*Acacia semitrullata* (P3)
382062	6335951	*Acacia semitrullata* (P3)
382062	6335957	*Acacia semitrullata* (P3)
382062	6335962	*Acacia semitrullata* (P3)
382064	6335956	*Acacia semitrullata* (P3)
382064	6335956	*Acacia semitrullata* (P3)
382064	6335957	*Acacia semitrullata* (P3)
382065	6335949	*Acacia semitrullata* (P3)
382065	6335949	*Acacia semitrullata* (P3)
382065	6335951	*Acacia semitrullata* (P3)
382065	6335954	*Acacia semitrullata* (P3)
382066	6335951	*Acacia semitrullata* (P3)
382066	6335951	*Acacia semitrullata* (P3)
382066	6335952	*Acacia semitrullata* (P3)
382066	6335956	*Acacia semitrullata* (P3)
382066	6335956	*Acacia semitrullata* (P3)
382066	6335960	*Acacia semitrullata* (P3)
382067	6335960	*Acacia semitrullata* (P3)
382067	6335961	*Acacia semitrullata* (P3)
382068	6335951	*Acacia semitrullata* (P3)
382068	6335961	*Acacia semitrullata* (P3)
382069	6335951	*Acacia semitrullata* (P3)
382069	6335953	*Acacia semitrullata* (P3)
382069	6335957	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382069	6335967	*Acacia semitrullata* (P3)
382069	6335969	*Acacia semitrullata* (P3)
382070	6335949	*Acacia semitrullata* (P3)
382070	6335950	*Acacia semitrullata* (P3)
382070	6335950	*Acacia semitrullata* (P3)
382070	6335953	*Acacia semitrullata* (P3)
382070	6335956	*Acacia semitrullata* (P3)
382070	6335965	*Acacia semitrullata* (P3)
382070	6335969	*Acacia semitrullata* (P3)
382070	6335970	*Acacia semitrullata* (P3)
382071	6335951	*Acacia semitrullata* (P3)
382071	6335956	*Acacia semitrullata* (P3)
382071	6335956	*Acacia semitrullata* (P3)
382072	6335953	*Acacia semitrullata* (P3)
382072	6335965	*Acacia semitrullata* (P3)
382072	6335966	*Acacia semitrullata* (P3)
382074	6335953	*Acacia semitrullata* (P3)
382074	6335953	*Acacia semitrullata* (P3)
382075	6335950	*Acacia semitrullata* (P3)
382076	6335947	*Acacia semitrullata* (P3)
382076	6335950	*Acacia semitrullata* (P3)
382076	6335951	*Acacia semitrullata* (P3)
382076	6335951	*Acacia semitrullata* (P3)
382076	6335955	*Acacia semitrullata* (P3)
382077	6335947	*Acacia semitrullata* (P3)
382077	6335947	*Acacia semitrullata* (P3)
382077	6335949	*Acacia semitrullata* (P3)
382077	6335950	*Acacia semitrullata* (P3)
382077	6335950	*Acacia semitrullata* (P3)
382077	6335950	*Acacia semitrullata* (P3)
382077	6335964	*Acacia semitrullata* (P3)
382078	6335947	*Acacia semitrullata* (P3)
382078	6335949	*Acacia semitrullata* (P3)
382078	6335952	*Acacia semitrullata* (P3)
382078	6335952	*Acacia semitrullata* (P3)
382078	6335953	*Acacia semitrullata* (P3)
382078	6335975	*Acacia semitrullata* (P3)
382079	6335950	*Acacia semitrullata* (P3)
382079	6335951	*Acacia semitrullata* (P3)
382080	6335946	*Acacia semitrullata* (P3)
382080	6335952	*Acacia semitrullata* (P3)
382081	6335945	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382081	6335945	*Acacia semitrullata* (P3)
382081	6335946	*Acacia semitrullata* (P3)
382081	6335951	*Acacia semitrullata* (P3)
382081	6335953	*Acacia semitrullata* (P3)
382081	6335953	*Acacia semitrullata* (P3)
382081	6335954	*Acacia semitrullata* (P3)
382082	6335942	*Acacia semitrullata* (P3)
382082	6335944	*Acacia semitrullata* (P3)
382082	6335946	*Acacia semitrullata* (P3)
382082	6335954	*Acacia semitrullata* (P3)
382082	6335955	*Acacia semitrullata* (P3)
382083	6335943	*Acacia semitrullata* (P3)
382083	6335945	*Acacia semitrullata* (P3)
382083	6335948	*Acacia semitrullata* (P3)
382083	6335950	*Acacia semitrullata* (P3)
382083	6335951	*Acacia semitrullata* (P3)
382084	6335946	*Acacia semitrullata* (P3)
382084	6335948	*Acacia semitrullata* (P3)
382084	6335952	*Acacia semitrullata* (P3)
382084	6335952	*Acacia semitrullata* (P3)
382085	6335953	*Acacia semitrullata* (P3)
382085	6335953	*Acacia semitrullata* (P3)
382086	6335954	*Acacia semitrullata* (P3)
382087	6335944	*Acacia semitrullata* (P3)
382087	6335946	*Acacia semitrullata* (P3)
382088	6335945	*Acacia semitrullata* (P3)
382088	6335952	*Acacia semitrullata* (P3)
382088	6335953	*Acacia semitrullata* (P3)
382089	6335943	*Acacia semitrullata* (P3)
382089	6335945	*Acacia semitrullata* (P3)
382089	6335945	*Acacia semitrullata* (P3)
382089	6335948	*Acacia semitrullata* (P3)
382089	6335953	*Acacia semitrullata* (P3)
382089	6335953	*Acacia semitrullata* (P3)
382090	6335943	*Acacia semitrullata* (P3)
382090	6335945	*Acacia semitrullata* (P3)
382091	6335942	*Acacia semitrullata* (P3)
382091	6335942	*Acacia semitrullata* (P3)
382091	6335946	*Acacia semitrullata* (P3)
382091	6335946	*Acacia semitrullata* (P3)
382091	6335966	*Acacia semitrullata* (P3)
382092	6335943	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382092	6335949	*Acacia semitrullata* (P3)
382092	6335949	*Acacia semitrullata* (P3)
382093	6335953	*Acacia semitrullata* (P3)
382093	6335970	*Acacia semitrullata* (P3)
382093	6335971	*Acacia semitrullata* (P3)
382097	6335948	*Acacia semitrullata* (P3)
382097	6335953	*Acacia semitrullata* (P3)
382099	6335952	*Acacia semitrullata* (P3)
382099	6335954	*Acacia semitrullata* (P3)
382100	6335955	*Acacia semitrullata* (P3)
382100	6335955	*Acacia semitrullata* (P3)
382100	6335955	*Acacia semitrullata* (P3)
382102	6335957	*Acacia semitrullata* (P3)
382103	6335955	*Acacia semitrullata* (P3)
382161	6335973	*Acacia semitrullata* (P3)
382162	6335970	*Acacia semitrullata* (P3)
382162	6335972	*Acacia semitrullata* (P3)
382169	6335968	*Acacia semitrullata* (P3)
382169	6335969	*Acacia semitrullata* (P3)
382169	6335969	*Acacia semitrullata* (P3)
382169	6335969	*Acacia semitrullata* (P3)
382177	6335942	*Acacia semitrullata* (P3)
382178	6335947	*Acacia semitrullata* (P3)
382297	6335980	*Acacia semitrullata* (P3)
382297	6335980	*Acacia semitrullata* (P3)
382298	6335984	*Acacia semitrullata* (P3)
382298	6335984	*Acacia semitrullata* (P3)
382298	6335984	*Acacia semitrullata* (P3)
382300	6335984	*Acacia semitrullata* (P3)
382302	6335985	*Acacia semitrullata* (P3)
382305	6335986	*Acacia semitrullata* (P3)
382483	6335980	*Acacia semitrullata* (P3)
382484	6335980	*Acacia semitrullata* (P3)
382484	6335985	*Acacia semitrullata* (P3)
382485	6335976	*Acacia semitrullata* (P3)
382485	6335984	*Acacia semitrullata* (P3)
382485	6335984	*Acacia semitrullata* (P3)
382487	6335983	*Acacia semitrullata* (P3)
382488	6335975	*Acacia semitrullata* (P3)
382489	6335976	*Acacia semitrullata* (P3)
382489	6335976	*Acacia semitrullata* (P3)
382490	6335976	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382490	6335978	*Acacia semitrullata* (P3)
382490	6335983	*Acacia semitrullata* (P3)
382491	6335974	*Acacia semitrullata* (P3)
382491	6335983	*Acacia semitrullata* (P3)
382491	6335983	*Acacia semitrullata* (P3)
382491	6335984	*Acacia semitrullata* (P3)
382491	6335984	*Acacia semitrullata* (P3)
382491	6335984	*Acacia semitrullata* (P3)
382492	6335979	*Acacia semitrullata* (P3)
382493	6335971	*Acacia semitrullata* (P3)
382493	6335973	*Acacia semitrullata* (P3)
382493	6335973	*Acacia semitrullata* (P3)
382493	6335975	*Acacia semitrullata* (P3)
382493	6335975	*Acacia semitrullata* (P3)
382493	6335983	*Acacia semitrullata* (P3)
382495	6335978	*Acacia semitrullata* (P3)
382495	6335980	*Acacia semitrullata* (P3)
382495	6335980	*Acacia semitrullata* (P3)
382495	6335981	*Acacia semitrullata* (P3)
382495	6335982	*Acacia semitrullata* (P3)
382495	6335983	*Acacia semitrullata* (P3)
382496	6335975	*Acacia semitrullata* (P3)
382496	6335980	*Acacia semitrullata* (P3)
382496	6335980	*Acacia semitrullata* (P3)
382496	6335980	*Acacia semitrullata* (P3)
382496	6335981	*Acacia semitrullata* (P3)
382497	6335981	*Acacia semitrullata* (P3)
382497	6335982	*Acacia semitrullata* (P3)
382497	6335982	*Acacia semitrullata* (P3)
382497	6335986	*Acacia semitrullata* (P3)
382497	6335987	*Acacia semitrullata* (P3)
382497	6335987	*Acacia semitrullata* (P3)
382498	6335982	*Acacia semitrullata* (P3)
382498	6335985	*Acacia semitrullata* (P3)
382498	6335986	*Acacia semitrullata* (P3)
382498	6335986	*Acacia semitrullata* (P3)
382498	6335986	*Acacia semitrullata* (P3)
382498	6335987	*Acacia semitrullata* (P3)
382499	6335984	*Acacia semitrullata* (P3)
382499	6335986	*Acacia semitrullata* (P3)
382499	6335987	*Acacia semitrullata* (P3)
382500	6335980	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382500	6335983	*Acacia semitrullata* (P3)
382500	6335983	*Acacia semitrullata* (P3)
382500	6335983	*Acacia semitrullata* (P3)
382501	6335980	*Acacia semitrullata* (P3)
382501	6335981	*Acacia semitrullata* (P3)
382501	6335983	*Acacia semitrullata* (P3)
382502	6335983	*Acacia semitrullata* (P3)
382502	6335983	*Acacia semitrullata* (P3)
382502	6335983	*Acacia semitrullata* (P3)
382502	6335984	*Acacia semitrullata* (P3)
382502	6335985	*Acacia semitrullata* (P3)
382503	6335985	*Acacia semitrullata* (P3)
382505	6335975	*Acacia semitrullata* (P3)
382505	6335984	*Acacia semitrullata* (P3)
382505	6335984	*Acacia semitrullata* (P3)
382505	6335984	*Acacia semitrullata* (P3)
382506	6335977	*Acacia semitrullata* (P3)
382506	6335981	*Acacia semitrullata* (P3)
382506	6335981	*Acacia semitrullata* (P3)
382506	6335983	*Acacia semitrullata* (P3)
382507	6335973	*Acacia semitrullata* (P3)
382507	6335977	*Acacia semitrullata* (P3)
382507	6335984	*Acacia semitrullata* (P3)
382511	6335976	*Acacia semitrullata* (P3)
382512	6335979	*Acacia semitrullata* (P3)
382525	6335977	*Acacia semitrullata* (P3)
382525	6335977	*Acacia semitrullata* (P3)
382525	6335978	*Acacia semitrullata* (P3)
382526	6335977	*Acacia semitrullata* (P3)
382556	6335970	*Acacia semitrullata* (P3)
382609	6335977	*Acacia semitrullata* (P3)
382611	6335976	*Acacia semitrullata* (P3)
382611	6335976	*Acacia semitrullata* (P3)
382611	6335976	*Acacia semitrullata* (P3)
382612	6335980	*Acacia semitrullata* (P3)
382613	6335991	*Acacia semitrullata* (P3)
382614	6335979	*Acacia semitrullata* (P3)
382615	6335983	*Acacia semitrullata* (P3)
382615	6335983	*Acacia semitrullata* (P3)
382616	6335978	*Acacia semitrullata* (P3)
382616	6335980	*Acacia semitrullata* (P3)
382617	6335981	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
382617	6335981	*Acacia semitrullata* (P3)
382619	6335979	*Acacia semitrullata* (P3)
382619	6335979	*Acacia semitrullata* (P3)
382619	6335979	*Acacia semitrullata* (P3)
382619	6335980	*Acacia semitrullata* (P3)
382619	6335980	*Acacia semitrullata* (P3)
382619	6335986	*Acacia semitrullata* (P3)
382619	6335987	*Acacia semitrullata* (P3)
382621	6335987	*Acacia semitrullata* (P3)
382623	6335986	*Acacia semitrullata* (P3)
382624	6335986	*Acacia semitrullata* (P3)
382624	6335987	*Acacia semitrullata* (P3)
382628	6335980	*Acacia semitrullata* (P3)
382629	6335983	*Acacia semitrullata* (P3)
382631	6335983	*Acacia semitrullata* (P3)
382635	6335979	*Acacia semitrullata* (P3)
382638	6335975	*Acacia semitrullata* (P3)
382639	6335986	*Acacia semitrullata* (P3)
382640	6335972	*Acacia semitrullata* (P3)
382747	6335994	*Acacia semitrullata* (P3)
382748	6335991	*Acacia semitrullata* (P3)
382984	6335975	*Acacia semitrullata* (P3)
383889	6335991	*Acacia semitrullata* (P3)
383891	6335992	*Acacia semitrullata* (P3)
383893	6335991	*Acacia semitrullata* (P3)
383894	6335993	*Acacia semitrullata* (P3)
383894	6335993	*Acacia semitrullata* (P3)
383895	6335988	*Acacia semitrullata* (P3)
383895	6335992	*Acacia semitrullata* (P3)
383896	6335991	*Acacia semitrullata* (P3)
383904	6335990	*Acacia semitrullata* (P3)
384002	6335991	*Acacia semitrullata* (P3)
384006	6335995	*Acacia semitrullata* (P3)
384012	6335996	*Acacia semitrullata* (P3)
384030	6335995	*Acacia semitrullata* (P3)
384038	6335992	*Acacia semitrullata* (P3)
384039	6335993	*Acacia semitrullata* (P3)
384040	6335990	*Acacia semitrullata* (P3)
384063	6335991	*Acacia semitrullata* (P3)
384068	6335993	*Acacia semitrullata* (P3)
385540	6336413	*Acacia semitrullata* (P3)
385554	6336404	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
385554	6336405	*Acacia semitrullata* (P3)
385555	6336402	*Acacia semitrullata* (P3)
385556	6336407	*Acacia semitrullata* (P3)
385561	6336404	*Acacia semitrullata* (P3)
385568	6336415	*Acacia semitrullata* (P3)
385569	6336405	*Acacia semitrullata* (P3)
385619	6336411	*Acacia semitrullata* (P3)
385645	6336416	*Acacia semitrullata* (P3)
385767	6336417	*Acacia semitrullata* (P3)
385767	6336417	*Acacia semitrullata* (P3)
385768	6336418	*Acacia semitrullata* (P3)
385769	6336419	*Acacia semitrullata* (P3)
385770	6336419	*Acacia semitrullata* (P3)
385770	6336419	*Acacia semitrullata* (P3)
385772	6336426	*Acacia semitrullata* (P3)
385816	6336426	*Acacia semitrullata* (P3)
385827	6336406	*Acacia semitrullata* (P3)
385831	6336409	*Acacia semitrullata* (P3)
385835	6336405	*Acacia semitrullata* (P3)
385837	6336406	*Acacia semitrullata* (P3)
385840	6336407	*Acacia semitrullata* (P3)
385846	6336407	*Acacia semitrullata* (P3)
385847	6336428	*Acacia semitrullata* (P3)
385851	6336427	*Acacia semitrullata* (P3)
385863	6336410	*Acacia semitrullata* (P3)
385875	6336403	*Acacia semitrullata* (P3)
385875	6336409	*Acacia semitrullata* (P3)
385876	6336409	*Acacia semitrullata* (P3)
385876	6336410	*Acacia semitrullata* (P3)
385877	6336407	*Acacia semitrullata* (P3)
385879	6336410	*Acacia semitrullata* (P3)
385879	6336433	*Acacia semitrullata* (P3)
385880	6336408	*Acacia semitrullata* (P3)
385880	6336408	*Acacia semitrullata* (P3)
385880	6336408	*Acacia semitrullata* (P3)
385880	6336409	*Acacia semitrullata* (P3)
385880	6336410	*Acacia semitrullata* (P3)
385880	6336411	*Acacia semitrullata* (P3)
385880	6336411	*Acacia semitrullata* (P3)
385880	6336429	*Acacia semitrullata* (P3)
385880	6336433	*Acacia semitrullata* (P3)
385881	6336431	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
385881	6336431	*Acacia semitrullata* (P3)
385881	6336431	*Acacia semitrullata* (P3)
385887	6336431	*Acacia semitrullata* (P3)
385888	6336431	*Acacia semitrullata* (P3)
385889	6336433	*Acacia semitrullata* (P3)
385890	6336429	*Acacia semitrullata* (P3)
385890	6336431	*Acacia semitrullata* (P3)
385890	6336431	*Acacia semitrullata* (P3)
385890	6336431	*Acacia semitrullata* (P3)
385892	6336431	*Acacia semitrullata* (P3)
385892	6336431	*Acacia semitrullata* (P3)
385892	6336432	*Acacia semitrullata* (P3)
385893	6336432	*Acacia semitrullata* (P3)
385893	6336432	*Acacia semitrullata* (P3)
385893	6336432	*Acacia semitrullata* (P3)
385893	6336434	*Acacia semitrullata* (P3)
385895	6336411	*Acacia semitrullata* (P3)
385895	6336429	*Acacia semitrullata* (P3)
385896	6336403	*Acacia semitrullata* (P3)
385897	6336413	*Acacia semitrullata* (P3)
385897	6336413	*Acacia semitrullata* (P3)
385904	6336406	*Acacia semitrullata* (P3)
385904	6336406	*Acacia semitrullata* (P3)
385904	6336420	*Acacia semitrullata* (P3)
385907	6336418	*Acacia semitrullata* (P3)
385908	6336431	*Acacia semitrullata* (P3)
385909	6336436	*Acacia semitrullata* (P3)
385910	6336429	*Acacia semitrullata* (P3)
385911	6336432	*Acacia semitrullata* (P3)
385911	6336442	*Acacia semitrullata* (P3)
385912	6336421	*Acacia semitrullata* (P3)
385912	6336444	*Acacia semitrullata* (P3)
385913	6336435	*Acacia semitrullata* (P3)
385914	6336418	*Acacia semitrullata* (P3)
385914	6336439	*Acacia semitrullata* (P3)
385915	6336421	*Acacia semitrullata* (P3)
385916	6336420	*Acacia semitrullata* (P3)
385916	6336439	*Acacia semitrullata* (P3)
385917	6336423	*Acacia semitrullata* (P3)
385917	6336433	*Acacia semitrullata* (P3)
385917	6336435	*Acacia semitrullata* (P3)
385917	6336438	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
385917	6336439	*Acacia semitrullata* (P3)
385918	6336434	*Acacia semitrullata* (P3)
385918	6336436	*Acacia semitrullata* (P3)
385919	6336435	*Acacia semitrullata* (P3)
385950	6336434	*Acacia semitrullata* (P3)
385951	6336434	*Acacia semitrullata* (P3)
385951	6336437	*Acacia semitrullata* (P3)
385952	6336438	*Acacia semitrullata* (P3)
385957	6336433	*Acacia semitrullata* (P3)
385959	6336438	*Acacia semitrullata* (P3)
385959	6336440	*Acacia semitrullata* (P3)
385962	6336441	*Acacia semitrullata* (P3)
385965	6336434	*Acacia semitrullata* (P3)
385969	6336455	*Acacia semitrullata* (P3)
385975	6336446	*Acacia semitrullata* (P3)
385979	6336459	*Acacia semitrullata* (P3)
385980	6336459	*Acacia semitrullata* (P3)
385982	6336457	*Acacia semitrullata* (P3)
385982	6336460	*Acacia semitrullata* (P3)
385984	6336466	*Acacia semitrullata* (P3)
385984	6336466	*Acacia semitrullata* (P3)
385987	6336460	*Acacia semitrullata* (P3)
385987	6336463	*Acacia semitrullata* (P3)
385988	6336452	*Acacia semitrullata* (P3)
385988	6336469	*Acacia semitrullata* (P3)
385989	6336466	*Acacia semitrullata* (P3)
385992	6336473	*Acacia semitrullata* (P3)
385993	6336467	*Acacia semitrullata* (P3)
385994	6336459	*Acacia semitrullata* (P3)
386000	6336468	*Acacia semitrullata* (P3)
386000	6336470	*Acacia semitrullata* (P3)
386001	6336472	*Acacia semitrullata* (P3)
386002	6336467	*Acacia semitrullata* (P3)
386003	6336474	*Acacia semitrullata* (P3)
386004	6336470	*Acacia semitrullata* (P3)
386018	6336464	*Acacia semitrullata* (P3)
386020	6336470	*Acacia semitrullata* (P3)
386021	6336467	*Acacia semitrullata* (P3)
386024	6336466	*Acacia semitrullata* (P3)
386025	6336481	*Acacia semitrullata* (P3)
386029	6336483	*Acacia semitrullata* (P3)
386030	6336476	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
386031	6336483	*Acacia semitrullata* (P3)
386035	6336484	*Acacia semitrullata* (P3)
386038	6336487	*Acacia semitrullata* (P3)
386038	6336488	*Acacia semitrullata* (P3)
386040	6336483	*Acacia semitrullata* (P3)
386046	6336469	*Acacia semitrullata* (P3)
386053	6336493	*Acacia semitrullata* (P3)
386054	6336495	*Acacia semitrullata* (P3)
386055	6336494	*Acacia semitrullata* (P3)
386062	6336491	*Acacia semitrullata* (P3)
386062	6336492	*Acacia semitrullata* (P3)
386063	6336491	*Acacia semitrullata* (P3)
386063	6336493	*Acacia semitrullata* (P3)
386082	6336490	*Acacia semitrullata* (P3)
386085	6336486	*Acacia semitrullata* (P3)
386136	6336510	*Acacia semitrullata* (P3)
386140	6336525	*Acacia semitrullata* (P3)
386150	6336535	*Acacia semitrullata* (P3)
386151	6336529	*Acacia semitrullata* (P3)
386151	6336536	*Acacia semitrullata* (P3)
386152	6336528	*Acacia semitrullata* (P3)
386152	6336528	*Acacia semitrullata* (P3)
386152	6336530	*Acacia semitrullata* (P3)
386153	6336533	*Acacia semitrullata* (P3)
386154	6336528	*Acacia semitrullata* (P3)
386155	6336531	*Acacia semitrullata* (P3)
386155	6336534	*Acacia semitrullata* (P3)
386157	6336507	*Acacia semitrullata* (P3)
386163	6336511	*Acacia semitrullata* (P3)
386163	6336511	*Acacia semitrullata* (P3)
386163	6336544	*Acacia semitrullata* (P3)
386164	6336538	*Acacia semitrullata* (P3)
386165	6336543	*Acacia semitrullata* (P3)
386167	6336543	*Acacia semitrullata* (P3)
386168	6336544	*Acacia semitrullata* (P3)
386169	6336541	*Acacia semitrullata* (P3)
386169	6336545	*Acacia semitrullata* (P3)
386170	6336542	*Acacia semitrullata* (P3)
386170	6336544	*Acacia semitrullata* (P3)
386171	6336542	*Acacia semitrullata* (P3)
386171	6336542	*Acacia semitrullata* (P3)
386172	6336521	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
386172	6336523	*Acacia semitrullata* (P3)
386172	6336548	*Acacia semitrullata* (P3)
386173	6336548	*Acacia semitrullata* (P3)
386174	6336522	*Acacia semitrullata* (P3)
386174	6336548	*Acacia semitrullata* (P3)
386174	6336549	*Acacia semitrullata* (P3)
386175	6336549	*Acacia semitrullata* (P3)
386176	6336522	*Acacia semitrullata* (P3)
386176	6336523	*Acacia semitrullata* (P3)
386176	6336523	*Acacia semitrullata* (P3)
386176	6336550	*Acacia semitrullata* (P3)
386179	6336548	*Acacia semitrullata* (P3)
386180	6336516	*Acacia semitrullata* (P3)
386180	6336528	*Acacia semitrullata* (P3)
386182	6336549	*Acacia semitrullata* (P3)
386185	6336529	*Acacia semitrullata* (P3)
386186	6336529	*Acacia semitrullata* (P3)
386190	6336551	*Acacia semitrullata* (P3)
386198	6336524	*Acacia semitrullata* (P3)
386204	6336538	*Acacia semitrullata* (P3)
386206	6336555	*Acacia semitrullata* (P3)
386207	6336540	*Acacia semitrullata* (P3)
386207	6336558	*Acacia semitrullata* (P3)
386213	6336568	*Acacia semitrullata* (P3)
386215	6336566	*Acacia semitrullata* (P3)
386215	6336566	*Acacia semitrullata* (P3)
386222	6336547	*Acacia semitrullata* (P3)
386232	6336551	*Acacia semitrullata* (P3)
386239	6336542	*Acacia semitrullata* (P3)
386263	6336565	*Acacia semitrullata* (P3)
386317	6336543	*Acacia semitrullata* (P3)
386319	6336521	*Acacia semitrullata* (P3)
386320	6336521	*Acacia semitrullata* (P3)
386320	6336525	*Acacia semitrullata* (P3)
386325	6336534	*Acacia semitrullata* (P3)
386340	6336540	*Acacia semitrullata* (P3)
386342	6336539	*Acacia semitrullata* (P3)
386343	6336535	*Acacia semitrullata* (P3)
386344	6336528	*Acacia semitrullata* (P3)
386346	6336536	*Acacia semitrullata* (P3)
386366	6336533	*Acacia semitrullata* (P3)
386366	6336534	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
386377	6336514	*Acacia semitrullata* (P3)
386384	6336531	*Acacia semitrullata* (P3)
386388	6336510	*Acacia semitrullata* (P3)
386390	6336511	*Acacia semitrullata* (P3)
386392	6336506	*Acacia semitrullata* (P3)
386404	6336523	*Acacia semitrullata* (P3)
386428	6336509	*Acacia semitrullata* (P3)
386454	6336503	*Acacia semitrullata* (P3)
386476	6336508	*Acacia semitrullata* (P3)
386482	6336505	*Acacia semitrullata* (P3)
386488	6336495	*Acacia semitrullata* (P3)
386491	6336495	*Acacia semitrullata* (P3)
386512	6336486	*Acacia semitrullata* (P3)
386513	6336484	*Acacia semitrullata* (P3)
386517	6336495	*Acacia semitrullata* (P3)
386520	6336485	*Acacia semitrullata* (P3)
386528	6336486	*Acacia semitrullata* (P3)
386549	6336484	*Acacia semitrullata* (P3)
386549	6336484	*Acacia semitrullata* (P3)
386553	6336489	*Acacia semitrullata* (P3)
386554	6336492	*Acacia semitrullata* (P3)
386554	6336493	*Acacia semitrullata* (P3)
386574	6336482	*Acacia semitrullata* (P3)
386574	6336483	*Acacia semitrullata* (P3)
386613	6336455	*Acacia semitrullata* (P3)
386613	6336456	*Acacia semitrullata* (P3)
386613	6336456	*Acacia semitrullata* (P3)
386615	6336455	*Acacia semitrullata* (P3)
386622	6336471	*Acacia semitrullata* (P3)
386623	6336478	*Acacia semitrullata* (P3)
386625	6336452	*Acacia semitrullata* (P3)
386638	6336465	*Acacia semitrullata* (P3)
386640	6336469	*Acacia semitrullata* (P3)
386641	6336464	*Acacia semitrullata* (P3)
386642	6336462	*Acacia semitrullata* (P3)
386643	6336464	*Acacia semitrullata* (P3)
386644	6336466	*Acacia semitrullata* (P3)
386645	6336468	*Acacia semitrullata* (P3)
386647	6336464	*Acacia semitrullata* (P3)
386661	6336474	*Acacia semitrullata* (P3)
386662	6336458	*Acacia semitrullata* (P3)
386668	6336458	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
386679	6336454	*Acacia semitrullata* (P3)
386681	6336453	*Acacia semitrullata* (P3)
386693	6336472	*Acacia semitrullata* (P3)
386721	6336464	*Acacia semitrullata* (P3)
386823	6336512	*Acacia semitrullata* (P3)
386823	6336512	*Acacia semitrullata* (P3)
386886	6336512	*Acacia semitrullata* (P3)
386898	6336507	*Acacia semitrullata* (P3)
386900	6336510	*Acacia semitrullata* (P3)
386901	6336503	*Acacia semitrullata* (P3)
386905	6336505	*Acacia semitrullata* (P3)
386906	6336522	*Acacia semitrullata* (P3)
386937	6336523	*Acacia semitrullata* (P3)
386942	6336522	*Acacia semitrullata* (P3)
386971	6336536	*Acacia semitrullata* (P3)
386974	6336531	*Acacia semitrullata* (P3)
387182	6336583	*Acacia semitrullata* (P3)
387219	6336588	*Acacia semitrullata* (P3)
387331	6336620	*Acacia semitrullata* (P3)
387331	6336621	*Acacia semitrullata* (P3)
387334	6336618	*Acacia semitrullata* (P3)
387334	6336621	*Acacia semitrullata* (P3)
387335	6336623	*Acacia semitrullata* (P3)
387335	6336624	*Acacia semitrullata* (P3)
387341	6336633	*Acacia semitrullata* (P3)
387344	6336644	*Acacia semitrullata* (P3)
387352	6336654	*Acacia semitrullata* (P3)
387352	6336656	*Acacia semitrullata* (P3)
387353	6336658	*Acacia semitrullata* (P3)
387353	6336661	*Acacia semitrullata* (P3)
387354	6336658	*Acacia semitrullata* (P3)
387354	6336659	*Acacia semitrullata* (P3)
387355	6336659	*Acacia semitrullata* (P3)
387355	6336659	*Acacia semitrullata* (P3)
387356	6336659	*Acacia semitrullata* (P3)
387381	6336719	*Acacia semitrullata* (P3)
387381	6336754	*Acacia semitrullata* (P3)
387381	6336759	*Acacia semitrullata* (P3)
387381	6336760	*Acacia semitrullata* (P3)
387384	6336723	*Acacia semitrullata* (P3)
387385	6336759	*Acacia semitrullata* (P3)
387386	6336760	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
387389	6336769	*Acacia semitrullata* (P3)
387390	6336745	*Acacia semitrullata* (P3)
387391	6336739	*Acacia semitrullata* (P3)
387391	6336744	*Acacia semitrullata* (P3)
387391	6336770	*Acacia semitrullata* (P3)
387392	6336744	*Acacia semitrullata* (P3)
387394	6336747	*Acacia semitrullata* (P3)
387397	6336753	*Acacia semitrullata* (P3)
387400	6336765	*Acacia semitrullata* (P3)
387400	6336770	*Acacia semitrullata* (P3)
387400	6336770	*Acacia semitrullata* (P3)
387400	6336770	*Acacia semitrullata* (P3)
387401	6336770	*Acacia semitrullata* (P3)
387401	6336770	*Acacia semitrullata* (P3)
387401	6336770	*Acacia semitrullata* (P3)
387402	6336773	*Acacia semitrullata* (P3)
387404	6336770	*Acacia semitrullata* (P3)
387409	6336808	*Acacia semitrullata* (P3)
387409	6336813	*Acacia semitrullata* (P3)
387410	6336782	*Acacia semitrullata* (P3)
387410	6336820	*Acacia semitrullata* (P3)
387411	6336813	*Acacia semitrullata* (P3)
387412	6336790	*Acacia semitrullata* (P3)
387413	6336783	*Acacia semitrullata* (P3)
387413	6336790	*Acacia semitrullata* (P3)
387414	6336823	*Acacia semitrullata* (P3)
387415	6336794	*Acacia semitrullata* (P3)
387416	6336793	*Acacia semitrullata* (P3)
387416	6336799	*Acacia semitrullata* (P3)
387417	6336794	*Acacia semitrullata* (P3)
387418	6336794	*Acacia semitrullata* (P3)
387418	6336794	*Acacia semitrullata* (P3)
387418	6336795	*Acacia semitrullata* (P3)
387418	6336799	*Acacia semitrullata* (P3)
387418	6336803	*Acacia semitrullata* (P3)
387420	6336802	*Acacia semitrullata* (P3)
387420	6336802	*Acacia semitrullata* (P3)
387420	6336803	*Acacia semitrullata* (P3)
387420	6336806	*Acacia semitrullata* (P3)
387420	6336807	*Acacia semitrullata* (P3)
387421	6336808	*Acacia semitrullata* (P3)
387422	6336803	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
387422	6336804	*Acacia semitrullata* (P3)
387422	6336805	*Acacia semitrullata* (P3)
387423	6336805	*Acacia semitrullata* (P3)
387423	6336806	*Acacia semitrullata* (P3)
387423	6336812	*Acacia semitrullata* (P3)
387423	6336812	*Acacia semitrullata* (P3)
387423	6336822	*Acacia semitrullata* (P3)
387423	6336841	*Acacia semitrullata* (P3)
387424	6336808	*Acacia semitrullata* (P3)
387424	6336812	*Acacia semitrullata* (P3)
387424	6336820	*Acacia semitrullata* (P3)
387424	6336823	*Acacia semitrullata* (P3)
387425	6336808	*Acacia semitrullata* (P3)
387425	6336823	*Acacia semitrullata* (P3)
387425	6336845	*Acacia semitrullata* (P3)
387426	6336811	*Acacia semitrullata* (P3)
387426	6336822	*Acacia semitrullata* (P3)
387427	6336814	*Acacia semitrullata* (P3)
387427	6336815	*Acacia semitrullata* (P3)
387427	6336815	*Acacia semitrullata* (P3)
387428	6336828	*Acacia semitrullata* (P3)
387428	6336828	*Acacia semitrullata* (P3)
387428	6336830	*Acacia semitrullata* (P3)
387429	6336819	*Acacia semitrullata* (P3)
387429	6336832	*Acacia semitrullata* (P3)
387430	6336830	*Acacia semitrullata* (P3)
387430	6336834	*Acacia semitrullata* (P3)
387430	6336838	*Acacia semitrullata* (P3)
387431	6336819	*Acacia semitrullata* (P3)
387431	6336819	*Acacia semitrullata* (P3)
387431	6336822	*Acacia semitrullata* (P3)
387431	6336823	*Acacia semitrullata* (P3)
387431	6336836	*Acacia semitrullata* (P3)
387431	6336837	*Acacia semitrullata* (P3)
387432	6336825	*Acacia semitrullata* (P3)
387432	6336827	*Acacia semitrullata* (P3)
387432	6336827	*Acacia semitrullata* (P3)
387432	6336830	*Acacia semitrullata* (P3)
387432	6336837	*Acacia semitrullata* (P3)
387433	6336821	*Acacia semitrullata* (P3)
387433	6336829	*Acacia semitrullata* (P3)
387433	6336829	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
387433	6336830	*Acacia semitrullata* (P3)
387434	6336828	*Acacia semitrullata* (P3)
387434	6336829	*Acacia semitrullata* (P3)
387436	6336834	*Acacia semitrullata* (P3)
387436	6336835	*Acacia semitrullata* (P3)
387438	6336833	*Acacia semitrullata* (P3)
387446	6336903	*Acacia semitrullata* (P3)
387446	6336909	*Acacia semitrullata* (P3)
387447	6336847	*Acacia semitrullata* (P3)
387450	6336860	*Acacia semitrullata* (P3)
387468	6336885	*Acacia semitrullata* (P3)
387537	6337028	*Acacia semitrullata* (P3)
387545	6337019	*Acacia semitrullata* (P3)
387546	6337036	*Acacia semitrullata* (P3)
387549	6337038	*Acacia semitrullata* (P3)
387554	6337029	*Acacia semitrullata* (P3)
387580	6337090	*Acacia semitrullata* (P3)
387611	6337099	*Acacia semitrullata* (P3)
387663	6337156	*Acacia semitrullata* (P3)
387663	6337157	*Acacia semitrullata* (P3)
387708	6337145	*Acacia semitrullata* (P3)
387714	6337165	*Acacia semitrullata* (P3)
387722	6337167	*Acacia semitrullata* (P3)
387731	6337174	*Acacia semitrullata* (P3)
387735	6337174	*Acacia semitrullata* (P3)
387755	6337176	*Acacia semitrullata* (P3)
387788	6337186	*Acacia semitrullata* (P3)
387790	6337189	*Acacia semitrullata* (P3)
387799	6337172	*Acacia semitrullata* (P3)
387799	6337173	*Acacia semitrullata* (P3)
387804	6337174	*Acacia semitrullata* (P3)
387823	6337183	*Acacia semitrullata* (P3)
387870	6337196	*Acacia semitrullata* (P3)
387872	6337197	*Acacia semitrullata* (P3)
387873	6337196	*Acacia semitrullata* (P3)
387874	6337194	*Acacia semitrullata* (P3)
387897	6337225	*Acacia semitrullata* (P3)
387933	6337207	*Acacia semitrullata* (P3)
388143	6337346	*Acacia semitrullata* (P3)
388143	6337346	*Acacia semitrullata* (P3)
388143	6337346	*Acacia semitrullata* (P3)
388143	6337346	*Acacia semitrullata* (P3)

Appendix A : GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant, September 2008.

Easting (WGS84)	Northing (WGS84)	Species
388143	6337346	*Acacia semitrullata* (P3)
388143	6337346	*Acacia semitrullata* (P3)
388325	6337750	*Acacia semitrullata* (P3)
		TOTAL (*Acacia semitrullata*) 843
382002	6335975	*Caladenia speciosa* (P4)
382008	6335974	*Caladenia speciosa* (P4)
382108	6335980	*Caladenia speciosa* (P4)
382160	6335976	*Caladenia speciosa* (P4)
382161	6335973	*Caladenia speciosa* (P4)
382238	6335973	*Caladenia speciosa* (P4)
382253	6335968	*Caladenia speciosa* (P4)
382279	6335975	*Caladenia speciosa* (P4)
382294	6335978	*Caladenia speciosa* (P4)
382295	6335977	*Caladenia speciosa* (P4)
382298	6335970	*Caladenia speciosa* (P4)
382299	6335970	*Caladenia speciosa* (P4)
382299	6335972	*Caladenia speciosa* (P4)
382300	6335973	*Caladenia speciosa* (P4)
382313	6335971	*Caladenia speciosa* (P4)
382322	6335982	*Caladenia speciosa* (P4)
382526	6335977	*Caladenia speciosa* (P4)
382526	6335977	*Caladenia speciosa* (P4)
382537	6335980	*Caladenia speciosa* (P4)
382589	6335975	*Caladenia speciosa* (P4)
387450	6336861	*Caladenia speciosa* (P4)
387450	6336865	*Caladenia speciosa* (P4)
		TOTAL (*Caladenia speciosa*) 22
382422	6335994	*Eucalytus rudis* ssp. *cratyantha* (P4)
		TOTAL (*Eucalyptus rudis* ssp. *cratyantha*) 1

Appendix B Recorded Locations of Significant Flora (360 Environmental 2007)

Appendix B: GPS Locations for Priority Flora recorded within the Water Corporation and the Associated Pipeline Corridor for the Binningup Desalination Plant by 360 Environmental in 2007

Easting (WGS84)	Northing (WGS84)	Species
387715	6337168	*Acacia semitrullata* (P3)
387753	6337181	*Acacia semitrullata* (P3)
387739	6337183	*Acacia semitrullata* (P3)
387939	6337218	*Acacia semitrullata* (P3)
387911	6337212	*Acacia semitrullata* (P3)
387714	6337167	*Acacia semitrullata* (P3)
387930	6337230	*Acacia semitrullata* (P3)
386769	6336469	*Acacia semitrullata* (P3)
386176	6336544	*Acacia semitrullata* (P3)
386073	6336503	*Acacia semitrullata* (P3)
385985	6336462	*Acacia semitrullata* (P3)
386005	6336462	*Acacia semitrullata* (P3)
386206	6336542	*Acacia semitrullata* (P3)
386581	6336489	*Acacia semitrullata* (P3)
386750	6336461	*Acacia semitrullata* (P3)
387455	6336902	*Acacia semitrullata* (P3)
386869	6336502	*Acacia semitrullata* (P3)
387275	6336605	*Acacia semitrullata* (P3)
387336	6336624	*Acacia semitrullata* (P3)
387436	6336832	*Acacia semitrullata* (P3)
386549	6336496	*Acacia semitrullata* (P3)
388262	6337576	*Acacia semitrullata* (P3)
385642	6336406	*Acacia semitrullata* (P3)
385817	6336408	*Acacia semitrullata* (P3)
385837	6336406	*Acacia semitrullata* (P3)
386185	6336541	*Acacia semitrullata* (P3)
385540	6336411	*Acacia semitrullata* (P3)
386213	6336562	*Acacia semitrullata* (P3)
384048	6335997	*Acacia semitrullata* (P3)
382487	6335973	*Acacia semitrullata* (P3)
381986	6335963	*Acacia semitrullata* (P3)
382025	6335973	*Acacia semitrullata* (P3)
382056	6335980	*Acacia semitrullata* (P3)
382153	6335975	*Acacia semitrullata* (P3)
383963	6335987	*Acacia semitrullata* (P3)
382685	6335991	*Acacia semitrullata* (P3)
382639	6335983	*Acacia semitrullata* (P3)
385757	6336419	*Acacia semitrullata* (P3)
382142	6335978	*Caladenia speciosa* (P4)
382314	6335988	*Caladenia speciosa* (P4)
382092	6335967	*Caladenia speciosa* (P4)
382422	6335994	*Eucalyptus rudis* subsp. *cratyantha* (P4)

WA WATER CORPORATION PROPOSED SOUTHERN SEAWATER DESALINATION PLANT: COMMONWEALTH PUBLIC ENVIRONMENT REPORT
EPBC AVIFAUNA ISSUES – DESKTOP REVIEW

1 INTRODUCTION

The proposed Southern Seawater Desalination Plant (SSDP) will produce around 50 GL of potable water per annum, with the potential to increase to 100 GL/year. Construction work is anticipated to commence in 2009, with operations commencing in 2011. The WAWC has identified Binningup as the preferred site of the new desalination plant, based on a range of social, environmental, technical and economic factors.

The WA Environmental Protection Authority (EPA) has allocated a 'Public Environmental Review (PER)' level of assessment for the project, under the WA *Environment Protection Act 1986*. On 21 April 2008 the PER was released for public comment for an eight week period, with submissions closing on 16 June 2008.

In parallel with the WA assessment process, the WAWC has also undertaken an assessment of the proposed activity under the terms of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An EPBC Act Referral was submitted to the Commonwealth Department of the Environment, Heritage, Water and the Arts (DEWHA). Subsequently, DEWHA has issued guidelines for a Public Environment Report, within which is a list of environmental issues and specific flora and fauna (including migratory shorebirds and marine avifauna) which have been identified as of distinct interest to the Commonwealth.

As a result of the Commonwealth assessment requirements, it was incumbent upon the WAWC to draft and submit for DEWHA review and assessment a cPER which conforms with the Commonwealth's requirements. These requirements are promulgated in DEWHA's *Guidelines for the Content of a Draft Public Environment Report (PER): The Development of the Southern Seawater Desalination Project, Binningup, WA (Reference: No. 2008/4173).*

WAWC commissioned URS to prepare the cPER and as part of that process a gap analysis of the WA State PER (i.e. sPER), was undertaken to identify potential gaps and deficiencies in the existing SSDP information in the context of DEWHA's specific concerns. The gaps identified that are the subject of this desktop review (EPBC Act related avifauna issues) are:

Migratory bird species listed under JAMBA, CAMBA and ROKAMBA
Prepare a summary and risk assessment in the context of EPBC Act significance criteria by reviewing information on the migratory bird species listed under the international agreements, Japanese Australia Migratory Bird Agreement (JAMBA), Chinese Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea Australia Migratory Bird Agreement (ROKAMBA). It was also considered that information was needed on migratory birds in the context of potential disturbance, or otherwise, to beach and nearby wetlands, particularly Peel-Yalgorup Ramsar wetland.

EPBC Listed Marine Avifauna
Prepare a summary and risk assessment for marine avifauna (e.g. seabirds etc) in terms of EPBC Act significance criteria.

2 REVIEW METHODOLOGY

The literature review included a range of data sources that were accessed to develop sufficient understanding of the EPBC Act listed marine avifauna and migratory species that may be in the area in order to assess likely impacts from the proposed SSDP. The review placed emphasis on the distribution and range of applicable EPBC Act and JAMBA/CAMBA/ROKAMBA listed species, taking into account factors such as:

- seasonal variation (or migratory behaviour) of the presence (or otherwise) of these species
- habitats and life cycle requirements of listed species
- habitats potentially affected by the proposed SSDP and associated works
- known significant sites for migratory species in the region (e.g. Peel-Yalgorup system, Vasse-Wonnerup wetland system).

In addition to existing information available from work done to-date by the WAWC for the proposed SSDP (i.e. sPER, EPBC Act referral etc), a range of literature sources and databases were reviewed to generate a list of relevant avifauna that may occur in the local region and obtain information on the factors listed above. These include:

- EPBC Act databases
- International agreements such as RAMSAR and the migratory birds agreements (JAMBA/CAMBA/ROKAMBA)
- Ramsar Sites Database Service operated by Wetlands International (www.wetlands.org/RSDB).
- Wetlands International reviews and updates of important sites for migratory shorebirds in Australia (i.e. sites determined from analysis of data from locations throughout the East Asian-Australasian Flyway).
- Information and species distribution maps provided by Storr and Johnstone 1988, Johnstone and Storr 1998 and the Handbook of Australian, New Zealand and Antarctic Birds (HANZAB).
- Specific references related to the status of migratory shorebirds (Straw 1997) and seabirds (Ross *et al*. 1996).

3 RELEVANT LEGISLATIVE POLICY AND INTERNATIONAL AGREEMENTS/CONVENTIONS

3.1 Environment Protection and Biodiversity Conservation Act 1999

The conservation status of avifauna species is assessed under the Commonwealth EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN 2001). There are six parts to the EPBC Act covering species that are extinct, extinct in the wild, critically endangered, vulnerable and conservation dependent. Migratory and listed marine species are also included under the EPBC Act. Avifauna species included under international agreements are formally recognised under Commonwealth legislation. The EPBC Act also lists migratory species that are recognised under international treaties such as those made between Australia and Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA).

3.2 Migratory Bird International Agreements

A range of migratory bird species are listed under bilateral international agreements concerning the protection of migratory shorebirds and their habitats (JAMBA/CAMBA/ROKAMBA). These agreements list terrestrial, water and shorebirds species which migrate between Australia and the respective other countries. The majority of listed species are shorebirds which are associated with saline wetlands and coastal shorelines. To complete their annual migration, shorebirds are dependent on intermediate staging sites where they can replenish the fat reserves needed to power them further in their migration. The East Asian-Australasian Flyway is the term used to describe the migration routes and the network of sites along it that are used by migrating shorebirds.

The East Asian - Australasian Shorebird Site Network is a network of both sites and people supported by governments and non-government organisations. Wetlands, which support 20,000 or more shorebirds or 1% of the flyway population of a migratory shorebird species or subspecies, are eligible to join the Shorebird Site Network. Managers of sites are encouraged under the Asia-Pacific Migratory Waterbird Conservation Strategy 2001-2005 and the Shorebird Action Plan, to establish a local advisory or liaison group and develop management plans. Such activities help to gain support for the effective management of these sites for shorebird conservation.

Wetlands International reviews and updates maps of internationally important sites for migratory shorebirds in Australia. This work links to the recent analysis of data throughout the East Asian-Australasian Flyway to reassess minimum population estimates and apply this to shorebird count data. By this process, 125 sites of international importance to migratory shorebirds have been identified in Australia.

3.3 Ramsar Convention

Australia is a signatory to the Ramsar Convention which provides for the designation of wetlands of international significance and encourages their wise use for the benefit of nature conservation. This international agreement has been further strengthened in Australia because 'the ecological character of declared Ramsar wetlands' is considered a Matter of National Environmental Significance under the EPBC Act. The convention encourages the designation of sites containing representative, rare or unique wetland types, or that are important for conserving biological diversity to the List of Wetlands of International Importance (Ramsar sites). The convention employs "Special Criteria Based on Waterfowl for Identifying Wetlands of International Importance". Using these criteria a wetland should be considered internationally important if it regularly supports > 20,000 waterbirds or 1% of the individuals in a population of one species or subspecies of waterbird (this includes migratory shorebirds).

Australia currently has 64 Ramsar sites which cover a total of approximately 7.3 million hectares. Australia seeks to protect these wetlands through a range of activities including appropriate legislation and policy frameworks, development and implementation of site management plans, and community education and awareness programs. The Ramsar sites include wetlands occurring within marine, coastal, inland and man-made settings and encompass a divesre array of wetland types or habitats which are recognised as being important to birds for reasons including:

- Support rare/endangered species
- Support an outstanding range of bird species
- Breeding or roosting area for waterbirds
- Staging area for migratory waterbird species
- Waterbird wintering/non-breeding/dry season area
- Supports endemic bird species

4 ASSESSMENT OF LISTED SPECIES THAT MAY POTENTIALLY OCCUR WITHIN THE REGION

The attached table summarises those species listed under the EPBC Act and migratory bird agreements that may potentially occur with the local region and adjacent coastal or oceanic waters. Their potential for occurrence was determined by:

- EPBC Act listed: conducting a 2 km radius search of the EPBC database (i.e. 2 km radius from the SSDP site); and

- Migratory Bird Agreement Species: viewing distribution maps and other reference sources to ascertain a particular species has been recorded from the Swan Coastal Plain and adjacent offshore waters.

An assessment of the likelihood for these species to occur within areas potentially influenced by the proposed SSDP and aspects related to their habitat requirements, life cycle and migratory behaviour is summarised below on the basis of groups of species with similar habitat requirements and behaviour patterns.

4.1 Seabirds

The term 'Seabirds' is generally used to collectively describe those bird species which spend a substantial part of their life foraging and breeding in the marine environments. Birds considered to be seabirds include gulls, terns, albatrosses, petrels, shearwaters, cormorants, gannets and boobies. The majority of these birds feed in coastal and oceanic waters and many migrate beyond Australian waters to feed and breed. Most species tend to forage on their own, though large feeding flocks will gather at rich or passing food sources. Squid, fish and krill are common food sources. Seabirds breed in colonies on remote islands and the WA DEC database on seabird breeding locations has not identified any breeding sites in the vicinity of the Binningup area and there is no potential for the SSDP to affect seabird breeding.

Fifteen species of seabird were identified as possibly occurring in the area (see Table 1). These were composed of 10 species of oceanic seabirds and five species of seabirds (terns) that may also feed in nearshore coastal waters and possibly make temporary landfall on the shoreline for resting/roosting purposes.

The oceanic seabirds (Giant Petrels, Albatross, Shearwaters, Skuas) range from rare to common visitors to waters off the south-west Western Australian coast and usually only beach washed dead specimens of these species are recorded as reaching the shoreline (typically after winter storms). Breeding sites for the Petrel and Albatross species are mostly in remote sub-Antarctic and Antarctic islands (e.g. Falklands east to Macquarie Island) as well as a few islands off Tasmania (Ross, *et. al.* 1993). Recovery of birds (mostly beach washed) along the WA coastline have included birds banded as nestlings from many distant locations such as the Orkney and Shetland Islands, Crozet Islands and South Georgia (Storr & Johnstone 1988).

The Shearwater species are known to breed on some islands along the south west and southern coast of Western Australia and the breeding locations for these species are:

- Wedge-tailed Shearwater: mostly breeds in tropical and subtropical islands with Rottnest and Carnac Islands being the southern-most localities.

- Fleshy-footed Shearwater: breeds in temporate islands in the southern Indian Ocean and the south-west Pacific. In WA it breeds on at least 40 islands along the south coast from Cape Leeuwin to east of Esperance (Daw Island).

- Short-tailed Shearwater: Breeds on temperate islands off the south coast of Australia. In WA breeding occurs on six islands in the Recherche Archipelago, east of Esperance.

The Wedge-tailed and Fleshy-footed shearwaters are also long-distance migrants out of Western Australia in their non-breeding season and the local breeding populations of these species make trans-equatorial migrations into the northern Indian Ocean during winter months (Johnstone & Storr 1998).

Due to the vast feeding ranges of oceanic seabird species and remote breeding locations it is extremely unlikely that the SSDP will result in any impact to those species.

Five species of tern may occur along the coast adjacent to the project site. Caspian and Crested Terns are the most common of the tern species in the south-west and is expected they would be present in nearshore marine waters and estuaries in the area. There is the potential for these species to use the sandy beaches between Bunbury and Mandurah (including the Binningup area) as a temporary resting/roosting site. The limited extent of disturbance to beach habitat from the SSDP project is unlikely to cause any significant disruption to the terns temporary use of the beach, particularly when considering the extent of similar habitat available along this section of coast and current recreational use of the beach and associated disturbance from uncontrolled four wheel drive and dog access and other pressures (as noted in Section 2.1.2 of the sPER). The terns listed in Table 1 all have extensive distribution ranges including the north and east Indian Ocean and western Pacific Ocean. Breeding localities for the three tern species (Crested, Caspian, Bridled Tern) known to regularly breed along the south-west WA coast include offshore islands such as those in the Lancelin area, the Rottnest Island to Safety Bay area and near Cape Leeuwin which are well beyond any potential zone of influence from the SSDP.

The White-winged Black Tern is an irregular visitor (September to May) to south-west WA where it may occur in large flocks. Its habitat preference in the Swan Coastal Plain is mainly freshwater lakes and swamps, occasionally estuaries, samphire and short-grass flats and lucerne fields (attracted to emerging dragonflies and swarming grasshoppers). Breeds in east Europe and north and central Asia (Johnstone & Storr 1998).

The Common Tern (*Sterna hirundo hirundo*) breeds in North America, Europe, North Africa and western Asia and is only a very rare visitor to the lower west coast of WA. It is a common moderately common to common along the northern WA coast (north of Carnarvon).

4.2 Migratory Shorebirds

Each year millions of shorebirds migrate between their northern hemisphere breeding areas in the Russian Far East, northern China and Alaska to as far south as Australia and New Zealand. The birds breed during the northern hemisphere summer and then move to the southern hemisphere localities during the non-breeding season. In Australia, large flocks of shorebirds arrive in October and feed mainly on small invertebrate fauna such as polychaete worms and small bivalves living in tidal mudflats and sandflats. In Western Australia, the Kimberley-Pilbara coast represents a major wintering area for shorebirds and it is estimated that for some species (e.g. Great Knot), up to 70-80% of the total world population spends its non-breeding season on that section of coast, hence the region is of worldwide importance (Johnstone & Storr 1998). In April, shorebirds birds fly from their Australian feeding grounds and return to breeding grounds in the northern hemisphere tundra. Some species of shorebird weighing as little as 30 g may migrate 25,000 km annually and some species may fly more than 6,000 km non-stop.

Table 1 lists 28 species of migratory shorebirds that may potentially occur in the local region (Swan Coastal Plain). Recorded occurrence of these species on the Swan Coastal Plain varies from being rarely recorded (vagrants such as the Long-toed Stint) to regular seasonal visitors (e.g. Bar-tailed Godwit, Common Greenshank and Red-necked Stint). Important migratory shorebird sites on the Swan Coastal Plain in the south-west of WA include the Peel-Yalgorup and Vasse-Wonnerup wetland systems which have extensive areas of feeding habitat for shorebirds (i.e. invertebrate rich sandflats/mudflats, estuarine and freshwater wetlands). More information on these sites is provided in Section 5.

The habitats that occur within the SSDP site (narrow sandy beach, dunes, coastal woodland and a degraded wetland or seasonally wet paddock) are unlikely to support significant shorebird populations or be considered as an important site within the network of wetland sites within the Swan Coastal Plain.

A few species of shorebirds (Little Whimbrel and Oriental Practincole) are considered to be aberrant 'grassland' waders that pefer dry grasslands and floodplains in northern WA coastal areas. These species usually stay within the tropical zone and are highly nomadic, responding to local thunderstorms and cylconic rains. Both these species are vagrant or scarce visitors to south-west WA.

4.3 Other Species

A few other species not included in the above seabird or migratory shorebird groupings may potentially occur in the area - these consist of 4 species of waterbirds (egrets/ibis), one species of raptor (White-bellied Sea Eagle) the Rainbow Bee-eater and the Fork-tailed Swift. The status of these species are either "migratory" (EPBC) and/or are listed under the migratory bird agreements.

Four waterbird species are birds listed on the JAMBA could occur in the survey area: Great Egret, Cattle Egret, Glossy Ibis and Eastern Reef Egret. Great Egret is common and widespread throughout Australia (except deserts) where it forages in aquatic habitats for fish, amphibians and invertebrates. The Cattle Egret is considered an irregular, mainly autumn visitor to the South-West and may be observed mainly in wet pasture in the company of livestock (Johnstone and Storr 1998). The Glossy Ibis is increasing on the Swan Coastal Plain and may be observed in and adjacent to freshwater lakes and other wetland areas. Given the degraded nature of the wetland within the wetland portion of the SSDP site (refer Section 5.4.4 of the sPER) it is unlikely that the site contains important habitat for the above waterbird species or supports breeding sites (e.g. tall *Melaleuca* trees above water). These species are highly mobile, that, if disturbed, are capable of finding other sites unassisted. There is sufficient suitable habitat present outside the development area and it is unlikely that the project will have any significant impact on these species.

Eastern Reef Egret is unlikely to occur in the vicinity of the project area. It is uncommon in the South-West where it mostly confined to islands (e.g. Rottnest, Carnac, Garden, Penguin) and rocky parts of mainland coast opposite them and is scarce or absent elsewhere (Johnstone & Storr 1998). In addition, its preferred habitat (tidal reef, mudflats, rocky shores) does not occur in the vicinity of the SSDP site. There is no reef habitat in the area in which marine structures associated SSDP will be built and therefore no potential for the project to affect these species.

The White-bellied Sea Eagle was identified by the EPBC Act database 2 km radius search, however, it is noted by Johnstone and Storr (1998) that while this species has been recorded from most of the WA coastline it does not occur on the lower west and south-west, between Peel Inlet and Wilson Inlet (this includes the Binningup area).

The Fork-tailed Swift (*Micropus pacificus*), is listed in the migratory bird agreements and may be observed flying overhead, often ahead of storm fronts. However, this bird rarely lands in Australia. This species is a migrant from Asia with arrival and departure times that are similar to the migratory shorebirds.

The Rainbow Bee-eater is a breeding migrant to the south-west during the September to April period where it is scarce to very common in the Darling Range and heavily wooded parts of the South-West (Johnstone & Storr 1998). During winter months it occurs in northern Australia (north of Gascoyne River in WA) and Indonesia. This species is likely to be in the local area during the spring and summer and was recorded from within the Banksia and Tuart vegetation types on the DDSP site (360 Environmental 2008). The Rainbow Bee-eater is often seen perching on telephone wires, fences and dead trees for where it makes shorts dashes to catch passing insects. It burrows into sand to form a nest, often at the margins of roads and tracks. If construction activities take place in spring and summer, it could potentially disrupt breeding of these species (360 Environmental 2008). During its annual southward migration to south-west WA, the Rainbow Bee-eater has a wide distribution and is a commonly

recorded species which is highly mobile and if disturbed, is capable of finding other refugia or foraging sites. Sufficient suitable habitat is present outside the development area to support displaced animals and it is unlikely that the proposed development will significantly impact on this species.

5 Ramsar Wetlands and Sites of International Importance to Migratory Shorebirds

Within the wider region there are two wetland systems that are designated under the Ramsar Convention as being wetlands on international significance. These sites are also recognised as being internationally important for migratory shorebirds within the East Asian - Australasian Shorebird Site Network. A brief summary of these two wetland systems is given below together with an assessment of the likelihood of the SSDP affecting these sites. More detail regarding their site characteristics significance and waterbird/shorebird significance and/or abundance is provided in that attached Appendix.

Peel-Yalgorup System

This Ramsar wetland site incorporates the largest and most diverse estuarine complex in south west Australia (Peel-Harvey Catchment Council 2008). Divided into three subsystems, The Peel-Harvey Estuary System and the Yalgorup Lakes System (including Lake Preston) lie approximately 2 km apart, and the Lake McLarty System which includes Lake McLarty and Lake Mealup lies to the east of the Peel-Harvey System (Australian Nature Conservation Agency 1996).

The Peel-Harvey Estuary is located immediately southwest of Mandurah and includes the Peel inlet (7500 ha) and the Harvey Estuary (5000 ha). The system has both tidal inflow from the Indian Ocean and river inflow from the Harvey, Murray and Serpentine Rivers as well as seven main drain systems entering the site. The Peel Inlet and Harvey Estuary differ in water chemistry, especially nutrients. The site has ecological value as the principal migration stop over and drought refuge area for migrating waterbirds area in south west Australia. The Peel Inlet and Harvey Estuary comprise the most important area for waterbirds in south west Australia. It regularly supports more than 20, 000 waterbirds each year and have had in excess of 150, 000 birds recorded at one time. The system regularly hosts over 1% of the populations of at lest 6 migratory shorebird species including the Red-necked Avocet, Red-necked Stint, Red-capped Plover, Banded Stilt, Caspian Tern and Fairy Tern (Peel-Harvey Catchment Council 2008).

The Yalgorup Lakes system is located southeast of the Peel Harvey System and approximately 25 km north of Bunbury. This 5600 ha wetland is comprised of two parallel lakes, Lake Clifton (1800 ha) and Lake Preston (3150 ha), with a series of smaller lakes between. All lakes are supplied principally by fresh groundwater and direct precipitation although some minor drains enter Lake Preston. The lakes are all saline due to long term concentration of salt by evaporation and no outflow from the system. Waterbird composition of the Yalgorup Lakes system consists of 40 recorded species, ten listed under treaties; including 15 shorebirds and four gulls and terns. 10,000 Australian Shelduck gather annually at Lake Clifton and/or Lake Preston. Eight species of migratory shorebird occur, most of them irregularly; only the Red-necked Stint occurs in significant numbers, with up to 380 individuals recorded at Lake Preston (Australian Nature Conservation Agency 1996). A maximum of 4000 birds were recorded at Lake Preston in 1999 (Wetlands International 2008).

The Peel-Yalgorup System Ramsar site is an extensive wetland system. The SSDP site is located 2 km south from the southern end of Lake Preston - this representing the southern limit of the Peel-Yalgorup System Ramsar site which extends some 50 km further to the north. The construction and operation of the SSDP is not expected to impinge on the ecological

value of this Ramsar site (in particular Lake Preston) or modify the ecological processes (e.g. water flows) that maintain the system.

Vasse-Wonnerup Wetlands System

The Vasse-Wonnerup Wetland System is located immediately north-east of Busselton and is 1000 ha in size comprising the Vasse and Wonnerup Estuaries and their seasonally inundated floodplains. The site is used as a compensating basin for discharge from four rivers. Inflow comes from the Vasse River, and Ludlow River. The estuaries are seasonal, apart from small pools in the deepest parts of the channels. This system is unique in Western Australia as it is an example of formerly estuarine basins now functioning as seasonal brackish lakes.

The Vasse-Wonnerup Wetland System is a major migration stop-over for a high diversity of waterbirds such as the Long-toed Stint and Wood Sandpiper and post-breeding refuge for the Black-winged Stilt. It is also a major breeding area for the Black Swan (*Cygnus atratus*) as well as a number of species of duck (Australian Nature Conservation Agency 1996). The Curlew Sandpiper was recorded in numbers of 2500 in 1993, and Sharp-tailed Sandpiper recoded in numbers of up to 2300 in 1993 (Wetlands International).

The SSDP site is located approximately 60 km north-east of Vasse-Wonnerup Ramsar site and the construction and operation of the desalination plant has no potential to adversely affect this important wetland area.

6 References

Australian Nature Conservation Agency (1996) *A Directory of Important Wetlands in Australia Second Edition*, ANCA, Canberra.

HANZAB (1990-1996), Handbook of Australian, New Zealand and Antarctic Birds, Volumes 1-3.

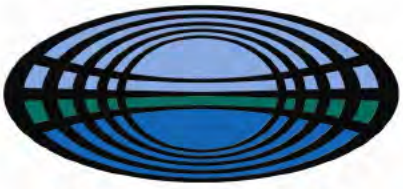
Johnstone R and Storr G, 1998, Handbook of Western Australian Birds, Volume 1 – Non-Passerines (Emu to Dollarbird). WA Museum, October 1998.

Ross G, Weaver K and Greig, J, 1996, The Status of Australia's Seabrirds. Proceedings of the National Seabird Workshop, Canberra, 1-2 November 1993.

Storr G and Johnstone R, 1988, Birds of the Swan Coastal Plain.

Straw, P, 1997, Shorebird Conservation in the Asia-Pacific Region. Published by the Australasian Wader Study Group of Birds Australia, October 1997.

360 Environmental 2008, Southern Seawater Desalination Project - 2007 Terrestrial Flora and Fauna Survey.



Southern Seawater Desalination Project

Mitigation and Offset Strategy

Prepared for
Water Corporation
by Strategen

April 2009

Southern Seawater Desalination Project

Mitigation and Offset Strategy

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Suite 7, 643 Newcastle Street Leederville WA
ACN: 056 190 419

April 2009

Disclaimer and Limitation

This report has been prepared for the exclusive use of the Client, in accordance with the agreement between the Client and Strategen ("Agreement").

Strategen accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any person who is not a party to the Agreement.

In particular, it should be noted that this report is a qualitative assessment only, based on the scope of services defined by the Client, budgetary and time constraints imposed by the Client, the information supplied by the Client (and its agents), and the method consistent with the preceding.

Strategen has not attempted to verify the accuracy or completeness of the information supplied by the Client.

Client: Water Corporation

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary Draft Report	V1	CM/WM	WM	Electronic	28/9/08
Draft Report	V2	CM/WM	WM	Electronic	20/10/08
2nd Draft Report	V3	CM/WM	WM	Electronic	22/10/08
Final Draft Report	V5	CM/WM	WM	Electronic	19/11/08
Final Report	FINAL	CM/WM	WM	Electronic	24/04/09

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 BACKGROUND

The Water Corporation, a corporatised government body charged with supplying drinking water to Western Australian residents, is proposing to establish a Reverse Osmosis (RO) seawater desalination plant at Binningup 130 km south of Perth on the south-west coast of Western Australia (WA). The plant will have an initial production capacity of 50 Gigalitres (GL)/year with potential to extend to 100 GL/year. Its primary components are the RO plant and associated seawater intake/outfall pipes within and into the ocean from Lots 32, 33 and part Lot 8 Taranto Road, Binningup, a 28.5 km long water transfer pipeline to Harvey, and a new water storage facility 3.5 km north-east of the Harvey town site.

In July 2007 the Water Corporation referred the proposal to the WA Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act* 1986, to construct and operate the Southern Seawater Desalination Project (SSDP). It was formally assessed at the level of Public Environmental Review (PER) under the State process. The Proposal was approved by the Minister of Environment with Ministerial Statement 792 released on 22 April 2009.

The SSDP Proposal was subsequently referred to the Department of Environment, Water, Heritage and Arts (DEWHA) for consideration of whether it constituted a Controlled Action and therefore required assessment under the *Environmental Protection and Biodiversity Act* (EPBC Act). DEWHA has since deemed that the SSDP has the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the EPBC Act, in particular threatened species and listed migratory species (Section 1.4). A Commonwealth Public Environmental Review (cPER) has been determined as the appropriate assessment approach by the DEWHA to allow a full assessment of the Proposal.

1.2 DESCRIPTION OF PROPOSED ACTION

The proposed action is made up of the following components:

1. RO plant and infrastructure, including:
    - a seawater intake structure (for an ultimate plant capacity of 100 GL/year)
    - seawater supply pipeline(s), which feeds into a seawater pump station (both for an ultimate plant capacity of 100 GL/year)
    - a minimum 50 GL/year, maximum 100 GL/year potable water production reverse osmosis desalination plant (including pre-treatment and post-treatment facilities) located at Lots 32,33 and Part Lot 8, Taranto Road Binningup (in the Shire of Harvey)
    - brine discharge pipeline(s) and diffuser array in the ocean (for an ultimate plant capacity of 100 GL/year)
2. Water transfer pipeline, being:
    - approximately 28.5 km of 1400 mm diameter buried water transfer pipeline from the plant to a water storage facility 3.5 km north east of Harvey

- approximately 1.5 km of 1400 mm diameter buried pipeline to deliver water from the storage tank in Harvey into the existing Stirling-Harvey Trunk main

- a regulating valve on the delivery main at a site already containing existing valve infrastructure.

3. Water Storage Facility, 3.5 km north east of Harvey, compromising:
   - initially one 32 Megalitre (ML) tank with provision for three additional 32 ML water storage tanks (ultimately being of a combined volume of 130 ML)
   - maintenance sump (initially 2ML with provision for expansion to 5 ML storage)

1.3 PURPOSE AND SCOPE OF DOCUMENT

This Mitigation and Offsets Strategy has been developed to outline:

- the nature and extent of impacts to species listed under the EPBC Act that are likely to be affected by the Proposal
- proposed on-site avoidance and mitigation to be implemented in design and during and following construction to reduce the local impact on these species
- proposed on-site and off-site strategies to offset residual impacts and ensure no net significant impact to these species.

This document is intended to be read in conjunction with the EPBC Referral and cPER documentation for this project.

1.4 EPBC LISTED SPECIES POTENTIALLY IMPACTED ON BY PROPOSAL

Following on from the findings of the cPER, the following species of National Environmental Significance will be subject to specific mitigation strategies to reduce the extent and significance of potential impacts:

- Western Ringtail Possum (*Pseudocheirus occidentalis*)
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)
- migratory bird species
- cetaceans
- Leatherback Turtle (*Dermochelys coriacea)*
- Loggerhead Turtle (*Caretta caretta*)
- Grey Nurse Shark (*Carcharias taurus)*
- Great White Shark (*Carcharodon carcharias*)
- Dwarf Hammer-orchid (*Drakaea micrantha*)
- Glossy-leaved Hammer-orchid (*Drakaea elastica*)

2. DEVELOPMENT OF MITIGATION STRATEGY

This Mitigation and Offset Strategy is based on the framework outlined in *Draft Policy Statement: Use of Environmental Offsets under the Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment and Water Resources (DEWR) 2007), EPA Bulletin No. 1 *Environmental Offsets – Biodiversity* (EPA 2008), EPA Position Statement No. 9 *Environmental Offsets* (EPA 2006) and EPA Guidance Statement No. 19 *Environmental Offsets – Biodiversity* (EPA 2008).

For the purpose of this strategy and consistent with DEWR (2007), 'mitigation' refers to the range of actions that can be undertaken on-site in design and construction to reduce the level of impacts of the development undertaken on-site. Environmental offsets provide compensation for those impacts, which cannot be adequately reduced through avoidance and mitigation.

Mitigation approach

Consistent with this terminology, the management of on-site environmental impacts to habitats of species of NES have firstly been addressed using the mitigation hierarchy outlined in EPA (2006) (Figure 1):

1. Avoid (i.e. exclude potential habitat of species altogether)
2. Minimise (limit magnitude) (i.e. reduce clearing of habitat to as low as possible)
3. Rectify (restore, repair) (e.g. rehabilitation of temporary disturbance areas
4. Reduce (over time) (e.g. reducing the permanent footprint over time)
5. Offset (initiative outside of footprint to reduce net impact on species)

Mitigation

This strategy therefore firstly outlines management actions that have or will be employed by Water Corporation to avoid impact on EPBC Act listed species wherever practicable. Where avoidance is not possible, Water Corporation will be implementing measures to minimise the extent of impact and/or rectify/reduce the significance of that impact over time, with the intention of ensuring the net impact is not significant. Such measures include rectifying impacts of clearing for construction in areas disturbed but not required for permanent plant or operation.

Where it has been deemed that a risk of a significant residual impact on an EPBC listed species still exists after mitigation, the offsetting of these impacts has been considered. An offset strategy has been outlined in the document for each species where such a risk may be inferred.

Offset definition EPA position versus DEWHA

There are many definitions of environmental offsets. The Australian Government defines environmental offsets as 'actions taken outside a development site that compensate for the impacts of that development - including direct, indirect or consequential impacts'. Based on this definition, some proposed initiatives to be implemented on-site, such as the rehabilitation of habitat outside of the development footprint, would be considered mitigation not offsets. Under the EPA Position Statement No. 9, on-site measures that are outside of the development footprint, once avoidance and minimisation measures are exhausted, would be considered offsets.

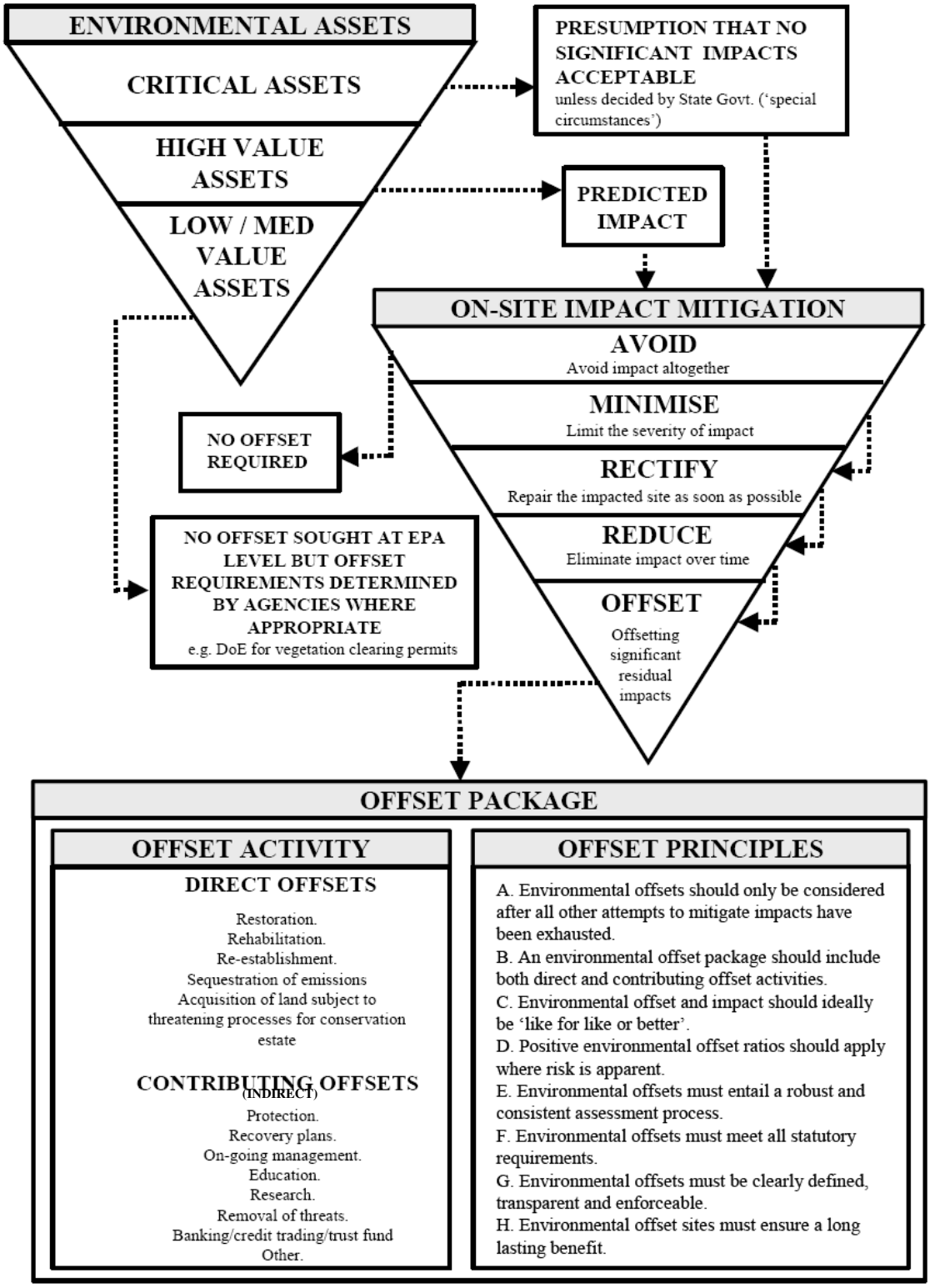


Figure 1 Decision framework for the use of environmental offsets (Source: EPA 2006). Note, contributing offsets are termed 'indirect' offsets in DEWR (2007)

Offsets (on-site and off-site)

To address this inconsistency, for the purpose of this strategy, any initiative to decrease the net impact on a species (other than minimisation) that is outside of the development footprint is referred to as an offset. Such offsets may be both on-site (e.g. rehabilitation of habitat in Lots 32, 33 and part Lot 8) and off-site (e.g. research, acquisition of land for conservation).

Approach to determining offsets

The offset strategies have been proposed based on position outlined in DEWR (2007):

1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

Types of offsets

This strategy adopts the Commonwealth terminology for 'types' of offsets, being that environmental offsets are generally categorised into direct and indirect offsets. Generally, the EPA equivalent to an indirect offset is a 'contributing' offset (Figure 1)

Direct offsets

Direct offsets are aimed at on-ground maintenance and improvement of habitat or landscape values. They may include:

- long-term protection of existing habitat – including through the acquisition and inclusion of land in the conservation estate, and covenanting arrangements on private land
- restoration or rehabilitation of existing degraded habitat
- re-establishing habitat.

Indirect offsets

Indirect offsets are the range of other actions that improve knowledge, understanding and management leading to improved conservation outcomes. They may include:

- implementation of recovery plan actions – including surveys
- contributions to relevant research or education programs
- removal of threatening processes
- contributions to appropriate trust funds or banking schemes that can deliver direct offsets through a consolidation of funds and investment in priority areas
- on-going management activities such as monitoring, maintenance, preparation and implementation of management plans etc.

3. DEFINITIONS

For the purposes of this report, the terms revegetation and rehabilitation have been defined as follows:

1. **Revegetation:** establishment of new plantings to create natural vegetation for National Environmental Significant species habitat and corridor linkage.
2. **Rehabilitation:** the botanical enhancement of degraded native vegetation National Environmental Significant species habitat and corridor linkage.

4. WESTERN RINGTAIL POSSUM

4.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

A previous survey (360 Environmental 2007) identified the occurrence of a small population of Western Ringtail Possum (WRP) within the Tuart and peppermint vegetation associations, and the Banksia and peppermint vegetation associations on the SSDP Plant site. Potential WRP movement corridors from north to south and east to west were also identified within the SSDP site that may allow movement through the site to other habitat areas.

The east-west corridor, which represents the most favourable vegetation for WRP has been able to be avoided during construction, however the narrow north-south peppermint corridor will be temporarily removed during construction for the installation of the buried seawater pipelines. It is not expected that this removal will have a long-term impact on the population as a whole, however the roaming range of a number of individuals will be affected until the corridor can be restored, as north-south movement of animals along the coastal fringe will be restricted.

4.2 ON-SITE AVOIDANCE AND MITIGATION

The primary approach to managing the impact on WRP was to avoid most of their potential habitat areas within the SSDP site that were in a good condition and minimise impact to those areas that cannot be avoided (Table 1, Table 2). To achieve this, the Water Corporation acquired additional land adjacent to the original site (Lots 32 and 33) designated for the plant to provide more space for the project. The purchase of Part Lot 8 to the immediate east of the original site, which contained an area of land previously cleared for grazing quarrying, has allowed Water Corporation to retain more native vegetation suitable for WRP in Lots 32 and 33 (Figure 2).

The main plant site has been shifted out of Lots 32 and 33 and into Part Lot 8, where it is mostly already cleared. Disturbance in Lots 32 and 33 is now restricted to that required for the seawater intake and desalination discharge pipelines between the plant and the ocean. The width of disturbance for this infrastructure has been minimised and is positioned on the southern side of the lots to avoid the denser stands of peppermint trees (Figure 2). The vegetation that will be cleared in Lots 32 and 33 is of lower value for WRP compared to that retained due to its poor condition and sparseness. In addition to the vegetation being retained in Lots 32 and 33, the purchase of Part Lot 8 enables Water Corporation to ensure the conservation of suitable WRP habitat within Part Lot 8, which was otherwise rural land (Figure 2). In total, approximately 15 ha of vegetation is required to be cleared on the plant site, however approximately only 2 ha of this clearing is vegetation of value to WRP or Carnaby's Black Cockatoo.

Management will also focus on the retention of movement corridors for the WRP (Table 2). With the majority of construction occurring in Part Lot 8, the east-west corridor will not be affected, thereby allowing WRP to move south and then east through the SSDP site or vice versa (west and then north) throughout construction and operation. However, the north-south corridor will be affected by the need to install the seawater intake and outfall pipelines. A narrow section of sparse peppermint vegetation that makes up part of the north-south corridor between the pump station and the plant site will need to be removed for the installation of the pipelines (Figure 2). Water Corporation is investigating options to allow WRP to continue to move in a north-south direction while the pipelines are being installed including possum bridges or placement of hessian material and brush cover over the foredune to

increase cover and enhance its function as a north-south corridor. The latter will be made possible by installing the pipelines by tunnelling underground instead of open trenching between the pumping station and the intake structures 500 m offshore. As a result the dune vegetation will not be disturbed from this work and an approximately 450 m vegetated corridor will remain during construction. In addition, Water Corporation will allow fauna movement throughout areas within open trenches by always keeping at least one corridor open between the pump station and the plant.

Following construction, the Water Corporation will revegetate the sections of the movement corridor disturbed (approximately 2.8 ha) using acacias (fast growing species' for rapid return of cover), peppermint trees (for foraging and shelter) and tuarts (for shelter). The net result will be a more intact north-south corridor. The current condition of the vegetation in this section is poor to very poor. This rehabilitation will have regional benefits as it will enhance the Yalgorup/Myalup/Leschenault Coastal North-South Linkage, a significant regional link.

A Revegetation Management Plan has been developed and is included as Appendix G of the cPER. The plan describes the methodology for on-site rehabilitation and includes:

- clearing protocol
- topsoil and mulch management
- weed management
- seeding and planting protocol
- monitoring

A Construction Environmental Management Framework has been prepared to ensure that remnant habitat is retained, and injury and mortality of WRP is avoided, during the construction of the plant and associated pipelines (Table 2).

These management measures will greatly reduce potential for long term impact on the WRP as their habitat within the SSDP site shall be retained and movement in all directions through the site will continue to be possible in the long term.

Table 1 Environmental objectives and targets for protection and management of WRP and its habitat during and after construction

Objective	Target
To minimise the disturbance to WRP and their habitat during construction and operation	No additional clearing outside of approved development footprint during construction
	Stock fences are erected around the retained WRP habitat prior to construction to ensure no access during construction
	No WRP death or injury attributable to the Project during construction and operation of the SSDP
Maintain and/or enhance the habitat linkages across site	Underground tunnelling used for installation of seawater intake and outfall pipelines through the foredunes.
	Retention of WRP movement corridors throughout construction and operation of SSDP
Revegetate and rehabilitate cleared or degraded WRP habitat respectively	Acceptable survival of tube stock plantings within rehabilitated and revegetated areas within three years of commencement of rehabilitation activities.
	Minimal weed infestation within revegetated and rehabilitated areas.

Table 2 On-site management actions for protection and management of WRP and its habitat during and after construction

Topic	Action	Timing	Responsibility
Habitat retention	1. Part lot 8, which has been previously disturbed by grazing and quarrying, acquired to construct plant and thereby reduce the extent of clearing of WRP habitat required on Lots 32 and 33.	Implemented during planning phase	Water Corporation
	2. At least 31 ha of remnant vegetation shall be retained in SSDP site (Figure 2). The vegetation to be retained has been identified as supporting a possum population. The vegetation to be retained also forms part of the east-west movement corridor.	Planning phase and construction Ongoing	Water Corporation
	3. Clearing of vegetation within lots 32 and 33 shall be restricted to degraded vegetation not suitable for WRP habitat with the exception of a narrow north-south corridor of degraded peppermint trees (Area 2 in Figure 2)	Planning phase and construction	Water Corporation
Maintenance of movement corridors	4. Underground tunnelling shall be used to install the seawater intake and outfall pipelines for approximately 450 m through the foredunes to reduce clearing of dune vegetation.	During Construction	Construction Contractor
	5. Water Corporation shall examine options, and implement if deemed feasible, to maintain and/or temporally a shelter corridor or other means to allow WRPs to move in a north-south direction across the SSDP site during the construction of the seawater intake and outfall pipelines. The use of possum bridges and artificial shelter belts will be examined.	Prior to and during construction	Water Corporation
	6. A corridor for the movement of WRP shall be maintained by restricting security fencing to around the seawater pump station and desalination plant construction sites. A connecting pipeline must be installed between the two sites, therefore a stock fence shall be placed between these two areas to discourage human traffic but not limit the movement of possums.	During Construction	Construction contractor
Construction Management	7. A Construction Environmental Management Framework to be developed prior to construction shall include the following management actions for WRP : • installation of fencing around remnant native vegetation and movement corridors • installation of fencing with ground level shrouding around open trenches • retention of potential habitat trees where possible • relocation of WRP prior to construction • protocols for clearing • protocol for vehicle usage and site management • actions to ensure injury/mortality to WRP is minimised during construction works • actions for dealing with injured fauna • protocol for WRP encounters during construction • environmental induction training • protocol for minimising construction at night.	Prior to construction	Water Corporation
Rehabilitation	8. Areas of the north-south WRP habitat corridor disturbed during construction shall be revegetated with peppermint and tuart trees following construction with the intention of improving its present condition from poor/very poor.	After construction	Water Corporation
	9. Approximately 10.7 ha of the SSDP site cleared for construction and not part of the permanent footprint of the plant shall be revegetated after construction, including the planting of peppermints and tuarts in spacing of 4 m.	After construction	Water Corporation

Topic	Action	Timing	Responsibility
	10. Rehabilitation shall be managed in accordance with the Revegetation Management Plan, which includes protocol on the following: • clearing • topsoil • mulching • weed management • seeding and planting • watering • monitoring.	After construction	Water Corporation

4.3 OFFSETS (ON-SITE)

In addition to 10.7 ha[1] of revegetation of areas disturbed during construction, another 10.5 ha of degraded native vegetation on the SSDP site, not associated with any construction activities, will be rehabilitated to improve flora linkages across the SSDP site and the quality of fauna habitat (Figure 3).

Species to be used in the rehabilitation of WRP habitat include:

- *Agonis flexuosa* (Peppermint)
- *Eucalyptus gomphocephala* (Tuart)
- typical understorey species relevant to the area being rehabilitated.

Seed will be collected within a nominal 50 km radius of the SSDP site to ensure that the seed collected is provenance correct. Use of local provenance seed can increase the success of revegetation as seedlings are already genetically adapted to the existing physical climate. Seed collection will be undertaken by an experienced and suitably qualified contractor. Further details on rehabilitation methodologies and species to be utilised are described in the Revegetation Management Plan (Appendix N of cPER).

The constructed berms built for screening purposes, will also be replanted using the above species. This includes an additional 7.7 ha of revegetation to that already proposed above. This includes planting a section directly adjacent to remnant vegetation, Taranto Road and the proposed access road in the north of Lot 8 of with juvenile plants rather than seedlings to enhance the north-south and east-west movement corridors at a faster rate.

The end result will be an increase in habitat available for WRP in Lots 32, 33 and Part Lot 8 and the protection of all habitat not required for the plant in the long term. These offsets which total over 17 ha (including the berm) are considered more than adequate to offset the approximate 2 ha of WRP habitat affected by the Proposal.

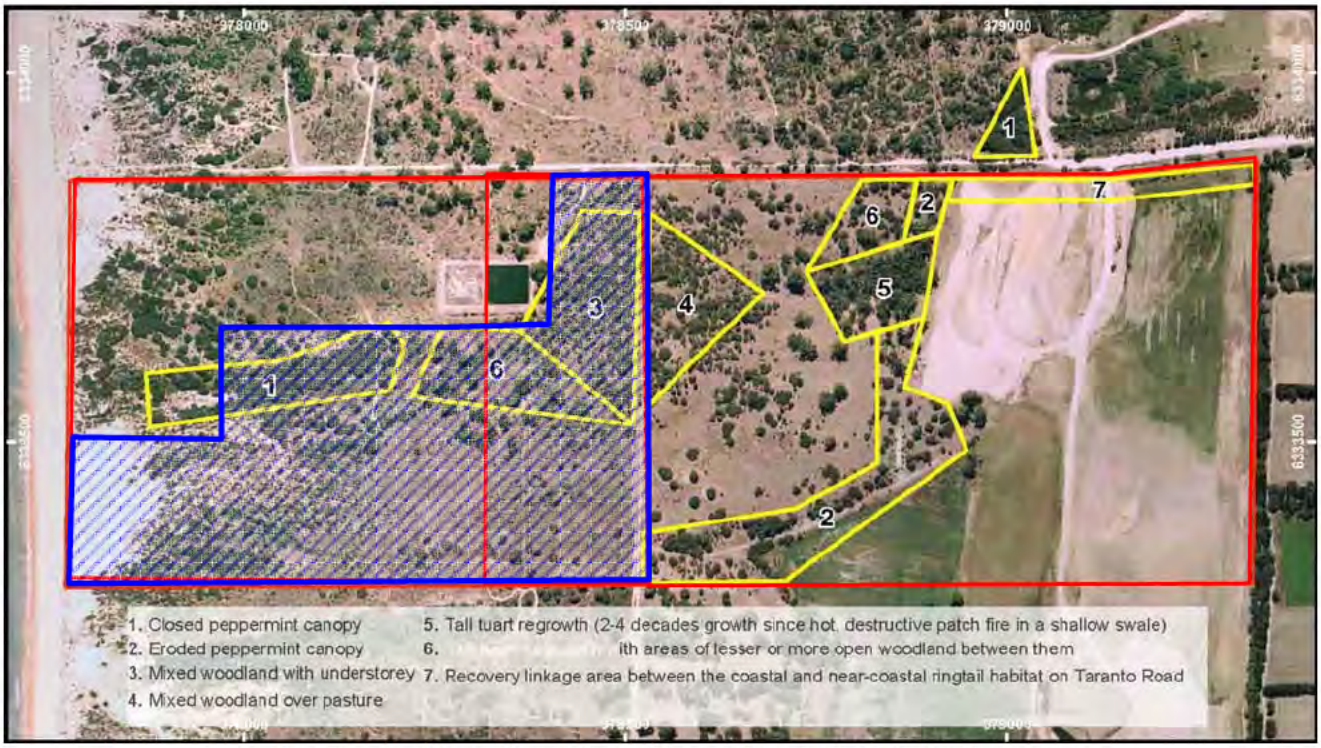
[1] 10.7 ha of revegetation includes 4.35 ha of native vegetation cleared for construction and 6.35 ha of land classed as agricultural land disturbed during construction

Supporting these on-site direct offsets will be a Site Habitat and Fauna Management Plan, which will provide the framework for Water Corporation to protect habitat on site (retained and restored) and ensure operational activities do not interfere with the use of the site by WRP. The plan will include a tree health as well as a WRP population monitoring program. It will include provision for Water Corporation to investigate any decline in health of habitat or WRP population and implement remedial actions if feasible.

4.4 OFFSETS (OFF-SITE)

The Water Corporation is actively seeking opportunities to partner with the Department of Environment and Conservation (DEC) on existing research programs and priorities by enabling them to extend the geographical range of their knowledge.

The numbers of individuals in the Western Ringtail Possum population utilising the SSDP site and land north and south of the site is not known, nor its relationship to the larger population known to exist in the Leschenault Peninsula Conservation Park to the south. A long term population study, spanning approximately five years and encompassing pre-construction, construction and post-construction phases of the SSDP, examining presence and numbers of WRP between Leschenault Peninsula and Yalgorup National Park would have benefits for future planning decisions for coastal development in the region. Such a study would involve funding of technical officers to conduct spotlighting (walking and in vehicles), arboreal cage traps and tagging, and surveys for dreys and faecal pellet counts to develop a population count and range extent for the WRP in this part of WA.



Likely impact on Western Ringtail Possum habitat without purchase of Part Lot 8

Proposed impact on Western Ringtail Possum utilising Part Lot 8

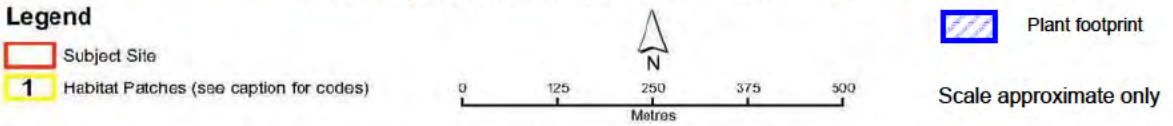
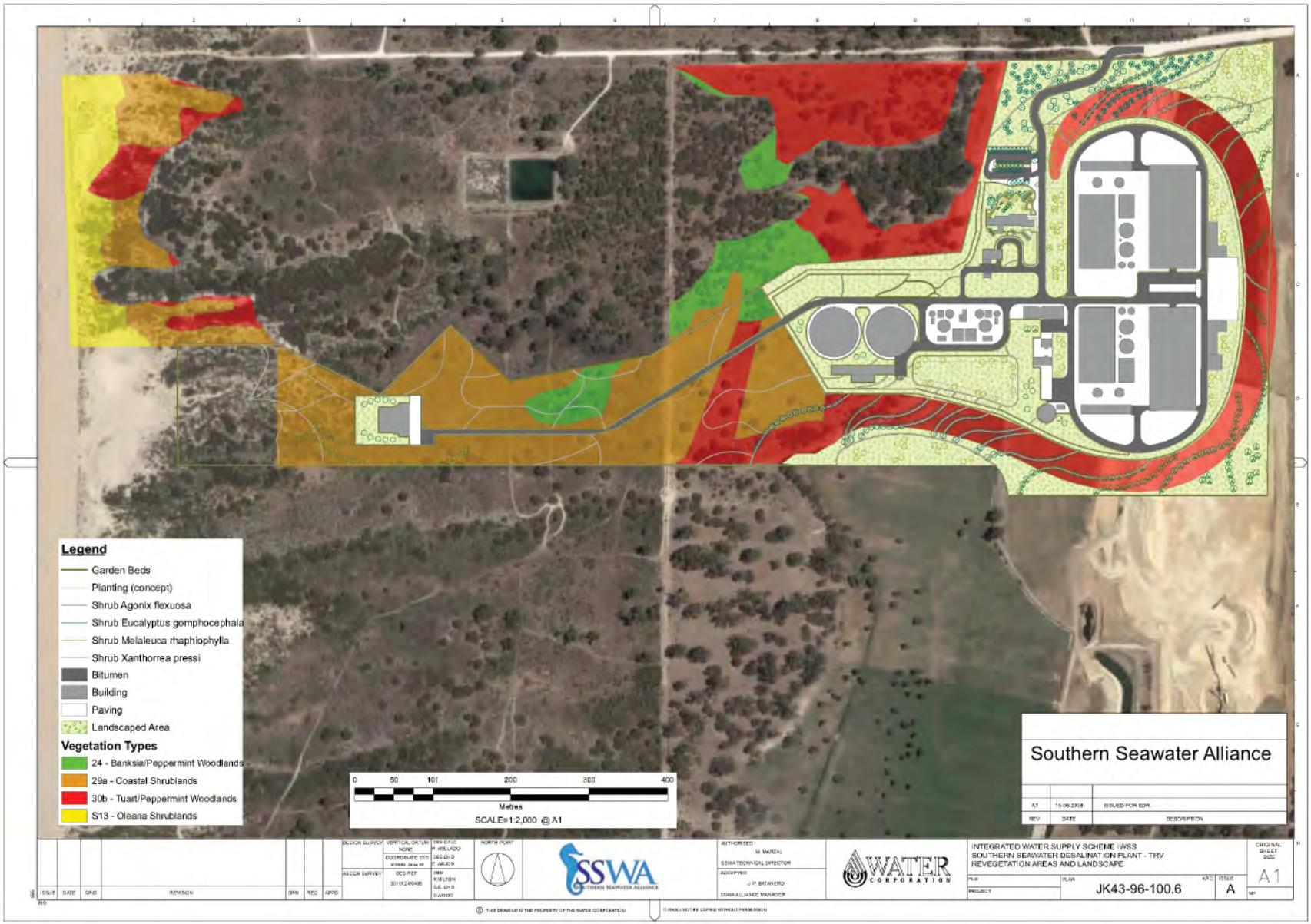


Figure 2 Predicted impact to Western Ringtail Possum habitat with and without use of Lot 8.



strategen

Southern Seawater Desalination Project

PROPOSED CONSTRUCTION AND REVEGETATION AREAS FOR THE PLANT SITE

FIGURE 3

5. CARNABY'S BLACK COCKATOO

5.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

The 2007 survey by 360 Environmental identified flocks of Carnaby's Black Cockatoo feeding in areas adjacent to the SSDP site and a small flock feeding on *Hakea prostrata* vegetation within the SSDP site.

Within the SSDP site, two potential nests/hollows were identified; however these will not be affected by construction works. 14 potential feeding trees were identified in the SSDP site, of which, up to four are likely to be removed during construction.

Three potential hollows/nests and 74 potential feeding trees were identified on or adjacent to the Water Transfer Pipeline. The three trees containing hollows will be retained as construction width can be restricted adjacent to these trees, however, up to an estimated 17 feeding trees are likely to be cleared for the construction of the pipeline.

No potential feeding or nesting trees will be affected by the construction works for the Harvey Summit Tanks.

The numbers of feeding trees that will be removed during construction suggest a limited impact on potential food sources for Carnaby's Black Cockatoo given the known reduction in foraging habitat for this species. However, relatively, this part of the coastal plain still supports large tracts of foraging habitat for this species, unlike the Perth metropolitan area. The loss of 21 feeding trees appears of low local-regional significance given approximately 10,000 ha of native vegetation, which contains large tracts of foraging habitat, exist in the surrounding region.

5.2 ON-SITE AVOIDANCE AND MITIGATION

On-site management for Carnaby's Black Cockatoo will focus on habitat retention (Table 4). The acquisition of Part Lot 8 for construction of the majority of the plant has allowed Water Corporation to retain more native vegetation suitable for Carnaby's Black Cockatoo. Without the purchase of Part Lot 8, the vast majority of feeding trees would have to be removed (Figure 4). With the shifting of most infrastructure to cleared areas in Part Lot 8 and the location of pipeline infrastructure towards the south of Lots 32 and 33, it has allowed Water Corporation to retain almost all of the feeding trees in Lots 32 and 33, most of the feeding trees in Part Lot 8 and both potential nesting trees on the SSDP site (Figure 4). In total, approximately 15 ha of vegetation is required to be cleared on the plant site, however approximately only 2 ha of this clearing is vegetation of value to WRP or Carnaby's Black Cockatoo.

The route and site selection process for the Water Transfer Pipeline and the tank site respectively, also took into account the objective of avoiding or minimising impact to Cockatoo foraging habitat. The majority of pipeline traverses road reserves and agricultural land, with only 7 ha of the 30 km corridor requiring clearing of vegetation. The tank facility is situated entirely on agricultural land.

Table 3 Environmental objectives and targets for protection and management of Carnaby's Black Cockatoo and its habitat during and after construction

Objective	Target
To minimise the disturbance to Carnaby's Black Cockatoo and their habitat during construction and operation	No additional clearing outside of approved development footprint during construction
	No Carnaby's Black Cockatoo death or injury attributable to the Project during construction and operation of the SSDP
Maximise the potential for the Project area to continue to be utilised by Carnaby's Black Cockatoo	All potential nesting trees avoided during construction and retained
	Restrict removal of feeding trees on SSDP site to four feeding trees identified in development footprint (as indicated on Figure 4)
Revegetate and rehabilitate cleared or degraded Carnaby's Black Cockatoo habitat respectively	Acceptable survival of tube stock plantings within revegetated and rehabilitated areas within three years of commencement of rehabilitation activities.
	Minimal weed infestation within revegetated and rehabilitated areas.

Table 4 On-site management actions for protection and management of Carnaby's Black Cockatoo and its habitat during and after construction

Topic	Action	Timing	Responsibility
Habitat retention	1. Part lot 8, which has been previously disturbed by grazing and quarrying, acquired to construct plant and thereby avoid removing habitat trees and reducing the number of feeding trees on Lots 32 and 33.	Implemented during planning phase	Water Corporation
	2. At least 31 ha of remnant vegetation shall be retained in SSDP site (Figure 4). The vegetation to be retained includes potential feeding trees and nests/hollows.	Planning phase and construction Ongoing	Water Corporation
	3. All potential nesting trees identified shall be retained within the SSDP site and the Water Transfer Pipeline	During Construction	Water Corporation Construction contractor
	4. The removal of identified feeding trees shall be restricted to the four recorded in the plant development footprint on the SSDP site and 17 in the Water Transfer Pipeline disturbance corridor.	During construction	Water Corporation Construction contractor
Construction management	5. A Construction Environmental Management Framework to be developed prior to construction shall include the following management actions for Carnaby's Black Cockatoo: • installation of fencing around remnant native vegetation and movement corridors • retention of potential habitat trees where possible • protocols for clearing • protocol for vehicle usage and site management • protocol for Black Cockatoos encounters during construction • environmental induction training.	Prior to construction	
Rehabilitation	6. Approximately 10.7 ha of the SSDP site cleared for construction and not part of the permanent footprint of the plant shall be revegetated after construction, including the planting of banksias, hakeas and tuarts in spacing of 4 m.	After construction	Water Corporation

Topic	Action	Timing	Responsibility
	7. Rehabilitation shall be managed in accordance with the Revegetation Management Plan which includes protocol on the following: • clearing • topsoil • mulching • weed management • seeding and planting • watering • monitoring	After construction	Water Corporation

5.3 OFFSETS

Although a significant impact to this species is unlikely as a result of the proposed action, the 10.5 ha of additional rehabilitation of degraded vegetation that will occur on the SSDP site in areas not associated with construction will aim to enhance and expand the suitable feeding habitat for Carnaby's Cockatoo within the Proposal site (Figure 3). The rehabilitation program will serve as a direct offset to impacts.

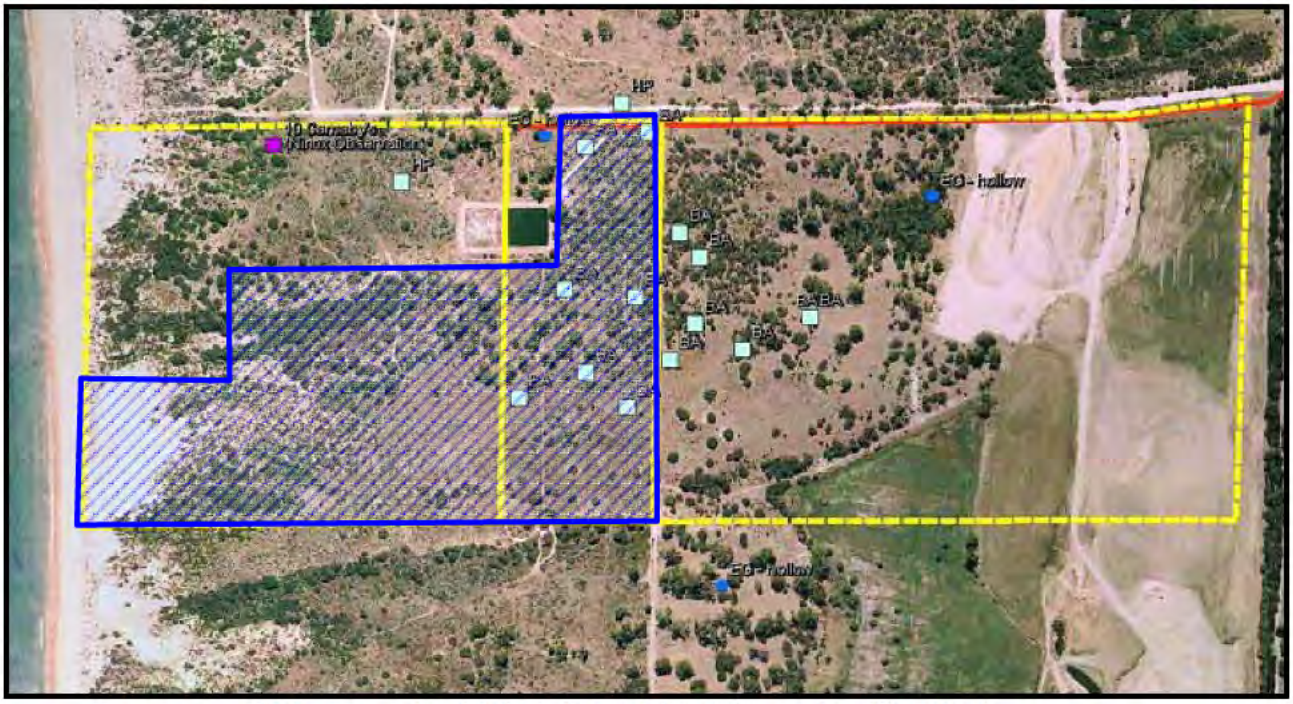
Species to be planted to ensure a greater abundance of feeding habitat in the future include:

- *Banksia attenuata*
- *Hakea prostrata*
- *Eucalyptus gomphocephala*
- typical understorey species relevant to the area being rehabilitated.

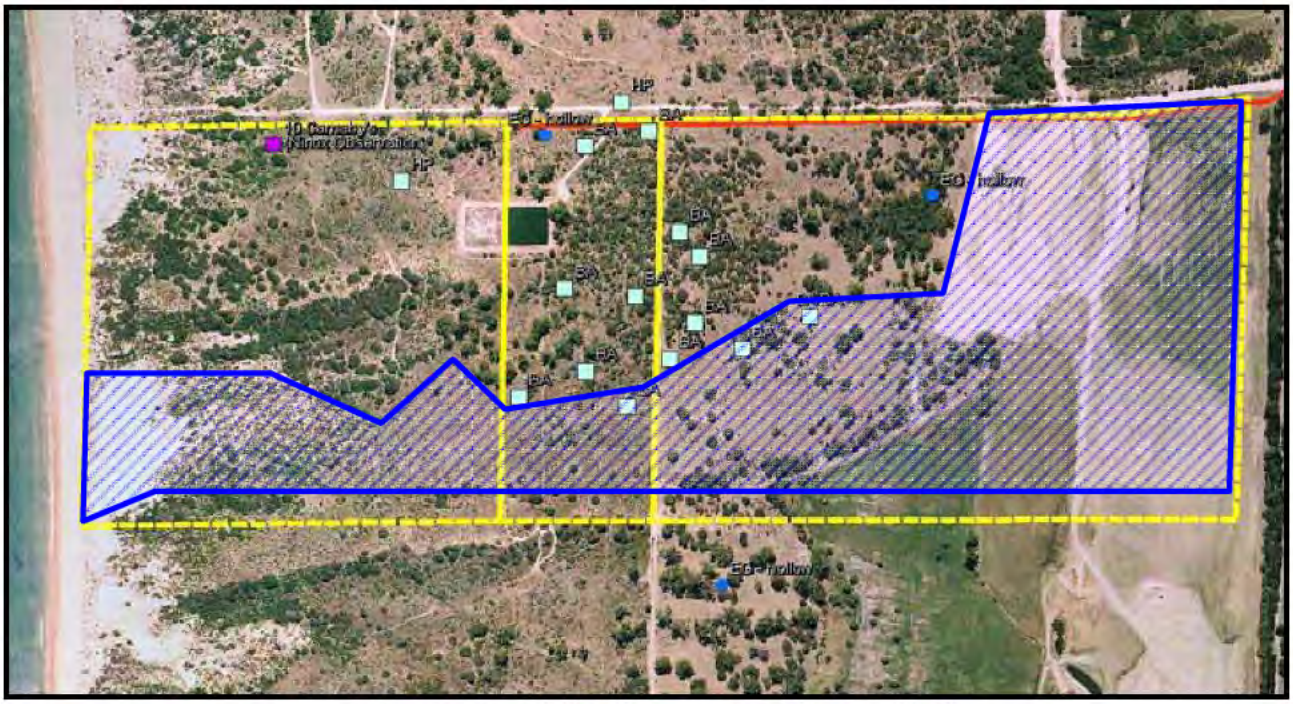
Section 4.3 describes the local provenance seed collection philosophy that will be adopted to maximise likely success of plant survival. Further details on rehabilitation methodologies and species to be utilised are described in the Revegetation Management Plan (Appendix G of cPER).

Screening planting of 3.5 ha of around the Harvey Summit water storage facility, which is currently cleared agricultural land, will also be undertaken. Species used will include Marri (*Corymbia calophylla*) and other local and other local endemic species suitable for Carnaby's Black Cockatoo foraging habitat.

Supporting these offsets will be a Site Habitat and Fauna Management Plan, which will provide the framework for Water Corporation to protect habitat on site (retained and restored) and ensure operational activities do not interfere use of the site by Carnaby's Black Cockatoos.



Likely impact on Carnaby's Black Cockatoo habitat without purchase of Part of Lot 8



Proposed impact on Carnaby's Black Cockatoo habitat utilising Part of Lot 8

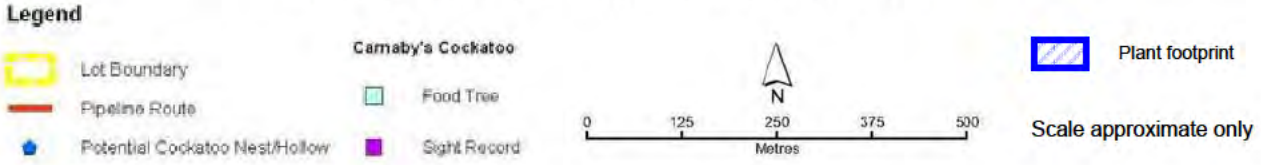


Figure 4 Predicted impact to Carnaby's Black Cockatoo habitat with and without use of Lot 8

6. BAUDIN'S BLACK COCKATOO

Baudin's Black Cockatoo was not sighted during surveys in the SSDP site, however the nesting sites identified could be utilised by this species. They could also conceivably frequent habitat along the pipeline route, however it is highly unlikely that the clearing proposed would significantly affect this species.

Management and mitigation measures to be implemented for Carnaby's Black Cockatoo will however have some similar benefits for Baudin's Black Cockatoo in regards to roosting trees and foraging habitat.

7. MIGRATORY BIRDS

7.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

Lot 8 contains a peripheral estuarine wetland area that is the northern and supra tidal extent of the Leschenault Inlet. The northern part of the Leschenault Inlet wetland system is known to be used by migratory birds. Birds such as the Great Egret, Cattle Egret and Glossy Ibis, listed on JAMBA and/or CAMBA, which have a possibility of occurring in nearby wetlands (URS 2008), may also occur in this wetland. The predicted maximum development footprint includes a portion of the degraded wetland area. Given the degraded nature of the wetland it is unlikely the site contains important habitat for these species or supports breeding sites. These species are also highly mobile, that, if disturbed, are capable of finding other sites unassisted. Final plant design may exclude further portions of the wetland area from disturbance.

The Rainbow Bee-eater, also listed under JAMBA, is likely to occur during September to April within the Proposal area (URS 2008) and was recorded within the Banksia and tuart vegetation types on the SSDP site. Sufficient suitable habitat for this species is available outside of the Proposal area, hence it is unlikely the proposed development will significantly impact this species.

7.2 ON-SITE AVOIDANCE AND MITIGATION

Final design of the plant layout will aim to minimise the impact to the partly modified Leschenault Inlet Conservation Category Wetland and fringing vegetation within Lot 8. The design of the plant has yet to be finalised due to the two different tenders for construction.

A Wetland Management Plan will be prepared as part of the Site Habitat and Fauna Management Plan and submitted to DEC prior to Part V Works Approval being issued. On-site management measures outlined for Carnaby's Black Cockatoo (Table 4) will have similar benefits for the Rainbow Bee-eater as it utilises similar habitats. A primary focus of the selection of infrastructure sites was to avoid and minimise the clearing of terrestrial native flora during construction (GHD 2007a), thereby minimising the loss of avifauna habitat.

Table 5 Environmental objectives and targets for protection and management of Migratory bird habitat during and after construction

Objective	Target
To minimise the disturbance to Migratory avifauna and their habitat during construction and operation.	No Migratory avifauna death or injury attributable to the Project during construction and operation of the SSDP
	No additional clearing within remnant vegetation identified for retention

Table 6 On-site management actions for protection and management of Migratory bird habitat during and after construction

Topic	Action	Timing	Responsibility
Habitat retention	1. Clearing procedures will ensure disturbance to the Conservation Category wetland at the RO plant site associated with the partly modified Leschenault Inlet will not exceed 1 ha.	Planning phase and during construction	Water Corporation
Wetland Management	1. A Wetland Management Plan shall be prepared as part of the Site Habitat and Fauna Management Plan and submitted to DEC prior to Part V Works Approval being issued.	Prior to construction	Water Corporation

7.3 OFFSETS

As it is unlikely the Proposal will have a significant impact on migratory bird species, offsets are not considered necessary. However, offsets for conservation significant wetlands described in Section 10.3 will result in benefits for migratory waterbird species.

8. MARINE FAUNA

8.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

Cetaceans

Cetaceans that are listed under the EPBC Act that may potentially frequent the coastal area in proximity to the seawater intake and outfall include:

- Southern Right Whale (*Eubalaena australis*) - Endangered
- Blue Whale (*Balaenoptera musculus*) - Endangered
- Humpback Whale (*Megaptera novaeangliae*) - Vulnerable
- Bryde's Whale (*Balaenoptera brydei*) - Migratory
- Pygmy Right Whale (*Caperea marginate*) - Migratory
- Dusky Dolphin (*Lagenorhynchus obscurus*) - Migratory
- Orca (*Orcinus orca*) - Migratory.

Other cetaceans that could conceivably occur in the Proposal area include: minke whale, common dolphin, Risso's dolphin, pan-tropical spotted dolphin, Indian Ocean bottlenose dolphin and bottlenose dolphin. The only confirmed sightings of cetaceans around Binningup are predominantly dolphins, most likely the bottlenose dolphin (URS 2008).

The use of the coastal areas off Binningup by cetaceans and therefore the potential to affect them during construction is difficult to judge as there have been no direct studies of marine mammals in this region (Western Whale Research 2008). Impacts associated with noise generated from the Proposal and shock effect in the event of any explosives use during construction are intrinsically low and will be further attenuated through the management measures described in Section 8.2. It is possible that the proposed activities may illicit some short-term behavioural changes, but these will be temporary (the duration of the activity) and only in the immediate area.

It is considered unlikely that the hypersaline brine discharge will impact on cetaceans as these animals are presumably able to sense changes in water salinity and avoid if necessary (Western Whale Research 2008).

Leatherback and Loggerhead turtles

The Loggerhead Turtle may utilise habitat within the vicinity of the SSDP for foraging and has been infrequently sighted in the area. The Leatherback Turtle has been occasionally seen in waters near Binningup, although this species is generally a non-nesting migrant visitor to Western Australia.

Literature reviews and an assessment on marine turtle risks generally concluded that the SSDP site presents minimal risks to turtles and the risks that do exist can be reduced via the management actions proposed in Section 8.2.

Similar to cetaceans, it is unlikely the brine discharge will impact on the Leatherback and Loggerhead turtles.

Grey Nurse and Great White Shark

Information available on the occurrence, species diversity, abundance, distribution and movements of marine mammals and sharks at or near the Proposed SSDP site is extremely limited, however the west coast Grey Nurse Shark and the Great White Shark may potentially occur near the Proposal area.

Grey Nurse and Great White Sharks that enter the Proposal area will able to detect the low frequency noises generated by the construction activities, however, no critical habitat or aggregation areas for either species are known to occur in the vicinity of the SSDP site, hence impact from construction noise is likely to be short-term and non-persistent.

Similar to cetaceans, it is unlikely the brine discharge will impact on the Grey Nurse and Great White Shark.

8.2 ON-SITE MITIGATION

The primary focus for management of large marine mammals and turtles during construction is to ensure their absence from the zone of active works (Table 8). The site for the intake and outfall pipes was selected because it was mostly devoid of habitat features that could attract large numbers of marine fauna to the area, hence the risk of impact is inherently low.

To further reduce the risk of impact to marine fauna, a 1 km marine exclusion area shall be established around the site during construction. This zone will be monitored and surveyed for the presence of marine fauna immediately prior to and during construction activities (Table 8). During blasting activities, if any fauna are sighted within 2 km of the activity, construction will not proceed or will cease until the individuals move out of the exclusion zone. Construction activities will only be conducted in daylight hours and benign sea conditions to enhance the effectiveness of the surveillance.

Table 7 Environmental objective and targets for protection and management of marine fauna and its habitat during and after construction

Objective	Target
To minimise the disturbance to protected marine fauna within the Project area.	No long term change in protected marine fauna movement and behaviour in the vicinity of SSDP
	No protected marine fauna fatalities or injuries within the SSDP site attributable to the Project

Table 8 On-site management actions for protection and management of marine fauna during construction and operation of the SSDP

Topic	Action	Timing	Responsibility
Design	1. Site for intake and outfall pipelines and diffuser selected in an area generally devoid of habitat features such as reefs, sponge gardens or algal beds with limited seagrass coverage which does not commence until about 1000 m offshore.	Implemented during planning phase	Water Corporation
Marine construction activities	2. If necessary to use explosives, only small charges shall be used.	During construction	Construction contractor

Topic	Action	Timing	Responsibility
	3. A 1 km marine exclusion and safety zone shall be established around the site during construction. The exclusion zone shall be monitored during noise intensive activities such as pile-driving and blasting to ensure they are clear of any conservation significant marine fauna.	During construction	Construction contractor
	4. An ocean watch vessel with a suitably qualified observer onboard shall survey the ocean for a 1 hour period prior to blasting within a 2 km radius of the blast site to confirm the presence or absence of marine fauna. Sighting will be undertaken from an elevated land position at the same time. If any are observed to be within the zone then detonation shall be delayed until such time as the observed fauna are outside the zone.	During construction	Construction contractor
	5. To enhance the effectiveness of surveillance, detonations shall only be conducted in daylight conditions and with benign sea conditions (e.g. sea state 3 or below) so that boat (and land-based observers if used) have a reasonable probability of sighting any marine fauna incursion into the safety zone.	During construction	Construction contractor
	6. All marine construction works shall cease if marine fauna are sighted within the marine exclusion zone	During construction	Construction contractor
	7. As far as practicable, any underwater blasting shall be conducted outside of the recognised migration periods in that area for southern right whales (May to October) and humpback whales (May to November)	During construction	Construction contractor

8.3 OFFSETS

Direct offsets for impacts on marine fauna are not considered necessary at this stage in consideration of the low likelihood of impacts to large marine fauna from the construction and operation of the SSDP.

In regard to indirect offsets, Water Corporation has commissioned Western Whale Research (WWR) to undertake a monitoring programme and is investigating the use of hydrophones to directly determine the presence of whales. The incorporation of an acoustic logger placed appropriately offshore of Binningup will provide the first recorded data of whale species that use or inhabit the on-shelf waters. In addition, a series of aerial surveys will provide data on the wider distribution and seasonal timing of species, small vessel surveys will enable identification of individuals, while land based surveys shall be used to provide an accurate baseline dataset that will provide data for the immediate area over time. The land based surveys will allow community members to have the opportunity to contribute sightings of whales to a study of whale migration routes.

A collaborative approach is envisaged between WWR and the Dolphin Discovery Centre in Bunbury who will be involved with the provision of volunteers, some training for local residents and the development of specific sighting forms and data entry.

This fieldwork will provide baseline information that integrates into the broader strategic research framework on the West coast.

9. DWARF HAMMER-ORCHID (*DRAKAEA MICRANTHA*) AND GLOSSY-LEAVED HAMMER-ORCHID (*DRAKAEA ELASTICA*)

9.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

Drakaea micrantha (Dwarf Hammer orchid) has been recorded from around the south coast, between Perth and Albany. It is usually found in open sandy patches in *Banksia* and Jarrah woodland where it grows under thickets of *Kunzea glabrescens* with the Flying Duck orchid (*Paracaleana nigrita*) and other *Drakaea* species (Hoffman and Brown 1998).

While there was a lot of apparently suitable habitat for *Drakaea micrantha* in the wetlands part of the Water Transfer Pipeline route (Boonilup Road area), only one plant was recorded. It was recorded in state forest approximately 45 m north of the Water Transfer Pipeline route on Boonilup Road in a seasonally dampland area (360 Environmental 2008). Given that one *Drakaea micrantha* plant was found, other *Drakaea micrantha* plants may be present at the same location (360 Environmental 2008).

Indirect impacts on *D. micrantha* from temporary dewatering within the pipeline corridor is unlikely due to the dewatering cone of depression being less than 30 m and limited to approximately seven days duration.

D. elastica (Glossy-leaved Hammer-orchid) is found between Cataby and Ruabon on the Swan Coastal Plain and occurs in white or grey deep sandy soil in Banksia woodland, often in association with *Kunzea* spp. (Hopper and Brown 2007). The species has been previously recorded in the Binningup Region but was not recorded in 360 Environmental 2007 survey or the 2008 survey (360 Environmental 2008, K. Gibbs, pers. Comm. 2008).

9.2 ON-SITE AVOIDANCE AND MITIGATION

The first option for management of *D. micrantha* and *D. elastica* shall be avoidance and minimising the clearing of suitable habitat for these species (Table 10). Currently only one *D. micrantha* individual has been recorded within the Proposal area, and this shall be avoided and vegetation clearing minimised by reducing the construction working width of the Water Transfer Pipeline from 50 m to 20 m in the area.

For any populations of *D. micrantha* or *D. elastica* found prior to construction and not able to be avoided, a Management Plan shall be prepared in consultation with DEWHA that shall describe a translocation program for the specimens. They shall be tagged in Spring at the time of survey and translocated in March/April, being the appropriate driest time of year at which to undertake such a program.

Revegetation of the pipeline route with low growing shrub species after construction should rectify some of the impact by restoring suitable habitat for both species.

Table 9 Environmental objective and targets for protection and management of *D. micrantha* and *D. elastica* during and after construction

Objective	Target
Ensure impacts on *D. micrantha* and *D. elastica* are adequately identified and minimised during construction	Occurrences of *D. micrantha* and *D. elastica* (as identified in the flora surveys) to be clearly identified on detailed design plans and in the field for the duration of the construction works.
	Areas containing *D. micrantha* and *D. elastica* (as identified in the flora surveys) not to be disturbed are clearly delineated in the field for the duration of the construction works.

Table 10 On-site management actions for protection and management of *D. micrantha* and *D. elastica* during construction the SSDP and associated infrastructure

Topic	Action	Timing	Responsibility
Baseline information	1. A spring flora survey shall be undertaken in October 2008 within and adjacent to the length of Water Transfer Pipeline alignment to identify the presence and location of *D. micrantha* and *D. elastica* plants.	Early October 2008	Water Corporation
Avoidance	2. Existing areas of cleared land shall be used preferentially over vegetated areas for pipeline and remnant vegetation avoided.	Already implemented in planning	Construction contractor
	3. Construction working width to be minimised and within the State Forest, approximately 50 m north of the Water Transfer Pipeline on Boonilup Road, where *D. micrantha* was identified, shall be reduced to 20 m to minimise vegetation clearing in this area.	During construction	Construction contractor
	4. If any populations of *D. micrantha* or *D. elastica* not previously recorded, are found within the road reserve (in the 2008 spring flora survey), opportunities to avoid or reduce the impact to these populations to the minimum practicable shall be investigated.	Prior to construction	Water Corporation
Translocation	5. For any populations of *D. micrantha* or *D. elastica* not able to be avoided, a Management Plan shall be prepared in consultation with DEWHA that shall addresses: • local translocation program, including description of proposed methodology, locations to be translocated to, and timing and responsibilities • monitoring program • contingency actions, including further research into propagation.	Prior to construction	Water Corporation
Rehabilitation	6. Areas cleared for buried pipeline installation shall be revegetated with low growing shrubs following construction. Seed used shall be local provenance collected within a 50 km radius of the pipeline route.	After construction	Water Corporation

9.3 OFFSETS

Due to the fact that only one individual of *D. micrantha* has been identified in the Proposal area and that it will be avoided by reducing the working width of the pipeline corridor, offsets do not appear warranted at this stage.

10. CONSERVATION SIGNIFICANT WETLANDS

10.1 NATURE, EXTENT AND SIGNIFICANCE OF IMPACTS

Lot 8 contains a peripheral estuarine wetland area that is the northern and supra tidal extent of the Leschenault Inlet. This wetland has been classified by the DEC in 1996 as a Conservation Category wetland. The wetland has a total area of 481.5 ha, of which approximately 2 ha occurs within the SSDP site. The portion of the wetland within the SSDP site is currently in a 'completely degraded' state, and as such the Water Corporation originally intended to use the wetland for parts of the infrastructure for the project, including additional filling, the construction of a visual/noise berm along the southern boundary and the placement of infrastructure such as buildings. No wetland vegetation was to be cleared as part of this Proposal as all such vegetation on the SSDP site has been previously cleared. It was considered that the remaining portion of wetland to the south of the SSDP site would not have been affected by this action. .

The proposed Water Transfer Pipeline will intersect or run adjacent to eight conservation significant wetlands (six Conservation Category wetlands and two Resource Enhancement wetlands) and their associated buffers, along Boonilup Road. Construction works for the pipeline will require the clearing of native vegetation within the Boonilup Road Reserve. The flora and fauna values within the road reserve have already been compromised by construction of the road, therefore it is expected that further impact on the wetlands from clearing of vegetation for pipeline construction will not reduce the value of the wetlands.

Dewatering of the groundwater will be required along the Water Transfer Pipeline route to allow dry installation of the pipeline within a 3 m deep pipeline excavation. For construction, dewatering to a depth of approximately 3.5 m will be required to allow for safe installation of the pipeline. Based on experience of similar installations by Water Corporation in the area, ground water levels are expected to naturally recover with seven days following the cessation of dewatering.

The Water Transfer Pipeline will be buried with the surrounding fill being coarse bedding sand for pipeline protection. This has the potential to alter groundwater flows by acting as a preferential pathway for water flow. The risk of preferential flow is greatest in areas that have heavy soils such as loam or peat. Creating preferential water flows has the potential to cause long-term environmental impact on wetlands such as draining or flooding.

10.2 ON-SITE AVOIDANCE AND MITIGATION

Avoidance

Due to the 'completely degraded' state of the portion of wetland in Part Lot 8, it shall not be completely avoided during the construction of the SSDP.

A criterion for the selection of an appropriate Water Transfer Pipeline route was the protection of wetlands. The total avoidance of wetland vegetation was not possible due to the geographical extent of the large chain of wetlands that extend north to south between Binningup and Harvey, however the alignment of the pipeline was chosen to avoid the clearing of large amounts of wetland vegetation as described below. The total length of pipe within Conservation Category wetlands along the chosen route of Boonilup Road will be approximately 150 m.

Minimisation

The final plant layout has been designed to minimise the impact to the partly modified Conservation Category wetland and fringing vegetation within Lot 8. The only part of the project that will be located within the DEC geomorphic boundary of the wetland will be the visual/noise berm of tuart/peppermint woodland and additional landscaping areas of native vegetation. The placement of infrastructure outside of the wetland boundary has reduced the area of disturbance of the wetland from the originally proposed 3 ha to 1 ha. In addition, as the wetland is presently cleared, it is considered that the planting of native vegetation for the berm and landscaping will result in improvement of wetland function on the SSDP site and will function as an upland habitat area adjacent to the wetland.

Wetland management of the wetland on part Lot 8 will be addressed in the Site Fauna and Habitat Management Plan and refer to procedures for ensuring the extent of disturbance to wetland areas is kept to the absolute minimum required (Table 11), controlling surface drainage to prevent siltation during construction, and spill prevention and response procedure.

Clearing of wetland vegetation along Boonilup Road shall be minimised during the construction of the Water Transfer Pipeline by utilising existing disturbed areas within the Boonilup Road Reserve as much as practicable. The construction working width will be restricted to 15 m (rather than the required 20 m) in areas where wetlands are affected to further reduce the amount of clearing of wetland vegetation. Total clearing along the Boonilup Road section is estimated to be less than 1 ha following application of these measures (Table 11). The maximum estimated impact on each wetland affected along Boonilup Road, as a percentage of its total area, is described in Table 11. Wetland No. 1970 is the most affected with 4.2% of its total area to be cleared. In total, the clearing in the five wetlands amounts to 1.93 ha, or 0.3% of their combined area of 627.6 ha (Table 11).

Table 11 Predicted impacts to conservation significant wetlands from construction of the Water Transfer Pipeline

Wetland No.	Wetland Type	Classification	Total area of wetland (ha)	Approximate impact to wetland (% of wetland affected)
13239	Conservation Category	Estuary peripheral	481.5	1 ha (0.2%)
1655	Conservation Category	Dampland	33.6	Impact to buffer only
1819	Conservation Category	Dampland	40.2	Impact to buffer only
1903	Conservation Category	Dampland	11.6	Impact to buffer only
1919	Conservation Category	Dampland	25.5	0.16 ha (0.6%)
1971	Conservation Category	Sumpland	10.8	0.17 ha (1.6%)
1974	Conservation Category	Sumpland	7.3	Impact to buffer only
1823	Resource Enhancement	Dampland	10.0	0.3 ha (3.0%)
1970	Resource Enhancement	Sumpland	7.1	0.3 ha (4.2%)
Total			627.6	1.93 ha (0.3%)

Source: EPA 2008

In regards to potential dewatering impacts, construction works for the Boonilup Road section shall only be undertaken in the dry (Summer) months, where groundwater is naturally at its lowest, to minimise the impact of groundwater drawdown on the wetland. A Dewatering and ASS Management Plan shall be developed if dewatering is required along the Boonilup Road section of the Water Transfer Pipeline, although this is unlikely in Summer. If required, dewatering could consist of an approximately 500 m set, progressively following the construction front. Construction works will be completed at a rate of 100 m/day, meaning dewatering in any one area will be limited to approximately five to seven days duration. No measurable effect is anticipated from such dewatering on the wetlands along the pipeline route (if required) because of the temporary nature of the operation and the staged method described. The Management Plan will include the monitoring of water levels in adjacent wetlands.

In wetlands areas intercepted by the pipeline where the in-situ material is impermeable or semi-impermeable, and therefore creating natural perched conditions in the wetlands, there is a potential for creating preferential water flows along the pipeline following infill of the pipeline trench with coarse sand with higher porosity. This will be managed by the installation of 1 m clay cut-off walls placed perpendicular to the pipeline within the trench to replace the intercepted impermeable strata layer. The clay cut-off walls will be a barrier to flow along the pipeline, effectively causing the groundwater to flow through the original pre-construction pathway. The clay cut-off walls will also be installed at the boundaries of the wetlands along Boonilup Road, at the edge of irrigated agricultural paddocks, property boundaries and in steeply sloping areas. In pervious soils, the course soil used for backfill will be similar in porosity to the sand surrounds and hence not create preferential water flows and no mitigation is deemed necessary.

Rectification

The proponent will mitigate impacts to wetlands through revegetation of cleared areas along the pipeline corridor after construction.

Table 12 Environmental objectives and targets for protection and management of conservation significant wetlands during and after construction

Objective	Target
To minimise the disturbance to 'conservation category' wetlands	No additional clearing within remnant vegetation identified for retention
	No long term effect on groundwater levels in vicinity of wetlands.

Table 13 On-site management actions for protection and management of conservation significant wetlands during and after construction

Topic	Action	Timing	Responsibility
Wetland vegetation	2. Clearing procedures will ensure disturbance to the Conservation Category wetland at the RO plant site associated with the partly modified Leschenault Inlet will not exceed 1 ha.	Planning phase and during construction	Water Corporation
	3. Clearing procedures will ensure disturbance to the wetlands and their fringing vegetation along Boonilup Road will not exceed the areas as described in Table 11	Planning phase and during construction	Water Corporation
	4. The construction width for the Water Transfer Pipeline corridor shall be reduced from 20 m to 15 m in areas through affected wetlands along Boonilup Road (Table 11)	Planning phase and during construction	Water Corporation
	5. Wetland management will be addressed in the Site Fauna and Habitat Management Plan and refer to procedures for: • ensuring the extent of clearing to wetland areas is kept to the absolute minimum required • controlling of surface drainage and erosion to prevent siltation of adjacent wetland areas during construction • spill prevention and response • dewatering control; and • rehabilitating areas disturbed within the Conservation Category wetland area but not required to be kept clear following construction.	Prior to construction	Water Corporation
	6. The pipeline corridor shall be revegetated following construction with suitable wetland native species in wetland areas and upland species in wetland buffer areas affected to rectify impact on wetlands in the medium to long term.	After construction	Water Corporation
Dewatering management	7. If dewatering is required along the Boonilup Road section of the Water Transfer Pipeline, a Dewatering and ASS and Management Plan shall be developed.	Prior to construction	Water Corporation
	8. Construction works for the pipeline shall be undertaken in the dry (summer) months to reduce the potential for dewatering to be required.	During construction	Water Corporation
Groundwater flows	9. Clay cut-off walls with a width of 1 m shall be installed within the trench perpendicular to the pipeline at the boundaries of the wetlands along Boonilup Road, at the edge of irrigated agricultural paddocks, property boundaries and in steeply sloping areas.	During construction	Water Corporation

10.3 OFFSETS (OFF-SITE)

Water Corporation is investigating an off-site wetland restoration project nearby to offset the impacts of the project on wetland areas. This is being done to meet the requirements of condition 10 of Ministerial Statement 792 which states:

"10-1 The proponent shall only clear native vegetation on Part Lot 8 Taranto Road, Binningup and the Boonilup Road section of the Water Transfer Pipeline subject to the satisfactory demonstration that an 'Offset Implementation Strategy' has been prepared and is able to be implemented in accordance with condition 10-2.

10-2 The 'Offset Implementation Strategy' referred to in condition 10-1 shall detail an offset which will provide an adequate restoration of an agreed wetland in accordance with Environmental Protection Authority *Guidance Statement No.19: Environmental Offsets – Biodiversity* (September 2008) and to the satisfaction of the CEO of the DEC".

After discussions with DEC Bunbury, Benger Swamp has been recommended as a potential site for this project as its protection and enhancement is a DEC priority. A separate Offsets Implementation Strategy containing further details of this offset is being prepared and will be submitted for approval to the DEC. A brief summary is included below.

10.3.1 Benger Swamp

Benger Swamp is situated on the Swan Coastal Plain between the Darling Scarp and Wellesley River, approximately 12 km south west of Harvey. Originally it covered an area of approximately 1000 ha, but over the last 100 years, this has been reduced to approximately 580 ha by the construction of a series of drains and levees (DEWHA 2008).

The Swamp supports a diverse array of waterbirds with some of the largest populations in WA, and is a breeding site for many of these species. Fourteen of these species are listed on international migratory treaties, thirteen are listed on the Japan Australia Migratory Bird Agreement (JAMBA) and thirteen are listed on the China Australia Migratory Bird Agreement (CAMBA). It supports two internationally rare species of waterbird, including a remnant population of the Australasian Bittern (*Botaurus poiciloptilus*), declared threatened under the WA Wildlife Conservation Act 1950, Schedule 1. Benger Swamp also supports a range of wildlife in addition to birds, including the long necked tortoise (*Chelodina Oblonga*), water rat (*Hydromys chrysogaster*) and three frogs: brown tree frog (*Litoria adelaidensis*); golden bell frog (*L. moorei*); and a species of *Crinia* (DEWHA 2008).

Benger Swamp is an example of a seasonal, freshwater marsh which has been detrimentally affected by various agricultural practices and other threatening processes such as weed invasion and feral animals. It is reliant on active management to maintain its biological/ecological value (DEWHA 2008).

10.3.2 Direct offsets

The Water Corporation is working with DEC in developing the restoration project for Benger Swamp to improve its wetland values through planting of native vegetation in degraded areas of the Swamp to re-establish habitat.

10.3.3 Indirect offsets

In addition to revegetation works at Benger Swamp, the Water Corporation will ensure strategies for weed control, feral animal control, fencing and monitoring will be included as part of the Restoration Project to further enhance the conservation value of Benger Swamp. Additional research activities such as an Australasian Bittern Survey are also being investigated.

11. CONCLUSION

The major mitigation measures for the SSDP to avoid, minimise or rectify impacts on species of National Environmental Significance include:

- acquisition of Part Lot 8 for the location of the SSDP plant to avoid or reduce the clearing of significant habitat areas on Lots 32 and 33
- avoiding significant habitat and/or flora species within the Project area through changes in project design
- maintaining WRP movement corridors within the SSDP site throughout construction and operation of SSDP
- revegetating 10.7 ha of the site not required for the operation of the SSDP with local provenance species after construction
- developing a Site Habitat and Fauna Management Plan for EPBC listed species and wetland management detailing actions to be implemented to ensure impacts to are minimised during construction and operation of the SSDP
- establishing a marine exclusion zone around the construction area to ensure the absence of large marine fauna during marine construction activities

Offsets for any residual impact after implementation of the above management measures include:

- rehabilitating 10.5 ha of degraded vegetation in Lots 32 and 33 (in addition to the rehabilitation of areas cleared for construction) and revegetating 7.7 ha of berms around south-east boundary of site to improve quality of fauna habitat and ecological linkages. The revegetation will be dominated by flora species used by WRP and Carnaby's Black Cockatoo for sheltering, foraging and roosting.
- investigating opportunities to fund research programs to enhance knowledge of the WRP in the region
- commissioning Western Whale Research to conduct further research and monitoring of whale presence and movement in the region
- investigating opportunities for a Wetland Restoration Project for Benger Swamp and supporting site management.

Taking into account these measures to be implemented, the proposed SSDP is not likely to have a significant impact upon specific Matters of NES afforded protection by the EPBC Act.

12. REFERENCES

360 Environmental 2007, *Binningup water treatment facility and pipeline corridor: due diligence flora and fauna investigation*.

360 Environmental 2008, *Southern Seawater Desalination Project 2007: Terrestrial Flora and Fauna Survey.*

Environmental Protection Authority 2008, *Southern Seawater Desalination Plant Report and Recommendations of the Environmental Protection Authority*, EPA, Perth, October 2008.

Environmental Protection Authority 2006, *Environmental Offsets Position Statement no. 9*, Environmental Protection Authority, Perth, January 2006.

Department of Environment and Water Resources (DEWR) 2007, *Draft Policy Statement: Use of Environmental Offsets Under the Environment Protection and Biodiversity Conservation Act 1999 Discussion Paper*, Australian Government, August 2007.

Department of Environment, Water, Heritage and Arts (DEWHA) 2008, *Australian Heritage Database – Benger Swamp, Swamp Road, Benger, WA, Australia*, [online], Australian Government, Available from: http://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;place_id=19498 [13 October 2008]

GHD 2007a, *Report for Southern Seawater Desalination Plant Summit Tank – Preliminary Site Assessment*

Gibbs, K. 2008, Personal Communication, Maunsell, October 2008.

Hoffman, N. and Brown, A. 1998, *Orchids of South-West Australia*, 2nd Edn. University of Western Australia Press, Perth.

Hopper, S. and Brown, A. 2007, *A Revision of Australia's hammer orchids (Drakaea; Orchiaceae), with some field data on species-specific sexually deceived wasp pollinators*, Australian Systematic Botany 20, 252-285.

URS 2008, *Southern Seawater Desalination Plant: Draft Commonwealth Public Environment Report (2nd Working Draft Report)*, Prepared for Water Corporation, 3 September 2008.

Western Whale Research 2008, *Preliminary Advice and Recommendations for the Minimisation of Potential Impacts of the SSDP upon Marine Mammals near Binningup, WA.* February 2008.

AN ABORIGINAL HERITAGE SURVEY FOR THE SOUTHERN SEAWATER DESALINATION PROJECT, SHIRE OF HARVEY, WESTERN AUSTRALIA.

A report prepared for the Water Corporation.

By Mr Brad Goode
Consulting Anthropologist
79 Naturaliste Terrace
DUNSBOROUGH WA 6281
bradnlee@westnet.com.au

Mrs Jacqueline Harris
Consulting Archaeologist
26 Camelia Street
North Perth WA 6006
jac234@bigpond.net.au

Report submitted July 2008 to:

Ms Vanessa Ugle
Water Corporation - Indigenous Resources
PO Box 100
LEEDERVILLE WA 6902

The Registrar
Department of Indigenous Affairs
PO Box 7770
Cloisters Square
PERTH WA 6000

HERITAGE SURVEY

79 Naturaliste Terrace
Dunsborough WA 6281
Email:- bradnlee@westnet.com.au
Phone:- 97553716

EXECUTIVE SUMMARY

The Water Corporation is proposing to construct the Southern Seawater Desalination Plant at Binningup Beach with the desalinated water piped to Harvey to be added into the South West Western Australian Integrated Water Supply System (IWSS). The Southern Seawater Desalination project is required to mitigate the shortage of water for consumption in the South West of Western Australia. The Water Corporation wishes to determine whether any sites of significance to Aboriginal people will be impacted upon by this proposed work thereby fulfilling their obligations under the Western Australian Aboriginal Heritage Act (1972).

As a result of archival research no previously recorded Aboriginal Heritage sites will be affected by the project proposal. The Water Corporation planning department advised that Aboriginal heritage issues had been taken into consideration during the initial planning stage and therefore the infrastructure and pipeline path had been designed to not impact any sites of significance to Nyungar people. Archival research conducted by the consultants confirms the Water Corporations advice.

As a result of consultations held with members of the Gnaala Karla Booja WC98_058 Native Title Claim group no Aboriginal Heritage sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within Lots 32, 33 and part Lot 8 Taranto Road. No sites were identified along the proposed pipeline path and within Wellington location 554 proposed for the storage tank site.

During the ethnographic survey a possible scar tree was identified to be located on the southern side of Boonilup Road at coordinate 387509mE and 6336988mN. It could not be determined if this trees scar was of Aboriginal origin as the tree had been used for a survey mark. It was requested by the Nyungar informants that the tree be reported as a site under section 5a of the 'Act', however in the opinion of the project archaeologist and a senior heritage officer at the DIA the tree was most likely scarred as a result of a surveyor using the tree as a location marker. It was requested by the Nyungar informants that the Water Corporation avoid the tree.

During the consultations a number of cultural issues were raised by the Nyungar informants. The area proposed for the development of the sea water pumping station was identified as an area where Aboriginal skeletal remains may be located. There is a considerable record in the region of traditional Aboriginal skeletal remains being found within the dunes fronting the sea. The Nyungar informants requested that all works that affect the dunal areas are monitored by two Nyungar representatives chosen from the group who participated in the survey. The area of the fore-dunes was also identified as an important fauna habitat for Nyungar food species and as such it was requested that excavation in the area should be minimized and that once completed the dunes should be reinstated to a natural state. It was further requested that once the construction was completed that the area remain accessible to Nyungars for hunting and not be fenced.

During the consultations one Nyungar consultant reported that it was spiritually inappropriate to desalinate water and bring desalinated water upon the land for consumption (see Appendix 4).

In regards to the pipeline crossing of all water courses within the project area the Nyungar community members consulted identified that where possible directional drilling was a much more culturally appropriate method. Directional drilling was considered to be less intrusive as it minimises the affect on the riparian zones, does not disrupt the flow of water and does not cause pollution by sedimentation of the water courses.

As a result of the above survey, the following recommendations are made:

It is recommended that as no sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified within the project area, that the Water Corporation should proceed with the project as planned.

It is recommended that the Water Corporation take into consideration the request of the Aboriginal community to engage two Aboriginal monitors chosen from the group who participated in the survey to inspect ground disturbing works that affect the construction of the seawater pump station (Lot 33), inlet and outlet pipelines to the sea (Lot 33 and beach), pipelines from the treatment plant site to the seawater pump station (Lots 8, 32 and 33) and the construction of service roads (lots 8, 32 and 33).

It is recommended that the Water Corporation give due consideration to the Aboriginal community requests that once the project is complete that Lots 8, 32 and 33 boundaries are not fenced in order to exclude Nyungars and wildlife access through the area.

It is further recommended that the Water Corporation give due consideration to Aboriginal community requests that all water courses crossed for the pipeline are crossed by directional drilling which is a culturally more appropriate method as opposed to open trenching.

CONTENTS

LIST OF FIGURES

REPORT

An Aboriginal Heritage Survey for the Southern Seawater Desalination Project, Shire of Harvey, Western Australia

ISSUE

The Water Corporation is proposing to construct the Southern Seawater Desalination Plant at Binningup Beach with the desalinated water piped to Harvey to be added into the South West Western Australian Integrated Water Supply System (IWSS). The Southern Seawater Desalination project is required to mitigate the shortage of water for consumption in the South West of Western Australia. The Water Corporation wishes to determine whether any sites of significance to Aboriginal people will be impacted upon by this proposed work thereby fulfilling their obligations under the Western Australian Aboriginal Heritage Act (1972).

REPORT OBJECTIVES

To report on archival research in order to determine if any previously recorded Aboriginal Heritage sites will be impacted upon by the above project proposal.

To report on consultations held with representatives of the Gnaala Karla Booja WC98_058 Native Title Claim group in order to determine if any new Aboriginal Heritage sites will be affected by this proposal.

To make recommendations with regards to the management of any identified sites should the project proposal proceed.

BACKGROUND

On the 10th January 2008, Ms Vanessa Ugle contacted Brad Goode and Associates and advised them of the need to conduct a Site Identification Aboriginal Heritage Survey of the proposed Southern Seawater Desalination plant and pipeline project.

The Water Corporation is responsible for public water supply and it has been identified that water supply capacities are at critical point within the greater Perth region and in the broader integrated water supply system of the South West therefore the Government has commissioned the Southern Seawater Desalination Project to address this need.

The proposed new Desalination Plant which will be powered by renewable energy sources is proposed to be constructed at Binningup Beach within Lots 32, 33 and part Lot 8 on Taranto Road. The plant site will contain:

- Up to 100GL/y reverse osmosis seawater desalination plant
- Up to two submerged seawater intake pipelines extending up to approximately 500m offshore.
- Process buildings including a seawater pump station, chemical storage facility, drying beds, reverse osmosis building, drinking water storage tanks and pump stations, administration, plant operation control, laboratory, workshop and general storage
- Two sea water concentrate (brine) outlets with diffusers extending to a distance of up to approximately 1100m offshore.

From the Binningup Beach Desalination Plant site, approximately 28.5km of 1400mm diameter steel pipeline will be installed to connect to a storage facility high on a hill north-east of the

township of Harvey. The pipeline path will mostly be trenched alongside road reserves approximately 3m in depth and will require a 5-8m in width clearing corridor (depending on soil type and stability). The pipeline path follows a corridor heading east along Taranto Road, north along Old Coast Road, north-east through a farm paddock, east along West Break, north along East Break, east to north-east on Boonilup Road, east along Rodgers Road, north along Government Road, east along Yambellup Road and River Road, crossing the South Western Highway travelling east through farm paddocks before connecting to the Harvey Water Storage Facility high on a hill at Wellington location lot 554. The Harvey Water Storage facility contains up to four storage 100ML tanks with up to 5ML sump. From the Harvey Storage facility the pipeline will connect to the existing Stirling Trunk Main of the Integrated Water Supply Scheme (IWSS).

Throughout the pipeline path a number of water courses will need to be crossed. It is proposed to open trench these water courses and divert the water flow through channels or pipes during construction. If turbidity results sterile hay bales will be installed in the water courses 10m down stream to trap the sediments. Following construction the bed and banks of the water courses crossed will be re-contoured and rehabilitated with plants of local provenance.

Some clearing of native vegetation will be required at the Seawater Desalination Plant Site, Water Transfer Main and the Harvey Summit Tank sites. Clearing will be keep to the minimum required.

At the Seawater Desalination Plant Site the area to be cleared is yet to be determined but all clearing will be contained within the shaded area shown on the attached plan in Appendix 3. At the plant site within the designated lots topsoil will be removed to a depth of 200mm and stored in windrows to be later spread back prior to rehabilitation. It is estimated that clearing will effect only one third of the designated lots with most effects contained within areas already in a highly disturbed state from quarrying and agriculture. A portion of the frontal dunes will be cleared and excavated to build the pump station and sea water intake and outtake pipes. These dunes will be reconstructed and rehabilitated once construction is complete. The intake and outtake pipes may require trenching of the beach by an excavator and sea bed trenched from a temporary jetty or a barge. Clearing for the pipeline through the dunes will require a 20m corridor. All areas cleared will be rehabilitated once construction is complete.

Implementation of the Southern Seawater Desalination Project will be staged. The initial stage of the construction will consist of the construction and operation for a 50GL/y water production plant with one 25ML water storage tank. All terrestrial and marine pipelines will be constructed for a 100GL/y capacity at the initial stage of constructions. The capacity of the plant site and water storage facility will be increased as water supply demand increases.

As a result of the above brief an archaeological inspection was carried out by Mrs Jacqueline Harris and assistants Mr Wayne Webb and Mr Ted Hard between the 20th and 23rd May 2008. The ethnographic survey was conducted by Mr Brad Goode and assistants Mr Colin Irvine and Mrs Melinda Cockman with members of the Gnaala Karla Booja Native Title Claim groups on the 17th and 18th June 2008. The ethnographic survey included a tour of Water Corporations existing Seawater Desalination Plant Site at Naval Base.

LOCATION

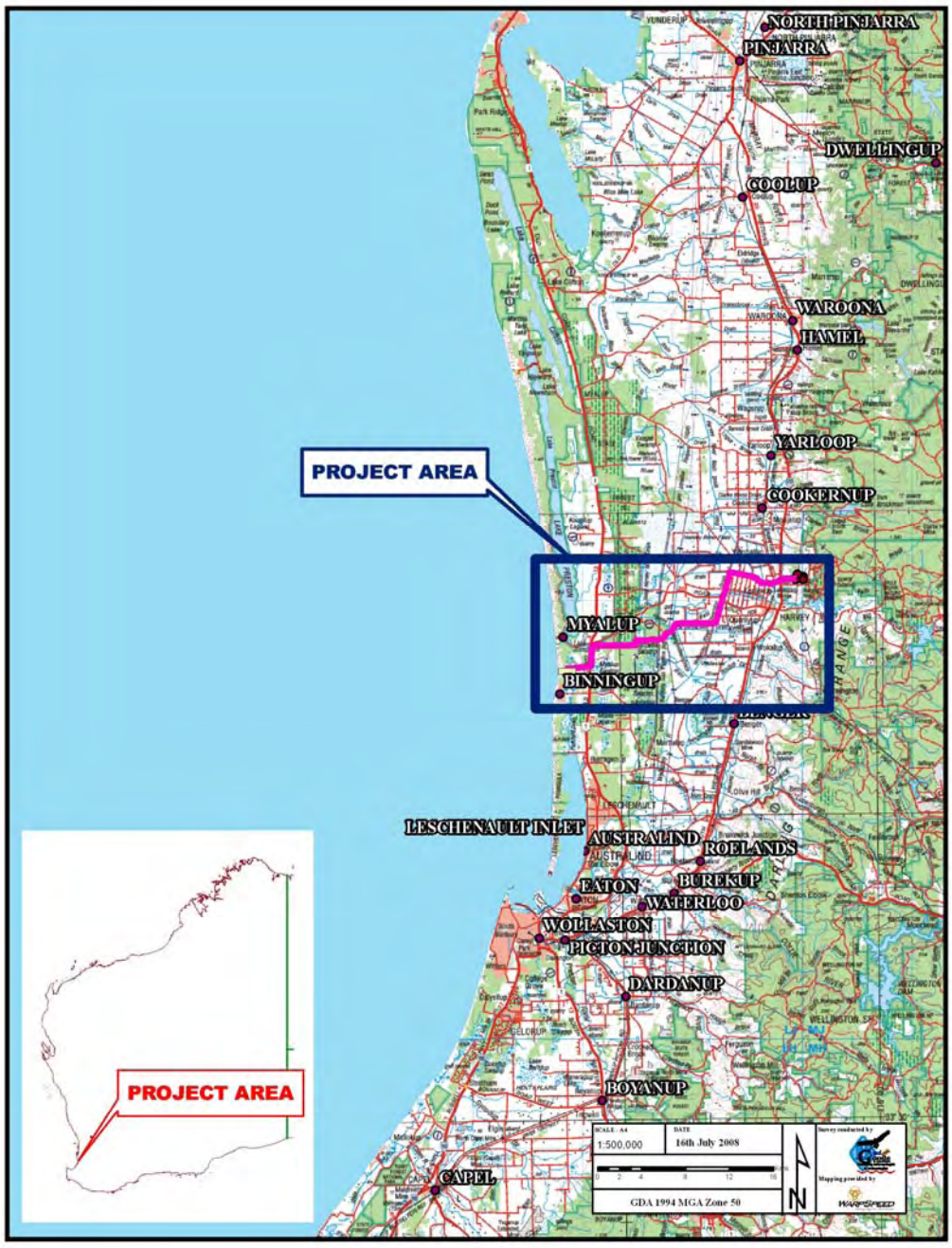


Figure 1. Location of the Project Area

ETHNOGRAPHIC & HISTORICAL BACKGROUND

TRADITIONAL NYUNGAR CULTURE

Prior to European settlement Western Australia's southwest was home to thirteen socio-dialectal groups who shared traditions and a common language with local variations. These groups, known collectively as *Nyungar* encompassed a triangle from Jurien Bay in the north to Esperance in the southeast (Berndt 1979, Tindale 1974, Tilbrook 1983). Before linguistic boundaries were formed these people were known by Europeans as the *Bibbulmun* and were said to be 'the finest group in all West Australia' (Bates 1938:59-61). The word Bibbulmun means many breasts, a name derived, perhaps, from the great fertility of the region or the number of women and children among the seventy subgroups.

Tindale (1974) recorded that the *Pindjarup* occupied the area from Pinjarra to Harvey, inclusive of the Leschenault Inlet and the lower reaches of the Murray River. Bates records the *Kunniung* (west) *Bibbulmun* people as having occupied the Bunbury area prior to colonization. Bates records the dialect of the Bunbury region as *Burrong Wongi* (Bates 1985:54).

To the south-east Tindale (1974:244, 260) and Berndt (1979) both record the region as home to the *Kaneang.* To the east were located the *Wilman* people who occupied the territory at Wagin and Narrogin, on the Collie, Hotham and Williams Rivers west of Collie.

Unlike their inland neighbours who employed the 'Old Australian tradition' of circumcision (Berndt & Berndt 1980) Nyungars restricted the physical marks of initiation to nasal septum piercing and cicatrisation. A boy at age nine or ten would be removed from his home camp to live with his maternal uncles for several years. During this time upper body cicatrisation and nasal septum piercing would take place and he would learn the lore of the country before returning to live with his immediate family, having passed into manhood. (Bates 1985, 151-158).

The two primary social moieties of the Nyungar, the *Manitchmat* (white cockatoo) and *Wordungmat* (crow) were the basis for marriage between a further four semi-moieties or clan groups. The semi-moieties *Tondarup* and *Didarruk* were derivatives of the former and *Ballaruk* and *Nagarnook* derivatives of the latter. (Berndt 1979:82; Bates 1985;74). It was strictly forbidden to marry within one's own moiety. In fact, the only lawful marriage was seen to be the cross cousin marriage of paternal aunts 'children to the maternal uncles' children. This form of social organization was identical in tribes across all of Western Australia (Bates 1966:24-25).

The basis for Aboriginal spirituality, land use and ownership lies in their Dreaming. In the Dreaming ancestral beings created the world and all within it thereby defining spiritual, social, moral and territorial division for its inhabitants. The spiritual essence of all ancestral beings not only transformed the landscape but also infused it with living spirit. The beings remained in significant sites and so all generations are linked to the Dreaming and to the eternal spiritual beings (Berndt 1979). The Nyungar held one central creator spirit, the *Waugal* (after Moore 1842, Berndt 1979; *woggal* after Bates 1938 & 1985), who created and is still present in all sources of water in the southwest. Bates (1985:219-221) notes that wherever the Waugal stopped or camped was sacred. As a consequence, these places were generally avoided (*winnaitch*). O'Connor, Quartermaine and Bodney (1989) provide a theoretical explanation of what they term "the ubiquitous Waugal myth." The Waugal, they say, is a water creative spiritual force with a serpentine physical manifestation, which created many of the south west rivers and whose essence remains in such as the Collie and Preston Rivers to this day. The author's state the imputation of religious significance to water sources is at least as old as recorded human history and that it is not surprising that in an arid country such as Australia it occurs in many totemic forms. O'Connor et al note Waugal sites of significance at various

locations on the Collie River at Collie, namely Bottoms Pool, Wuridjong Pool, Telfer Pool and Wellington Dam.

Aborigines throughout all of Australia have historically held two distinct and complementary forms of relationship to the land: esoteric (sacred, ritual, mythological and ceremonial) and economic (biographical, historical and habitation). Stanner clarifies their difference by using the terms *estate, range and domain*. Estate refers to the home ground or Dreaming place of a particular descent group. Range refers to the tract of country over which the group travelled for hunting and foraging, and included their estate. In short, range gave economic boundaries and estate offered a sense of place and of spiritual meaning for both the individual and the group as a whole. A descent group's domain refers to the combination of both estate and range (Stanner 1965:2). The strength of attachment to a particular place would vary from person to person and/or family to family but the associations with the land were, and remain today, crucial elements of Aboriginal society.

Nyungars employed a mobile lifestyle and movement by local family groups was usually along a series of well-defined tracks or paths (*bidi)* which followed the corridors of easiest movement. The fluidity of the kinship system among Nyungars was recorded in early ethnographic studies as individuals were noted to have moved freely between these family runs (Salvado 1977:130-131).

EUROPEAN SETTLEMENT AND ABORIGINAL SOCIAL DISRUPTION

According to Bates (1985:54) the population of the Nyungars before settlement was around 40,000 but more recent research suggests a far lower estimation of around 6,000 (Berndt 1979; Green 1984; Tilbrook 1983) who lived mainly on the coastal plain. Population of the less favourable forest and woodland environments is thought to have been more sparse (Anderson 1984; Tilbrook 1983).

During his expedition of 1829, Lieutenant Preston, officer on the HMS Sulpher, was accompanied by naval surgeon Dr Collie and set sail from the Swan River Settlement to examine the south-western coast. Passing through the channel between Garden Island and Cape Peron they chartered the water south to Murray River. Following this they travelled on to Port Leschenault and, upon entering the inlet discovered a river about three miles from their camp. They named it the Preston River, after the Lieutenant. On the same day they discovered another river just a few miles downstream of the Preston and named it the Collie River, in honour of the doctor. Collie, the mining town, was also later named in his honour. The explorers reported seeing a group of about 30 Aborigines at the mouth of the Collie River. They found themselves:

> "In the midst of natives who testified the greatest and most friendly eagerness to be allowed to approach us… carrying green boughs and without any weapons of offence or defence… after a very amicable interview during which we did not admit them close to the tents they returned seemingly very much gratified with what they had seen and with a few trifles which they had gotten" (Martinick 1994:15).

Surveyor-General Lieutenant Roe followed on from the early surveyors of 1830 to survey the 'very good' land surrounding the Preston and Collie Rivers. He discovered valuable forestland and a range of hills that he named after himself (Sanders 1975:3). During his explorations around the Preston and Collie Rivers, Lieutenant Roe reported no sightings of Aborigines but noted traces of old habitations that were constructed of boughs and grass. It is thought these may have been the remnants of Nyungars winter camps.

Lieutenant Henry William St Pierre Bunbury formed a post at Pinjarra on the Murray River in 1836 in order to investigate the district and was known for his good relations with the Aborigines. Before his return to England in 1837 he pioneered land exploration between Pinjarra and the emerging district of Vasse. An Aboriginal guide named Monang and others

from the Pinjarrup tribe led the party to Leschenault Inlet, where the Collie and Preston Rivers flow into Koombana Bay. Here the Gomborrup people lived well as food was plentiful and the land was rich (Sanders 1975:99). Bunbury reported his encounters with hundreds of people from differing groups of Aborigines as he travelled from the inlet up the Collie and Preston Rivers and inland from the Preston River (Hallam 1979:69). Interaction between Aborigines and settlers in the Bunbury region was commonplace by 1840 and was said to have been 'a mixture of cordiality, mutual support and yet underlying suspicion and fear' (Barker & Laurie, 1992:8). Although many settlers perceived them as "unattractive and dirty", Preston and Collie formed a very different impression and had friendly communications with local Aborigines.

The following passage presents one of the settler's views of the Aborigines of the Murray and Vasse River areas in the early 1840's:

> "The opinion that they are in a state of starvation is altogether erroneous, for I never saw people more sleek and apparently well fed than they are, expecting indeed some of the women who only get the remains of what the voracious appetite of their husband leaves. In the district within 60 or 70 miles round us there appear to be but four tribes. Our immediate tribe bears the cognomen of the 'Elaap' Tribe, from their headquarters being at 'Elaap', which is the land immediately at the entrance of the Inlet up to the River Preston. They appear to be the least warlike and best disposed of all the tribes we hear of.
> The tribe adjoining northwards is the Murray Tribe or 'Pinjarrup' Tribe and are the fiercest and most warlike, but they are at such a distance that we seldom hear of them. To the eastward is the Mountain Tribe who possess the darling Range and they bear a bad character. And to the southward, the 'Undelup' or Vasse tribe who are generally peaceable but they lately speared to death a respectable settler Mr. Layman.
> All these tribes are perpetually at war with each other and their customs prevent their increase and will probably lead to their annihilation. When a death occurs in one tribe it is necessary for that tribe to put to death one of another, and this is carried so far that if a child is born dead, the sacrifice of a living person in another tribe is required.
> They acquire their wives - for they have sometimes several – by inheritance from deceased brother or from betrothment from birth; but more generally by stealth from another tribe. When this occurs the outrage is avenged by the death, or by severe wounding of one of the offending tribe; and various other equally destructive customs prevail. They have so far a right of property established amongst them, that most of the men have a tract of country which they call theirs: but the right seems to only extend to catching animals or spearing birds upon it for possession of all the country seems common to all the natives who are perpetually wandering about from one part to another attended by their wives and children without any object or pursuit but food which they appear to find in abundance. Flour however is their delight, and the moment a white man pitches his tent they continually surround it, and sit at the fire waiting anxiously the gift of flour.
> They seem to have no religion but they are in great fear of an Evil Spirit without the knowledge of a good spirit and their apprehension of danger from the Evil Spirit is such that they scarcely ever move after dark out of their miar - a slender cover from the weather which the women daily make with a few boughs of slight bending shrubs.
> It is not easy to estimate the total number of a tribe, but I think that amongst whom we dwell does not number more than 150 men, women and children. They are all occasionally visitors to us and we are never without some: once or twice we have had from 45 to 48 with us in the camp at one time, but I have endeavoured to put a stop to this assemblage of them, and to restrict their numbers to 5 or 6, because when numbers are assembled, they dance and become excited, when accidents might almost unintentionally occur.

> I have also forbidden them to bring their spears into our village, which after some difficulty I have affected because the men never go without two barbed spears in their hands.
> We have hitherto found these poor people perfectly harmless and good natured. In fact their good humour and good temper is most remarkable. They are always laughing and happy and I can always describe them as being good-humoured idle beggars. I have tried various means to make them work and on the whole with better success than I was led to expect, but they will not stick to their work. If I have induced them to work hard one day, in clearing a road, the next day they are all gone leaving word that they are too tired to work and are gone to the shore to eat whale - or to fight the 'Undelap' Tribe - but some amongst them almost dwell around our tents and cut wood, go messages and loiter about till wanted for any large job.
> They are in their form well made though small (not by any means of the slender disproportionate make which I had been led to believe) and excessively graceful in their walk as well as shape. They are generally very dark in colour with curling hair (not exactly woolly) but change their appearance by besmearing their faces, hair and bodies with Wiljay or a sort of red ocre and grease. They are acute and intelligent, but I am convinced not capable of civilisation or mental cultivation.
> Our intercourse with them has been entirely of a friendly character unclouded by any untoward event. I have endeavoured to prevent their being treated with roughness or derision by any of my people and I am glad to say the best understanding now subsists between them all. I often walk unarmed over all parts of the bush and never have and apprehension of the natives. They rejoice at our being here, as all occasionally benefit by us, and seek our favour and protection on all occasions." (M. Waller Clifton 1841 cited in Barnes P, 2001:33)

Before 1890 the South-West region supported only small pockets of agriculture and a young timber industry and both were strained by extreme transport difficulties (De Garis 1993:110). Although deposits of coal were known to exist at Collie in the 1880's mining did not begin until the 1890s. Completion of the Bunbury harbour works in 1907 and further ongoing development of the southwest's railway system opened up greater possibilities for coal export. By the 1920's heavy engines could run coal direct from Collie to Bunbury to be loaded onto ships. The first full cargo of Collie coal bound for South Australia left the Bunbury wharf in 1923 (Barker & Laurie 1992:171-224). The southwest's hardwoods, on the other hand, had already found markets in the eastern colonies and overseas before the 1870's. Before construction of a bridge across the Brunswick River in 1845, milled timber was placed on a lighter (semi submerged raft) and sailed to the port of Bunbury via the Collie River and Leschenault Estuary. A second bridge across the Collie River was built in 1844, and a third over the Preston River in 1848 (Sanders 1975; O'Brien 1996:45).

Amidst ongoing tension as indigenous and colonial people jostled to retain their own cultural practices, farmers across Western Australia regularly employed Aborigines as a convenient and cheap source of labour. Heavily relied upon to support the foundation of European farming techniques, Aborigines were generally offered little if any payment for work and were often given goods such as flour, sugar and tobacco in exchange for farm labour and domestic help (Shann 1926). Their importance was verbally acknowledged when in 1898 John Forrest said 'Colonization would go on with very slow strides if we had no natives to assist us' (Goddard & Stannage 1984). Although some continued to pursue a traditional way of life others worked on homesteads or were involved in the timber industry.

By the turn of the twentieth century over half of the Aboriginal population in the southwest was of mixed race descent (Haebich 1988: 47). Colonial rulers saw children of one British parent as having potential if they could be trained to live as Europeans and the Industrial Schools Act of 1874 brought their removal to missions where they were prepared for servant-hood or menial

apprentice work in the European community. Aboriginal parents of these children were afforded no comment in this process.

The Depression of the 1930's saw unemployed Nyungars receive a lower sustenance rate than unemployed Europeans. Nyungar people were often employed to clear for farming the land they formerly lived on. Living more or less permanently in fringe camps, seeking out seasonal employment and supplementing their diet with game, fish and some bush tucker was a lifestyle which predominated for many Aboriginal people until late into the 1960's (McDonald et al., 1994).

Governor Stirling originally called Harvey 'Korijekup'. 'Korijekup' was the name given by the Harvey Aborigines to the place of the red tailed black cockatoo. In 1829 Governor Stirling selected 12,800 acres known as Wellington Location 50A and called it the Harvey River Settlement. It is thought that Governor Stirling selected the name 'Harvey' in honour of the commanding officer, Admiral Sir John Harvey, of West Indian Station of the Royal Navy under whom Stirling served in 1817. (www.harvey.wa.gov.au – history of Harvey)

Binningup, located in the Shire of Harvey, named after its Aboriginal name meaning place of midges, remained relatively un-settled until the post war period (Collard 1996). The unique Binningup Beach Estate was the brainchild of a handful of Voluntary Defence Service personnel who had been stationed at a lookout point at Binningup. During their service they noted the unique and tranquil environment and how user friendly the place would be to families, so they set out a plan to achieve their dream lifestyle. (Yates, A. 2008 and Crook, A 1989)

The plan to finance the development was simple, to become a shareholder one must pay by instalment 55 pound ($110.00) total sum, and also make a commitment to conducting clearing and construction. The syndicate was formed in 1952 and by 1955 and a lot of hard work the venture was completed successfully. (Yates, A. 2008)

Binningup land is bounded by Myalup to the north, Wellesley and Harvey to the east, south to Parkfield and west to the Indian Ocean. (www.harvey.wa.gov.au – history of Binningup)

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Indigenous Affairs (DIA) Sites Register, a review of any relevant site files, and a review of any unpublished ethnographic reports that relate to the Shire of Harvey from Binningup to Harvey area.

SITES REGISTER SEARCH

Prior to commissioning a consultant to conduct a survey the Water Corporation searched the DIA sites register in the Shire of Harvey to determine the locations of all previously recorded Aboriginal Heritage sites. When designing the location of all infrastructures for the project all previously recorded sites were avoided within the initial designs.

Prior to the survey taking place the consultants conducted a further search of the DIA Sites Register by auto download from DIA FPT site onto a cadastral base of the area with the project infrastructure and pipeline path located in order to determine if there were any previously recorded Aboriginal Heritage sites that would affect the project proposal.

The search revealed that **no** previously recorded Aboriginal Heritage sites would be affected by the project proposal. The Water Corporation planning department advised that Aboriginal heritage issues had been taken into consideration during the initial planning stage and therefore the infrastructure and pipeline path had been designed to not impact any sites of significance to Nyungar people, the Water Corporations initial search was therefore verified by the consultants.

REVIEW OF RELEVANT ETHNOGRAPHIC REPORTS

Goode, B. 2000. *Ethnographic survey of South Western Highway, Waroona to Bunbury, Western Australia.* Unpublished report prepared for Gutteridge Haskins Davey Pty Ltd, on behalf of Main Roads Western Australia.

During this ethnographic survey of the South Western Highway corridor from Waroona to Bunbury, which crosses the Collie River, Aboriginal informants provided a dreaming story which explains the significance of the Collie River as the path of a mythological dreaming figure, the '*Ngarngungudditj Walgu'* Dreaming:

> "The '*Ngarngungudditj Walgu*' came from the north east of Collie where he travelled forming the rivers and creeks resting along the way making waterholes…
>
> … He came through what we know today as Collie forming the Collie River and as he moved he created hills visiting places in and around Collie he moved towards the coast and came out where Eaton is today as he came to the end he turned his body creating what is the estuary today, as he turned he pushed the land out and then he travelled back up the Collie River he travelled about the Collie area finally he rests at Mininup a well known swimming place on the Collie River…
>
> …The old people used to say you can see his spirit in the water late at night during the full moon and his long silvery beard…
>
> …It is also said that if a stranger to the area comes and wishes to swim in the Collie River or fish he must wipe his armpit and then pick up some sand in the same hand and then throw the sand in the water for the spirit to smell this and he would not be harmed in any way or if he is not welcomed the water will become rough and the weather might change *'Ngarngungudditj Walgu'* in my language means 'Hairy Faced Serpent." *Joe Northover- Keeper of the dreaming*.

During the survey Wallam's Camp was also reported by informant Mr Kenneth Wallam whom had lived in the area since 1954. This bush camp was reported to be located 2km north of Harvey, approximately 80m east of the South Western Highway, in a bush reserve opposite the Harvey Cement Works. Honeymoon Road lies to the south of the campsite. The camp was a tin and potato bag structure that occupied an area of approximately 10-15m^2. It was located at the base of a stand of Marri trees and there was a tree-lined embankment to the east. The Kelly family camped further along the embankment, in the trees, approximately 50m to the north. Both families shared a well that was built in a soak in the vicinity of the camps. The well could not be located during the initial survey. The reported site has been assessed by the ACMC as 'not a site under the Act' and has been accessioned as stored data.

The pipeline path is located just to the north of the South Western Highway crossing and Wallam's Camp and the camp will not be affected by the current project proposal. The Collie River is not crossed by the pipeline path.

Goode, B. 2006. *An Aboriginal Heritage Survey of the proposed South West Yarragadee Water Supply Pipeline Route, Water Treatment Plant, Bore Fields and Collector Mains, South West of Western Australia.* Report prepared for the Water Corporation.

This report was commissioned by the Water Corporation in order to progress the proposal to develop the South West Yarragadee Aquifer in order to harvest up to 45 gigalitres of ground water to be fed into the Perth Integrated Water Supply System. This report identified a number of issues with regards to Water Corporations wish to abstract this resource as the Yarragadee Aquifer and the Blackwood River system was considered a site of significance in association with Waugal beliefs by the Nyungar community. A number of issues were also identified with Water Corporations wish to run a pipeline from its treatment plant in Jarrahwood to a connection point in Harvey, to the north of Bunbury. The pipeline is proposed to cross a number of rivers that are also identified as being significant in regards to Waugal beliefs inclusive of Site ID 20434 Blackwood River, Site ID 19795 Preston River, Site ID 19796 Ferguson River, Site ID 16713 Collie River Waugal and Site ID 17776 Brunswick River and will be directly affected by the project proposal.

In this report, it was recommended that the rivers that the pipeline dissects should not have their flows disturbed by trenching and that the only acceptable way to put a pipe across these rivers was by overhead suspension. It was also requested by members of the Gnaala Karla Booja Native Title Claim group that prior to any works taking place within their claim area that affects water courses that appropriate proprietary rituals would need to be conducted in order to mitigate any possible delirious spiritual affects upon the Nyungar community as a result of the Water Corporations actions.

In relation to our current project area the Gnaala Karla Booja Native Title Claim representatives inspected the proposed pipeline path along Government Road, stopping at the Harvey River crossing. The group said that the Harvey River should also be registered as an Aboriginal Heritage site of generalised religious significance, in association with Waugal beliefs, as were all the other rivers in the region. According to the group, the Harvey River is of the same or similar significance to Nyungar people as all other waterways and wetlands. The group did not specify any mythological stories associated with the Harvey River but nevertheless believed in its sanctity. It was the general view that if a crossing was to be made, that overhead methods would be preferred, as this does not obstruct the flow of the water across the landscape. Resulting from this report the DIA has not proceeded with registration of the Harvey River. The reasoning being is that this section of the river is a man made canal and that the ethnographic information was of a too 'generalized nature' to meet the criteria of section 5b of the Act.

In relation to the Harvey area, no other issues were raised. It was the overall consensus of the Nyungars consulted that they did not support the Water Corporations proposed South West Yarragadee project and that other alternatives should be considered.

Yates, A 2008 *Report on a Desktop Review of Registered Aboriginal Sites and Previous Site Surveys Binningup Beach, Shire of Harvey.* Report prepared for Mirvac Pty Ltd.

This report was conducted on behalf of Mirvac as a desktop study to identify places of Aboriginal significance, and areas subject to previous surveys within the Binningup Beach Area in the Shire of Harvey.

There are no registered Aboriginal sites within proximity to the Mirvac Binningup Land holdings at Binningup. According to the Aboriginal Elders of the Peel Region an important traditional Aboriginal track that ran from the Swan to the Vasse Rivers passed along the plain between the Peel Harvey Estuary and the Indian Ocean. This track was later used by the early settlers as a main roadway between Mandurah and Bunbury, which now forms Old Coast Road.

There are a few artefact sites located further east associated with the Old Coast Road Aboriginal track and Myalup Swamp. There has been a few regional Aboriginal Heritage Studies that cover the wider Peel-Preston-Leschenault area but no specific studies or surveys have been conducted at Binningup Beach. This report did not contain any Aboriginal heritage issues that will affect our current project proposal.

OUTCOMES OF ARCHIVAL RESEARCH

As a result of archival research no previously recorded Aboriginal Heritage sites will be affected by the project proposal. The Water Corporation planning department advised that Aboriginal heritage issues had been taken into consideration during the initial planning stage and therefore the infrastructure and pipeline path had been designed to not impact any sites of significance to Nyungar people. Archival research conducted by the consultants confirms the Water Corporations advice.

IDENTIFICATION OF SPOKESPEOPLE

THE RIGHT TO SPEAK ON HERITAGE ISSUES

Various authors have discussed the contemporary problem of who in the Aboriginal Community has the authority to speak on heritage issues within an area. O'Connor et al. (1989:51) suggest that when this question is posed to people in Aboriginal Australia, answers are usually framed by such terms as 'the traditional owners', i.e., those people who are defined by place of birth i.e. descent. Meyers presents a broader and more contemporary view of 'ownership' based upon descent and association:

> "An estate, commonly a sacred site, has a number of individuals who may identify with it and control it. They constitute a group solely in relationship to this estate. Identification refers to a whole set of relationships a person can claim or assert between himself or herself and a place. Because of this multiplicity of claims, land holding groups take essentially the form of bilateral, descending kindred. Membership as a recognised owner is widely extended" (Meyers cited in Machin, 1993:22).

Meyers then goes on to further clarify the current perception of 'ownership' when he states:

> "....such rights exist only when they are accepted by others. The movement of the political process follows a graduated series of links or claims of increasing substantiality, from mere identification and residual interest in a place to actual control of its sacred association. The possession of such rights as recognised by others, called 'holding' (*kanyininpa*) a country, is the product of negotiation" (Ibid.).

While the notion of descent is clearly an important criterion within Meyers analysis, it must be seen in terms of the contemporary Nyungar situation. Nyungar tradition in the south west has been seriously eroded since colonisation, lines of descent have been broken, and previously forbidden and mixed marriages have interconnected many Nyungar groups who would not have traditionally had a close association (Ibid.). Consequently, in contemporary times the criteria of historical 'association' seems to be important in regards to the 'right to speak' on heritage issues within an area:

> "Traditional subsistence no longer sufficed to support Aboriginals so they combined this with menial work on farms and over time new relationships to land developed. As a consequence, the more recent history associated with their involvement with European agriculture and labour patterns is often more relevant than the pre-contact mode of attachment to an old way of life and the roots of the identity as original owners of the land. Biographical associations are often tied to post-settlement labour patterns and identification. These can predominate. This is part of a dynamic process of ethnicity, identity and tradition" (Machin, 1995:11).

O'Connor, et al. (1989) identified several criteria for determining contemporary community spokes people. A spokesperson must have a long-term association with an area, usually as a young person, and had extensive contact with a member or members of the 'pivotal generation of the culture transmitters'; those people whom, as children themselves, had contact with people who could pass on their traditional knowledge. A spokesperson must also demonstrate knowledge of the region's natural resources, its hunting, fishing and camping grounds, its local water sources, and the flora. This is important because a person without this knowledge is unlikely to be seen by their fellow Nyungars as truly being from that country, despite having been born or lived in that area. In some cases, people from outside a specific region have established themselves by political activism. They are accepted by their fellow Nyungar because they may have participated in mainstream white pursuits, such as advanced education,

or legal and political careers, that have empowered them within the broader community. As such, these people are a valuable resource to the local Aboriginal Community. The people consulted in this survey fulfil at least one of these criteria.

NATIVE TITLE CLAIMS OVER THE SURVEY AREA

Currently, there is one registered Native Title applications and one unregistered application that overlays the project area, lodged with the Register of Native Title Claims and the Schedule of Applications held by the Commonwealth Native Title Tribunal. The Schedule of Applications includes registered applications, unregistered applications, and applications still undergoing the registration test.

- Gnaala Karla Booja WC 98/058

  Applicants:
  Mr. Derrick Smith, Mr. Franklyn Nannup, Mr. Harry Narkle, Mr. Joseph Northover, Mr. Joseph Walley, Mr. Mervyn Abraham, Mr. Peter Michael, Ms. Barbara Corbett-Stammner, Ms. Lorraine Bellotti.

- Single Noongar Claim (Area 1) WC03_006 (unregistered)

  Applicants:
  Anthony Bennell, Alan Blurton, Alan Bolton, Martha Borinelli, Robert Bropho, Glen Colbung, Donald Collard, Clarrie Collard-Ugle, Albert Corunna, Shawn Councillor, Dallas Coyne, Dianna Coyne, Margaret Colbung, Edith De Giambattista, Rita Dempster, Aden Eades, Trevor Eades, Doolan-Leisha Eattes, Essard Flowers, Greg Garlett, John Garlett, Ted Hart, George Hayden, Reg Hayden, John Hayden, Val Headland, Eric Hayward, Jack Hill, Oswald Humphries, Robert Isaacs, Allan Jones, James Khan, Justin Kickett, Eric Krakouer, Barry McGuire, Wally McGuire, Winnie McHenry, Peter Michael, Theodore Michael, Samuel Miller, Diane Mippy, Fred Mogridge, Harry Narkle, Doug Nelson, Joe Northover, Clive Parfitt, John Pell, Kathleen Penny, Carol Petterson, Fred Pickett, Rosemary Pickett, Phillip Prosser, Bill Reidy, Robert Riley, Lomas Roberts, Mal Ryder, Ruby Ryder, Charlie Shaw, Iris Slater, Barbara Stamner-Corbett, Harry Thorne, Angus Wallam, Charmaine Walley, Joseph Walley, Richard Walley, Trevor Walley, William Webb, Beryl Weston, Bertram Williams, Gerald Williams, Richard Wilkes, Andrew Woodley, Humphrey Woods, Dianne Yappo, Reg Yarran, Saul Yarran, Myrtle Yarran, Ken Colbung

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

The selection of spokespeople for this survey was based on assistance given from South West Aboriginal Land and Sea Council's (SWALSC) Ms Wendy Gilbert who arranged for the Gnaala Karla Booja claimants to elect the spokespeople for the survey at the working party meeting held on the 30th April 2008. The consultants own previous experience in conducting Heritage survey's in the region for more than a decade has also greatly aided the selection of knowledgeable and appropriate spokespeople who represent those with both traditional and historical interests within the area by examining this advice and comparing the list of informants against the consultants own records and confirming that those selected represented a good cross section of community members with both traditional and historical interests in the area. As a result of this pre-consultation process, the following Aboriginal people were selected to participate in the survey

Mr Joe Northover is an applicant to the Gnaala Karla Booja Native Title Claim is the former chairperson of the Ngalang Booja Council of Collie and was formerly employed as an Aboriginal Heritage Officer with the Department of Indigenous Affairs in Bunbury. Mr Northover is widely recognised as a traditional custodian of the '*Ngarngungudditj Walgu*' story about the Collie River Site ID 16713. Mr Northover was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC.

Mr James Khan is a member of the Gnaala Karla Booja Native Title Claim group and sits on the working party at the South West Aboriginal Land and Sea Council. Mr Khan is the vice chairperson of Ngalang Booja Council in Collie. Mr Khan is also the treasurer of South West Aboriginal Medical Service (SWAMS) and is an Aboriginal Education Officer (AIEO) at the Collie Senior High School. Mr Khan is also the team manager of the local football club that coaches many young Aboriginal boys. Mr Khan was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC.

Mr Peter Michael is an applicant of the Gnaala Karla Booja Native Title Claim group and the chairperson of the Bunbury Nyungar Employment Education Development Aboriginal Corporation (NEEDAC). Mr Michael was born in Collie and has spent most of his life in Bunbury where he currently resides. Mr Michael has a long history in being active in heritage circles in the region and has assisted many anthropologists on heritage matters that affect the Bunbury area. Mr Michael was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC.

Mrs Barbara Stammner-Corbett is an applicant to the South West Boojarah and Gnaala Karla Booja Native Title Claim and an executive member for the working party at SWALSC. Mrs Barbara Corbett was born at Picton and claims traditional blood ties through matrilineal descent to the south-west region. Ms Corbett has strong historical ties to the region being the daughter of Mr Frank Corbett and the niece of Mr Dan Corbett who were schooled at the Bussell family's Ellensbrook Mission at the turn of the 19th century. Ms Corbett was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC.

Mr Dennis Hill was born in Pingelly to parents Mr Charlie Hill and Ms Rachael Abraham. Mr Hills great grandfather is Joseph Hill. Mr Hill attended school at Burekup and upon leaving school has worked various jobs including a farm labourer on potato farms in the Bunbury area. Mr Wayne Hill was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC but due to not being contactable, Mr Dennis Hill his uncle, was nominated to represent his family.

Mrs Isla Bellotti (nee Bennell) was born in Pingelly to parents Mr Henry Bennell and Ms Violet Hill. Mrs Bellotti attended school at Burekup and has also completed a course at TAFE on Aboriginal studies. Mrs Bellotti has worked in Bunbury in various places of employment including a shop assistant, St John of God Hospital in food services and at the Bunbury Hostel/Lodge as a housemaid. Mrs Bellotti has also been an Aboriginal Visitor Councillor in Bunbury and Perth Regional Prisons. Mrs Bellotti is also associated with the Bunbury Woman's Aboriginal Corporation. Ms Geri Hayden was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC but was unable to attend and therefore nominated Mrs Isla Bellotti to represent her family.

Mrs Shirley Hayward is an executive of the Ngalang Boodja Council Collie and sits on the working party for the Gnaala Karla Booja Native Title Claim group at SWALSC. Mrs Hayward is Mr Peter Michael's sister and was a member of the former South West Commission of Elders. Mrs Hayward has worked in community welfare for 13 years inclusive of the Catholic Aboriginal Education Council in Bunbury. Mrs Hayward has ties to the Collie/ Bunbury area and has lived there for the last 40 years. Mrs Hayward was selected to participate in this survey by the Gnaala Karla Booja working party at SWALSC.

Mrs Melba Wallam was born in Pingelly to parents Mr Frederick Little and Ms Frances Abraham. Mrs Wallam has resided in Harvey with her late husband Pastor Len Wallam since the 1950's. Mrs Wallam attended school in Pingelly and has since attended Bunbury TAFE and University to complete degrees in Human Services Administration and Teachers Aid Assistant.

Mrs Wallam is a member of the Gnaala Karla Booja Native Title Claim group was selected to participate in this survey by the working party at SWALSC.

Mr Franklin Nannup was born in Narrogin to parents Mr Frank Nannup and Ms Cissie Ugle. Mr Nannup's grandparents were born in Busselton and Collie. Mr Nannup has been a part of the Middar Aboriginal Theatre for over 30 years and currently resides in Mandurah. Mr Nannup is a member of the South West Boojarah and Gnaala Karla Booja Native Title Claim groups and was selected to participate in this survey by the working party at SWALSC.

Mr Mervyn Abraham was born in Pingelly to parents Mr Sam Abraham and Ms Eliza Bennell. Mr Abraham's grandparents were born in Wondering and Brookton/Beverley area. Mr Abraham attended school in Pingelly and has been employed as a bouncer in a Northbridge nightclub for 22 years and is currently driving buses in Balga. Mr Abraham is a member of the Gnaala Karla Booja Native Title Claim groups and was selected to participate in this survey by the working party at SWALSC.

COMMUNITY CONSULTATION

AIMS

- To establish contact with Aboriginal people who retain traditional or current knowledge pertaining to the region.
- To determine if there are any sites of significance as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) within the project area.
- To record any ethnographic information provided about identified sites.
- To generate consensual recommendations from the Aboriginal community representatives in regards to any Section 18 requests and to record management strategies for identified ethnographic and archaeological sites.

METHOD

The Nyungar informants selected to participate in this survey were contacted by phone and sent a letter outlining the arrangements for when the on-site meetings would take place at the Perth Seawater Desalination Plant and the proposed Binningup Seawater Desalination Plant and pipeline path. All informants were briefed to the project, with the aid of a large aerial photograph overlaid with the project details. All participants were also provided with a small handout providing maps of the project area and specific details of the project. The informants participated in a tour of the Perth Seawater Desalination Plant and also inspected the proposed Binningup Desalination Plant site and pipeline path from Binningup through to Harvey. Discussions between the Nyungar community and the consultants were conducted as to the affect that the proposed work would have on the cultural values of the area and any issues identified with regards to the proposal were recorded by the anthropologist.

COMMUNITY CONSULTATION PROCESS

On the 17th June 2008 the consultant Mr Brad Goode and assistants Mr Colin Irvine and Mrs Melinda Cockman met with representatives of the Gnaala Karla Booja Native Title Claim group Mrs Shirley Hayward, Mrs Barbara Corbett, Mr James Khan, Mr Joe Northover, Mr Peter Michael, Mrs Melba Wallam, Mr Dennis Hill, Mrs Isla Bellotti, Mr Mervyn Abraham, Mr Franklin Nannup and Mr Sean O'Hara (SWALSC Future Acts Officer) at the Rockingham Desalination Plant. Also present at the meeting was Water Corporation representatives Ms Vanessa Ugle (Indigenous Resources Project Manager), Mrs Tracey Smith (Indigenous Resource Project Manager Assistant), Mr Lindsay Haji-Ali (Indigenous Resources Project Officer), Mr John Stansfield (Project Manager), Mr Chris Davie (Project Engineer) and Mr Alan Hill (Senior Environmental Officer).

Following introductions, Mr John Stansfield informed the Nyungar community members present about the process undertaken with seawater desalinisation and the construction of the Kwinana plant. Following this description the survey team were invited to take a tour of the plant. During the tour the group were shown the water intake area, the filtration building and all of the major parts of the plant. The group also had the environmental impact and monitoring of the plant explained to them and was shown one of the water quality monitoring buoys that had been removed from the Cockburn Sound for maintenance. Following this inspection the group was shown a short film that showed the plant's construction including the primary earthworks and trenching to install the Perth plant intake, outlet and mains connection pipes.

After the meeting the group drove to Binningup Beach where they were able to inspect the site of the proposed Southern Seawater Desalination Plant. The group was shown an aerial photograph of the site and the positioning of the various parts of the desalination plant indicated to them. Each member of the group was also provided with a copy of the project overview which contains aerial photographs showing the plant and pipelines to Harvey and relevant parts of the Public Environmental Review document.

Figure 2. The survey team at the Myalup Roadhouse on Taranto Road being briefed about the proposed Southern Seawater Desalination project. View looking to the north-west.

Mr Stanfield advised that the Binningup site consists of an area at the eastern end that has previously been quarried to remove lime; this part of the land has been extensively disturbed and is the proposed location of the plant buildings and machinery. Between the degraded eastern end of the land and the beach there is a series of dunes covered with vegetation. Mr Stanfield explained that an access road alongside the pipes carrying water to and from the ocean will be constructed through the dunes taking sand to fill some of the eastern portion of land. At the western end of the land a large inlet pit (a seawater pump station) will need to be constructed to pump the water from the ocean to the plant.

Mr Alan Hill, the Senior Environmental Officer for Water Corporation gave the group an overview of the positioning and the environmental impacts of the proposed plant. Mr Hill explained to the group that a very large pit (up to 15m deep) would need to be dug at the front of the site to install the seawater pump station. This would require dewatering during the construction period to allow the walls and floor of the pit to be built. Once the pit is constructed it will have a roof built slightly above the ground level and the frontal dunes between the ocean and the pit will be restored, this will reduce the visibility of the pump house from the sea once construction is completed. Mr Hill advised that the manner of installing the pipes between the ocean and the plant was proposed to install a temporary jetty to allow an excavator to trench from and then used as a platform to install the pipes from was explained to the group. Mr Hill also informed the group about the location of the seawater intake and outlet pipes with regard to the impact on the sea bed and benthic habitat. The location of the pipes has been chosen to avoid areas of reef and will end 200m before the edge of the offshore seagrass beds.

The Nyungar informants expressed their concern over the installation of the seawater pipes, stating that it was important that the pipes discharge and water extraction should not affect fish habitat or fishing in the area. Mr Hill advised the group that the area was not identified as regionally unique in terms of fish habitat and based on environmental studies it was expected that the installation and long term operation of the pipes and plant would not affect regional fishing stocks in the area.

Mr Brad Goode informed the Nyungar participants that an archaeological inspection had been conducted by Mrs Jacqueline Harris, Mr Wayne Webb and Mr Ted Hart and that no archaeological material had been located at the proposed Binningup Plant site, along the pipeline corridor or at the water storage facility in Harvey. Mr Goode also advised that no previously recorded Aboriginal Heritage sites are located within the project area or would be affected by the project proposal. Mr Goode advised that the Water Corporation had intentionally designed the pipeline path to avoid any previously recorded Aboriginal Heritage sites so as not to disturb these areas of importants to Nyungar people.

Following this discussion, the group then drove to the lower eastern portion of the proposed Desalination Plant site located on Taranto Road. Mr Stansfield indicated to the group the degraded area of land proposed for the water processing plant and the possible positioning of a proposed bund along the southern and eastern portions of the land. Mr Stanfield explained that the purpose of the bund is to visually screen the plant from the Binningup town to the south and as a noise abatement barrier. Mr Stansfield identified the dunal area where the proposed inlet and outlet pipe between the seawater pump station at the west end of the site and the water processing plant at the eastern end of the land will need to be constructed. Mr Stansfield explained that this path would need to be 30 to 40m in width to accommodate the pipes and the road. Mr Stansfield advised that the soil excavated from this access road/pipeline pipe would be used to fill part of the eastern portion of the site which has been quarried.

Figure 3. Proposed site of the Southern Seawater Desalination Plant. View looking to the south.

The group stated that the area had always been used by Nyungar people who used to travel from the hinterland to the coast to seasonally collect food. During the historical period the area was known to Nyungar people as a place to hunt and collect foods and family groups would regularly visit the area. In contemporary times the area is known to the group as fishing and hunting areas that are regularly used by the regions Nyungar community. The presence of the wetland to the east and its disturbed habitat was raised and concerns expressed as to the affect the project proposal would have upon the frogs and birds of this environment.

Mr Alan Hill advised that the wetland was in a disturbed state due to drought, farming and the quarrying that had already been conducted at the site. Mr Hill advised that the Water Corporation might consider options to preserve what remains of the wetland and to create a swale near the eastern end of the land to provide better connectivity between areas of remnant wetlands to the north and south.

Mr Stansfield advised that an access road would be created along the northern boundary of the land to provide formalised access to the existing waste water treatment plant located in the project area. It was advised that this access road will be of a normal single lane width. The Nyungar informants were advised that the areas disturbed during the construction of the seawater pumping station, access roads and pipelines would be revegetated as a part of the project.

The Nyungar consultants identified the dunes in the area of the access road and pipelines as an area that was likely to contain burials and that the earthworks in that part of the site would need to be monitored by Nyungar representatives. No other issues were identified. It was acknowledged that the Desalination Plant site was located in an area which is already in a highly disturbed state.

The group then drove to the west, adjacent to Binningup Beach to inspect the proposed site of the Seawater Pump Station. Mr John Stansfield advised that this site is where a large pit will be dug to a depth of 15 meters within the dunes. Bentonite will be pumped into the ground which minimises the dewatering needed to build the walls and floor of the pit. Mr Stanfield advised that the walls of the pit will be installed in sections and after the construction of the pit and associated pipelines the sand dune between the pit and the beach will be replaced and revegetated. The finished level of the pit will be slightly above ground level.

Figure 4. Survey team inspecting the Southern Seawater Pump Station site located within the dunes along Binningup Beach. View looking to the south-west

Mr Peter Michael suggested that when the route of the pipeline and access roads was determined the route should be walked over by an archaeologist. Mr Michael and Mr Len Wallam both had knowledge of the area being used currently as a hunting place, with kangaroos and emus known to occupy the area behind the dunes to shelter and feed. The area is used seasonally, usually during autumn when the ground starts to get wetter and the vegetation becomes a little stronger. The men said they recognised the area was fragile during the summer months when the sand became dry and that they would avoid damaging the area by staying away at that time of year (summer). Mr Wallam said he had first hunted in the area with his father when he was seven years old and said he knew that his grandfather used to visit the area from Roelands and would hunt up along the coast as far as Lake Clifton. Mr Wallam said that his father had taught him to stop and make a fire when they caught an animal and they would cook and eat some of the meat on the spot, he said they did this as a way of giving thanks to the animal and the land that had fed them. Both Mr Michael and Mr Wallam showed they had a long association with the area and knowledge of the areas resources and that they today continue using the area for hunting and maintaining cultural practices.

When asked to make a statement of significance of the land. Mr Wallam stated “It feels like the land is a part of your heart, it saddens me to think that the kangaroo has to move out of his home, move camp ... for progress”. He said he had a strong emotional connection to the land and other members of the group agreed with him. Mrs Barbara Corbett said she used to come to the area from Waroona as did families from Roelands, Burekup and other towns along the South West Highway. Many families were involved in seasonally harvesting potatoes and would visit the adjacent coastal areas to fish, hunt and camp. Mrs Isla Bellotti said she had first visited the area with her family when she was aged 8 and continues to visit the site to this day. Mr James Khan told the group he believed that the traditional Nyungar people in the area had been hunted away from the coast by the early settlers and that he believed there could be burials in the sand dunes and throughout the area. The group declined to make any recommendations or statements regarding the project until the following day.

On the following day, 18th June 2008 the group met at the Myalup Roadhouse where a brief meeting was held to discuss recommendations after the previous day’s inspection of the Desalination Plant Site. The group stated that they believed there could be burials in the dunes toward the western part of the site in areas that had not been disturbed and therefore requested that two Aboriginal monitors should be present during the earthworks clearing and top soil disturbance in all areas of the Binningup Desalination Plant site.

Mr Joe Northover stated that he was opposed to the proposed desalination of seawater for cultural reasons. In the South-West Yarragadee survey Mr Northover had stated that it was not culturally appropriate to mix the spirits of salt and freshwater. Mr Northover during this survey was opposed to changing water from salt to fresh and bringing this water which belongs in the ocean onto the land. Mr Northover was not prepared in front of the group to provide any further details regarding this cultural taboo. Mr Northover stated to the consultants that he would detail this information in writing as a restricted appendix to the report (see Appendix 4 – Letter from Joe Northover).

Following the initial meeting the group was briefed by Mr Goode on the proposed pipeline to pump the freshwater from the plant to a large header tank located in the hills north-east of Harvey. The group were advised that the pipeline would be 1400mm in diameter and would be trenched into the ground. The pipeline path will be trenched alongside road reserves approximately 3m in depth and approximately 5-8m width (depending on soil type and stability). The pipeline path follows the corridor heading east along Taranto Road, north along Old Coast Road, east along West Break, north along East Break, east to north-east on Boonilup Road, east along Rodgers Road, north along Government Road, east along Yambellup Road and River Road, passing across the South Western Highway through farm paddocks before connecting to the Harvey Water Storage Facility. It was advised that where the pipeline passes

wetlands the trench will be sealed to minimize hydrologic and environmental impacts on the wetlands. Where the pipeline passes through areas of remnant native vegetation the pipeline will be laid beneath the existing road and the road remade following the pipe-laying.

The survey team then proceeded to drive the pipeline route heading north along the Old Coast Road before turning east along Myalup Road, then south along a dirt track before stopping on the corner of East Break and South Break Roads at coordinate 382777mE and 6335980mN. The survey stopped at this location to indicate where the pipeline path now ran after crossing through an inaccessible paddock between the Old Coast Road and this location.

The Nyungar consultants advised that they were not aware of any heritage sites in the area and that they had no issues with the proposed pipeline thus far. It was noted by the group that the pipeline path run alongside a firebreak track through a pine plantation that was already in a highly disturbed state.

Figure 5. The survey team on the corner of East Break and South Break Roads at coordinate 382777mE and 6335980mN inspecting where the pipeline path runs east-west. View looking to the west.

The group then continued east along East Break Road turning north-east along Boonilup Road and following the pipeline route. The survey team stopped in an area of remnant bush at coordinate 385637mE and 6336410mN. Mr Alan Hill advised that the pipeline will be laid beneath the road through this section of the route to minimize clearing.

The group identified the large Christmas trees, Melaleuca and Banksia trees in the area to be significant as habitat trees, and as a food source for black cockatoo and requested that these trees be avoided if possible. Mrs Barbara Corbett advised that the Banksia trees were well known as a food source and also that the cones were used by traditional people as a means of carrying fire. Spearwood (Kunzea) also grows throughout this area of bush and the older members of the group recalled cutting ‘bean sticks’ for the farmers from this type of bush. The Spearwood was also cut for crayfish pots and sold by the Nyungar people to the fishermen. The Spearwood was an economic resource to the Nyungar people during the historical period. It was advised by the Nyungar informants that minimal clearing throughout the area of native vegetation was preferable and that the area should be rehabilitated with local native species once

the works are completed. The protection of large trees through marking them as habitat trees was encouraged. The possible use of unavoidably felled timber for wood carving by groups within the Nyungar community was also raised. No Aboriginal heritage sites were identified within the area and no further issues were raised.

The survey team then continued further along Boonilup Road, along the pipeline path. The survey team then stopped to inspect a possible scarred tree noticed by the Nyungar consultants. On inspection it was difficult to determine if the tree had been scarred by a surveyor or had been scarred at an earlier date and later used by a surveyor as a convenient survey point marker. The hard wood of the tree has been marked with a surveyors mark and numbers but the tree did not show any signs of having been de-barked with a metal axe (which presumably would have been made at the same time as the clearly visible mark and numbers). The tree showed no signs of axe marks but was of an age that suggests the scar could have been of Aboriginal origin. The recorded location of this tree was at coordinate 387509mE and 6336988mN and the scar was 1m from the ground facing the northwest. The tree's scar measured 900mm in length and 375mm across in the centre. Several of the Nyungar informants were of the opinion that the trees scar was likely to be of Aboriginal origin but had no specific first hand knowledge of such origins. All consulted requested that the tree be reported to the DIA as a significant site under section 5a of the 'Act'. The archaeologist Mrs Jacqueline Harris could not determine if the tree was of Aboriginal origin. A photograph of the tree was sent to a DIA Senior Heritage Officer to provide their comment on the tree and it was their opinion that the tree was most likely scarred as a result of a surveyor using the tree as a location marker and was unlikely to be of Aboriginal origin.

Figure 6. Identified possible Scar Tree located at coordinate 387509mE and 6336988mN. View looking to the south-east.

The survey team then continued north-east along Boonilup Road, then east along Rodgers Road following the pipeline path. The team then turned north onto Government Road where the pipeline path is proposed to be installed within the road reserve. The pipeline path then diverted east along Yambellup Road which the survey team followed until the route entered inaccessible farm paddocks. The survey team then drove to the South West Highway where the pipeline route begins to climb the scarp to the tank site.

Mr Goode advised the Nyungar informants of an Aboriginal Heritage Site known as Wallam's Camp located to the south of the pipeline path and east of the South Western Highway in an area of remnant bush. Mr Goode advised that this site would not be affected by the proposed works. The Wallam family members and other informants confirmed that the camp would not be affected.

The group then drove east along Honeymoon Road before turning north into a farm paddock and stopping at the proposed location of the header tank on the hillside at coordinate 399711mE and 6341991mN. Mr Alan Hill explained to the group that the tank site had been chosen as a location where the tanks are not easily visible.

Mr Goode advised that at the base of the hill the proposed pipeline would pass close to a creek and that some large trees along the fence will need to be removed to lay the pipeline. The group made the statement that every effort should be made to try and save as many of the large old trees along the route as possible. The large trees provide habitat for birds, possums and other animals and as such are important to Nyungar people. The group also requested that Water Corporation take special care when crossing creeks, rivers and wetlands.

On the whole the group expressed a preference for having the pipeline bored beneath rivers and wetlands where possible as it does not disturb the natural course of the river. The group requested that Aboriginal monitors be on site during the initial clearing of the desalination plant site, access roads, seawater pumping station site and the inlet and outlet pipes through the dunes. The monitors should be present when the trees and scrub were removed and during the initial ground disturbance or removal of the topsoil. The group also suggested that the possibility of employing a significant percentage of young Nyungar people at different stages of the rehabilitation works should be investigated. The group requested that Water Corporation make further provision for site visitation post construction and rehabilitation in order that the community can verify and check that the work was in keeping with community expectations.

Figure 7. Location of the proposed water storage facility in Harvey looking back towards the pipeline path. View looking to the west.

COMMUNITY CONSULTATION OUTCOMES

As a result of consultations held with members of the Gnaala Karla Booja WC98_058 Native Title Claim group no Aboriginal Heritage sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within lots 32, 33 and part lot 8 Taranto Road. No sites were identified along the proposed pipeline path and within Wellington location 554 proposed for the storage tank site.

During the ethnographic survey a possible scar tree was identified to be located on the southern side of Boonilup Road at coordinate 387509mE and 6336988mN. It could not be determined if this trees scar was of Aboriginal origin as the tree had been used for a survey mark. It was requested by the Nyungar informants that the tree be reported as a site under section 5a of the 'Act', however in the opinion of the project archaeologist and a senior heritage officer at the DIA the tree was most likely scarred as a result of a surveyor using the tree as a location marker. It was requested by the Nyungar informants that the Water Corporation avoided the tree.

During the consultations a number of cultural issues were raised by the Nyungar informants. The area proposed for the development of the sea water pumping station was identified as an area where Aboriginal skeletal remains may be located. There is a considerable record in the region of traditional Aboriginal skeletal remains being found within the dunes fronting the sea. The Nyungar informants requested that all works that affect the dunal areas are monitored by two Nyungar representatives chosen from the group who participated in the survey. The area of the fore-dunes was also identified as an important fauna habitat for Nyungar food species and as such it was requested that excavation in the area should be minimized and that once completed should be reinstated to a natural state. It was further requested that once the construction was completed that the area remain accessible to Nyungars for hunting and not be fenced.

During the consultation one Nyungar consultant reported that it was spiritually inappropriate to desalinate water and bring desalinated water upon the land for consumption.

In regards to the pipeline crossing of all water courses within the project area the Nyungar community members consulted identified that where possible directional drilling was a much more culturally appropriate method. Directional drilling was considered to be less intrusive as it minimises the affect on the riparian zones, does not disrupt the flow of water and does not cause pollution by sedimentation of the water courses.

SUMMARY AND RECOMMENDATIONS

The Water Corporation is proposing to construct the Southern Seawater Desalination Plant at Binningup Beach with the desalinated water piped to Harvey to be added into the South West Western Australian Integrated Water Supply System (IWSS). The Southern Seawater Desalination project is required to mitigate the shortage of water for consumption in the South West of Western Australia. The Water Corporation wishes to determine whether any sites of significance to Aboriginal people will be impacted upon by this proposed work thereby fulfilling their obligations under the Western Australian Aboriginal Heritage Act (1972).

As a result of consultations held with members of the Gnaala Karla Booja WC98_058 Native Title Claim group no Aboriginal Heritage sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within Lots 32, 33 and part Lot 8 Taranto Road. No sites were identified along the proposed pipeline path and within Wellington location 554 proposed for the storage tank site.

During the ethnographic survey a possible scar tree was identified to be located on the southern side of Boonilup Road at coordinate 387509mE and 6336988mN. It could not be determined if this trees scar was of Aboriginal origin as the tree had been used for a survey mark. It was requested by the Nyungar informants that the tree be reported as a site under section 5a of the 'Act', however in the opinion of the project archaeologist and a senior heritage officer at the DIA the tree was most likely scarred as a result of a surveyor using the tree as a location marker. It was requested by the Nyungar informants that the Water Corporation avoid the tree.

During the consultations a number of cultural issues were raised by the Nyungar informants. The area proposed for the development of the sea water pumping station was identified as an area where Aboriginal skeletal remains may be located. There is a considerable record in the region of traditional Aboriginal skeletal remains being found within the dunes fronting the sea. The Nyungar informants requested that all works that affect the dunal areas are monitored by two Nyungar representatives chosen from the group who participated in the survey. The area of the fore-dunes was also identified as an important fauna habitat for Nyungar food species and as such it was requested that excavation in the area should be minimized and that once completed the dunes should be reinstated to a natural state. It was further requested that once the construction was completed that the area remain accessible to Nyungars for hunting and not be fenced.

During the consultation one Nyungar consultant reported that it was spiritually inappropriate to desalinate water and bring desalinated water upon the land for consumption (see Appendix 4).

In regards to the pipeline crossing of all water courses within the project area the Nyungar community members consulted identified that where possible directional drilling was a much more culturally appropriate method. Directional drilling was considered to be less intrusive as it minimises the affect on the riparian zones, does not disrupt the flow of water and does not cause pollution by sedimentation of the water courses.

As a result of the above survey, the following recommendations are made:

It is recommended that as no sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified within the project area, that the Water Corporation should proceed with the project as planned.

It is recommended that the Water Corporation take into consideration the request of the Aboriginal community to engage two Aboriginal monitors chosen from the group who participated in the survey to inspect ground disturbing works that affect the construction of the

seawater pump station (Lot 33), inlet and outlet pipelines to the sea (Lot 33 and beach), pipelines from the treatment plant site to the seawater pump station (Lots 8, 32 and 33) and the construction of service roads (lots 8, 32 and 33).

It is recommended that the Water Corporation give due consideration to the Aboriginal community requests that once the project is complete that Lots 8, 32 and 33 boundaries are not fenced in order to exclude Nyungars and wildlife access through the area.

It is further recommended that the Water Corporation give due consideration to Aboriginal community requests that all water courses crossed for the pipeline are crossed by directional drilling which is a culturally more appropriate method as opposed to open trenching.

BIBLIOGRAPHY

Anderson, J. 1984. *Between Plateau and Plain. Occasional papers in Prehistory*, no. 4 A.N.U., Canberra.

Barker, A. J. and Laurie, M. 1992. *Excellent Connections. A History of Bunbury 1836 – 1990.* City of Bunbury: Bunbury WA.

Barnes, P 2001 *Marsden Hill and all that.* Self Published

Bates, D. 1938. *The Passing of the Aborigines. A Lifetime Spent Among the Natives of Australia.* Butler and Tanner: London.

Bates, D. 1966. *The Passing of the Aborigines.* John Murray: London

Bates, D. 1985. *The Native Tribes of Western Australia.* I. White (Ed.) National Library of Australia: Canberra.

Berndt, R.M. (Eds.) 1979. *Aborigines of the West. Their Past and Present.* University of Western Australia Press: Perth.

Berndt, R. M. and Berndt, C. H. (Eds). 1980. *Aborigines of the West: Their Past & Their Present.* University of Western Australia Press: Perth.

Collard, L 1996. *An Analysis of Nyungar Influence in South West Western Australia*. Murdoch University Theses.

Crook, A. 1989 *Binningup, The History*.

deGaris, B. K. 1993. *Portraits of the South West. Aborigines, Women and the Environment.* University of Western Australia Press: Perth

Goddard, E. and Stannage, T., 1984. *John Forrest and the Aborigines.* In Reece, B. and Stannage, T. (Eds.). European – Aboriginal relations in Western Australian history. Department of History, University of Western Australia Press: Nedlands.

Goode, B. 2000. *Ethnographic survey of South-Western Highway, Waroona to Bunbury, Western Australia.* A report prepared for GHD Pty Ltd. on behalf of MRWA.

Goode, B. 2006 *An Aboriginal Heritage Survey of the proposed South West Yarragadee Water Supply Pipeline Route, Water Treatment Plant, Bore Fields and Collector Mains, South West of Western Australia.* Report prepared for the Water Corporation.

Green, N. 1984. *Broken Spears.* Focus Educational Services: Perth

Haebich, A. 1988. *For Their Own Good: Aborigines and Government in the South West of Western Australia 1900 – 1940.* University of Western Australia Press: Nedlands.

Hallam, S. J. 1979. *Fire and Hearth.* Australian Institute of Aboriginal Studies. Canberra.

Machin, B. 1993. *Ethnographic Survey: Dunsborough Pipeline*. An unpublished report prepared for the Western Australian Water Authority.

Machin, B. 1995. *Ethnographic Survey: Jangardup Project*. Unpublished report.

Martinick W. G. and Associates. 1994. *The Wellington Forest Archaeological Survey and Historical Research Project.* Unpublished report for The Wellington Forest Advisory Group.

McDonald, Hales and Associates. 1994. *National Estates Grants Programme. Aboriginal Heritage sites in the Lower Southwest. Heritage study.* Unpublished report prepared for the Gnuraren Aboriginal Corporation.

Moore, G.F. 1842. *A Descriptive Vocabulary of the Language in Common Use Amongst the Aborigines of Western Australia.* Orr: London.

O'Brien, T. N. 1996. *Some Abridged History of Bunbury 1658 – 1995.* Leslie O'Brien Publishing: Garran ACT.

O'Connor, R., Quartermaine, G. and Bodney, C. 1989. *Report on an Investigation into the Aboriginal Significance of Wetlands and Rivers in the Perth – Bunbury Region.* Western Australian Water Resources Council.

Salvado, R. 1977. *The Salvado Memoirs.* (Translated and edited by E.J. Stormon). University of Western Australia Press: Perth

Sanders, T. 1975. *Bunbury. Some Early History.* Union Offset: A.C.T.

Shann, E.O.G. 1926. *Cattle Chosen*. Westminster Press: London.

Stanner, W. 1965. *Aboriginal Territorial Organization: Estate, Range, Domain and Regime*. Oceana, 33(1).

Tindale, N. B. 1974. *Aboriginal Tribes of Australia.* Australian National University Press: Canberra.

Tilbrook, L. 1983. *Nyungar Traditions.* University of Western Australia Press: Nedlands.

www.harvey.wa.gov.au – historical details of Harvey and Binningup.

Yates, A 2008 *Report on a Desktop Review of Registered Aboriginal Sites and Previous Site Surveys Binningup Beach, Shire of Harvey.* Report prepared for Mirvac Pty Ltd.

APPENDIX 1. SITES REGISTER SEARCH

Search Criteria

4 sites in a search polygon. The polygon is formed by these points (in order):

MGA Zone 50	
Northing	Easting
6335000	377000
6339000	389000
6343000	393000
6343000	400500
6341500	400500
6339500	393000
6337000	392500
6332000	377000

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Status

L	Lodged
I	Insufficient Information
P	Permanent register
S	Stored data

Coordinate Accuracy

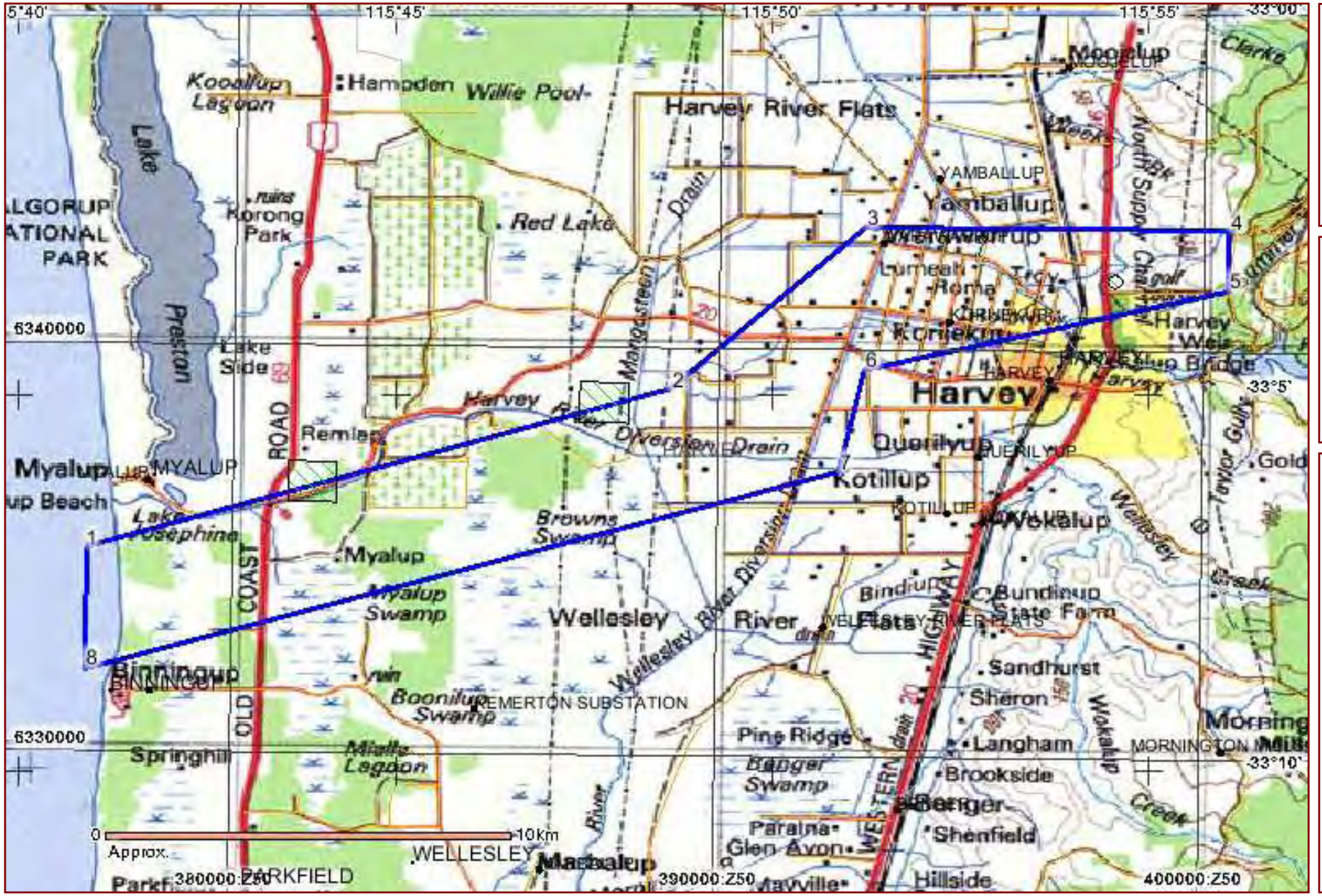
Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
5801	S	O	N	Harvey 49/myalup Beach Rd.	Artefacts / Scatter	Camp, [Other: ?]		381639mE 6336648mN Zone 50 [Unreliable]	S00348
5802	S	O	N	Harvey 50/myalup Beach Rd.	Artefacts / Scatter	Camp, [Other: ?]		387639mE 6338648mN Zone 50 [Unreliable]	S00349
5811	S	O	N	Harvey 60.	Artefacts / Scatter	Camp, [Other: ?]		380777mE 6336050mN Zone 50 [Reliable]	S00359
17779	S	O	N	Wallams Camps 1 & 2	Man-Made Structure, Historical	Camp, Water Source	*Registered Informant names available from DIA.	398169mE 6341718mN Zone 50 [Reliable]	



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

APPENDIX 2. LETTER OF ADVICE

Brad Goode
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
Phone: (08) 9755 3716
Fax: (08) 9756 7660
E-mail: bradnlee@westnet.com.au
ABN: 40 803 184 260

18th June 2008

We the undersigned have been consulted by Bradley Goode on behalf of the Water Corporation for the proposed Southern Seawater Desalination Project. We would like to make the following recommendations in relation to the West Australian Aboriginal Heritage Act (1972).

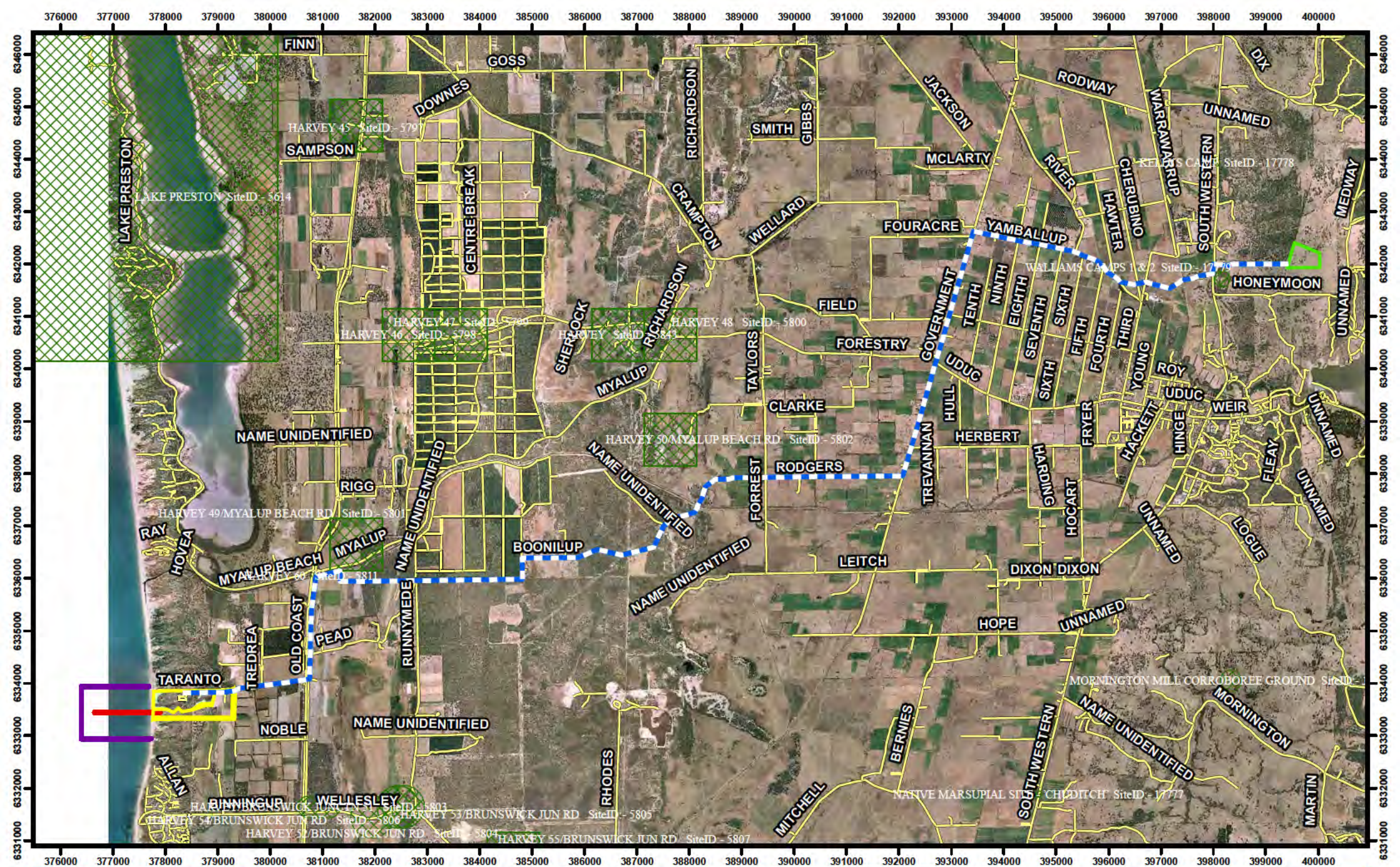
x No Ethno sites as defined by section 5
x Area from plant site to Ocean outlet to be monitored. (Stalitol remains/ecological concerns)
x Habitats trees identified + preserved
x Water courses crossed by boring
x Heritage management plan to address safety for monitors.

Gnaala Karla Booja WC98_058 Native Title Claim Group

Name	Date	Signature
Shirley Hayward	18.6.2008	S Hayward
Barbara Corbett	18.6.2008	Barbara Corbett
Merv Abraham	18.6.2008	
James Khan	18.6.2008	
Joe Northover	18.6.2008	
Peter Michael	18.6.2008	
Melva Wallam	18.6.2008	Melba Wallam
Denis Hill	18.6.2008	Denis Hill
Franklin Nannup	18.6.2008	
Isla Bellotti	18.6.2008	I Bellotti

x When work is complete all restorations to be inspected by Nyungar monitors. post construction + post re-habilitation

APPENDIX 3. MAPS OF THE PROJECT AREA



WATER CORPORATION
Binningup to Harvey
Proposed Pipeline Route

Legend
Route2
alliance areas
BO
HarveySummitTanksSite
Marine Construction Exclusion Area
Marine Pipe line(s)
roads
sites

DATE
5th Feb 2006

SCALE - at A4
1:90,006

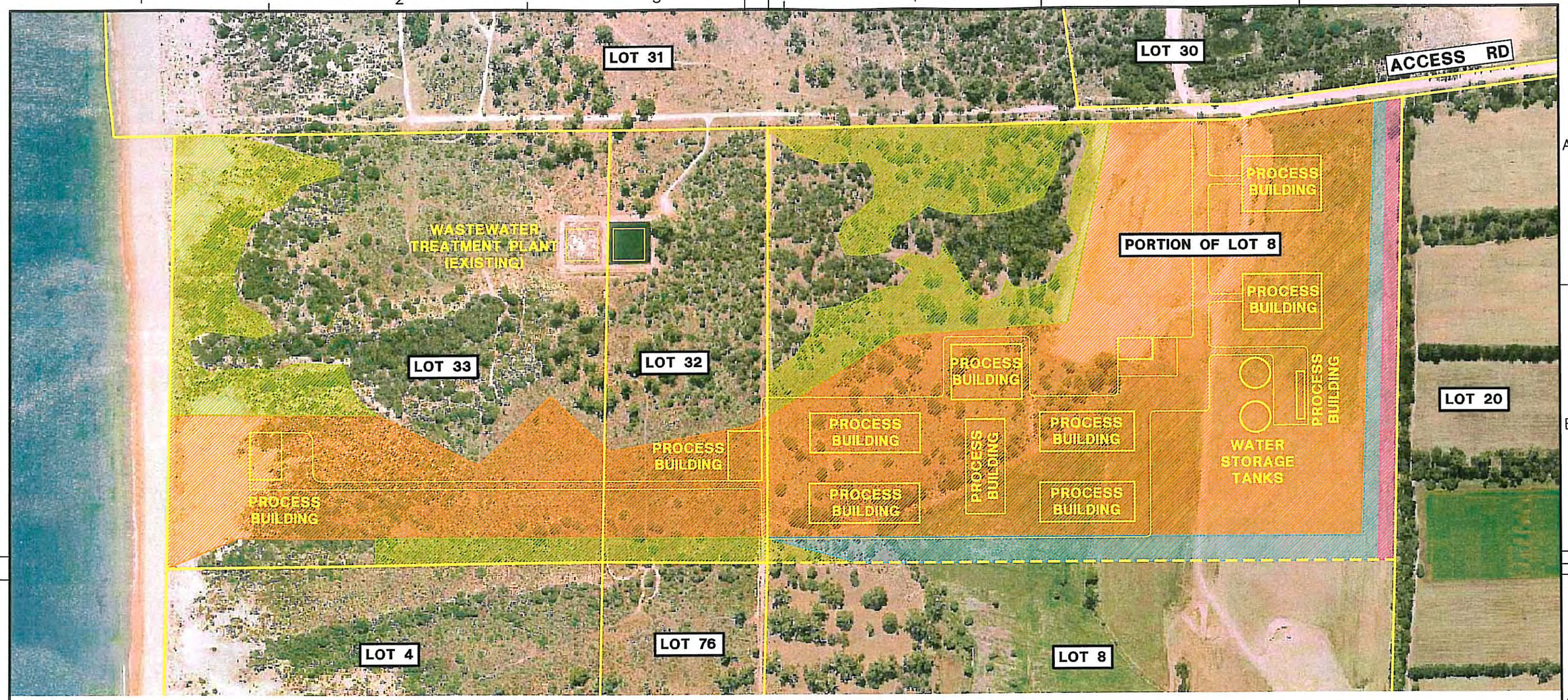
0 500 1,000 2,000 3,000
Meters

N

GDA 1994 MGA Zone 50

Survey conducted by
BRAD GOODE & ASS - 79 Naturaliste Terrace, DUNSBOROUGH WA 6281

Mapping provided by
WARPSPEED GIS - P.O. BOX 147, VASSE WA 6280



LEGEND

- VISUAL AND NOISE BERM WITH REVEGETATION
- SSDP CONSTRUCTION AREA (ACTUAL CLEARED AREA FOR CONSTRUCTION WILL BE MUCH LESS) – AREAS WITHOUT PLANT INFRASTRUCTURE TO BE REHABILITATED POST CONSTRUCTION
- POTENTIAL AREAS FOR REHABILITATION (REFER TO BIODIVERSITY OFFSET COMMITMENTS)
- LOT 8 ACCESS ROAD

TERRESTRIAL CONSTRUCTION & REVEGETATION AREAS

PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

NOTE:
BOUNDARIES SHOWN ARE INDICATIVE ONLY AND MUST BE VERIFIED PRIOR TO COMMENCEMENT OF CONSTRUCTION.

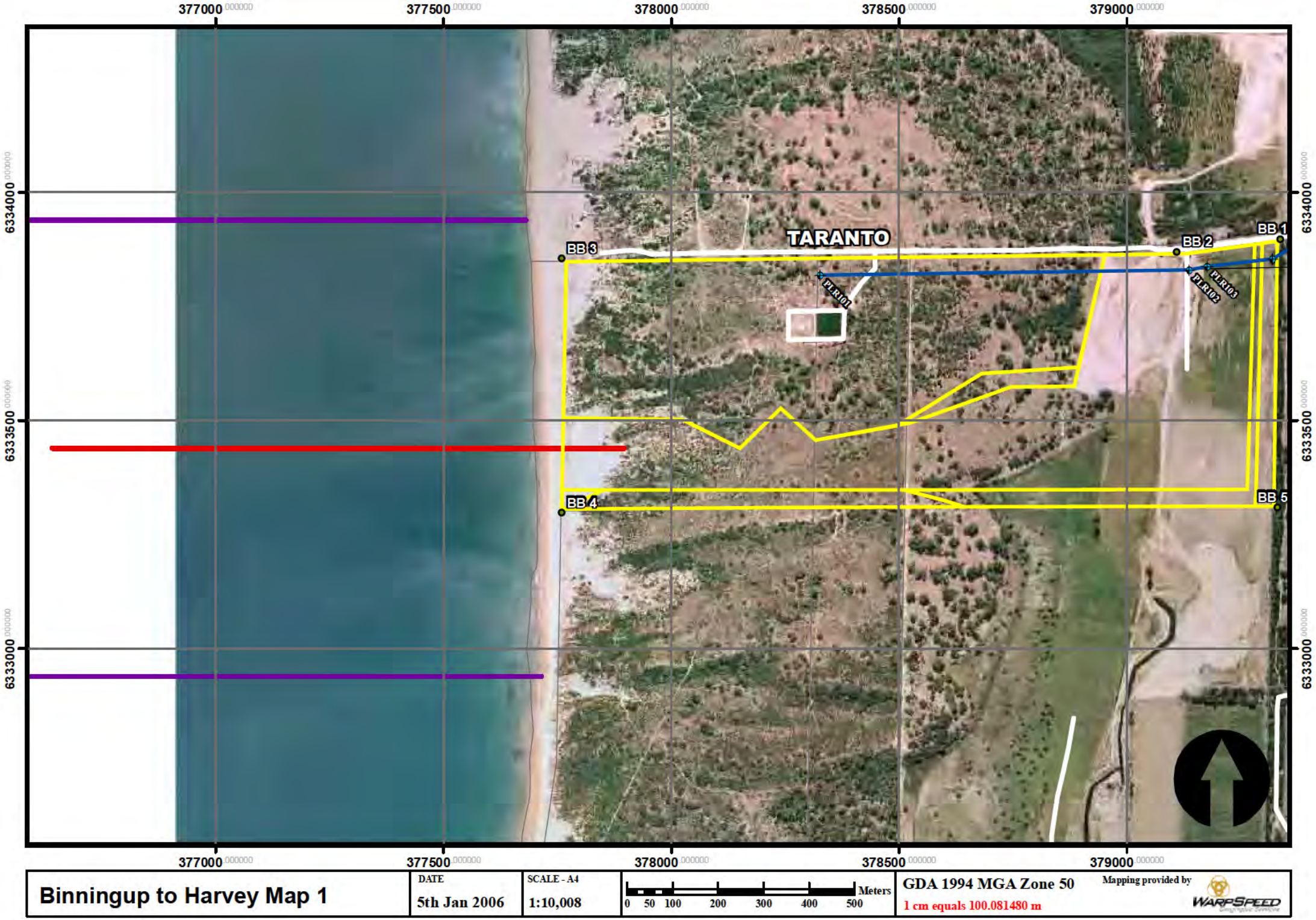
100 50 0 100 200 300 m (1:5000 AT A3)

COORDINATE SYSTEM: MGA94–50

DES CALC DES CHD DRN A CLEAVER Q.C. CHD G CLEAVER		RECOMMENDED SENIOR ENGINEER, WT APPROVED 23/6/08 PRINCIPAL ENGINEER, WT	WATER CORPORATION	INTEGRATED WATER SUPPLY SCHEME – IWSS SOUTHERN SEAWATER DESALINATION PLANT – BINNINGUP TERRESTRIAL CONSTRUCTION & REVEGETATION AREAS	ORIGINAL SHEET SIZE A3
				FILE PROJECT	PLAN IK67–95–1–14 CAD ISSUE A MF

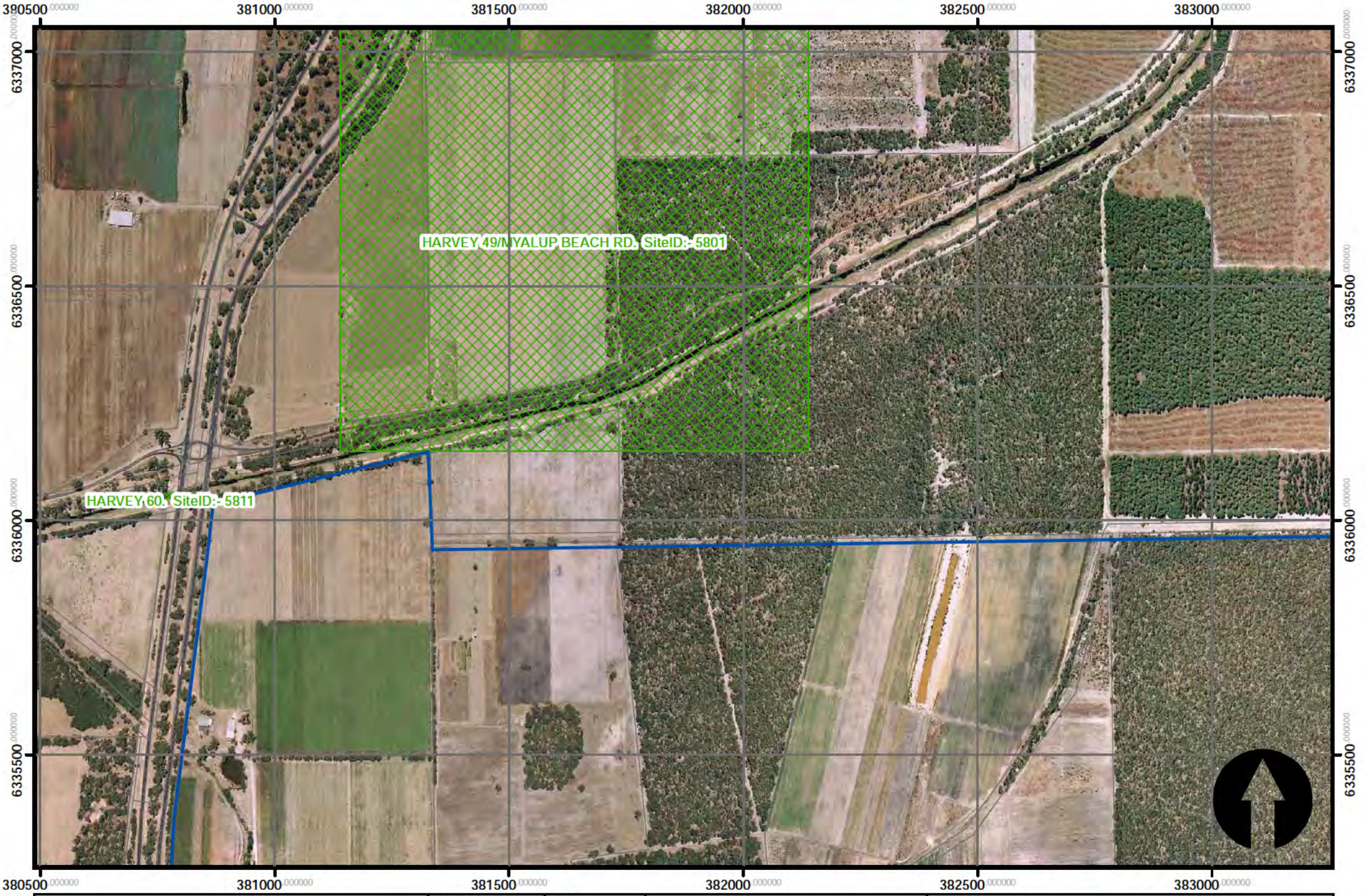
283 394

CAD MANAGEMENT_NOT READ ONLY\WT\SWR\SOUTHERN SEAWATER DESALINATION\CAD\IK67\IK67-001-015-01A 14:20 16/06/2008 cleavea0/WS11263



Binningup to Harvey Map 1	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,008	0 50 100 200 300 400 500 Meters	1 cm equals 100.081480 m	WARPSPEED

Binningup to Harvey Map 2	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	1 cm equals 100 m	WARPSPEED



Binningup to Harvey Map 3	DATE	SCALE - A4			
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	GDA 1994 MGA Zone 50 1 cm equals 100 m	Mapping provided by WARPSPEED

Binningup to Harvey Map 4	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	1 cm equals 100 m	WARPSPEED

Binningup to Harvey Map 5	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	1 cm equals 100 m	WARPSPEED

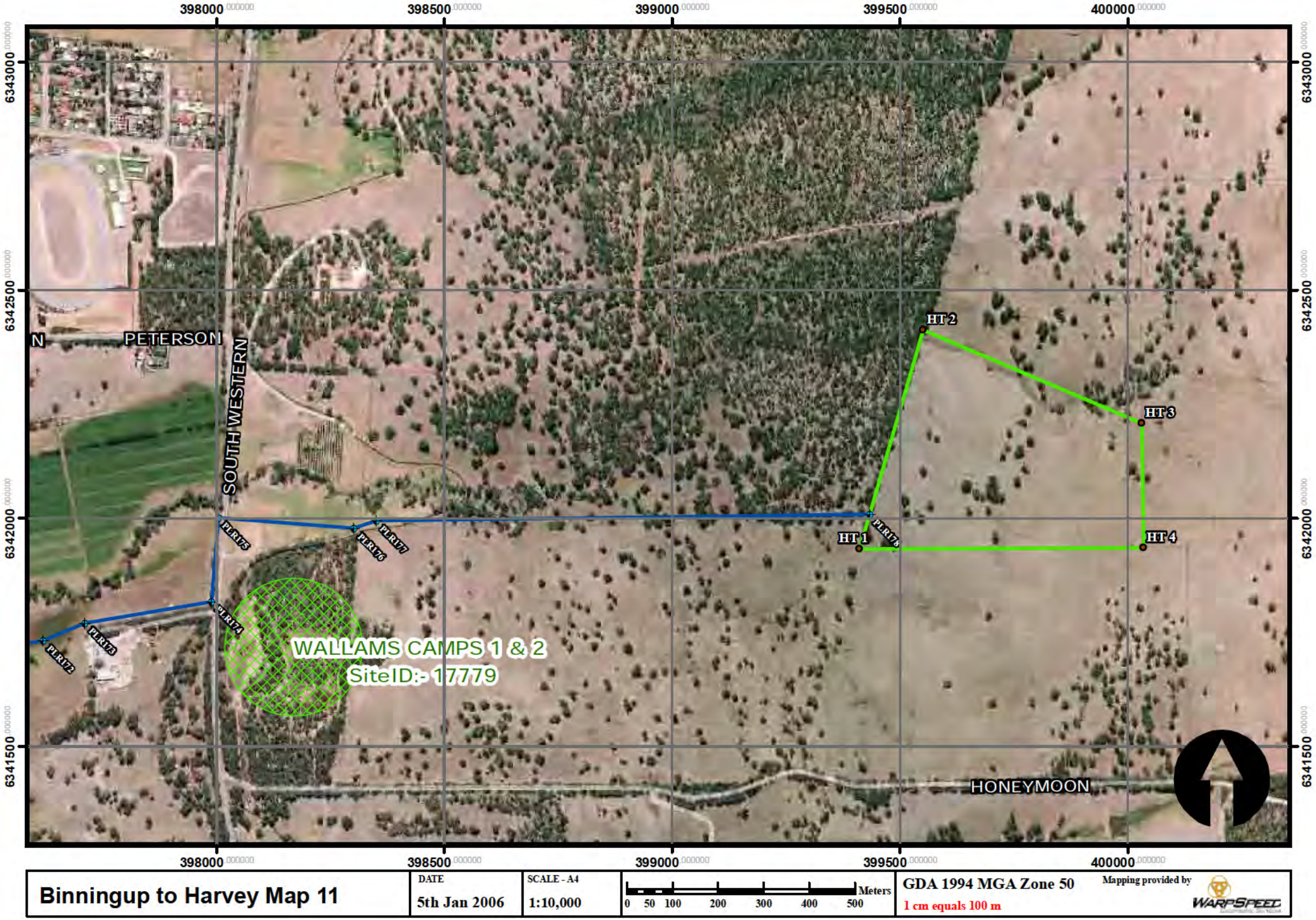
Binningup to Harvey Map 6	DATE 5th Jan 2006	SCALE - A4 1:10,000	0 50 100 200 300 400 500 Meters	GDA 1994 MGA Zone 50 1 cm equals 100 m	Mapping provided by WARPSPEED

Binningup to Harvey Map 7	DATE 5th Jan 2006	SCALE - A4 1:10,000	Meters 0 50 100 200 300 400 500	GDA 1994 MGA Zone 50 1 cm equals 100 m	Mapping provided by WARPSPEED

Binningup to Harvey Map 8	DATE	SCALE - A4							Meters	GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0	50	100	200	300	400	500	1 cm equals 100 m	WARPSPEED

Binningup to Harvey Map 9	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	1 cm equals 100 m	WARPSPEED

Binningup to Harvey Map 10	DATE	SCALE - A4		GDA 1994 MGA Zone 50	Mapping provided by
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	1 cm equals 100 m	WARPSPEED



Binningup to Harvey Map 11	DATE	SCALE - A4			
	5th Jan 2006	1:10,000	0 50 100 200 300 400 500 Meters	GDA 1994 MGA Zone 50 1 cm equals 100 m	Mapping provided by WARPSPEED

APPENDIX 4. CONFIDENTIAL LETTER FROM MR JOE NORTHOVER

Confidential.

The reason I'm objecting to the desalination plant proposed for Myalup near Binningup is based on cultural beliefs.
Both salt water and fresh water have different spirits. The salt water spirit we call Wardan and fresh water Ngarngungudditj Walgu. It will be wrong to take the sea water and turn it into fresh water as it will create an unbalance. At the moment this occurs within its natural worlds within the river systems

I would not like to see this happen it is wrong and against my beliefs. I strongly believe in my law my culture and myself.

When we come to talk to the spirits what are we to say? Where would they be? Totems have been lost and forgotten

Dabarkan Wardan dabarkan, balap kurliny kepwiri gnany Koorda Boodja noonan moort Wardan

While throwing sand in the water this is said and repeated again.

Joseph Northover

REPORT ON AN ARCHAEOLOGICAL SURVEY OF THE SOUTHERN SEAWATER DESALINATION PROJECT

A report prepared for WATER CORPORATION

JUNE, 2008

Jacqueline Harris and Wayne Webb

EXECUTIVE SUMMARY

An archaeological investigation for Aboriginal heritage sites was commissioned by Water Corporation for the proposed Southern Seawater Desalination Project. The proposed location of the infrastructure extends from Harvey North to Binningup.

The Southern Seawater Desalination Project involves the construction and operation of an osmosis seawater desalination plant located at Lots 32 and 33 and Part Lot 8 on Taranto Road in the Shire of Harvey. The plant will include: two submerged seawater intake pipelines extending up to approximately 500m offshore; process buildings; two seawater concentrate (brine) outlets; 100ML water storage facility located north-east of the town of Harvey; and approximately 28.5km of 1400mm diameter steel pipeline to connect the plant to the storage facility, and the storage facility to the existing Stirling Trunk Main of the IWSS.

The field survey commenced on 20th May until 23rd May 2008 and was conducted by Jacqueline Harris, archaeologist and Wayne Webb, a Bibbulman/Wadandi representative and senior field assistant. Mr Ted Hart assisted the team as a Gnaala Karla Booja representative and Ms Toni Webb as a field driver throughout the survey. Ms Vanessa Ugle and Mr Lindsay Hajl-Ali, Project Officers, Water Corporation accompanied the team to ensure access to land was achieved.

The proposed study area included a tank site, water treatment plant and pipeline. The pipeline route extended from Harvey North to Binningup, a distance of 28 kms. The proposed pipeline corridor is 20ms wide. The proposed treatment plant is located 1.2kms east of the coastline on Taranto Road, Binningup. The plant area measures 1.5kms EW and 0.5kms NS., an area of 75 hectares. The proposed tank site is located 4kms northeast of Harvey and 525m north of Honeymoon Road. It measures 330m EW and 660m NS, an area of 20 hectares.

The total survey of the proposed pipeline route to identify any archaeological sites was designed to incorporate two persons or more walking abreast, spaced 10m apart along the road reserve or firebreak. In addition, predictive intensive transects were conducted at firebreaks, devegetated patches, along the river bank and drainage line and any other area of site potential. The survey of the tank site incorporated six persons transecting the area abreast spaced at 10-15m apart. The survey of the desalination plant site incorporated four persons walking transects abreast and spaced at 20m apart.

It was estimated that the overall percentage coverage of the project area was around 50%. Ground visibility within the fields of pasture and along the river banks was around 10 - 20% but increased to 40% in woodlands and forests and 50% in less dense sections of coastal heath.

The proposed pipeline corridor ran along the reserve of roads and tracks or in the firebreaks of properties adjacent to the fence line. The project area diversified as each division of the coastal plain was transected. At the tank site the land was steep and undulating with granite outcrops. On the flats there were frequent water channels within market gardens and paddocks of pasture. The land changed from clay-logged paddocks to white sand with Banksia and then briefly to swamplands with melaleucas and grass trees. Following swampland was pine forests. West of the highway the land became sandy but extensively disturbed by lime stone mining. The desalination plant site is a large pit where limestone mining has stripped the land leaving a huge cavity. The route of the pipeline from the desalination plant to the sea follows a natural depression in the dune system.

An online search of the site register at Heritage and Culture Division, Department of Indigenous Affairs, was undertaken on 4 April 2008. The search defined three archaeological sites that lay in proximity to the project area. Archival research established that three archaeological sites

were not in the vicinity of the proposed works. Further these sites have been classified by the ACMC as "stored data".

No new archaeological site, as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972), was located within or in close proximity to the project area in the course of the survey. No isolated artefacts were located. Therefore there will be no known impact upon an archaeological site from the proposed development.

The pipeline route, tank and plant locations were specifically designed to avoid previously recorded archaeological sites and areas of site potential such as swamps, rivers and lakes. The proposed installations impact areas that have been previously disturbed by farming, mining and infrastructure.

No archaeological site was located within or in close proximity to the project area in the course of the survey. No archaeological sites were previously registered within the project area. There are no archaeological barriers present to effect the proposed development.

If the ground is excavated to install inlet and outlet pipes to transect the coastal sand dunes for 1.2kms **it is recommended** that monitoring occur by Aboriginal Traditional Owners to ensure that any skeletal or artefactual material that may be present is avoided, conserved, documented and/or collected.

The most likely areas where archaeological sites, in particular, artefact scatters or burials, may occur are banks of rivers, lakes, creeks and exposed sandy deposits. The removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites that may lie beneath the ground surface. **It is recommended** that Water Corporation inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 15 of the Western Australian Aboriginal Heritage Act (1972).

If Water Corporation locate an archaeological site in the process of survey or ground excavation, **it is recommended** that work cease in the immediate area. Any skeletal material should be reported to Department of Indigenous Affairs and the Western Australian Police Service. Any artefactual material should be reported to Heritage and Culture Division, Department of Indigenous Affairs.

INTRODUCTION

PURPOSE OF HERITAGE SURVEY REPORT

An archaeological investigation for Aboriginal heritage sites was commissioned by Water Corporation for the proposed Southern Seawater Desalination Project. The proposed location of the infrastructure extends from Harvey North to Binningup.

The Southern Seawater Desalination Project involves the construction and operation of: up to 100 GL/y reverse osmosis seawater desalination plant located at Lots 32 and 33 and Part Lot 8 on Taranto Road in the Shire of Harvey (approximately 140km south of Perth).

The plant will include:

- up to two submerged seawater intake pipelines extending up to approximately 500m offshore;
- process buildings including a seawater pump station, chemical storage facility, drying beds, reverse osmosis building, drinking water storage tank(s) and pump station(s), administration, plant operations control, laboratory, workshop and general storage;
- up to two seawater concentrate (brine) outlets with diffusers extending to a distance of up to approximately 1100m offshore;
- 100ML water storage facility (in up to 4 storage tanks) with up to 5ML sump located north-east of the town settlement in the Shire of Harvey; and
- approximately 28.5km of 1400mm diameter steel pipeline to connect the plant to the storage facility, and the storage facility to the existing Stirling Trunk Main of the IWSS.

The scope of work was provided in a written document to Brad Goode & Associates by Project Manager, Ms Vanessa Ugle, Water Corporation.

The objective of the investigation was to establish if any archaeological sites were located in the vicinity of the proposed study area and determine any effects the proposal may have over such sites. A report was required several weeks after completion of fieldwork.

The field survey commenced on 20 May until 23 May 2008 and was conducted by Jacqueline Harris, archaeologist and Wayne Webb, a Bibbulman/Wadandi representative and senior field assistant. Mr Ted Hart assisted the team as a Gnaala Karla Booja representative and Ms Toni Webb as a field driver throughout the survey. Ms Vanessa Ugle and Mr Lindsay Hajl-Ali, Project Officers, Water Corporation accompanied the team to ensure access to land was achieved. At the same time, Mr Brad Goode and Mr Colin Irvine conducted an ethnographic investigation.

STUDY AREA

The proposed study area included a tank site, water treatment plant and pipeline. The pipeline route extended from Harvey North to Binningup, a distance of 28 kms. The proposed pipeline corridor is 20ms wide.

Harvey is located 140 kms south of Perth and 20kms inland and Binningup is 135kms south of Perth and on the coastline.

The proposed treatment plant is located 1.2kms east of the coastline on Taranto Road, Binningup. The plant area measures 1.5kms EW and 0.5kms NS, an area of 75 hectares. The proposed tank site is located 4kms northeast of Harvey and 525m north of Honeymoon Road. It measures 330m EW and 660m NS, an area of 20 hectares.

The proposed pipeline proceeds downhill in an east west direction from Harvey tank site across country but along a fence line until it reaches River Rd. The pipeline continues in an east west direction within the road reserve of River and Yambellup Roads. At Government Road the route runs in a NE/SW diagonal in the road reserve turning east at Rogers Road. This road follows into Boonilup Road at a diagonal. The route follows the road that changes to a track that dissects a nature reserve. The pipeline skirts a pine forest and nature reserve in Pead Road Reserve. It then crosses several fields and proceeds north to skirt Harvey River Diversion Drain. The route proceeds down the road reserve of Perth Bunbury Highway. It proceeds along Taranto Road to the proposed Desalination Plant.

ENVIRONMENT

Climate

The project area lies within the south-west region of Western Australia which is characterised as a dry Mediterranean climate consisting of hot, dry summers and mild, wet winters (Beard 1981). Average annual rainfall is 800 mm where the highest rainfall occurs within June. The mean maximum temperature in February is 29.6° and mean minimum lowest temperature is 7.3° in July.

Geology & Topography

The study area lies within the Perth Basin, a deep trough filled with Phanerozoic sedimentary rocks with a surface mantle of Quaternary deposits. The corridor transects the Darling Scarp and Swan Coastal Plain.

The Darling Scarp contains very steep slopes with shallow red and yellow earth and rock outcrop. The Swan coastal plains, a 20-30km corridor, consist of thin sand and clays with thicker sand areas associated with coastal dune systems. The older deposits have been laterised and extensively stripped. The sand types are divided into a series of narrow divisions as the plains slopes gradually to the coast.

Descending from the Darling Scarp is the foothills composed of Dardanup Deposits of alluvial fans with dark grey soils, Guilford Formation composed of a flat plain with medium textured deposits and yellow duplex sands and Serpentine River Deposit of poorly drained plain with fine textured alluvial soils.

Adjacent to the foothills is a wide lens of Basendean Sands consisting of sand plains with low dunes and occasional swamps, iron or humus podzols with areas of complex dunes. This is followed by a thin lens of Karrakatta Sands of undulating landscape with deep yellow sands over limestone that is adjacent to the Yoongarillup Deposits of plains with low ridges and swales with shallow yellow and brown sands over marine limestone.

Another narrow lens of Vasse Marine Deposit composed of poorly drained plains with variable and undifferentiated estuarine and marine deposits follows. Finally the inlet/outlet pipes are situated in the Quindalup Dune System, a series of parallel linear dunes running along the coast and associated with a fallen sea level over 5,000 years ago. These dunes consist of calcareous sands, mostly unconsolidated but cemented in lower layers. (Beard 1981, DCE 1980).

Vegetation

The vegetation changes according to the varied landform and soil formations. In the Darling Scarp there are low open marri woodlands on the edge of the scarp. In the flats is a mosaic of marri woodland with patches of Banksia on sand. The Guildford complex contains a band of mixed open tuart woodland followed by a closed scrub of paperbark and river gums fringing woodland. *Eucalyptus calophylla* woodlands were present in better-drained soils with some *E. wandoo* with *E. marginata* on higher grounds and *E. rudis* in riverine fringes. On ground prone

to flooding there was a low woodland or forest of *Melaleuca rhaphiophylla* and thickets of sedgeland.

The wide band of Bassendean Sands contains jarrah and tuart woodland to low woodland and sedgelands. Karrakatta Sands comprise open eucalypt forest and woodland. Closer to the coast the Yoongarillup Deposits comprise tuart woodland with peppermint trees and the Vasse Complex contains a closed scrub of paperbark fringing woodland. The vegetation complex of Quindalup Dunes comprises a coastal dune complex of strand and fore dunes of *Spinifex longifolius, Tetragonia implexicoma* and *Cakile maritime* and mobile and stable dunes of *Acacia Cyclops, Scaevola crassifolia* and *Olearia axillaries*. Low closed forests of *Melaleuca lanceolata* and *Callitris pressei* occur in small pockets (Beard 1981, DCE 1980).

ARCHAEOLOGICAL RESEARCH

DESKTOP STUDY

An online search of the site register at Heritage and Culture Division, Department of Indigenous Affairs, was undertaken on 4 April 2008. Eight grid references were extrapolated from a 1:50,000 topographic map showing the proposed route. A narrow polygon defined the project area allowing a buffer zone of 1.5 km either side of the corridor (See register search in Appendix). The search defined three archaeological sites that lay in proximity to the project area. One site within the area was defined as ethnographic and is discussed in the ethnographic section of the report.

Details of the three archaeological sites follow. These consisted of artefact scatters and campsites. The sites were plotted on a topographic map. Any archaeological site that lay within 500m of the project area was marked for further investigation in the field.

Site ID 5801 Harvey 49/Myalup Beach Road GDA94 Zone 50 381639 6336648 S00348

DIA 5801 was reported to be an artefact scatter. It consisted of a quartz chip. Vera Novak, Peter Yu and Brian Blurton located the artefact in 1975. The ACMC have determined that the isolated artefact is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data on the register under resolution decision ID 4350, No 123, Meeting ID 484 on 8/8/00. It was located 34.65 miles south of Dawesville along Myalup Beach Road. It was in a patch of white sand. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

Site ID 5802 Harvey 50/Myalup Beach Road GDA94 Zone 50 387639 6338648 S00349

DIA 5802 was reported to be an artefact scatter. It consisted of a 15 quartz flakes and chips, some of which were retouched. Vera Novak, Peter Yu and Brian Blurton located the artefacts in 1975. The ACMC have determined that the artefact scatter is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data on the register under resolution decision ID 4350, No 123, Meeting ID 484 on 8/8/00 It was located 38.3 miles south of Dawesville along Myalup Beach Road. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

Site ID 5811 Harvey 60 GDA94 Zone 50 380777 6336050 S00359

DIA 5811 was reported to be an artefact scatter. It consisted of one porcelain flake. Vera Novak, Peter Yu and Brian Blurton located the artefacts in 1975. The ACMC have determined that the isolated artefact is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data on the register under resolution decision ID 4350, No 123, Meeting ID 484 on 8/8/00 It was located 34.15 miles south of Dawesville immediately southwest of a bridge across Harvey River Diversion Drain. It was located in yellow sand overlying limestone. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

REVIEW OF HERITAGE SURVEY REPORTS

Hames Consultancy Group 2003 *Report of Aboriginal Heritage aspects of the proposed widening of the Dampier to Bunbury natural gas pipeline corridor between Kwinana and Bunbury*. Unpublished report prepared for Gas Pipeline Working Group.

The project area comprised a corridor between Dampier and Bullsbrook being widened from 30m to 100m with lateral corridors to Oakajee Industrial estate and North Eastern Goldfields. South of Perth the corridor widens to 50m. The corridor extends from Postans at Kwinana Junction to Australind, a distance of 125kms with the first 85kms 30m wide and the following

40kms 16m wide. As there was uncertainty about which side of the road the proposed expansion area was on, both sides were included in the survey.

The survey methodology was not stated. No new sites or previously recorded sites were located. Artefacts may have been removed or disturbed by farming activities.

Quartermaine, G 1987. *From Perth on Harvey to Kwinana 330kV Transmission Line. Appendix C.* Unpublished report prepared for State Energy Commission.

The proposed route follows existing power line easements between the proposed Harvey Substation and Kwinana. The survey strategy comprised driving along the length with inspections at regular intervals. Seven archaeological sites were located. These were small low density quartz scatters, six of which were located on the grey/white sandy margins of swamps and the other on the northern bank of Murray River. All sites were subject to disturbance by vegetation clearance and firebreaks.

Goode, B. 2003 *A Desktop Preliminary Aboriginal Heritage Survey for Water Corporations proposed Development of the Yarragadee Aquifer in the Lower South West corner of Western Australia.* Unpublished report prepared for Gutteridge Haskins and Davey.

A comprehensive review of 27 relevant reports was undertaken by B Goode in a preliminary desktop survey for the Yarragadee aquifer programme in 2003.

A summary of the archaeological content as gleaned from the reports discussed in Goode (2003) follows. A limited number of archaeological sites have been located as a result of consultancy surveys within the southwest and in the vicinity of the proposed pipeline corridor and bore fields. Isolated artefacts are more frequently identified but they, *per se*, do not constitute a site. From the synopsis of southwest sites it is determined that archaeological sites are more likely to occur within disturbed lands, in devegetated areas and in close proximity to water sources such as rivers, pools, swamps, creeks and lakes.

Harris J & Webb W 2006 *Report on an archaeological survey of pipeline route, water treatment plant, borefield and collector mains for southwest Yarragadee Water Supply*. Unpublished report prepared for the Water Corporation.

The study area included a bore field, collector mains, water treatment plant and pipeline. The pipeline route extended from Harvey North to Jarrahwood south, a distance of 110 kms. The proposed pipeline corridor is 100ms wide and crosses a river at nine separate locations, namely Brunswick, Collie, Ferguson, Preston and three tributaries, Capel and St Johns Rivers.

The systematic sample survey of the proposed pipeline route to identify any archaeological sites was designed to incorporate a 30% sample with up to four persons walking abreast, spaced about 25m apart. No archaeological site was located but two isolated artefacts were located. The route, bores and plant location was specifically designed to avoid previously recorded archaeological sites and areas of site potential such as swamps, rivers and lakes and only impacts areas that have been previously disturbed by farming and infrastructure.

ARCHAEOLOGICAL CONTEXT

A considerable amount of research has been conducted in the southwest corner of Western Australia (see Dortch 1977, Hallam 1986, Ferguson 1985, Pearce 1982) and as a consequence the archaeological patterning of the region is well developed. The project area is located within the coastal plain, woodlands and Darling Scarp of the southwest.

Ethnographic and archaeological surveys on the Swan Coastal Plain have confirmed the concentration of Aboriginal occupation around wetlands, swamps, rivers and estuaries

(O'Connor et al 1995). This pattern was originally proposed by Hallam (1986) on the coastal plain around Perth and further enforced by subsequent research. An anomaly to this archaeological patterning, however, was suggested by Veth & Moore (1989), after an extensive survey of Scott Coastal Plain which failed to locate any archaeological material, suggesting a very low occupation density for the low-lying swampy plain.

A variety of ethnohistorical sources describe the activities of Aboriginal people on the coastal plain, their subsistence techniques and semi-permanent camps about wetlands during summer. Several sources have noted that people dispersed in winter to hunt in the forested uplands, yet there is scant information pertaining to this part of the subsistence cycle. On the basis of ethnohistorical evidence, Hallam (1979) has proposed that the forest was little exploited and the less dense woodland further inland was targeted by Aboriginal groups.

An alternative model has been proposed by Anderson (1984) and Pearce (1982) based on studies carried out in jarrah forests where they propose that the resources of the forest were widely exploited by highly mobile hunting groups but these groups did not establish large camp sites. Both recorded numerous small artefact scatters, comprised predominantly of quartz tools and debitage. In the South Canning Forest Anderson estimated a density of 1.7 sites per square kilometre while Pearce found a density of 1 site per square kilometre in Collie. Anderson also noted the particular problems concerning low visibility and poor access inherent in the survey of forests.

Excavations were undertaken in jarrah forests by Pearce (1982) and Anderson (1984) where datable organic material was recovered. A sandy site on the edge of a swamp at Collie established occupation at 5810 ± 330BP in the deepest part of the forest; a cave at Boddington yielded a date of 3230 ± 170 BP (Pearce 1982); while Anderson recovered a date of 1280 ± 80 BP at North Dandalup.

One of the earliest evidence for prehistoric occupation of the South-West of Australia is an alluvial terrace site at Upper Swan, located 25 km north-east of Perth and dated at 38,000 B.P. years (Pearce and Barbetti, 1981). Two other sites in the south-west have also yielded Pleistocene dates, Devil's Lair near Margaret River and Helena River. The length of occupation at the limestone cave at Devil's Lair ranges from 47,000 years B.P. to 6,500 years B.P. while Helena River yields an early date of 29,000 B.P. years from the basal level as well as a mid-Holocene date of 4,000 B.P closer to the surface (Dortch 1977, 2002, Schwede 1990). In addition, Dortch (1975) located a silcrete quarry and manufacturing site on the Darling Plateau at Northcliffe. His excavations revealed extensive use of geometric microliths from prior to 6,000 B.P. until 3,000 B.P.

West of the project area, Lilley (1993) surveyed the coastal plain and forest uplands around Margaret River but failed to find any archaeological material in the forest and few sites on the coastal plain. He concludes that the faint archaeological signature of the region is the result of low population densities caused by a relatively impoverished resource base, particularly in jarrah forests. He considers that the technical problems inherent in the region of low site survival rates, poor access and low surface visibility, while contributing factors in site surveys, nevertheless do not affect the outcome of an actual scarcity of archaeological sites in the area.

South of the project area Ferguson (1985) produced an occupation model for the far southwest predicting extensive use of uplands during earlier times of cooler, drier climate and less dense forest. With increased rainfall and subsequent increase in forest density during the early Holocene, Ferguson proposed sparser occupation in the forest uplands and increased occupation of the coastal plain and interior woodlands.

Research into occupation patterns on the coastal plain, woodland and jarrah forest of the Perth region can be transposed to the lower south-west because of the similar environmental and

geomorphic features. A large data base on site locations and assemblages exists as a result of a systematic study of the Swan Coastal Plain undertaken by Hallam (1986) in the 1970s and early 1980s. Hallam's objective was to explain the changing occupation patterns of prehistoric Aboriginal populations. Using numbers and types of sites within ecological zones as a means of comparison, Hallam describes the patterning and nature of archaeological assemblages from the littoral zone, through the coastal sand plain to the foothills and Darling Scarp.

Hallam concludes that Aboriginal occupation was focused around lakes and swamps of the Bassendean Sands and Pinjarra Plains and these occupation sites double numerically in the last few hundred years before European contact. A broad chronology was developed based on the presence of certain indicators within the assemblage. The presence of fossiliferous chert indicates the Early Phase, backed pieces and flat adzes the Middle Phase, quartz chips the Late Phase and glass or ceramic, the Final Phase. Schwede (1990), in a more recent analysis of quartz debitage, finds these chronological markers problematic, in particular, the Late Phase and concludes that all phases were rich in quartz assemblages.

From such research, a predictive model of site type and location can be projected for the project area. There is a high probability that any sites located will be scatters of less than 10 artefacts and manufactured from quartz. These sites will occur adjacent to a water source and be situated on or near tracks or cleared areas. It is necessary, however, to take into account the high level of disturbance caused by intensive farming by European colonists in the C19th and C20th that may have largely obliterated or camouflaged archaeological sites.

SITE SIGNIFICANCE

If any sites are located a scientific assessment is made of its significance. The significance of an archaeological site is determined by its ability to address regional and site-specific research questions and by its representativeness (Bowdler 1984). Significance is a mutable quality, changing as more sites are recorded, research questions are answered or new research directions arise. Broad research questions that sites in the Southwest may address include:

a) the antiquity of colonisation of the southwest zone;

b) social and technological changes that may have occurred in the mid-Holocene;

c) specific patterns of occupation in regional zones; and

d) dating of industrial sequences in the region.

SURVEY METHODOLOGY

The field survey was conducted using a Garmin GPS map 60CS with datum WGS84, 1:50,000 cadastral map and a series of 1:10000 aerial photographs demarcating the proposed project area. The survey design was formulated using a combination of predictive and systematic transects throughout the project area with particular emphasis on devegetated and riverine locations.

The total survey of the proposed pipeline route to identify any archaeological sites was designed to incorporate two persons or more walking abreast, spaced 10m apart along the road reserve or firebreak. In addition, predictive intensive transects were conducted at firebreaks, devegetated patches, along the river bank and drainage line and any other area of site potential.

Only two areas were unable to be accessed on foot. One was a 400m section across a market garden between River Road and Third Street where permission of access was denied unless the team was monitored to prevent any touching of produce and the other section was a two kilometre section where a pine forest had been just ripped up and was been sprayed at the time of survey with an unknown substance by a low flying plane. The latter section was driven in a slow moving 4WD while the former section was assessed from an adjacent road. The section of the route along Government Road had previously been followed in the Yarragadee Survey (Harris & Webb 2006).

The survey of the tank site incorporated six persons transecting the area abreast spaced at 10-15m apart. A creek line just out of the project area was also inspected. The survey of the desalination plant site incorporated four persons walking transects abreast and spaced at 20m apart. Where visibility was poor from dense coastal scrub meandering tracks were followed.

The pipeline corridor, tank and plant site affected most 85 lots, some of which were owned or leased by an individual farmer or company. Some farmers owned several lots and each lot varied in size. Water Corporation officers gained access to properties by ringing landowners after having informed them by letter sent by mail several weeks prior to the survey. The pipeline corridor was mostly in road reserve or firebreaks so there was minimal impact on the farm lots. The proposed route was frequently marked by flagging or steel markers. The route followed an ephemeral tributary of Harvey River, Harvey River and followed and crossed Harvey River Diversion Drain.

It was estimated that the overall percentage coverage of the project area was around 50%. Typical deterrents to a greater coverage were bellowing bulls in paddocks, locked gates, electric fences and 150km/hr gale force winds off the coastline. Ground visibility within the fields of pasture and along the river banks was around 10 - 20% but increased to 40% in woodlands and forests and 50% in less dense sections of coastal heath.

SURVEY AREA

The proposed pipeline corridor ran along the reserve of roads and tracks or in the firebreaks of properties adjacent to the fence line. The project area diversified as each division of the coastal plain was transected. At the tank site the land was steep and undulating with granite outcrops. A transmission line crossed the undulating grass paddock. Occasional trees of river gum, marri and balga dotted the paddock. The pipeline corridor proceeded down hill within paddocks alongside a creek, firebreak and fence line. Granite outcrops with quartz intrusions were frequent.

On the flats there were frequent water channels within market gardens and paddocks of pasture. Beside the river the area had been revegetated with peppermints, paperbarks, balgas, melaleucas, hoveas and river gums. Some paddocks in the low-lying lands had been laser levelled. Numerous ditches surrounded the irrigation properties.

The land changed from clay-logged paddocks to white sand with Banksia, balgas, tea tree and jarrah trees and then briefly to swamplands with melaleucas and grass trees. Following swampland was pine forests that had obliterated the natural vegetation and left wide tracks alongside the plantations or the newly stripped plantations. West of the highway the land became sandy but extensively disturbed by lime stone mining.

The desalination plant site is a large pit where limestone mining has stripped the land leaving a huge cavity. West of the proposed plant site is an effluent plant site with numerous sandy tracks among a low coastal heath. The land was previously used as farmland and thus there much regrowth of peppermints, tuarts, saltbush and banksias on previously de-vegetated land. The fore-dunes are composed of large high sand dunes of white sand covered in coastal heath. The proposed route of the pipeline from the desalination plant to the sea follows a natural depression in the dune system.

The route of the pipeline and site for tanks and desalination plant was purposively designed to affect previously disturbed areas.

FIELD SURVEY RESULTS

The survey established that no previously registered archaeological sites impact upon the proposed development area and that three archaeological sites were not in the vicinity of the proposed works. Further these sites have been classified by the ACMC as “stored data”.

Site ID 5801 Harvey 49/Myalup Beach Road GDA94 Zone 50 381639 6336648 S00348

DIA 5801 was reported to be an artefact scatter. It consisted of a quartz chip. The ACMC have determined that the isolated artefact is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data on the register. It was located 34.65 miles south of Dawesville along Myalup Beach Road and it was in a patch of white sand. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

The proposed pipeline route does not disturb DIA 5801. The proposed route is 900m northwest of the nominated location.

Site ID 5802 Harvey 50/Myalup Beach Road GDA94 Zone 50 387639 6338648 S00349

DIA 5802 was reported to be an artefact scatter. It consisted of a 15 quartz flakes and chips, some of which were retouched. The ACMC have determined that the isolated artefact is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data on the register. It was located 38.3 miles south of Dawesville along Myalup Beach Road. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

The proposed pipeline route does not disturb DIA 5802. The proposed route is 2.7kms north of the nominated location.

Site ID 5811 Harvey 60 GDA94 Zone 50 380777 6336050 S00359

DIA 5811 was reported to be an artefact scatter. It consisted of one porcelain flake. The ACMC have determined that the isolated artefact is not a site under the Aboriginal Heritage Act 1972 and it is therefore placed as stored data. It was located 34.15 miles south of Dawesville immediately southwest of a bridge across Harvey River Diversion Drain. The site details have been deemed insufficient to accurately or confidently determine the location of the site.

The proposed pipeline route does not disturb DIA 5811. The proposed route is 350m east of the nominated location.

No new archaeological site, as defined by Section 5 of the West Australian Aboriginal Heritage Act 1972, was located within or in close proximity to the project area in the course of the

survey. No isolated artefacts were located. It is considered that the survey techniques employed in the field survey were sufficient to have located any major archaeological site present on the surface.

POTENTIAL EFFECTS

No previously recorded or newly recorded site was found to be located within or in close proximity to the proposed development during the course of the survey. Therefore there will be no known impact upon an archaeological site from the proposed development.

The pipeline route, tank and plant locations were specifically designed to avoid previously recorded archaeological sites and areas of site potential such as swamps, rivers and lakes. The proposed installations impact areas that have been previously disturbed by farming, mining and infrastructure.

The archival results indicate that there is moderate potential for artefact scatter sites to be discovered within the swampy areas and woodland but low potential in the coastal sand dunes. Because artefact scatter sites are frequent in the region close to major river and water resources, there is a probability that artefact scatters may occur at exposed sandy devegetated areas or be uncovered following the removal of overlying sands by wind erosion or developers excavating and clearing the land near the Harvey River and tributary.

It is possible that a scarred tree may remain in the study area but the likelihood is limited as many of the original trees have been logged and the rivers banks have been stripped and revegetated with native tree species.

Because of the high numbers of burials located in coastal dunes, there is moderate to high potential for skeletal remains to be present in the sandy coastal scrub heath of the remnant sand dunes. While having been partially modified in the past when used as farmland the coastal dunes retain some integrity that increases the likelihood for skeletal remains to be located. As an inlet and outlet pipeline is proposed to transect the sand dunes for 1.2kms it is considered appropriate that monitoring occur by Aboriginal Traditional Owners when the ground is excavated for installation of the pipes.

There is limited prospect for any quarry sites. While there are granite outcrops in the scarp and limestone on the coastal sand dunes there is no natural stone outcropping between these extremities.

CONCLUSIONS

DISCUSSION

An archaeological survey was conducted along a proposed pipeline route extending from Harvey to Binningup, a distance of 28 kms x 20ms wide. The survey included a treatment plant at Binningup and a tank site at Harvey. The proposed pipeline runs adjacent to a tributary creek line, Harvey River and Harvey River Diversion Drain as well as along road and track reserves and firebreaks.

The project area was diverse in landform and vegetation, consistent with a transect from Darling Scarp to the Swan Coastal Plain. From the undulating steep hills beyond Harvey, the pipeline route passed the typical flat low-lying farmland of the Pinjarra Plains, the flat sand plains of Bassendean Sands, the intervening swamp land and the coastal dunes to the coastline. Limited original vegetation remained on these farms except along fence lines, river banks and nature reserves. The study area was extensively disturbed from farming activities, construction of roads and tracks, infrastructure, irrigation systems, pine forests, limestone mining, artificial drains, fence lines and firebreaks.

The proposed route and tank/plant sites were selected to avoid clearing of native vegetation, lakes, wetlands and heritage sites. Where possible the proposed pipeline route and infrastructure transected properties along fence lines, in firebreaks, road reserves, pine plantations and generally in highly disturbed contexts. The purposive design for the pipeline and infrastructure was highly effective in that no green fields were disturbed.

A number of archaeological sites have been previously recorded in the vicinity. These consisted of small quartz artefact scatters. During the survey there was low to moderate potential for the location of artefact scatters because a section of the proposed development was in the Pinjarra Plains of the Swan Coastal Plain where a high proportion of sites are located and because a section of the pipeline route runs adjacent to a major river. Few archaeological sites have been previously recorded away from a water source in the region.

The predictive site pattern of the region attests to the importance of water sources in the location of archaeological sites. If archaeological sites were present, according to the model, they would predictably be small quartz scatters of an ephemeral nature and of low to moderate significance. Furthermore, it is likely that any archaeological site on or beneath the surface, in this context, would be extensively disturbed from clearing, farming activities, laser levelling and irrigation.

Ground visibility was low in fields of dense pasture and grasses and along river banks and low to moderate within the woodland and coastal plain. Archaeological research in woodland/forest suggests artefact scatter sites are frequently found in disturbed ground, particularly in areas where, prior to disturbance, there is low visibility. Archaeological sites nevertheless require some land integrity for the sites to have any provenance and, thus, scientific significance. The high disturbance factor of intensive farming techniques and infrastructure and low to moderate visibility are seen as the major contributors to the lack of archaeological sites located in the study area.

Major alterations to the project area have obliterated or camouflaged potential sites, if present, and farming and horticultural activities have altered parts of the original terrain and ground surface over 150+ years. Some of the large old trees that may have been scarred in the past from Aboriginal usage have been removed during clearance, in particular along river banks.

RECOMMENDATIONS

No archaeological site was located within or in close proximity to the project area in the course of the survey. No archaeological sites were previously registered within the project area. There are no archaeological barriers present to effect the proposed development.

If the ground is excavated to install inlet and outlet pipes to transect the coastal sand dunes for 1.2kms **it is recommended** that monitoring occur by Aboriginal Traditional Owners to ensure that any skeletal or artefactual material that may be present is avoided, conserved, documented and/or collected.

The most likely areas where archaeological sites, in particular, artefact scatters or burials may occur are banks of rivers, lakes, creeks and exposed sandy deposits. The removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites that may lie beneath the ground surface. **It is recommended** that Water Corporation inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 15 of the Western Australian Aboriginal Heritage Act (1972).

If Water Corporation locate an archaeological site in the process of survey or ground excavation, **it is recommended** that work cease in the immediate area. Any skeletal material should be reported to Department of Indigenous Affairs and the Western Australian Police Service. Any artefactual material should be reported to Heritage and Culture Division, Department of Indigenous Affairs.

BIBLIOGRAPHY

Anderson J. 1984. *Between Plateau and Plain.* Occasional Papers in Prehistory. No. 4 A.N.U. Canberra.

Beard J.S. 1981 *Swan: Vegetation Survey of Western Australia*. U.W.A. Press

Bowdler S. 1984. Archaeological significance as a mutable quality. In S Sullivan & S. Bowdler (eds) *Site Survey and Significance Assessment in Australian Archaeology* R.S.P.S., A.N.U. Canberra: 1-9.

Department of Conservation and Energy 1980. Atlas of Natural Resources Darling System Western Australia.

Dortch C. 1975 Geometric microliths from a dated archaeological deposit near Northcliffe, Western Australia. *Journal of the Royal Society of Western Australia*. 54 103-13

Dortch C.E. 1977 Early and late stone industrial phases in Western Australia in Wright R.V.S. (ed) *Stone Tools as Cultural Markers* A.I.A.S. Canberra: 104-132

Dortch C.E. 2002 Modelling past Aboriginal hunter-gatherer socio-economic and territorial organisation in Western Australia's lower South-west. *Archaeology in Oceania* 37:1: 1-22.

Ferguson W. 1985 *A mid-Holocene depopulation of the Australian south-west.* Unpublished PhD thesis, A.N.U. Canberra.

Goode B. 2003. *A Desktop Preliminary Aboriginal Heritage Survey for Water Corporations proposed Development of the Yarragadee Aquifer in the Lower South West corner of Western Australia*. Unpublished report for Gutteridge Haskins and Davey.

Hallam S.J. 1979 *Fire and Hearth: a study of Aboriginal usage and European usurpation in south-western Australia.* A.I.A.S. Canberra.

Hallam S.J. *1986 Prehistoric Aboriginal populations on the Swan Coastal Plain, Western Australia.* Final Report on the Project: Australian Research Grants Scheme.

Hames Consultancy Group 2003. *Report of Aboriginal Heritage aspects of the proposed widening of the Dampier to Bunbury natural gas pipeline corridor between Kwinana and Bunbury.* 2003. Unpublished report for Gas Pipeline Working Group.

Harris J & Webb W 2006. *Report on an archaeological survey of pipeline route, water treatment plant, borefield and collector mains for southwest Yarragadee Water Supply* 2006. Unpublished report for Water Corporation.

Lilley I. 1993. Recent research in south-western, Western Australia. *Australian Archaeology* No. 36, pp 34-41

O'Connor R., Quartermaine G. & Yates A. 1995. *An Investigation into the Aboriginal Significance of Wetlands and Rivers in the Busselton – Walpole Region.* Prepared for Water Authority of Western Australia.

Pearce R.H. & Barbetti M. 1981. A 38,000 year old archaeological site at Upper Swan, Western Australia. *Archaeology in Oceania.* 16:173-178

Pearce R.H. 1982. *Archaeological sites in the jarrah forest at South-western Australia.* Australian Archaeology No. 14, 18-24

Quartermaine G. 1987. *From Perth on Harvey to Kwinana 330kV Transmission Line. Appendix C.* 1987. Unpublished report for State Energy Commission.

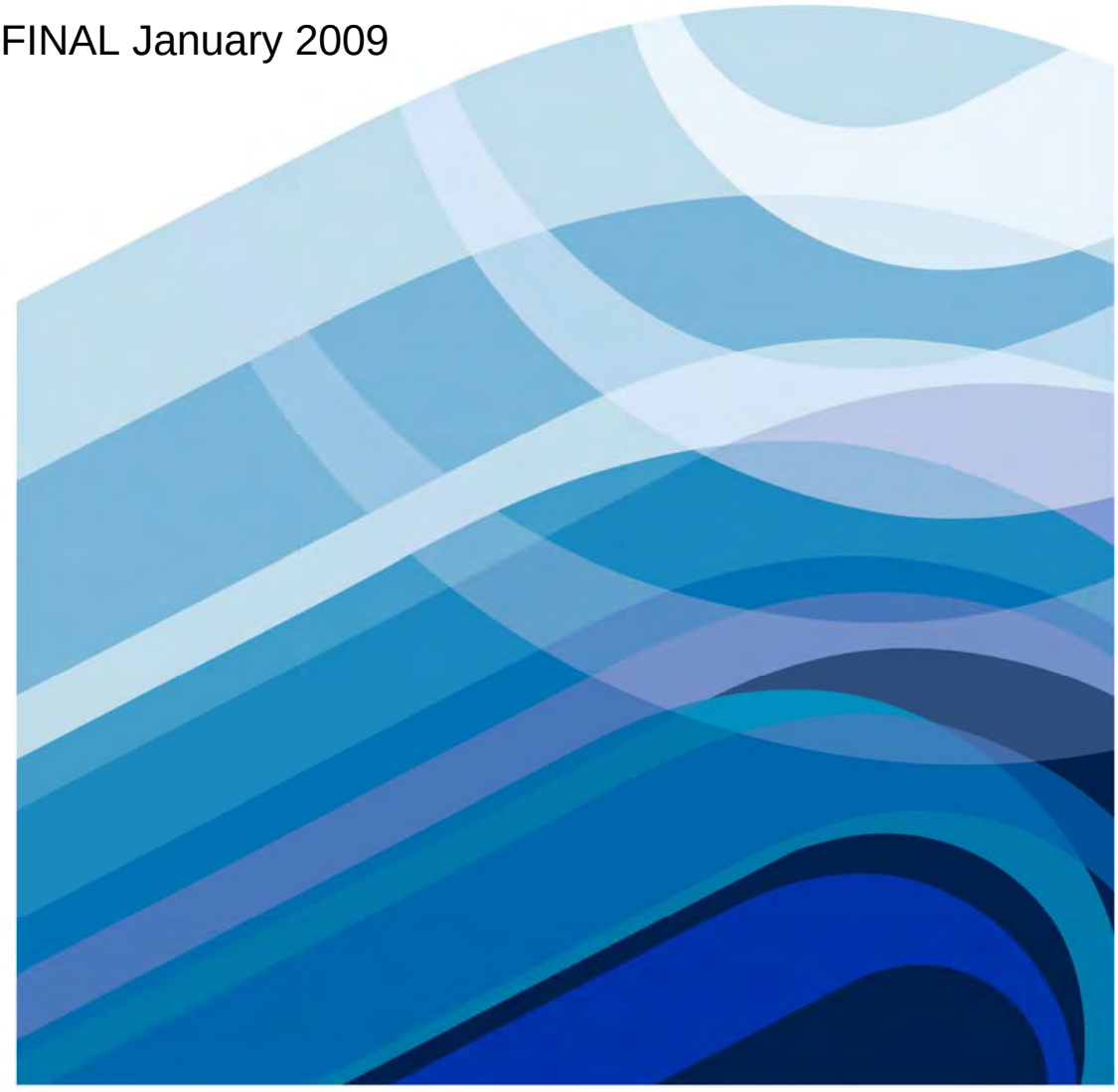
Schwede M. 1990. *Quartz, the multifaceted stone: a regional prehistory of the Helena River Valley on the Swan Coastal Plain of Southwestern Australia.* Unpublished PhD thesis, University of Western Australia. Nedlands.

Veth P. & Moore P. 1989 *Report on an archaeological and ethnographic survey near Beenup, Augusta, W.A.* Prepared for Lewis Environmental Consultants.

Southern Seawater Desalination Project

Construction Environmental Management Framework

FINAL January 2009



Project Number:

C-W01781
C-W01783

Document Number:

CDMS 558434
File JT1 2007 07264

Document History

Report	Version	Prepared by	Reviewed by
Southern Seawater Desalination Plant - Construction Environmental Management Plan.	Draft for Internal Review November 2007.	S A Hawkins, Snr. Environmental Scientist - Water Corporation.	Wallis J – Project Management Churchill N – Project Management Stansfield J – Project Management Oliver M - Project Management Goullee J – Project Management Smith R – Project Management Brown S – Project Management Faskel F - Project Management Congdon K - Project Management Herbert N – Infrastructure Design Lee S – Infrastructure Design Watson G – Environment Branch (Operations) Cole J - Environment Branch (Approvals) Baker A - Environment Branch (Approvals) Scott M – Sustainability Unit Robertson B – Capital Investment Doubikin R – Asset Management SW Lund L – Indigenous Resources Roffman T – OS&H Branch Basanovic G – Incident Management Madin J – Project Communications Wallis I (CEE) – Consulting Marine Engineer Bailey M (Oceanica) - Consulting Marine Scientist Lane K (ENV) – Consulting Terrestrial Scientist
Southern Seawater Desalination Project - Construction Environmental Management Plan.	Draft for Internal Review February 2008.	S A Hawkins, Snr. Environmental Scientist - Water Corporation.	D Lunetina - Environment Branch A Baker – Environment Branch D Thorpe - Environment Branch
Southern Seawater Desalination Project - Construction Environmental Management Framework.	Draft for Environmental Protection Authority February 2008.	D Luketina, Mgr Environment – Water Corporation. A Baker, Principal Environmental Scientist – Water Corporation. D Thorpe, Environmental Scientist – Water Corporation.	Environmental Protection Authority.
Southern Seawater Desalination Project - Construction Environmental Management Framework.	Public Environmental Review April 2008.		Environmental Impact Assessment - Public Environmental Review.
Southern Seawater Desalination Plant - Construction Environmental Management Framework.	**Final January 2009.**	**G Groth, Snr. Environmental Officer - Water Corporation.**	**Churchill N – Project Management**

Reference

This document should be cited as:

Water Corporation (2008) *Southern Seawater Desalination Project Construction Environmental Management Framework January 2009.*

Contents

List of Figures

List of Tables

1.0 Overview

1.1 Project Outline

The Water Corporation is a public utility of the State Government of Western Australia responsible for public water supply in accordance with the *Water Corporation Act 1995* (WA) and associated legislation. The Water Corporation's Southern Seawater Desalination Project (SSDP) is critical Government infrastructure for public water supply to the Integrated Water Supply Scheme (IWSS).

The Southern Seawater Desalination Project involves the construction and operation of:

- A reverse osmosis seawater desalination plant to produce Up to 100 GL/y, located at Lots 32 and 33 and Part Lot 8 on Taranto Road in the Shire of Harvey (approximately 140km south of Perth).The plant will include:
    - Up to four submerged seawater intake pipelines extending up to 600m offshore.
    - Seawater pump station.
    - Chemical storage facility for chemicals including ferric sulphate, sulphuric acid and sodium hypochlorite.
    - Dual media filters (including backwash tanks) and drying beds.
    - Reverse osmosis building.
    - Potabilisation and storage facilities for chlorine, fluorosilicic acid, lime, carbon dioxide and minor process chemicals.
    - Drinking water storage tank(s) and pump station(s).
    - Up to four seawater brine outlets with diffusers extending to a distance of up to 1100m offshore.
    - Site amenity buildings for purposes including administration, plant operations control, laboratory, workshop and general storage.
- 100ML water storage facility (in up to 4 storage tanks) with up to 5ML sump located north-east of the town settlement in the Shire of Harvey.
- Approximately 30km of 1400mm diameter cement-lined steel pipeline to connect the plant to the storage facility, and the storage facility to the existing Stirling Trunk Main of the Integrated Water Supply System (IWSS).

Implementation of the Southern Seawater Desalination Project will be staged, with initial construction and operation for 50 GL/y water production capacity and with one water storage tank up to 32 ML capacity. All terrestrial and marine pipelines will be constructed for a 100 GL/y capacity at the initial stage of construction including all earthworks. The capacity of the plant site and water storage facility will be increased as water supply demand increases.

An overview map identifying the project infrastructure location is contained in Figure 1-1. Detailed maps of the infrastructure locations are contained in Appendices 1 to 3.

The Southern Seawater Desalination Project will produce drinking quality water from seawater abstracted via the inlet pipe(s). The desalination process allows for the recovery of approximately 42% of the volume of the seawater as drinking water with the remaining water being discharged as a waste brine solution. This brine will be approximately twice as saline as the feed water (i.e. seawater).

The intake pipelines will extend from the shore up to 600m offshore and the outlet pipelines up to 1100m offshore. The outlet pipe discharge system will include a multi-port diffuser which will facilitate mixing in the Low Ecosystem Protection Area (LEPA) surrounding the outlet diffuser (see Figure 1-2). The multi-port outfall is designed to constrain the salinity increase to 1 ppt or less above ambient conditions at the boundary of the LEPA. The LEPA is surrounded by a High Protection Ecosystem Area (HEPA).

Construction works will occur at several separate locations at the same time in order to meet the water supply demand timeframes. Construction works will generally be undertaken during daylight hours (0600hrs to 1900hrs), however construction works may be required 24-hours per day.

Figure 1-1 Locations of the Southern Seawater Desalination Project Infrastructure.

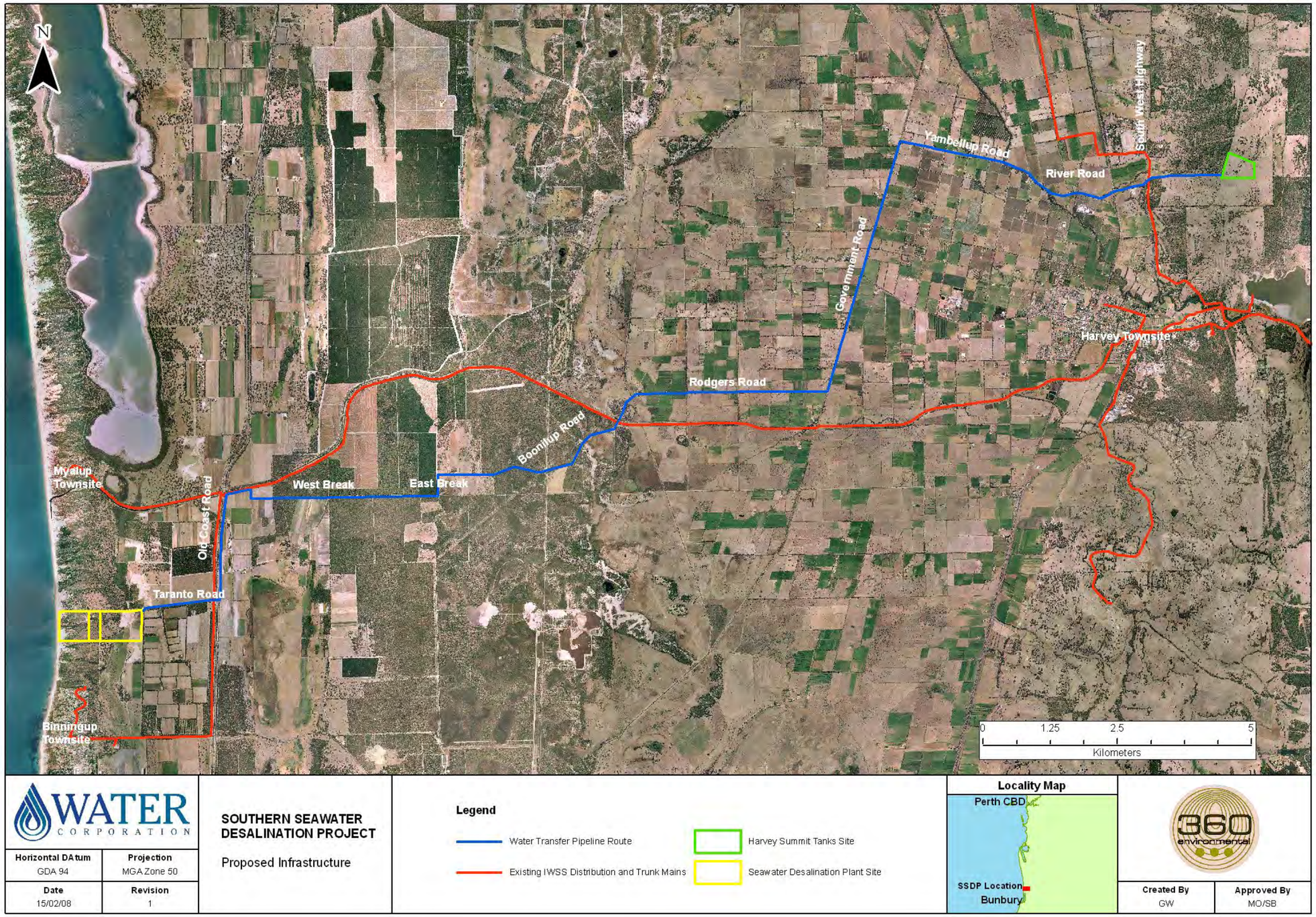
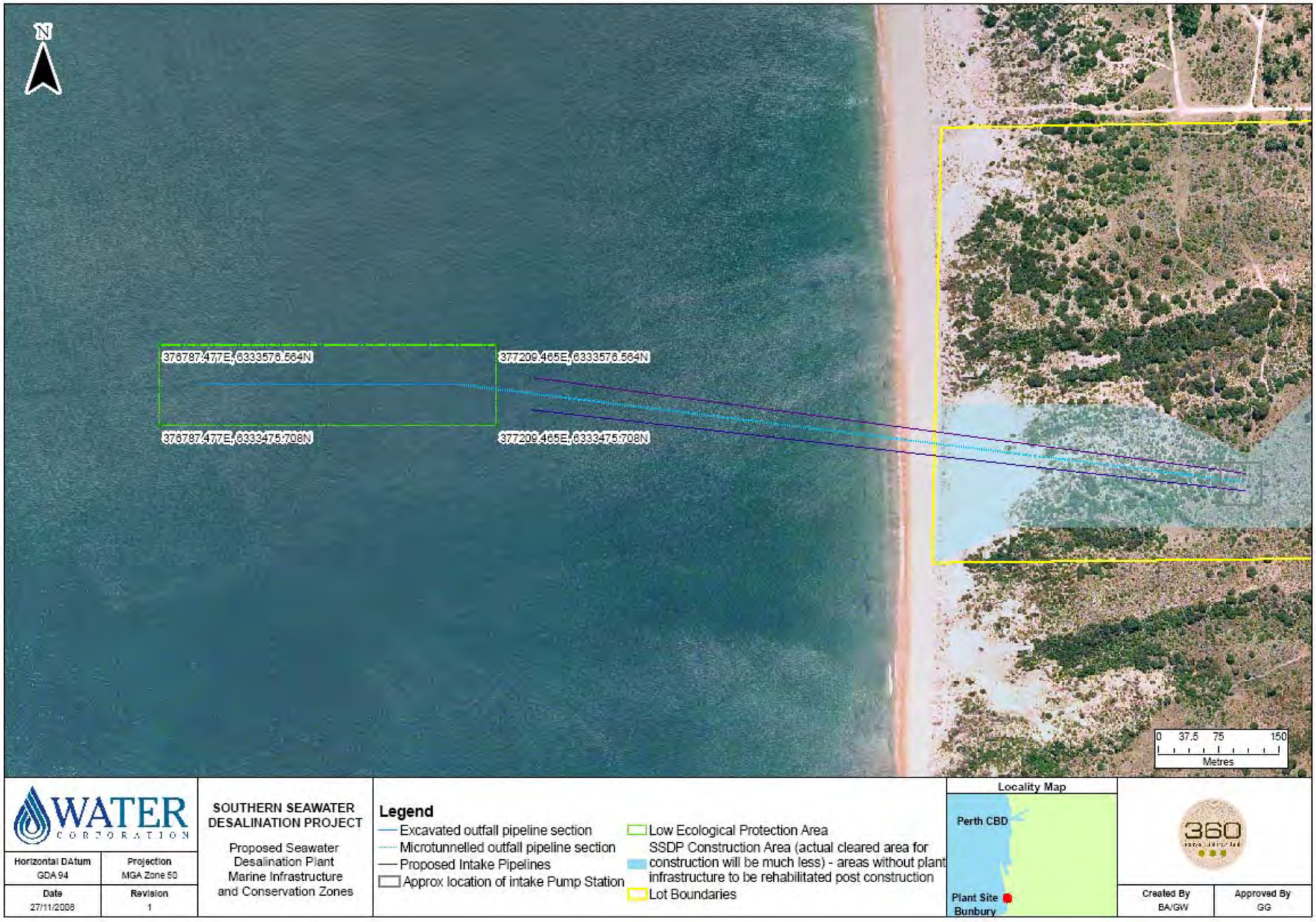


Figure 1-2 Schematic of the Outlet and the LEPA surrounding the diffuser



1.2 Purpose of this CEMF

This Construction Environmental Management Framework (CEMF) outlines the actions to be taken to minimise environmental impacts arising during construction. It is the primary objective that all environmental impacts during construction are avoided or minimised as far as practicable at all construction locations.

It is the purpose of this CEMF to:

1. address the statutory environmental requirements for the project (refer below).
2. identify the actions to be undertaken to manage the environmental impacts of the construction works.
3. address community and government expectations of transparency and accountability by identifying the management actions and making this CEMF publicly available.

1.2.1 Environmental Requirements of the CEMF

Construction of the project is regulated by Statement No. --- issued by the Minister for the Environment under s45(5) of the *Environmental Protection Act 1986* (WA). A copy of the Statement is contained in Appendix 6. The Western Australian Department of Environment and Conservation (DEC) is responsible for monitoring the implementation of conditions pursuant to s48(1) of the *Environmental Protection Act 1986* (WA).

This CEMF meets the requirements of the Water Corporation's Commitment 4 made in the Public Environmental Review, which states (Table 1-1):

Commitment No.	Commitment	Timing
4 Construction Environmental Management Framework – Implementation	The following management plans within the Construction Environmental Management Framework will be implemented: 1. Land Clearing and Trench Management. 2. Seawater Pipeline Installation Management 3. Watercourse Crossing Management 4. Dewatering and Acid Sulphate Soils Management 5. Hygiene (Plant Pathogen) Management 6. Fire Management 7. Waste Management 8. Noise Management 9. Vibration Management 10. Discharge of Pipeline Pressure Testing and Disinfection Waters Management 11. Rehabilitation Management 12. Environmental Incident Management 13. Compliance Management 14. Auditing Management	During construction and post-construction as defined by the plan.

Table 1-1 The Water Corporation's Commitment 2.1 of the Public Environmental Review.

The environmental issues listed above are addressed in a range of management plans in this CEMF. As this CEMF will be actively used during construction works, matters outside of the requirements of Commitment 4, including non-environmental matters and matters dealt with under requirements of other legislation, have also been included for operational completeness.

Furthermore, monitoring of the benthic habitat is not covered within this CEMF, although commencing prior to construction (to establish baseline data) and continuing throughout the operation of the SSDP Plant. Section 7.0 of the Operation Environmental Management Framework (OEMF) addresses this matter in detail.

This CEMF focuses on the management actions to be implemented during construction by construction staff. Consequently, background environmental information on the proposal has been intentionally limited. Background information is located in the Public Environmental Review (PER)

document produced for the environmental impact assessment process, available at www.watercorporation.com.au.

It is the intention of the Water Corporation that this CEMF is developed with the assistance of the stakeholders listed for each management plan. Stakeholders will be consulted for specific matters within their spatial or statutory jurisdiction during the environmental impact assessment process to enable the stakeholders to have an opportunity to provide input into the management actions governing the project.

1.3 Specifications

This CEMF and the materials and methodologies therein are correct as of the publication date. The following changes to materials and methodologies will not invalidate this plan:

1. Changes to materials that do not result in additional or different environmental impacts.
2. Minor changes to methodologies that do not result in lessened environmental monitoring and/or additional or different environmental impact.

Changes to the materials or methodology that may result in reduced monitoring and/or cause a significant environmental impact will be referred to the relevant advisory agencies prior to implementation of the change.

This plan needs to be read in conjunction with the applicable Ministerial Conditions and other regulatory instruments.

1.4 Implementation of Contingency Actions

The CEMF outlines a number of contingency actions that may be used in the event that the management actions proposed do not achieve the purpose stated in each management plan

1.5 Environment Policy

This CEMF has been drafted to support The Water Corporation's Environmental Policy as contained in Appendix 4.

1.6 Training on the CEMF

All staff involved in the construction of the PSDP will receive training on relevant management plans within this CEMF. The names of the people trained on this CEMF will be recorded in a CEMF Training Log along with the date and the specific plans for which that training was conducted.

1.7 Infrastructure Construction

This CEMF addresses matters related to construction. A separate Operation Environmental Management Framework (OEMF) contains management plans relating to operation.

1.8 Amendments arising from Public Environmental Review

This document may be amended following submissions through the environmental impact assessment process. This document (as amended) will be made publicly available prior to construction.

1.9 Limitations

There are a number of minor limitations contained in this version of the CEMF. These matters are:

1. The Statement number and a copy of the Statement have not been inserted as the proposal is awaiting an implementation decision from the Minister for the Environment under s45(5) of the *Environmental Protection Act 1986* (WA). The Statement number and a copy of the Statement will be inserted following the implementation decision from the Minister. This matter will not affect review of this document.
2. The location of acid sulphate soils, plant diseases, habitat trees and weed infestations have not been included in the infrastructure maps. This information was not available

at the time of publication of the maps. This information is available in *Southern Seawater Desalination Project 2007 Terrestrial Flora and Fauna Survey* (360 Environmental, January 2008). These matters will be incorporated into the maps for the CEMF prior to construction. These matters will not affect review of this document as the management actions are explicit in how these matters will be mapped prior to construction.

3. The approvals referred to in Appendices 5, 6 and 7 have not been inserted as they have not been issued at the time of publication. These approvals will be obtained and inserted into this CEMF prior to construction. These approvals are:
    a. Statement of Environmental Conditions under the *Environmental Protection Act 1986* (WA).
    b. Permit to Interfere with Bed and Banks of Watercourses under the *Rights in Water and Irrigation Act 1914* (WA).
    c. Consent to Interfere with a Registered Aboriginal Heritage Site under the *Aboriginal Heritage Act 1972* (WA).

2.0 Definitions

The terms used in this CEMF have the following meanings:

Airblast Level means the noise level resulting from blasting with explosives.

Biofouling means the accumulation of marine organisms (flora or fauna) that attach to vessel hulls, ropes, anchors and other equipment.

Blast overpressure means the sharp instantaneous rise in ambient atmospheric pressure resulting from detonation of an explosive.

Bund means an embankment of earth or a wall constructed of brick, stone or concrete to form the perimeter of a compound that will prevent lateral movement of the material contained within the embankment or wall.

Declared Rare Flora means the flora protected under the *Wildlife Conservation Act 1950* (WA) due to it being rare, in danger of extinction, or otherwise in need of special protection.

Elder means a mature person of Aboriginal decent with experience and knowledge on matters related to aboriginal culture, customs, traditions and/or heritage, as determined by the Aboriginal community.

Environmental Harm means the direct or indirect alteration of the environment as defined by the *Environmental Protection Act 1986* (WA).

Environmental Incident means any event or impact on the environment involving the Water Corporation and/or its contractor's actions or assets that is capable of:

- causing harm to the environment or any person or property;
- causing pollution; and/or
- coming to the attention of an environmental regulatory agency.

Excavator means a machine used for excavating soil or sediment material and may include a backhoe excavator, bulldozer, dredge or other similar equipment.

Ground Disturbing Activities means the disturbance of earth or waters involving machinery including clearing, excavation, backfilling and compacting, but excludes geotechnical investigations, surveying, fencing and rehabilitation works.

Fauna means animals.

Flora means plants.

Habitat Tree means a mature native tree containing hollows that may be suitable for habitat of native fauna.

Harvey Summit Tanks means the water storage and balancing facility located approximately 3km north-east of the Harvey Townsite. The Harvey Summit tanks consist of up to 100ML of water storage (in up to 4 tanks) and a maintenance sump of up to 5ML capacity.

Initial Ground Disturbing Activities means the disturbance of earth or waters involving machinery including clearing and excavation to a depth of 0.5m, but excludes geotechnical investigations, surveying, excavation in excess of 0.5m, backfilling, compacting, fencing and rehabilitation works.

Integrated Water Supply Scheme (or IWSS) means the water transfer network supplying drinking quality water to 1.5 million West Australians in the Perth metropolitan area, south-west, central wheatbelt and the goldfields regions.

Landowner means the person(s) or management body that lawfully owns or lawfully manages a specific parcel of land.

pH_F means a field test of a water and soil paste to determine the presence of actual acid sulphate soils.

pH_{FOX} means a field test of a water and soil paste to determine the presence of potential acid sulphate soils (stored acidity).

Photosynthetically active radiation means the spectral range of light useful for plants for photosynthesis.

Seawater Desalination Plant Site means the site of the Seawater Desalination Plant including Lots 32 & 33 Taranto Road Binningup, Part Lot 8 (to the southern boundary of Lots 32 and 33) Taranto Road Binningup, and includes the seawater pipelines located on part of Reserve 29628 (to the southern boundary of Lots 32 and 33) and the Indian Ocean (to the southern and northern boundaries of Lots 32 and 33) to a nominal distance of 1250m from the high water mark.

Pollution means the direct or indirect alteration of the environment to its detriment or degradation, to the detriment of an environmental value, or is of a prescribed kind from an emission (as defined by the *Environmental Protection Act 1986* (WA)).

Priority Flora means flora that is recognised by the DEC as being under threat and in urgent need of further study; but is not yet declared rare flora under the *Wildlife Conservation Act 1950* (WA). Priority Flora is divided into Priority 1, Priority 2, Priority 3 and Priority 4 listings, with Priority 1 being the flora most under threat.

Registered Site means a defined spatial area registered as having significance to Aboriginal persons under the *Aboriginal Heritage Act 1972* (WA). The term excludes sites listed as "Stored Data" on the Department of Indigenous Affairs heritage database, which are not classified as sites under the *Aboriginal Heritage Act 1972* (WA).

Superintendent's Representative means the person nominated by the Superintendent from time to time in writing by and representing the Superintendent.

Sterile Hay Bales are hay bales that do not contain viable seeds and will therefore not introduce weed propagules when used for turbidity management.

Trunkmain and Water Transfer Pipeline means the pipeline that connects the Seawater Desalination Plant to the Harvey Summit Tanks, and the Harvey Summit Tanks to the existing Stirling Trunkmain of the IWSS, for the purpose of transferring drinking water.

Watercourse means a river, creek, gully, brook or irrigation channel that contains or has contained water, but excludes wetlands.

Water level indicator means a round steel post with a flat marked gauge plate of white background and black 1cm increment gauge markings each with a total nominal length of 2.0m (refer Water Corporation Plan B055-18-1 for example).

Wetland means land that is permanently, seasonally or intermittently waterlogged or inundated with water, but excludes watercourses.

Windrow means a line of stockpiled material, such as soil or vegetation.

3.0 Abbreviations

The following abbreviations used in this CEMF have the following meanings:

Terms

ALT	Alliance Lead Team - committee consisting senior management representatives from the project Alliance organisations.
AMT	Alliance Management Team - committee consisting on-site management personnel from Alliance organisations.
AQIS	Australian Quarantine and Inspection Service
CEMF	Construction Environmental Management Framework
DAF	Department of Agriculture and Food (WA)
DEC	Department of Environment and Conservation (WA)
DEWHA	Department of the Environment, Water, Heritage and Arts (C'th)
DIA	Department of Indigenous Affairs (WA)
DoCEP	Department of Consumer and Employment Protection (WA)
DoF	Department of Fisheries (WA)
DoH	Department of Health (WA)
DoW	Department of Water (WA)
DPI	Department for Planning and Infrastructure (WA)
FESA	Fire and Emergency Services Authority (WA)
FPC	Forest Products Commission (WA)
IWSS	Integrated Water Supply Scheme
MRWA	Main Roads Western Australia
MSDS	Materials Safety Data Sheet
NATA	National Association of Testing Authorities
OC	Organochlorine
SWALSC	South West Aboriginal Land and Sea Council (WA)
PAR	Photosynthetically active radiation
WAPC	Western Australian Planning Commission

Measurement

cm	Centimetre
m	Metre
m^2	Square metre
km	Kilometre
ha	Hectare
kg	Kilograms
kg/ha	Kilograms per hectare
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
ML	Megalitre
GL/y	Gigalitres per year
ML/y	Megalitres per year
^oC	Temperature in degrees Celsius
dB	Decibels of noise
S%	Sulphur percentage

4.0 Responsibility Matrix

The matrix below provides guidance on the plans that are relevant to contractors involved in the project. Given that contracts have not been let, and the management structure and responsibilities of delivery of this project not finalised, this matrix are indicative of the division of responsibilities:

CEMF Reference	Contractor Seawater Desalination Plant (Alliance)	Contractor Water Transfer Pipeline	Contractor Supply	Water Corporation Supervisory Staff
Overview	✓	✓	✓	✓
Land Clearing and Trench Management	✓	✓		✓
Seawater Pipeline Installation	✓			✓
Watercourse Crossing Management		✓		✓
Dewatering and Acid Sulphate Soils	✓	✓		✓
Hygiene Management	✓	✓	✓	✓
Fire Management	✓	✓		✓
Waste Management	✓	✓		✓
Aboriginal Heritage Management	✓	✓		✓
Traffic and Public Safety Management	✓	✓	✓	✓
Noise Management	✓	✓	✓	✓
Vibration Management	✓	✓		✓
Dangerous Goods and Explosives Management	✓	✓	✓	✓
Organochlorine (Dieldrin) Management		✓		✓
Discharge of Pressure-Test Water and Disinfection	✓	✓		✓
Rehabilitation Management	✓	✓		✓
Environmental Incident Management	✓	✓		✓
Non-Compliance Management	✓	✓		✓
Community Complaints Management	✓	✓		✓
Auditing of CEMF	✓	✓		✓

Table 4-1 Responsibility Matrix

5.0 Land Clearing and Trench Management

5.1 Context

The construction works will require clearing of agricultural pasture and native vegetation at the Seawater Desalination Plant site, Water Transfer Pipeline route and the Harvey Summit Tanks site. The construction area supports locally and regionally significant flora and fauna, some of which are specifically protected under State and/or Commonwealth legislation. Clearing will be carried out within defined clearing widths to minimise construction impacts on flora and fauna and to reduce the area requiring rehabilitation.

Construction of the Water Transfer Pipeline will require the excavation of trenches for pipeline installation. Excavated trenches have the potential to trap fauna, which may present an undesirable risk to the health of the fauna and/or contractors working within the trench.

Separate management actions are required for land clearing in agricultural land and native vegetation, with specific actions on retaining topsoil for seed and nutrient retention for the rehabilitation works.

Dust can be generated from land clearing activities, and from cleared areas exposed to wind. Dust generation has the potential to be a physical and health hazard, and can adversely affect the amenity of the construction staff, the community and agricultural crops.

5.2 Purpose

The purpose of the Land Clearing and Trench Management Plan is to outline management actions to:

1. minimise construction impacts on flora and fauna, more specifically to:
    a. protect Declared Rare Flora, consistent with the provisions of the *Wildlife Conservation Act 1950* (WA).
    b. protect Critically Endangered, Endangered and Vulnerable flora, consistent with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (C'th).
    c. minimise impacts on Priority Flora identified by the DEC.
    d. protect Specially Protected Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950* (WA).
    e. protect Critically Endangered, Endangered and Vulnerable fauna, consistent with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (C'th).
    f. minimise impacts on Priority fauna identified by the DEC.
    g. minimise opportunities for fauna become trapped in the excavated trenches.
    h. response procedures for fauna that enter excavated trenches.
2. remove topsoil during clearing, and return it following installation of infrastructure.
3. minimise and control dust generation.

5.3 Performance Indicators

Performance will be demonstrated by:

5.3.1 Vegetation

1. Vegetation clearing is limited to within pre-determined clearing widths.
2. Habitat trees will be marked prior to construction and retained where possible.

3. Protected flora and fauna will not be disturbed without approval under the *Wildlife Conservation Act 1950* (WA) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (C'th) (as appropriate).
4. Topsoil is managed to maximise germination of native vegetation contained in the topsoil.

5.3.2 Fauna

5. Trapped fauna are removed from the trench and released without harm.

5.3.3 Dust

6. No visible dust leaving the construction area.
7. No public complaints received regarding dust.

5.4 Management Actions

5.4.1 General

Prior to Construction

1. The Seawater Desalination Plant site, Water Transfer Pipeline route and the Harvey Summit Tanks site will be surveyed for the presence of Declared Rare Flora (as per the *Wildlife Conservation (Rare Flora) Notice 2008* and Priority Flora prior to construction. The survey will also identify the presence of Critically Endangered, Endangered and Vulnerable flora (as per the *Environment Protection and Biodiversity Conservation Act 1999* (C'th)).
2. If Declared Rare Flora are identified within the construction area a Licence to take Declared Rare Flora will be applied for, in accordance with the *Wildlife Conservation Act 1950* (WA) and the *Wildlife Conservation Regulations 1970* (WA).
3. The Seawater Desalination Plant site, Water Transfer Pipeline route and the Harvey Summit Tanks site will be surveyed for the presence of specially protected fauna (as per the *Wildlife Conservation (Specially Protected Fauna) Notice 2008* prior to construction.
4. If specially protected fauna are identified within the construction area a Licence to take specially protected fauna will be applied for in accordance with the *Wildlife Conservation Act 1950* (WA) and the *Wildlife Conservation Regulations 1970* (WA).
5. The Seawater Desalination Plant site, Water Transfer Pipeline route and the Harvey Summit Tanks site will be surveyed for the presence of potential habitat trees prior to construction.

Fauna Management

6. A barrier will be established at the end of each installed pipeline (excluding marine pipelines) at the end of each working day to prevent fauna entering the installed pipelines.
7. The end of each open excavation will be graded at the end of each day to provide a ramp for trapped fauna to escape the trench.
8. The Seawater Desalination Plant site and excavated trenches will be visually inspected prior to construction works commencing on each day to determine the presence of trapped fauna. The visual inspection will be conducted during daylight hours and will be completed by no later than 0900hrs.
9. Any fauna found within the Seawater Desalination Plant site or within any excavated trench will be removed and relocated to a minimum distance of 50m from the site or trench. The fauna removed will be recorded in the Fauna Removal Log, which shall be retained at the site office.
10. The types of fauna listed below will be treated by a qualified veterinary doctor (on-site or off-site) if found injured within the Seawater Desalination Plant site or the excavated trenches.
    - livestock (in consultation with the Landowner)
    - all birds
    - kangaroos

- large reptiles (includes snakes, monitor lizards and bobtails)
- Western Ringtail Possums or Brushtail Possums
- Chuditch (Western Quoll - native cat)
- Quokkas
- Southern Brown Bandicoot (Quenda)
- Woylie (Brush Tailed Bettong)
- Western Brush Wallabies

The injured fauna will not be harmed or killed unless a decision to euthanize (kill) any injured fauna is made by a veterinary doctor. A decision to euthanize livestock will only be made by the Landowner.

11. Dead fauna will be removed from the Seawater Desalination Plant site and excavated trenches to prevent additional fauna from entering the Seawater Desalination Plant site or excavated trenches to source food. They will be disposed of as putrescible waste (to landfill).

12. No dogs, cats or firearms will be allowed within any construction area.

Dust from Construction Works

13. Daily weather forecasts will be obtained for temperature and wind speed (South West Land Division - Bureau of Meteorology) and will make the forecast information available to persons involved in dust generating activities and dust suppression activities.

14. Water trucks and/or water cannons will be used to dampen areas identified as being potentially dust generating (sandy soils, soil stockpiles, unsealed access roads etc). The frequency of dampening will be determined based on weather conditions.

15. Dewatering water maybe used for dust suppression activities if the dewatering water meets the criteria for discharge to land contained in the Dewatering and Acid Sulphate Soils Management Plan.

16. Other dust control measures may be implemented (such as hydro-mulching, wind fencing, hardstanding or chemical dust supressants).

17. Vehicles transporting soils off-site will be covered to minimise dust generation during transport.

5.4.2 Seawater Desalination Plant

Clearing of Native Vegetation

18. Clearing of native vegetation will only commence once permission is obtained. It will be limited to those areas identified for clearing as contained in Appendix 1.

19. All timber trunks cleared will retained and stockpiled to a nominal height of no more than 3 metres. Vegetation crowns that have been cleared will be separately retained and stockpiled to a nominal height of no more than 5 metres. Vegetation crowns will be cut into sections of approximately 1m in length prior to stockpiling. The cleared and stockpiled vegetation trunks and crowns will be used during site rehabilitation[2].

20. Cleared vegetation will not be burned.

21. The Seawater Desalination Plant site will be surveyed at the completion of clearing works to determine the area (in ha or m^2) of native vegetation cleared. The area of clearing will be recorded.

22. Approximately 200mm of topsoil will be removed from the cleared areas and stockpiled in a windrow of no greater than 10 metres nominal height on the Seawater Desalination Plant site. The stockpiled topsoil will be used for rehabilitation works following construction.

23. A stock fence will be installed at the boundary of the defined Seawater Desalination Plant site clearing area (refer Appendix 1) to fence off the native vegetation that will be retained. The stock fence will be a 5 strand wire fence strained with posts with strand heights at 250mm, 500mm, 750mm, 1000mm and 1250mm above ground level prior to clearing. The fencing will aim to prevent unauthorised vehicle access and to discourage human traffic between the native vegetation and the construction areas, while still permitting fauna movement through the native vegetation and the construction areas.

24. Separate security fences will be installed of at least 1.8m height immediately around the Seawater Desalination Plant infrastructure and the Seawater Pump Station construction areas to prevent unauthorised human access.

Post-Construction

25. The Seawater Desalination Plant site will be contoured, including re-creation of the primary dune, establishment of earth screening bunds, and contouring of the whole site to achieve stable batters.
26. Areas compacted by construction works (excluding retained access and laydown areas) and that are to be rehabilitated, will be ripped. The areas will be ripped along the contour to a depth of approximately 300mm. Land will be graded following ripping to ensure that high or low points do not remain.
27. Stockpiled topsoil will be evenly spread over the ripped and graded areas as soon as reasonably practicable following the ripping and grading.
28. The retained large trunks and cut vegetation crowns will be randomly spread over the ripped, graded and topsoiled areas. Any other retained vegetation from dieback infected areas will be evenly spread within the dieback infected area (refer Hygiene Management Plan).
29. Excess overburden will be disposed of firstly within the Seawater Desalination Plant site, secondly to adjoining properties with agreement of adjoining Landowners, or thirdly the excess overburden will be disposed of to landfill.
30. If the overburden is from an area determined to be dieback infected, the overburden will be disposed of on-site (refer to Hygiene Management Plan).

5.4.3 Water Transfer Pipeline and Harvey Summit Tanks

Native Vegetation

Clearing - Pipeline

31. The clearing corridor for pipeline installation will be no greater than 20 metres width in native vegetation (excluding pipeline storage and vehicle turning points), excepting the pipeline section between the storage facility and the Stirling Trunkmain (where two pipelines will be installed – one to the Harvey Summit Tanks and one from the Harvey Summit Tanks) in which the clearing width will be no greater than 30 metres. The single pipeline clearing width maybe reduced to a minimum 15m width in sections less than 250m length to avoid sensitive environmental or social areas.
32. The clearing corridor will be marked in sections (up to 3km per section) with pegs and flagging tape (or other suitable marking method) prior to clearing.
33. Potential habitat trees will be marked with a different coloured flagging tape (or other suitable marking method) prior to clearing with a view to retaining the habitat trees. Potential habitat trees will only be cleared where retention is not practicably possible for pipeline installation.
34. Clearing of native vegetation will only commence once approval is received (hold point).
35. Only vegetation within the marked clearing areas (excepting the retainable habitat trees) will be cleared. During clearing, where existing fallen logs with a diameter larger than 300mm (950mm circumference) partially overlay the area to be cleared, the log will be cut at the clearing boundary to preserve the part of the log outside of the clearing corridor.
36. Each calendar week a survey of the area will be conducted to determine the area (in ha or m^2) of native vegetation cleared. The survey area will be recorded, and weekly updates will be provided along with the as-constructed drawings of the infrastructure.
37. Clearing in the State Forest will be conducted in consultation with the FPC (which retains rights to such timber). In consultation with the FPC, salvageable timber (trunks) that have been cleared will be removed to a location agreed with the FPC.
38. Any non-salvageable timber trunks will be retained and stockpiled to a nominal height of no more than 3 metres for later use in rehabilitation[1]. Retained tree crowns will be separately

stockpiled to a nominal height of no more than 5 metres after cutting the crowns into sections of approximately 1m length for later use in rehabilitation[1].

39. Cleared vegetation will not be burned.
40. Approximately 200mm of topsoil will be removed from 5m either side of the pipe centreline and stockpile it in a windrow of no greater than 5 metres nominal height. If access roads are constructed, topsoil will also be removed and stockpiled from these locations prior to construction of the access roads. Topsoil will be stockpiled for a period not exceeding two months for pipeline installation.
41. The trench will be excavated (to the required depth), with the excavated overburden stockpiled in a separate windrow of no greater than 5 metres nominal height.
42. The topsoil and overburden stockpiles maybe temporarily relocated to a point close to its place of origin where the clearing width is restricted to less than 20m. If the topsoil and overburden is dieback infected, the topsoil and overburden will only be relocated to with dieback infected areas (refer to the Hygiene (Plant Pathogen) Management Plan).
43. A temporary security fence will be installed of approximately 1.8m height around any open trench greater than 0.5m depth at the end of each construction day. The purpose of the fence will be to prevent access to the open trench by large terrestrial fauna (such as kangaroos). The fence base will have a continuous fabric shroud (such as shade cloth) pegged to the ground with a minimum height of 0.25m to prevent access to the construction site by small terrestrial fauna (such as snakes and lizards).

Fauna Management - Additional

44. The trench will be left open for the minimum time practicable to minimise the chance of fauna entering the trench and becoming trapped.
45. It will be ensured that at the end of each day, the length of open trench with a depth greater than 1.0m will not exceed 1000m for each separate construction area.

After Pipeline Installation

46. The overburden will be returned to the trench in layers, with each layer compacted in the trench at a thickness of no greater than 150mm to minimise soil consolidation in the trench following construction.
47. Clay cut-off walls[3] will be installed across the pipeline trench in agricultural land generally at a distance of no greater than 500m apart, as well as at the edge of wetland boundaries, irrigated paddocks, property boundaries and steeply sloping areas. The clay cut-off walls will be constructed of low to medium plasticity non-dispersive clay, sandy clay or silty clay with a nominal width of 1000mm and compacted in 150mm layers to minimise soil consolidation in the trench following construction.
48. Excess overburden will be disposed of to a suitable location agreed, firstly with the Landowner (the Landowner has first preference to retain excess overburden from their own property), secondly with adjoining Landowners, or thirdly the excess overburden will be disposed of to landfill.
49. If the overburden is from an area determined to be dieback infected, the overburden will be disposed of on-site (refer to Hygiene (Plant Pathogen) Management Plan).
50. The compacted areas (excluding retained access roads) will be ripped along the contour to a depth of approximately 300mm following backfilling and compaction of the trench. The land will be graded following ripping to ensure that high or low points do not remain.
51. The retained large trunks and cut vegetation crowns will be randomly spread over the ripped and graded areas. Any other retained vegetation from dieback infected areas will be evenly spread within the dieback infected area (refer Hygiene Management Plan)
52. The stockpiled topsoil will be evenly respread over the construction area as soon as reasonably practicable following ripping, grading and distribution of large trunks.

5.4.4 Agricultural Land

Prior to clearing

53. A land assessment survey will be undertaken (including photographs and/or video) of each land parcel (including road reserves) to determine pre-construction land condition.

54. Written notification will be provided to the landowner at least 14 days prior to the commencement of ground disturbing activities, including fencing, to enable the Landowner to prepare for construction (such as stock movement).

55. Prior to clearing on each lot, the construction corridor in agricultural land will be fenced where there is a risk of livestock (cattle or sheep) entering the open trench. The fence will be a 5 strand wire fence strained with posts and will be connected to the existing fences in each lot. The fence will be electrified where the existing fences in the lot are electrified, with strand heights at 200mm (earthed), 400mm (earthed), 600mm (electrified), 800mm (earthed) and 1000mm (electrified) above ground level.

Clearing

56. The clearing corridor for pipeline installation will be between 20 and 30 metres width in agricultural land (excluding pipeline storage and vehicle turning points).

57. The clearing corridor will be marked in sections (up to 3km per section) with pegs and flagging tape (or other suitable marking method) prior to clearing. Only then may the clearing be undertaken.

58. Cleared vegetation will not be burned.

59. approximately 200mm of topsoil will be removed from 5m either side of the pipe centreline and stockpile it in a windrow of no greater than 5 metres nominal height following vegetation clearing. If access roads are constructed, topsoil will also be removed and stockpiled from these locations prior to construction of the access roads.

60. The pipeline trenches will be excavated (to the required depth), with the excavated overburden stockpiled in a separate windrow of no greater than 5 metres nominal height.

61. Stockpiles of topsoil or overburden may be temporarily relocated to a location within 500m of its place of origin on occasions where the pipeline clearing corridor width is restricted to less than 30m width.

After Pipeline Installation

62. The overburden will be returned to the trench in layers, with each layer compacted at a thickness of no greater than 150mm to minimise soil consolidation in the trench following construction.

63. Clay cut-off walls[3] will be installed across the pipeline trench in agricultural land generally at a distance of no greater than 500m apart, as well as at the edge of wetland boundaries, irrigated paddocks, property boundaries and steeply sloping areas. The clay cut-off walls will be constructed of low to medium plasticity non-dispersive clay, sandy clay or silty clay with a nominal width of 1000mm and compacted in 150mm layers to minimise soil consolidation in the trench following construction.

64. Excess overburden will be disposed of to a suitable location agreed, firstly with the Landowner (the Landowner has first preference to retain excess overburden from their own property), secondly with adjoining Landowners, or thirdly the excess overburden will be disposed of to landfill.

65. The compacted areas (excluding retained access roads) will be ripped along the contour to a depth of approximately 300mm following backfilling and compaction of the trench. The Contractor will grade the land following ripping to ensure that high or low points do not remain.

66. The stockpiled topsoil will be evenly respread over the construction area as soon as reasonably practicable following ripping and grading.

5.5 Additional Information

[1] Fauna Removal

A Licence will be required under r17 of the *Wildlife Conservation Regulations 1970* (WA) issued by the DEC to take native fauna from the trench. A licence is not required for removal of livestock from the trench.

Guidance on fauna handling, fauna diseases and occupational safety matters in handling fauna can be sourced from the document *Minimising Disease Risk in Wildlife Management: Standard operating procedures for fauna translocation, monitoring and euthanasia in the field (*DEC, July 2005).

Photographs of native fauna that are likely to be encountered by the construction works are provided in the fauna Identification Chart (Figures 1-1 to 1-15). The Fauna Identification Chart will be displayed at the site offices to assist with field identification.

[2] Cleared Vegetation

The cutting of the vegetation crowns to a length of approximately 1m, then respreading over the cleared areas following construction, will help to create a microclimate suitable for seed germination. The cut and spread crowns will also assist with erosion control and minimise dust generation.

[3] Clay Cut-off Walls

Clay-cut-off walls will be installed to provide an impermeable seal (or plug) against preferential water movement through the pipeline bedding material along the length of the pipeline. The clay cut-off walls will be installed perpendicular to the trench.

5.6 Contingency Actions

Where the above actions do not achieve the purpose of this plan or are not complied with, the following contingency actions will be implemented as required:

Vegetation Clearing

1. The cause will be investigated and implementation of the management actions will be reinforced. If appropriate, the management actions will be amended.
2. Any environmental impacts will be mitigated.

Fauna

3. Fauna ladders and ramps will be installed within the open excavations to allow fauna to escape.
4. Shelters for fauna will be installed. Each shelter will consist of a damp hessian bag or an upturned ice-cream container (or other equivalent shade device). The shelters will be inspected for the presence of fauna as part of the inspection procedure.

Dust

5. Temporary wind fencing and/or hydro-mulching will be installed.
6. Dust generating construction work will temporarily cease during windy conditions until weather conditions become favourable.

5.7 Related Plans

1. Dewatering and Acid Sulphate Soils.
2. Hygiene Management.
3. Watercourse Crossing Management.
4. Incident Management.
5. Rehabilitation Management.

5.8 Relevant Legislation

1. *Wildlife Conservation Act 1950*, and *Regulations 1970* (WA).
2. *Environmental Protection Act 1986*, and *Regulations 1987* (WA).
3. *Conservation and Land Management Act 1984*, and *Regulations 2002* (WA).
4. *Environment Protection and Biodiversity Conservation Act 1999* (C'th).

5.9 Advisory Agencies

The following organisations will be consulted on this plan:

1. DEC
2. DAF
3. FPC
4. Conservation Commission
5. Shire of Harvey
6. DEWH

Table 5-1 Native Vegetation Clearing Log

Southern Seawater Desalination Project
Land Clearing and Trench Management

Native Vegetation Clearing Log

The purpose of the Native Vegetation Clearing Log is to record the area of native vegetation cleared. The area of native vegetation cleared will assist in determining the materials required for rehabilitation (tubestock, seed, staff). The Native Vegetation Clearing Log is to be completed by the Contractor on a weekly basis.

Name ……

Page ……. of …….

Date of Entry	Location and Property Reference	Area Cleared (m^2 or ha - specify)	Name and Position	Initial

Table 5-2 Fauna Removal Log

Southern Seawater Desalination Project
Land Clearing and Trench Management

Fauna Removal Log

The purpose of the Fauna Removal Log is to record the number, location and removal of fauna from within the trench. The Fauna Removal Log is to be completed by the Contractor on each day that fauna is removed from the trench.

Name ……

Page …… of ……

Date of Entry	Location and Property Reference	Fauna Description (eg. snake, lizard)	No. Removed	Alive (Y/N)	Method of Removal	Name and Position	Initial

Figure 5-1 Fauna Identification Chart

Southern Seawater Desalination Project
Land Clearing and Trench Management

Fauna Identification Chart

This chart identifies fauna that may occur within the Southern Seawater Desalination Project area.

Western Grey Kangaroo

Tammar Wallaby

Woylie (Brushed Tailed Bettong)

Chuditch (Western Quoll). Specially Protected – Rare or likely to become extinct.

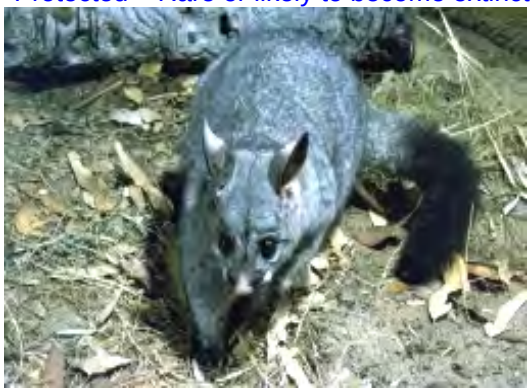
Quokka.
Specially Protected Rare or likely to become extinct.

Western Pygmy Possum

Western Ringtail Possum. Specially Protected – Rare or likely to become extinct.

Brushed Tailed Phascogale. Specially Protected – Rare or likely to become extinct.

Southern Brown Bandicoot (Quenda)



Brushed Tailed Possum

Forest Red-Tailed Black Cockatoo. Specially Protected – Rare or likely to become extinct

White Tailed Black Cockatoo. Specially Protected – Rare or likely to become extinct (Baudin's and Carnaby's Cockatoo)

Dugite Snake

Carpet Python

Monitor Lizard

Photos: DEC WA (Wells & Wells) – www.environment.wa.gov.au
Australian Wildlife Conservancy – www.australianwildlife.org
Fourth Crossing Wildlife (Chris McGregor) – www.fourthcrossingwildlife.com

6.0 Seawater Pipeline Installation Management

6.1 Context

The Southern Seawater Desalination Project will require the installation of ocean pipelines for seawater intake and brine discharge. The intake pipelines will extend from the shore to approximately 600m offshore and the outlet pipelines to up to 1100m offshore. This management Plan covers installation of these pipelines, intake structures and the diffuser.

Maps produced from previous surveys show the presence and distribution of marine habitats, including flora and fauna. The marine pipelines and infrastructure have been located where they will have minimal impact on the marine ecology of the area.

Marine macroflora (including seaweeds and seagrasses) species occur at a distance from approximately 500m offshore to greater than 2500m offshore from the Seawater Desalination Plant site. More specifically, seagrasses are more than 1200m from the shore along the pipe alignment. The seawater intake and outlet pipelines will be located along an alignment that generally contains bare sand and shell material, however from 500m offshore the marine works are within 100m of marine flora to the south, west and north. The construction works may impact on the marine flora in close proximity. Environmental monitoring will be undertaken to ensure that the impacts of marine construction works are within a defined area.

The specific construction methods for seawater pipeline installation have yet to be selected. Initial investigations indicate open trenching is likely to be the most appropriate construction method and that blasting will not be required. The different construction alternatives under consideration are listed within this plan with the management actions for each construction method identified. Apart from the area of excavation, the environmental impacts of each construction method predominantly relate to the suspension of sediments, which can both reduce light available to marine flora for photosynthesis and settle onto marine flora.

Underwater blasting is unlikely, however may be required to remove rock where excavation is not practicable or possible. Blasting has the potential to affect marine mammals (including whales and dolphins) if they are within the immediate vicinity of blasts. Management actions are specified based upon Western Whale Research (2008) to minimise the impacts of underwater blasting on whales and dolphins.

6.2 Purpose

The purpose of the Seawater Pipeline Installation Management Plan is to outline management actions to:

1. minimise impacts on ocean water quality and marine flora during marine construction works.
2. minimise impacts of blasting on marine mammals.
3. inform the community of the location and timing of the works.
4. to quantify the final area of disturbance.

6.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

6.4 Management Actions

Prior to Construction

1. Vessels reaching the construction site by sea from international waters will discharge all ballast waters at least 12 nautical miles from the Western Australian coastline in accordance with Australian Quarantine and Inspection Service (AQIS) requirements for ballast water discharge.
2. All marine vessels will be visually inspected prior to entry to Australian Waters to confirm they are free from biofouling and sediments in accordance with AQIS requirements.
3. AQIS Bunbury (Phone 08 9791 4787) will be contacted to confirm any need for a quarantine inspection of marine vessels entering Australian Waters prior to their entry to Australian Waters.
4. A temporary Marine Exclusion Area will be established with marine warning buoys installed in the ocean at nominally 300m, 550m, 800m, 1050m and 1300m from the beach at nominally 500m north and 500m south of the marine pipeline alignment. Additional buoys will be installed at nominally 250m intervals between the two 1300m warning buoys in a north-south direction (refer Figure 6-1). The marine warning buoys will demarcate the marine construction zone where public marine access will be restricted during construction. The marine warning buoys will be marked identifying that the buoys mark a marine exclusion zone, and will be fitted with a flashing warning light to be visible at night.
5. Approval for installation of the marine warning buoys will be obtained from the DPI under the *Marine Navigational Aids Act 1973* (WA) prior to installing the warning buoys.
6. A Beach Exclusion Area will be established at nominally 200m north and 200m south of the marine pipelines' alignment to prevent public access to the construction area. The beach exclusion area will remain until beach construction works are completed and it is safe for the public to access the beach area.
7. The Marine Exclusion Area and the Beach Exclusion Area will be made known to the public by:
    a. Installation of signage at the Binningup and Myalup beach car parks that contain a map identifying the beach and marine exclusion areas, and the dates during which the access restrictions will apply.
    b. Installation of signage on each exclusion fence. The signage will contain a map identifying the Marine Exclusion Area and the Beach Exclusion Area, and the dates during which the access restrictions will apply.
    c. Placing a *Notice to Mariners* in public notices section of *The West Australian* newspaper and the *Harvey Reporter* newspaper identifying the Marine Exclusion Area and the marine warning buoys, in consultation with the DPI.
8. A marine biological survey with special emphasis on the distribution of seagrasses and macroalgae will be undertaken in the area shown in Figure 6-1 within the 12 months prior to the commencement of marine works to determine the species distribution and density of marine macroflora. The results of this survey will be used to compare the marine macroflora distribution and density post construction to determine impacts due to marine construction works.
9. The beach profile will be monitored during and post -marine construction activities. Profiles will be collected in the same locations as used by UWA (2008b).

Construction – Construction Works

10. Offshore construction works will be contained within the Marine Exclusion Zone and will not extend further offshore than that necessary to place infrastructure in accordance with the nominal distances given in the approved Characteristics Table.
11. To avoid damaging seagrass areas, where practicable barge anchors and other large anchors will not be placed more than 1300m offshore, and in areas free of marine flora and fauna.

12. All marine construction works will temporarily cease if whales or dolphins (cetaceans) are sighted within the Marine Exclusion Area. Marine construction works may resume when the cetaceans are outside of the Marine Exclusion Area.

13. Construction will consist of some or all of the methods outlined in the following section:

Excavation and Backfilling

a. The maximum width of the excavated trench offshore will be 50m.

b. Excavated material from the trench may be sidecast to either side of the trench, where sidecasting is part of the construction method[1].

c. Where excavated material is sidecast, the vertical drop distance will be minimised as far as is practicable to minimise potential sediment suspension.

d. The total number of days on which excavation occurs offshore of the nominal 6m depth contour or where rock is encountered, whichever is further offshore, shall not exceed 122 days[1].

e. The trench containing the installed pipeline will be backfilled. Backfill may include material different from that excavated. Rock armouring, concrete and other anchoring materials may be used.

f. Any rock, concrete or pipelines within the beach or surf zone will be covered with sand to nominally level with the surrounding beach.

Jetty and Sheet Piling

g. A temporary construction jetty and/or sheet piling may be constructed from the beach and into the ocean for pipeline installation.

h. Visual monitoring will be conducted for the presence of whales and dolphins during pile driving from the pile driving machinery. Pile driving will temporarily cease if whales or dolphins are sighted within the Marine Exclusion Area.

i. The beach profile will be restored if jetty and/or sheet piling causes greater than 50m length and/or 5m width accretion or erosion on either side of the works, or if erosion is likely to extend to the primary dune. The source of the fill will be accreted sand or the excavated trench material.

Thrust Boring / Sub-Sea Tunnelling / Directional Drilling

j. Thrust boring or sub-sea tunnelling or directional drilling may be used for pipeline installation, with the launch pit to be land based and the receival pits to be ocean based.

k. Water-based drilling fluid will be used for boring or tunnelling or drilling. An oil-based drilling fluid will not be used for boring or tunnelling or drilling.

l. Sheet piles, rock or concrete may be used in the construction of the receival pit. (see sheet Piling, above)

m. Excavated material from the trench may be sidecast to either side of the trench, where sidecasting is part of the construction method.

Pipeline Burial/Partial Burial/Non-Burial

n. Seawater pipelines will be buried under the beach and offshore until a nominal 6m seawater depth contour. The depth of sand cover in the beach and surf zone over pipelines (and rock and concrete placed over the pipelines) shall be designed to prevent exposure during a 1 in 100 year storm.

o. The seawater pipelines may be rock armoured, anchored with metal and/or concrete weights and/or anchored with piles grouted into the sea floor.

p. Offshore of the nominal 6m depth contour, seawater pipelines may be placed on the sea floor, in a partially buried position, or in a completely buried position. Pipelines will be installed so that the pipelines, any rock or concrete armouring or anchoring do not project more than 10% of the water depth (based upon mean sea level) or 1.0m above the general level of the surrounding sea floor, whichever is lesser.

Construction – Marine Monitoring

14. Monitoring will be conducted for marine turbidity and photosynthetically active radiation (PAR) during excavation and backfilling, construction of receival pits, construction of the jetty and sheet piling, and correction of erosion and accretion of the beach profile.

15. Monitoring for the turbidity and PAR of the marine waters will be at 500m north (Site A) and 500m south (Site B) of the marine construction works at a distance of 1300m from the beach. Turbidity will also be monitored at 1250m south (Control Site A) and 1250m north (Control Site B)[2] (Refer Table 6-1 and Figure 6-1).

Table 6-1 Marine Monitoring Locations –Coordinates

Site	Northings (m N)	Eastings (m E)
A	6334027	376410
B	6333027	376410
Control Site A	6332277	376999
Control Site B	6334777	376999

16. Any visible turbidity plume from the marine construction works will be tracked and turbidity measured within the plume at 500m from the marine pipelines if the plume is visible at between 250m and 1300m from the shoreline.

17. Turbidity and PAR will be measured twice on each day of marine construction works. One set of measurements will be in the morning and one in the afternoon with at least 4 hours between measurements. PAR will be measured 1 m below the water surface and turbidity and PAR will be measured at 1m from the sea floor using a field probe. The turbidity and PAR results will be recorded in the Marine Monitoring Log.

18. Subject to safety considerations (i.e. in accordance with the *Occupational Safety and Health Act 1984* (WA)), based upon the judgement of the monitoring vessel master/skipper or marine works supervisor, monitoring for PAR and turbidity may temporarily cease. The master/skipper or marine works supervisor shall make a note in the Marine Monitoring Log as to the sea state and weather conditions in such circumstances. Where marine conditions do not allow marine monitoring to be undertaken, the marine works may continue in the absence of marine monitoring if it is safe to do so.

19. Monitoring equipment for PAR and Turbidity measurements will be maintained and serviced in accordance with the manufacturer's specifications to minimise the probability of equipment malfunctions. All equipment malfunctions will be recorded in the Marine Monitoring Log. All equipment malfunctions will be rectified as soon as is reasonably practicable.

20. The Marine Monitoring Log will be submitted to the Department of Environment and Conservation on a monthly basis during the offshore construction period.

Construction – Underwater Blasting

21. The Shire of Harvey will be informed prior to any underwater blasting.

22. Public notice signage will be installed on the Beach Exclusion Area fencing (500m north and south) and at the entrance to the main public beach at both Binningup and Myalup on each day of blasting. The public notice signage will indicate the proposed time(s) of the day in which underwater blasting will be undertaken.

23. An Ocean Watch Vessel[3] will survey the ocean for a 1 hour period immediately prior to blasting within a 2km radius of the blast site to confirm the presence or absence of whales and dolphins. Sighting for whales and dolphins will also be undertaken from elevated land near the blast site for a 1 hour period immediately prior to blasting.

24. Blasting will not be undertaken if whales or dolphins are located within a 1km radius of the blast area (as advised by Western Whale Research, 2008).

25. The Ocean Watch Vessel will ensure other vessels do not come within 500m of the blast site.

26. A Blast Supervisor will be responsible for the safe conduct of blasting. The Blast Supervisor will ensure that the minimum weight of explosives suitable to undertake the work is used (i.e. the weight of explosives does not exceed the weight of explosives required).
27. The Blast Supervisor will ensure that the explosive charges are placed in closely staggered drill holes (i.e. not surface blasting). The Blast Supervisor will determine the exact separation distances between drill holes. The Blast Supervisor will consider the suitability of delayed blasts to minimise blast energy.
28. The Underwater Blasting Log will be completed for each blast.
29. Visible fish mortalities[4] from within 500m of the blast site will be removed immediately following blasting to minimise attraction of scavenging fish and birds to the area.
30. Any surplus charges not detonated immediately following each blast will be removed.

Post Construction

31. The beach profile will be restored consistent with the surrounding natural beach profile.
32. The beach profile will be monitored over a 12 month period following marine works. The profiling will commence within 6 months of the marine works being completed. Profiles will be collected in the same locations as used by UWA (2008b). Should the profiles show greater erosion in the vicinity of the marine works than elsewhere, an additional 12 months of profiling will be undertaken.
33. The exclusion fence, ocean warning buoys[5], signage at the Binningup and Myalup beach car parks, and all other infrastructure and materials will be removed from all beach areas.
34. Disturbed beach areas will be rehabilitated in accordance with the Rehabilitation Management Plan.
35. A marine biological survey with special emphasis on the distribution of seagrasses and macroalgae will be undertaken in the area shown in Figure 2-1 within 12 months following the completion of marine works to determine the species distribution and density of marine macroflora. The survey will include a comparison of marine macroflora distribution and density with the pre-construction marine macroflora survey to determine impacts due to marine construction works.

6.5 Additional Information

[1] Excavation impacts

Suspended sediments from excavation can reduce light levels and thereby impact seagrasses. The area of greatest impact on turbidity and PAR is within 100-200m from the marine works, where the majority of suspended sediments settle (Oceanica, 2008b). The impacts on the seagrass species that occur around 1300m and further offshore will be temporary if excavation of areas containing rock (which can result in more turbid suspensions) is limited to 4 months (122 days) (Oceanica, 2008b). Further, the variable nature of the currents (UWA, 2008a) means that light attenuation due to suspended sediments from excavation on any particular seagrass area would be considerably less than 122 days.

[2] Marine Monitoring Sites

Control Sites A and B at 1250m north and south of the marine construction works were selected to provide background water quality data that is not affected by the construction activities nor unduly influenced by other human sources.

The monitoring sites 1300m offshore (Sites A and B) have been selected to coincide with the closest seagrass areas.

Turbidity is a measure of the cloudiness or amount of light scattered in the water. Light required for photosynthesis is measured by *Photosynthetically Active Radiation* (PAR). There is no standard direct correlation between turbidity and PAR – rather it tends to be site specific. For this reason, both parameters are measured.

[3] Warning Blasts

A small charge warning blast was considered to warn off dolphins, whales and fish from the blast site prior to the full charge blast. Advice obtained for the blasting for construction of the Bunbury Wastewater Treatment Plant Ocean Outfall was that a warning blast can attract inquisitive animals (such as dolphins) and the suspended sediment plume created can attract fish. Consequently, a small charge warning blast could result in higher marine mortalities during the full charge blast. Accordingly, ocean surveys (Ocean Watch Vessel) and land surveys for dolphins and whales are considered more appropriate than a small charge warning blast.

[4] Fish Mortalities

There are no practicable measures to reduce fish mortality that could be implemented. Consequently, no measures are proposed to reduce fish mortalities other than the removal of visible fish mortalities to minimise scavenging fish from entering the blasting area for future blasts.

[5] Permanent Markers

Note that some permanent buoys/markers are possibly needed to mark permanent Marine Exclusion Zones around the seawater intake structures and the diffuser structures. These exclusion zones will be much smaller than the temporary Marine Exclusion Zone used during construction. The location of the permanent markers will be specified in the Operational Environment Management Plan

Monitoring of other Water Quality Parameters

The marine water quality monitoring focuses on turbidity and PAR monitoring as it is known that sediment particles can become suspended in the water column from seabed disturbing construction works. Other water quality parameters (such as dissolved oxygen) are considered unlikely to be impacted by construction due to rapid mixing in the high energy marine environment. Consequently, the monitoring of water quality parameters during construction has been restricted to turbidity and PAR.

Silt Curtains

The use of silt curtains extending from the sea floor to the water surface was considered for containment of turbid waters resulting from marine construction works. Experience from the Perth Seawater Desalination Project located in Cockburn Sound found that during inclement weather the silt curtains were destroyed. As the marine waters at the Southern Seawater Desalination Project are higher energy than Cockburn Sound, it is considered improbable the silt curtains could be effectively deployed and maintained during construction. The decision not to use silt curtains is consistent with the marine construction works used for the Bunbury Wastewater Treatment Plant Ocean Outfall, located approximately 25km to the south and constructed in 2002. Accordingly, silt curtains are not proposed as part of the marine construction works.

Disposal of Excavated Material

Advice obtained from the Australian Government Department of the Environment, Water, Heritage and the Arts (formerly the Department of Environment and Water Resources; formerly the Department of Environment and Heritage) for the Perth Seawater Desalination Plant (letter dated 14 April 2005) confirmed that a Permit was not required under the *Environment Protection (Sea Dumping) Act 1981* (C'th) as (1) the backfilling is for a purpose other than the mere disposal of the matter, and (2) procedures were in place for ensuring the backfilling did not cause marine pollution. Accordingly, a Permit is not required under the *Environment Protection (Sea Dumping) Act 1981* (C'th) for the Southern Seawater Desalination Project. Similar circumstances apply for the *Western Australian Marine (Sea Dumping) Act 1981* (WA), and accordingly, a Permit is not required under that Act.

6.6 Contingency Actions

No contingency actions are proposed.

6.7 Related Plans

1. Dangerous Goods and Explosives Management
2. Environmental Incident Management
3. Community Complaints Management
4. Rehabilitation Management Plan

6.8 Relevant Legislation

1. *Environmental Protection Act 1986* (WA).
2. *Marine Navigational Aids Act 1973* (WA)
3. *Quarantine Act 1908* (C'th)
4. *Wildlife Conservation Act 1950* (WA)
5. *Wildlife Conservation Regulations 1970* (WA)
6. *Occupational Safety and Health Act 1984* (WA)

6.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. AQIS
2. DEC
3. DoF
4. DoCEP (Worksafe WA)
5. DPI
6. Shire of Harvey
7. DEWHA

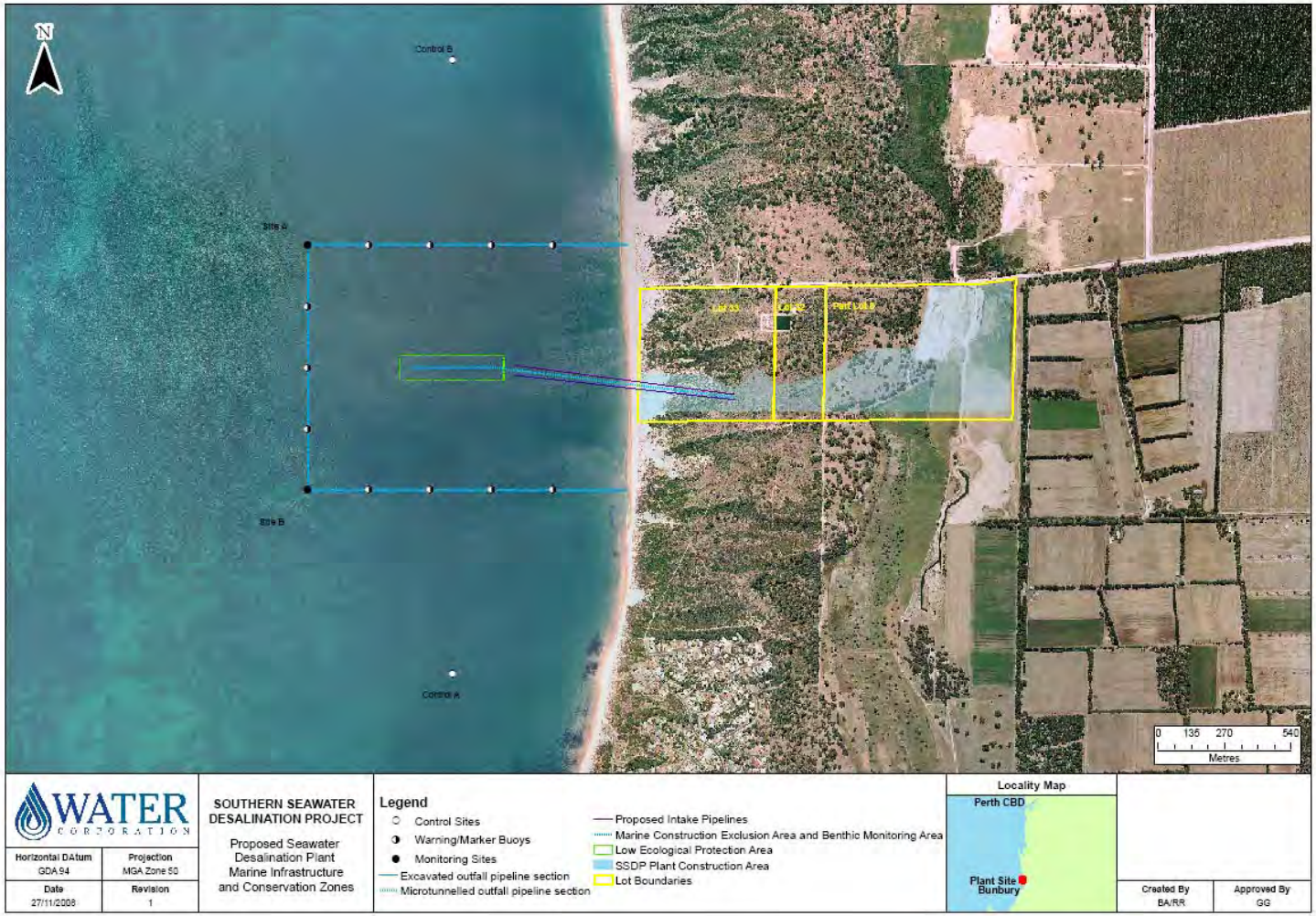


Figure 6-1 Marine Exclusion Area, Marine Pipelines and Monitoring Sites

Table 6-2 Marine Monitoring Log

Southern Seawater Desalination Project
Seawater Pipeline Installation Management

Marine Monitoring Log

The purpose of the Marine Monitoring Log is to record the marine turbidity and PAR during seawater pipeline installation.

Date: _____

Name: _____

Position: _____

Monitoring comments (optional):

_____

_____

_____

MONITORING TIME: Morning / Afternoon (please circle)

SAFE TO SAMPLE?: Yes / No (please circle)

COORDINATES:

Site	Northings (m N)	Eastings (m E)
A	6334027	376410
B	6333027	376410
Control Site A	6332277	376999
Control Site B	6334777	376999

FIELD SAMPLING RESULTS:

	Turbidity (NTU)				
	Site A	Site B	Control A	Control B	Mean of Control A & B
Time					
Recording at 2m from sea floor					

	Photosynthetically Active Radiation (PAR) (µmol/m/s)				
	Site A	Site B	Control A	Control B	Mean of Control A & B
Time					
Recording at 2m from sea floor					

Table 6-3 Underwater Blasting Log

Southern Seawater Desalination Project
Seawater Pipeline Installation Management

Underwater Blasting Log

The purpose of the Underwater Blasting Log is to record the key aspects of each underwater blast.

Date of Blast	Location of Blast	Weight of Charge (kg)	Time whale and dolphin surveys completed	Time of Blast	Mortalities (total number and species)	Comments	Name and Position

Page …… of …

7.0 Watercourse Crossing Management

7.1 Context

The Water Transfer Pipeline from the Seawater Desalination Plant site to the Harvey Summit Tanks will cross a number of watercourses (drains, rivers and streams). Construction activities at the watercourses have the potential to disrupt natural water flows and add suspended sediment material (particulates) to the water column.

The watercourses may provide habitat for flora and fauna. Some of the watercourses may also have heritage significance to persons of Aboriginal descent (refer Aboriginal Heritage Management).

All watercourse crossings will be constructed using an open trench as identified in Figure 7-1. The pipeline will be buried below the watercourse so that watercourse flows are not interrupted following construction.

7.2 Purpose

The purpose of the Watercourse Crossing Management Plan is to outline management actions to minimise:

1. impacts on water quality and watercourse flow.
2. impacts on beds and banks of watercourses.

7.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

7.4 Management Actions

Prior to Construction

1. A permit to interfere with the beds and banks of watercourses will be obtained from the DoW in accordance with s17 of the *Rights in Water and Irrigation Act 1914* (WA).

Construction

2. Liaison with Harvey Water will occur at least 14 days prior to any works carried out in irrigation watercourses operated by Harvey Water.
3. Vegetation clearing will be undertaken at watercourses, if required, in accordance with the Land Clearing and Trench Management Plan.
4. The flow of the watercourse will be diverted by channel or by diversion pipeline. If a watercourse contains water that is not flowing or flowing slowly, it will be temporarily dammed with any minor water flow to be transferred by pump and pipeline.
5. A continuous row of sterile hay bales will be installed and maintained approximately 10m downstream of the construction works for sediment filtration and flow velocity reduction if the watercourse is visually turbid from construction works at a distance of approximately 100 metres downstream of the construction works. The bales will be fixed using stakes to the base of the watercourse during construction.

Post Construction

6. Any installed bales and stakes will be removed within 7 days following the completion of construction works at the watercourse.
7. The banks of the watercourse will be re-contoured using construction equipment so that the banks are returned to the original profile with equivalent pre-construction stability.
8. The banks of the watercourse will be rehabilitated as documented in the Rehabilitation Management Plan, with cleared and cut vegetation placed on the banks to minimise erosion and encourage microclimates for seed germination.

7.5 Contingency Actions

If the watercourse is visually turbid at a distance of 100m downstream of the construction works after the installation of sterile hay bales, the following actions will be undertaken:

1. installation of additional continuous row(s) of sterile hay bales or a geofabric barrier downstream of the construction works for sediment filtration and flow velocity reduction;

2. addition of Alum (aluminium sulphate $Al_2(SO_4)^{3-}$) to remove sediments from suspension between the construction works and the bales/geofabric. The concentration of alum required will be dependent on the level of sedimentation of the water. Soda Ash (sodium carbonate Na_2CO_3) will also be applied for pH correction during Alum dosing at a rate of 2 parts Alum: 1 part Soda Ash.

7.6 Related Plans

1. Land Clearing and Trench Management
2. Dewatering and Acid Sulphate Soils Management
3. Aboriginal Heritage Management
4. Rehabilitation Management

7.7 Relevant Legislation

1. *Rights in Water and Irrigation Act 1914*, and *Regulations 2000* (WA).

7.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. DoW
3. Conservation Commission
4. Harvey Water

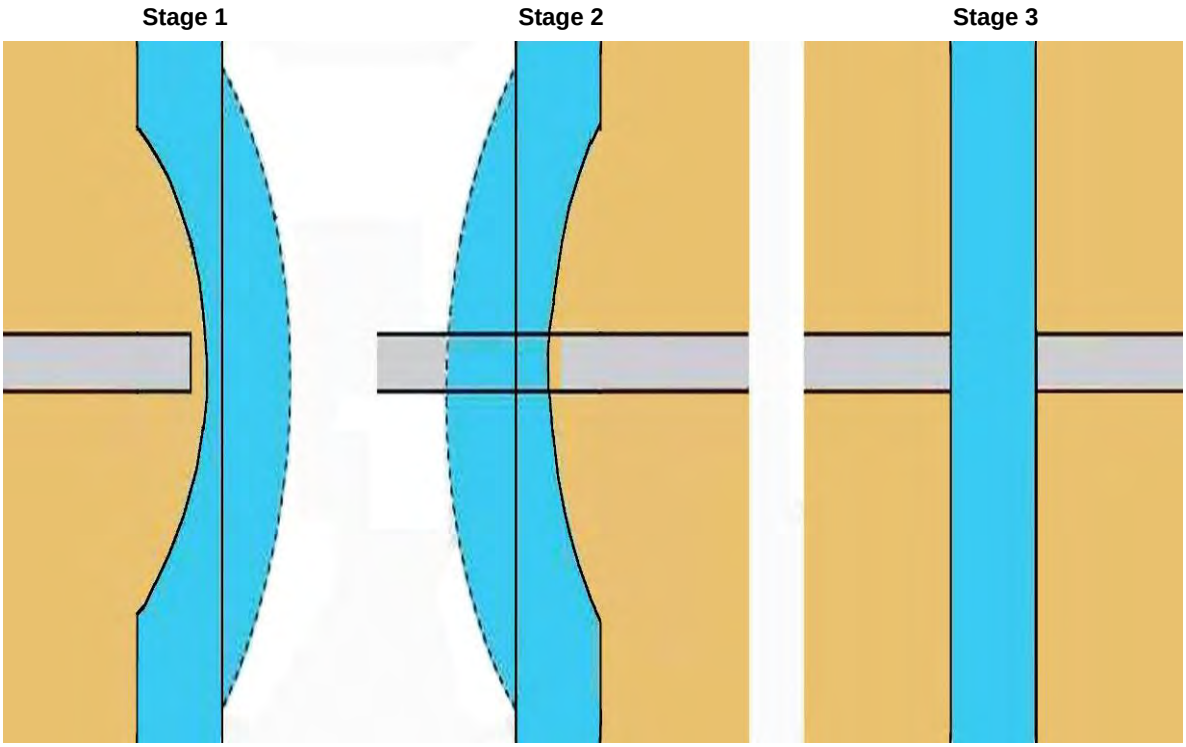


Figure 7-1 Watercourse Crossing by Open Trenching.

For ‘Stage 1’ the watercourse is diverted to one side, making one side dry for pipeline installation. At ‘Stage 2’ the watercourse is diverted in the opposite direction, making the other side dry for pipeline construction and to connect to the pipeline installed during ‘Stage 1’. ‘Stage 3’ involves the re-alignment of the watercourse banks to the original alignment and profile. The pipeline is buried below the land and the watercourse.

8.0 Dewatering and Acid Sulphate Soils Management

Management of dewatering and acid sulphate soils will be undertaken in a manner consistent with the risk based approach outlined in the Water Corporation Acid Sulphate Soil and Dewatering Management Strategy (Water Corporation 2007)

8.1 Context

Dewatering by spears and pumps will be required for excavations and installation of infrastructure in areas where the watertable is above the installation depth. Pipeline installation will occur during dry periods to reduce the need for dewatering, with the temporal extent of dewatering limited by the pipeline installation rate (at approximately 100m per day), with dewatering in any one area being completed within approximately 7 days.

The construction areas may also contain Acid Sulphate Soils (ASS), which are naturally occurring soils and sediments containing sulphide minerals. When ASS is dewatered, excavated or otherwise exposed to air, the sulphides react with oxygen in the air to form sulphuric acid. Sulphuric acid can contaminate the groundwater and cause the release of metals bound in the soil (such as arsenic, aluminium and iron).

Mapping completed by the WAPC (May 2007) identifies that the infrastructure has the following ASS risks:

	ASS RISK (for excavations up to 3m depth)
Seawater Desalination Plant:	2 ha of "high to moderate risk" (degraded remnant wetland) 19 ha of "moderate to low risk" 63 ha of "no known risk" (Note: marine areas have not been mapped by WAPC, however ASS are not expected due to the limestone marine environment).
Water Transfer Pipeline:	5.5 km of "no known risk"
	23 km of "moderate to low risk"
	0.5 km of "high to moderate risk" 0.5 km of no data recorded (Note: ASS is not expected due to the high elevation of the land (approximately 80m AHD to 130m AHD))
Harvey Summit Tanks:	No data recorded (Note: ASS are not expected due to the high elevation of the land (approximately 130m AHD to 170m AHD)).

Table 8-1 ASS Risk mapping for the Southern Seawater Desalination Project areas.

The ASS identified at the Seawater Desalination Plant site is not anticipated to be of concern as those areas will be filled to achieve the necessary height for infrastructure installation. Exposure of ASS in stockpiles and within the excavated trench for the Water Transfer Pipeline will be limited due to the rate of pipeline installation (at approximately 100 metres per day).

8.2 Purpose

The purpose of the Dewatering and Acid Sulphate Soils Management Plan is to outline management actions to:

1. minimise the environmental impacts of dewatering.
2. identify and manage areas of ASS.

8.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

8.4 Management Actions

Prior to Construction

1. The presence of ASS and the depth to groundwater will be determined as described below:
    a. Sample sites will be located at 500m[1] intervals along the pipeline routes, except for the Boonilup Road section where the sampling distance will be 100m[1]. At the Seawater Desalination Plant site the degraded remnant wetland will be sampled (minimum 2 sample sites).
    b. At each sample site, one 500 gram sample will be taken from the centre of each soil layer (horizon)[2] to a depth of approximately 4.0 metres[3]. The sample will be collected and placed in a sealed plastic bag, excluding air. Shell material, if present, will be removed from the sample in the field. Samples will be placed in a field freezer or esky containing ice, then frozen within 24 hours of collection (i.e. on return from field sampling).
    c. Each soil sample will be tested by the Suspension Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS)[4] suite method by a laboratory accredited by NATA for analysis by SPOCAS.
    d. For each soil profile, the following will be recorded:
        i. Location (geo-referenced to eastings and northings) of the sample site.
        ii. Depth from which the soil sample was taken.
        iii. Description of thickness, soil texture and grain size for each layer.
        iv. Description of colour using a Munsell colour chart for each layer.
        v. Description of soil mottling, organic matter, moisture content, and presence of shell material for each layer.
        vi. Estimation of the water table depth below ground level.
        vii. Photograph of the soil profile with a field marking indicating the sample collection points.
    e. Reporting of the results will include:
        i. Description of the equipment and methods used for sample collection.
        ii. Maps with geo-referenced coordinates of each sampling site.
        iii. Results of SPOCAS tests (includes Titratable Actual Acidity, Titratable Peroxide Acidity, Acid Neutralising Capacity, Titratable Sulfidic Acidity).
        iv. Recorded matters listed in part ‘1d’ (above).
        v. NATA endorsed laboratory report for the laboratory results.
        vi. Description of Chain of Custody for samples collected for laboratory analysis.
        vii. Discussion of laboratory analysis.

Construction

Dewatering General

2. Excessive dewatering will be avoided. The rate of dewatering will be limited to the minimum rate required for the infrastructure to be installed within the trench.

Dewatering to Ocean

3. Dewatering water maybe discharged to the ocean from the Seawater Desalination Plant site. It will be ensured that the dewatering water is discharged within the surf zone (nominally within 0m to 25m of the shoreline) where the dewatering water will be rapidly mixed by wave action.
4. Dewatering discharge will not create a visible plume greater than 100m from the discharge location.

Dewatering to Land

5. Dewatering water will be infiltrated on-site within cleared or agricultural areas. Infiltration of dewatering water will be within a defined area (may require earth bunding).
6. Dewatering to native vegetation will only occur where no other practicable disposal option exists.
7. Dewatering water maybe used for dust suppression if monitoring confirms that the discharge water meets the following water quality criteria for discharge to land (below).

Dewatering to a Watercourse

8. Dewatering water may be discharged to a watercourse if monitoring confirms that the water meets the water quality criteria for discharge to a watercourse (Table 8-2).
9. Dewatering water will be discharged to a watercourse via a settling tank/bund to remove suspended sediments. The size of the settling tank/bund will be designed (subject to land availability) to allow for sufficient retention time to remove visible suspended solids.
10. The dewatering water will be discharged from the settling tank/bund onto a hard surface (such as a rocky ledge), or via a diffuser, to minimise flow velocity that could erode the watercourse bed, banks or vegetation of the watercourse, and to aerate the discharge.
11. A continuous row(s) of sterile hay bales or geofabric will be installed, through which the discharge will pass prior to entering the watercourse if the settling tank/bund does not sufficiently remove suspended sediments (i.e. the watercourse is visibly turbid). The bales/geofabric will be fixed using stakes to the base of the watercourse. The bales/geofabric and stakes will be removed following the completion of discharge.
12. If required, the dewatering discharge will be dosed with Alum (aluminium sulphate - $Al_2(SO_4)^{3-}$) to remove sediments from suspension within the settling tank/bund or on the discharge side of the bales/geofabric. The concentration of alum required will be dependent on the level of sedimentation of the water. Soda Ash will also be applied (sodium carbonate - Na_2CO_3) during Alum dosing at a rate of 2 parts Alum: 1 part Soda Ash for pH correction.

Monitoring of Dewatering Discharge to a Watercourse or Land

13. The discharge water will be monitored at the discharge point once per day for pH and temperature using a calibrated multimeter probe(s).
14. The water within a watercourse to which dewatering water is discharged will be monitored at 100m upstream and 100m downstream of the discharge point for pH and temperature using a calibrated multimeter probe(s). The results of discharge will be compared to the upstream water quality.
15. The discharge will be managed such that the following water quality objectives are achieved:

	Temperature	**pH**
Discharge to Watercourse[5]	Within ± 2 degrees Celsius in watercourse (100m downstream v. 100m upstream)	6.0-8.5 for discharge water *or* within ± 2 pH units in watercourse (100m downstream v. 100m upstream)
Discharge to Land	Not applicable	4-10 for discharge water[6]
Discharge to Ocean	Not applicable	4-10 for discharge water[6]

Table 8-2 Dewatering Discharge Objectives.

16. A visual turbidity assessment will be taken of the discharge and of the watercourse at 100m upstream and downstream of the discharge.
17. Sterile hay bales and/or a geofabric will be installed within the watercourse downstream of the discharge to reduce turbidity if the watercourse is identified as visibly turbid.
18. The watercourse will be dosed on the discharge side of the bales/geofabric with Alum (aluminium sulphate - $Al_2(SO_4)^{3-}$) to reduce turbidity if the installation of bales/geofabric does not sufficiently reduce turbidity. The concentration of alum required will be dependent

on the level of turbidity of the water. Soda Ash (sodium carbonate - Na_2CO_3) will also be applied during Alum dosing at a rate of 2 parts Alum: 1 part Soda Ash for pH correction.

19. The results of monitoring for pH, temperature and turbidity will be recorded on the Water Discharge Monitoring Log.

20. The pH of the dewatering waters will be neutralised with liquid lime if the dewatering discharge water quality does not meet the discharge objectives for pH. The rate of neutralisation will be based on achieving a neutralised discharge quality to within the pH discharge water objective of pH 6.0-8.5 for a watercourse or pH 4.0-10.0 for discharge to land or ocean.

21. The rate of dewatering will be adjusted, or location of dewatering changed, if the dewatering discharge to a watercourse does not meet the temperature discharge objectives.

Dewatering on Boonilup Road Wetland (Watercourse) Area

22. A fixed water level indicator will be installed with 1cm increments into the open water area of each wetland containing open water within 100m of the Water Transfer Pipeline on Boonilup Road (excluding the Harvey-Myalup Drain).

23. The wetland water levels will be monitored and recorded on the Wetland Water Level Monitoring Log to 1cm accuracy in all wetlands within 100m of the Water Transfer Pipeline on Boonilup Road on each day during construction.

24. Dewatering water may be temporarily discharged to any wetland that records a reduction in water level greater than 10cm (and accounting for any natural reduction in water levels recorded in wetlands beyond the immediate construction area). Discharge will continue until the natural water level is restored to within 1cm. Discharge will be monitored and recorded on the Water Discharge Monitoring Log.

ASS Soil Management

25. The ASS risk (based on preconstruction investigations) will be marked on the infrastructure maps for the Water Transfer Pipeline (Appendix 2). The maps will identify a 500m/100m buffer on pipeline areas identified as having ASS given the investigation confidence (sampling) interval was 500m/100m for preconstruction investigations.

26. Field sampling and field analysis will be conducted for pH_F and pH_{FOX} at 50m intervals within the 500m/100m buffer during construction to determine the starting location of ASS where present. The field sampling and analysis will be conducted in accordance with Appendix 1 of *Performing and Interpreting Soil Field pH* of *Draft Identification and Investigation of Acid Sulfate Soils* (DoE, May 2006).

27. ASS material will be stockpiled separately from non-ASS material. Stockpiles of ASS material will be placed on a pad of Aglime (pulverised limestone) of no less than 100mm depth.

28. Stockpiles of ASS material will be neutralised by thorough mixing with the following ratios of aglime (pulverised limestone) based on the ASS risk supplied in Appendix 2:

	ASS Assessment			
	Nil	**Low** *(S% 0.03-0.4)*	**Medium** *(S% 0.5 -1.9)*	**High** *(S% 2.0-5.0)*
Rate of Aglime dosing[7] (tonne of lime : tonne soil excavated)	No treatment required	2:100	8:100	19:100

Notes:
1. Ratios are based on tonnage, not volume. Estimation of the bu k density of the ASS material is required prior to neutralisation.
2. Aglime dosing rates are for pure fine Aglime (100% $CaCO_3$) using a safety factor of 1.5. If commercial grade lime is used the rates must be proportionally emended to account for change in purity.
3. Aglime dosing rate includes the weight of Aglime pad on which ASS material is placed.
4. Limestone has not been recommended given low surface (reaction) area and high volume requirements for neutralisation.

Table 8-3 Aglime Dosing Rates for ASS Soils.

29. Neutralised ASS material maybe disposed of to:
    a. the excavated trench.
    b. a suitable location agreed with the Landowner (the Landowner has first preference to retain excess overburden from their own property).
    c. a suitable location agreed with adjacent Landowners (with preference to Landowners on the pipeline route) or other nearby Landowners.
    d. a local landfill as inert waste.
    e.

Reporting

30. The following details will be recorded and reported weekly:
    a. volume of dewatering.
    b. locations of dewatering discharge.
    c. volume of ASS material excavated and neutralised.
    d. disposal locations of neutralised ASS material.

8.5 Additional Information

ASS Sampling

[1] It is noted that *Draft Identification and Investigation of Acid Sulfate Soils* (DoE, May 2006) recommends an ASS linear sampling interval of 50m. The preconstruction sampling interval to be undertaken for the pipeline will be at 500m intervals (which is predominantly "moderate to low risk"), with 100m intervals for the Boonilup Road section (which is mostly "moderate to low risk" with sections of "high to moderate risk"). The recommended interval of 50 metres for investigative sampling is not practicable (would equate to approximately 800 sites), consequently, a conservative linear interval buffer of 500m/100m will be added to the results of investigation sampling from the ASS delineation mapping, with field testing at 50m intervals conducted during construction for field delineation.

[2] It is noted that *Draft Identification and Investigation of Acid Sulfate Soils* (DoE, May 2006) recommends an ASS vertical sampling interval of 0.25 metres, or greater where soil layers are less. The recommended interval for investigative sampling is not considered necessary as the material will not be returned in layers (excepting topsoil). One sample from each soil layer will be sufficient to determine the overall ASS risk and allow ASS, if present, to be quantified by volume and concentration for effective management during construction.

[3] 4 metres is the approximate maximum reach of the machinery which will be used for geotechnical excavations and construction. Sampling beyond this depth is not practicable.

[4] SPOCAS tests are being conducted on all soil samples collected. Tests for pH_F and pH_{FOX} will not be conducted for pre-construction delineation of ASS as the DEC (formerly as the WA Department of Environment, May 2006) identifies that tests for pH_F and pH_{FOX} have a 20-40% error (false positives and false negatives). Consequently, tests for pH_F and pH_{FOX} (as a precursor for determining the need for SPOCAS testing) are not considered by the Principal to be reliable for pre-construction delineation of ASS.

Dewatering Discharge

[5] pH 6.5 is the lower guideline value for South-western freshwater river ecosystems by ANZECC (2000). pH 6.0 is the guideline action trigger level recommended by DoW (2006).

[6] pH range of 4-10 is consistent with the *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA).

[7] the aglime dosing rate is based on Appendix 1 of *Acid Sulfate Soils Guideline Series – Treatment and Management of disturbed acid sulfate soils* (DEC, October 2004).

Dewatering Licence

A licence from the DoW to conduct dewatering activities is not required as a result of powers contained in s83(2)(b)(i) of the *Water Agencies (Powers) Act 1984* (WA).

8.6 Contingency Actions

No contingency actions are considered necessary.

8.7 Related Plans

1. Land Clearing and Trench Management Plan
2. Watercourse Crossing Management Plan

8.8 Relevant Legislation

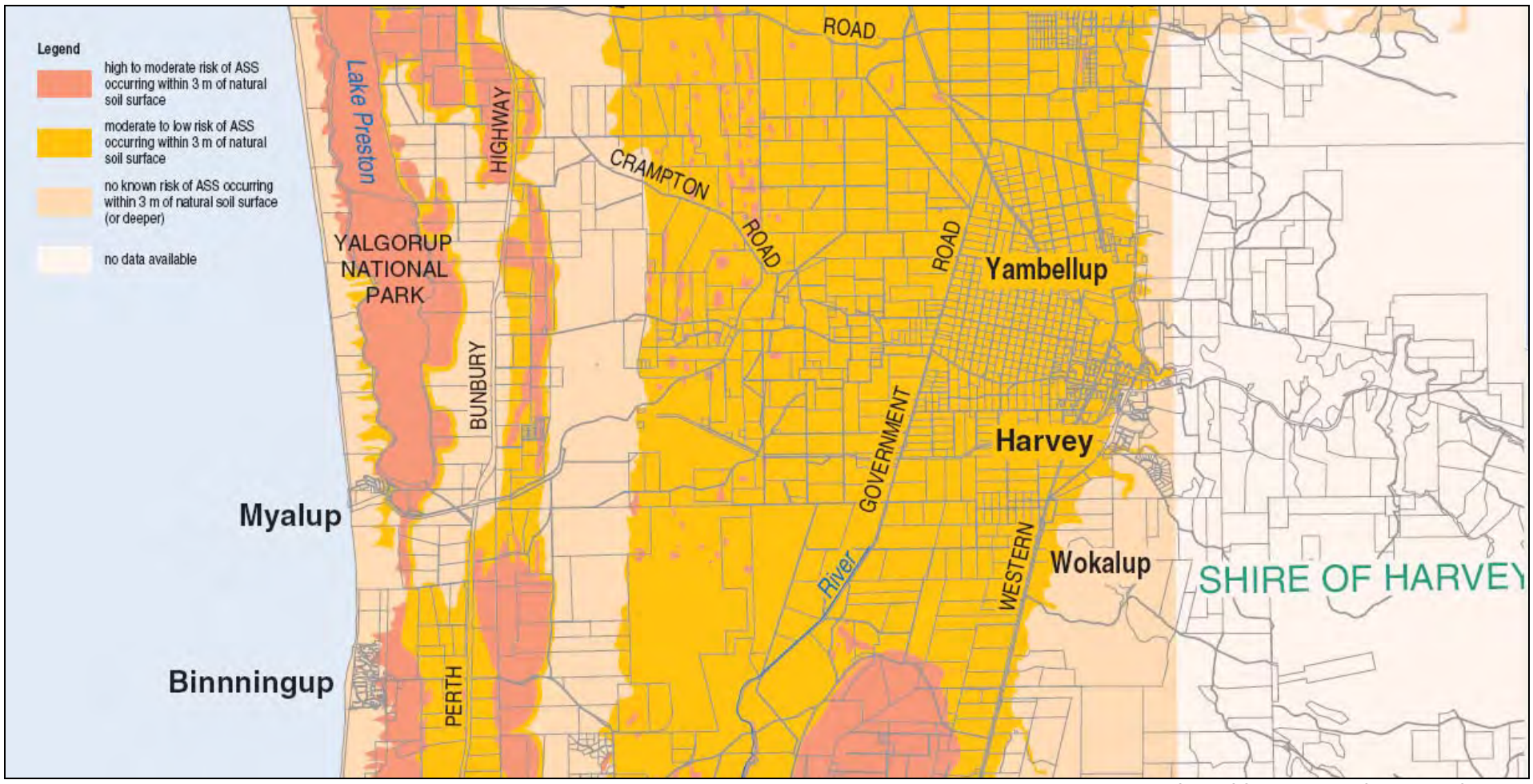
1. *Environmental Protection Act 1986*, and *Regulations 1987* (WA).
2. *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
3. *Contaminated Sites Act 2003*, and *Regulations 2006* (WA).
4. *Water Agencies (Powers) Act 1984* (WA).

8.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. DoW

Figure 8-1 ASS Risk Mapping for the Construction Area.



. Source: Adapted from WAPC (May 2007).

Table 8-4 Water Discharge Monitoring Log

Southern Seawater Desalination Project
Dewatering and Acid Sulphate Soils Management

Water Discharge Monitoring Log

The purpose of the Water Discharge Monitoring Log is to record the water quality of water discharge to land/water. The Water Discharge Monitoring Log is to be completed by the Site Environmental Scientist on each day of water discharge.

Name ……

Page …… of ……

Date of Entry	Property Description and Sample Site (e.g. discharge, watercourse upstream or downstream)	Discharge Rate (L/min)	Temp. (^{o}C)	pH	Turbidity (visible)	Name and Position	Initial

Table 8-5 Wetland water Level

Southern Seawater Desalination Project
Dewatering and Acid Sulphate Soils Management

Wetland Water Level Monitoring Log

The purpose of the Wetland Water Level Monitoring Log is to record the water level in the open water of wetlands within 100m of the Boonilup Road Section of the Water Transfer Pipeline. The Wetland Water Level Monitoring Log is to be completed by the Site Environmental Scientist on each day of construction of the Water Transfer Pipeline on Boonilup Road.

Name ……

Page ……. of …….

Date of Entry	Wetland No / Description	Water Level at Construction Start (cm)	Current Water Level (cm)	Is Level Change greater than 10cm?	Dewatering to wetland required (accounting for natural reductions in water level)?	Name and Position	Initial

9.0 Hygiene (Plant Pathogen) Management

9.1 Context

The construction areas may contain infestations of the plant pathogens that cause Phytophthora Dieback (*Phytophthora cinnamomi*) and Armillaria Root Disease (*Armillaria luteobubalina*). The symptoms of plant pathogens include the dieback of limbs and branches, yellowing of foliage, and vegetation death.

The construction areas also contain a range of weed species, which have the potential to compete with native flora and can affect agricultural productivity. Dormant weed seeds can be contained in topsoil, which when disturbed by construction activities can cause the weed seeds to germinate. Weed species are often opportunistic and can quickly colonise cleared land.

Plant pathogens and weeds are spread through the movement of soil from infected areas to uninfected areas. The construction areas will be surveyed prior to construction for evidence of plant pathogens and significant weed infestations. These areas will be marked on the infrastructure maps contained in Appendix 2.

9.2 Purpose

The purpose of the Hygiene Management Plan is to outline management actions to minimise:

1. the spread of the plant pathogens (*Phytophthora cinnamomi* and *Armillaria luteobubalina*) and weeds from infested to uninfested land.

9.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the management actions (hygiene procedures) to minimise the spread of plant pathogen and weeds.
2. Weed distribution and density post-construction compared to pre-construction records.

9.4 Management Actions

Prior to Construction

1. Identified infestations of declared weeds and Watsonia (*Watsonia bulbillifera*) will be sprayed to minimise weed spread during construction.
2. It will be ensured that vehicles and machinery (including wheels, racks, undercarriage and inside cabins) and footwear are to be inspected and cleaned of sods of dirt and slurry prior to entry to the construction areas.

Construction

3. Construction materials (e.g. soil, revegetation material) will not be sourced from areas known to contain forest diseases or high weed infestations.
4. Hygiene Inspection Points (with signage, refer Figure 20) will be established at the sites to be marked on the infrastructure maps contained in Appendix 2 (based on a pre-construction dieback survey to prevent soil transfer from infected areas to uninfected 'protectable' areas).
5. It will be ensured that all vehicles, footwear and equipment entering the Hygiene Inspection Points will be cleaned to remove attached sods of dirt (including the tyres, undercarriage and inside cabin of the vehicle). Vehicles, footwear and equipment will be cleaned by:

a. air hosing and brushing during dry conditions.
b. low volume, high pressure water hosing during wet/boggy conditions.

6. Construction vehicles will be kept within the clearing corridor (nominally 20 metres in native vegetation and 30m in agricultural land – refer to Land Clearing and Trench Management Plan).
7. Topsoil, overburden or vegetation will not be transported from dieback infected areas to uninfected 'protectable' areas.
8. Excess overburden will be disposed of from dieback infected areas on-site within the dieback infected construction corridor by evenly spreading over the construction area prior to spreading the infected topsoil. This may result in a raised land level. Where disposal of overburden by this manner is not practicable due to excessive mounding, an alternative disposal location will be sought.
9. Cleared vegetation will not be removed from determined dieback infected areas. All cleared vegetation from dieback infected areas will be retained within the dieback infected areas.
10. Topsoil will not be respread from agricultural areas in areas of native vegetation in order to minimise the spread of pasture species.

Post-Construction

11. The construction area will be monitored for weed infestations in spring (September to November) for a period of 12 months following completion of the construction works. The monitoring will include:
    a. the species of weeds identified.
    b. an estimation of the distribution and densities of weeds.
    c. a comparison with pre-construction weed distribution and densities to identify areas requiring spraying, based on photographs from the land condition survey (refer to Land Clearing and Trench Management Plan).
12. The construction areas will be sprayed where weed infestations exist at densities or distributions at more than 50% above pre-construction levels during the 12 month weed monitoring period. The spraying of agricultural land will be conducted in consultation with the Landowner using a herbicide listed in the 2006/2007 DAF Canola, Pulse and Legume Pasture Spraying Charts (Bulletin 4674, 2006) (refer Figure 21). The spraying within native vegetation will be conducted using Fusilade® herbicide. Weed infestations immediately adjacent to watercourses will be sprayed in a manner which prevents overspray to the watercourse, or alternatively the weeds will be removed by hand.
13. The construction area will be monitored for weed infestations annually in spring (September to November) for a further period of 2 years following completion of the construction works. The monitoring will include:
    a. the species of weeds identified.
    b. an estimation of the distribution and densities of weeds.
    c. a comparison with pre-construction weed distribution and densities to identify areas requiring spraying, based on photographs from the land condition survey (refer to Land Clearing and Trench Management Plan).
14. The construction areas will be annually sprayed where weed infestations exist at densities or distributions at more than 50% above pre-construction levels during the 3 year weed monitoring period. The spraying of agricultural land will be conducted in consultation with the Landowner using a herbicide listed in the 2006/2007 DAF Canola, Pulse and Legume Pasture Spraying Charts (Bulletin 4674, 2006) (refer Figure 21). The spraying within native vegetation will be conducted using Fusilade® herbicide. Weed infestations immediately adjacent to watercourses will be sprayed in a manner which prevents overspray to the watercourse, or alternatively the weeds will be removed by hand.

9.5 Additional Information

Hygiene Inspection Points

Hygiene Inspection Points will be designed such that:

1. there is physical separation between object being cleaned and effluent produced (i.e. grate over a sump).
2. cleaning wastewater is infiltrated on-site within infested areas.
3. the object being cleaned does not become re-contaminated by the wastewater.

Figure 9-1 Hygiene Inspection Point Signage.

(600 x 350mm – Black lettering on white background. Corporate logos are in colour)

Herbicides

A range of herbicides suitable for use is contained in spray charts produced by the DAF (refer Figure 21). As different herbicides may use the same active ingredient, but with varying concentrations, the application rate must be adjusted according to the directions supplied by the manufacturer of each individual herbicide.

9.6 Contingency Actions

No contingencies are considered necessary.

9.7 Related Plans

1. Land Clearing and Trench Management
2. Watercourse Crossing Management

9.8 Relevant Legislation

1. *Conservation and Land Management Act 1984*, and *Regulations 2002* (WA)
2. *Agriculture and Related Resources Protection Act 1976* (WA)

9.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. DAF
3. Conservation Commission

Figure 9-2 DAF Spray Charts. Page 1 of 7.

Grains Research & Development Corporation

2006/2007
CANOLA, PULSE AND LEGUME PASTURE SPRAYING CHARTS
BULLETIN 4674

ISSN 1448-0352
Replaces Bulletin 4618

Department of Agriculture

These charts list herbicides registered in Western Australia for the control of weeds in pulse and canola crops and legume pastures.

Compiled by Vanessa Stewart, John Moore and Julie Roche

USERS OF ANY CHEMICAL PRODUCT SHOULD ALWAYS READ THE PRODUCT LABEL BEFORE USE AND FOLLOW THE DIRECTIONS SPECIFIED ON THAT LABEL

REGISTRATIONS
These charts summarise registered broad acre herbicide uses and rates per hectare for common weeds and should be used as a guide only.

PRODUCTS CONTAINING THE SAME ACTIVE INGREDIENT
For many herbicides there may be a large number of alternative products containing the same or different concentrations of the same active ingredient.

In these charts a representative active ingredient concentration has been specified and the herbicide rate stated is for products with that concentration.

Where it is known that there are alternative products available that have a different active ingredient concentration/s the following statement has been included with the product details (in red text):

'Alternative concentration/s available'

Where this alert appears users should check their product label to determine active ingredient concentration and use the rates specified on that label.

ALTERNATIVE PRODUCTS
There may be variation in registered uses, withholding periods and rates between alternative products containing the same active ingredient at the same and/or different concentrations of that active ingredient. Follow the directions on the label of the product to be used.

CODE
The chart should be read with reference to the code present.

WEED IDENTIFICATION
To identify weeds mentioned in this chart consult:

- *Weeds: The Ute Guide (Southern Edition Version 2)*
  Available GRDC Ground Cover Direct - 1800 11 00 44
- *Western Weeds (A guide to the weeds of Western Australia)*
  Available Department of Agriculture Western Australia (South Perth) - (08) 9368 3333

IMPORTANT DISCLAIMER

1. The information in this chart has been written for Western Australian conditions and may not be applicable or suitable for use in States other than Western Australia.
2. The State of Western Australia, the Minister for Agriculture, the Chief Executive Officer of the Department of Agriculture, the Grains Research and Development Corporation and their respective officers, employees and agents:

a) do not make any representation or warranty as to the accuracy, reliability, completeness or currency of the information in the chart (including but not limited to information which has been provided by third parties);

b) make no representation or warranty that any of the active ingredients or products specified in this chart are registered pursuant to the Agricultural and Veterinary Chemicals Code Act 1994 (WA);

c) have relied on the information contained in the Australian Pesticides and Veterinary Medicines Authority database and herbicide labels in preparing this chart and accept no liability for any errors in this chart that arise from such reliance; and

d) will not be liable, in negligence or otherwise, to any person for any loss, liability or damage arising out of an act or failure to act by any person in using or relying on any information, representation or statements contained in this publication.

Notes

Restricted herbicides

The following herbicides have restricted use in areas where grapes and tomatoes are grown commercially:

MCPA, MCPB, 2,4-D, 2,4-DB, dicamba and picloram.

Consult the Department of Agriculture for information concerning the storage and application of these herbicides near these areas.

2,4-D Additional label instructions for application

Additional instructions to strengthen the current label warnings in relation to minimising chemical spray drift.

"This is a PHENOXY HERBICIDE that can cause severe damage to susceptible crops such as cotton, grapes, tomatoes, oilseed crops and ornamentals.

- DO NOT use unless wind speed is more than 3 kilometres per hour and less than 15 kilometres per hour as measured at the application site.

- DO NOT apply with smaller than coarse to very coarse spray droplets according to the ASAE S572 definition for standard nozzles."

Herbicide compatibility - Tank mixing

Before tank mixing pesticides you should ask the following questions;

- Is the mixture proven and registered?

- Is the proposed mixture the best approach to the problem?

Before making a mixture the physical compatibility of the components should be checked. This can be done in a glass jar or similar transparent container. It requires accurate measurement of the component chemicals and mixing in the correct volume of water so as to achieve the same concentrations as the proposed tank mix. Use the same water as that which will be used in the paddock.

Allow test jar to sit for several hours or longer following agitation.

If gelling, precipitation or separation occurs after standing then the tank mix should not be used unless after re-agitation the gel or precipitate goes back into solution or suspension.

Mixing Order

Fill the tank with water to at least one third to half full then mixing should be in the order of:

- wettable powders,

- flowables,

- emulsifiable concentrates,

- water solubles

- followed by surfactants.

Physical compatibility does not imply biological compatibility. Unproven tank mixes may have poorer weed control and/or cause crop damage. Compatibilities should be checked annually as formulations may vary between seasons and between companies.

Check the label for information on product compatibilities and recommendations on suggested intervals between application of various products.

Check label for information on tank mixes and the addition of crop oils and other surfactants/adjuvants. The addition of adjuvants to some herbicides or mixtures can result in severe crop damage.

Herbicide resistance

Continuous use of the same herbicide or herbicides with the same mode of action may lead to the development of herbicide resistance to that group of chemicals. Selection of resistant populations can occur in as little as 3-4 years.

Research indicates that once a weed population is resistant to herbicides from MOA groups A and B it will not become susceptible to those herbicides again.

Herbicide Mode of Action

Herbicides act by interfering with specific processes occurring in plants. This interference is described as the herbicide's Mode of Action. In Australia, the group to which a herbicide product belongs is identified by a letter code, A, B, C… This code is found on all product labels and herbicide drums.

Avoiding herbicide resistance

The adoption of Integrated Weed Management (IWM) is likely to prevent or at least delay herbicide resistance.

IWM involves the use of many different approaches to weed control including techniques that are chemical, mechanical, agronomic and biological.

Examples of weed management techniques include cultivation, burning, grazing, hay cutting, spray topping, crop topping, seed collection, seeding rates, crop competition and crop choice/rotation.

Resistance risk of herbicides

The risk of developing resistance to herbicides is different for each of the mode of action groups. A low risk rating does not mean that resistance will not develop.

High Risk – Group A and Group B herbicides

Moderate Risk – Groups C, D, E, F, G

Low risk – Groups I, J, K, L, M, N

Herbicide use guidelines

1. Read the label.

2. Apply only one application of any herbicide from any herbicide MOA group in a single season.

3. Where a herbicide from a specific group has been used on a particular paddock, avoid using a herbicide from the same group in the following season for control of that weed in that paddock.

4. Consider using tank mixes of products with different modes of actions that also control the target weed species.

Herbicide Mode of Action Groups

MOA	MOA Sub-group	Example Herbicides
A	Fops - Aryloxyphenoxy-propionates	Diclofop-methyl, fenoxaprop haloxyfop, propaquizafop, quizalofop
	Dims - Cyclohexanediones	Butroxydim, clethodim, sethoxydim, tepraloxydim, tralkoxydim
B	Sulfonyl ureas	Chlorsulfuron, iodosulfuron-methyl, mesosulfuron-methyl, metsulfuron, triasulfuron
	Sulfonamides	Flumetsulam, metosulam
	Imidazolinones	Imazamox, imazapic, imazapyr, imazethapyr
C	Ureas	Diuron, linuron
	Triazines	Atrazine, cyanazine, simazine, terbutryn
	Triazinones	Metribuzin
	Nitriles	Bromoxynil
D	Dinitro-anilines	Oryzalin, pendimethalin, trifluralin
E	Thiocarbamates	Tri-allate
F	Nicotinanilides	Diflufenican, picolinafen
	Isoxazolidinones	Isoxaflutole
G	Diphenyl ethers	Oxyfluorfen
	Pyrimidinones	Butafenacil
	Triazolinones	Carfentrazone-ethyl
I	Benzoic acids	Dicamba
	Phenoxyalkanoic acids	2,4-D, 2,4-DB, MCPA
	Pyridine carboxylic acids	Clopyralid
K	Amides	Metolachlor
	Amino propionates	Flamprop-methyl
	Benzamides	Propyzamide
L	Bipyridyliums	Diquat, paraquat
M	Glycines	Glyphosate
N	Glycines	Glufosinate

Known resistant weeds in Australia

Weed species	MOA groups to which resistance has developed
Annual ryegrass	A, B, C, D, E*, K*, M
Barley grass	A, B, L
Brome grass	A
Capeweed	L
Fumitory (Dense Flower)	D
Indian hedge mustard	B
Paterson's curse	B
Prickly lettuce	B
Silvergrass	L
Sowthistle	B
Wild oat	A, B, K
Wild radish	B, C, F, I
Wild turnip	B

* Resistance to these MOA groups has been detected in cross resistance testing - not in populations where field selection of resistance has occurred.

Figure 9-2. DAF Spray Charts. Page 2 of 7. Print A3 for best results.

Pasture topping options - label registrations

Herbicide	Trade name	Operation	Rate/ha	Withholding period	Notes - See label for additional critical comments
Diquat/paraquat 115/135 g/L	e.g. Spray.Seed®	Spray topping for control of grass seed set	**800 mL/ha**	GSF - 1 day (7 days horses) - remove stock from treated areas 3 days before slaughter	- Apply in a minimum of 50 L/ha water by boom spray. - Apply at end of growing season. Heavily graze paddocks during spring flush period to prevent early seed heads emerging. - Remove all stock about 3 weeks before end of growing season to allow seed heads to emerge evenly. - Set boom spray at a height to give double overlap spray pattern at the top of the pasture being sprayed.
		Hay freezing	**1.5 L/ha**	As above	- Hay freezing for maximum retention of protein for summer grazing.
Paraquat 250 g/L	e.g. Gramoxone® (alternative paraquat products are available which have this registration)	Spray topping Grasses generally (particularly Annual ryegrass)	**400 mL/ha**	GSF - 1 day (7 days horses) - remove stock from treated areas 3 days before slaughter	- Heavily graze paddocks during spring flush to encourage even head emergence. - Remove stock 2-3 weeks before anticipated maturity of target. - Delay spraying until last heads at the bottom of the plant have emerged and initial signs of haying off appear. - Set boom spray at a height to give double overlap spray pattern at the level of the seed heads.
		Spray topping Barley grass	**400 mL/ha**	As above	- Manage paddocks as above. Spray after head emergence when all seed heads are green and no sign of haying off.
		Spraytop - graze to destroy seed heads (Prevention of Annual ryegrass Toxicity (ARGT))	**400 mL/ha**	As above	- Grazing management as for spray topping. Remove stock 3-4 weeks before anticipated maturity date. - Spray must be applied within 10 days of first annual ryegrass seed heads emerging. - To ensure adequate control of toxin development, heavy continuous grazing is essential from 1 day after spraying until the pasture has completely hayed off. Regrowth after spraying must be eaten off to prevent new seed heads which could become toxic.
		Hay freezing	**800 mL/ha**	As above	- Graze paddocks as for spray topping. Remove stock 3-4 weeks before anticipated maturity. Apply prior to start of haying off regardless of grass species.
Glyphosate 450 g/L (isopropylamine salt) **	Numerous	Pasture topping for annual grass and Capeweed seed set reduction	Barley grass, Brome grass, Capeweed, Silvergrass: **240-360 mL/ha**; Annual ryegrass: **360 mL/ha**	Not required when used as directed	- Remove stock prior to treatment to allow even regrowth. - Apply to capeweed and annual ryegrass at flowering. For other grasses apply from head - milky dough stage. - Use high rate for dense infestations or where annual ryegrass is present. - Apply before signs of plants haying off. - Reduction in pasture legume population may occur. - DO NOT apply to clover or medic crops intended for seed or hay.

** NOTE: Glyphosate products come in many different concentrations of active ingredient and in different formulations. Follow directions and use rates specified on the label of the product being used.

Figure 9-2. DAF Spray Charts. Page 3 of 7. Print A3 for best results.

Pulse and canola crop-topping, pre-harvest desiccation and pre-harvest weed control registrations

Herbicide	Trade name	Operation	Crop	Rate/ha	Withholding period	Notes - See label for additional critical comments
Diquat 200 g/L	Reglone®	Pre-harvest crop desiccation	Chickpeas, Faba beans, Dry peas Lentils, Lupins	2 to 3 L/ha	GSF: 1 day Harvest: Lupins - NS Chickpeas, Lentils, Faba beans, - 2 days Dry peas - NRD	- Spray as soon as crop reaches full maturity. - Helps overcome slow and uneven ripening and harvest weed problems - Add Agral® at 200 mL/100 L or BS 1000® at 160 mL/100 L prepared spray.
		Pre-harvest crop desiccation	Canola	1.5 to 3.0 L/ha	GSF: 1 day Harvest: 4 days	- Spray when 70% of the pods are yellow and the seeds are browny/bluish and pliable. - Canola ripens unevenly and is prone to pod shatter and seed loss. - Direct harvest 4-7 days after spraying. - Add Agral® at 200 mL/100 L or BS 1000® at 160 mL/100 L.
Paraquat 250 g/L	e.g. Gramoxone® (Alternative paraquat products are available which also have this registration)	Crop topping to reduce Annual ryegrass seed set	Chickpeas, Faba beans, Field peas, Lentils, Lupins, Vetch	400 or 800 mL/ha	GSF: 1 day (7 days horses) - remove stock from treated areas 3 days before slaughter Harvest: 14 days	- Spray when the ryegrass is at the optimum stage, that is when the last ryegrass seed heads at the bottom of the plant have emerged and the majority are at or just past flowering (with anthers present or glumes open) but before haying off is evident. - Use of the higher rate in these crops is usually more reliable and gives a greater reduction in seed set. - Reduction in crop yield may occur especially if the crop is less advanced relative to the ryegrass, that is if crops have a majority of green immature pods. The higher rate may also result in higher yield losses. In practice crop yield losses in excess of 25% may occur. - Apply by ground boom only in 50-100 L/ha. - Spray with a calibrated boom spray designed to give double overlap at the level of the ryegrass seed heads. Pressures of 250-350 kPa and use of 110015 or 02 nozzles or equivalent will aid coverage.
Glyphosate **540 g/L**	Roundup PowerMAX®[1]	Crop topping to reduce viable seed set (Annual ryegrass)	Faba beans, Field peas	320-680 mL/ha	GSF: 7 days Harvest: 7 days	- Use lower rate if ryegrass is flowering and higher rate if ryegrass is at milky dough stage. - Application should be made at or after crop maturity. Application before this time may significantly reduce yields (in practice losses in excess of 25% can occur). - Apply when the average seed moisture content is below 30%. For Faba beans this is indicated by the pods going black, for Field peas by the pods going yellow. - DO NOT USE ON CROPS INTENDED FOR SEED OR SPROUTING
		To desiccate crop as a harvest aid and weed control (may reduce germination % of seed to unacceptable levels of crops intended for production)	Chickpeas, Faba beans, Field peas, Lentils	680 mL - 1.8 L/ha	GSF: 7 days Harvest: 7 days	- Apply by boom or by air. Use higher rates where crops or weeds are dense and where faster desiccation is required. Application should be made at or after crop maturity. - Chickpeas and Lentils - apply when physiologically mature and less than 15% green pods. - Field peas - apply when seeds turn yellow and average seed moisture content is below 30%. - Faba beans - apply when the pods turn black and average seed moisture content is below 30%.
Metsulfuron + Glyphosate **540 g/L**	Ally® +Roundup PowerMAX®[2]	Crop desiccant and knockdown weed control	Chickpeas	5 g + 0.5-1.1 L	GSF: 7 days Harvest: 7 days	- Apply when chickpeas physiologically mature with < 15% green pods - Use higher glyphosate rate when crops or weeds are dense and faster desiccation required.

[1,2] While there are alternative glyphosate and metsulfuron products available as far as we can determine they do not currently have these registrations on their labels for WA and as such cannot be used for this use. Registration changes occur frequently. Check the label of your specific product to see if a registration is in place for Western Australia.

Figure 9-2. DAF Spray Charts. Page 4 of 7. Print A3 for best results.

HERBICIDE OPTIONS FOR USE IN LEGUME PASTURES

PRE-EMERGENCE: IMAZETHAPYR 700 g/kg (Spinnaker®); S-METOLACHLOR 960 g/L (Dual® Gold); TRIFLURALIN 480 g/L
POST-EMERGENCE: all other columns

Weeds	IMAZETHAPYR 700 g/kg (Spinnaker®)	S-METOLACHLOR 960 g/L (Dual® Gold) Alternative concentration/s available	TRIFLURALIN 480 g/L Alternative concentration/s available	2,4-D AMINE 500 g/L (Spray/Graze) Alternative concentration/s available	2,4-DB 500 g/L (e.g. Buttress®) Alternative concentration/s available	ATRAZINE 500 g/L Alternative concentration/s available	BROMOXYNIL 200 g/L (e.g. Bromicide®)	BROMOXYNIL/DIFLUFENICAN 250/25 g/L (e.g. Jaguar®) Alternative concentration/s available	See notes regarding rates BUTROXYDIM/FLUAZIFOP 250/212 g/kg (Fusion®Super)	DICLOFOP-METHYL 375 g/L	DIFLUFENICAN 500 g/L (e.g. Brodal® Options)	DIFLUFENICAN/MCPA 25/250 g/L (e.g. Tigrex®) Alternative concentration/s available	DIQUAT 200 g/L (Reglone®)	DIURON 900 g/kg Alternative concentration/s available	FLUAZIFOP-P-BUTYL 128 g/L (Fusilade® Forte) Alternative concentration/s available
Herbicide Group	B	K	D	I	I	C	C	C/F	A/A	A	F	F/I	L	C	A
Annual ryegrass	70-140 g S	NRW	1.2-1.7 L			NRW			230-320 g	1.0 L				1.0-2.0 kg	820 mL Luc 0.82-1.24 L
Barley grass	70-140 g S		NRW						230-320 g				see label	1.0-2.0 kg	820 mL Luc 0.82-1.24 L
• Brome grass			NRW S						285-320 g				see label	NRW S	820 mL Luc 0.82-1.24 L
• Cape tulip				NRWA	see label										
Capeweed	NRWA S			0.75-1.0 L	2.1-3.2 L	NRW	1.4-2.0 L	500 mL-1.0 L			200 mL S	0.5-1.0 L	see notes	1.0-2.0 kg	
• Chickweed	NRWA							1.0 L S			NRWA S	1.0 L S		2.0 kg	
Corn gromwell (Ironweed, Sheepweed)							1.4-2.0 L	500-750 mL			200 mL S	1.0 L		NRW S	
•Cotula							NRWA	NRWA							
• Crassula								500 mL S			200 mL S	500-750 mL		NRW	
Dock (seedlings)				0.75-1.0 L	1.0-2.0 L			1.0 L S				1.0 L S		2.0 kg	
Doublegee (Spiny emex)	70-140 g S			0.75-1.0 L	2.1-3.2 L	NRW	2.0 L	500-750 mL				1.0 L S		1.0-2.0 kg	
• Erodium (Storksbill)	70-140 g			NRWA				500 mL S				1.0 L S	see notes	NRW	
• Fumitory			1.2-1.7 L	see label	see label		2.0 L S	0.75-1.0 L S				see label			
• Iceplant						Permit						1.0 L S		NRW	
• Lesser Canary grass			1.2-1.7 L						230-320 g						820 mL Luc NRW
• Mallows					Not common WA species			NRWA S			200 mL S	1.0 L S			
Mintweed (*Salvia reflexa*)	NRWA					1.1 kg		NRWA S							
• Mustards	70-140 g			0.75-1.0 L	1.0-2.0 L	NRW	2.0 L	0.5-1.0 L			100-200 mL	0.5-1.0 L		NRW	
Paterson's curse	70-140 g S			0.75-1.0 L	2.1-3.2 L		2.0 L S	500-750 mL			NRWA S	1.0 L S			
Peppercress							1.4-2.0 L	1.1 L				1.0 L S			
Prickly lettuce	NRWA S			NRW	2.1-3.2 L			1.0 L S			NRWA	0.5-1.0 L			
Saffron thistle				1.5 L	2.1-3.2 L		1.4-2.0 L	1.0 L				1.0 L S		1.0-2.0 kg	
Silvergrass (Vulpia)													see label		
Slender thistle				0.75-1.0 L	2.1-3.2 L									1.0-2.0 kg	
Sorrel (seedlings)				NRWA				1.0 L S			NRWA S	NRWA			
Sowthistle				0.75-1.0 L	2.1-3.2 L			1.0 L S				1.0 L S		1.0-2.0 kg	
Toad rush	70-140 g	200-250 mL						1.0 L S			NRWA S	1.0 L		NRW	
Volunteer canola	NRW not IT			NRW				500-750 mL				500 mL			
Volunteer cereals									230-320 g						820 mL Luc NRW
Volunteer field peas								750 mL S							
Volunteer lupins	NRW			NRWA				0.5-1.0 L S				1.0 L S			
Wild oat	70-140 g S		1.2-1.7 L S						230-320 g	1.5-2.0 L				NRWA	820 mL Luc 0.82-1.24 L
Wild radish	70-140 g S			0.75-1.0 L	NRWA S	NRW	2.0 L	350 mL-1.0 L			100-200 mL	0.25-1.0 L		NRWA	
Wild turnip				0.75-1.0 L	1.0-2.0 L	NRW	2.0 L	500-750 mL			100-200 mL	0.5-1.0 L		NRWA	
Wireweed	70-140 g S		1.2-1.7 L	NRW	2.1-3.2 L	NRW	2.0 L S	1.0 L			NRWA S	750 mL S		2.0 kg	
Yellow burrweed	NRWA S		NRW				1.4-2.0 L	750 mL			NRWA S			NRW	
Lucerne 1st Year	X	NRC	IBS SCO	NRC	see label	X	1 leaf +	3-8 leaf	PO	SCO	NRC	NRC	NRC	X	> 2-3 leaf
Lucerne Established	after C/G	NRC	IBS SCO	NRC	see label	PO	< 150 mm regrowth	PO	PO	SCO	NRC	NRC	see label	see notes	PO
Medic	NRC	NRC	IBS SCO	NRC	3-8 leaf	NRC	see label	see label	PO	SCO	NRC	NRC	NRC	NRC	PO
Sub Clover	NRC	IPP	IBS SCO	see label	3-8 leaf	NRC	1 leaf +	3-8 leaf	PO	SCO	> 3 leaf	3-8 leaf	NRC	NRC	PO
Serradella	see label	NRC	NRC	NRC	NRC	NRC	NRC	NRC	NRC	SCO	NRC	NRC	NRC	NRC	NRC
Weed Stage	PE	PE	PE	see label	2-6 leaf	5-8 cm	to 6 leaf	see label cot-8 leaf	2 leaf-ET	2-4 leaf	2-6 leaf see label	2-6 leaf see label	see label	PE - seedling	5 leaf - ET
Wetting agent (WA)/Oil	NN	NN	NN	NN	see label	NN	NN	NR	Oil required	WA	NR	NR	WA	NN	NN
Formulation	WG	EC	EC	AC	AC	tank mix	EC	EC	EC	EC	SC	EC	AC	WG	EC
Rainfastness	2 hours	NS	NS	6 hours	4 hours	NS	3 hours	4 hours	1 hour	2 hours	4 hours	4 hours	NS	NS	1 hour
Aerial application	Yes	No	No	Yes	No	No	Yes	NR	Yes	Yes	NS	Not WA	Yes	No	Yes
Withholding Period- GSF	14 days	13 weeks	NRD	7 days	7 days	NRD	14 days	14 days	21 days	7 weeks	14 days	7 days	1 day	NRD	21 days

Weeds	FLUMETSULAM 800 g/kg (Broadstrike®) Alternative concentration/s available	HALOXYFOP 520 g/L (e.g. Verdict® 520) Alternative concentration/s available	IMAZAMOX 700 g/kg (Raptor®)	IMAZETHAPYR 700 g/kg (Spinnaker®)	MCPA AMINE 500 g/L (Spray/graze)	PARAQUAT (e.g. Gramoxone®) 250 g/L (Autumn/early winter)	PARAQUAT (e.g. Gramoxone®) 250 g/L (Late winter/early spring)	PARAQUAT/DIQUAT 135/115 g/L (e.g. Spray.Seed®)	PROPAQUIZAFOP 100 g/L (e.g. Correct®)	PROPYZAMIDE 500 g/L (e.g. Kerb®)	QUIZALOFOP-P-ETHYL 99.5 g/L (e.g. Targa®) Alternative concentration/s available	SETHOXYDIM 186 g/L (Sertin®)	SIMAZINE 500 g/L Alternative concentration/s available	TEPRALOXYDIM 200 g/L (Aramo®)	TERBUTRYN/MCPA 275/160 g/L (e.g. Agtryne® MA)
Herbicide Group	B	A	B	B	I	L	L	L/L	A	K	A	A	C	A	C/I
Annual ryegrass		75-100 mL + oil 100 mL + WA				Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L	300-450 mL	1.0-1.5 L	300 or 375 mL	0.5-1.0 L		175-300 mL	
Barley grass		50-75 mL + oil 75-100 mL + WA	45 g			Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L	200 mL	1.0-1.5 L	250 mL	see label		175-250 mL	
• Brome grass		50-75 mL + oil 75-100 mL + WA	45 g			Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L	300 mL	1.0-1.5 L	300 or 375 mL	see label		175-250 mL	
• Cape tulip					see label										
Capeweed	25 g + D see label				0.35-1.4 L	see label	see label	1.6-2.4 L							1.0-1.5 L
• Chickweed	NRWA S		NRW					1.6-2.4 L		1.5-2.0 L					
Corn gromwell (Ironweed, Sheepweed)								1.6-2.4 L							NRW
•Cotula	25 g					**	**								
• Crassula						**	**								1.0-1.5 L
Dock (seedlings)					0.35-1.4 L										
Doublegee (Spiny emex)	25 g + D		45 g S	see notes		**	**	1.6-2.4 L							NRW
• Erodium (Storksbill)		50-100 mL + oil	45 g		NRWA	see label	see label	1.6-2.4 L							1.0-1.5 L
• Fumitory	NRWA S				see label	**	**	1.6-2.4 L							
• Iceplant															
• Lesser Canary grass						Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L		1.0-1.5 L		1.0 L			
• Mallows	25 g see label					**	**	1.6-2.4 L							
Mintweed (*Salvia reflexa*)															
• Mustards	25 g		45 g	70-140 g	0.35-1.4 L	**	**	1.6-2.4 L							NRW
Paterson's curse	25 g S				0.35-1.4 L			1.6-2.4 L		1.5-2.0 L					300-500 mL or 1.0-1.5 L
Peppercress	25 g														
Prickly lettuce															
Saffron thistle					NRWA										NRW
Silvergrass (Vulpia)			50 g see label			Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L		1.0-1.5 L			0.75-1.0 L		
Slender thistle					NRWA										
Sorrel (seedlings)										1.5-2.0 L					
Sowthistle					NRWA										
Toad rush				70-140 g		**	**	1.6-2.4 L							1.0-1.5 L
Volunteer canola	25 g (Not IT)				NRWA	**	**	1.6-2.4 L							
Volunteer cereals		50-75 mL + oil 75-100 mL + WA	45 g			Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L	200 mL B, O, W 250 mL Tr	NRW	250 mL B, W	1.0 L W, O		175-250 mL	
Volunteer field peas								1.6-2.4 L							
Volunteer lupins	10-25 g		45 g		see label	**	**	1.6-2.4 L							
Wild oat		37.5-50 mL + oil 50-75 mL + WA	45 g			Sub 0.6-1.6 L Luc 1.2-1.6 L	Luc 1.6-2.4 L	1.6-2.4 L	250 mL	1.5-2.0 L	125 or 250 mL	1.0 L		175-250 mL	
Wild radish	25 g S		45 g S		0.35-1.4 L			1.6-2.4 L							
Wild turnip	25 g		45 g		0.35-1.4 L			1.6-2.4 L							NRW
Wireweed	see label		45 g S	70-140 g S				1.6-2.4 L		1.5-2.0 L					NRW
Yellow burrweed	25 g														NRW
Lucerne 1st Year	> 2-3 leaf	> 2 leaf	3 leaf - pre fl	2 leaf +	NRC	X	X	X	PO	3 leaf +	PO	PO	NRC	NRC	NRC
Lucerne Established	PO	> 2 leaf	pre fl	after C/G	NRC	> 12 month	> 12 month	2-4 cm see notes	PO	pre July 31	PO	PO	see label	NRC	NRC
Medic	> 2-3 leaf	> 2 leaf	3 leaf - pre fl see notes	NRC	NRC	NRC	NRC	NRC	PO	3 leaf +	PO	PO	NRC	NRC	NRC
Sub Clover	> 2-3 leaf	> 2 leaf	3 leaf - pre fl	see label	4 leaf - pre fl	> 6 leaf	NRWA	> 6 leaf see notes	PO	3 leaf +	PO	PO	3 leaf < 8 wks post sow	SCO	3 leaf +
Serradella	> 3 leaf	NRC	3 leaf - pre fl	2 leaf +	NRC	NRC	NRC	NRC	PO	see label	NRC	NRC	NRC	NRC	NRC
Weed Stage	< 10 cm see label	2 leaf-ET	Gr < 2 T Bl cot-3 leaf	cot-3 leaf	cot-5 cm see label	young	young	< 10 cm	3 leaf-MT	PE-PO see label	3 leaf-ET/MT	2-6 leaf/T	2 leaf-T Gr	2 leaf-FT	see label
Wetting agent (WA)/Oil	see label	see label	WA see label	WA	NN	see label	see label	see label	WA or veg oil	see label	WA &/or Oil	Oil required	NR	Oil	NN
Formulation	WG	EC	WG	WG	AC	AC	AC	AC	EC	SC	EC	EC	SC	EC	SC
Rainfastness	4 hours	1 hour	2 hours	2 hours	6 hours	1 hour	1 hour	1 hour	1 hour	NS	3 hours	2 hours	NS	1 hour	6 hours
Aerial application	Yes	Yes	No	No	Yes	No	No	No	Yes	NS	NS	Yes	No	No	Yes
Withholding Period- GSF	3 days	Luc 21 days Sub/Med 7 days	7 days	14 days	7 days	1 day (horses 7 days)	1 day (horses 7 days)	1 day (horses 7 days)	3 days	25 days	Luc 28 days Sub/Med 14 days	14 days	grazing 14 days cutting 21 days	4 weeks	7 days

Code	Definition
•	Check label for species controlled
**	Label states 'will provide control of some small broad-leaved weeds'
AC	Aqueous concentrate
After C/G	After cutting and/or grazing
B	Barley
Bl	Broad-leaved weeds
cot	Cotyledon
D	Diuron
DNG	Do not graze
EC	Emulsifiable concentrate
ET	Early tillering
fl	Flowering
FT	Full tillering
Gr	Grass weeds
GSF	Withholding period for grazing or cutting for stock food
IBS	Incorporated by sowing
IPP	Immediately post planting
Luc	Lucerne
Med	Medics
MT	Mid tillering
NN	Not necessary
Not IT	Inadequate control of imidazolinone tolerant canola
NR	Not recommended
NRC	Not registered for use in this crop (pasture)
NRD	Withholding period not required when used as directed
NRW	Not registered for this weed in these crops (pastures)
NRWA	No registration for this pattern of use in WA
NS	Not stated
O	Oat
Oil	Spray oil
PE	Pre-emergence
Per/Permit	Use permitted under APVMA permit
PO	Post-emergence
Pre fl	Pre flowering
Pre S	Pre sowing
PSPE	Post sowing pre-emergence
S	Suppression only of this weed
SC	Suspension concentrate
SCO	Seed crops only
see label	Refer to label for clarification on tank mixes, growth stages, adjuvants etc.
Sub	Sub. clover
Tr	Triticale
T	Tiller/s, tillering
veg oil	Vegetable based spray oil
W	Wheat
WA	Wetting agent
WG	Water dispersible granule
WP	Wettable powder
X	DO NOT USE on first year lucerne

Note: The use of brand, trade and proprietary names has been done solely for the purpose of assisting users in identifying products.
It does not imply a preferred recommendation. Alternative products with the same active ingredient as products specified on this chart may perform as well or better than those specified products.

Pasture tolerances
Exact values for species/variety tolerance are difficult to determine as variations can occur due to stage of pasture growth, variety or environmental conditions. Follow label directions. Seek advice from your chemical manufacturer, Department of Agriculture or local agronomist on individual species/variety tolerance.

POISON'S EMERGENCY INFORMATION CENTRE
13 11 26

- Herbicide resistance to this mode of action sub group is confirmed in Australian populations of this weed.
- Herbicide resistance has been confirmed in Australian populations of this weed species to one or more MOA components of this herbicide mixture.
- Herbicide resistance is expected based on other data.

STOP **ALWAYS READ THE LABEL OF THE PRODUCT YOU ARE ABOUT TO USE**

- **Product registrations may vary between seasons.**
- There may be variation in rates, registered uses and/or withholding periods between labels of individual products containing the same active ingredient
- **Always check the label to ensure compliance with the registrations of the specific product being used.**

Figure 9-2. DAF Spray Charts. Page 5 of 7. Print A3 for best results.

HERBICIDE OPTIONS FOR WEED CONTROL IN PULSE CROPS

PRE CROP EMERGENCE HERBICIDE OPTIONS

Weeds	ATRAZINE + SIMAZINE 500+500 g/L (Alternative concentration/s available)	CARFENTRAZONE-EHTYL 240 g/L (Hammer®)	CYANAZINE 900 g/kg (Bladex®) (Alternative concentration/s available)	DIURON 900 g/kg (Alternative concentration/s available)	DIURON + TRIFLURALIN 500 g/L + 480 g/L respectively (Alternative concentration/s available)	IMAZETHAPYR 700 g/kg (Spinnaker®)	ISOXAFLUTOLE 750 g/kg (Balance®)	METRIBUZIN 750 g/kg (e.g. Lexone®) (Alternative concentration/s available)	PENDIMETHALIN 330 g/L (Alternative concentration/s available)	SIMAZINE 500 g/L (Alternative concentration/s available)	SIMAZINE + TRIFLURALIN 500 g/L + 480 g/L respectively (Alternative concentration/s available)	TRI-ALLATE 500 g/L (e.g. Avadex® Xtra) (Alternative concentration/s available)	TRIFLURALIN 480 g/L (Alternative concentration/s available)
Herbicide Group	C+C	G	C	C	C+D	B	F	C	D	C	C+D	E	D
Annual ryegrass	0.5-1.0 L + 0.5-1.0 L Sim S		1.1 kg	Lu 1.1 kg S Fp 835 g-1.2 kg	2.0 L + 1.25 L trif S	70 g S		180-380 g S see label	2.0-3.0 L see label	see notes	see notes	see notes	1.2-1.7 L
Barley grass	0.5-1.0 L + 0.5-1.0 L Sim S		1.1 kg S	Fp 835 g-1.2 kg		70 g S		see label		see notes	see notes		
• Brome grass	0.5-1.0 L + 0.5-1.0 L Sim S		1.1 kg S	Lu 1.1 kg S Fp 835 g-1.2 kg				180-380 g		see notes	see notes		1.7 L S
Capeweed	0.5-1.0 L + 0.5-1.0 L Sim	25-75 mL + kdown	1.1 kg	Lu 1.1 kg Fp 835 g-1.2 kg		NRWA S	100 g	180-380 g S see label		see notes	see notes		
• Clovers	0.5-1.0 L + 0.5-1.0 L Sim	25-75 mL + kdown		Lu 1.1 kg				180-380 g S		see notes	see notes		
Dock (seedling)	NRW			Lu 1.1 kg S				180-380 g		see notes	see notes		
Doublegee (Spiny emex)	0.5-1.0 L + 0.5-1.0 L Sim	25-75 mL + kdown	1.1 kg	Lu 1.1 kg Fp 835 g-1.2 kg	2.0 L + 1.25 L trif	70 g S	see label	180-380 g		see notes	see notes		
• Erodium	NRW	25-75 mL + kdown	NRWA			70 g		180-380 g		NRW	see notes		
• Fumitory	25-75 mL + kdown		1.1 kg S					180-380 g		see notes	see notes		1.2-1.7 L
• Lesser canary grass												see notes	1.2-1.7 L
Mallows		25-75 mL + kdown											
• Mustards	0.5-1.0 L + 0.5-1.0 L Sim		1.1 kg	Fp 835 g-1.2 kg		70 g	100 g	180-380 g		see notes	see notes		
Silver grass (Vulpia)	0.5-1.0 L + 0.5-1.0 L Sim						see label	NRW	2.0-3.0 L S see label	see notes	see notes		
Sorrel (seedling)				Lu 1.1 kg S						see label			
Soursob				NRW						see label	see notes		
Volunteer canola	NRW not TT					NRW not IT				see notes not TT			
Volunteer cereals	0.5-1.0 L + 0.5-1.0 L Sim S									see notes			
Volunteer lupins						NRW							
Wild oat	0.5-1.0 L + 0.5-1.0 L Sim S			Lu 1.1 kg S Fp 835 g-1.2 kg	2.0 L + 1.25 L trif S	70 g S		NRWA	2.0-3.0 L S	see notes	see notes	1.6 L	1.2-1.7 L S
Wild radish	0.5-1.0 L + 0.5-1.0 L Sim	25-75 mL + kdown	1.1 kg S	Lu 1.1 kg Fp 835 g-1.2 kg	2.0 L + 1.25 L trif	70 g S	100 g	180-380 g		see notes	see notes		
Wild turnip (Mediterranean turnip)	0.5-1.0 L + 0.5-1.0 L Sim		1.1 kg	Lu 1.1 kg Fp 835 g-1.2 kg	2.0 L + 1.25 L trif	NRW		180-380 g		see notes	see notes		
Wireweed	0.5-1.0 L + 0.5-1.0 L Sim		1.1 kg S	Lu 1.1 kg S		70 g S	see label	180-380 g S	2.0-3.0 L see label	see notes	see notes	see notes	1.2-1.7 L
Narrow leaved lupins	Pre S; PSPE	Pre S	NRC	Pre S; PSPE	IBS	NRC	NRC	NRC	IBS	Pre S; PSPE	IBS	IBS	IBS
Field peas	NRC	Pre S	Pre S; 3-5 node	Pre S; PSPE see notes	NRC	PSPE	NRC	PSPE; 3 node Permit	IBS	NRC	NRC	IBS	IBS
Chickpeas	NRC	Pre S	Pre S	NRC	NRC	NRWA	PSPE	PSPE	IBS	Pre S; PSPE	IBS	IBS	see label
Faba beans	NRC	Pre S	Pre S	NRC	NRC	PSPE	NRC	PSPE	IBS	Pre S; PSPE	IBS	IBS	see label
Lentils	NRC	Pre S	Pre S	NRC	NRC	NRC	NRC	PSPE	NRC	NRC	NRC	NRC	NRWA
Vetches	NRC	Pre S	NRWA	NRC	NRC	NRC	NRC	PSPE	NRC	NRC	NRC	NRC	IBS
Weed Stage	PE	< 6-8 leaf	PE-3 cm	PE-seedling	PE	PE	PE	PE-4 leaf	PE	PE	PE	PE	PE
Wetter(WA)/Oil	NN	see label	NR	NN	NN	NN	NR	NR	NN	NN	NN	NN	NN
Formulation	tank mix	EC	WG	WG	tank mix	WG	WG	DF/WG	EC	SC	tank mix	EC	EC
Rainfastness	NS	1 hour see notes	NS	NS	NS	2 hours	NS	NS	NS	NS	NS	NS	NS
Aerial application	No	No	No	No	No	Yes	No	see label	No	No	No	NS	No
Withholding period	H & GSF see labels	H NRD GSF 14 days	H & GSF NRD	H & GSF NRD	H & GSF NRD	H NRD GSF 14 days	H NRD GSF 4 wks	H NRD GSF-0 or 14 days see label	H & GSF NRD	H NRD GSF Ck 9 wks GSF Fb 8 wks	H NRD GSF Ck 9 wks GSF Fb 8 wks	NRD	H & GSF NRD
Notes	Do not use on whitish or grey sands. Apply maximum of 750 mL/ha atrazine + 750 mL/ha simazine on yellow sands. **DO NOT** apply atrazine post emergence to lupins - it will kill them. Sufficient rainfall to wet the soil through to the root zone necessary within 2-3 weeks of application.	CAUTION: Emerged grain legumes are extremely sensitive to Hammer®. Ensure boom cleaned thoroughly as per label instructions prior to post-emergent spraying. Addition to knockdown improves speed at which visual symptoms develop. Do not sow for one hour after application. Use low rates for small weeds in good growing conditions. Use high rates for older weeds that may have grown in less than optimal conditions.	Temporary crop damage (yellowing) may occur where applied to crops grown on sand over clay (duplex soils). Do not apply to soils with high sand or gravel content. For peas, pre-sowing applications preferred to post emergent application, check label. If mixing with glyphosate add ammonium sulphate 2% w/v.	**Peas:** Do not use on sandy soils. Use lower rate pre-sowing in low rainfall wheatbelt and use higher rate immediately after sowing in Great Southern area. Weak on grasses. Tank mix with trifluralin where annual ryegrass is expected. [Apply to lupins on light soils only]. Do not use on white or grey sands. Apply in minimum 50 L water/ha.	Will provide better control of annual ryegrass than diuron alone.	Spinnaker® may not kill weeds, however severe weed stunting will eliminate competition. Do not apply after end of June in low rainfall areas.	Ensure applied after furrow closure, direct contact of herbicide with seed may cause crop injury. A minimum spray volume 50 L/ha recommended. Refer to label for plant back periods for other crops and minimum post application rainfall requirements.	Use lower rates on sands and highest rates on very heavy soils. Plant crop at least 5 cm deep. Best results when rain follows within a few days of spraying. Note: Use in peas permitted under permit. Note: Can be applied as an early post-emergent option in field peas only when the crop is at the 3 node stage. Post emergent application to other pulse crops will result in crop damage.	Incorporate by sowing within 24 hours of application. Attempting to incorporate when soils are very wet or very dry may result in insufficient mixing and therefore poor weed control.	Rates - Chickpeas 1.0-2.0 L/ha; Faba beans 2.0-2.5 L/ha; Lupins 1.0-2.0 L/ha on light soils; 2.0-3.0 L/ha on gravelly loam soils. Add trifluralin if annual ryegrass or wild oats are expected.	Rates - Chickpeas 2.0 L/ha Sim + 1.25-1.7 L/ha trifluralin; Faba beans 1.0-1.5 L/ha Sim + 800 mL/ha of trifluralin; Lupins 1.0-2.0 L/ha Sim + 1.25 L/ha of trifluralin. For lupins maximum 1.5 L/ha simazine on yellow sands. Application should not be made to ridged or excessively cloddy soil.	Apply up to 3 weeks before to immediately before sowing. Incorporate immediately on wet soil, on dry soil, may be left for up to 24 hours. Plant 5 cm deep. Tank mix with trifluralin if annual ryegrass, annual phalaris or wireweed present or for enhanced control of wild oats emerging from top 1 cm.	Incorporate by seeding within 4 hours of application. Use lower rates on sandy soils. Use higher rate for heavy stubble cover. Stubble cover above 40-50% can reduce weed control achieved. Check rate for each crop species.

POST CROP EMERGENCE HERBICIDE OPTIONS

Weeds	BUTROXYDIM/FLUAZIFOP-P 250/212 g/L (Fusion® Super)	CLETHODIM 240 g/L (Select®)	CLETHODIM/HALOXYFOP 200/48 g/L (Motsa®)	CYANAZINE 900 g/kg (Bladex®) (Alternative concentration/s available)	DICLOFOP-METHYL 375 g/L	DIFLUFENICAN 500 g/L (e.g. Brodal® Options)	DIFLUFENICAN + METRIBUZIN 500 g/L + 750 g/kg respectively (Alternative concentration/s available)	FLUAZIFOP-P 128 g/L (Fusilade® Forte) (Alternative concentration/s available)	FLUMETSULAM 800 g/kg (Broadstrike®)	HALOXYFOP 520 g/L (e.g. Verdict® 520) (Alternative concentration/s available)	IMAZAMOX 700 g/kg (Raptor®)	METOSULAM 714 g/L (Eclipse®)	PICOLINAFEN 750 g/kg (Sniper®)	PROPAQUIZAFOP 100 g/L (e.g. Correct®)	QUIZALOFOP-P-ETHYL 99.5 g/L (e.g. Targa®) (Alternative concentration/s available)	SETHOXYDIM 186 g/L (Sertin®)	SIMAZINE "top up" 500 g/L (Alternative concentration/s available)	TEPRALOXYDIM 200 g/L (Aramo®)
Herbicide Group	A/A	A	A/A	C	A	F	F+C	A	B	A	B	B	F	A	A	A	C	A
Annual ryegrass	230-320 g	150-250 mL	200-300 mL	0.55-1.1 kg	1.0 L			410-820 mL see label		75-100 mL Oil 100 mL WA				300-450 mL see label	300 or 375 mL	0.5-1.0 L	0.75-2.0 L S	175-300 mL
Barley grass	230-320 g	175-250 mL	150-200 mL	0.55-1.1 kg S				410-820 mL see label		50-75 mL Oil 75-100 mL WA	45 g			200 mL see label	250 mL	see label	0.75-2.0 L S	175-250 mL
• Brome grass	285-320 g	175-250 mL	150-200 mL	0.55-1.1 kg S				410-820 mL see label		50-75 mL Oil 75-100 mL WA	45 g			300 mL see label	300 or 375 mL	see label	0.75-2.0 L S	175-250 mL
Capeweed				0.55-1.1 kg		200 mL S	100 mL + 100-150 g Mbz S		25 g S			NRW	50 g S				0.75-2.0 L	
• Clovers												NRW						
Dock (seedling)																	0.75-2.0 L	
Doublegee (Spiny emex)				0.55-1.1 kg			100 mL + 100-150 g Mbz S		25 g S		45 g S	NRW					0.75-2.0 L	
• Erodium				NRWA						NRW	45 g							
• Fumitory				0.55-1.1 kg S														
• Lesser canary grass	230-320 g	150-250 mL	150-200 mL					410-820 mL		NRW						1.0 L		
Mallows						200 mL S	NRW		NRW S									
• Mustards				0.55-1.1 kg		100-200 mL	NRW		NRWA		45 g	NRW					0.75-2.0 L	
Silver grass (Vulpia)											NRW						0.75-2.0 L	
Sorrel (seedling)						NRWA S												
Soursob																		
Volunteer canola									NRW not IT		NRW not IT	NRW not IT						
Volunteer cereals	230-320 g	175-250 mL W,O 250 mL B	150-200 mL					410-820 mL see label		50-75 mL Oil 75-100 mL WA	45 g			200 mL W,O,B 250 mL Tr	250 mL W, B	1.0 L W, O see label	0.75-2.0 L	175-250 mL
Volunteer lupins									25 g		45 g							
Wild oat	230-320 g	175-250 mL	150-200 mL		1.5-2.0 L			410-820 mL see label		37.5-50 mL Oil 50-75 mL WA	45 g			250 mL see label	125 or 250 mL see label	1.0 L	0.75-2.0 L S	175-250 mL
Wild radish				0.55-1.1 kg S		100-200 mL	100 mL + 100-150 g Mbz		25 g S		45 g S	7-10 g	33-50 g				0.75-2.0 L	
Wild turnip (Mediterranean turnip)				0.55-1.1 kg		100-200 mL	NRW		25 g		45 g	NRW					0.75-2.0 L	
Wireweed				0.55-1.1 kg S		NRWA S					45 g S							
Narrow leaved lupins	PO	PO-80% flower	PO-flower	NRC	PO	2-6 leaf see notes	> 3 leaf see label	PO	NRC	2 leaf-pre fl	NRC	8 leaf-flower bud	2-6 leaf	PO	PO	PO-pre fl	PO see notes	PO
Field peas	PO	PO-full flower	PO-flower	Pre S; 3-5 node	PO	3 node-pre fl	NRC	PO	2-6 nodes	2 node-pre fl	PO-4 node	NRC	3 node-pre fl	PO	PO	PO-pre fl	NRC	PO
Chickpeas	PO	PO-full flower	PO-flower	NRC	NRC	NRC	NRC	PO	4-6 branch	2 leaf-pre fl	NRC	NRC	NRC	PO	PO	PO-pre fl	NRC	PO
Faba beans	PO	PO-full flower	PO-flower	NRC	NRC	NRC	NRC	PO	NRC	2 leaf +	3-6 node Per	NRC	NRC	PO	PO	PO-pre fl	NRC	PO
Lentils	PO	PO-2 node	PO-7 node	NRC	NRC	3 leaf-pre fl	NRC	NRC	4-8 leaf	2 node-pre fl	NRC	NRC	NRC	PO	PO	PO-pre fl	NRC	PO
Vetches	PO	NRC	NRC	NRC	NRC	NRC	NRC	PO	NRC	2 node-pre fl	NRC	NRC	NRC	PO	PO	NRC	NRC	PO
Weed Stage	2 leaf-ET	2 leaf-FT	2 leaf-ET	PE-3 cm	2-4 leaf	2-6 leaf	to 25 cm	2 leaf-ET	< 5 cm	2 leaf-ET	Gr < 2 T Bl cot-3 leaf	< 8 leaf; < 20 cm	2-8 leaf	3 leaf-MT	3 leaf-ET/MT	2-6 leaf/T	2 leaf-T Gr < 10 cm Bl	2 leaf-FT
Wetter(WA)/Oil	Oil required	Oil see notes	Oil see notes	NR	WA	NR see notes	NR	NN	NR	see notes	WA	NR	NR	WA see label	WA & or Oil	Oil required	NN	Oil
Formulation	EW	EC	EC	WG	EC	SC	Tank mix	EC	WG	EC	WG	WG	WG	EC	EC	EC	SC	EC
Rainfastness	1 hour	1 hour	1 hour	8 hours	2 hours	4 hours	4 hours	1 hour	4 hours	1 hour	2 hours	2 hours	4 hours	1 hour	3 hours	2 hours	NS	1 hour
Aerial application	Yes	Yes	Yes	No	Yes	NS	No	Yes	Yes	Yes	No	see label	No	Yes	NS	Yes	No	No
Withholding period	see notes	H NRD GSF 21 days	H NRD GSF 8 wks	GSF & H NRD	H NRD GSF 7 wks	H NRD GSF 14 days	H NRD GSF 14 days	see label GSF 3-7 wks H 5-17 wks	H NRD GSF 4 wks	H NRD GSF 28 days	H NRD GSF 6 wks	H NRD GSF 4 wks	H NRD GSF Lu 6 wks GSF Fp 4 wks	see label H 7-15 wks	see label H 6-12 wks GSF 28 days	H NRD GSF 21 days	H NRD GSF see label	H 12 wks GSF 4 wks
Notes	Always apply with Supercharge® at 1 L/100 L, or D-C-Trate® at 2 L/100 L of spray solution. Do not apply in less than 50 L/ha water. Use lower rates for young weeds growing in ideal conditions, higher rates for weeds that are predominantly at early tillering, in dense populations or growing in less than ideal conditions Fb GSF&H 5 wks; Ck/Fp GSF&H 7 wks; Lu GSF 3 wks H 4 wks.	See label for specific details on crop growth stage. Use lower rates for small weeds in good growing conditions. Always apply with D-C-Trate® at 2 L/100 L; Hasten® or Kwickin® at 1 L/100 L volume; Uptake® at 500 mL/100 L spray volume. The addition of Liase® at 2% may improve control if application conditions are not ideal.	The lower doses will provide effective control if applied under ideal conditions to weeds that are smaller, actively growing and free from stress. Always apply with Hasten®, Kwickin® or Uptake® at 1 L/100 L of spray volume.	Use the higher rate where large weeds are present. Post emergence application to chickpeas, faba beans and lentils will result in crop damage.	Wetter essential unless not recommended for tank mixes. Check label for tank mix recommendations. 500 g/L formulations not registered in pulses.	150 mL/ha is the preferred rate when the first weeds are at the 4 leaf stage. Increase rates for older and larger weeds or for dense weed infestations. Do not add oil. Apply when weeds are actively growing. Best 4-6 weeks after sowing. Brodal® Options lupin growth stage 2 leaf - before start of primary flowering (Big Bud)	Crop damage (leaf burn) may occur if crop is stressed, e.g. by brown leaf spot or is still adversely affected by simazine. Not recommended where more than 2.5 L of simazine used before seeding. Do not apply with wetting agents, crop oils or grass selectives. Crop damage more common south of Great Eastern Highway. Do not apply to Myallie lupins if atrazine has been applied pre-emergence.	See label for maximum rate information for different pulse crops. Apply at lowest rate only if weeds not tillering and before 5 leaves present. Use higher rate once tillering started.	Do not apply to crops suffering from any other herbicide treatment. Lupins controlled at 25 g. Do not add oils and wetters.	**Note:** Latest crop growth stage for application varies between products - check label. Check label for tank mixing with post emergence broadleaf herbicides. Use non-ionic wetting agent where tank mixing. Increase rates when grasses more than 4 leaf stage. See label for specific adjuvant recommendations. Broadleaf herbicides should not be mixed with this product. Spray at least one week apart.	Do not use adjuvants other than BS 1000® or equivalent at 200 mL per 100 L water. Do not roll field peas after germination if use of Raptor® is planned. Controls lupins at 45 g. Faba bean registration on permit. Do not apply if frost is forecast.	Use only on healthy crops. A slight yellowing often accompanied by height reduction may be noticeable from 1-4 weeks after application. Do not use oils or wetters. Use higher rate when large wild radish populations or crop competition is poor.	Use lower rate on 2-4 leaf radish. Use higher rate at 4-6 leaf radish. To achieve effective control of 6-8 leaf radish good spray coverage of weeds is essential, majority of plants must be 2-6 leaf. Peas grown on high pH soils in the presence of free lime may be less tolerant.	Do not use crop oils. For best control wait until 75% of annual ryegrass have begun tillering. Can be tank mixed for broad spectrum of grass weeds. See label for details.	Use higher rate under high weed burden and/or when weeds are tillering. See label for specific adjuvant details.	See label for adjuvant requirements. Use 500 mL rate for annual ryegrass prior to tillering. See label for grass selective mixtures to improve control of brome, barley grass, wild oats and self sown cereals. Do not allow spray mix to sit overnight. See label for clarification of latest crop growth stages	Apply within 4 weeks of sowing. To be used in conjunction with pre-emergent application of simazine. Do not apply to lupins showing signs of damage from pre-emergent application.	Always apply Hasten® or Kwickin® at 1 L/100 L spray volume or similar adjuvant see label compatibility section. The lower doses will only provide effective control if applied under ideal conditions to susceptible weeds that are smaller, actively growing and free from temperature or moisture stress.

• Check label for species controlled

ALWAYS READ THE LABEL OF THE PRODUCT YOU ARE ABOUT TO USE AND FOLLOW THE DIRECTIONS ON THE LABEL

Figure 9-2. DAF Spray Charts. Page 6 of 7. Print A3 for best results.

HERBICIDE OPTIONS FOR WEED CONTROL IN CANOLA CROPS

PRE CROP EMERGENCE HERBICIDE OPTIONS

Weeds	ATRAZINE 500 g/L Only for TT varieties. Alternative concentration/s available	SIMAZINE 500 g/L Only for TT varieties. Alternative concentration/s available	CARFENTRAZONE-EHTYL 240 g/L (Hammer®)	s-METOLACHLOR 960 g/L (Dual®Gold) Alternative concentration/s available	ORYZALIN/TRIFLURALIN 125/125 g/L (e.g. Duet®/Yield®)	PENDIMETHALIN 330 g/L Alternative concentration/s available	TRI-ALLATE 500 g/L (e.g. Avadex®Xtra) Alternative concentration/s available	TRIFLURALIN 480 g/L Alternative concentration/s available
Herbicide Group	C	C	G	K	D/D	D	E	D
Annual ryegrass	2.0-4.0 L S	2.0-4.0 L S		NRW	1.6 or 2.3 L	1.8-3.0 L	NRW see notes	1.2-1.7 L
Barley grass	2.0-4.0 L S	2.0-4.0 L S						
♦ Brome grass	2.0-4.0 L S	2.0-4.0 L S						
Capeweed	2.0-4.0 L	2.0-4.0 L	25-75 mL + kdown					
♦ Clovers	2.0-4.0 L	2.0-4.0 L	25-75 mL + kdown					
Doublegee (Spiny emex)	2.0-4.0 L	2.0-4.0 L	25-75 mL + kdown					
♦ Erodium (Storksbill)	2.0-4.0 L	2.0-4.0 L	25-75 mL + kdown					
♦ Fumitory	2.0-4.0 L	2.0-4.0 L			1.6 or 2.3 L S			1.2-1.7 L
Medics	NRW							
♦ Mustards	2.0-4.0 L	2.0-4.0 L						
Silver grass (Vulpia)	2.0-4.0 L	2.0-4.0 L			1.6 L S	2.0-3.0 L S		
Toadrush				150-250 mL				
Volunteer cereals	NRW	NRW						
Volunteer legumes			NRW					
Wild oat	2.0-4.0 L S	2.0-4.0 L S			1.6 or 2.3 L S	1.8-3.0 L S	1.6 L	1.2-1.7 L
Wild radish	2.0-4.0 L S	2.0-4.0 L S	25-75 mL + kdown					
Wild turnip (Mediterranean turnip)	2.0-4.0 L	2.0-4.0 L						
Wireweed	NRW S	NRW			1.6-2.3 L	1.8-3.0 L	see notes	1.2-1.7 L
Canola Stage	Pre S; PSPE	Pre S; PSPE	Pre S	see notes	IBS	IBS	IBS	IBS
Weed Stage	PE-2 leaf	PE	< 6-8 leaf	PE	PE	PE	PE	PE
Wetting agent (WA)/Oil	see label	NN	see label	NN	NN	NN	NN	NN
Formulation	SC	SC	EC	EC	EC	EC	EC	EC
Rainfastness	NS	NS	1 hour	NS	NS	NS	NS	NS
Aerial Application	No	No	No	No	No	No	No	No
Withholding Period - Harvest	NRD	NRD	NRD	NRD	NRD	NRD	NRD	NRD
Withholding Period - GSF	15 weeks	15 weeks	14 days	10 weeks	NRD	NRD	NRD	NRD

POST CROP EMERGENCE HERBICIDE OPTIONS

Weeds	ATRAZINE 500 g/L Only for TT varieties. Alternative concentration/s available	BUTROXYDIM/FLUAZIFOP-P 250/212 g/L (Fusion®) Super	CLETHODIM 240 g/L (Select®)	CLETHODIM/HALOXYFOP 200/48 g/L(Motsa®)	CLOPYRALID 300 g/L (e.g. Lontrel®) Alternative concentration/s available	DICLOFOP-METHYL 375 g/L	FLUAZIFOP-P 128 g/L (Fusilade® Forte) Alternative concentration/s available	HALOXYFOP 520 g/L (e.g. Verdict® 520) Alternative concentration/s available	PROPAQUIZAFOP 100 g/L (e.g. Correct®)	QUIZALOFOP-P-ETHYL 99.5 g/L (e.g. Targa®) Alternative concentration/s available	SETHOXYDIM 186 g/L (Sertin®)	TEPRALOXYDIM 200 g/L (Aramo®)	IMAZAPIC/IMAZAPYR 525/175 g/kg (OnDuty®) (Clearfield) varieties Only for imidazolinone tolerant (IT)
Herbicide Group	C	A/A	A	A/A	I	A	A	A	A	A	A	A	B/B
Annual ryegrass	1.0-2.0 L	210 g	150-250 mL	200-300 mL		1.0 L	410 mL see label	75-100 mL Oil 100 mL WA	300-450 mL see label	300 or 375 mL	0.5-1.0 L see label	175-300 mL	40 or 55 g
Barley grass	NRW	210 g	175-250 mL	150-200 mL			410 mL see label	50-75 mL Oil 75-100 mL WA	200 mL see label	250 mL	see label	175-250 mL	40 g
♦ Brome grass	NRW	250-280 g	175-250 mL	150-200 mL			NRW	50-75 mL Oil 75-100 mL WA	300 mL see label	300 or 375 mL	see label	175-250 mL	40 g
Capeweed	NRW				300 mL								see notes
♦ Clovers					150 mL								40 g
Doublegee (Spiny emex)	NRW												40 g
♦ Erodium (Storksbill)								NRW					40 g S
♦ Fumitory													40 g
Medics					150 mL								40 g S
♦ Mustards	1.0-2.0 L												20-40 g
Silver grass (Vulpia)	NRW												40 g S see label
Toadrush													40 g
Volunteer cereals	NRW	210 g	175-250 mL W,O 250 mL B	150-200 mL			410 mL see label	50-75 mL Oil 75-100 mL WA	200 mL W,B,O 250 mL Tr	250 mL B,W	1.0 L W, O see label	175-250 mL	20 g O 40 g W, B
Volunteer legumes					100-250 mL see label								40 g S vetch only
Wild oat		210 g	175-250 mL	150-200 mL		1.5-2.0 L	410 mL see label	37.5-50 mL Oil 50-75 mL WA	250 mL see label	125 or 250 mL	1.0 L see label	175-250 mL	20-40 g
Wild radish	1.0-2.0 L												20-40 g
Wild turnip (Mediterranean turnip)	1.0-2.0 L												20-40 g
Wireweed	NRW												40 g
Canola Stage	PO	4 leaf +	PO-BFB	BSE; BFB	2-8 leaf	PO	PO-6 leaf	2 leaf-BSE	PO	PO	PO-BFB	PO-BSE	2-6 leaf
Weed Stage	PE-2 leaf	2 leaf-ET	2 leaf-FT	2 leaf-ET	< 10 cm	2-4 leaf	2-5 leaf	2 leaf-ET	3 leaf-MT	3 leaf-ET/MT	2-6 leaf	2 leaf-FT	see label
Wetting agent (WA)/Oil	Oil required	Oil required	Oil see notes	Oil see notes	NN	WA	NN	see notes	WA see label	WA &/or Oil	Oil required	Oil required	Oil
Formulation	SC	WG	EC	EC	AC	EC	EC	EC	EC	EC	EC	EC	WG
Rainfastness	NS	1 hour	1 hour	1 hour	3 hours	2 hours	1 hour	1 hour	1 hour	3 hours	2 hours	1 hour	2 hours
Aerial Application	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NS	Yes	No	No
Withholding Period - Harvest	NRD	17 weeks	NRD	8 weeks	12 weeks	NRD	17 weeks	NRD	16 weeks	11 weeks	NRD	NRD	NRD
Withholding Period - GSF	6 weeks	21 days	21 days	8 weeks	12 weeks	7 weeks	21 days	28 days	see label	28 days	21 days	4 weeks	6 weeks

Notes

- **Atrazine (pre):** **Only for Triazine Tolerant (TT) Canola!** For best results apply to bare moist soil, either immediately before seeding or as a PSPE treatment at or within 7 days of sowing. The use of atrazine in canola is subject to adherence to the Integrated Weed Management strategy for TT Canola. See label for details.
- **Simazine:** **Only for Triazine Tolerant (TT) Canola!** For best results apply to bare moist soil, either immediately before seeding or as a PSPE treatment at or within 7 days of sowing. The use of simazine in canola is subject to adherence to the Integrated Weed Management strategy for TT Canola. See label for details.
- **Carfentrazone-ehtyl:** CAUTION: Emerged canola is extremely sensitive to Hammer®. Ensure boom cleaned thoroughly as per label instructions prior to post-emergent spraying. Apply with knockdown herbicides at label rates to increase visual speed at which broadleaf weeds develop visual symptoms and improve final control. Do not sow for one hour after application. Use low rates for small weeds in good growing conditions. Use high rates for older weeds that may have grown in less than optimal conditions.
- **s-Metolachlor:** Apply to moist soil. Use rates toward higher end of range where longer residual control is required. Apply at or immediately after planting before crops and weeds emerge. When sowing using knife points and zero tillage and leaving a seeding slot do not apply post seeding unless harrows or similar have filled-in the seeding slot before application. Alternatively apply immediately before seeding.
- **Oryzalin/Trifluralin:** Incorporation within 4 hours of application recommended. If tank mixing with knockdown herbicides the mixture should be kept thoroughly agitated and sprayed within 1 hour of mixing. Low rate for use with conventional cultivation, high rate for use with direct seeding.
- **Pendimethalin:** Incorporate by sowing within 24 hours of application. Use higher rates on medium to heavy textured soils and lower rates on light textured soils. Heavy soil which are cloddy or have surface crust or surface seal should be avoided. Waterlogged conditions after application may retard emergence.
- **Tri-allate:** Apply up to 3 weeks before to immediately before sowing. Incorporate immediately on wet soil, on dry soil, may be left for up to 24 hours. Plant 5 cm deep. Tank mix with trifluralin, if annual ryegrass, annual phalaris or wireweed are present and for enhanced control of wild oats emerging from top 1 cm of seed bed.
- **Trifluralin:** Apply 4 weeks before or just before sowing. Incorporate within 4 hours. Water logging immediately post seeding and or sowing deeper than approx. 1-2 cm can severely reduce emergence.
- **Atrazine (post):** **Only for Triazine Tolerant (TT) Canola!** Apply to moist soil when weeds are actively growing. The addition of 0.5-1% v/v of crop oil will enhance post emergence activity. The use of atrazine in canola is subject to adherence to the Integrated Weed Management strategy for TT Canola. See label for details.
- **Butroxydim/Fluazifop-P:** Always apply with Supercharge® at 1 L/100 L, or D-C-Trate® at 2 L/100 L. Canola can be sensitive. To minimise leaf symptoms do not apply to any variety before majority (80%) of plants are at the true 4 leaf stage (4th leaf expanded 5th leaf emerging).
- **Clethodim:** Use lower rates for small weeds in good growing conditions. Always apply with D-C-Trate® at 2 L/100 L; Hasten® or Kwickin® at 1 L/100 L volume; Uptake® at 500 mL/100 L spray volume. The addition of Liase® at 2% may improve control if application conditions are not ideal.
- **Clethodim/Haloxyfop:** The lower doses will provide effective control if applied under ideal conditions to weeds that are smaller, actively growing and free from stress. Always apply with Hasten®, Kwickin® or Uptake® at 1 L/100 L of spray volume.
- **Clopyralid:** Effective treatment for transplant capeweed control. Can be tank mixed with most other herbicides. Also available in 750 g/kg formulation, adjust rates accordingly. Volunteer faba beans and lupins will only be suppressed.
- **Diclofop-methyl:** Wetter essential unless not recommended for tank mixes. Check label for tank mixture recommendations. 500 g/L formulation not registered for use in canola.
- **Fluazifop-P:** Do not apply at flowering stage of weeds. Do not allow weeds to reach late tillering stage before applying. Apply in no less than 50 L/ha water. See label for rates for larger weeds.
- **Haloxyfop:** Increase rates when grasses more than 4 leaf stage. Use Uptake® at 0.5 L/100 L or if using other oils 1.0 L/100 L and add a non-ionic wetter at 200 mL/100L. Note: Withholding periods vary between individual products - check label.
- **Propaquizafop:** Use with either a non ionic surfactant such as BS 1000® at 0.2% v/v or Hasten® or Kwickin® at 0.5% v/v. Do not use with Synertrol® or Codacide® oil. For best control wait until 75% of annual ryegrass have begun tillering. Can be tank mixed for broad spectrum of grass control. See label for details.
- **Quizalofop-P-ethyl:** Use higher rate under high weed burden and/or when weeds are tillering. See label for surfactant/wetting agent details.
- **Sethoxydim:** See label for adjuvant details. See label for grass selective mixtures to improve control brome, barley grass, wild oats and self sown cereals. Do not allow spray mix to sit overnight.
- **Tepraloxydim:** For adjuvant requirements see label compatibility section. The lower doses will only provide effective control if applied under ideal conditions to susceptible weeds that are smaller, actively growing and free from temperature or moisture stress. Do not apply after the commencement of stem elongation or after 8 leaf stage, whichever is earliest.
- **Imazapic/Imazapyr:** **For use with Clearfield production system (Imidazolinone tolerant) canola only.** Always apply with Hasten® or Kwickin® at 0.5 L/100 L. Tank mixture with 150 mL clopyralid 300 g/L improves capeweed control if applied at cotyledon - 4 leaf stage of capeweed. Use 55 g rate where annual ryegrass significant weed. Do not use at 40 to 55 g on shallow, strongly duplex soils in WA.

Legend:

- Herbicide resistance to this mode of action sub group has been confirmed in Australian populations of this weed species.
- Herbicide resistance has been confirmed in Australian populations of this weed species to one or more MOA components of this herbicide mixture.
- Herbicide resistance is expected based on other data.

STOP

ALWAYS READ THE PRODUCT LABEL

- Product registrations may vary between seasons.
- There may be variation in rates, registered uses and/or withholding periods between labels of individual products containing the same active ingredient, of the same or a different concentration and of the same or different formulation.
- Always check the label to ensure compliance with the registrations of the specific product being used.

CODES FOR PULSE AND CANOLA SPRAY CHARTS

Code	Definition
♦	Check label for species controlled
AC	Aqueous concentrate
B	Barley
BFB	Before flower bud
BI	Broad-leaved weeds
BSE	Before stem elongation
Ck	Chickpeas
cot	Cotyledon
DF	Dry flowable
EC	Emulsifiable concentrate
ET	Early tillering
Fb	Faba beans
Fp	Field peas
FT	Fully tillered
Gr	Grass weeds
GSF	Withholding period for grazing or cutting for stock food
H	Harvest withholding period
IBS	Incorporated by sowing
IPP	Immediately post planting
IT	Imidazolinone tolerant (Clearfield®)
kdown	Knockdown herbicide (glyphosate or paraquat/diquat)
Le	Lentils
Lu	Lupins
Mbz	Metribuzin
MT	Mid tillering
NN	Not necessary
Not IT	Will not provide adequate control of IT Canola
Not TT	Will not provide adequate control of TT Canola
NR	Not recommended
NRC	Not registered for use in this crop
NRD	Withholding period not required when used as directed
NRW	Not registered for this weed in these crops
NRWA	No registration for this pattern of use in WA
NS	Not stated
O	Oats
Oil	Spray oil
PE	Pre-emergence
Per/Permit	Use permitted under APVMA permit
PO	Post-emergence
Pre fl	Pre flowering
Pre S	Pre sowing
PSPE	Post sowing pre-emergence
S	Suppression only of this weed
SC	Suspension concentrate
see label	Refer to label for clarification on tank mixes, growth stages, adjuvants etc.
Sim	Simazine
T	Tiller/s or Tillering
Tr	Triticale
trif	Trifluralin
TT	Triazine tolerant
Ve	Vetch
W	Wheat
WA	Wetting agent
WG	Water dispersible granule
wks	Weeks
WP	Wettable powder

Note: The use of brand, trade and proprietary names has been done solely for the purpose of assisting users in identifying products.

It does not imply a preferred recommendation. Alternative products containing the same active ingredient may perform similarly to those products specified.

Crop tolerances

Exact values for species/variety tolerance are difficult to determine as variations can occur due to stage of crop growth, variety or environmental conditions. Follow label directions. Seek advice from your chemical manufacturer, Department of Agriculture or local agronomist on species/variety tolerance.

POISON'S EMERGENCY INFORMATION CENTRE 13 11 26

For further weed management informatiion:
Department of Agriculture, Western Australia
South Perth (08) 9368 3333
www.agric.wa.gov.au

Figure 9-2. DAF Spray Charts. Page 7 of 7. Print A3 for best results.

10.0 Fire Management

10.1 Context

The construction works include activities that may represent a fire risk. Such risks may arise from welding and grinding, vehicle movements over dry vegetation, and disposal of matches or cigarettes. Fires have the potential to cause irreversible damage to the environment, property and human heath or life.

10.2 Purpose

The purpose of the Fire Management Plan is to outline management actions to:

1. minimise the risk of preventable fires.
2. respond to fires in an appropriate manner.

10.3 Performance Indicators

Performance will be demonstrated by:

1. absence of fires generated during construction.
2. response to fires in accordance with the management actions.

10.4 Management Actions

Fire Prevention - General

1. A Site Fire Officer will be designated for each construction area to identify and rectify potential fire hazards. Construction staff will report potential fire hazards to the Site Fire Officer.
2. The daily 'fire danger' ratings will be obtained from the Bureau of Meteorology and will display the ratings daily at the site office for the awareness of construction personnel.
3. The lighting and smoking of cigarettes will be prohibited except in designated cleared areas and immediately outside of site buildings.
4. Cleared vegetation from the construction area will not be burned.
5. Dry chemical or carbon dioxide fire extinguishers[1] will be located in close proximity to all cutting, grinding or welding (or any other spark generating activity).
6. A shroud will be installed if cutting, grinding or welding (or any other spark generating activity) occurs within 5m of vegetation/dry grasses. The shroud will be installed between the activity and the vegetation to capture sparks.
7. Flammable liquids and materials (including explosives) will only be stored in designated areas fitted with a dry chemical or carbon dioxide fire extinguisher.
8. On the advice of FESA or relevant Local Government Authority, construction work that may present a high risk of ignition (e.g. cutting, grinding or welding) may be temporarily terminated on days declared to have a "high", "very high" or "extreme" fire danger and if there are a number of fires in close proximity in order to avoid the potential for further depletion of fire fighting resources.

Fire Prevention - Vehicles

9. It will be ensured that all construction vehicles will be fitted with a dry chemical or carbon dioxide fire extinguisher[1].

10. There will be daily inspections of all construction vehicles to remove combustible material from radiators, tracks, guards and undercarriages.
11. It will be ensured that construction vehicles are inspected and serviced to prevent or repair oil and fuel leaks prior to the start of construction works, and then inspected monthly.
12. It will be ensured that tractors, bulldozers and road graders will not be used during prohibited burning times, unless they are fitted with a vertical exhaust pipe that is maintained in a sound and efficient condition and fitted with a spark arrestor (r37A *Bush Fires Act 1954* (WA)).

Fire Response

13. Training will be provided to construction staff on the proper use of fire extinguishers.
14. A mobile water tanker will be located within 10km of any construction area for fire response. Each water tanker will be equipped with a connectable hose that can be used for fire fighting.
15. Dewatering water maybe used for fire response (irrelevant of water quality).
16. Fires will be managed by:
    a. Small fires – fire extinguishers and/or on-site water tankers will be used by the field personnel to extinguish the fire.
    b. Large fires – FESA will be called to attend and extinguish fires that cannot be managed by the field personnel. Phone 000.
17. The relevant Local Government Authority and FESA will be notified of any fire in which fire fighting equipment is used. Notification will be made as soon as reasonably practicable following the detection of the fire.
18. The DEC, FPC and the Conservation Commission will also be notified of any fire in which fire fighting equipment is used in land vested with the Conservation Commission (State Forest). Notification will be made as soon as reasonably practicable following the detection of the fire.

10.5 Additional Information

[1] Fire extinguishers

Carbon dioxide fire extinguishers and dry chemical powder fire extinguishers are both suitable for ordinary combustibles, flammable liquids, flammable gasses and live electricity.

Dry chemical powder fire extinguishers are suitable for ordinary combustibles, flammable liquids, flammable gasses, live electricity and cooking oils.

10.6 Contingency Actions

No contingency actions are considered necessary.

10.7 Related Plans

1. Land Clearing and Trench Management Plan.
2. Dangerous Goods and Explosives Management Plan

10.8 Relevant Legislation

1. *Bush Fires Act 1954* (WA).

10.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. FESA
2. DEC
3. FPC
4. Conservation Commission
5. Relevant Local Government Authority

11.0 Waste Management

11.1 Context

The construction works will produce a range of liquid and solid wastes. These wastes include:

- site office rubbish, paper, packaging and domestic wastes.
- spent welding rods, grinding wheels, visors and shot blast from welding operations.
- spoil and surplus rock from boring activities or backfilling.
- sewage from temporary toilets.
- used lubricating oils from machinery maintenance.

Inappropriate waste disposal has the potential to contaminate soil, surface water or groundwater and affect visual amenity. Wastes from construction must be disposed of in a lawful and environmentally acceptable manner.

11.2 Purpose

The purpose of the Waste Management Plan is to outline management actions to:

1. reuse waste materials where possible
2. recycle wastes where practicable
3. dispose of construction wastes in an acceptable manner.

11.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

11.4 Management Actions

Construction

1. Separate and marked waste bins will be established for:

CATEGORY	DISPOSAL
General wastes.	Dispose on-site in a covered bin to prevent attraction of vermin. Bulk disposal offsite to the nearest landfill.
Recyclables (generally glass, paper and plastics).	Bulk dispose offsite to the nearest recycling facility. May be disposed of to landfill if a facility does not exist within 50km of the construction area.
Steel Recycling (generally steel pipe and other steel wastes).	Bulk dispose offsite to the nearest steel recycling facility. May be disposed of to landfill if a facility does not exist within 50km of the construction area.
Hydrocarbons (generally drums/containers containing oil, grease, petrol, diesel or hydrocarbon contaminated soil).	Dispose on-site to plastic lined or bunded bins. Bulk dispose offsite to: 1. a Controlled Waste Contractor licensed under the *Environmental Protection (Controlled Waste) Regulations 2004* (WA); or 2. a hydrocarbon recycler (Note: if hydrocarbons are recycled they are not a controlled waste for transport purposes).

Table 11-1 Waste Bins for General Wastes, Recyclables, Steel Recycling and Hydrocarbons.

2. Periodic disposal of wastes from the construction area to the identified disposal locations will be arranged.
3. Wastes, other than excess overburden (excluding spoil) will not be buried on any construction site.
4. All wastes will be removed from all construction sites following the completion of construction works.
5. Excess overburden produced from trench excavation will be disposed of to:
    a. the excavated trench or the Seawater Desalination Plant site.
    b. a suitable location agreed with the Landowner (the Landowner has first preference to retain excess overburden from their own property),
    c. a suitable location agreed with adjacent Landowners (with preference to Landowners on the pipeline route).
    d. a local landfill as inert waste.

    Other suitable sites for disposal of excess overburden may be identified. Disposal of soils affected by ASS will be treated as per the Dewatering and Acid Sulphate Soils Management Plan prior to disposal.

Post-Construction

6. Any waste that is identified post-construction will be removed.

11.5 Contingency Actions

1. The following actions will be undertaken if wastes are not appropriately disposed of:
    a. investigate the cause.
    b. alter management actions, if required.
    c. inform all field personnel of revised management actions.
    d. mitigation of any environmental and visual impacts.

11.6 Related Plans

1. Dewatering and Acid Sulphate Soils Management Plan.

11.7 Relevant Legislation

1. *Environmental Protection Act 1986*, and *Regulations 1987* (WA).
2. *Environmental Protection (Controlled Waste) Regulations 2004* (WA).

11.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. Shire of Harvey

12.0 Aboriginal Heritage Management

12.1 Context

The *Aboriginal Heritage Act 1972* (WA) registers and protects sites of importance to Aboriginal persons. It is an offence to interfere with a registered site[1] without the consent of the Western Australian Minister for Indigenous Affairs. The construction works avoid all existing registered sites on the Department of Indigenous Affairs database.

The construction area is also subject to a native title claim by the Gnaala Karla Boojah Native Title Claimant Group (NTCG) under the *Native Title Act 1993* (C'th). The South West Aboriginal Land and Sea Council is the representative body for the Gnaala Karla Booja NTCG. Native title has yet to be determined by the National Native Title Tribunal.

Prior to construction, an Aboriginal heritage survey of the Seawater Desalination Plant site, Water Transfer Pipeline and the Harvey Summit Tanks site will be conducted with the Gnaala Karla Booja NTCG to identify the presence of any unidentified Aboriginal heritage sites. If new sites are identified by the preconstruction survey, consent will be obtained from the Minister for Indigenous Affairs to interfere with those sites prior to construction. Initial ground disturbing activities at registered sites will be conducted in the presence of a Cultural Monitor from the Gnaala Karla Booja NTCG.

Despite preconstruction surveys, additional heritage materials or artefacts may also be identified during construction.

12.2 Purpose

The purpose of the Aboriginal Heritage Management Plan is to outline management actions to:

1. identify the presence of Aboriginal heritage sites
2. manage disturbance of registered Aboriginal heritage sites, if required.
3. identify procedures in the event that a new potential site is identified during construction.

12.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

12.4 Management Actions

Prior to Construction

1. An Aboriginal heritage survey of the Seawater Desalination Plant site, Water Transfer Pipeline and the Harvey Summit Tanks site will be conducted with the Gnaala Karla Booja NTCG.

During Construction

2. A Cultural Monitor will be employed in consultation with the Gnaala Karla Booja NTCG to monitor initial ground disturbing activities at any registered Aboriginal heritage site identified. The Cultural Monitor will be paid at a rate in accordance with The Water Corporations policies for Cultural Monitors.

3. Shade, water and personal protective equipment (hard hat, safety glasses, noise (ear) protection and high visibility vest) will be provided to the Cultural Monitor. The Cultural Monitor will be responsible for personal transport to the construction areas.

4. The Cultural Monitor will monitor initial ground disturbing activities to:
    a. detect the presence of archaeological material of heritage significance.
    b. detect human skeletal material.
    c. advise on minimisation of construction impacts on heritage values.
5. The Cultural Monitor will advise during the construction works if archaeological material or human skeletal material is identified, as well as any matters of heritage concern.
6. Construction works will be undertaken in the absence of the Cultural Monitor if for any reason the arranged Cultural Monitor does not attend the site. A replacement Cultural Monitor will be sort as soon as reasonably practicable following the absence if future attendance at the construction works by the Cultural Monitor is unlikely.
7. Construction works will cease as soon as practicable within a nominal 20 metres of any archaeological material (artefacts including hunting tools, scatters, scar trees) identified within the construction area. An archaeologist will be engaged to record the identified material and to advise the DIA if the identified material is likely to be of Aboriginal heritage significance. Construction activities within 20 metres of the identified material will only recommence based on advice of the archaeologist or the DIA.
8. Construction works will cease as soon as practicable within a nominal 20 metres of any skeletal material identified within the construction area. The Harvey Police Station (Phone 9729 1001, located at 17A Hayward St in Harvey) will be contacted to attend and determine a resolution of the matter. Construction activities will only recommence within 20 metres of the identified material on the direction of the Superintendent based on advice of the Police.
9. Any dispute between the Cultural Monitor and site construction personnel will be resolved on advice from the Water Corporation's Manager, Indigenous Resources Section (Phone 9420 3864)

12.5 Additional Information

[1] The construction works avoid all locations identified by the DIA site register. A number of locations on the DIA site register occur within the greater Harvey area:

DIA SITE ID	LOCATION NAME	TYPE	REGISTER	SITE?
5614	Lake Preston	Artefacts / Scatter	Stored data	No
5843	Harvey	Artefacts / Scatter	Stored data	No
5797	Harvey 45	Artefacts / Scatter	Stored data	No
5798	Harvey 46	Artefacts / Scatter	Stored data	No
5799	Harvey 47	Artefacts / Scatter	Stored data	No
5800	Harvey 48	Artefacts / Scatter	Stored data	No
5801	Harvey 49/Myalup Beach Road	Artefacts / Scatter	Stored data	No
5802	Harvey 50/Myalup Beach Road	Artefacts / Scatter	Stored data	No
5811	Harvey 60	Artefacts / Scatter	Stored data	No
17778	Kellys Camp	Man-Made Structure, Historical	Stored data	No
17779	Wallams Camps 1 & 2	Man-Made Structure, Historical	Stored data	No
17783	Mornington Mill Corroboree Ground	Ceremonial	Permanent	YES

Table 12-1 Locations listed the DIA site register.

Only the Mornington Mill Corroboree Ground is classified as an Aboriginal heritage site under the *Aboriginal Heritage Act 1972* (WA).

Sites that are classified on the 'Permanent' register are classified as sites under the *Aboriginal Heritage Act 1972* (WA) and are protected. Sites classified as 'Stored data' are not sites under the

Aboriginal Heritage Act 1972 (WA) due to unreliable information, however are maintained on the DIA database as a record of having been previously reported and for future reference.

12.6 Contingency Actions

No contingency actions are considered necessary.

12.7 Related Plans

1. Land Clearing and Trench Management Plan
2. Watercourse Crossing Management Plan

12.8 Relevant Legislation

1. *Aboriginal Heritage Act 1972* (WA), and *Regulations 1974* (WA).
2. *Native Title Act 1993* (C'th)

12.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. SWALSC
2. DIA

13.0 Traffic and Public Safety Management

13.1 Context

There will be in excess of 5000 vehicle movements for the cartage of pipelines and other equipment (excludes support vehicle movements) for the Southern Seawater Desalination Project. Some partial road closures will be required, and increased traffic volumes from construction vehicles will result in short-term impacts on local traffic movement.

Construction will occur within publicly accessible roads and road reserves, private farmland and State Forest. The construction works involve deep earthworks, materials storage and handling, and heavy machinery and equipment that could pose a risk to members of the public if accessing the site.

13.2 Purpose

The purpose of the Traffic and Public Safety Management Plan is to outline management actions to:

1. manage construction vehicle traffic and local traffic.
2. minimise construction impacts on local traffic movements.
3. reduce the risk to public accessing the construction site.

13.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

13.4 Management Actions

Traffic

1. Traffic management activities on public roads will be coordinated with MRWA and the Shire of Harvey prior to construction.
2. It will be ensured that construction vehicles will typically use the following major roads for the transport of construction materials and equipment to minimise disturbance on local traffic and the community:
    a. South Western Highway
    b. Perth-Bunbury Highway (Old Coast Road)
    c. Government Road
    d. Forestry Road

    Local roads will be used for accessing the construction sites where major roads do not allow access to the construction works.
3. The use of local roads by semi-trailers and road trains will be limited for the transport of construction materials and equipment to daylight hours (nominally 6am-8pm) to minimise noise impacts on residences positioned on local roads.
4. Road signage will be displayed within all construction areas in accordance with Australian Standard 1742.3-2002 *Manual of Uniform Traffic Control Devices - Part 3: Traffic control devices for works on roads*.
5. Road access in the construction area will be maintained by the use of signed detours and/or a single lane. Advisory signs will be installed sufficiently in advance of the construction works to allow road users to take alternative routes.
6. A temporary crossover(s) will be installed to maintain access by Landowners to their properties if the existing crossover is disturbed by the construction works. All disturbed

crossovers will be repaired or replaced as soon as practicable following construction works affecting that property.

7. It will be ensured that construction vehicles do not exceed 50km/h on non-bituminised roads or access tracks outside of the active construction area.
8. A 15km/h speed limit will be imposed within the active construction area. Signage of the speed limit will be displayed within construction areas.

Safety

9. The public will be excluded from accessing all construction areas where practicable. Open excavations (such as trenches and dewatering pits) will be fenced or otherwise demarcated where there is a risk of public access.
10. Advisory warning boards identifying hazards, risks, safety requirements and emergency phone numbers will be installed at each entry to all construction areas.
11. Machinery and plant that is located in publicly accessible locations will be secured (in a locked compound where practicable) when the construction site is not occupied.

13.5 Additional Information

The statutory requirements and guidelines that apply to the *Local Government Act 1995* (WA), *Main Roads Act 1930* (WA) and the *Road Traffic Act 1974* (WA), will be aware of and complied with.

13.6 Contingency Actions

No contingency actions are considered necessary.

13.7 Related Plans

1. Land Clearing and Trench Management
2. Noise Management

13.8 Relevant Legislation

1. *Local Government Act 1995* (WA)
2. *Main Roads Act 1930* (WA)
3. *Road Traffic Act 1974* (WA)

13.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. MRWA
2. Shire of Harvey

14.0 Noise Management

14.1 Context

Construction works will generate noise that may interfere with the amenity of occupants of near residential properties. Noise from the construction works will be monitored to determine and manage the impacts of noise.

Noise in Western Australia is regulated under the *Environmental Protection (Noise) Regulations 1997* (WA). Construction works (excluding blasting) are generally exempt from compliance with the assigned noise levels between the hours of 7.00 am and 7.00 pm, subject to a number of provisions (the provisions are contained within the plan). Despite this exemption, construction noise should still be managed and noise level objectives set to minimise noise impacts.

Noise from blasting activities during construction is regulated under the *Environmental Protection (Noise) Regulations 1997* (WA). Blasting noise limits apply.

The nearest noise sensitive premises for the Seawater Desalination Plant site is approximately 600m to the south east. The nearest noise sensitive premises for the Harvey Summit Tanks site is approximately 650m to the north east. A number of noise sensitive premises occur within 50m of the Water Transfer Pipeline.

14.2 Purpose

The purpose of the Noise Management Plan is to outline management actions to:

1. identify noise objectives and blasting noise limits.
2. undertake noise monitoring.
3. outline corrective actions to variances of noise objectives and limits.

14.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

14.4 Management Actions

General Construction Considerations

1. Plant and practices that have the lowest possible noise emissions, will be used where practicable.
2. Portable noise generating equipment (e.g. generators) will be located as far away from noise sensitive premises as practicable. Noise screening will be installed where particularly noisy construction works are conducted adjacent to residential premises.
3. Known noisy activities (e.g. rock breaking) will be scheduled during daylight hours (nominally 7am to 7pm) where they occur within 100m of residential premises. Notice to the Landowner of the residential premises will be provided prior to the commencement of such works.

Noise Meter Calibration

4. Noise will be measured using a portable sound level meter. It will be ensured that the meter is calibrated at least every 2 years by a laboratory accredited by NATA to undertake calibration of sound level measuring instruments.

5. The portable sound level meter will be tested in the field (using a standard sound source) prior to, and after, any series of measurements to be taken. The tests will be undertaken to confirm if the meter is accurate within ±0.5 dB.

Measuring Construction Noise

6. Noise levels will be measured at least once every 7 days during construction, or in response to any complaint that may arise. Noise monitoring will be undertaken for a period of no less than 15 minutes, and no greater than 4 hours.
7. The frequency of noise monitoring maybe increased (up to a maximum daily monitoring frequency) if complaints of unacceptable noise are received.
8. Noise measurements will be undertaken at the boundary of the construction sites and at least 1.2m above ground level. For the Seawater Desalination Plant site and the Harvey Summit Tanks site, the boundary is the cadastral (land) boundary of the site. For the Water Transfer Pipeline, the boundary will be the edge of the pipeline working width (30m for agricultural land and 20m for native vegetation).
9. Noise measurements will be undertaken on the Water Transfer Pipeline route at least 3 metres from any noise reflecting surface (building wall, vehicles, etc).
10. All noise measurements will be recorded in the Noise and Vibration Monitoring Log.
11. The occupiers of each premises will be given written notice at which noise emissions will be likely to exceed the specified noise levels at least 24 hours prior to such works for Sunday and Night Construction Works (7.00pm to 7.00 am).
12. It will seek to meet the following noise level objectives:

Location of measurement	**Time of day**	**Assigned level (dB)**		
		L_{A10} (not to be exceeded more than 10% of the time)	L_{A1} (not to be exceeded more than 1% of the time)	L_{Amax} (must not be exceeded at any time)
Boundary of Water Transfer Pipeline working width when less than 15m from a Residential of Rural Building	0700 to 1900 hrs Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hrs Sunday and Public Holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hrs all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hrs on any day to 0700 hrs Monday to Saturday and to 0900 hrs Sunday and Public Holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Boundary of Seawater Desalination Plant site or Boundary of Harvey Summit Tanks site. Boundary of Water Transfer Pipeline working width when greater than 15m from Residential of Rural Building	All Hours	60	75	80

Note:

(1) An influencing factor of 2 dB will be added to the Assigned Level where there is a major road within 100 metres of the construction works (6000-15000 vehicles per day; e.g. Old Coast Road and South Western Highway).

(2) 10 db will be added to the noise measurement where impulsiveness is present (banging, thumping).

Table 14-1 Noise Level Objectives for Construction.

Measuring Blasting Noise

13. Blasting will only be undertaken between 7.00 am and 6.00pm on any day.

14. Blasting noise (airblast level) will be measured if blasting occurs within 100 metres of any residential premises. Airblast level will be measured at the nearest noise sensitive premises (where access is possible) at between 1.2 and 1.6 metres in height above ground level, and at least 5 metres from any noise reflecting surface (building wall, vehicles, etc).

15. The following blasting noise criteria will be complied with:

Day/Time	Airblast assigned level (dB)
0700 to 1800hrs Monday to Saturday	125 dB $L_{linear, peak}$ for any blast
	120 dB $L_{linear, peak}$ for nine in any 10 consecutive blasts, regardless of interval.
0700 to 1800hrs Sundays	120 dB $L_{linear, peak}$ for any blast
	115 dB $L_{linear, peak}$ for nine in any 10 consecutive blasts, regardless of interval.

Table 14-2 Blasting Noise Criteria.

14.5 Additional Information

Regulation 7 of the *Environmental Protection (Noise) Regulations 1997* (WA) prohibits the exceeding of assigned levels of noise defined by Regulation 8. Table 14-1 (above) identifies the assigned levels contained in Regulation 8. Regulation 13 exempts construction works at construction sites from compliance with the assigned levels between 7.00am and 7.00pm, subject to a number of provisions (the provisions are contained within the plan). Consequently, Table 14-1 lists the assigned levels as "objectives" and not as defined limits for construction works for the project.

The blasting noise criteria have been stated as limits as there are no exemptions in the *Environmental Protection (Noise) Regulations 1997* (WA) that allow for variation from the assigned levels.

14.6 Contingency Actions

1. Actions maybe taken to reduce noise impacts on residential premises if the construction noise criteria or the blasting noise criteria are exceeded. Such actions may include:
    a. noise bunds or screens.
    b. adjusting the work schedule for the offending work to be conducted in more appropriate time.
    c. changing the technology or method of construction.
    d. temporary relocation of the affected Landowner (subject to agreement with the Landowner).
2. Noise monitoring will be undertaken to confirm that the noise criteria have been achieved by the directed actions.

14.7 Related Plans

1. Land Clearing and Trench Management.
2. Explosives and Dangerous Goods Management Plan
3. Vibration Management Plan

14.8 Relevant Legislation

1. *Environmental Protection Act 1986* (WA)
2. *Environmental Protection (Noise) Regulations 1997* (WA)

14.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. Shire of Harvey

Table 14-3 Noise and Vibration Log

Southern Seawater Desalination Project
Noise Management Plan & Vibration Management Plan

Noise and Vibration Monitoring Log

The purpose of the Noise and Vibration Monitoring Log is to record the levels of noise and vibration against the criteria. The Noise and Vibration Monitoring Log is to be completed by the Site Environmental Scientist.

Name ……

Page …… of ……

Date of Entry	Location of monitoring location (Lot number and location description)	Construction activity description (general construction, blasting, etc)	Noise (dB)	Applicable Noise Criteria Limit (dB)	Vibration (mm/s)	Applicable Vibration Criteria Limit (mm/s)	Name and Position	Initial

15.0 Vibration Management

15.1 Context

Vibration caused by construction works (including earthmoving, rock breaking and blasting) has the potential to affect the integrity of buildings and their fittings. The areas of impact may include walls (internal and external), architraves and skirtings, glass and mirrors, tiled flooring, and external fixtures such as concrete pools and brick fences.

The nearest vibration sensitive premises for the Seawater Desalination Plant site is approximately 600m to the south east. The nearest vibration sensitive premises for the Harvey Summit Tanks site is approximately 650m to the north east. A number of vibration sensitive premises occur within 50m of the Water Transfer Pipeline.

A Building Inspector will be engaged to undertake property condition assessments of properties within 100m of all construction works, and within 1000m of any blasting, to determine any structural impacts caused by vibration.

15.2 Purpose

The purpose of the Vibration Management Plan is to outline management actions to:

1. undertake vibration monitoring.
2. identify the pre-construction condition of properties.
3. identify the post-construction condition of properties.

15.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

15.4 Management Actions

Vibration Monitoring

1. Vibration will be monitored using a portable vibration monitor at least once every 7 days if construction works are within 100 metres of residential premises. The frequency of monitoring maybe increased (up to a maximum daily monitoring frequency) for residences within 20m of the construction works.
2. The vibration monitoring will be undertaken at a distance of 5 metres from any residential premises, at a location between the construction works and the residential premises.
3. All noise measurements will be recorded on the Noise and Vibration Monitoring Log (refer to Noise Management Plan).
4. The following vibration standard (the safe limit applied for blasting affecting residential buildings) will be complied with:

Frequency	Vibration Standard
Not to be exceeded for 9 in 10 blasts.	5 mm/s
Not to be exceeded at any time	10 mm/s

Table 15-1 Vibration Standards.

Property Assessment

5. Landowners located within 100mof all construction works, and within 1000m of any blasting, will be offered a pre-construction property condition assessment prior to construction. The assessment will be conducted by a Building Inspector. The assessment will be conducted in consultation with the Landowner to identify any existing building defects (e.g. cracking). The assessment will include use of a video and/or photographs to document any existing building defects. A Property Condition Report will be prepared by the Building Inspector and provided to the Landowner.
6. The Building Inspector will undertake a second property condition assessment in consultation with the Landowner following the completion of construction works near the property for comparison to the pre-construction property condition report.
7. Any new building defects, or worsened existing defects, that are caused by the construction works will be repaired. The repairs will be conducted in consultation with the Landowner and to a standard equivalent or better than the pre-construction condition.
8. No fee will be charged to the Landowner to undertake the property condition assessments, reports or any required repair works.

15.5 Additional Information

Vibration Standard

[1] The German Standard DIN 4150-3 (1999) has been used as the vibration standard.

Noise and Vibration Monitoring Log

The Noise and Vibration Monitoring Log is contained in the Noise Management Plan.

Property Condition Report

An example Property Condition Report is attached to this plan. The Building Inspector may use a separate report that meets the same minimum requirements identified in the example Report.

15.6 Contingency Actions

Vibration Monitoring

1. The construction technology or method will be modified or the work schedule adjusted, to reduce the cumulative impacts of construction works if the vibration standard for blasting is exceeded.

Property Assessment

2. A resolution will be facilitated between the Landowner if agreement cannot be reached as to the nature and scale of impacts, or the nature and quality of remediation, of any vibration impacts.

15.7 Related Plans

1. Land Clearing and Trench Management
2. Explosives and Dangerous Goods Management Plan
3. Vibration Management Plan

15.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DoCEP
2. Shire of Harvey

Table 15-2 Property Condition Report

PROPERTY CONDITION REPORT	
Property Owner:	_____
Property Address:	_____
	_____
Date Pre-construction assessment:	_____/_____/ 20_____
Pre-construction Building Inspector:	_____
Date Post-construction assessment:	_____/_____/ 20_____
Post-construction Building Inspector:	_____

The Building Inspector will inspect each area of the property, paying particular attention to the condition of walls (internal and external), architraves and skirtings, glass and mirrors, tiled flooring, and external fixtures such as concrete pools and brick fences.

Pre-construction Condition	Post-construction Condition
Entry/Hallway	
Notes: Photographs: Yes ☐ Video: Yes ☐	Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐
Lounge Room	
Notes: Photographs: Yes ☐ Video: Yes ☐	Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐

Family Room			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Dining Room			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Kitchen			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Bedroom 1			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	

Bedroom 2			
Notes:		Change?:	Yes ☐ No ☐
		Action Required?:	Yes ☐ No ☐
		If action required, list:	
Photographs: Yes ☐	Video: Yes ☐	Photographs: Yes ☐	Video: Yes ☐
Bedroom 3			
Notes:		Change?:	Yes ☐ No ☐
		Action Required?:	Yes ☐ No ☐
		If action required, list:	
Photographs: Yes ☐	Video: Yes ☐	Photographs: Yes ☐	Video: Yes ☐
Bedroom 4 / Study			
Notes:		Change?:	Yes ☐ No ☐
		Action Required?:	Yes ☐ No ☐
		If action required, list:	
Photographs: Yes ☐	Video: Yes ☐	Photographs: Yes ☐	Video: Yes ☐
Bathroom 1			
Notes:		Change?:	Yes ☐ No ☐
		Action Required?:	Yes ☐ No ☐
		If action required, list:	
Photographs: Yes ☐	Video: Yes ☐	Photographs: Yes ☐	Video: Yes ☐

Bathroom 2			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Toilet			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Laundry			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	
Garage			
Notes: Photographs: Yes ☐ Video: Yes ☐		Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐	

House Exterior	
Notes: Photographs: Yes ☐ Video: Yes ☐	Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐
Other (eg Pool, Brick Fencing)	
Notes: Photographs: Yes ☐ Video: Yes ☐	Change?: Yes ☐ No ☐ Action Required?: Yes ☐ No ☐ If action required, list: Photographs: Yes ☐ Video: Yes ☐
Additional Comments (optional):	**Additional Comments (optional):**
Agreement	
Building Inspector: _____ Landowner: _____	Building Inspector: _____ Landowner: _____

The Building Inspector and the Landowner are to sign this Property Condition Report to indicate agreement to the above information.

16.0 Dangerous Goods and Explosives Management

16.1 Context

Dangerous goods used and stored during construction works will include hydrocarbons (fuels & oils), and chemicals for water treatment (chlorine, acids). Spillages of dangerous goods have the potential to:

- contaminate soil, surface water and groundwater.
- impact personnel and public safety.
- create an ignition source.

Dangerous goods must be contained (bunded) to prevent spillages and ensure compliance with regulatory requirements.

Explosives may also be stored and used for blasting of rock for pipeline installation. Explosives need to be contained to prevent unauthorised access and ignition.

16.2 Purpose

The purpose of the Dangerous Goods and Explosives Management Plan is to outline management actions for:

1. the storage and containment of dangerous goods and explosives.
2. responding to a spill of a dangerous good.
3. the reporting of incidents involving dangerous goods and explosives.

16.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

16.4 Management Actions

Dangerous Goods

1. A Licence issued by the Chief Inspector of the DoCEP under s45A(1) of the *Explosives and Dangerous Goods Act 1961* (WA) will be obtained prior to any storage of dangerous goods.
2. Liquid dangerous goods will be stored in a bund or compound capable of containing 110% of the volume of the dangerous goods stored. For packaged liquid dangerous goods (goods in a number of smaller containers), the goods shall be stored in a bund or compound capable of containing 110% of the volume of the largest container.
3. Dangerous goods will be stored in minimum quantities (where possible) to minimise the environmental impact if spillage occurs.
4. Dangerous goods will be segregated to ensure incompatible dangerous goods are not co-located (refer Figure 16-1).
5. Dangerous goods will not be stored within 25m of any watercourse or wetland.

Explosives

6. A Permit issued by the Chief Inspector of the DoCEP under s34 of the *Explosives and Dangerous Goods Act 1961* (WA) will be obtained prior to any storage or use of explosives at construction sites.

7. A Shotfirer's Permit under r116A of the *Explosives and Dangerous Goods (Explosives) Regulations 1963* (WA) will be obtained for use of explosives.

8. FESA will be notified where any unexploded ordnances are located or stored within the construction area. Construction within 20m of identified unexploded ordnance will cease until FESA has attended and confirmed the area safe to continue work.

Record Keeping

9. Material Safety Data Sheets will be maintained for each dangerous good and each explosive stored. The MSDS will be located outside of the compound in which the material is stored. The compound will be placarded in accordance with the DoCEP's *Guidance Note for Placarding*.

10. Deliveries of dangerous goods and explosives will only be accepted if they are accompanied by a Materials Safety Data Sheet (MSDS) for that dangerous good or explosive, or, if there is an existing and current MSDS for that dangerous good or explosive already held on the site.

11. A Dangerous Goods and Explosives Log (Manifest) will be maintained of all dangerous goods and explosives held on the construction sites. The Log will be stored in a secure location at the site entrance. The Log will identify the:
    a. date on which the goods were received.
    b. location(s) at which the goods are stored.
    c. volume/quantity stored at each location.
    d. date and volume/quantity removed from storage when used.
    e. name of the person(s) receiving/removing goods to/from storage on each occasion.

    A site plan that identifies the storage location of each dangerous good will accompany the Log.

Safety

12. Dangerous goods and explosives will be stored in a locked compound to prevent unauthorised access.

13. Ignition sources (e.g. welding equipment, cigarettes, lighters) will be prohibited within any compound used for the storage of dangerous goods or explosives.

Training

14. All construction staff will be trained on identification, storage and handling procedures for dangerous goods and explosives. Construction staff will also be trained on response procedures (including use of Spill Response Kits) for accidents and incidents and emergencies involving dangerous goods or explosives.

Accidents, Incidents and Emergencies

15. A Spill Response Kit will be installed and maintained at each construction site for the clean-up and containment of spills to land or water. Each spill kit will contain:
    a. universal absorbent pads or pillows or blankets.
    b. a containment boom (for containing discharges to water).
    c. labelled plastic contaminated waste bags.
    d. safety gloves.

    Contaminated material will be disposed of from a spill in accordance with the Waste Management Plan.

16. The Chief Inspector of the DoCEP will be notified of any accident involving explosives or dangerous goods (s55(1) of the *Explosives and Dangerous Goods Act 1961* (WA)).

17. FESA will be notified of any incident involving dangerous goods or an explosive that has had, or has the potential to, have a significant impact on the environment or human safety.

18. The DEC will be notified of any incident involving dangerous goods or an explosive that has had, or has the potential to, have a significant impact on the environment.

16.5 Additional Information

An example Dangerous Goods and Explosives Log is attached to this plan.

16.6 Contingency Actions

No contingency actions are considered necessary.0

16.7 Related Plans

1. Incident Management
2. Waste Management

16.8 Relevant Legislation

1. *Explosives and Dangerous Goods Act 1961* (WA)
2. *Explosives and Dangerous Goods (Dangerous Goods Handling and Storage) Regulations 1992* (WA)
3. *Explosives and Dangerous Goods (Explosives) Regulations 1963* (WA)
4. *Environmental Protection Act 1986* (WA)
5. *Occupational Safety and Health Regulations 1996* (WA)

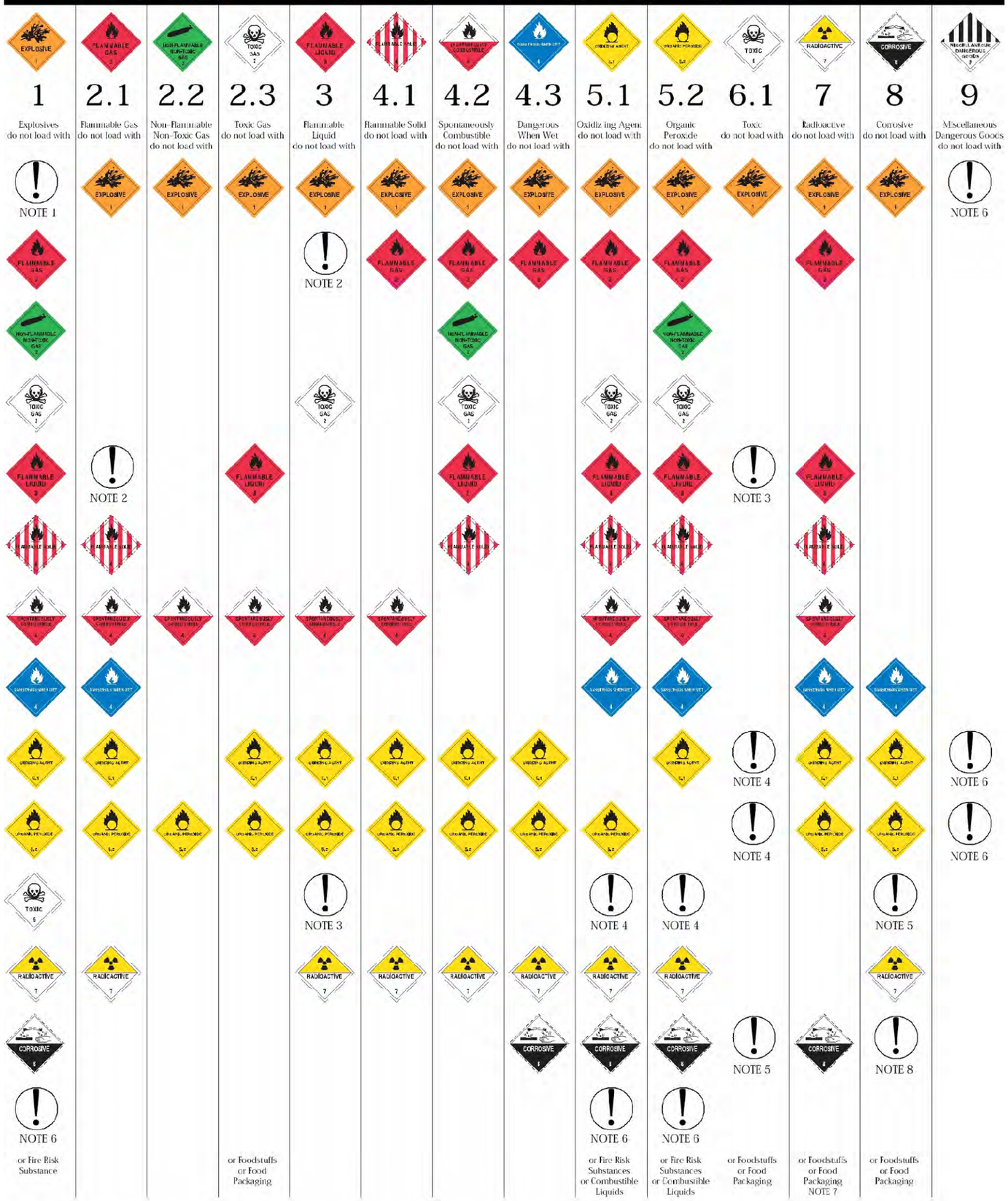
16.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DoCEP
2. FESA
3. DEC

Recognising dangerous goods

Segregation of dangerous goods in road vehicles and freight containers



NOTES:

1. Refer to explosives regulations for details of the transport of explosives. Explosives of Class 1.4 S may be transported with dangerous goods of any other Class if the total quantity of dangerous goods does not exceed 1,000 kg.
2. When both Classes are in bulk.
3. When Class 3 substance is nitromethane.
4. When Class 6 substance is a fire risk substance.
5. When Class 6 is a cyanide and Class 8 is an acid (is acidic).
6. When Class 9 substance is a fire risk substance.
7. See also the Code of Practice for the Safe Transport of Radioactive Substances.
8. Concentrated strong acid is to be segregated from concentrated strong alkali.

Figure 16-1 Guidance on Segregation of Dangerous Goods.

This guidance has been designed for road vehicles and freight containers, however is also applicable to storage on construction sites. Print A3 for best results

Table 16-1 Dangerous and Explosive Goods Manifest (6 pages)

Southern Seawater Desalination Project
Page 1 of 6

Dangerous Goods and Explosives Log

The principal purpose of the manifest is to provide contractors and emergency service authorities with information about the quantity, type and location of dangerous goods and explosives stored.

Licensee
……

Address of Premises
……

Date of Preparation
……

Site Plan No.
……

Emergency Contacts

Name	Position	Telephone	
		B/H: A/H/Mobile:	
		B/H: A/H/Mobile:	
		B/H: A/H/Mobile:	
		B/H: A/H/Mobile:	
		B/H: A/H/Mobile:	
		B/H: A/H/Mobile:	

Dangerous Goods and Explosives Emergency Contacts

Water Corporation's Emergency Contacts

Name	Position	Organisation	Telephone	
George Basanovic	Corporate Incident Management Coordinator	Water Corporation	B/H: A/H/Mobile:	9420 3247 [redacted]
Ciaran MacCarron	Manager Occupational Health and Safety	Water Corporation	B/H: A/H/Mobile:	9420 3690 [redacted]
Mark Oliver	Senior Project Manager – Seawater Desalination Plant	Water Corporation	B/H: A/H/Mobile:	9420 3752 [redacted]
John Stansfield	Project Manager – Seawater Desalination Plant	Water Corporation	B/H: A/H/Mobile:	9420 3406 [redacted]
John Goullee	Principal Project Manager – Water Transfer Pipeline and Harvey Summit Tanks	Water Corporation	B/H: A/H/Mobile:	9420 2149 [redacted]
Gordon Groth	Senior Environmental Officer	Water Corporation	B/H: A/H/Mobile:	9420 2796 [redacted]
Trevor Roffman	OSH Coordinator, Project Management Group	Water Corporation	B/H: A/H/Mobile:	9420 2413 [redacted]
Guy Watson	Environmental Operations Manager	Water Corporation	B/H: A/H/Mobile:	9420 3832 [redacted]

External Emergency Contacts

Position	Telephone	
Fire and Emergency Services Authority (Bunbury)	B/H: A/H/Mobile:	9780 1900 000 all hours
Police (Harvey)	B/H: A/H/Mobile:	9729 1001 - 17A Hayward St Harvey 000 all hours
Department of Consumer and Employment Protection Resources Safety Division	B/H:	9222 3595
Department of Environment and Conservation (Perth)	B/H: A/H/Mobile:	9726 4111 1300 784 782

Dangerous Goods - Maximum Permissable Quantities

Summary of Maximum Permissible Quantities - Licence under s45A of the *Explosives and Dangerous Goods Act 1961* (WA)

Bulk Storage

Tank Id No.	Dangerous Goods					Tank	
	Name	Class	Sub Risk(s)	UN No.	PG	Type	Capacity (L)

Package Storage Areas

Storage area			Dangerous Goods			Quantity (kg)	
	Name	Class	Sub Risk(s)	UN No.	PG	Average	Maximum

Other Packaged

Storage Area	Class	Sub Risk(s)	Packaging Group	Average Quantity (kg or L)	Maximum Quantity (kg or L)

Dangerous Goods - Receipt/Removal Log

Date Received/ Removed	Storage Location	Type of Dangerous Good	Maximum Permissible Quantity (kg)	Quantity Received (kg)	Quantity Removed (kg)	Quantity Remaining in Storage (kg)	Name of Person Receiving/ Removing

Explosives - Maximum Permissable Quantities

Summary of Maximum Permissible Quantities – Permit under s34 of the *Explosives and Dangerous Goods Act 1961* (WA)

Bulk Storage

Tank Id No.	Dangerous Goods					Tank	
	Name	Class	Sub Risk(s)	UN No.	PG	Type	Capacity (L)

Explosives - Receipt/Removal Log

Receipt/Removal

Date Received/ Removed	Storage Location	Type of Explosives	Maximum Permissible Quantity (kg)	Quantity Received (kg)	Quantity Removed (kg)	Quantity Remaining in Storage (kg)	Name of Person Receiving/ Removing

17.0 Organochlorine (Dieldrin) Management

17.1 Context

The Water Transfer Pipeline crosses land in which dieldrin pesticide, an organochlorine (OC), was historically applied to the soil surface for the control of the African black beetle in potato crops and to control weevils in fruit trees. Residual OC contamination exists in the top 10cm to 15cm of soil in the OC contaminated land. The residual OC contamination will require management during construction.

The WA Department of Agriculture and Food (DAF) (circa 2004) has determined the known dieldrin concentrations in the affected land:

Land on Water Transfer Pipeline route	Dieldrin Concentration (mg/kg)	Length of water transfer main affected
[redacted], Shire of Harvey	0.21	200m
[redacted], Shire of Harvey	0.07-0.09	150m
[redacted], Shire of Harvey	0.06-0.3	125m

Table 17-1. Land Affected by Residual OC Contamination on the Water Transfer Pipeline Route. The location of the OC contaminated lands have been suppressed and will remain strictly confidential as requested by the DAF (refer to Additional Information below).

Aerial imagery of the affected lands is depicted in Figure 23. Construction works are expected to impact approximately 1425m^3 of OC contaminated soil (475m length x 20m width x 15cm depth).

The residual OC contamination does not represent a health risk to construction staff and no personal protective equipment is required (the health investigation level for dieldrin is 10.00mg/kg for occupation of residential dwellings and 50.00mg/kg for occupation of commercial and industrial sites).

The risk is that construction works will remobilise dieldrin in the soil to the surface, with cattle consuming the remobilised dieldrin through ingestion of pasture and soil. Dieldrin consumed by cattle can bio-accumulate in the meat and milk; making it unsuitable for human consumption.

17.2 Purpose

The Purpose of the Organochlorine (Dieldrin) Management Plan is to outline management actions to:

1. manage remobilisation of residual OC contaminated soil during construction.
2. ensure that livestock do not access exposed OC contaminated soil during construction and immediately following post-construction.

17.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

17.4 Management Actions

Hygiene

1. It will be ensured that all vehicles and equipment will be brushed and/or air jetted to remove sods of dirt attached to the vehicle (including tyres, undercarriage and inside cabin) prior to exiting OC affected land to minimise contamination of adjacent lands (note there is no requirement for cleaning procedures prior to entering the affected land)

Construction

2. It will be ensured that livestock do not access OC affected land under construction or stockpiles of OC affected material.
3. A maximum 20m construction width will be used through OC contaminated land. The construction width maybe further reduced in the OC contaminated land to further minimise the area and volume of OC contaminated soil disturbed that would require management.
4. OC contaminated topsoil (top 15cm) will be stockpiled separately from soil stockpiles from other land. OC contaminated topsoil will not be placed on non- OC contaminated land.
5. An agreement with the Landowner will be reached on the management of OC contaminated topsoil by one of the following methods:
    a. **Remediation**[1]: Removal of OC contaminated topsoil to a depth of 15cm, replaced with 15cm of clean fill.
    b. **Partial Remediation**[2]: Removal of OC contaminated topsoil to a depth of 15cm, replaced with 50% clean fill and 50% OC contaminated topsoil to a depth of 15cm.
    c. **No Remediation**[3]: Removal of OC contaminated topsoil to a depth of 15cm during construction, which will be replaced following construction to a depth of 15cm.

    Where an agreement cannot be reached on the method, the 'No Remediation' method will be undertaken.
6. Surplus OC contaminated topsoil from the construction works maybe disposed of within the excavated trench of the affected agricultural land, with a minimum cover of 750mm of uncontaminated soil.
7. Surplus OC contaminated topsoil maybe disposed of to landfill or any other location not used for agriculture.
8. Surplus overburden (soil beneath 15cm depth) maybe disposed of to any land as this soil will not be OC contaminated.

Post-Construction

9. Liaisons will occur with the Landowner to ensure that livestock are excluded from land on which no remediation[3] has occurred until that area has been rehabilitated with pasture grass (refer to Rehabilitation Management Plan for agricultural lands).

17.5 Additional Information

Confidentiality

The location of the OC contaminated lands will remain strictly confidential as requested by the DAF. The locations of the OC contaminated lands will only be provided to the construction staff on the Water Transfer Pipeline. The locations of the OC contaminated lands will not be made available in the publicly available copy of the CEMF to maintain this confidentiality.

Pre-construction testing

Preconstruction testing of the affected lands will not be undertaken. The previous testing results from the DAF (circa 2004) are considered sufficient for construction management given that all OC contaminated land will be managed by the same management actions listed in this plan (i.e. the concentration is irrelevant to management). The DAF have provided verbal confirmation that pre-construction testing is not required (pers. com. 22 October 2007 A.Drage (DAF) to S.Hawkins (Water Corporation)).

Remediation

[1] Where the Landowner agrees to 'Remediation' of the OC contaminated land, topsoil will not be returned. The area will be fertilised and seeded as defined by the Remediation Management Plan. The DAF will then be able to assess the land to determine if it can be regarded as remediated.

[2] Where the Landowner agrees to 'Partial Remediation' of the OC contaminated land, the OC contaminated topsoil will be returned. Partial Remediation is considered an option as the Landowner may wish to retain the seed bank and nutrients contained in the topsoil. The area will be fertilised and seeded as defined by the Remediation Management Plan. The affected land may remain determined as OC contaminated by the DAF.

[3] Where the Landowner agrees to 'No Remediation' of the OC contaminated land, the OC contaminated topsoil will be returned in full. No Remediation is considered an option as the Landowner may wish to retain the seed bank and nutrients contained in the topsoil. The area will be fertilised and seeded as defined by the Remediation Management Plan. The affected land will likely remain determined as OC contaminated by the DAF.

17.6 Contingency Actions

No contingency actions are considered necessary.

17.7 Related Plans

1. Land Clearing and Trench Management
2. Dewatering and Acid Sulphate Soils Management

17.8 Relevant Legislation

1. *Agricultural Produce (Chemical Residues) Act 1983* (WA)

Note: The *Contaminated Sites Act 2003* (WA) and *Regulations 2006* (WA) do not apply as the residual OC contamination is a result of correct application of a pesticide (refer s5(2) and s4 of the *Contaminated Sites Regulations 2006* (WA)).

17.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DAF
2. DoH
3. DoCEP (Worksafe WA)

Figure 17-1 Organochlorine Contaminated Land

at [redacted], [redacted] and [redacted] The location of the OC contaminated lands has been intentionally 'blacked-out' in this publicly available version of this plan to comply with the confidentiality requirements of the DAF.

18.0 Discharge of Pipeline Pressure Testing and Disinfection Waters Management

18.1 Context

Following the construction of sections of the Water Transfer Pipeline, each section will be pressure tested to confirm its structural integrity. Each section tested will be approximately 5km in length. The pressure testing will be conducted using groundwater, scheme water, or a disinfection water containing 12.5% sodium hypochlorite.

Immediately prior to operation, the entire 30km Water Transfer Pipeline will be disinfected with 12.5% sodium hypochlorite. Disinfection is required in order to reduce bacterial contamination within the pipeline. This process will produce a disinfection water at approximately 5mg/L to 20mg/L chlorine.

Both the pressure test water and disinfection water will have a pH of between 8 to 12 pH units resulting from interaction with the lime in the cement lining of the pipeline.

The pressure test and disinfection waters will be unsuitable for domestic supply, and consequently must be discharged to the environment in an appropriate manner.

Residual chlorine contained in disinfection waters can be consumed by material with a high carbon content (such as soil and vegetation), or can be neutralised with 10% Sodium Thiosulphate using a de-chlorination unit. The impacts of pH can be controlled by management of flow rates for discharge to a watercourse, or can be neutralised by acid dosing (using a non-chlorinated acid).

The estimated total volume of controlled discharge to the environment will be approximately 100 ML (50 ML each from the pressure test water and the disinfection water).

The waters will be discharged from section valves to land, watercourses along the pipeline route, or to the ocean. The quality of the discharge waters will be monitored prior to, and during, discharge to the environment.

18.2 Purpose

The purpose of the Discharge of Pipeline Pressure Testing and Disinfection Waters Management Plan is to outline the management actions to:

1. Define the method and management of discharge of pressure test water and disinfection water to the environment.

18.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.
2. Results of pH and chlorine monitoring in compliance with the discharge criteria.

18.4 Management Actions

General

1. Sections of pipeline between section valves (approximately 5km each) of the Water Transfer Pipeline will be pressure tested following construction of that section. The pressure testing will be conducted using groundwater, scheme water, or disinfection water containing 12.5% sodium hypochlorite.
2. The entire Water Transfer Pipeline will be disinfected with 12.5% sodium hypochlorite prior to operation.
3. Pressure test and disinfection waters will be preferentially discharged to the following major watercourses via scour valves:
   a. Harvey River
   b. Myalup/Harvey Main Drain
   c. Harvey Irrigation Channels
4. Disinfection water maybe preferentially discharged to agricultural land where approval of the Landowner has been obtained, or secondly to minor watercourses or drains, where discharge to the major watercourses is not practicable.
5. Pressure test and disinfection waters maybe discharged to the ocean at the Seawater Desalination Plant site. The discharge will occur through the outlet pipeline constructed for the Seawater Desalination Plant, or alternatively through a separate pipeline located in the surf zone (nominally 10m to 25m from the shoreline).

Chlorine and pH Discharge Criteria

6. The following discharge criteria apply:

	Chlorine (mg/L)	**pH**
Discharge to Watercourse	1.0[1] for discharge water	6.0 to 8.5 for the discharge water ***or*** ± 2 pH units downstream v. upstream measured at 100m from the discharge[2]
Discharge to Agricultural Land	1.0[1] for discharge water	4.0 to 10.0 for the discharge water[3]
Discharge to Ocean	Not applicable[4]	4.0 to 10.0 for the discharge water[3]

Table 18-1 Chlorine and pH Discharge Criteria

Management and Monitoring of Chlorine

7. Disinfection water will be tested for total chlorine prior to discharge to confirm that the total residual chlorine meets the discharge objectives. Testing may be conducted by water samples taken to a laboratory, or by field test equipment capable of accuracy to 1.0mg/L.
8. A mobile de-chlorination unit will be used to neutralise the residual chlorine with 10% Sodium Thiosulphate if the disinfection water has residual chlorine greater than 1.0mg/L.
9. Disinfection water will be discharged to a watercourse through a series of sterile hay bales. The bales will assist to aerate the discharge, reduce flow velocity, and reduce any suspended solids and turbidity. The bales will also assist in the neutralisation of residual chlorine (by acting as a carbon source).

Management and Monitoring of pH

10. The pH of the pressure test water and disinfection water will be field tested for (by multimeter) at the discharge point prior to discharge to confirm that the pH meets the discharge criteria on each day of discharge.
11. The pH of the pressure test water and disinfection water will be field tested for (by multimeter) at 100m upstream and 100m downstream of the discharge point on each day of discharge if the discharge does not meet the pH criteria for the discharge water for

discharges to a watercourse. The rate of discharge will be adjusted so that the pH in the watercourse downstream of the discharge is within ± 2 pH units of the upstream water quality.

12. The pH of the discharge water will be neutralised with sulphuric acid if the pH of the discharge does not meet the pH discharge criteria (with flow adjustment).

18.5 Additional Information

Discharge Criteria for Chlorine and pH

[1] Chlorine at 1.0mg/L is consistent with chlorine residual in potable water supply and is in accordance with the Water Corporation's guideline for disposal of disinfection water. Chlorine will be diluted by mixing within the watercourse, and consumed through biological uptake by bacteria, sediments and flora.

[2] Discharge pH is consistent with ANZECC/ARMCANZ and DoW guidelines for freshwater. Watercourse pH is consistent with the Water Corporation's guideline for disposal of disinfection water.

[3] pH limits defined by the *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA).

[4] Chlorine concentration for discharge to the ocean is not of concern given the concentration of chlorine present in the ocean as chloride (being part of sodium chloride (salt)).

De-chlorination

The Water Corporation's Water Technologies Division has two mobile de-chlorination units that may be made available upon request. The rate of de-chlorination capability is approximately 4ML/day. The discharge water may be pH corrected using an acid prior to de-chlorination.

Reuse

Consideration may be given to the reuse of the pressure test water and/or the disinfection water by a transfer of the water from one section of the pipeline to the next, with disinfection reoccurring in the next section. This will reduce the volume of water to be disposed of to the environment.

Consideration may also be given to reuse of the pressure test water and/or the disinfection water by discharge to a Harvey Summit Tanks such as the Harvey Dam.

18.6 Contingency Actions

1. Pressure testing of the pipeline may be repeated if the pressure test identifies that there are defects in the pipelines. The same procedure for monitoring the discharge of pressure test water to the environment will apply.
2. The same procedure for monitoring the discharge of the disinfection water to the environment will apply if disinfection is repeated.

18.7 Relevant Legislation

1. Environmental Protection Act 1986 (WA).
2. *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA).

18.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DoW
2. DEC
3. Harvey Water

19.0 Rehabilitation Management

19.1 Context

Construction of the Seawater Desalination Plant, Water Transfer Pipeline and the Harvey Summit Tanks will involve clearing of agricultural land and native vegetation (located in agricultural land, road reserves and State Forest). Rehabilitation of areas cleared will be undertaken as soon as reasonably practicable following the completion of construction works.

Following the implementation of rehabilitation actions, the success of the rehabilitation works will be monitored for a period of one year for agricultural lands, and for 5 years for native vegetation.

19.2 Purpose

The purpose of the Rehabilitation Management Plan is to outline management actions for:

1. rehabilitation of agricultural land disturbed during construction to a condition that is equal to the pre-construction condition and that is acceptable to the Landowner.
2. rehabilitation of native vegetation (including dune vegetation) to a condition that supports a self-sustaining plant community with comparable density and diversity to the pre-existing vegetation.

19.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

19.4 Management Actions

19.4.1 Seawater Desalination Plant

Native Vegetation

1. The proponent's completion objective for rehabilitation of Seawater Desalination Plant site for native vegetation is:

Native Vegetation	*Rehabilitation will achieve a post-construction condition of native vegetation that will, in the future[1], likely support a self-sustaining plant community with comparable species density and species diversity to the pre-existing vegetation.*

2. The Seawater Desalination Plant site will be re-contoured, including re-creation of the primary dune, establishment of earth screening bunds, and contouring of the whole site to achieve stable batters.
3. Seed for rehabilitation will be collected from within nominally 50km of the construction site between (nominally) December to March of the year prior to seeding. A Licence will be obtained from the CEO of the DEC under s88(1) of the *Conservation and Land Management Act 1984* (WA) for collection of seed within DEC managed land (Note: Licence application to be made in accordance with r83 of the *Conservation and Land Management Regulations 2004* (WA)).
4. Seed will be collected based upon the species list identified in Table 19-2. The mass of each species collected will be determined based on seed availability (including consideration of recalcitrant species).
5. Following ripping of the compacted areas (refer to Land Clearing and Trench Management), the land will be seeded[2] with native vegetation seed at a rate of 5kg/ha. The 5kg/ha seed

base will be mixed with a 10kg/ha bulking agent (such as white sand) to achieve a more even spread of seed.

6. A slow release fertiliser having a low phosphorus content (such as Osmocote® PLUS Native Gardens (ratio Nitrogen 17: Phosphorus 1.6: Potassium 8.7)) will be applied at a nominal rate of 200kg/ha (by total weight, or at a rate as directed by the manufacturer) at the time of seeding.
7. Areas seeded and fertilised will be irrigated once per week for a period of 4 weeks following seeding and fertilising to encourage seed germination at a nominal irrigation rate of 50kL/ha (being equivalent to 5mm rainfall). Irrigation will be undertaken using a diffuse spray to prevent erosion during irrigation. Where seeding is undertaken in the months of December, January, February or March, there will be additional irrigation of the seeded area once per week for those months.
8. The revegetation works will be monitored for growth cover and vigour for a period of five springs following seeding and fertilising. The monitoring will assess the density and diversity of the rehabilitated areas compared to pre-construction photographs and any relevant pre-construction reports (including flora surveys).
9. Supplementary seeding, direct planting, fertilising and/or irrigation will be undertaken if the monitoring identifies poor growth in any revegetation area following the completion of spring monitoring,
10. Growth of large tree species (such as Jarrah and Marri) will be removed from within 7.5m of buried pipelines during the monitoring period[3]. Removal of these species will occur by cutting at the base of the plant and applying a Glyphosate herbicide to the cut surface.

19.4.2 Pipeline and Harvey Summit Tanks

Agricultural Land

11. The completion objective for rehabilitation of construction areas of agricultural land is:

Agricultural Land	*Rehabilitation will achieve a post-construction agricultural condition that is equal or better than the pre-construction agricultural condition, and is acceptable to the Landowner.*

12. Irrigation paddocks (that were laser levelled prior to construction) will be re-laser levelled as soon as practicable following construction on each lot.
13. Following ripping of the compacted areas (refer to Land Clearing and Trench Management), land disturbed by construction works will be seeded in consultation with the Landowner. Generally, three types of seed mixes containing a combination of rye grass and clover will be used, being separate proportions for irrigated agriculture, dry land agriculture, or agriculture on winter waterlogged land.
14. The following rates of seed and fertiliser will be applied on agricultural land under rehabilitation:

Seed (kg/ha)	Phosphorus (kg/ha)	Nitrogen (kg/ha)	Potassium (kg/ha)	Sulphur (kg/ha)
25	40	35	20	20

Table 19-1 Seed and Fertiliser Application rates

Seed and fertiliser applications rates maybe varied by agreement with the Landowner.

15. The seed and fertiliser will be supplied to the Landowner at the above rate if the Landowner wishes to undertake the seeding and fertilising on their own land.
16. The Landowners of laser levelled irrigation paddocks will be requested to commence irrigation following seeding and fertilising to encourage seed germination. All non-irrigated paddocks will be irrigated with a nominal depth of 10mm of water (equivalent to 100kL/ha) following seeding and fertilising to encourage seed germination. Irrigation will be undertaken using a diffuse spray to prevent erosion during irrigation.

17. The growth success of rehabilitation works on agricultural land will be monitored for a period of one full spring following seeding and fertilising. The growth success will be measured by vegetation cover and vigour compared to pre-construction photographs.

18. Soil consolidation of the construction areas will be monitored on all laser levelled irrigation paddocks and measure any soil consolidation.

19. A report will be provided detailing the monitoring undertaken and the results of growth success and soil consolidation.

20. In consultation with the Landowner (and at no cost to the Landowner), seeding, fertilising and irrigation will be repeated in any areas that do not have vegetation cover or vigour that is equal to or better than the preconstruction condition within the first 12 months following the completion of all construction works on the land.

21. In consultation with the Landowner (at no cost to the Landowner), remedial works will be undertaken to correct soil consolidation if the trench settles or consolidates greater than 3cm in laser levelled irrigation paddocks, or greater than 10cm in non-irrigated paddocks, within the first 12 months following the completion of all construction works. The remedial works to be undertaken will involve (as per the Land Clearing and Trench Management Plan):
    a. removal of topsoil.
    b. replacement and compaction with clean fill of equivalent soil type.
    c. replacement of topsoil.
    d. seeding and fertilising as stated above.
    e. Any other actions as agreed on with the Landowner (which may or may not include other actions to account for consequential loss or future soil consolidation).

Native Vegetation

22. The completion objective for rehabilitation of construction areas with native vegetation is:

Native Vegetation	*Rehabilitation will achieve a post-construction condition of native vegetation that will, in the future[1], likely support a self-sustaining plant community with comparable species density and species diversity to the pre-existing vegetation.*

23. Following ripping of the compacted areas (refer to Land Clearing and Trench Management), the land will be seeded[2] with native vegetation seed at a rate of 5kg/ha. The 5kg/ha seed base will be mixed with a 10kg/ha bulking agent (such as white sand) to achieve a more even spread of seed.

24. Seed for rehabilitation will be collected from within 50km of the construction site between (nominally) December to March of the year prior to seeding. A Licence will be obtained from the CEO of the DEC under s88(1) of the *Conservation and Land Management Act 1984* (WA) for collection of seed within State Forest (Note: Licence application to be made in accordance with r83 of the *Conservation and Land Management Regulations 2004* (WA)).

    The species of seed to be collected will be based upon the species list identified in Table 15-2. The mass of each species collected will be determined based on seed availability (including consideration of recalcitrant species).

25. A slow release fertiliser having a low phosphorus content (such as Osmocote® PLUS Native Gardens (ratio Nitrogen 17: Phosphorus 1.6: Potassium 8.7)) will be applied at a nominal rate of 200kg/ha (by total weight, or at a rate as directed by the manufacturer) at the time of seeding.

26. Areas seeded and fertilised will be irrigated once per week for a period of 4 weeks following seeding and fertilising to encourage seed germination at a nominal irrigation rate of 50kL/ha (being equivalent to 5mm rainfall). Irrigation will be undertaken using a diffuse spray to prevent erosion during irrigation. Where seeding is undertaken in the months of December, January, February or March, the seeded area will be additionally irrigated once per week for those months.

27. The revegetation works will be monitored for growth cover and vigour for the period of one full spring following seeding and fertilising. A report on the monitoring undertaken will be prepared.

28. If the monitoring identifies poor growth in any revegetation area following the completion of spring monitoring, supplementary seeding, direct planting, fertilising and/or irrigation will be undertaken.

29. Following the spring monitoring and any supplementary works, there will be annual monitoring of the rehabilitation works for a further 4 spring periods (i.e. a total of 5 spring monitoring years). The monitoring will assess the density and diversity of the rehabilitated areas compared to pre-construction photographs and any relevant pre-construction reports (including flora surveys).

30. Direct planting by seedlings maybe undertaken if supplementary works within the monitoring period are required to improve vegetation density or diversity.

31. Growth of large tree species (such as Jarrah and Marri) will be removed from within 7.5m of the Water Transfer Pipeline centreline within the Water Corporation's monitoring period[3]. Removal of these species will occur by cutting at the base of the plant and applying a Glyphosate herbicide to the cut surface.

19.5 Additional Information

Native Vegetation Rehabilitation

[1] The density and diversity of rehabilitated native revegetation will change over time. Such changes over time include:

1. increase in overstorey height.
2. development of understorey with increased overstorey height.
3. leaf litter drop from overstorey to suppress weed species.
4. species recruitment from adjacent vegetation.

As the changes listed above can only be developed over time, it would be unlikely that rehabilitation of native vegetation could be deemed to support a self-sustaining plant community with comparable species density and species diversity to the pre-existing vegetation within a period of 20 to 30 years.

A 20 to 30 year timeframe for implementing rehabilitation of native vegetation is considered inappropriate given that:

1. native revegetation requires limited active management once established.
2. the area of native vegetation to be cleared is small (<15ha).
3. large trees cannot be planted within 7.5m of the pipeline (due to root damage of rubber ring joints), so the vegetation structure will be different for a large proportion of the rehabilitation.
4. the *likelihood* of the vegetation to meet the completion objectives into the future can be assessed after a lesser time period (5 years after establishment)

Consequently, the likelihood of the vegetation achieving the completion objectives in the future will be assessed after a period of 5 years. The 5-year assessment will include:

1. calculation of the current species density and species diversity in comparison to the pre-construction species density and species diversity
2. the likelihood of recruitment of species from adjacent vegetation.
3. a determination if the native vegetation will, within a period of 30 years, likely achieve the completion objectives. The determination will be made in consultation with the Landowner with a view to hand over management of the rehabilitated areas to the Landowner
4. the determination will include any requirement to fund minor active management (such as weed control) to the Landowner.

[2] Timing of seeding for native vegetation will be dependant on seed availability.

Infrastructure Maintenance

[3] It is required by this plan to remove large trees species from within 7.5m of buried pipelines to prevent tree roots from interfering with the rubber ring joints that connect the pipe lengths. This operational maintenance work will need to be undertaken throughout the life of the project in consultation with the relevant Landowner(s) beyond the timeframe covered by this CEMF.

Weed Management

The 3 year monitoring and management period for weeds in agricultural land and native vegetation specified in the Hygiene Management Plan is separate to the monitoring and management periods for rehabilitation. These actions will be undertaken concurrently.

19.6 Contingency Actions

Native Vegetation

1. Additional or alternative actions required will be considered to meet the completion objectives if the rehabilitation works in native vegetation do not meet the completion objectives within 5 years.

Agricultural Land

2. A resolution will be facilitated with the Landowner if agreement cannot be reached as to the success of rehabilitation works on agricultural land.

19.7 Related Plans

1. Land Clearing and Trench Management
2. Well Construction Management
3. Hygiene Management

19.8 Relevant Legislation

1. *Conservation and Land Management Act 1984* (WA) and *Regulations 2004* (WA).

19.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. DAF
3. Conservation Commission
4. Shire of Harvey

Table 19-2 Native Flora to be Considered for Rehabilitation of Native Vegetation

(from 360 Environmental 2008).

Notes:
1. The *WAH No.* is the plant family number used by the Western Australian Herbarium.
2. *Declared weed* means the species has been declared under the *Agriculture and Related Resources Protection Act 1976* (WA).
3. Priority flora species are as defined by the Department of Environment and Conservation, but have no specific legal protection.
4. *NS* indicates a weed of national significance as defined by Thorp & Lynch (2000).

WAH No.	FAMILY / TAXA	COMMON NAMES	NOTES
3	**Selaginellaceae**		
	Selaginella gracillima		
011C	**Dennstaedtiaceae**		
	Pteridium esculentum	bracken	
016A	**Zamiaceae**		
	Macrozamia riedlei	zamia	
017A	**Pinaceae**		
	Pinus pinaster	maritime pine	weed
20	**Typhaceae**		
	Typha orientalis	bullrush	weed
23	**Potamogetonaceae**		
	Potamogeton drummondii	pond weed	
26	**Juncaginaceae**		
	Triglochin sp. B Flora of Australia (P.G. Wilson 4294)		
	Triglochin trichophora		
	Triglochin huegelii		
	Triglochin nana		
27	**Alismataceae**		
	Alisma lanceolatum	water plantain	weed
31	**Poaceae (grasses)**		
	Aira caryophyllea	silvery hairgrass	weed
	Aira cupaniana	early hairgrass	weed
	Aira praecox	early hairgrass	weed
	Ammophila arenaria	marram grass	weed
	Amphipogon laguroides subsp. laguroides		
	Amphibromus nervosus		
	Amphipogon turbinatus		
	Amphipogon amphipogonoides		
	Amphipogon laguroides subsp. laguroides		
	Austrodanthonia occidentalis		
	Arundo donax	'bamboo'	weed
	Austrostipa campylachne		
	Austrostipa compressa		
	Austrostipa flavescens		
	Austrostipa sp.		
	Avena barbata	wild oats	weed
	Briza maxima	blowfly grass	weed
	Briza minor	shivery grass	weed
	Bromus diandrus	great brome	weed
	Bromus hordeaceus	soft brome	weed
	Bromus rubens	red brome	weed
	Cynodon dactylon	couch	weed
	Dactylis glomerata	cocksfoot	weed
	Deyeuxia quadriseta	reed bentgrass	weed
	Dichelachne crinita	longhair plumegrass	
	Ehrharta brevifolia	annual veldt grass	weed
	Ehrharta calycina	perennial veldt grass	weed
	Ehrharta longiflora	annual veldt grass	weed
	Elymus scaber		
	Eragrostis curvula	African love grass	weed
	Glyceria declinata		weed
	Holcus lanatus	Yorkshire fog	weed
	Holcus setiger	annual fog	weed
	Hordeum geniculatum	barley grass	weed
	Hordeum leporinum	barley grass	weed
	Lagurus ovatus	hair's tail grass	weed
	Lolium multiflorum	talian rye grass	weed
	Lolium perenne	perennial ryegrass	
	Lolium rigidum	annual rye grass	weed
	Medicargo polymorpha		weed
	Microlaena stipoides var. stipoides		
	Paspalum sp.		weed
	Pennisetum clandestinum	kikuyu	weed
	Poa annua	winter grass	weed
	Poa drummondiana	knotted poa	weed
	Poa poiformis	coastal poa	
	Poa porphyroclados		

	Poa porphyroclados		
	Polypogon monspeliensis	annual beardgrass	weed
	Sorghum halepense	Johnson grass	weed
	Spinifex hirsutus	hairy spinifex	
	Stenotaphrum secundatum buffalo grass	buffalo grass	weed
	Vulpia bromoides	squirrel tail fescue	weed
	Vulpia muralis		weed
32	**Cyperaceae (sedges)**		
	Baumea articulata	jointed rush	
	Baumea preissii subsp. laxa		
	Bolboschoenus caldwellii	marsh club-rush	
	Carex appressa	tall sedge	
	Carex preissii		
	Cyathochaeta ?avenacea		
	Cyperus sp.		
	Cyperus tenellus	tiny flatsedge	weed
	Eleocharis acuta	common spike-sedge	
	Ficinia nodosa	knotted club-rush	
	Gahnia trifida	coastal saw-sedge	
	Isolepis cernua var. setiformis		
	Isolepis hystrix		weed
	Isolepis marginata	coarse club-rush	weed
	Isolepis stellata	star club-rush	
	Lepidosperma gladiatum	coastal sword-sedge	
	Lepidosperma longitudinale	pithy sword-sedge	
	Lepidosperma pubisquameum		
	Lepidosperma scabrum		
	Lepidosperma squamatum		
	Lepidosperma tetraquetrum		
	Mesomelaena graciliceps		
	Schoenus caespititius		
	Schoenus curvifolius		
	Schoenus efoliatus		
	Schoenus grandiflorus	large flowered bogrush	
	Schoenus subfascicularis		
	Schoenus sublateralis		
	Tetraria capillaris	hair sedge	
	Tetraria octandra		
35	***Araceae***		
	Zantedeschia aethiopica	Arum lilly	Declared weed
39	***Restionaceae (rushes)***		
	Anarthria laevis		
	Desmocladus asper		
	Desmocladus flexuosus		
	Hypolaena exsulca		
	Lepyrodia glauca		
	Lepyrodia muirii		
	Lyginia barbata		
	Lyginia imberbis		
	Meeboldina roycei		
	Meeboldina scariosa		
40	***Centrolepidaceae***		
	Aphelia cyperoides		
	Centrolepis aristata	pointed centrolepis	
	Centrolepis drummondiana		
	Centrolepis mutica		
47	**Commelinaceae**		
	Cartonema philydroides		
50	**Philydraceae**		
	Philydrella pygmaea subsp. pygmaea		
52	**Juncaceae**		
	Juncus articulatus	jointed rush	
	Juncus bufonius	toad rush	weed
	Juncus kraussii	sea rush	
	Juncus microcephalus		weed
	Juncus pallidus	pale rush	
	Juncus pauciflorus	loose flower rush	
	Juncus subsecundus	finger rush	
	Juncus usitatus	common rush	weed
	Luzula meridionalis	field woodrush	
054B	**Asparagaceae**		
	Asparagus asparagoides	bridal creeper	Declared weed & NS
054C	**Dasypogonaceae**		
	Acanthocarpus preissii		
	Dasypogon bromeliifolius	pineapple bush	
	Lomandra hermaphrodita		
	Lomandra maritima		
	Lomandra micrantha subsp. micrantha		
	Lomandra nigricans		
	Lomandra odora	tiered matrush	
	Lomandra preissii		
	Lomandra purpurea	purple matrush	
	Lomandra sericea	silky matrush	

	Lomandra sonderi		
054D	**Xanthorrhoeaceae**		
	Xanthorrhoea brunonis		
	Xanthorrhoea preissii	grass tree or blackboy	
054E	**Phormiaceae**		
	Dianella revoluta var. divaricata		
054F	**Anthericaceae**		
	Agrostocrinum hirsutum		
	Agrostocrinum scabrum subsp. scabrum		
	Caesia micrantha	pale grass-lily	
	Chamaescilla corymbosa var. corymbosa		
	Corynotheca micrantha var. micrantha		
	Dichopogon capillipes		
	Johnsonia acaulis		
	Laxmannia squarrosa		
	Sowerbaea laxiflora	purple tassels	
	Thysanotus arbuscula		
	Thysanotus arenarius		
	Thysanotus manglesianus	fringed lily	
	Thysanotus multiflorus	many-flowered fringe lily	
	Thysanotus thyrsoideus		
	Tricoryne elatior	yellow Autumn lily	
054G	**Asphodelaceae**		
	Trachyandra divaricata	onion weed	weed
054J	**Colchicaceae**		
	Burchardia congesta		
	Wurmbea monantha		
55	**Haemodoraceae**		
	Anigozanthos manglesii subsp. manglesii	kangaroo paw	
	Conostylis aculeata subsp. aculeata	prickley conostylis	
	Conostylis aculeata subsp. preissii		
	Conostylis juncea		
	Haemodorum ?sparsiflorum		
	Phlebocarya ciliata		
60	**Iridaceae**		
	Gladiolus undulatus	wild gladiolus	weed
	Patersonia occidentalis	purple flag	
	Romulea obscura		weed
	Romulea rosea var. rosea	Guilford grass	weed
	Romulea sp.		
	Watsonia sp.		weed
66	**Orchidaceae**		
	Caladenia discoidea	dancing orchid	
	Caladenia flava subsp. flava		
	Caladenia latifolia	pink fairy orchid	
	Caladenia longicauda subsp. calcigena		
	Caladenia marginata	white fairy orchid	
	Caladenia paludosa		
	Caladenia speciosa		DEC Priority 4 species
	Cryptostylis ovata		
	Disa bracteata		weed
	Diuris corymbosa		
	Drakaea glyptodon	king-in-his-carrage	
	Drakaea micrantha		Declared Rare Flora
	Elythranthera brunonis	purple enamel orchid	
	Elythranthera emarginata	pink enamel orchid	
	Eriochilus dilatatus subsp. dilatatus		
	Eriochilus dilatatus subsp. multiflorus		
	Leporella fimbriata	hare orchid	
	Lyperanthus serratus	rattle beak orchid	
	Microtis media subsp. media		
	Microtis media subsp. quadrata		
	Paracaleana nigrita	flying duck orchid	
	Prasophyllum parvifolium	Autumn leek orchid	
	Pterostylis aff. nana		
	Pterostylis brevisepala		
	Pterostylis crenulata		
	Pterostylis recurva	jug orchid	
	Pterostylis sanguinea		
	Pterostylis vittata	banded greenhorn	
	Pyrorchis nigricans	red beaks	
	Thelymitra benthamiana	cinnamon sun orchid	
	Thelymitra crinita	blue lady orchid	
	Thelymitra flexuosa	twisted sun orchid	
	Thelymitra graminea		
	Thelymitra macrophylla		
	Thelymitra paludosa		
	Thelymitra vulgaris		
70	**Casuarinaceae**		
	Allocasuarina sp.		Introduced horticultural species
88	**Urticaceae**		
	Parietaria ?cardiostegia		
	Parietaria debilis	pelitory	

90	**Proteaceae**		
	Adenanthos meisneri		
	Adenanthos obovatus	basket flower	
	Banksia attenuata	slender banksia	
	Banksia grandis	bull banksia	
	Banksia ilicifolia	holy-leaved banksia	
	Banksia littoralis	swamp banksia	
	Grevillea diversifolia subsp. diversifolia		
	Hakea lissocarpha	honey bush	
	Hakea prostrata	harsh hakea	
	Hakea ruscifolia	candle hakea	
	Hakea varia	variable-leaved hakea	
	Persoonia longifolia	snottygobble	
	Persoonia saccata	snottygobble	
	Petrophile linearis	pixie mops	
	Stirlingia latifolia	blueboy	
92	**Santalaceae**		
	Exocarpos sparteus	broom ballart	
	Leptomeria cunninghamii		
	Leptomeria pauciflora	sparse-flowered currant bush	
	Santalum acuminatum	quondong	
97	**Loranthaceae**		
	Nuytsia floribunda	Christmas tree	
103	**Polygonaceae**		
	Persicaria ?prostrata		weed
	Polygonum aviculare	wireweed	
	Rumex crispus	curled dock	weed
105	**Chenopodiaceae**		
	Rhagodia baccata subsp. baccata		
	Threlkeldia diffusa	coast bonefruit	
109	**Phytolaccaceae**		
	Phytolacca octandra	red ink plant	weed
110	**Aizoaceae**		
	Carpobrotus edulis	hottentot fig	weed
	Carpobrotus virescens	coastal pigface	
111	**Portulacaceae**		
	Calandrinia brevipedata	short-stalked purselane	
	Calandrinia granulifera	pygmy purselane	
	Calandrinia liniflora	parakeelya	
	Calandrinia sp. SW coastal (J. Dodd 753)		
113	**Caryophyllaceae**		
	Cerastium glomeratum	mouse ear chickweed	weed
	Cerastium pumilum		weed
	Petrorhagia dubia	velvet pink	weed
	Silene gallica	French catchfly	weed
	Stellaria pallida		
119	**Ranunculaceae**		
	Clematis linearifolia		
	Ranunculus sessiliflorus	smallflower buttercup	
131	**Lauraceae**		
	Cassytha racemosa forma racemosa		
	Cinnamomum camphora	camphor laural	weed
136	**Fumariaceae**		
	Fumaria muralis	wall fumitory	weed
138	**Brassicaceae**		
	Cakile maritima	sea rocket	weed
	Heliophila pusilla		weed
	Stenopetalum gracile		
143	**Droseraceae**		
	Drosera erythrorhiza subsp. squamosa		
	Drosera gigantea subsp. geniculata		
	Drosera menziesii subsp. penicillaris		
	Drosera macrantha	bridal rainbow	
	Drosera minutiflora		
	Drosera neesii	jewel rainbow	
	Drosera pallida	pale rainbow	
	Drosera porrecta		
149	**Crassulaceae**		
	Crassula colorata var. acuminata		
	Crassula colorata var. colorata		
152	**Pittosporaceae**		
	Marianthus tenuis		
161	**Rosaceae**		
	Rubus sp.	blackberry	Declared weed & NS
163	**Mimosaceae (acacias)**		
	Acacia applanata		
	Acacia cochlearis	rigid wattle	
	Acacia cyclops	coastal wattle	
	Acacia dentifera		
	Acacia extensa	wiry wattle	
	Acacia huegelii		
	Acacia lasiocarpa var. lasiocarpa		
	Acacia paradoxa	kangaroo thorn	weed

	Acacia pulchella var. glaberrima		
	Acacia pycnantha	golden wattle	weed
	Acacia saligna	orange wattle	
	Acacia semitrullata		DEC Priority 3 species
	Acacia stenoptera	narrow winged wattle	
	Acacia truncata (Sand dune variant)		
	Acacia urophylla		Introduced horticultural species
	Acacia willdenowiana	grass wattle	
	Paraserianthes lophantha subsp. lophantha	formerly Albizia	Introduced horticultural species
164	**Caesalpiniaceae**		
	Labichea punctata	lance-leaved cassia	
165	**Papilionaceae (peas)**		
	Aotus gracillima		
	Aotus procumbens		
	Aotus sp.		
	Bossiaea eriocarpa	common brown pea	
	Callistachys lanceolata	connich	
	Chamaecytisus palmensis	tagasaste	weed
	Daviesia divaricata subsp. divaricata		
	Daviesia physodes		
	Dillwynia dillwynioides		DEC Priority 3 species
	Dipogon lignosus	dolichos Pea	weed
	Euchilopsis linearis	swamp pea	
	Gastrolobium ebracteolatum		
	Gompholobium capitatum		
	Gompholobium confertum		
	Gompholobium polymorphum		
	Gompholobium tomentosum	hairy yellow pea	
	Hardenbergia comptoniana	native wisteria	
	Hovea pungens	Devil's pins	
	Hovea trisperma	common hovea	
	Isotropis cuneifolia subsp. cuneifolia		
	Jacksonia furcellata	grey stinkwood	
	Jacksonia gracillima		
	Jacksonia sternbergiana	stinkwood	
	Kennedia prostrata	scarlet runner	
	Latrobea tenella		
	Lotus angustissimus	narrow leaf trefoil	weed
	Lotus subbiflorus		weed
	Lotus uliginosus	greater lotus	weed
	Lupinus cosentinii	lupins	weed
	Melilotus indicus		weed
	Melilotus siculus		weed
	Ornithopus compressus	yellow serradella	weed
	Pisum sativum		weed
	Pultenaea ochreata		
	Pultenaea reticulata		
	Templetonia retusa	cockies tongues	
	Trifolium angustifolium var. angustifolium	narrow leaf clover	weed
	Trifolium campestre var. campestre	hop clover	weed
	Trifolium cernuum	drooping flower clover	weed
	Trifolium hybridum var. hybridum	alsike clover	weed
	Vicia sativa subsp. nigra	common vetch	weed
	Viminaria juncea	swishbush	
167	**Geraniaceae**		
	Erodium cicutarium	common stalksbill	weed
	Geranium molle	dove's foot cranesbill	weed
	Geranium retrorsum		
	Pelargonium capitatum	rose pelargonium	weed
	Pelargonium littorale subsp. littorale		
168	**Oxalidaceae**		
	Oxalis corniculata	yewllow wood sorrel	weed
	Oxalis perennans		
	Oxalis pes-caprae	soursob	weed
173	**Zygophyllaceae**		
	Zygophyllum fruticulosum	shrubby twinleaf	
	Zygophyllum simile		
175	**Rutaceae**		
	Boronia dichotoma		
	Diplolaena dampieri	southern Diplolaena	
	Philotheca spicata	pepper and salt	
182	**Tremandraceae**		
	Platytheca galioides		
	Tetratheca hirsuta	black eyed Susan	
183	**Polygalaceae**		
	Comesperma calymega	blue-spike milkwort	
	Comesperma flavum		
	Comesperma virgatum	milkwort	
185	**Euphorbiaceae**		
	Euphorbia paralias	sea spurge	weed
	Euphorbia terracina	Geraldton carnation weed	weed
	Monotaxis occidentalis		
	Phyllanthus calycinus	false Boronia	

	Poranthera drummondii		
	Poranthera microphylla	small Poranthera	
215	**Rhamnaceae**		
	Spyridium globulosum	basket bush	
223	**Sterculiaceae**		
	Lasiopetalum membranaceum		DEC Priority 3 species
	Thomasia cognata		
226	**Dilleniaceae**		
	Hibbertia cuneiformis	cutleaf Hibbertia	
	Hibbertia hypericoidesi		
	Hibbertia racemosa	stalked guinea flower	
	Hibbertia stellaris	orange stars	
	Hibbertia vaginata		
263	**Thymelaeaceae**		
	Pimelea lanata		
265	**Lythraceae**		
	Lythrum hyssopifolia	lesser loosestrife	weed
273	**Myrtaceae**		
	Agonis flexuosa var. flexuosa	peppermint	
	Astartea scoparia		
	Calothamnus quadrifidus	one-sided bottlebrush	Introduced horticultural species
	Calytrix angulata	yellow starflower	
	Calytrix flavescens	summer starflower	
	Calytrix fraseri	pink summer calytrix	
	Corymbia calophylla	marri	
	Darwinia citriodora	lemon-scented Darwinia	
	Eucalyptus gomphocephala	tuart	
	Eucalyptus gomphocephala (mallee form)		
	Eucalyptus marginata subsp. marginata	jarrah	
	Eucalyptus platypus	moort	Introduced horticultural species
	Eucalyptus rudis subsp. cratyantha		DEC Priority 4 species
	Eucalyptus rudis subsp. rudis	flooded gum	
	Eucalyptus wandoo	wandoo	
	Hypocalymma angustifolium	white myrtle	
	Kunzea glabrescens	spearwood	
	Leptospermum laevigatum	Victorian tea tree	weed
	Melaleuca incana subsp. incana	grey honeymyrtle	
	Melaleuca lanceolata	rottnest teatree	Introduced horticultural species
	Melaleuca lateritia	robin redbreast bush	
	Melaleuca preissiana	Moonah	
	Melaleuca preissiana	Moonah	
	Melaleuca rhaphiophylla	swamp paperbark	
	Melaleuca teretifolia	banbar	
	Melaleuca thymoides		
	Melaleuca trichophylla (glabrous form)		
	Melaleuca viminea subsp. viminea		
	Pericalymma ellipticum	swamp teatree	
275	**Onagraceae**		
	Oenothera mollissima		weed
	Oenothera stricta	common Evening Primrose	weed
276	**Haloragaceae**		
	Gonocarpus pithyoides		
281	**Apiaceae**		
	Actinotus glomeratus		
	Centella asiatica		
	Daucus glochidiatus	Australian carrot	
	Eryngium pinnatifidum subsp. pinnatifidum		
	Homalosciadium homalocarpum		
	Hydrocotyle callicarpa	small pennywort	
	Hydrocotyle pilifera var. glabrata		
	Hydrocotyle pilifera var. pilifera		
	Hydrocotyle tetragonocarpa		
	Platysace filiformis		
	Trachymene coerulea subsp. coerulea		
	Trachymene pilosa	native parsnip	
	Xanthosia huegelii		
288	**Epacridaceae**		
	Astroloma ciliatum	candle cranberry	
	Astroloma sp.		
	Brachyloma preissii subsp. obtusifolium		
	Conostephium pendulum	pearl flower	
	Leucopogon australis	spiked beard-heath	
	Leucopogon conostephioides		
	Leucopogon cordatus		
	Leucopogon parviflorus	coast beard-heath	
	Leucopogon propinquus		
	Leucopogon racemulosus		
	Leucopogon sprengelioides		
	Lysinema ciliatum	curry flower	
293	**Primulaceae**		
	Anagallis arvensis var. arvensis	pimpernel	weed
	Anagallis arvensis var. caerulea	pimpernel	weed
	Samolus junceus		

301	**Oleaceae**		
	Olea europaea	olive	weed
302	**Loganiaceae**		
	Logania serpyllifolia subsp. angustifolia		
	Logania vaginalis	white spray	
	Phyllangium divergens		
	Phyllangium paradoxum		
303A	**Menyanthaceae**		
	Villarsia albiflora		
304	**Apocynaceae**		
	Alyxia buxifolia	dysentery bush	
	Vinca major	blue periwinkle	weed
305	**Asclepiadaceae**		
	Gomphocarpus fruticosus	cotton bush	Declared weed
307	**Convolvulaceae**		
	Dichondra repens	kidney weed	
307A	**Cuscutaceae**		
	Cuscuta epithymum	lesser dodder	weed
310	**Boraginaceae**		
	Heliotropium curassavicum	smooth heliotrope	
	Echium plantagineum	Paterson's curse	weed
313	**Lamiaceae**		
	Hemiandra glabra subsp. glabra		
	Hemiandra pungens	snakebush	
	Mentha x piperita	eau de Cologne mint	weed
315	**Solanaceae**		
	Anthocercis littorea	yellow tailflower	
	Solanum linnaeanum	apple of sodon	Declared weed
	Solanum nigrum	black berry nightshade	weed
	Solanum symonii		
	Cuscuta epithymum	lesser dodder	
316	**Scrophulariaceae**		
	Bacopa ?monnieri		
	Dischisma arenarium		
	Parentucellia viscosa	sticky bartsia	
	Veronica distans		
	Dischisma arenarium		weed
320	**Orobanchaceae**		
	Orobanche australiana	Australian broomrape	
	Orobanche minor	lesser broomrape	weed
326	***Myoporaceae***		
	Myoporum insulare	blueberry tree	
329	**Plantaginaceae**		
	Plantago lanceolata	ribwort plaintain	weed
331	**Rubiaceae**		
	Opercularia hispidula	hispid stinkweed	
	Opercularia vaginata	dog weed	
339	**Campanulaceae**		
	Wahlenbergia capensis	cape bluebell	weed
	Wahlenbergia gracilenta	annual bluebell	
340	**Lobeliaceae**		
	Isotoma hypocrateriformis	woodbridge poison	
	Lobelia alata	angled Lobelia	
	Lobelia rhytidosperma	wrinked-seeded Lobelia	
	Lobelia tenuior	slender Lobelia	
341	**Goodeniaceae**		
	Dampiera linearis	common Dampiera	
	Lechenaultia biloba	blue Leschenaultia	
	Lechenaultia floribunda	free-flowering Leschenaultia	
	Scaevola calliptera		
	Scaevola crassifolia	thick-leaved fan-flower	
343	**Stylidiaceae**		
	Levenhookia pusilla	midget stylewort	
	Levenhookia stipitata	common stylewort	
	Stylidium aff. junceum		
	Stylidium brunonianum	pink fountain triggerplant	
	Stylidium calcaratum	book trigger plant	
	Stylidium carnosum	fleshy-leaved triggerplant	
	Stylidium guttatum	dotted triggerplant	
	Stylidium junceum	reed triggerplant	
	Stylidium piliferum	common butterfly triggerplant	
	Stylidium repens	matted triggerplant	
	Stylidium schoenoides	cow kicks	
345	**Asteraceae**		
	Arctotheca calendula	capeweed	weed
	Arctotheca populifolia	dune Arctotheca	weed
	Asteridea pulverulenta	common bristle daisy	
	Carduus tenuiflorus	sheep thistle	
	Cirsium vulgare	spear thistle	weed
	Conyza bonariensis	flaxleaf fleabane	weed
	Cotula coronopifolia	waterbuttons	weed
	Craspedia variabilis		
	Euchiton sphaericus		weed

Hyalosperma cotula		
Hyalosperma pusillum		
Hypochaeris glabra	smooth catsear	weed
Lactuca serriola	prickley lettuce	weed
Lagenophora huegelii		
Millotia myosotidifolia		
Millotia tenuifolia var. tenuifolia	soft Millotia	
Olearia axillaris	coastal daisybush	
Olearia paucidentata	Autumn scrub daisy	
Ozothamnus cordatus		
Podotheca angustifolia	sticky longheads	
Quinetia urvillei		
Rhodanthe citrina		
Senecio diaschides		weed
Senecio pinnatifolius var. latilobus		
Siloxerus humifusus	procumbent Siloxerus	
Sonchus oleraceus	common sowthistle	weed
Trichocline spathulata	native gerbera	
Ursinia anthemoides	Ursinia	weed

20.0 Environmental Incident Management

20.1 Context

Environmental incidents have the potential to occur on construction sites due to the scale and type of works being undertaken. For the purposes of this CEMF, an Environmental Incident is:

> *any event or impact on the environment involving actions or assets associated with the project that is capable of:*
> 1. *causing harm to the environment or any person;*
> 2. *causing pollution; and/or*
> 3. *coming to the attention of the public or an environmental regulatory agency.*

Environmental incidents include matters such as:

1. chemical spills (including hydrocarbons).
2. fires.
3. discharges of contaminated waters to the environment.
4. environmental monitoring results indicating an impact to the environment or any person (water quality, noise, etc).
5. death or injury of a marine mammal (such as whales or dolphins) or terrestrial fauna.

Environmental incidents do not include matters where there is no impact on the environment or do not cause concern for external groups, for example, a routine variance to compliance with this CEMF (routine variances will be dealt with under the Non-compliance Management Plan).

The Water Corporations Standard *SG110 Incident Management Corporate Planning Model* defines the manner in which the Principal responds to incidents. Environmental incidents relating to construction of the Southern Seawater Desalination Project shall be conducted as per Standard SG110.

20.2 Purpose

The purpose of the Environmental Incident Management Plan is to outline management actions to:

1. identify, manage and report on environmental incidents.
2. identify management actions required for prevention of future environmental incidents.

20.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

20.4 Management Actions

Determining an Environmental Incident

1. Suspected environmental incidents will be reported to an on-site environmental scientist. The environmental scientist will assess the impact site and make a determination (based upon professional experience) on whether the suspected environmental incident is confirmed.

2. If a confirmed environmental incident occurs, the incident will be repored as soon as reasonably practicable to:

Name	Position	Organisation	Telephone	
George Basanovic	Corporate Incident Management Coordinator	Water Corporation	B/H: A/H/Mobile:	9420 3247 [redacted]
Mark Oliver	Senior Project Manager – Seawater Desalination Plant	Water Corporation	B/H: A/H/Mobile:	9420 3752 [redacted]
John Stansfield	Project Manager – Seawater Desalination Plant	Water Corporation	B/H: A/H/Mobile:	9420 3406 [redacted]
John Goullee	Principal Project Manager – Water Transfer Pipeline and Harvey Summit Tanks	Water Corporation	B/H: A/H/Mobile:	9420 2149 [redacted]
Gordon Groth	Senior Environmental Officer	Water Corporation	B/H: A/H/Mobile:	9420 2796 [redacted]
Guy Watson	Environmental Operations Manager	Water Corporation	B/H: A/H/Mobile:	9420 3832 [redacted]

Table 20-1 The Water Corporations Environmental Incident Contact List.

During an Environmental Incident

3. The on-site environmental scientist will determine if the incident is likely to have a continued environmental impact if construction work continues.
4. Based on that advice, construction work that would continue to have an environmental impact will temporarily cease. Other construction works not related to the environmental incident and environmental impact will continue.
5. Construction works at the affected area will only recommence on the approval of the on-site environmental scientist.
6. The incident will be investigated and an Incident Report (refer Figure 24) will be completed as soon as reasonably practicable (generally within 24 hours). The Incident Report will be provided to the persons listed above.
7. All Incident Reports will be logged on a file retained at the construction site office.

Reporting an Environmental Incident

8. Environmental incidents will be reported to the DEC by phone as soon as reasonably practicable following the environmental incident if the environmental incident has caused or is likely to cause pollution, or material or serious environmental harm (in accordance with s72(1) of the *Environmental Protection Act 1986* (WA)). Contact both:
    a. DEC Bunbury Office
    Phone: 9726 4300
    b. DEC Pollution Response (Perth)
    Phone: 1300 784 782

    Written confirmation of the environmental incident will be provided to the CEO of the DEC, based on the Incident Report.
9. Environmental incidents will be reported to the Local Government Authority, FESA and the Police as appropriate (as per Standard SG110).
10. All environmental incidents will be reported to the DEC as part of annual compliance reporting required under the Minister for the Environment's Statement of Conditions imposed under the *Environmental Protection Act 1986* (WA), irrespective of whether the environmental incidents have caused or is likely to cause pollution, or material or serious

environmental harm (in accordance with s72(1) of the *Environmental Protection Act 1986* (WA)).

Remediation of an Environmental Incident

11. The on-site environmental scientist, will determine any requirement to undertake remediation works, and the manner in which remediation works will be undertaken. Additional advice maybe sought from The Water Corporation, the other on-site personnel or the DEC in making that determination.

Post Environmental Incident Training

12. There will be a briefing following the investigation of a confirmed environmental incident. The briefing will include any identified construction process improvements that could prevent reoccurrence of the same environmental incident.
13. The CEMF will be updated (as appropriate) to reflect process improvements.

20.5 Contingency Actions

No contingency actions are considered necessary.

20.6 Related Plans

1. Fire Management
2. Dewatering and Acid Sulphate Soils Management
3. Land Clearing and Trench Management
4. Dangerous Goods and Explosives Management

20.7 Relevant Legislation

1. *Environmental Protection Act 1986* (WA)

20.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC
2. FESA

INCIDENT REPORT

From: _____ Branch/Region: _____

Description: _____

REPORT

WHAT HAPPENED: _____

WHY: _____

WHEN: _____

WHERE: _____

EXTENT OF IMPACT - Actual _____

Potential - *(Consider; Secondary Effects, Environment, Customer, Community, Corporation's System)* _____

THOSE INFORMED OF THE INCIDENT (*Internal & External*) (*When?*) _____

PROGNOSIS - (*Consider; Action Taken, Action Planned, Time to Resolution*) _____

DECISION and NOTIFICATION by BRANCH/REGION

IS THE INCIDENT REPORTABLE? ☐ NO ☐ YES (provide details) ☛

IS IT? ☐ MINOR ☐ SIGNIFICANT ☐ MAJOR

(Seek advice from senior management or the CIMC if unsure)

Decisions made by (Name): (*print*) _____

Designation: _____

Notified Control Centre/CIMC
Customer Contact & Scheduling/Manager

Report to (Name): _____

Date: ..../..../.... Time: _____

Agreed report back (*who & when*)

_____

Report By: _____

Signed: _____ Date: _____ Contact Phone (24 *hr*) _____

Branch/Region: _____ Time: _____ Contact Fax (24 *hr*) _____

Contact Callsign (24 *hr*) _____

A copy of this form must be faxed/phoned to the
Corporate Incident Management Coordinator Fax (09) 420 2656 Mobile 0417 180 677

Figure 20-1 Water Corporation's Incident Report Form

21.0 Compliance Management

21.1 Context

This CEMF outlines the actions, criteria and objectives to be implemented or achieved during construction. If for any reason the actions, criteria or objectives are not implemented or achieved, a response process is required to correct those matters within an appropriate timeframe and with notification to appropriate personnel.

21.2 Purpose

The purpose of the Compliance Management Plan is to outline the management actions to:

1. identify, communicate and correct non-conformity with the management actions contained in this CEMF.

21.3 Performance Indicators

Performance will be demonstrated by:

1. Resolution of non-conformity with the management actions contained CEMF in accordance with the actions contained in this plan.

21.4 Management Actions

1. The site personnel, Water Corporation, or third parties (such as regulators, local government authorities and the public) may identify potential non-conformity with the actions, criteria or objectives identified in this CEMF. All potential non-coconformities will be reported to the an appropriately qualified environmental scientist on site.
2. The report will be investigated within 48 hours notification to confirm its validity.
3. An Improvement Notice will be issued if the report is confirmed as valid (i.e. there is a non-conformity with the CEMF). The Improvement Notice details:
    a. the nature of the non-conformity;
    b. an assessment of the environmental impact;
    c. a decision on the corrective action(s) required. This may include revision of the actions, criteria or objectives identified in the CEMF;
    d. the timeframes allowed to implement the corrective actions;
    e. any requirements to inform contracting staff of the corrective actions to prevent reoccurrence; and
    f. close-out of corrective actions.

    The Improvement Notice is shown at Figure 21-1.
4. The corrective actions contained in the Improvement Notice will be implemented.
5. The actions required by the Improvement Notice will be completed and notification that the corrective actions have been completed will be provided to the environmental scientist..
6. The environmental scientist will review the actions taken, will be confirm that the corrective actions have been implemented and the complete the close-out section of the Improvement Notice.
7. A copy of all completed Improvement Notices will be maintained at the Site Office.

21.5 Additional Information

An Improvement Notice is a written communication tool that is used to improve environmental performance. An Improvement Notice should not be regarded as a sanction.

The process flowchart for management of CEMF non-compliances is contained in Figure 21-2.

21.6 Contingency Actions

If there is a dispute between the on-site environmental scientist and construction personnel, regarding the requirements contained in an Improvement Notice, the Water Corporation will resolve the dispute.

21.7 Related Plans

All plans are considered relevant

21.8 Relevant Legislation

1. *Environmental Protection Act 1986* (WA)

21.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC

Improvement Notice

Report - On-site environmental scientist and responsible construction personnel to complete

Date: _____

Location: _____

Contractor: _____

Nature of Non-Compliance Reported: _____

_____

_____

Is the Reported Non-Compliance Valid? Yes / No (please circle)

Assessment of Environmental Impact: _____

_____

_____

Corrective Actions to be Implemented: _____

_____

_____

Timeframe for completion: Immediately 24hrs 48hrs 7 days (please circle)

Contractor to Inform Staff: Yes/No (please circle)

Issue Date and Time: _____

Issued to (Name and Position):

Close-out - Responsible construction personnel to complete

Describe the corrective actions implemented: _____

_____

_____

_____

Name: Signature: Date:

Close-out - On-site environmental scientist to complete

Corrective actions have been implemented?: Yes / No (please circle)

Are additional corrective actions required? Yes / No (please circle)
If Yes – complete a new Improvement Notice with the new corrective actions

Name: Signature: Date:

A copy of the completed Improvement Notice is to be forwarded to the Site Management Team

Figure 21-1 Improvement Notice

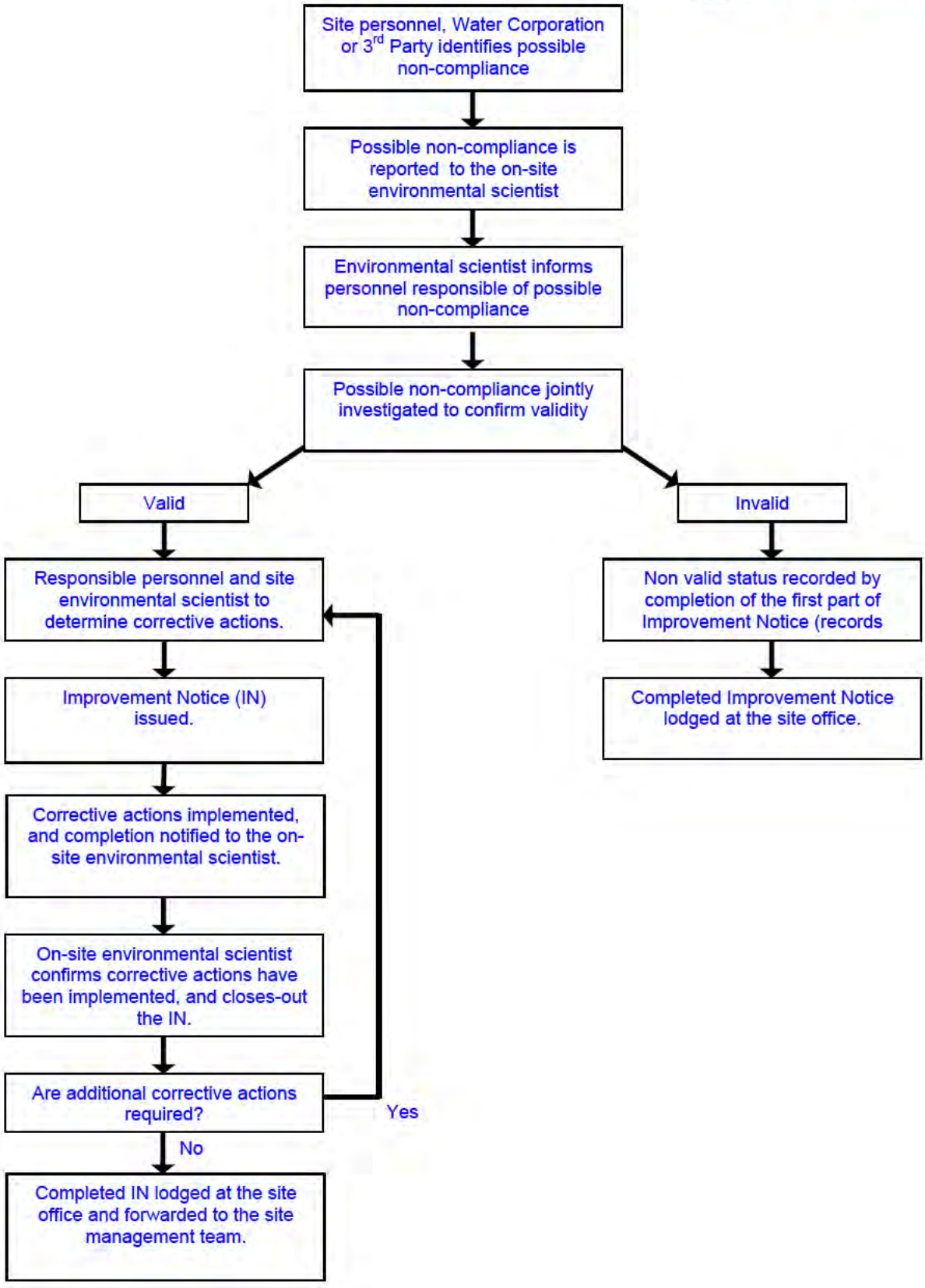


Figure 21-2 Compliance Assessment Process Flowchart

22.0 Community Complaints Management

22.1 Context

Construction works will occur in public and private lands and in close proximity to private residences. Impacts on the community during construction works are expected. A community complaints process will be established to ensure that community complaints are managed effectively.

22.2 Purpose

The purpose of the Community Complaints Management Plan is to outline management actions to:

1. record complaints received from the community.
2. record the response to community complaints received.

22.3 Performance Indicators

Performance will be demonstrated by compliance with the prescribed management actions.

22.4 Management Actions

1. There will be a designated Communications Officer to coordinate the receipt, investigation and resolution of community complaints.
2. There will be a free-call telephone number and an email address through which the community can telephone/email and have their complaints recorded.
3. The Communications Officer will acknowledge receipt of emailed complaints within nominally 48 hours of receipt.
4. The free-call telephone number and email contact details will be displayed at the external fence to each construction site.
5. The Communications Officer (or delegate) will record all complaints received on a Community Complaint Record (Figure 22-1). All Community Complaint Records will be maintained at the site office.
6. The Communications Officer will commence investigations into the nature and cause for the complaint within nominally 48 hours of receipt of the complaint. The investigation will include consultation with the on-site environmental scientist to determine if the cause for the complaint was in conformity with the management actions contained within this CEMF.
7. The Communications Officer will seek to provide a response to the complainant within 7 days of receipt of the complaint. The Communications Officer will complete the Community Complaint Record with details of how the complaint was addressed and the close-out discussions with the Complainant.
8. The Communications Officer will retain all Community Complaint Records at the site office during construction.
9. The Communications Officer will provide a copy of all Community Complaint Records at the end of each month during construction.

22.5 Contingency Actions

No contingency actions are considered necessary.

22.6 Related Plans

All plans are considered relevant.

22.7 Relevant Legislation

1. *Environmental Protection Act 1986* (WA)

22.8 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. Shire of Harvey
2. DEC

Community Complaint Record

Complaint Receipt – Communications Officer to Complete

Date: _____

Time: _____

Complainant Details: Name: _____

Telephone Number(s): _____

Email address: _____

Residential Address: _____

Postal Address: _____

Nature of Complaint: _____

_____

_____

_____

Does the complaint require further investigation? Yes / No (please circle)

Estimated timeframe for completion: 24hrs 48hrs 7 days (please circle)

Relevant on-site personnel: _____

Construction location relevant to complaint: _____

Details of investigations undertaken: _____

_____

_____

_____

Assessment of complaint: _____

_____

Are corrective actions to be implemented? (if yes, describe) _____

_____

Close-out with Complainant - Communications Officer to Complete

Date of response to Complainant: _____

Time of response to Complainant: _____

Method of response: Telephone Email (please circle)

Describe the actions implemented: _____

_____

_____

_____

_____

Is the complaint resolvable? Yes / No (please circle)

Inform staff? Yes / No (please circle)

Does the Complainant wish to be added to the project mailing list? Yes / No (please circle)

Officer Name: _____ Signature: _____

A copy of all completed Community Complaint Records is to be forwarded to the Superintendent at the end of each month of construction.

Figure 22-1 Community Complaint Record

23.0 Auditing of the CEMF

23.1 Context

This CEMF for the Southern Seawater Desalination Project outlines a large number of management actions to be implemented during construction. These management actions will be audited to confirm that the management actions have been implemented. Auditing will be undertaken by the Alliance Lead Team (ALT) or their assigned representatives and an External Auditor, and may also be undertaken by local and state regulatory agencies.

Where auditing identifies that the management actions contained in the CEMF have not been implemented or do not achieve a satisfactory environmental performance, the specified contingency actions will be undertaken. Where contingency actions are not specified or are considered unsuitable, the auditor will seek to identify alternative actions to achieve the intended environmental objective.

23.2 Purpose

The purpose of Auditing of the CEMF is to outline management actions to:

3. identify the schedule and context of audits against the management actions contained within this CEMF.
4. confirm compliance with the management actions.
5. identify potential improvements in environmental performance.

23.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions contained in this CEMF.

23.4 Management Actions

1st Party Audits - Alliance Management Team (AMT)

10. The AMT or its delegates (including the on-site environmental scientist) will undertake daily informal observations of compliance with the management actions contained in this CEMF. These audits need not be recorded.

2nd Party Audits – Water Corporation

11. The Water Corporation will undertake assessments of compliance with the management actions contained in this CEMF each 3 consecutive months of construction. Reports generated from the audits will be provided to the AMT.

3rd Party Audits – Water Corporation's External Auditor

12. The Water Corporation will employ an External Auditor to undertake audits each 12 consecutive months of construction. The External Auditor will be a Certified Environmental Practitioner or Auditor, preferably with experience in the water industry.

3rd Party Audits – DEC

13. The DEC may undertake compliance audits of construction works at any time pursuant to the provisions of s48(1) and Part VI of the *Environmental Protection Act 1986* (WA).

3rd Party Audits – Shire of Harvey or other State Government Agency

14. The Contractor and the Principal will welcome inspections and audits by the Shire of Harvey and other State Government agencies interested in the project. The Principal will arrange the timing of such audits and inspections following requests from the Shire of Harvey and other State Government agencies.

23.5 Additional Information

1. All audits by all parties should seek to indicate if the project has:
    a. complied with the requirements as stipulated in the CEMF; and
    b. achieved satisfactory environmental performance.

    Non-conformity will be deemed to have occurred if the requirements of this CEMF have not implemented and there is unsatisfactory environmental performance.

    Both criteria are relevant, because although the CEMF may not have been strictly followed, alternative (and more appropriate) actions to achieve the intended environmental outcome may have been implemented. Alternatively, compliance with the actions specified in the CEMF may not have achieved satisfactory environmental performance and require modification/corrective action.

2. It is expected that any audit by a 3rd party (other than the Water Corporation's External Auditor) will be limited to within the statutory jurisdiction of that party.

23.6 Contingency Actions

No contingency actions are considered necessary.

23.7 Related Plans

All plans are considered relevant.

23.8 Relevant Legislation

1. *Environmental Protection Act 1986 (WA)*

23.9 Advisory Agencies

The following organisations have been consulted on development of this plan:

1. DEC

24.0 References

The following documents were reviewed and/or cited in preparation of the CEMF:

360 Environmental (February 2007) *Binningup Water Treatment Facility and Pipeline – Due Diligence Flora and Fauna Survey*.

360 Environmental (March 2007) *Perth Seawater Desalination Plant Dredging and backfilling Environmental Management Plan*.

360 Environmental (January 2008) *Southern Seawater Desalination Project Terrestrial Flora and Fauna Survey.*

Australian and New Zealand Environment and Conservation Council (October 2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Chapter 3.

Commonwealth of Australia (2007) *Environment Protection and Biodiversity Conservation Act 1999 Decision to Approve the Taking of an Action: Bleached Kraft Pulp Mill at Bell Bay, Tasmania* (Gunns Limited).

Commonwealth of Australia (2007) *Chief Scientist's Report on the Scientific Aspects of the Department of Environment and Water Resources Recommendation Report, Relevant Supporting Documentation and Public Comments on the Gulls Limited Pulp Mill Proposal (EPBC 2007/3385) in Tasmania.*

D A Lord and Associates Pty Ltd (February 2002) *Bunbury Ocean outlet: Addendum to Construction Environmental Management Framework: Blast Management Plan* (Draft). Report No 00/189/3

Department of Agriculture Western Australia (1999) *Farmnote 40/98: Direct seeding of native plants for revegetation*.

Department of Agriculture Western Australia and Grains Research and Development Corporation (2006) *2006/2007 Canola, Pulse and Legume Pasture Spraying Charts – Bulletin 4674.*

Department of Conservation and Land Management (July 2005) *Minimising Disease Risk in Wildlife Management: Standard operating procedures for fauna translocation, monitoring and euthanasia in the field.*

Department of Environment (August 2003) *General Guidance on Managing Acid Sulfate Soils*.

Department of Environment (October 2004) *Acid Sulfate Soils Guideline Series – Treatment and management of disturbed acid sulfate soils*.

Department of Environment and Conservation (27 August 2007) *Perth Seawater Desalination Licence.* Letter to the Water Corporation from Director Environmental Regulation Division on marine field monitoring.

Department of Environmental Protection (1997) *Environmental Protection (Noise) Regulations 1997: Summary of the Regulations.*

Department of Industry and Resources (2003) *Guidance Note S310 Rev 5: Guidelines for the Preparation of an Emergency Plan and Manifests*.

Department of Water (April 2006) *Water Quality Protection Note #13 – Dewatering of soils at construction sites.*

Department of Water (June 2006) *Draft Water Quality Protection Note #83 - Infrastructure corridors near sensitive water resources.*

Environmental Protection Authority (New South Wales) (2006) *Assessing Vibration: A technical guide.*

Kellogg Brown and Root Pty Ltd (2007a) *Southern Seawater Desalination Plant – Marine Investigations: Water Quality Monitoring – Stage 1*.

Kellogg Brown and Root Pty Ltd (2007b) *Southern Seawater Desalination Plant – Marine Investigations: Water Quality Monitoring – September and October 2007*.

National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination) Measure 1999: Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater*.

National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination) Measure 1999: Schedule B (7a) Guideline on Health-Based Investigation Levels.*

German Standard DIN 4150-3 (1999) *Structural vibration – effects of vibration on structures*.

Oceanica (2008b), *Impact of Dredging on Seagrass Health and Sessile Invertebrates*.

Ralph P.J., Durako M.J., Enriquez S., Collier C.J. and Doblin M.A. (2007) *Impact of light limitation on seagrasses.* In *Journal of Experimental marine Biology and Ecology*. Vol 350. p176-193.

Standards Australia (1981) *Australian Standard AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites*.

Standards Australia (1994) *Australian Standard AS 3780-1994 The storage and handling of corrosive substances.*

Standards Australia (2002) *Australian Standard AS 1742.3-2002 Manual of Uniform Traffic Control Devices - Part 3: Traffic control devices for works on roads*.

Thorp, J R, & Lynch, R (2000) *The Determination of Weeds of National Significance.* National Weeds Strategy Executive Committee, Launceston.

University if Western Australia Marine Research Group (2008) *Characteristerising the marine benthic habitats of the proposed Binningup Desalination Plant Site: Interpretation from underwater towed video: Dec-07*. Report to Kellogg Brown and Root.

University if Western Australia (2008b), *Beach Profile Monitoring at Binningup Beach, school of Environmental Systems Engineering*.

Water Corporation (December 1999) *Work Instruction: Water Storage – Reservoir – Alum Dosing*.

Water Corporation (January 2007) *Guideline*: *Drafting and Implementation of Environmental Management Plans.*

Water Corporation (2007) *Water Corporation Acid Sulphate Soil and Dewatering Management Strategy.* AQUA Document No. 441876.

Water Corporation (2000) *Disinfection Guidelines for Water Mains.* Document No BWW 024-1.

Water Corporation (undated) *Guidelines for the Disposal of Disinfection Water.* Document No BWW 024-2.

Water Corporation (July 2003) *Pipeline Chlorination Trailer Operations and Maintenance Manual*.

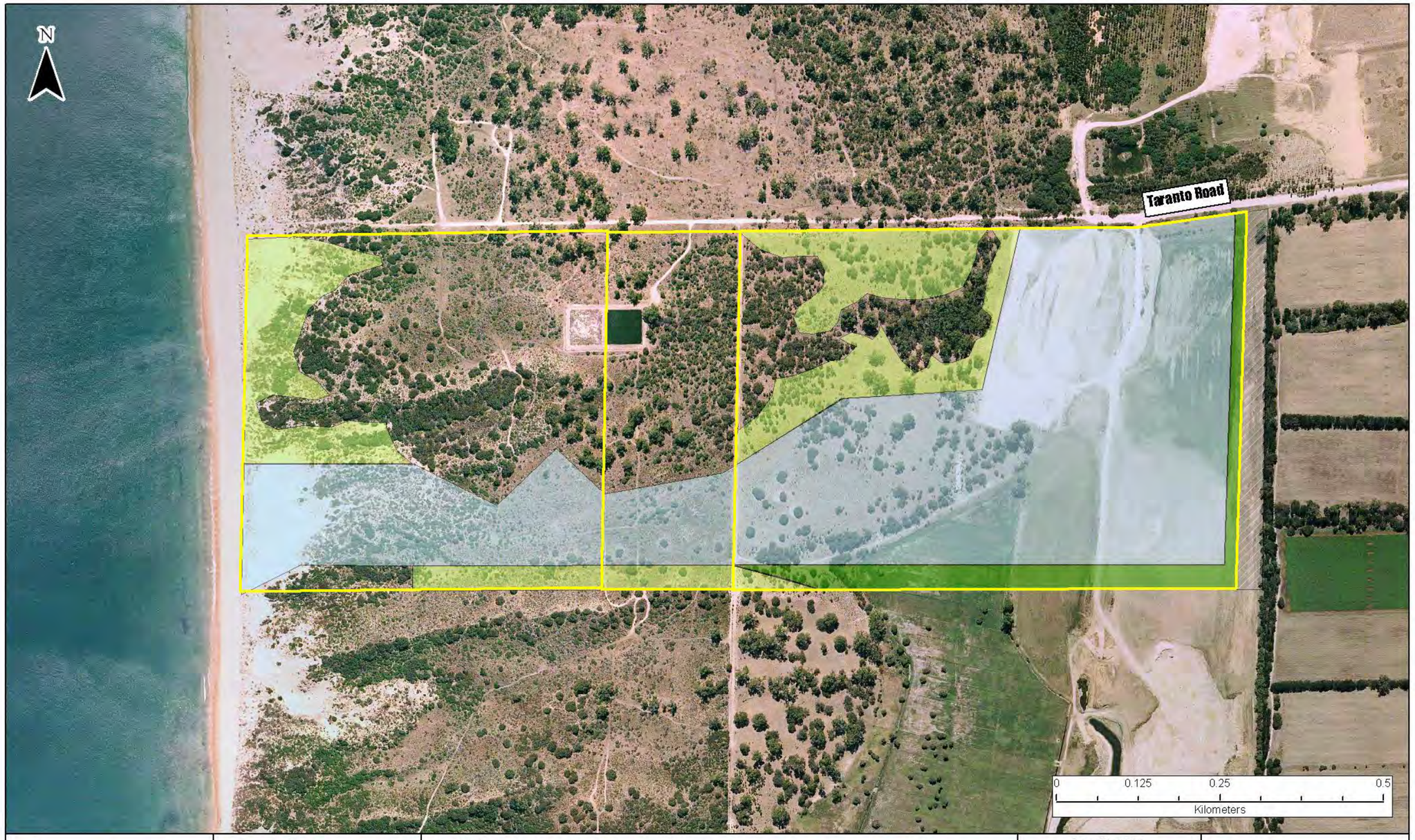
Water Corporation (16 September 2003) *SG113 Guideline for Indigenous Issues – Engagement of Indigenous People as Aboriginal Heritage Monitors During Water Corporation Activities*.

Water Corporation (October 2004) *SG110 Incident Management Corporate Planning Model*.

Water Corporation (December 2005) *Environment Branch Incident Response Procedures*.
Wester Whale Research (2008), *Cetacean Management Advice*.

Legislation referred to in this CEMF can be accessed via the Western Australian State Law Publisher website at *http://www.slp.wa.gov.au* or via the Australasian Legal Information Institute website at *http://www.austlii.edu.au*.

Appendix 1 - Seawater Desalination Plant Site Structure Map



WATER CORPORATION

Horizontal DAtum	Projection
GDA 94	MGA Zone 50
Date	**Revision**
15/02/08	1

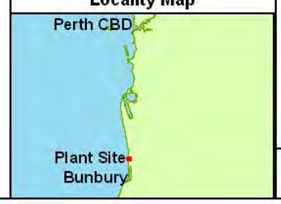
SOUTHERN SEAWATER DESALINATION PROJECT

Proposed Seawater Desalination Plant Terrestrial Construction and Revegetation Areas

Legend

- SSDP construction area (actual cleared area for construction will be much less) - areas without plant infrastructure to be rehabilitated post construction
- Visual and noise berm with revegetation
- Lot 8 access road
- Lot boundaries
- Potential areas for rehabilitation (refer to biodiversity offset commitments)

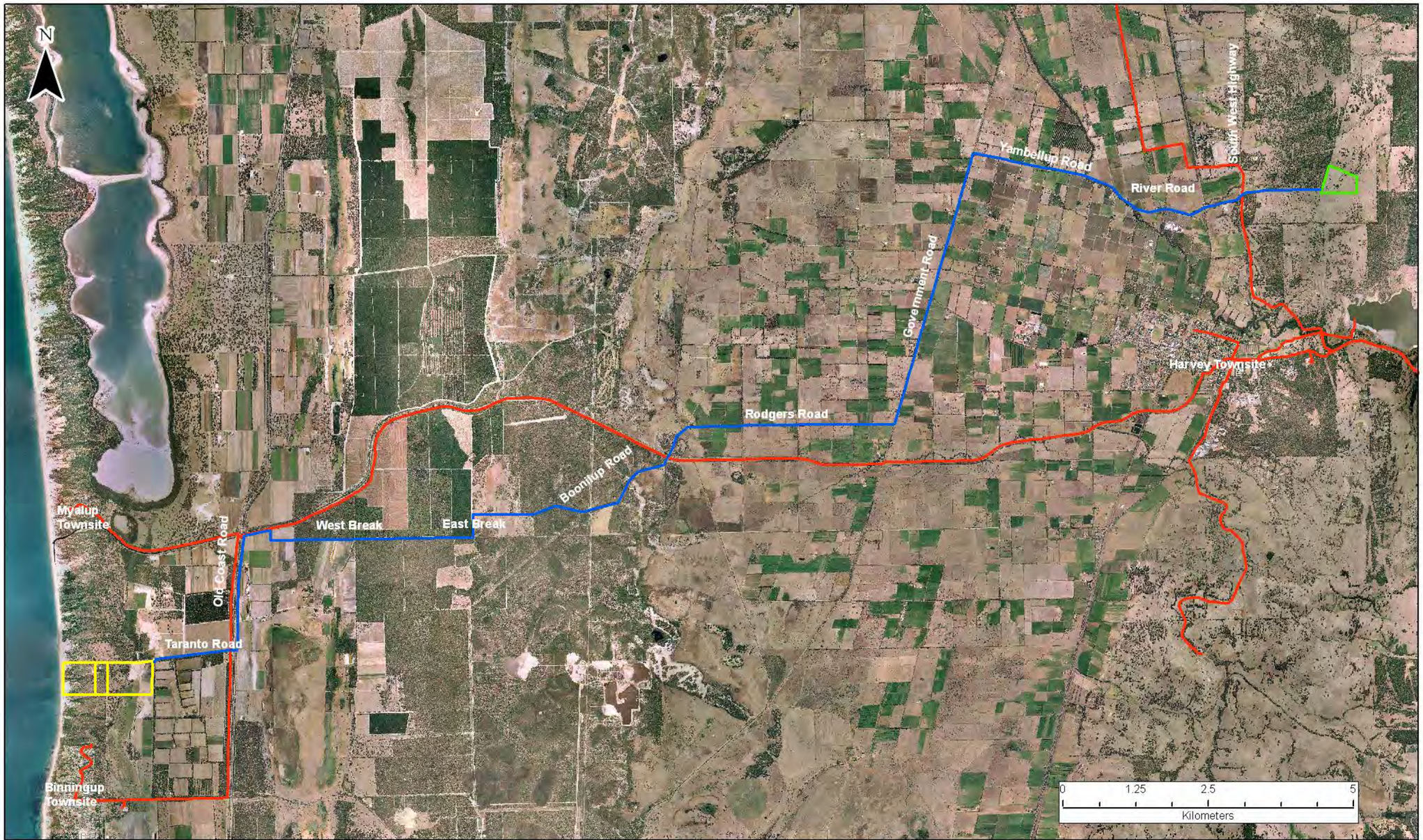
Locality Map



360 environmental

Created By	Approved By
GW	MO/SB

Appendix 2 - Water Transfer Pipeline Maps



WATER CORPORATION

Horizontal DAtum	Projection
GDA 94	MGA Zone 50
Date	**Revision**
15/02/08	1

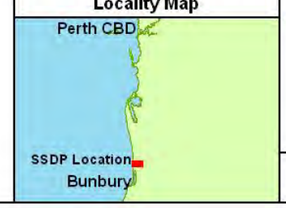
SOUTHERN SEAWATER DESALINATION PROJECT

Proposed Infrastructure

Legend

- Water Transfer Pipeline Route
- Existing IWSS Distribution and Trunk Mains
- Harvey Summit Tanks Site
- Seawater Desalination Plant Site

Locality Map



360 environmental

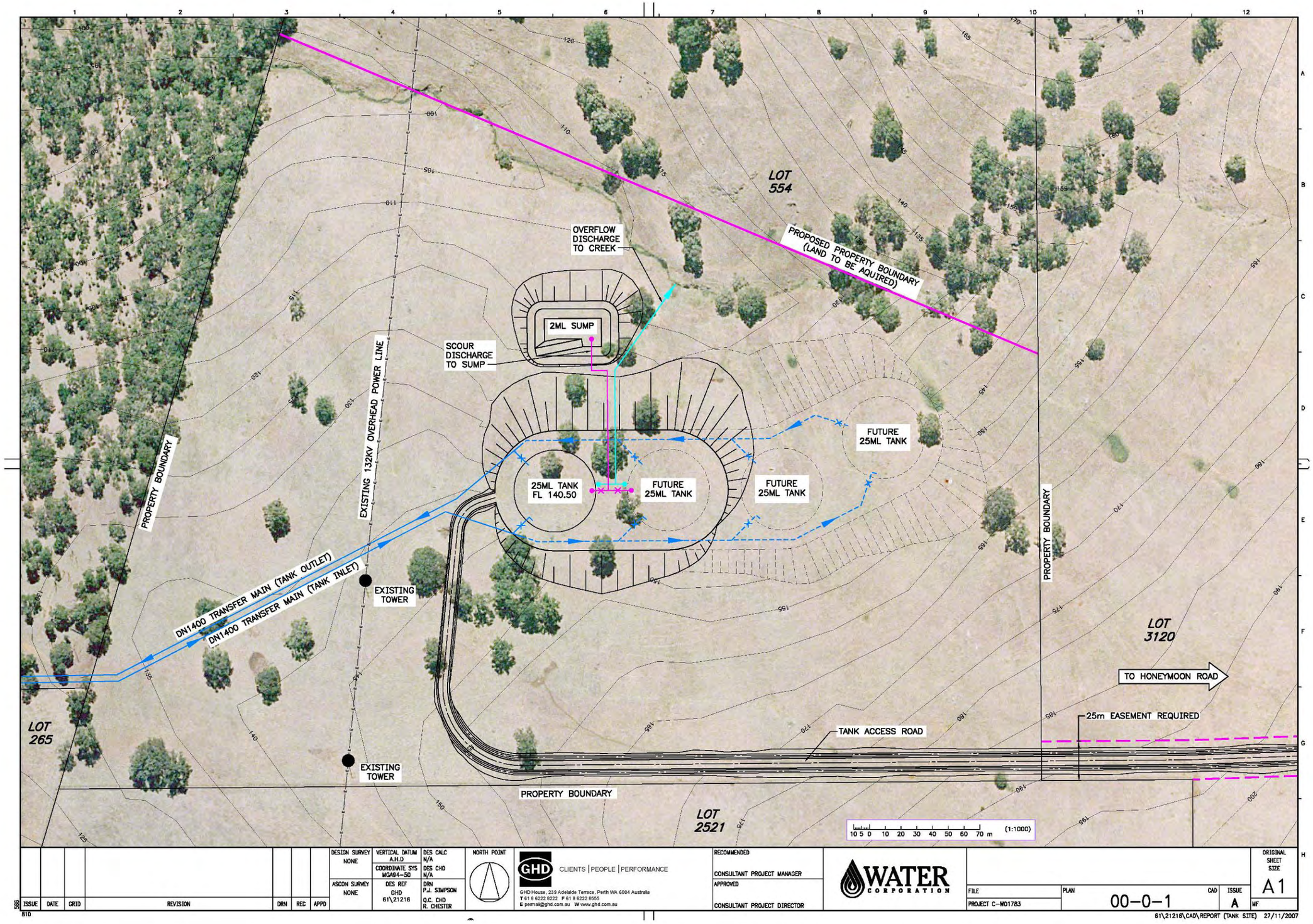
Created By	Approved By
GW	MO/SB

Appendix 3 - Harvey Summit Tanks Structure Maps

DESIGN SURVEY NONE	VERTICAL DATUM A.H.D	DES CALC N/A	NORTH POINT	GHD CLIENTS | PEOPLE | PERFORMANCE	RECOMMENDED	WATER CORPORATION	ORIGINAL SHEET SIZE A2
	COORDINATE SYS MGA94–50	DES CHD N/A		GHD House, 239 Adelaide Terrace, Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au	CONSULTANT PROJECT MANAGER		
ASCON SURVEY NONE	DES REF GHD 61\21216	DRN P.J. SIMPSON			APPROVED	FILE PROJECT C–WO1783	PLAN 00–0–3 CAD ISSUE A
		Q.C. CHD R. CHESTER			CONSULTANT PROJECT DIRECTOR		MF

400
566

61\21216\CAD\REPORT (LOCALITY PLAN) 27/11/2007



ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

DESIGN SURVEY NONE | ASCON SURVEY NONE | VERTICAL DATUM A.H.D | COORDINATE SYS MGA94-50 | DES REF GHD 61\21216 | DES CALC N/A | DES CHD N/A | DRN P.J. SIMPSON | Q.C. CHD R. CHESTER

NORTH POINT

GHD CLIENTS | PEOPLE | PERFORMANCE
GHD House, 239 Adelaide Terrace, Perth WA 6004 Australia
T 61 8 6222 8222 F 61 8 6222 8555
E permail@ghd.com.au W www.ghd.com.au

RECOMMENDED
CONSULTANT PROJECT MANAGER
APPROVED
CONSULTANT PROJECT DIRECTOR

WATER CORPORATION

FILE PROJECT C-WO1783 | PLAN 00-0-1 | CAD | ISSUE A | ORIGINAL SHEET SIZE A1 | MF

61\21216\CAD\REPORT (TANK SITE) 27/11/2007

Appendix 4 - Water Corporation Environmental Policy

Introduction

The Water Corporation provides essential water, wastewater and drainage services to the people of Western Australia. We take water from the environment and return drainage water and treated wastewater and its by-products back into the environment.

In doing this, we aim to provide sustainable, safe and reliable water services to customers and the community.

This policy applies to the Statewide operations of the Water Corporation, which includes all activities, services and products provided by the Corporation to its customers, in accordance with its operating licence.

All employees, and where practicable, 'second parties' (Water Corporation agents, alliance participants, contractors and suppliers) will comply with and support implementation of this policy.

Commitment

The Corporation is committed to:

- playing a leading role in the sustainable future of Western Australia's water resources;
- compliance with applicable environmental legal requirements and with other environmental requirements to which the Corporation subscribes;
- preventing pollution and minimising the adverse effects of our activities; and
- excellence and continual improvement in environmental performance, including conserving natural resources and ecological systems and enhancing them where practicable.

How

Our commitments will be met by:

- providing appropriate services, resources and infrastructure to meet our stated objectives;
- identifying, assessing and managing our environmental risks;
- developing and implementing environmental improvement programmes with measurable targets;
- regularly reviewing and auditing our environmental systems and performance;
- developing and maintaining appropriate incident response plans and minimising the adverse environmental consequences of any accidents; and
- promoting efficient use of resources and minimisation of waste.

Our Environmental Management System provides the framework for developing, implementing, monitoring and reviewing our environmental objectives, targets and actions.

PCY230 Environmental Policy
31 October 2007
CDMS#: 375822

Peter D Moore
Chief Operating Officer

DOCUMENT UNCONTROLLED IF PRINTED

Appendix 5 - Water Corporation's Statement of Environmental Conditions under the Environmental Protection Act 1986 (WA)

<to be inserted when issued>

Appendix 6 - Water Corporation's Permit to Interfere with Bed and Banks of Watercourses under the Rights in Water and Irrigation Act 1914 (WA)

<to be inserted when issued>

Appendix 7 - Water Corporation's Consent to Interfere with Registered Heritage Sites under the Aboriginal Heritage Act 1972 (WA)

<to be inserted when issued, if required>

MEMORANDUM

DATE: Tuesday 19 August 2008

TO: Andrew Baker, Principal Environmental Scientist

FROM: Vanessa Ugle Manager Aboriginal Heritage Approvals

SUBJECT: **Binningup Desalination Plant No2**

RE: Aboriginal Heritage Survey - Recommendations

The Indigenous Resources Section with the assistance of a qualified Anthropologist and Archaeologist carried out an Aboriginal Heritage Survey of the proposed new Desalination Plant in Binningup.

The survey consists of two parts an Ethnography and Archaeology component. The Archaeology component was carried out on the 20-23 May 2008 and the Ethnography component was carried out with members of the Gnaala Karla Boodja Native Title Claim Group on the 17-18th June 2008.

As a result of the survey being carried out, the following recommendations were made;

1) **It is recommended** that as no sites as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified within the project area, that the Water Corporation should proceed with the project as planned.

2) **It is recommended** that the Water Corporation take into consideration the request of the Aboriginal community to engage two Aboriginal Monitors chosen from the group who participated in the survey to inspect ground disturbing works that affect the construction of the seawater pump station (Lot 33), inlet and outlet pipelines to the sea (Lot 33 and beach), pipelines from the treatment plant site to the seawater pump station (Lots 8, 32 and 33) and the construction of service roads (lots 8,32 and 33 boundaries are not fenced in order to exclude Nyungars and wildlife access through the area.

3) **It is further recommended** that the Water Corporation give due consideration to Aboriginal community requests that all water courses crossed for the pipeline are crossed by directional drilling rather than open trenching which is considered culturally inappropriate.

4) No archaeological site was located within or in close proximity to the project area in the course of the survey. No archaeological sites were previously registered within this project area. There are no archaeological barriers present to effect the proposed development.

5) If the ground is excavated to install inlet and outlet pipes to transect the coastal sand dunes for 1.2km **it is recommended** that monitoring occur by Aboriginal Traditional Owners to ensure that any skeletal or artefactual material that may be present is avoided, conserves, documented and /or collected.

6) The most likely areas where archaeological sites, in particular, artefact scatters or burials may occur are banks of rivers, lakes, creeks and exposed sandy deposits. The removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites that may lie beneath the ground surface. **It is recommended** that Water Corporation inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 15 of the Western Australian Aboriginal Heritage Act (1972).

7) If Water Corporation locate an archaeological site in the process of survey or ground excavation, **It is recommended** that work cease in the immediate area. Any skeletal material should be reported to Department of Indigenous Affairs and the Western Australian Police Service. Any artefactual material should be reported to Heritage and Culture Division, Department of Indigenous Affairs.

Please find attached a copy of the Aboriginal Heritage Survey Report " by Brad Good and Associates Consulting Anthropologists and Archaeologists".

If you have any further queries regarding this project, please contact me on 9420 3679.

For your information,

Vanessa Ugle
Manager Heritage Approvals, Indigenous Resources