OAKAJEE PORT & RAIL

OPR Rail Development

Public Environmental Review

OPR Rail Development
Public Environmental Review

Prepared for:

Office of the Environmental Protection Authority

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Quality Information

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Date July 2010

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Reviewed by Oakajee Port and Rail Pty Ltd

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Revision	Revision Date	Details	Authorised	
			Name / Position	Signature
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Final	09/07/2010	Final - G. Edwards: OPR		

Invitation to Make a Submission

OPR RAIL DEVELOPMENT

The Environmental Protection Authority (EPA) invites people to make a submission on this Proposal. The environmental impact assessment process is designed to be transparent and accountable, and includes specific points for public involvement, including opportunities for public review of environmental review documents. In releasing this document for public comment, the EPA advises that no decisions have been made to allow this proposal to be implemented.

Oakajee Port and Rail Pty Ltd (OPR) proposes to develop a 570 km rail to link the iron ore mines of the Mid-West to a port at Oakajee, approximately 24 km from Geraldton.

The proposed development known as the Oakajee Rail Development Proposal is a component of the larger Oakajee Port and Rail Development Proposal which consists of:

- a deepwater port facility at Oakajee.

  This submission does not seek to gain any additional approvals for the Oakajee Deepwater Port, which has already been assessed under Part IV of the *Environmental Protection Act 1986* and approved via Ministerial Statement 469 (the Approved Port); and

- additional landside infrastructure and services, known as the proposed Oakajee Terrestrial Port Development; that were not included in the approved Oakajee Deepwater Port Proposal. This proposal is the subject of a separate assessment process.

The Proposal described here relates to the 530 km of rail formation and associated infrastructure within a 4 km corridor within pastoral land areas and up to a 3.2 km corridor within freehold land areas. In addition a 10 to 15 km spur line to Weld Range and a 20 km Mullewa spur line are proposed.

OPR seek to develop this Proposal on a commercial basis, to promote open access to all users of the port and rail infrastructure and in particular to service mining operations in the Mid-West, Gascoyne and Pilbara regions.

In accordance with the *Environmental Protection Act 1986* (WA), this Public Environmental Review (PER) has been prepared which describes the Proposal and its likely effects on the environment. This PER is available for a public review period of 4 weeks from 2 August 2010, closing on 30 August 2010.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Where to get copies of this document

Full printed copies (at a cost of $10), or a CD copy or summary document (available free of charge) may be obtained from:

Elizabeth Ralph
Oakajee Port and Rail
Level 3, 33 Richardson Street,
WEST PERTH WA 6005
Phone: (08) 9486 0777

An electronic version of the document is also available at www.opandr.com.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the Proposal.

All submissions received by the EPA will be acknowledged. Electronic submissions will be acknowledged electronically. OPR will be required to provide adequate response to points raised in submissions. In preparing its assessment report for the Minister for the Environment, the EPA will consider the information in submissions, OPR's responses and other relevant information. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the *Freedom of Information Act 1992*, and may be quoted in full or in part in the EPA report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific Proposal. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the Proposal more environmentally acceptable.

When making comments on specific Proposals in the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the PER;
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering; and
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: 30 August 2010

The EPA prefers submissions to be sent in electronically using one of the following:

- the submission form on the EPA's website: www.epa.wa.gov.au/submissions.asp; or
- by email to eia@dec.wa.gov.au.

Alternatively submissions can be:

- posted to:

  Chairman – Environmental Protection Authority
  Locked Bag 33
  Cloisters Square WA 6850

  Attention: Patrick Cavalli; or

- Delivered to:

  Environmental Protection Authority
  Level 4, The Atrium
  168 St Georges Terrace, Perth

  Attention: Patrick Cavalli; or

- faxed to (08) 6467 5562 (Attention: Patrick Cavalli)

If you have any questions on how to make a submission, please ring the EPA Assessment Officer, Patrick Cavalli, on (08) 6467 5411.

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **I**

1 INTRODUCTION **1**

1.1 BACKGROUND 1

1.1.1 Proposal Context 1

1.2 PURPOSE OF THIS DOCUMENT 2

1.3 THE PROPONENT 5

1.4 PROPOSAL OVERVIEW 6

1.4.1 Overall OPR Proposal Components 6

1.4.2 Investigation Works 6

1.4.3 Special Act Corridor 6

1.4.4 Proposal Characteristics 7

1.5 REGIONAL PROPOSALS CONTEXT 9

1.5.1 Oakajee Deepwater Port 9

1.5.2 Oakajee Deepwater Port Support Facilities 10

1.5.3 OPR Terrestrial Port Development 10

1.5.4 Oakajee Industrial Estate 11

1.5.5 Mid-West Mining Operations 11

1.6 TIMING 12

2 PROPOSAL JUSTIFICATION **13**

2.1 PROPOSAL RATIONALE 13

2.2 BENEFITS OF THE PROPOSAL 13

2.3 ALTERNATIVES CONSIDERED 14

2.3.1 Proposal Area Alignment 14

2.4 NO DEVELOPMENT OPTION 15

3 PROPOSAL APPROVALS **17**

3.1 STATE STATUTORY EIA 17

3.2 COMMONWEALTH STATUTORY ENVIRONMENT IMPACT ASSESSMENT 17

4 PROPOSAL DESCRIPTION **20**

4.1 DEFINITION OF THE PROPOSAL 20

4.2 LOCATION 20

4.3 LAND TENURE 25

4.4 PROPOSAL COMPONENTS 26

4.4.1 Trains 26
4.4.2 Rail Formation and Track 26
4.4.3 Rail Construction Materials 27
4.4.4 Drainage Structures 28
4.4.5 Vehicular Bridges 31
4.4.6 Supporting Infrastructure 32
4.4.7 Workforce and Operations 35
4.5 CONSTRUCTION SEQUENCE 36
5 EXISTING ENVIRONMENT 37
5.1 REGIONAL SETTING 37
5.1.1 Climate 37
5.1.2 Biogeography 40
5.1.3 Land Systems 43
5.1.4 Topography 43
5.1.5 Geology 44
5.1.6 Soils 45
5.1.7 Conservation Estates / Significant Areas 46
5.2 SUMMARY OF ENVIRONMENTAL INVESTIGATIONS 49
5.2.1 Vegetation and Flora 49
5.2.2 Fauna 84
5.2.3 Surface Hydrology 110
5.2.4 Groundwater 112
5.2.5 Contaminated Sites 121
5.3 SOCIAL SETTING 121
5.3.1 Population and Demographics 121
5.3.2 Industry and Employment 122
5.3.3 Facilities and Infrastructure 122
5.3.4 Native Title 124
5.3.5 Heritage 124
6 STAKEHOLDER ENGAGEMENT 128
6.1 COMMUNITY RELATIONS AND ENGAGEMENT STRATEGY 128
6.2 ENGAGEMENT TO DATE 130
6.3 ISSUES RAISED 134
6.4 FUTURE ENGAGEMENT STRATEGY 137
7 ENVIRONMENTAL IMPACTS AND MANAGEMENT 138

7.1 IDENTIFICATION OF RELEVANT FACTORS 138
7.2 VEGETATION AND FLORA 139
7.2.1 Overview 139
7.2.2 Key statutory requirements, environmental policy and guidance 139
7.2.3 Aspects and Impacts 141
7.2.4 Vegetation and Flora Impact Assessment 142
7.2.5 Proposed Mitigation and Management Measures 154
7.2.6 Predicted Outcome 157
7.3 FAUNA 159
7.3.1 Overview 159
7.3.2 Key statutory requirements, environmental policy and guidance 160
7.3.3 Aspects and Impacts 161
7.3.4 Fauna Impact Assessment 162
7.3.5 Proposed Mitigation and Management Measures 167
7.3.6 Predicted Outcome 170
7.4 CONSERVATION ESTATES 171
7.4.1 Overview 171
7.4.2 Key statutory requirements, environmental policy and guidance 171
7.4.3 Aspects and Impacts 171
7.4.4 Conservation Estate Impact Assessment 171
7.4.5 Proposed Mitigation and Management Measures 172
7.4.6 Predicted Outcome 173
7.5 SURFACE HYDROLOGY 174
7.5.1 Overview 174
7.5.2 Key statutory requirements, environmental policy and guidance 174
7.5.3 Aspects and Impacts 175
7.5.4 Surface Hydrology Impact Assessment 176
7.5.5 Proposed Mitigation and Management Measures 177
7.5.6 Predicted Outcome 180
7.6 GROUNDWATER 181
7.6.1 Overview 181
7.6.2 Key statutory requirements, environmental policy and guidance 181
7.6.3 Aspects and Impacts 183
7.6.4 Proposed Mitigation and Management Measures 184
7.6.5 Predicted Outcome 186

7.7 NOISE, VIBRATION AND LIGHT 187
7.7.1 Overview 187
7.7.2 Key statutory requirements, environmental policy and guidance 188
7.7.3 Aspects and Impacts 189
7.7.4 Impact Assessment 189
7.7.5 Proposed Mitigation and Management Measures 195
7.7.6 Predicted Outcome 196
7.8 AIR QUALITY (DUST) 198
7.8.1 Overview 198
7.8.2 Key statutory requirements, environmental policy and guidance 198
7.8.3 Aspects and Impacts 199
7.8.4 Dust Impact Assessment 199
7.8.5 Proposed Mitigation and Management Measures 200
7.8.6 Predicted Outcome 200
7.9 SOIL QUALITY 201
7.9.1 Overview 201
7.9.2 Key statutory requirements, environmental policy and guidance 201
7.9.3 Aspects and Impacts 203
7.9.4 Soil Quality Impact Assessment 203
7.9.5 Proposed Mitigation and Management Measures 204
7.9.6 Predicted Outcome 206
7.10 WASTE AND HAZARDOUS MATERIALS 207
7.10.1 Overview 207
7.10.2 Key statutory requirements, environmental policy and guidance 207
7.10.3 Aspects and Impacts 207
7.10.4 Waste and Hazardous Materials Impact Assessment 208
7.10.5 Proposed Mitigation and Management Measures 208
7.10.6 Predicted Outcome 210
7.11 GREENHOUSE GAS EMISSIONS 211
7.11.1 Overview 211
7.11.2 Key statutory requirements, environmental policy and guidance 211
7.11.3 Aspects and Impacts 213
7.11.4 Proposed Mitigation and Management Measures 213
7.11.1 Predicted Outcome 214
7.12 HERITAGE 215

7.12.1 Overview 215
7.12.2 Key statutory requirements, environmental policy and guidance 215
7.12.3 Aspects and Impacts 216
7.12.4 Heritage Impact Assessment 217
7.12.5 Proposed Mitigation and Management Measures 217
7.12.6 Predicted Outcome 218
7.13 VISUAL AMENITY 219
7.13.1 Overview 219
7.13.2 Key statutory requirements, environmental policy and guidance 219
7.13.3 Aspects and Impacts 219
7.13.4 Visual Amenity Impact Assessment 220
7.13.5 Proposed Mitigation and Management Measures 220
7.13.6 Predicted Outcome 221
7.14 OTHER SOCIAL AND ECONOMIC 222
7.14.1 Overview 222
7.14.2 Key statutory requirements, environmental policy and guidance 223
7.14.3 Aspects and Impacts 223
7.14.4 Other Social and Economic Factors Impact Assessment 224
7.14.5 Proposed Mitigation and Management Measures 224
7.14.6 Predicted Outcome 225
8 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE 226
8.1 INTRODUCTION 226
8.1.1 Background 226
8.1.2 Assessment Process 226
8.1.3 Summary of Proposed Action Relevant to EPBC Act Consideration 227
8.2 LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES 227
8.2.1 Identification of species 227
8.2.2 Nature and extent of likely impact 233
8.3 MEASURES TO AVOID OR REDUCE IMPACTS 244
8.3.1 Performance Management 244
8.3.1 Management Strategies 244
8.3.2 Western Spiny-tailed Skink 245
8.3.3 Malleefowl 246
8.4 PREDICTED OUTCOMES 246
9 PROPOSAL ENVIRONMENTAL MANAGEMENT FRAMEWORK 248

9.1 PRINCIPLES OF ENVIRONMENTAL PROTECTION 248
9.2 ENVIRONMENTAL MANAGEMENT SYSTEM 250
9.2.1 Environmental Management Plans 253
9.2.2 Consolidated Key Management Actions 254
9.2.3 Rehabilitation and Closure 265
10 SUMMARY AND CONCLUSIONS 266
11 ACRONYMS 280
12 REFERENCES 283
APPENDICES 292

TABLES

Table 1-1 ESD requirements 3
Table 1-2 Ownership and proponency of major elements of the Oakajee Development 9
Table 1-3 Proposal key dates 12
Table 4-1 Proposal key characteristics 20
Table 4-2 Potential bridge requirements 29
Table 4-3 Indicative sequence of construction 36
Table 5-1 Soil landscape systems occuring within the Proposal Area 43
Table 5-2 Land systems occurring within the Study Area 44
Table 5-3 Conservation estates within the Proposal Area 47
Table 5-4 Beard vegetation associations within the Study Area 51
Table 5-5 Ecologia vegetation units recorded within the Study Area 54
Table 5-6 Vegetation condition assessment 57
Table 5-7 PEC recorded within the Study Area 58
Table 5-8 Beard vegetation associations within the Study Area with <30% of their pre-European extent remaining 58
Table 5-9 Extent of significant vegetation units within Study Area 62
Table 5-10 Flora diversity of the Study Area 72
Table 5-11 Flora diversity within the freehold and pastoral land areas 72
Table 5-12 Priority flora species recorded in the Study Area 76
Table 5-13 Assumptions of number of plants 77
Table 5-14 Description of fauna habitats of the Study Area 87
Table 5-15 Fauna species within the Study Area (potential and recorded) 87
Table 5-16 Vertebrate fauna species found within the Study Area 88
Table 5-17 Conservation significant fauna recorded 91
Table 5-18 Conservation significant fauna not recorded but may potentially occur within Study Area 95
Table 5-19 Sites where determined or potential SRE species were located 99
Table 5-20 Habitat types associated with SRE species 99
Table 5-21 Species found during SRE survey within the Study Area (Ecologia, 2010d) 100
Table 5-22 Subterranean fauna records from land and soil landscape systems within Study Area 107
Table 5-23 Monitoring bores that may contain subterranean fauna 108
Table 5-24 Estimated yield potential of selected 'alternative' groundwater supply areas 120
Table 5-25 Mid-West population distribution 2006 (MWDC 2006) 121
Table 5-26 Native Title claims 124

Table 6-1 OPR 2009 conference/forum participation 130
Table 6-2 Summary of stakeholder consultation 131
Table 6-3 Summary of stakeholder interests 135
Table 6-4 Future stakeholder engagement and consultation 137
Table 7-1 Estimated area of disturbance 143
Table 7-2 Beard vegetation associations within the Proposal Area with <30% of their pre-European extent remaining 144
Table 7-3 Conservation significant vegetation associations within the Proposal Area 146
Table 7-4 Significant vegetation units 147
Table 7-5 Estimated impact on vegetation units using indicative disturbance areas 148
Table 7-6 Priority Flora species found within the Proposal Area 150
Table 7-7 Predicted impact on Priority Flora species based on indicative alignment 151
Table 7-8 Vegetation and flora management objectives, targets and performance indicators 154
Table 7-9 Proposed vegetation and flora management strategies 155
Table 7-10 SRE species and potential SRE species 159
Table 7-11 Impact to fauna habitat types within the Proposal Area 163
Table 7-12 Fauna management objectives, targets and performance indicators 168
Table 7-13 Proposed fauna management strategies 169
Table 7-14 Potential impacts on conservation and proposed conservation reserves 172
Table 7-15 Conservation estate management objectives, targets and performance indicators 172
Table 7-16 Proposed conservation estate management strategies 173
Table 7-17 Surface water management objectives, targets and performance indicators 178
Table 7-18 Proposed surface hydrology management strategies 179
Table 7-19 Groundwater management objectives, targets and performance indicators 184
Table 7-20 Proposed groundwater management strategies 186
Table 7-21 Receivors and noise criteria 191
Table 7-22 Noise modelling summary – comparison of results 192
Table 7-23 Noise and vibration management objectives, targets and performance indicators 195
Table 7-24 Proposed noise, vibration and light management strategies 196
Table 7-25 NEPM for ambient air quality 199
Table 7-26 Air quality management objectives, targets and performance indicators 200
Table 7-27 Proposed air quality management strategies 200
Table 7-28 Soil quality management objectives, targets and performance indicators 204
Table 7-29 Proposed soil quality management strategies 206
Table 7-30 Waste and hazardous material management objectives, targets and performance indicators 209

Table 7-31 Proposed waste and hazardous material management strategies 210
Table 7-32 Estimated GHG emissions from diesel fuel usage 213
Table 7-33 GHG emissions management objectives, targets and performance indicators 214
Table 7-34 Proposed GHG management strategies 214
Table 7-35 Heritage management objectives, targets and performance indicators..... 217
Table 7-36 Proposed heritage management strategies 218
Table 7-37 Visual amenity management objectives, targets and performance indicators..... 220
Table 7-38 Proposed visual amenity management strategies..... 221
Table 7-39 Management objectives, targets and performance indicators for other social and economic factors..... 224
Table 7-40 Proposed social and economic management strategies 225
Table 8-1 NES fauna management objectives, targets and performance indicators 244
Table 8-2 Matters of NES general management strategies 245
Table 9-1 Application of Principles of Environmental Protection..... 249
Table 9-2 EMS management strategies 251
Table 9-3 Consolidated key management actions for the Proposal..... 255
Table 9-4 Rehabilitation management strategies..... 265
Table 10-1 Potential environmental and social impacts 268

FIGURES

Figure 1-1 Proponent ownership structure 5
Figure 1-2 Components of the OPR Port and Rail Development 8
Figure 2-1 Proposal Area 16
Figure 3-1 EP Act and EPBC Act assessment and approval process 19
Figure 4-1 Indicative fill and cut cross sections of the Rail Corridor 21
Figure 4-2 Overview of Proposal Area 22
Figure 4-3 General arrangement plan of the Proposal Area (1 of 2) 23
Figure 4-4 General arrangement plan of the Proposal Area (2 of 2) 24
Figure 4-5 Local Government Areas 25
Figure 4-6 Typical bridge design 29
Figure 4-7 Potential bridge locations 30
Figure 4-8 Cross section of a culvert 31
Figure 5-1 Mean annual rainfall and temperature for Geraldton (BoM 2009) 37
Figure 5-2 Mean annual rainfall and temperature for Meekatharra (BoM 2009) 38
Figure 5-3 9am and 3pm wind roses from Geraldton weather station 39
Figure 5-4 9am and 3pm wind roses from Meekatharra weather station 40
Figure 5-5 IBRA Regions associated with the Proposal 42
Figure 5-6 Conservation estates 48
Figure 5-7 Location of significant vegetation associations (1 of 3) 59
Figure 5-8 Location of significant vegetation associations (2 of 3) 60
Figure 5-9 Location of significant vegetation associations (3 of 3) 61
Figure 5-10 Location of significant vegetation units within the Proposal Area (1 of 6) 63
Figure 5-11 Location of significant vegetation units within the Proposal Area (2 of 6) 64
Figure 5-12 Location of significant vegetation units within the Proposal Area (3 of 6) 65
Figure 5-13 Location of significant vegetation units within the Proposal Area (4 of 6) 66
Figure 5-14 Location of significant vegetation units within the Proposal Area (5 of 6) 67
Figure 5-15 Location of significant vegetation units within the Proposal Area (6 of 6) 68
Figure 5-16 Areas of mulga communities 70
Figure 5-17 Areas of salt lake vegetation communities 71
Figure 5-18 Location of DRF recorded within the Proposal Area 75
Figure 5-19 Location of Priority Flora within the Study Area (1 of 3) 78
Figure 5-20 Location of Priority Flora within the Study Area (2 of 3) 79
Figure 5-21 Location of Priority Flora within the Study Area (3 of 3) 80
Figure 5-22 Location of weed species within the Study Area 83

Figure 5-23 Fauna survey sections and sampling locations 85
Figure 5-24 Conservation significant bird species recorded 93
Figure 5-25 Conservation significant reptile species recorded 94
Figure 5-26 Location of SRE survey sites 98
Figure 5-27 Potential SRE species habitat (1 of 3) 103
Figure 5-28 Potential SRE species habitat (2 of 3) 104
Figure 5-29 Potential SRE species habitat (3 of 3) 105
Figure 5-30 Location of recorded subterranean invertebrate fauna 109
Figure 5-31 Overview of surface water drainage within the Study Area 111
Figure 5-32 Mid-West groundwater resources 115
Figure 5-33 Regional aquifer type and productivity 116
Figure 5-34 Groundwater bore locations within Study Area 117
Figure 5-35 DoW licensed bore locations 118
Figure 5-36 Groundwater investigation areas 119
Figure 5-37 Registered Native Title claimant areas in relation to the Proposal Area 126
Figure 5-38 Location of DIA registered heritage sites 127
Figure 6-1 External stakeholder engagement strategy 129
Figure 6-2 Stakeholder themes 134
Figure 7-1 Sheetflow drainage culvert design 177
Figure 7-2 Location of potentially noise impacted residences – entire Proposal 193
Figure 7-3 Location of potentially noise impacted residences – Chapman Valley 194
Figure 8-1 Matters of NES recorded within the Proposal Area 231
Figure 8-2 Slender-billed Thornbill records 232
Figure 8-3 Regional Western Spiny-tailed Skink survey results 239
Figure 9-1 EMS process flowchart 252
Figure 9-2 EMS structure 253

Definition of Terms

Term	Definition
Oakajee Development	The overall development of the Oakajee area including the approved marine port, future port development, Oakajee Industrial Estate (OIE) and Oakajee Port and Rail (OPR) proposals.
Oakajee Port and Rail Development	The larger OPR Proposal comprising the marine port, terrestrial port and rail components, each the subject of a separate approvals process.
Oakajee Deepwater Port	The deepwater port facility at Oakajee for which the Department of State Development is the proponent. This Proposal was approved by the WA Government in 1998, with the release of Ministerial Statement 469 (MS469), and more recently updated with an approved Section 45C process.
The Proposal	The OPR Rail Proposal as outlined in this PER.
Proposal Area	The area described in this document described as the Special Act Corridor (SAC) being usually a 4 km corridor within pastoral land areas and a 3.2 km corridor within freehold land areas. The Proposal Area also includes some minor areas that may be external to the SAC for the purpose of accessing construction and other materials as required.
Rail Corridor	The proposed linear corridor that contains the rail tracks, parallel access roads, water pipeline and fibre optic cable that will ultimately be required for operating the rail. The term Rail Corridor is not used to refer to borrow areas, quarries, other access tracks, water supply or other service spurs. The Rail Corridor has less flexibility in terms of location that these other elements. A potential alignment for the Rail Corridor has been discussed at times in this PER for impact assessment purposes, however there may be some minor amendments due to environmental, heritage, practical and landholder constraints.
Study Area	The area surveyed for a particular environmental survey. This will mostly match the Proposal Area, however in some cases will extend beyond the Proposal Area boundaries. In a minority of instances there may be some areas of the Proposal Area that are not part of the Study Area. Any such areas will be subject to survey and the same management measures as are identified for the Proposal Area.

EXECUTIVE SUMMARY

This document and attachments comprise the Public Environmental Review (PER) documentation for the proposed Oakajee Rail Development (the Proposal), a Proposal for construction and operation of rail infrastructure to connect Mid-West mining operations with the Oakajee Port.

The proponent for the Proposal is Oakajee Port and Rail Pty Ltd (OPR) which was established as an infrastructure provider to develop and coordinate an iron ore supply chain comprising rail and port infrastructure for iron ore sourced from the Mid-West region of WA.

Development Background

The Proposal is a component of the larger Oakajee Port and Rail Development, also consisting of:

- A deepwater port facility at Oakajee for which the Minister for State Development is the proponent. The Oakajee Deepwater Port was approved by the WA Government in 1998, with the release of Ministerial Statement 469.

  The original approval was subject to additional processes under the *Environmental Protection Act 1986* in 2009, as follows:

  - Section 45C (clarification of approved Proposal) – clarification of the location and scale of the Proposal was approved by the Chairman of the Environmental Protection Authority (EPA) under delegated authority on the 2 September 2009, with administrative revisions on the 1 December 2009; and
  - Section 46 (extension of time to implement the Proposal) – a three year extension to the substantial commencement date was approved by the Minister for the Environment on the 25 November 2009 via the release of Statement No. 815.

- The Oakajee Terrestrial Port Development which will include the infrastructure necessary for the acceptance, storage and export of ore materials to the overseas market. This proposal is the subject of a separate and parallel approval process for which OPR is the proponent. This proposal is for the infrastructure required to develop and operate a 45 Mtpa iron ore export facility as a first stage.

  It is understood that the Government of WA has plans to further develop the Oakajee area as a multi-user, multi-product port when there is a demand for further import and export facilities serving the region and in particular the Oakajee Industrial Estate. Development beyond OPR's 45Mtpa iron ore project will be the subject to future approvals processes and stakeholder consultation.

On 20 March 2009 the State of WA and OPR entered into a State Development Agreement (SDA). This SDA provided OPR exclusive rights to build the Oakajee Port and a northern railway line, and operate it for a determined period.

Proposal Overview

The railway and the facilities covered in this Proposal will connect Oakajee, approximately 24 km north of Geraldton, to Jack Hills, 380 km to the north-east, in the Mid-West of WA.

The objective of the Proposal is to develop an open access world-class rail ore transport infrastructure for the State of WA, including those components outlined in Table ES-1.

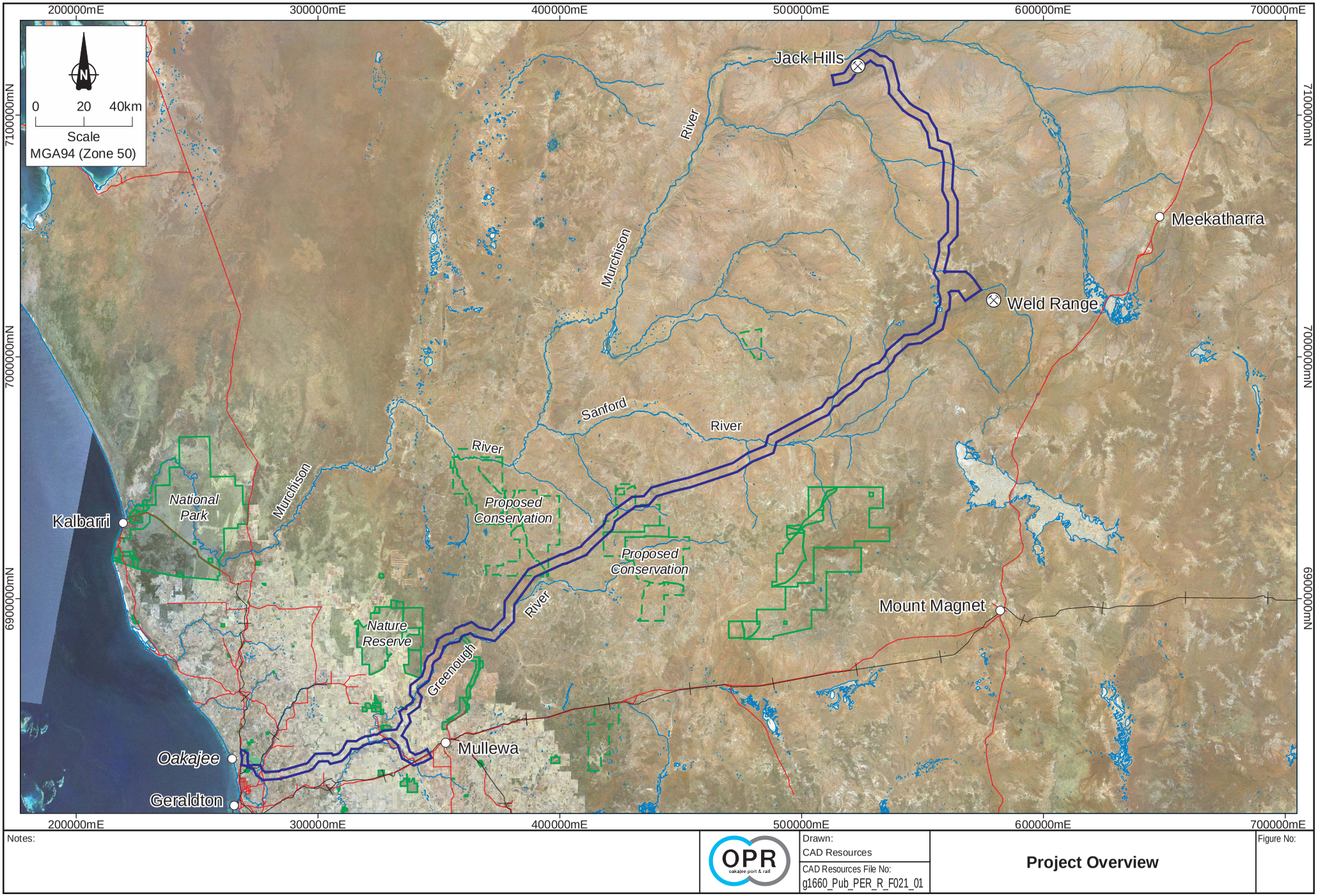
The key characteristics and environmental footprint of the Proposal are summarised in Table ES-1:

Figures ES-1 and ES-2 highlight the environmental footprint of the Proposal.

Table ES-1 Key characteristics of the Proposal

Non-spatial elements	Description	
Proposal Life	In excess of 50 years	
Throughput	45 Mtpa of iron ore	
Train Operations	Diesel electric locomotives, up to 200 wagons (approximately 2 km in length) with a carrying capacity of approximately 20,000 tonnes. Approximately 18 train movements per day (9 each way).	
Operating hours	24 hours/day, 365 days/year	
Accommodation	Construction: 6 camps capable of holding up to 3000 personnel in total Operation: Up to 2 camps holding up to 80 personnel in total	
Construction timeframe	Approximately 36 months	
Groundwater requirements	Construction: approximately 3.5 GL (total over 36 months), Operation: approximately 140 ML per year	
Spatial elements	**Description**	**Approximate footprint**
Rail Corridor	Includes approximately 570 km of rail line including a 10 – 15 km spur, 20 km spur line near Mullewa , access roads, rail crossings, rail loops, rail sidings optic fibre cable, water pipeline, approximately nine bridges. Final operating disturbance width of 50 – 80 m	4500 ha
Construction activities	Including borrow pits, ballast quarries, turkey's nests, associated access roads	1450 ha
Supporting facilities	Including accommodation camps, lay down areas, communication towers, water supply, workshops, associated access roads	1050 ha
Total area of native vegetation clearing	Maximum area of native vegetation clearing within the freehold area	100 ha
	Approximate area of native vegetation clearing within the pastoral area	5900 ha
Total area of disturbance	Combination of native vegetation clearing and disturbance of cleared land.	7000 ha

Figure ES-1 Proposal Area



Notes:

OPR oakajee port & rail

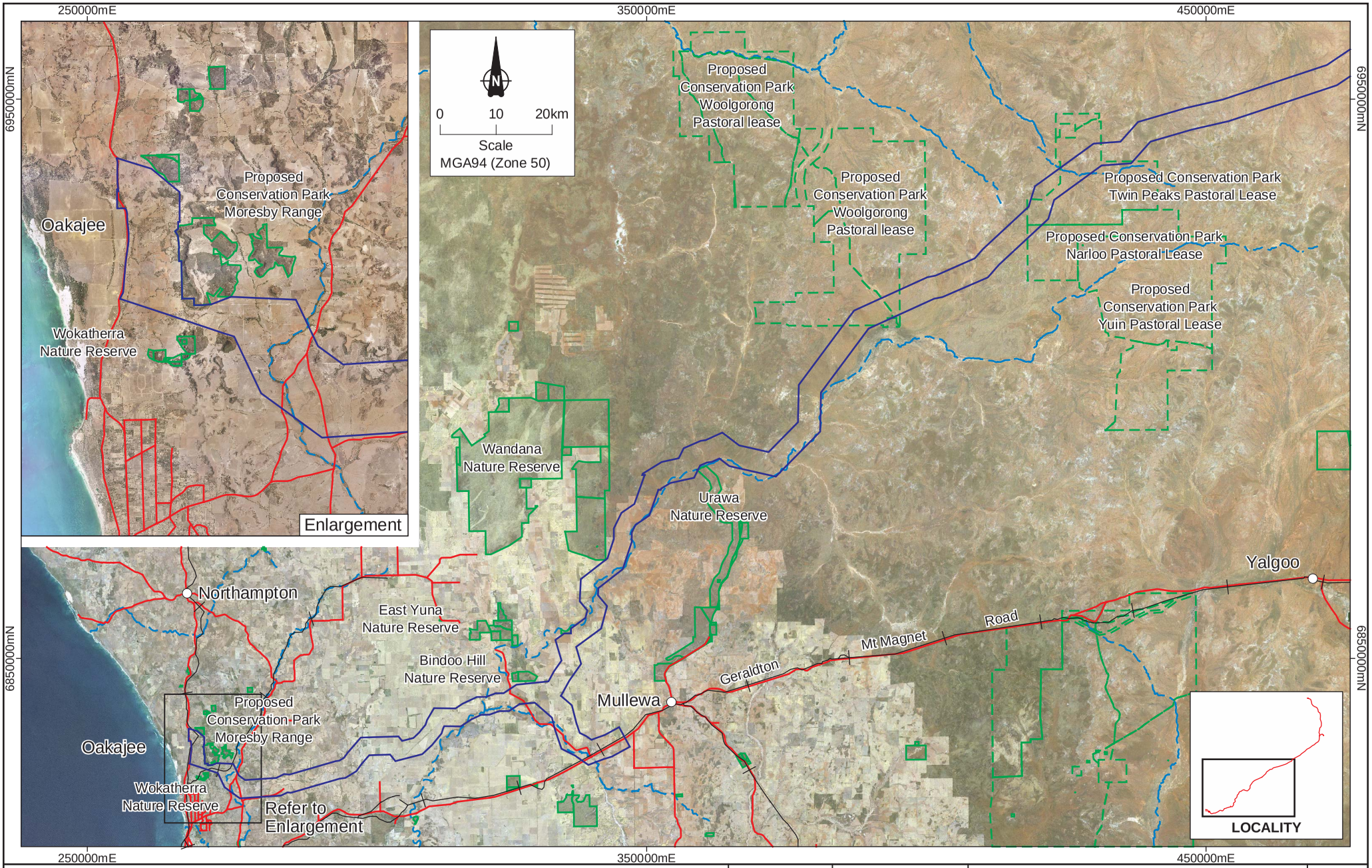
Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_R_F021_01

Project Overview

Figure No:

Figure ES-2 Proposal Area (Freehold Area)



Notes:
DEC Estates data supplied by Department of Environment and Conservation

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_P_F021_02

Project Overview
Freehold / Pastoral Interface

Figure No:

Benefits of the Proposal

The existing port and rail system at Geraldton has limited capacity to accommodate the expanding iron-ore industry in the Mid-West region. In addition, due to depth limitations, Geraldton port can only partially load Panamax-class vessels. Further expansion of Geraldton Port is inhibited by the Port's location in the town of Geraldton.

The proposed Oakajee Port and Rail Proposal will provide an iron ore transport, receiving, handling and exporting facility within the Mid-West region.

Oakajee was planned by the Government of WA to mitigate environmental and community impacts, including dust and noise emissions and heavy vehicle traffic, associated with bulk-commodity exports in close proximity to a population centre.

The development of the Proposal will result in financial and social benefits throughout the region through increases in employment opportunities, infrastructure development in more suitable locations and a flow-on effect to the non-mining sectors. Geraldton is currently benefiting from the re-development of the town following removal of rail components of the port facilities from the town centre.

Environmental Assessment

The Proposal was referred to the Environmental Protection Authority (EPA) in October 2009. Based on the information in the referral document, it was determined that the likely environmental impacts associated with the Proposal are sufficient to warrant formal assessment under the *Environmental Protection Act 1986* (EP Act). In November 2009 the EPA advertised that the Proposal would be the subject of a PER level of assessment, including a four week public comment period. No appeals were made to the level of assessment.

The purpose of the PER is to assist the EPA in assessing the environmental impacts of the Proposal under Section 40 of the EP Act. Preparation of this document has been undertaken in accordance with the Environmental Scoping Document (OPR, 2010) as agreed with the EPA and according to the *Guidelines for Preparing a Public Environmental Review /Environmental Review and Management Plan* (EPA, 2009b).

OPR has commissioned a range of environmental investigations to identify key risks to the environment as a result of the Proposal. Environmental surveys to date have included vegetation and flora, fauna (including short range endemics and subterranean invertebrate fauna), surface hydrology, groundwater, noise, Aboriginal heritage and social impacts.

Environmental Factors

Environmental factors relevant to the Proposal are considered to be:

- Vegetation and flora – the Proposal is expected to require approximately 7000 ha of ground disturbance, including approximately 6000 ha of native vegetation. Some clearing will be required in the freehold area, which has already been extensively cleared. Four Priority Ecological Communities, three *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed flora species (of which two are also listed as Declared Rare Flora (DRF)) and 87 Priority Flora species have been recorded within the Proposal Area;
- Fauna – habitat will be impacted by the Proposal. Five species listed under the EPBC Act have been recorded within the Proposal Area, as have two migratory bird species. An additional eight listed species listed under the *Wildlife Conservation Act (1950)* were also recorded within the Proposal Area;

- Surface hydrology – the Proposal Area crosses a number of major and minor drainage lines, as well as sheetflow areas;
- Groundwater – the Proposal involves the construction of approximately 200 groundwater bores for use as construction, potable or maintenance water;
- Noise, light and vibration – the Proposal will generate noise, vibration and light emissions, with noise emissions during operation being of most interest;
- Air quality – the Proposal will generate dust emissions during construction;
- Soil quality – the Proposal Area intersects with several areas of potential acid sulfate soil (ASS) risk;
- Wastes and hazardous materials – the Proposal will generate construction, industrial, hazardous, domestic and other wastes. Hazardous materials will be stored within the Proposal Area, predominantly during construction;
- Greenhouse gases (GHG) – the Proposal will generate GHG emissions;
- Aboriginal heritage – sites are known to exist within the Proposal Area and there is the potential for additional unknown sites to be discovered;
- Visual amenity – the Proposal will be visible from nearby vantage points; and
- Other social and economic factors – including nuisance issues, public risk and benefits.

Stakeholder Consultation

OPR is committed to ongoing stakeholder and community engagement and recognises the importance of genuine stakeholder involvement in the identification of potential issues and concerns, as well as appropriate management of impacts.

Community and stakeholder consultations in relation to the Proposal were commenced in 2006 by Murchison Metals Ltd and continue to the present date with OPR.

Key stakeholders identified early in the planning phase of the Proposal include:

- Local government authorities;
- State and Commonwealth government agencies;
- Local communities;
- Traditional owners; and
- Interested groups and organisations.

Key themes from community and stakeholder consultations relating to environmental impacts have been:

- changes to surface hydrology;
- salinity;
- groundwater overuse;
- impacts on vegetation and flora;
- weeds;
- Aboriginal heritage;
- impacts on fauna;

- visual amenity;
- impacts on land use;
- emissions – dust, noise, light, GHG;
- traffic impacts; and
- community engagement.

The above issues raised by stakeholders have been addressed in this PER.

OPR will continue to engage with the stakeholders identified in this PER, including regulatory authorities, throughout the construction and operational phases of the Proposal, on a range of social and environmental issues. OPR is currently implementing a Community Stakeholder Engagement Plan to ensure future communication and consultation with key stakeholders through a range of mechanisms.

Environmental Management

The scope of the environmental impact assessment and consideration of social issues has been defined following consultation with key stakeholders and agreed with the EPA through the environmental scoping process. The scope of investigations has required a range of specialist studies, the results of which are included in this document. The full reports of the key specialist studies are included as appendices to this PER.

Table ES-2 identifies the relevant environmental factors, EPA objectives and summarises the potential impacts, and identifies environmental management and mitigation measures to reduce impacts and the predicted outcome.

Table ES-2 Environmental factors relevant to the assessment of the Proposal

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
BIOPHYSICAL					
Vegetation and Flora	Maintain the abundance, biodiversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance of adverse impacts and improvement of knowledge.	• Native vegetation subject to broad scale grazing with low levels of disturbance throughout the pastoral area in the eastern two thirds of the Study Area • Approximately 830 vascular flora species recorded within the Study Area. • Largely cleared land used for farming with small, detached remnants of native vegetation in the western third of the Study Area (freehold area). • 62 Weed species recorded within the Study Area, including 3 Declared Weeds occurring largely in the freehold area • 26 Beard vegetation associations recorded within Study Area. • 72 Ecologia vegetation units recorded within Study Area. • No Threatened Ecological Communities (TECs) known from within the Study Area. • 4 Priority Ecological Communities (PECs) known from within the Study Area. • 3 EPBC Act listed flora species, 2 of which are Declared Rare Flora (DRF). 87 Priority Flora (PF) recorded within the Study Area. • Agricultural land use in the freehold area dominated by broad scale dryland farming with crops and pastures.	• The most significant potential impact identified is the direct impact of clearing of native vegetation for construction of the Rail Corridor. Most of the disturbance of native vegetation is in the pastoral area 5900 ha out of a total of 6000 ha). • Indirect impacts may also occur on vegetation within and immediately adjacent to the Rail Corridor and ancillary facilities from interference with local drainage patterns. • Spread of weeds, particularly from construction and maintenance activities • Indirect impacts through possible increases in the frequency of fire. • Increased risk of erosion and / or sedimentation impacting on vegetation. • Possible fragmentation of vegetation and flora populations, which may impact on population dynamics and increase edge effects	• Clearing control system will be implemented to restrict the number and extent of cleared areas to the minimum needed for safe and efficient implementation of the Proposal. • Vegetation clearing will be minimised and will occur within clearly defined boundaries. • All conservation significant locations will be avoided where possible and will be marked with restricted access. • Throughout the freehold area native vegetation will not be cleared except for the purposes of the Rail Corridor itself and access tracks where alternative routes are not practicable. • Rail Corridor restricted to an average 100 m disturbance width through areas of native vegetation in the freehold area. • PECs will be avoided and a 50 m buffer will be put in place around these areas. • More detailed weed assessments completed along the corridor prior to significant ground disturbance and hygiene controls based on this information and consultation with landholders. • Restricted movement of topsoil and machinery or hygiene controls between sites where weeds could be spread to new locations during construction. • Workforce education to include weed awareness and control information. • Maintain Weed Hygiene Program such that weed inspection reports, records of weed hygiene certificates and weed survey data is recorded, assessed and reported. The Weed Hygiene Program will be regularly reviewed. • Use incident reporting system to identify and rectify non-compliance with the Weed Hygiene Program, • Post-construction weed survey and weed control program to ensure that new weed infestations from construction activities are controlled. • Preparation and implementation of construction rehabilitation management plans in consultation with landholders. • Monitoring of vegetation health to ensure that	**Vegetation Clearing** • Approximately 6000 ha of native vegetation. • Up to 100 ha of vegetation clearing in the freehold area. • Sheetflow dependant Mulga will not be significantly impacted due to the installation of 'environmental' culverts • Weeds controlled by survey, hygiene and control measures. • Consideration of offset package for residual environmental impacts. **Significant communities:** • No impacts to TECs or PECs. • Reductions in vulnerable Beard and Burns (1976) mapped associations all less than 0.2% or pre-European extent and not considered significant. • >92% of significant Ecologia vegetation units within the Study Area to remain undisturbed by the Proposal **Significant Flora:** • No impacts to DRF • Majority of Priority Flora species will not be significantly impacted by the Proposal. 11 species subject to further surveys pre-disturbance to allow Proposal to avoid where practicable resulting in no threat to the viability of Priority Flora species.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome

				surface hydrology management measures are effective.
				• Fire Management Plan implemented to limit the risk of inadvertent fire ignition and define fire fighting capability requirements.
				• All proposed disturbance areas located outside of the Study Area to be surveyed for all potential TEC, PEC, DRF and Priority Species to the same level as the remainder of the Study Area.
				• All final proposed disturbance areas will be subject to detailed targeted surveys for DRF and the following Priority Flora species:
				  • *Chamelaucium* sp. Yalgoo (P1)
				  • *Eremophila* sp. Tallering (P1)
				  • *Goodenia lyrata* (P1)
				  • *Gunniopsis divisa* (P1)
				  • *Petrophile vana* (P1)
				  • *Ptilotus tetrandrus* (P1)
				  • *Eremophila arachnoids* subsp. *Arachnoids* (P3)
				  • *Homalocalyx echinulatus* (P3)
				  • *Tecticornia cymbiformis* (P3)
				  • *Thryptomene sp. Moresby Range (P3)*
				  • *Thryptomene sp. Wandana (P3)*	

				• Significant disturbance (>5% of remaining species) of Priority flora species will be avoided throughout the design and construction phases where practicable. Where significant disturbance is unavoidable OPR will liaise with DEC prior to disturbance. • Implementation of measures to offset residual environmental loss. Such measures may include support of one or more of: the Moresby Range Regional Strategy, acquisition of native vegetation areas for conservation management, support for further survey and scientific investigation. Final offset measures will be determined in consultation with EPA and DEC.	

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
Fauna	Maintain the abundance, biodiversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance of adverse impacts and improvement of knowledge.	Continuous fauna habitat with low levels of disturbance throughout the pastoral area. Highly fragmented fauna habitat associated with remnant native vegetation throughout the freehold area. A total of 21 conservation significant fauna species have been identified as occurring or likely to occur within the Study Area, including 5 EPBC listed species. Intensive survey work arranged by OPR on the Western Spiny-tailed Skink (Black form) has resulted in an increase of around 50% in the known populations and extended the known range. 2 confirmed and 4-6 possible SRE species occur within Study Area. Stygofauna and Troglofauna expected to be found throughout the Study Area.	**Fauna Habitat:** • The most significant potential impact identified is the direct impact of clearing of habitat for construction of the Rail Corridor. Most of the disturbance of native vegetation is in the pastoral area. • Indirect impacts may also occur on habitat within and immediately adjacent to the Rail Corridor and ancillary facilities from interference with local drainage patterns. **Significant Fauna** Of the 21 species identified, survey and assessment work has found that only 7 may potentially be impacted by the Proposal. ▪ Malleefowl ▪ Crested Bellbird (southern subspecies) ▪ Rufous Fieldwren (western subspecies) ▪ Western Spiny-tailed Skink (Black form) ▪ Gilled Slender Blue-tongue ▪ Yuna Broad-blazed slider ▪ *Lerista eupoda* • Incidental fauna impacts via vehicle strike. • Potential increase in feral animal activity. • Indirect impacts through possible increases in the frequency of fire. • Potential indirect impacts via noise, light spill and vibration. • Potential impacts on subterranean fauna via groundwater drawdown associated with water supply. • Potential impacts on SRE through habitat removal.	• Turkeys nest dams will be fenced to restrict access by fauna. • Minimise the length of open trench at any one time. • Inspect trenches and excavations regularly and remove any trapped animals promptly. • No domestic animals or pets will be permitted on site. • Feral animal control strategies will be developed and implemented consistent with regional and local feral animal control initiatives. • All disturbance areas have or will be surveyed for Priority Fauna and EPBC protected species prior to disturbance. • Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat. • With the exception of the Rail Corridor, no disturbance will be permitted to occur within a 200 m buffer of known *Egernia stokesii badia* habitat. If the Rail Corridor must pass through these areas, a 50-60m buffer will be maintained between the rail line and specific habitat used for shelter (rock outcrops), and the construction disturbance width will be limited to an average of 100 m. Additional culverts will be installed in these areas as fauna underpasses. • Relocation of *Egernia stokesii badia* individuals if found within the disturbance envelope. • Any handling of *Egernia stokesii badia* will be undertaken by a suitably experienced reptile handler. • No active Malleefowl nests will be disturbed. Where a nest is discovered that cannot be avoided the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for permission to disturb. • Borrow pits or turkeys nests in the Weld Range area will be avoided where practicable, and Rail Corridor will be restricted to an average 100 m in width. • Exclude livestock from construction areas. • Consult with relevant agencies regarding the rail crossing of the State Barrier Fence	**Fauna Habitat** • Approximately 6000 ha of potential fauna habitat will be cleared. • Majority of fauna habitat within the Proposal Area is well represented throughout the surrounding region through the pastoral area. • Fauna habitat is largely avoided in the freehold area. **Significant Vertebrate Fauna:** • Of the 7 species potentially impacted, the only species with known direct impacts to potential habitat is the Spiny-tailed Skink (Black form). The impact is expected to be restricted to the potential habitat surrounding 2 known populations out of more than 50 known populations hence is not considered a significant threat to the species. • Impacts on the remaining species are expected to be negligible due to habitat avoidance, broad distribution or minimal impact to defined habitat (e.g. where habitat is riparian, impacts are generally narrow and perpendicular to the habitat). **Significant Invertebrate Fauna:** • The narrow linear nature of the Proposal disturbance is unlikely to cause a significant impact on SREs. • Short term nature of peak water demand for construction, abundance of suitable habitat and

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
					adaptation to dynamic water table conditions means no significant impact on stygofauna expected. • Limited potential to impact on troglofauna due to the narrow linear footprint of the Proposal and widespread habitat. **Fauna - General** • There will be some occasional direct loss of fauna due to vehicle strike. • There may be some localised movement of fauna away from the rail construction and operational corridor due to increased presence of people and machinery and the resulting increase in ambient noise and vibration. • Control measures for feral animals, fire, dam access, trenches, incident reporting and workforce education are expected to limit fauna impacts to negligible.
Conservation estates	Protect the environmental values of areas identified as having significant environmental attributes.	Conservation reserves in the freehold area tend to be small and fragmented. There is a proposal to create a larger reserve based around the values of the Moresby Range. There are a number of other small conservation reserves near to the Proposal Area throughout the freehold area. The Proposal crosses one reserve, Reserve 16200 which is vested in the Minister for Water Resources for the purposes of water supply and conservation of flora and fauna, In the pastoral area there are three areas proposed for conservation reservation: • Former Woolgorong Pastoral Lease • Former Twin Peaks Pastoral Lease	• Reduction in the size of Conservation estate. • Clearing of native vegetation and potential fauna habitat in Conservation Estate. • Clearing of native vegetation and potential fauna habitat in proposed conservation estate (recently acquired pastoral leases) in the pastoral area. • Possible indirect impacts on Conservation Estate associated with introduction of weeds, disturbance of local drainage, increased risk of fire, introduction of feral animals.	• Conservation reserves or proposed conservation reserves have now been excluded from the Proposal Area where feasible (the Proposal Area boundaries have been altered to avoid these areas). A considerable amount of planning and consultation used to define the Proposal Area to avoid and minimise interaction with conservation estate and proposed conservation estate. • The boundaries of these reserves are therefore at, or near to, the boundary of the Proposal Area. Where disturbance is unavoidable, the width of the Rail Corridor and the size and location of borrow areas will ensure that the area of disturbance within proposed reserves will be minimised. • Temporary construction infrastructure such as borrow areas, construction access and water supply will be minimised within proposed conservation reserves. Accommodation	• Planning has avoided direct impact on existing conservation reserves with the exception of 14.6% of Reserve 16200 (2.5 ha) to enable separation of rail and road traffic for safety reasons. • No impact to the Moresby Range Nature Reserve • Planning has minimised the Intersection of the Proposal with three proposed conservation reserves. Expected maximum disturbance: ○ 0.2% of Woolgorong Ex-Pastoral Station ○ 1.3% of Twin Peaks Ex-Pastoral Station ○ 0.2% of Narloo Ex-

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		• Former Narloo Pastoral Lease.		camps and ballast quarries will not be located within proposed reserves. • Strict weed management procedures including vehicle hygiene, detailed weed surveys (pre and post construction) and weed control measures to be implemented in proposed nature conservation reserves. • Preparation and implementation of construction rehabilitation management plans in consultation with landholders. • Emergency Management Plan implemented to limit the risk of inadvertent fire ignition and define fire fighting capability requirements. • Other measures identified in Vegetation and Flora, and Fauna sections of this PER, implemented as appropriate within proposed conservation reserves.	Pastoral Station. • Potential indirect impacts on Conservation Estate and Proposed Conservation Estate managed by the development and implementation of specific management plans to control weeds, feral animals, drainage and fire.
Surface Hydrology	Maintain the quantity and quality of surface water so that existing and potential environmental values, including ecosystem function, are protected. To maintain the integrity, ecological functions and environmental values of wetlands.	• Study Area lies within the catchments of the Chapman, Greenough and Murchison Rivers. • Most creeks and rivers within the Study Area are episodic and major flows are the result of cyclone and major storm events. • The Study Area does not contain any wetlands of significance. • The Study Area intersects one RIWI Act Surface Water Management Area; the Greenough River and Tributaries. • The most significant surface water features in the Study Area are the Greenough River and tributaries and sheetflow in areas of sheetflow dependant vegetation.	• Changes to surface water flow caused by altered drainage conditions. • Impacts on stream vegetation due to altered stream flow conditions. • Impacts on sheetflow dependent vegetation due to altered sheet flow conditions. • Approximately 9 bridges over waterways and a number of culverts. • Pooling of water during significant rainfall events. • Increases in sediment loads particularly during construction. • Contamination of surface water from hydrocarbon or other spills. • Increased stream bed or bank erosion near drainage crossings. • Impacts on farm and pastoral productivity due to altered drainage conditions.	• Prepare and implement a Surface Water Management Plan (SWMP). • Beds and Banks permits are to be obtained prior to construction activities. • Culverts and bridges will ensure downstream hydraulic capacity is maintained. • Suitable drainage mechanisms (such as environmental culverts) will be installed in areas of sheetflow dependant vegetation and at defined low points. • Design and install culverts, bridges or water crossings at drainage crossings, and at those areas of vegetation identified as surface water dependent, according to the following commitments: ○ minimise interference to overland flow, maintain sheet flow and reduce shadow effects ○ reduce pooling alongside the rail ○ include appropriate erosion protection ○ Where infrastructure may cause drainage to flow parallel to the rail formation, place culverts at regular intervals together with small interceptor banks to direct runoff and reduce ponding ○ Where practicable, construct bridges and major crossings at right angles to major drainage channels ○ Monitoring of selected waterways to occur to ensure surface water flows are maintained.	• No significant impacts on surface hydrology are expected as bridge and culverts will be designed to maintain surface water flows. • Minor, localised impacts may occur in some areas including drainage shadow effects in sheetflow areas, and localised ponding along drainage lines but will be minimised by the use of environmental culverts. • Significant rainfall events during construction may cause short-term localised erosion but risks will be minimised as construction sediment controls will be established as soon as practicable. Within regional context erosion or subsequent impacts not expected to be significant. • Minimal risk of contamination of surface water as standard hydrocarbon and waste management controls are implemented. • Impacts on farm and pastoral productivity are not

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				• Bridges will generally be designed perpendicular to the watercourse to reduce the likelihood of stream diversions. Culverts will be in the same direction as drainage lines; therefore likelihood of diversion is reduced. • All waterway crossings will be implemented in accordance with conditions set by DoW. These requirements will ensure that surface water hydrology is not significantly impacted • Further detailed investigations to refine understanding of areas of sheetflow dependant vegetation that may be impacted. A hydrology assessment will be performed for these areas to determine more detailed drainage measures to maintain sheetflow and restrict drainage shadows to within the area originally disturbed by the construction footprint. • Detailed consultation with landholders to assist in the design of rail and road drainage design, land access arrangements and land management measures. • Standard controls for hydrocarbon and waste management to be implemented to minimise the risk of spills and contamination.	expected to be significant with the implementation of detailed surface water management measures.
Groundwater	Maintain the quantity and quality of groundwater so that existing and potential environmental values. Including ecosystem function, are protected.	• Low level use of shallow aquifers with no significant groundwater users or groundwater dependent vegetation identified within the Study Area. • The Study Area intersects two RIWI Act Groundwater Management Areas; the Gascoyne and East Murchison. • The Proposal does not intersect any Public Drinking Water and Supply areas.	• Potential drawdown on aquifers from up to 200 bores required for construction, with some being retained during operation • Drawdown impacts could include impacts on groundwater dependent vegetation, stygofauna and other groundwater users. • Possible impacts on pastoral water supply • Possible impact on groundwater quality or from hydrocarbon or other spillage or contamination.	• Continue to investigate potential water sources for the Proposal in consultation with DoW and DEC. • All groundwater sources will be investigated and licensed under the RIWI Act. • Groundwater bore construction and abstraction will be licensed under the RIWI Act and managed according to licence conditions and associated management measures which will include monitoring and reporting. • Specific investigations will determine appropriate trigger levels for contingency actions. Associated monitoring will be conducted to compare results against these trigger levels. • Bores no longer required will be rehabilitated in accordance with DoW guidelines. • Ongoing consultation with landholders to include water supply aspects. Any impacts on pastoral water supply due to the Proposal will be rectified by OPR.	• The majority of groundwater abstraction will be short-term and/or relatively small volumes over a number of locations, which will significantly reduce the likelihood of significant impact. • Groundwater use will be licensed under the RIWI Act which will ensure sustainable use. • Risks of groundwater contamination minimised by the implementation of standard controls for hydrocarbon storage. • Impacts on pastoral water supply not considered likely.
POLLUTION					
Noise, Vibration and Light Spill	To protect the amenity of nearby residents from noise impacts	• Background noise levels consistent with rural setting - measured noise	**Construction** • Blasting may be necessary in isolated	• The preferred Rail Corridor has been selected to minimise the number of receptors impacted and the degree of impact has been minimised	• Ambient noise levels will increase during both construction and

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	resulting from activities associated with the Proposal by ensuring that noise levels meet statutory requirements and acceptable standards. To avoid or manage potential impacts from light overspill and comply with acceptable standards.	levels from 4 locations varied from LA90 23 - 26 dB at night, while the day time levels ranged from LA90 27 - 30 dB. • Vibration currently restricted to minor and low level vibrations from rural activities. • Few light sources, particularly in the eastern part of the Study Area. Light sources generally restricted to farm houses, road traffic and occasional farming activities at night.	locations where continuous rock is encountered leading to noise and vibration. • Construction noise will be short term (weeks-months) as the construction face will continuously advance. • Activities such as compaction during construction may cause vibration but the proximity to residences means that this is unlikely to be felt and is expected to be short term. • Temporary lighting during construction activities. **Operation** • Increase in noise sources means 3 receptors may exceed the outdoor noise limit criteria at night (State Planning Policy 5.4). An further 3 receptors in this category are owned by LandCorp and are not considered noise sensitive premises. • An additional 7 receptors may exceed the outdoor noise target criteria at night. A further 7 receptors are owned by LandCorp (see above). • Train movements are expected to be audible at approximately 55 receptors (including those above). • Light impacts restricted to road crossings, signals and temporary illumination of tracks by trains and service vehicles at night. Light impacts from maintenance camps expected to be negligible due to their remote location. • Increases in vibration levels in close proximity to rail.	by route selection where possible. • Consultation programme with affected landholders based around preferred centreline to identify and agree upon mitigation options that may include external sound barriers, internal sound-proofing and building relocation. • Use a combination of noise reduction methods to comply with the Noise Regulations (construction) and SPP5.4 (rail operation). • Modelling completed for the preferred centreline as well as practical extremities of the SAC to determine the range of possible noise outcomes and to cater for possible minor changes to preferred centreline. • Personnel will be made aware of noise related issues during inductions • Consultation with affected premises regarding key construction activities will commence before construction and continue throughout construction. • A Construction Noise Management Plan will be submitted for approval in accordance with the Environmental Protection (Noise) Regulations 1997 prior to commencement of construction. • Design and place any construction lighting to reduce intrusion to residences where practicable. Design and place lighting in accordance with Australian Standard AS4282-1997 Control of Obtrusive Effects of Outdoor Lighting. • An Operation Noise Management Plan will be developed which will include more detailed information on the following: ○ Selection of construction and operational equipment ○ Noise and vibration monitoring plans and results to be made publicly available ○ Verification of noise modelling ○ Monitoring to determine the success of noise mitigation measures ○ Monitoring to check on vibration levels at selected locations as required ○ Contingency actions to be taken when noise target is exceeded, or noise complaint is received ○ Incident management procedures ○ Reporting requirements ○ Specification of any zones where the operation of the rail will require further residential development to consider	operational phases within adjacent areas. • Compliance with SPP5.4 expected to be attained by consultation and negotiation with landholders regarding a range of mitigation measures at an individual landholder level. • Compliance with noise regulations during construction, criteria expected to be able to be achieved subject to a Construction Noise Management Plan under the Environmental Protection (Noise) Regulations (1997) • Occasional noise events from rail movements audible at up to 55 sensitive receptors largely throughout the freehold area. • Light impacts able to be managed using Australian Standard. • Vibration impacts expected to be insignificant as they will be restricted to within 20 m of the Rail Corridor.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				"deemed-to-comply" measures.	

Air Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Dust is currently restricted to localised, short-term events caused by the movement of cattle, and vehicle movements on unsealed roads.
		• Large scale episodic dust events caused by general dust lift during windy conditions occur occasionally and may lead to exceedances of NEPM levels.
		• Within freehold areas, dust is also generated from erosion processes due to agricultural activities such as ploughing prior to seeding and the summer grazing of stock.
			• Activities or areas that may result in dust emissions include:
			  ○ Exposed surfaces
			  ○ Construction earthworks
			  ○ Blasting and crushing of rock
			  ○ Vehicle movements and ore transport
			• The construction face will be constantly moving, meaning that construction impacts will generally be short-term in nature.
				• Best practice dust controls to ensure that dust emissions are minimised and avoided.
				• Perform visual dust monitoring of construction and operations areas to ensure that fugitive emissions meet required standards.
				• Progressive and staged clearing of vegetation to limit the number of open areas
				• Restricted vehicle movements to designated access tracks.
				• Apply water sprays and/or dust suppressants to exposed areas and unsealed roads during construction.
				• Set and enforce vehicle speed limits.
				• Contractual specification of Dust Extinction Moisture (DEM) levels for ore haulage.
				• Control occupational dust levels in accordance with the requirements of the Mines Safety and Inspection Regulations 1995 and *Occupational Health and Safety Act 1984*.
				• Prepare and implement an Air Quality Management Plan that includes objectives, targets, and detailed management actions to minimise dust emissions at source, monitoring, incident management, and contingency measures.
					• Dust emissions will increase during both construction and operational phases but will be managed under an Air Quality Management Plan that will detail management actions for both phases. Impacts are not expected to be significant following management measures.
					• Emissions from construction will be short-term and subject to best practice dust controls.
					• Emissions from operations are expected to be insignificant.
					• Compliance with relevant Occupational Health and Safety air quality standards.

Soil Quality	Ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria	• 16% of Study Area expected to have moderate-high risk of Acid Sulphate Soils (ASS). • Broadacre farming throughout the freehold area that includes cropping and grazing, with some more intensive land use towards the western end of the Study Area. Soils throughout this zone have been repeatedly cultivated and may be depleted in organic matter and nutrients. • Grazing on unimproved pasture (largely native vegetation) throughout the Pastoral Area • Soil erosion from occasional dust storms and intense rainfall events.	• Potential changes to soil chemistry through disturbance of ASS. • Alterations to soil structure from disturbance impacting on productivity and stability. • Potential increase in soil erosion. • Potential changes to soil productivity. • Contamination of soils from hydrocarbon or other spillage. • Indirect impacts (on soils and farm productivity) via spread of weeds and diseases.	• Potential ASS areas identified from geological mapping. • Design infrastructure to minimise disturbance of ASS. • When excavation in areas of potential higher risk ASS is required a detailed survey will completed in accordance with DEC guidelines (DEC, 2004). • Prepare and implement an ASS Management Plan to manage construction activities in areas of known or suspected ASS. • Detailed individual rehabilitation plans for areas disturbed for construction purposes. • Consultation with individual landholders completed as part of land access negotiations to include integration of farm plan aspects into construction management. This will include drainage management, biosecurity, vehicle hygiene, stock and cropping management during construction and operation. • Generic Borrow Area Rehabilitation Plan for other borrow areas to be retained within the operational corridor.	• The application of individual landholder consultation and management controls through the land access negotiations for biosecurity, drainage management, and integration with farm planning is expected to result in impacts being acceptable. • No significant impacts are anticipated arising from disturbance of ASS as only 1.3% of the 16% of Proposal Area expected to have moderate-high risk of ASS requires excavation.
Waste and Hazardous Materials	To ensure that emissions do not adversely affect	• Minimal hazardous material stored and no registered contaminated sites within the Study Area due to rural	**Waste** • Solid and liquid wastes will be generated by	• Inert and putrescible waste will be disposed of at licensed or registered landfills created along the Rail Corridor where distance to existing	• The waste or hazardous material issues are similar to those faced and

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	land use. • Nearby waste management facilities are limited to Shire landfills that are significant distances apart. • Minor dumping of waste consistent with historic rural activities. • Some hazardous materials (particularly diesel) may be transported along major roads to service inland mining operations.	the Proposal and may impact upon the environment by causing contamination, increasing the risk of disease and encouraging feral animals. • Up to 6 Wastewater Treatment Plants (WWTPs) required for a peak workforce of up to 3000. • Liquid hydrocarbon wastes will be generated during both construction and operational phases. • Inert and putrescible solid wastes will be generated during both phases of the Proposal. These will largely be associated with the accommodation requirements of the construction workforce. **Hazardous Materials** • Hazardous materials such as fuel, oils, lubricants, chemicals and explosives will be required for the construction (and some for operation) and may be stored inappropriately or spilt potentially casing contamination of soil or water, and exposing native animals and livestock to hazards. • Fuels oils are flammable and could lead to an increased risk of fire. • Transport of hazardous materials along major traffic routes is not expected to be significant and the potential for vehicle/rail interaction has been eliminated by the selection of a grade separation bridges where the rail crosses the North West Coastal Highway (NWCH) and the Chapman Valley Road.	Shire Landfills is prohibitive. • Prepare and implement a Waste Management Plan based on the hierarchy of waste minimisation. • Treated wastewater from Construction and Operations Camps will be discharged at designated spray irrigation areas to be established near the camps, or the wastewater will be treated to a standard that is suitable for use for dust suppression (subject to DoH requirements). • WWTPs will be subject to licensing under Part V of the EP Act. • Wastewater will be spread over a large area (in accordance with WQPN – Irrigation with Nutrient Rich Wastewater). • Hazardous wastes will be stored and transported in accordance with relevant legislation to ensure that there is no discharge to the environment. • Hydrocarbons will be transported, stored and used in accordance with industry best practice to reduce the risk of spillage to the environment. • Hydrocarbon spills will be reported as incidents and responded to immediately. Spill kits will be kept in designated positions to allow swift response. Any contaminated soil or used clean up equipment will be taken to a licensed facility. • Hazardous material handling, storage and spill response will occur in accordance with Dangerous Goods Licences issued under the *Dangerous Goods Safety Act 2004* and Australian Standards. • Prepare and implement a Hazardous Materials and Contamination Management Plan to document in detail how chemicals, hydrocarbons and hazardous goods or waste will be managed. This plan will ensure compliance with the *Contaminated Sites Act 2003*.	managed by many other remote operations in WA. The quantities of waste expected to be generated are not significant. • Application of industry best practice preventative controls such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to reduce contamination risks to the environment to a level that is insignificant. • Current legislative controls are expected to ensure that waste and hazardous materials are managed to avoid significant impacts to the environment.
Greenhouse Gas Emissions	To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.	• Greenhouse Gas (GHG) emissions from the Mid-West are currently minor. • Majority of iron ore in the Mid-West currently being transported by road. • No industries that are required to report under the NGER Act are currently located within the Study Area.	• 48,000 kL of diesel to be used during construction, estimated 45,000 kL during operation. • Estimates: 250,000 t of CO2-e during construction, 130,000 t /yr during operation. • Represents approx 0.02% of Australia's annual GHG emissions.	• Energy use monitoring will be undertaken monthly and results reported to OPR Management. • OPR will identify and comply with all energy usage and GHG reporting requirements, and any future Commonwealth GHG legislation. • Consider fuel efficiency and emissions profiles for all new locomotive purchases. • Implement energy saving strategies for the rail system addressing factors such as fuel type,	• The Proposal is not expected to make a significant contribution to Australia's annual GHG emissions (0.02% of Australia's annual GHG emissions will be generated). • The Proposal will increase the GHG efficiency of Mid-

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				equipment design, rail design, operational procedures, schedules, loading and unloading systems, and technology.	West mines hauling ore to port. • Reporting under the NGER Act will be required. • OPR is expected to participate in the proposed Carbon Pollution Reduction Scheme.
• SOCIAL SURROUNDS					
Heritage	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	• Indigenous heritage sites are known at a number of locations in the Study Area. • The Proposal is within the external boundaries of the Naaguja, Amangu, Widi Mob, Mullewa Wadjari and Wajarri Yamatji Native Title claims. • DIA registered Aboriginal sites within the Proposal Area include Weld Range and Jack Hills, which are known to have mythological associations to local Indigenous people.	Potential impacts relate primarily to direct disturbance and include: • Disturbance of sites during construction • Landscape level changes • Collection and/or defacing of artefacts/artworks • Accidental damage of artefacts by off-road vehicle use • Indirect disturbance to sites from changes in water flows, spillages, dust, or other indirect impacts. • Sites associated with watercourses within the Proposal Area are the most likely to be impacted as the sites tend to be concentrated around water courses and the Proposal must cross a number of water courses.	• OPR will avoid Aboriginal sites wherever practicable. Where it is not practicable to do so, OPR will consult with each of the native title claim groups in relation to the mitigation and salvage of any affected Aboriginal sites and seek the consent of the Minister for Indigenous Affairs pursuant to Section 18 of the AH Act. • OPR has agreed processes in place with each of the Native Title claim groups affected by the Proposal to facilitate the identification of unregistered Aboriginal sites and Aboriginal heritage surveys will be progressively conducted over the Proposal Area prior to commencement of construction. • OPR has in place Heritage Protocols with Native Title groups. The implementation of these protocols will be via an Aboriginal Heritage Management Plan which includes: • Protection of sites in situ. • Consultation and Section 18 processes, if required, for those sites that cannot be avoided. • Earthworks management – including the use of monitors. • Salvage and storage management. • OPR will also implement procedures (as identified in the Heritage Protocol) for the identification and management of any additional sites located during the construction phase of the Proposal. • OPR intends to negotiate Comprehensive Agreements with each of the registered Native Title Claimant Groups. Such agreements would outline opportunities for Indigenous involvement e.g. employment, training and contracting arrangements.	• The Proposal will have an unavoidable impact on a number of Aboriginal heritage sites. Where practicable, significant heritage sites will be avoided. Ongoing consultation and indigenous participation in heritage survey work will assist OPR to ensure that impacts are acceptable. • With the implementation of management measures, the risk of inadvertent disturbance of sites is minimised and any unavoidable disturbance is authorised under the AH Act.
Visual Amenity	To ensure that aesthetic values are considered and measures are adopted to reduce visual	• Study Area includes areas of gentle undulation in the freehold area, with largely cleared farming land and relatively low population concentrations.	• The Proposal will be a long linear feature with potential impacts to viewscapes from public and private locations at the western end. • Viewscapes are more significant in the western part of the Proposal Area as the route	• Route selection and engineering constraints related to grade and earthmoving mean that impacts on visual amenity are limited. • Prepare and implement a Visual Amenity Management Plan (VAMP) that will include	No viewscape impacts on major settlements, townships or communities. Impacts to public viewscapes

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	impacts on the landscape as low as reasonably practicable.	• Population and exposure to visual impact is highest through the Wokatherra Gap (through the Moresby Range) and Chapman Valley at the western end of the Study Area. • The Moresby Range has local iconic value as a viewscape from Geraldton and surrounds and is the subject of a specific planning activity by the Shire of Chapman Valley. • The rail will be unable to be seen from Geraldton town due to distance and screening by the Moresby Range. • In the pastoral area the land is relatively flat and vegetation is mostly intact. There are large distances between residential dwellings and these are limited to pastoral landholders.	traverses the Chapman Valley and Wokatherra Gap in the Moresby Ranges. • In undulating areas the topography creates both visual exposure and screening depending upon location. • Through the pastoral area the Proposal is not expected to have a significant visual impact as: ○ The land remains relatively uncleared, and the vegetation will generally provide a visual barrier ○ The land is relatively flat, therefore the number of visual vantage points is reduced.	visual amenity modelling for public viewscapes through the Wokatherra Gap and Chapman Valley. • The VAMP will outline mitigation measures that may include visual screening (rail or viewscape), rehabilitation, and use of local native species. • Progressive rehabilitation of disturbed areas (including the rail embankment) to minimise the visual effect of bare earth. • Using local provenance species and matching local relative plant densities and strata in rehabilitation areas. • Consideration of viewscapes from residence locations to be included in land access negotiations. • Minimisation of the height of the rail embankment • Minimisation of exposure to any lighting through compliance with Australian Standard AS4282-1997 Control of Obtrusive Effects of Outdoor Lighting.	around the Moresby Range (Wokatherra Gap) and Chapman Valley will be mitigated via the use of measures that include rehabilitation screening. Visual impacts during construction will be short term.
Other social and economic	To ensure that existing and planned recreational uses are not compromised over the extent of the region. To ensure that risk from the proposal is as low as reasonably achievable and complies with acceptable standards and EPA criteria.	• The Study Area and surrounds currently generates income largely from farming, mining and fishing. • The Study Area does not contain or pass in close proximity to any major population centres. The land use is rural, and the Proposal Area contains numerous track and minor road crossings. • Due to the rural land use of the Study Area recreational activities are limited; however several landholders located within or near the Study Area offer accommodation to tourists.	• Possible impacts on public recreation via restrictions to access, opening up of new access, additional population pressure on recreational assets (particularly during construction). • Possible risks to public safety largely from road/rail interactions and from storage and transport of hazardous goods such as diesel. • Possible impacts to farming and pastoral operations.	• Workforce inductions will include information about regional recreational assets (particularly relevant environmental information), management of public interactions with the Proposal and environmental management requirements for the Proposal. • Workforce inductions will include information on acceptable access, activities and behaviours relating to construction areas through all freehold and pastoral properties. • Consultation with individual landholders completed as part of land access negotiations to include integration of farm plan aspects into construction management. This will include drainage management, biosecurity, vehicle hygiene, stock and cropping management during construction and operation. • The public will be excluded from all construction areas, therefore these areas are not expected to provide a public risk. • In accordance with access agreements and leases negotiated with the State, signage will be erected and maintained to alert members of the public to risks and hazards and exclude them from construction and operational areas. • Include Public Risk in Risk Assessment and Risk Management programmes • Public notices shall be communicated prior to any works taking place that may affect public access.	• Risks to the public from rail/road interactions are expected to be managed to as low as reasonably achievable by using grade separation at major crossings and industry standard safety warning systems at other crossings. • Application of industry best practice preventative controls to hazardous materials such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to reduce risks to the public to a level that is insignificant. • Recreational use of the Proposal Area is minor. Workforce education processes are expected to reduce the risk of unacceptable workforce impacts on recreational assets to negligible.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				• Prepare and implement a Traffic Management Plan that includes designated traffic areas, measures for safe traffic interactions with the public and arrangements with local government and Main Roads WA. • Rail Safety and Risk will be managed according to the *Rail Safety Act 1998* including risk assessment and safety provisions for all level crossings.	Increase in accessibility to areas is not expected to lead to significant recreational use pressures. • Dissection of farm paddocks and inconvenience for farm operations is expected to be managed via land access negotiations with individual landholders.

Environmental Management Framework

An ISO 14001:2004 based Environmental Management System (EMS) will be finalised prior to commencement of construction of the Proposal.

The EMS will provide the fundamental tools of risk identification and control through the guiding principles of the OPR Corporate Environmental Policy. Continuous improvement in the EMS will be achieved through regular review, routine audits and an annual management review of the system.

Specific environmental aspects of the construction and operation of the Proposal will be managed through the implementation of Environmental Management Plans (EMPs), developed as part of the EMS. These EMPs will also include details of monitoring that will be undertaken, performance standards applied to the results and reporting requirements. The EMPs will be regularly reviewed and updated, in alignment with the ISO 14001:2004 continuous improvement approach.

Critical environmental factors relevant to the Proposal will be incorporated into the EMPs, including:

- Aboriginal and non-indigenous cultural heritage;
- ASS;
- air quality;
- vegetation and flora;
- fauna;
- hazardous materials and contamination;
- noise and vibration;
- recreational access;
- surface water and groundwater; and
- sustainable resource management – covering waste, power and water management.

A Safety Management System will be developed separately but will be aligned to the EMS framework. The Safety Management System will take the lead on Emergency Response issues, including spill management, with support via the EMS.

Summary and Conclusion

The development of the Proposal shall not impact upon any TEC, PEC or DRF. Based on predictions of clearing using the indicative Rail Corridor alignment five out of the 87 species of Priority Flora recorded within the Study Area will be impacted, to a maximum of 3.8% of their known population. Additional surveys prior to disturbance will be commissioned for those species with the highest risk of being significantly impacted.

There will be minimal disturbance to significant vegetation communities. Significant Beard and Burns (1976) associations will be cleared by a maximum of 0.2% of their pre-European extent. A minimum of 92% of significant Ecologia (2010a) vegetation units will remain unaffected by the Proposal.

The Proposal does not impact upon any existing conservation reserves, with the exception of Reserve 16200, which has been vested in the Minister for Water for the conservation of water supply and conservation of flora and fauna. Approximately 14.6% of Reserve 16200 will be impacted.

The expected maximum disturbance to the Narloo, Woolgorong and Twin Peaks proposed conservation reserves, is 0.2%, 0.2% and 1.3% respectively.

The development of the Proposal may result in the direct loss of some fauna due to accidental strikes of trains; however it is likely that over time local fauna will avoid the immediate area. No significant impacts are expected to fauna listed under the EPBC Act and/or the WC Act, including the Malleefowl and Western Spiny-tailed Skink. Significant impacts on SRE species is considered unlikely due to the linear nature of the infrastructure and the reduced disturbance footprint within the freehold area. No significant impacts are expected for subterranean fauna as no significant excavations or long term abstraction of large volumes of groundwater.

There may be minor, localised impacts to the surface hydrology in some areas, including drainage shadow effects in sheetflow areas, and localised ponding along drainage lines. The drainage shadow is expected to be limited to the general disturbance envelope, due to the use of environmental culverts. The predicted outcome is no significant indirect impacts to sheetflow dependent vegetation, such as Mulga.

The majority of groundwater abstraction within the Proposal Area will be short-term and/or relatively small volumes over a number of locations, which will substantially reduce the likelihood of unacceptable impact. All groundwater use will be licensed under the RIWI Act which will ensure sustainable use.

The preferred Rail Corridor alignment has been selected to minimise the number of receptors impacted. The Proposal will result in three residences receiving noise in excess of the limit set in State Planning Policy 5.4, and seven residences receiving noise in excess of target criteria (WAPC 2009b). Noise mitigation measures may include external noise barriers, internal sound proofing and building. Consultation with affected landholders will determine the appropriate mitigation measures to be taken.

Dust emissions are expected primarily during construction of the Proposal. Emissions will be short-term and subject to best practice dust controls.

The waste and hazardous material issues relating to this Proposal are similar to those faced and managed by many other remote operations in WA. Significant risk reduction will be achieved through the application of industry standard preventative controls, storage and handling standards, incident reporting and remedial capacity.

It is anticipated that the Proposal will contribute approximately 0.02% of Australia's annual Greenhouse Gas emissions. Emissions will be reported under the NGER Act, and OPR will be required to participate in the proposed Carbon Pollution Reduction Scheme.

Management measures will minimise the risk of inadvertent disturbance to registered and unregistered Aboriginal heritage sites; however the Proposal will directly impact a number of sites. Permission will be sought under the AH Act for disturbance to any registered site. Management measures will minimise the risk of inadvertent disturbance to registered and unregistered sites. OPR will continue to liaise with Native Title claimants in the area and work towards creating sustainable opportunities for Aboriginal people.

The design, alignment, and position of the Rail Corridor on lower relief land will prevent significant impacts to general visual amenity in agricultural and pastoral landscapes and from the sensitive location of the Moresby Range. Disturbance minimisation and rehabilitation will minimise any impacts to visual amenity as a result of the Proposal.

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1 INTRODUCTION

1.1 BACKGROUND

The idea of developing a deepwater port at Oakajee, about 24 kilometres (km) north of Geraldton in Mid-West Region of Western Australia (WA) has a long history having been initially identified as early as the 1960's (anecdotally). In the 1980s when it was raised as an adjunct to a proposed Kimberley based bauxite mining project. In 1997, the WA Environmental Protection Authority (EPA) provided advice to the then State Government Minister for the Environment on environmental issues associated with development of a deepwater port at Oakajee. A subsequent proposal from the then WA Government Minister for Resources Development led to assessment of the Oakajee deepwater port concept by the EPA, resulting in the release, on the 25th February 1998, of Ministerial Statement 469 (MS 469) by the then Minister for the Environment. MS 469 established the legally binding environmental conditions under which the Oakajee deepwater port development could proceed, the original term of the environmental approval extending to the 25th February 2003. The term of environmental approval for the Oakajee deepwater port pursuant to MS 469 has subsequently been extended on several occasions, the current expiry date being the 25th February 2013.

Historically, establishment of the Oakajee Port has been linked to expansion in the mining sector, originally the proposed Kimberley based bauxite project and more recently, growth of the Mid-West iron ore mining sector. The number of Mid-West iron ore projects currently being progressed has increased the impetus for development of the Oakajee port. The State Government initiated a competitive tendering process from consortia interested in developing the port and associated infrastructure, Oakajee Port and Rail Pty Ltd (OPR) being the successful bidder.

OPR's development proposals for the Oakajee deepwater port and associated infrastructure comprise the following distinct components, the approvals for which are being obtained (or have already been obtained) through separate environmental impact assessment (EIA) processes:

- Oakajee Deepwater Port Development – approved under Statement 469;
- Port Terrestrial Development – subject of separate Public Environmental Review (PER); and
- Rail Development – subject of this PER.

This document addresses only the Oakajee Rail Development Proposal (the Proposal). This proposal is for the infrastructure required to develop and operate a 45 Mtpa iron ore export facility as a first stage.

It is understood that the Government of WA has plans to further develop the Oakajee area as a multi-user, multi-product port when there is a demand for further import and export facilities serving the region and in particular the Oakajee Industrial Estate.

Development beyond OPR's 45 Mtpa iron ore project (the subject of this PER) will be the subject to future approvals processes and stakeholder consultation.

1.1.1 Proposal Context

On the 20th March 2009 the State Government of WA and OPR entered into a State Development Agreement (SDA). This SDA provided OPR exclusive rights to build Oakajee Port and a northern railway line.

In accordance with section 11 of the *Public Works Act 1902* (PW Act), the Governor, by Order in Council, has declared the railway a Public Work and has authorised the Public Transport Authority (PTA) of WA to undertake, construct or provide a railway line and associated infrastructure to link iron ore mines in the mid-west region of WA with a deepwater port to be constructed at Oakajee. The Proposal is therefore a Public Work as defined by Section 2 of the PW Act.

On the 24th July 2009, the PTA authorised OPR to undertake feasibility works within the Proposal Area on its behalf, in accordance with the power under section 182 of the *Land Administration Act 1997*. Final approval of the railway corridor by the Government is currently pending and minor variations to the corridor are still possible.

The Proposal will be located within a 4 km corridor in the pastoral area and 3.2 km corridor in the freehold area, 2 km and 1.6 km respectively either side of a centreline that is to be defined by a Special Act of Parliament. Any reference to the Proposal Area in this document is relevant to the Special Act Corridor (SAC), unless stated otherwise.

1.2 PURPOSE OF THIS DOCUMENT

OPR has liaised with the Office of the EPA (OEPA) and the previous EPA Service Unit (EPASU) of the Department of Environment and Conservation (DEC), regarding EIA requirements for the Proposal. The EPA have determined that the Proposal will be assessed pursuant to the provisions of Part IV of the *Environmental Protection Act 1986* (EP Act) at a PER level.

OPR has established that the Proposal is to be considered a controlled action and will therefore require assessment pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Department of Environment, Water, Heritage and the Arts (DEWHA) has determined that under the terms of a bilateral agreement on EIA between the State and Commonwealth Governments, the WA EPA's EIA process will satisfy Commonwealth requirements.

This PER has been prepared in accordance with requirements pursuant to both the WA EP Act and the Commonwealth EPBC Act. The PER conforms to the scope outlined in OPR's Environmental Scoping Document (ESD) for the Proposal as agreed with EPA and DEWHA in July 2010.

Table 1-1 lists the ESD study requirements and the relevant sections of the PER where these have been addressed.

The PER has also been prepared in accordance with the following documents:

- *EIA (Part IV Division 1) Administrative Procedures 2002* of the EP Act; and
- *Guidelines for Preparing a PER/Environmental Review and Management Programme* (EPA, 2009b).

This PER provides EPA and DEWHA with information on the Proposal and demonstrates how the impacts of the Proposal on the key environmental factors (including relevant matters of National Environmental Significance (NES)) will be mitigated and managed. In this regard, OPR has committed to the implementation of Environmental Management Plans (EMPs) addressing the Proposal's potential construction and operational impacts.

The PER will be subject to a four week public review period.

Table 1-1 ESD requirements

Factor	Investigations undertaken	PER documentation to Include	PER Section Reference
Vegetation and Flora	• Level 2 survey (single phase – performed by *Ecologia* Environment (Ecologia) from 2007 to 2009), consistent with EPA Position Statements 2, 3 & 9 and Guidance Statement No. 51. • Threatened flora survey – performed by *Ecologia* in 2009. Access restriction on Meka Station – currently excluded from survey. • Threatened flora details available for surveys conducted on previous alternate alignments by *Ecologia* in 2006/2007. • Identification of declared and environmental weed species. • Identification of any areas outside of surveyed areas that may be disturbed.	Survey findings, including vegetation mapping, and mapping of conservation significant species and vegetation;	5.2.1
		General impact assessment, including assessment of impact of fire risk and vegetation dependant on surface water sheetflow	7.2
		Evaluation of local and regional significance and impacts on conservation significant flora species, particularly Declared Rare Flora (DRF) and Priority Flora species;	7.2 & 8
		Evaluation of impacts on significant vegetation communities, particularly the Moresby Range Priority Ecological Community (PEC)	7.2
		Definition of autumn survey in the Moresby Range including the PEC area, plus spring survey for *Caladenia hoffmanii*	Appendix 1
		Definition of approach to borrow pits and quarries including further spring vegetation and flora survey work to cover all disturbance areas including borrow pits, quarries, groundwater bores should these need to be outside the existing survey envelope;	7.2 & 7.9
		Impact assessment, including assessment of impact of the rail infrastructure on vegetation dependant on surface water sheetflow;	7.2 & 7.5
		Control measures for weed management;	7.2
		Management measures to reduce impact on vegetation.	7.2
Fauna	• Level 2 vertebrate fauna survey (by Ecologia from 2006 to 2009) of the Proposal Area has been conducted, consistent with EPA Position Statement No. 3 and Guidance Statement No. 56. • Identification of threatened fauna that could potentially utilise the Proposal Area. • SRE Surveys conducted in May/June, July and October 2009 (Ecologia), consistent with EPA Position Statement No. 3 and Guidance Statement No. 20 and 56. • Risk assessment on potential impact to subterranean fauna undertaken based on a review of existing fauna records mapped against land system and soil landscape systems (Ecologia, 2010e).	Survey findings, including vertebrate and invertebrate fauna, short-range endemics (SREs)	5.2.2
		Assessment of impacts and risks relating to subterranean fauna, SREs and conservation significant fauna	7.3 & 8
		Plans for any further fauna survey or other work, particularly to cover areas outside the existing survey envelope	-
		Impact assessment, including evaluation of local and regional significance	7.3 & 8
		Quantify extent of habitat reduction with particular reference to conservation significant species such as the Slender-billed Thornbill, Carnaby's Black Cockatoo, Malleefowl and Western Spiny-tailed Skink	8
		Management measures to reduce impact on fauna and fauna habitat.	7.3
		Details of any additional surveys performed for the Western Spiny-tailed Skink	8
Conservation Significant Areas	• Investigated alignment with no direct impacts on A class reserves. • During design phase, measures by which potential impacts can be reduced have been investigated and will be implemented as practicable. • Documentation of residual impacts.	Review of conservation tenure and values within close proximity to footprint	5.1.7
		Impact assessment	7.4
		Management measures to reduce impact on conservation areas and proposed conservation areas.	7.4

Factor	Investigations undertaken	PER documentation to Include	PER Section Reference
Surface Hydrology	• Assessment of surface water flows, based on desktop review and field visit (Aquaterra, 2009a). • Identification of drainage sensitive vegetation (Ecologia) and assessment of design options to minimise risk of vegetation impacts. • Drainage design criteria	Impact assessment including potential impacts on natural drainage systems and sensitive vegetation communities, and potential impacts of drainage systems on infrastructure	7.5
		Management measures to reduce impact on natural surface water flows, surface water quality, surface-water flow dependant vegetation and drainage, impacts on infrastructure	7.5
Groundwater	• Assessment of water requirement for construction and operational phases of the Proposal (Aquaterra, 2009b). • Assessment of groundwater availability to meet demand (Aquaterra, 2009b).	Review of water requirements for Proposal	4.4.6
		Impact assessment, including assessment of potential impact of abstraction on the groundwater resource, sustainability of abstraction and on groundwater-dependent biological values	7.6
		Management measures to minimise water requirements and reduce impacts on groundwater	7.6
Noise, Light and Vibration	• Baseline noise assessment undertaken by Lloyd George Acoustics (2010). • Noise modelling undertaken by Lloyd George Acoustics (2010), including comparison against relevant criteria (WA Planning Commission's (WAPC's) State Planning Policy 5.4 (SPP5.4): Road and Rail Transport Noise and Freight Consideration in Land Use Planning).	Baseline noise and noise modelling results; Impact assessment including compliance with statutory requirements for noise relating to sensitive receptors	7.7
		Consideration of impacts from light and vibration	7.7
		Management measures to reduce impacts on sensitive receptors	7.7
Air Quality	Potential sources of dust and management strategies identified.	Impact assessment	7.8
		Management measures to avoid dust generation and reduce impacts on sensitive receptors.	7.8
Soil Quality	A desktop risk assessment for acid sulfate soils (ASS) has been undertaken for the Proposal Area (GHD, 2010).	Impact assessment based on risk assessment review	7.9
		Management measures, including site rehabilitation strategies and sampling and analysis strategies for ASS, if required.	7.9
Waste	Identification of the types of waste likely to be generated by the Proposal.	Impact assessment	7.10
		Management measures, including waste avoidance, minimisation, and disposal.	7.10
Greenhouse Gases (GHG)	Identification of GHG emitting facilities / activities and likely quantities / minimisation strategies.	Impact assessment - quantify expected GHG emissions from construction and operation	7.11
		Management measures – including addressing the requirements of EPA Guidance Statement No. 12.	7.11
Aboriginal Heritage	Surveys with all affected Native Title claimants have commenced and are ongoing.	Identification of registered sites	5.3.5
		Discussion of the heritage assessment / consultation process	7.12
		Discussion of disturbance approach – i.e. preference to avoid, however, where this is not possible seek approvals to disturb under the *Aboriginal Heritage Act 1972* (AH Act)	7.12
		Management measures, including use of exclusion zones, clearing permitting system and Aboriginal heritage monitors.	7.12
Visual Amenity	Visual amenity modelling undertaken by Calibre Engenium Joint Venture in 2009 & 2010.	Identification of sensitive viewsheds	7.13
		Impact assessment	7.13
		Management measures with reference to the *Visual Landscape Planning in WA* (WAPC, 2008).	7.13

Factor	Investigations undertaken	PER documentation to Include	PER Section Reference
Other Social and Economic	Stakeholder and community consultations in relation to the rail development have been undertaken since signing the SDA in March 2009.	Summary outcomes of community consultation	6
		Consideration of risks to the public	7.14
		Impact assessment and consideration of outcomes of community consultation	6 & 7.14
		Management measures	7.14

1.3 THE PROPONENT

OPR is the Proponent for the Oakajee Rail Development Proposal. OPR is the manager of an unincorporated joint venture between MML, MDPL and CRL, established in September 2007 to develop and coordinate the operation of a supply chain comprising port and rail infrastructure for iron ore sourced from the Mid-West region of WA.

MML is an Australian Stock Exchange Listed company with a 50% holding in CRL. The remaining 50% of CRL is held by MDP, a subsidiary of Mitsubishi Corporation, Japan's largest general trading company. CRL owns the Jack Hills Iron Ore Project within the Mid-West region, and currently has a 50% economic interest in OPR, with MML and MDP each owning a 25% direct share. Figure 1-1 summarises OPR's organisational structure.

Following a competitive tender process, OPR was appointed in July 2008 by the State Government as the preferred developer of the Oakajee deepwater port. On the 20th March 2009 the State Government and OPR entered into a SDA which provided OPR exclusive rights to build the Oakajee Port (both marine and terrestrial) and a northern railway line.

The PTA will own the railway infrastructure, but OPR will construct and operate it for a defined period, the length of which is currently the subject of negotiation.

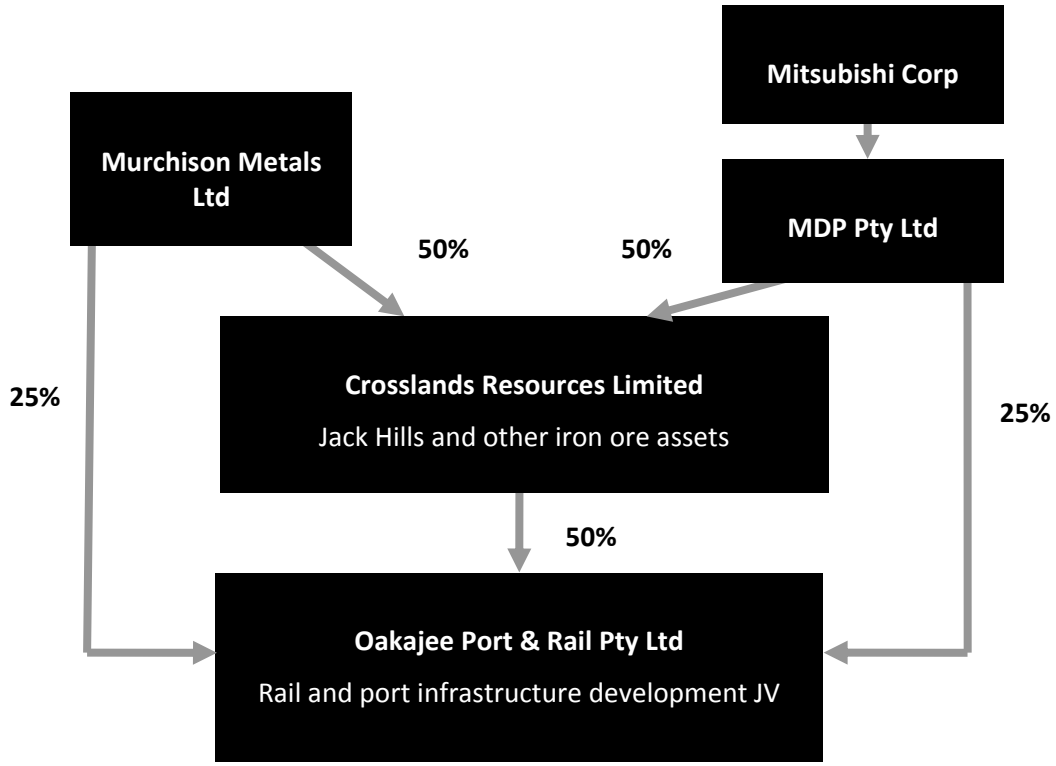


Figure 1-1 Proponent ownership structure

Proponent Contact:

Damien McAlinden	OPR Environment Manager
Email	dmcalinden@opandr.com
Street Address	Level 3, 33 Richardson Street WEST PERTH WA 6005
Postal Address	P.O. Box 9031 Nicholson Road SUBIACO WA 6008
Office Phone	08 9486 0777
ABN	25 117 240 007
Website	http://www.opandr.com

1.4 PROPOSAL OVERVIEW

1.4.1 Overall OPR Proposal Components

As indicated above, the Proposal forms the rail component of the overall Oakajee Port and associated infrastructure development proposed by OPR. As such, the Proposal is distinct from the:

- deepwater port at Oakajee previously approved through Statement 469; and
- port related terrestrial landside development that has been referred separately to the EPA for assessment.

Figure 1-2 identifies the limits of the deepwater port, port terrestrial and a rail component of the overall development proposed by OPR.

1.4.2 Investigation Works

There will be some works required in order to continue the investigation phase of Proposal environmental assessment. These works may include the construction of minor temporary accommodation camps, access tracks, drill pads and laydown areas to support the investigations. Approval for the construction of this infrastructure will be sought as part of other applications and therefore does not form part of this Proposal.

1.4.3 Special Act Corridor

This Proposal is a Public Work as defined in Section 2 of the PW Act. The Special Act Corridor will comprise the boundary of the Proposal Area, which is a 4 km wide corridor within the pastoral area, reducing to a 3.2 km wide corridor within the freehold area. The corridor has been narrowed in some areas to avoid sensitive locations such as proposed conservation reserves. It has also been widened for the Weld Range spur to accommodate two main alignment options currently being considered. This corridor will be defined by a Special Act of WA Parliament. Section 96 of the PW Act provides that a railway may only be "made" under the authority of a Special Act.

A Special Act is a short piece of legislation which sets out the designated route of the railway. The Special Act authorises the construction of a railway within a corridor up to 1.6 km either side of the designated route or such further distance as the Special Act provides.

The requirement of a Special Act enables Government oversight of rail network planning. The corridor width provides flexibility to avoid unforseen obstacles identified during ongoing feasibility

work, such as land support issues, aboriginal heritage sites or to avoid environmental factors such as rare flora and fauna.

1.4.4 Proposal Characteristics

The rail formation and associated infrastructure does not directly impinge on any major settlements, townships or communities.

The Proposal documented in this PER comprises the following features:

- approximately 570 km of rail formation and track (including two spur lines), with a typical final disturbance width of 50 – 80 m;
- watercourse/drainage channel crossings including up to nine bridges, multi-barrel culverts for major drainage channels and additional culverts for environmental flows;
- two vehicular bridges, including the North West Coastal Highway (NWCH) Bridge providing grade separation of train and vehicular traffic;
- supporting infrastructure including:
    - up to three large quarries and numerous borrow pits;
    - approximately 200 groundwater production bores;
    - power via generators for construction camps, bores, etc;
    - up to six construction camps, each catering for approximately 200 - 800 personnel at peak occupancy, some portions being retained to accommodate maintenance personnel;
    - vehicle access tracks;
    - laydown areas;
    - mine loops at Jack Hills and Weld Range; and
    - temporary rail welding depot, sleeper plant and ballast stockpiles at a Construction Depot, part of which will be retained as a permanent track maintenance depot; and
- Up to 18 train movements a day (in the western portion of the rail from Oakajee to the Mullewa spur) for a 45 million tonnes per annum (Mtpa) scenario.

OPR will fund and operate (for the lease term) the integrated open access rail network to service the port at Oakajee.

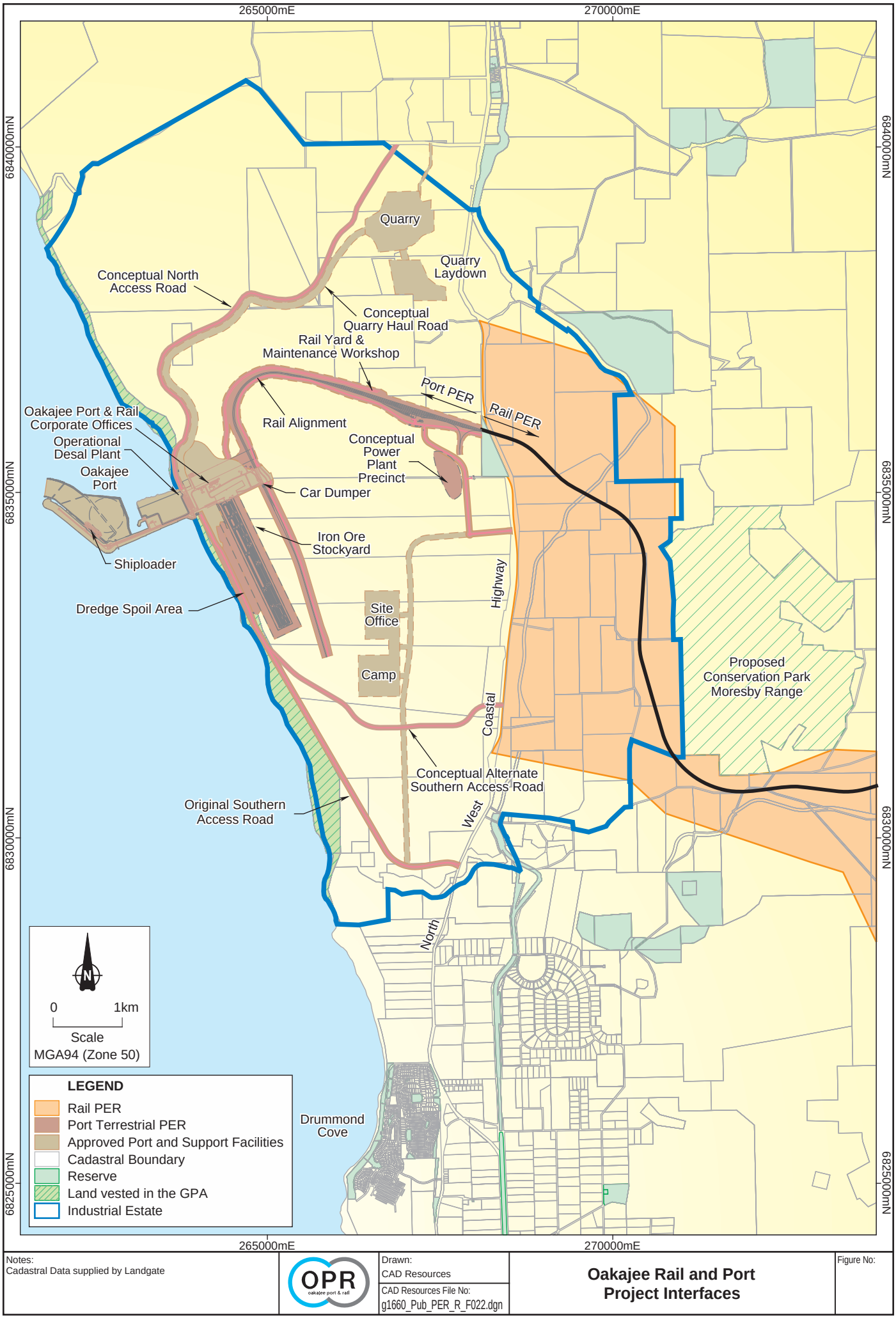


Figure 1-2 Components of the OPR Port and Rail Development

1.5 REGIONAL PROPOSALS CONTEXT

Several projects of regional significance are related to the Proposal. This section provides a summary of each of these projects, including a description and the owners and proponents. With the exception of the OPR Rail Development, none of the listed elements form part of the Proposal. Table 1-2 summarises the various regional elements related to the Proposal.

Table 1-2 Ownership and proponency of major elements of the Oakajee Development

Element	Owner	Proponent	Scope/Comment
OPR Rail Development	WA State Government, via PTA, to lease to OPR.	OPR (refer to Section 1.3)	PER process underway Open access rail facility to service potential Mid-West mines Refer to Section 1.4
Oakajee Deepwater Port	WA State Government initially via Department of State Development (DSD) and ultimately via Geraldton Port Authority (GPA)	Minister for State Development initially, OPR during construction phase, then GPA for operation	PER process complete Approval granted (MS 469) Includes marine common use infrastructure components – dredged channel, breakwater and marine facilities. Refer to Section 1.5.1
Oakajee Deepwater Port Support Facilities (quarry and construction camp)	WA State Government owns the land and will lease to OPR	OPR for design and construction, GPA for operations (quarry for maintenance activities only)	Will undergo a Part V works approval process Includes construction camp facilities (for personnel) and quarry support services (offices, crib rooms, ablutions, explosives magazines etc), laydown area and haulage road from quarry to breakwater Refer to Section 1.5.2
Terrestrial Port Development	WA State Government owns the land and will lease to OPR via GPA	OPR	PER process underway Includes access roads, rail unloading, stockpiles, conveyors and shiploaders Refer to Section 1.5.3
Oakajee Industrial Estate	WA State Government, via LandCorp	LandCorp/facility operators	Individual land users will submit their Proposals for assessment as plans are developed. A buffer zone has been set aside surrounding the estate Refer to Section 1.5.4
Mid-West mining operations	WA State Government owns the land and leases to mining operator via Mining Tenement	Mining operators	Individual mine operators will submit their Proposals for assessment as plans are developed Refer to Section 1.5.5

1.5.1 Oakajee Deepwater Port

The Minister for Resources Development submitted a proposal to construct a deepwater port facility at the Oakajee site in 1997. The proposal included predominantly marine facilities, with the key infrastructure items including a breakwater, harbour basin, berths, approach channel and reclamation area. Onshore construction support facilities were also included in the submission (refer to Section 1.5.2).

The EPA's advice and recommendations to the Minister for the Environment on this proposal were prepared as EPA Bulletin 866 (September 1997). The EPA did not identify any environmental factors where, with appropriate management, the EPA's objective in relation to the factor could not be achieved.

Following the EPA's Section 38 advice, approval was granted subject to conditions, via Statement 469 dated 25 February 1998.

The deepwater port approval is still current, following the approval of a Section 45C process in September 2009 and a Section 46 process in November 2009 (Ministerial Statement 815). DSD remains the proponent for the approved port.

The port will be managed by the GPA.

1.5.2 Oakajee Deepwater Port Support Facilities

The deepwater port requires the following work activities which may commence prior to the finalisation of the Rail Proposal environmental assessment process.

- quarry – rock material for construction of the breakwater; and
- construction camp for personnel.

The locations for the quarry(ies) and construction camp had not been determined at the time of this PER submission.

In relation to a quarry(ies) Section 5.3 of the EPA Bulletin 866 (Sept 1997) states:

> *"The proponent has advised that a Proposal for quarrying rock material for breakwaters and other port infrastructure will be referred to the EPA separately. The Oakajee concept plan indicates that one or more quarries may be required to supply material for the construction of the breakwater. The EPA will assess the environmental impacts of the quarrying operation including transport and rehabilitation, when a Proposal has been received."*

The current proposal is for a quarry to be located within the Oakajee Industrial Estate (OIE) buffer, therefore, having no offsite transport/amenity issues. No vegetation clearing is required for the quarry, however, minimal vegetation clearing (outside Deepwater Port landside areas) will be required for the haul road. OPR is liaising with the proponent for Statement 469 (DSD) regarding quarry approvals.

The construction camp is expected to be located on the cleared plateau within the OIE buffer.

1.5.3 OPR Terrestrial Port Development

The OPR Terrestrial Port Development includes the infrastructure necessary to unload and stockpile ore delivered by rail, as well as the shiploading facilities required for export. The relevant facilities it includes are:

- rail yard and service maintenance workshops;
- rail formation and alignment;
- ore inloading system, consisting of car dumpers, stackers and conveyor circuit;
- ore outloading system, consisting of reclaimers, shiploaders and conveyor circuit;
- ore lump re-screening circuit;
- stockpile facilities, allowing a total storage volume of 6.5 Mt; and
- support infrastructure including administration offices, maintenance workshops, sample stations, waste facilities, desalination plant, access roads, service corridor and fuel storage.

The OPR Terrestrial Port Development is currently the subject of a separate PER process (for which OPR is the proponent) and it is for the infrastructure required to develop and operate a 45 Mtpa iron ore export facility as a first stage.

It is understood that the Government of WA has plans to further develop the Oakajee area as a multi-user, multi-product port when there is a demand for further import and export facilities serving the region and in particular the Oakajee Industrial Estate.

Development beyond OPR's 45 Mtpa iron ore project (the subject of the OPR Terrestrial Port Development PER) will be the subject to future approvals processes and stakeholder consultation.

In some cases infrastructure proposed by the OPR Terrestrial Port Development is situated within the footprint of the Approved Port, for example, the ship loader and the operational desalination plant. In these areas it is only the infrastructure / facility itself that is the subject of the Part IV assessment.

The western boundary of Reserve 16200 (Figure 1-2) forms the demarcation point between the rail that is part of the OPR Terrestrial Port Development and the rail that forms part of the OPR Rail Development (the Proposal). Rail within the port area will be managed by the GPA, with the remainder vested in the PTA and leased to OPR.

1.5.4 Oakajee Industrial Estate

The OIE and a surrounding buffer zone has been acquired in freehold by the State Government as part of it long term strategic planning process. This facility and Proposal installations will be the subject of separate approvals process(es) in the future, to be managed by LandCorp and/or future Proposal proponents.

LandCorp and OPR have been working collaboratively on the port development and OIE interfaces to ensure that the Port Proposal is consistent with the Government's long-term OIE objectives.

1.5.5 Mid-West Mining Operations

The Proposal will provide an integrated rail network linking future mining operations of the Mid-west to the port at Oakajee. It is considered that the foundation customers of the Oakajee port will be the Jack Hills mine operated by CRL, the Weld Range mine operated by Sinosteel Midwest Limited and the Karara mine operated by Gindalbie Metals Limited.

There are several other mining operations in the Mid-West region that could potentially export through Oakajee Port in the future.

Each of the mining operations will be subject to their own Bankable Feasibility Studies and environmental approval processes.

1.6 TIMING

Table 1-3 Proposal key dates

Activity	Timeframe
PROPOSAL APPROVALS	
Submission of Proposal Referral Document	October 2009
Submission of Referral under EPBC Act (Commonwealth)	May 2010
Submission of draft PER document	May 2010
DEWHA Decision on bi-lateral assessment	June 2010
Submission of final PER Document	July 2010
Public review period	July 2010
Response to Public comments	August 2010
Release of EPA Report	December 2010
WA Ministerial Approval	February 2011
Commonwealth Ministerial Approval	March 2011
PROPOSAL IMPLEMENTATION*	
Commence construction	April 2011
Commence operation	Q1 2014

*refer to Section 4.5 for more detail

2 PROPOSAL JUSTIFICATION

2.1 PROPOSAL RATIONALE

The objective of the Proposal is to develop an integrated world-class open access rail network to service the Oakajee Port and the existing and future mines of the Mid-West.

The Proposal will result in financial and social benefits throughout the mid-west region through increases in employment opportunities, infrastructure and flow-on effect to the non-mining sectors.

The Premier of Western Australia (WA), the Honourable Colin Barnett, has made the following statement in relation to the Oakajee Port and Rail Development, of which this Proposal is a vital component:

> *"The development of a deep sea port, associated rail infrastructure and a purpose built, world class industrial estate at Oakajee is the single most important Proposal for WA's economic development over the next 50 years."*
>
> *"This Proposal envisages a major new export port, industrial precinct and heavy freight transport access, near a major regional centre, but well away from residential areas and with significant capacity for future expansion."*

2.2 BENEFITS OF THE PROPOSAL

The Proposal will generate many direct jobs during the construction and development phase, and underpin the growth of the Mid-West iron ore mining sector. Over a 25 year period, it is estimated that expansion of Mid-West iron ore mining will deliver about $7 billion in additional royalties and taxation payments to the State and Federal Governments respectively, and generate some 4,000 direct jobs per year.

Other strategic, community and economic benefits stemming from the Proposal include:

Strategic Benefits

- investment of capital into WA and the Mid-West region;
- coordinated investment in and development and management of integrated mine, rail and port infrastructure;
- underpins development of the regional iron ore sector through certainty of supply to the market;
- improved development and export opportunities across a range of commodities;
- alleviation of potential environmental impacts arising from further development of the existing Geraldton port; and
- strengthened relationships with strategic trading partners in South East Asia.

Community Benefits

- over 1,000 jobs a year during construction;
- over 60 direct employees during operation;
- population increases that will lead to greater investment in community amenities such as schools, housing and health care;
- improved road safety and amenity through reductions in heavy truck road traffic;
- provision of local training opportunities (through public and private technical educational providers);

- opportunities for the indigenous community through the development of agreements addressing indigenous involvement (e.g. employment, training and contracting arrangements); and
- community business development opportunities.

Economic benefits

- a total of at least 12,000 direct and indirect jobs a year in WA expected due to increased economic activity;
- expected increase in household expenditure as a result of population growth expected of $16 million per year;
- flow-on effects to other industries such as construction, materials, transport, retail and recreation; and
- $1.5 billion a year to Gross State Product.

2.3 ALTERNATIVES CONSIDERED

Planning for further development of the Mid-West region has included consideration of various options for enhancing capacity for the movement and export of bulk commodities through Geraldton. Initially, Proposals centred on the expansion of ship loading facilities at the existing Geraldton Port. However, the growth of Geraldton as a regional residential centre around the existing port and associated infrastructure constrains opportunities for future expansion of bulk export facilities at the port. This, combined with difficulties associated with deepening of the existing port to accommodate larger vessels, has led to recognition of the need to develop alternative facilities to service the growing needs of the Mid-West region for additional port capacity. The overall development proposed by Oakajee Port and Rail (OPR) represents a combined Government and private sector commitment to satisfying this need.

Until the OPR's port, port terrestrial and rail developments are operational, most significant outputs from the growing Mid-West iron ore mining sector will continue to be hauled by road to Geraldton for export through the existing port. The attendant inefficiencies, risks and costs have excluded consideration of road transport as an alternative to the Proposal.

2.3.1 Proposal Area Alignment

The proposed alignment of the Proposal Area/Special Act Corridor (SAC) has been the subject of considerable investigation and consultation with key stakeholders. For example, the current SAC alignment has been modified to exclude remnant native vegetation, vegetation reserves and known Declared Rare Flora locations through the Wokatherra Gap. The alignment was also modified in consideration of possible future developments that would see a rail link between Narngulu and Oakajee. Similarly, the route reflects consideration of the proposed location of the Murchison Radio-Astronomy Observatory proposal with the alignment selected to be further south and east than would have been the case without consideration of this alignment. As detailed design proceeds, the planning of the rail centreline will take into account finer details such as the location of residences, heritage sites and specific ground conditions.

These constraints have been balanced against constraints of topography/grade, rock outcrops, fixed entry points into the Oakajee Industrial Estate, alignments for crossing major roads and watercourses. The constraints of topography and grade are the most significant at a macro planning level.

The most significant factors were as follows:

- strategic options (e.g. minimising rail distance between the port and mining operations);
- topography (grade and requirement for cut and fill);
- Murchison Radio-Astronomy Observatory (and associated buffer requirements);
- port and mine interfaces;
- geotechnical conditions;
- conservation estates;
- waterways and areas of inundation;
- conservation significant flora, fauna and vegetation communities; and
- Aboriginal heritage sites.

Following a competitive tender process, OPR and the WA Government signed an exclusive State Development Agreement in March 2009 for the construction of a rail link to the Oakajee Port based on this route that OPR nominated.

2.4 NO DEVELOPMENT OPTION

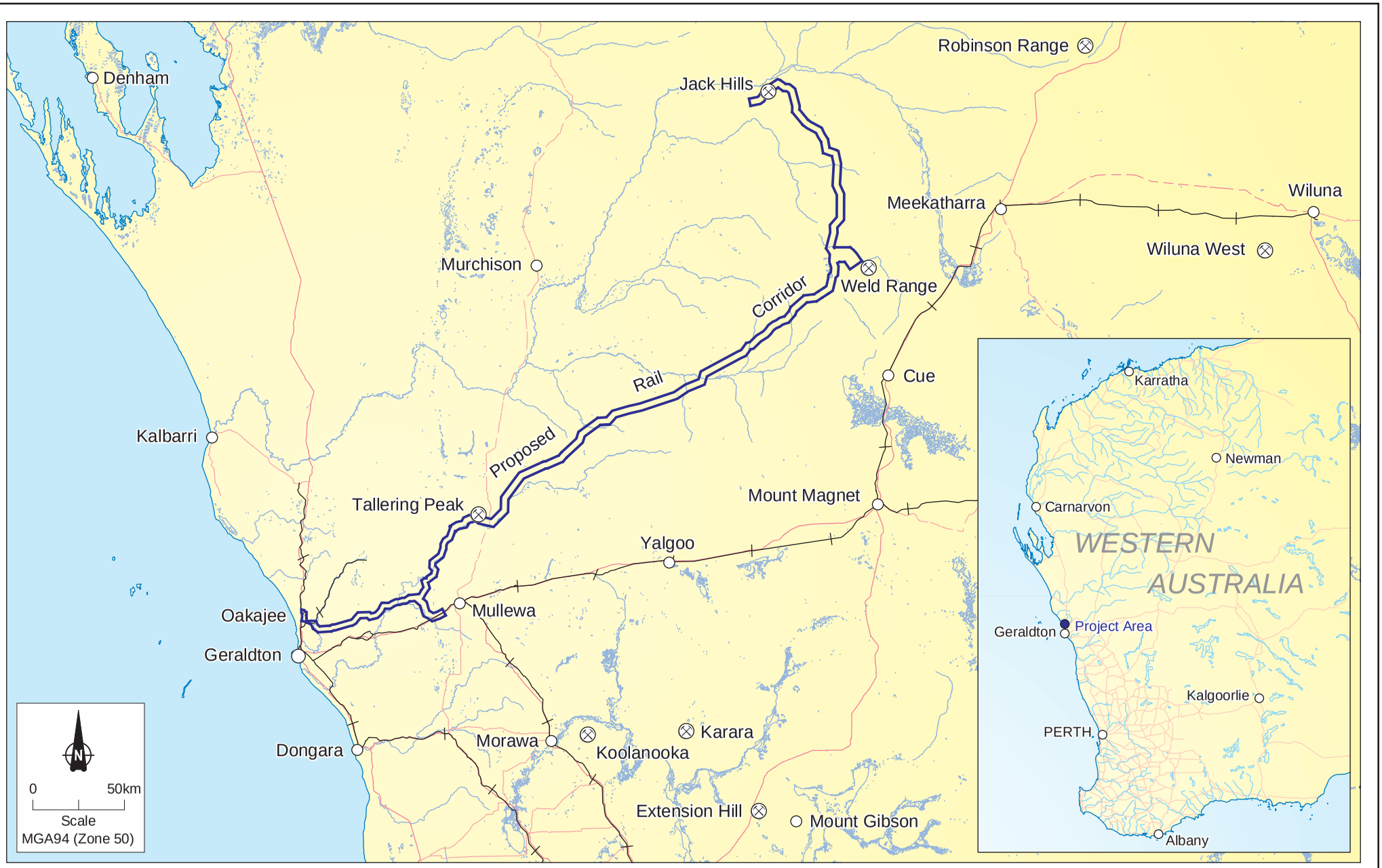
The fundamental implication of not proceeding with the Proposal is that its strategic, community and economic benefits, as outlined in Section 2.2, will not be achieved.

An important consequence of not progressing the Proposal is that the development of transport infrastructure to support Mid-West mining operations will be fragmented and likely to depend on truck movement of ore to either Geraldton or Oakajee for export. For the following reasons, this outcome is considered likely to produce greater long-term environmental, road safety and economic impacts than the rail option:

- inefficiency and ongoing costs of road for bulk good movements in the region;
- high frequency of large road trains will impact on other road users, with a greater risk of accident and injury, and increased road maintenance requirements; and
- greater fuel consumption, spillage and emission profile of road transport.

A “no development option” would result in either; the stranding of Mid-West mines (including Weld Range, Jack Hills and Karara) export products from the market place and/or more trucks on Mid-West roads to either the Geraldton and/or Oakajee Ports. The latter transport option would likely result in the delivery of lesser tonnages to port than the mines are now contemplating and consequent inefficiencies in resource development. This option is likely to severely impact the economic viability of the mining projects.

Figure 2-1 Proposal Area



	OPR oakajee port & rail	Drawn: CAD Resources CAD Resources File No: g1660_Pub_PER_R_F001.dgn	**Location of Proposed Rail Alignment**

Figure No:

3 PROPOSAL APPROVALS

3.1 STATE STATUTORY ENVIRONMENTAL IMPACT ASSESSMENT

As outlined in Section 1.1, the Proposal was referred to the Environmental Protection Authority (EPA) in October 2009. On the 9th November 2009 the EPA advertised that the Proposal would be the subject of a Public Environmental Review (PER) level of assessment, including a four week public review period. No appeals were made against the EPA's decision regarding assessment of the Proposal.

OPR submitted a draft Environmental Scoping Document (ESD) in February 2010 which detailed the potential environmental issues raised by the Proposal and planned environmental studies. The ESD included a preliminary assessment of the potential environmental impacts, and the preliminary management strategies proposed. The EPA approved the ESD, subject to several minor amendments, in July 2010.

This PER document has addressed all the environmental factors and studies identified in the approved ESD, the PER has been released for a public review period of four weeks, during which time the public may make submissions to the EPA regarding the Proposal.

At the completion of the four week public review period, the EPA will provide copies of the submissions to OPR, who is required to prepare a summary of the key issues and matters raised and provide responses that are to the satisfaction of the EPA.

The EPA will assess the Proposal taking into account the PER document, submissions, OPR's responses and external advice, and will develop and submit a report to the Minister for the Environment. The report will address the relevant environmental factors and conditions to which the implementation of the Proposal should be subject.

The Minister for the Environment will then publish and circulate the report. In accordance with Section 100(2) of the *Environmental Protection Act 1986* (EP Act), any person may lodge an appeal with the Minister for the Environment against the content and/or recommendations of the EPA assessment report within 14 days of publication.

Figure 3-1 provides an overview of the formal State and Commonwealth Environmental Impact Assessment (EIA) processes, pursuant to the EP Act and EPBC Act.

3.2 COMMONWEALTH STATUTORY ENVIRONMENT IMPACT ASSESSMENT

Under the EPBC Act a project or proposal (referred to as an 'action') will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of NES.

A significant impact is one that has a notable consequence on the matter of NES. Whether or not an action is likely to have a significant impact depends upon the context, intensity, duration and geographic extent of the action, as well as the sensitivity, value and quality of the environment which is to be impacted.

DEWHA determined that the Proposal can be accessed through the State assessment process, which is accredited under the bilateral agreement between the State and Federal governments. Under the bilateral agreement, this PER and an assessment report from the State process will provide the basis for review of potential impact on matters of National Environmental Significance (NES) and approval, if appropriate, by the Federal Environment Minister.

DEWHA has advised that the relevant matters of NES are:

- Slender-billed Thornbill (*Acanthiza iredalei iredalei*);
- Western Spiny-tailed Skink (*Egernia stokesii badia*);
- Malleefowl (*Leipoa ocellata*);
- Hoffman's Spider Orchid (*Caladenia hoffmanii*);
- Howtharra Mallee (*Eucalyptus blaxelii*); and
- Moresby Range Drummondita (*Drummondita ericoides*).

An ESD that described the proposed scope of investigations and content of the PER, including reference to matters of NES, was reviewed and commented on by DEWHA. This PER has been prepared in accordance with the ESD.

The Proposal's effects on these species have been addressed (refer to Section 8) and it is considered unlikely to have a significant impact. Nevertheless, to enable DEWHA to assess the potential impacts of the Proposal on the EPBC Act listed species, the PER has been developed with the objective of satisfying Australian Government EIA requirements through an accredited State assessment process undertaken pursuant to the bilateral agreement on EIA between the Australian and State Governments.

The Commonwealth Statutory EIA process will only be completed upon completion of the State Statutory EIA.

Figure 3-1 provides an overview of the EIA process pursuant to the EP Act and EPBC Act under the bilateral agreement.

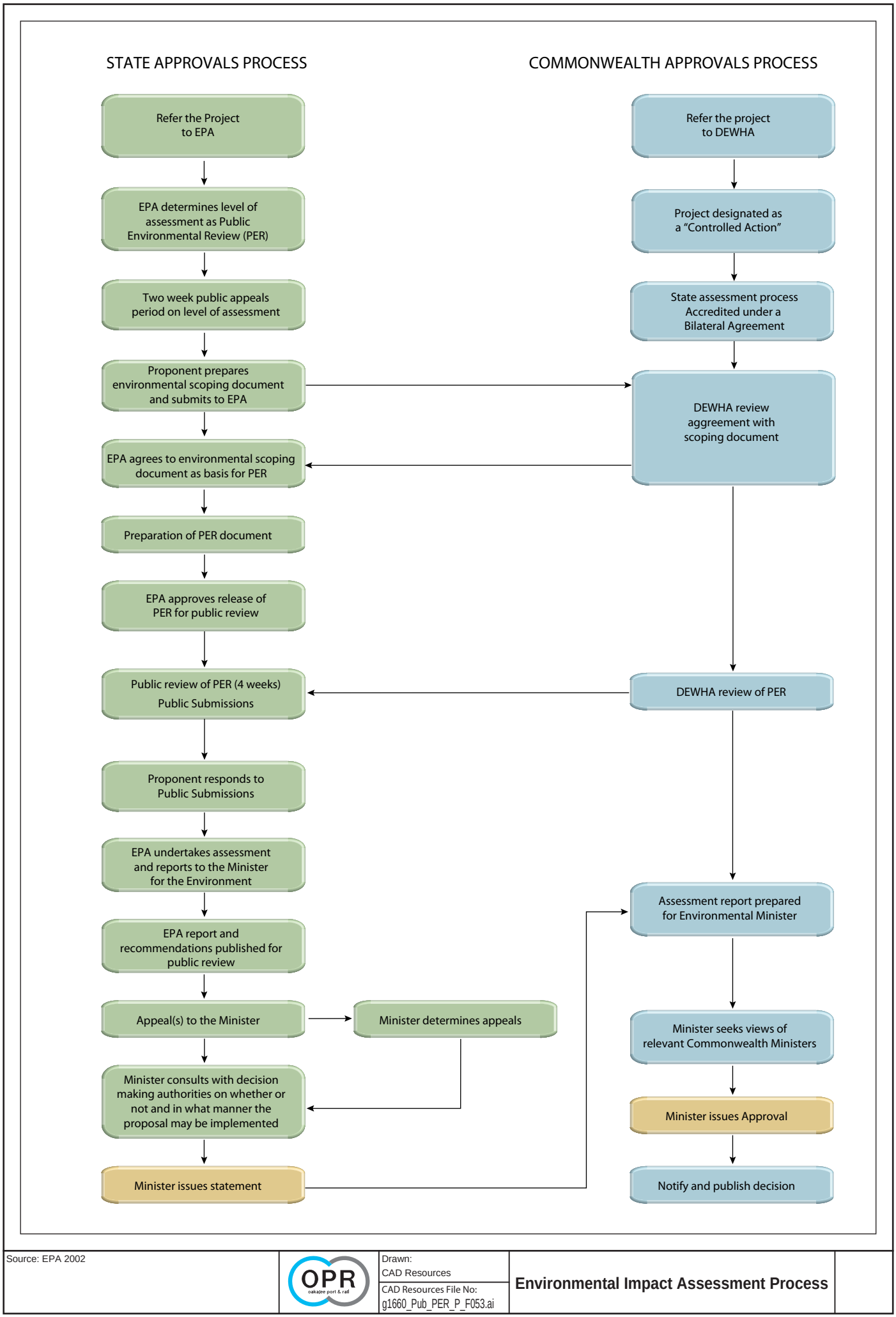


Figure 3-1 EP Act and EPBC Act assessment and approval process

4 PROPOSAL DESCRIPTION

4.1 DEFINITION OF THE PROPOSAL

Figure 4-1 and Figure 4-2 provide a simplified outline of the Proposal while Figure 4-3 and Figure 4-4 present the Proposal in greater detail.

In conjunction with Figure 4-2, Table 4-1 describes the Proposal's key characteristics which will form an appendix to the Ministerial Statement issued for the Proposal.

Table 4-1 Proposal key characteristics

Non-spatial elements	Description	
Proposal Life	In excess of 50 years	
Throughput	45 Mtpa of iron ore	
Train Operations	Diesel electric locomotives, up to 200 wagons (approximately 2 km in length) with a carrying capacity of approximately 20,000 tonnes. Approximately 18 train movements per day (9 each way).	
Operating hours	24 hours/day, 365 days/year	
Accommodation	Construction: 6 camps capable of holding up to 3000 personnel in total Operation: Up to 2 camps holding up to 80 personnel in total	
Construction timeframe	Approximately 36 months	
Groundwater requirements	Construction: approximately 3.5 GL (total over 36 months), Operation: approximately 140 ML per year	
Spatial elements	**Description**	**Approximate footprint**
Rail Corridor	Includes approximately 570 km of rail line including a 10 – 15 km spur, 20 km spur line near Mullewa , access roads, rail crossings, rail loops, rail sidings optic fibre cable, water pipeline, approximately nine bridges. Final operating disturbance width of 50 – 80 m	4500 ha
Construction activities	Including borrow pits, ballast quarries, turkey's nests, associated access roads	1450 ha
Supporting facilities	Including accommodation camps, lay down areas, communication towers, water supply (up to 50 km from the Special Act Corridor), workshops, associated access roads	1050 ha
Total area of native vegetation clearing	Maximum of 100 ha of native vegetation clearing within the freehold area	100 ha
	Approximately 5900 ha of native vegetation clearing within the pastoral area	5900 ha
Total area of disturbance	Of which approximately 6000 ha is native vegetation	7000 ha

4.2 LOCATION

Oakajee Port and Rail proposes to construct a multi-user rail facility linking the Oakajee Port and the expanding iron ore mining operations within the Mid-West, Murchison and Gascoyne regions of Western Australia (WA). Oakajee is approximately 24 kilometres (km) north of Geraldton, while the iron ore deposits which will be exported through the port are located several hundred kilometres to the north-east and south-east of Geraldton.

The rail infrastructure subject of this Public Environmental Review (PER) (Figure 4-2) commences at the western boundary of Reserve 16200 (traversed by the North West Coastal Highway (NWCH)), and extends approximately 530 km in a north easterly direction from Oakajee to the mining operations at Jack Hills. The Proposal includes a spur line to the Weld Range (approximately 10-15 km in length), and the Mullewa spur (approximately 20 km in length).

Areas of regulatory consideration within the Proposal Area include:

- the buffer for the Murchison Radio-astronomy Observatory on the Boolardy pastoral lease;
- the Dampier to Bunbury Gas Pipeline corridor; and
- land subject to several tenements, including those granted under the *Iron and Steel (Mid West) Agreement Act 1997* near Tallering Peak.

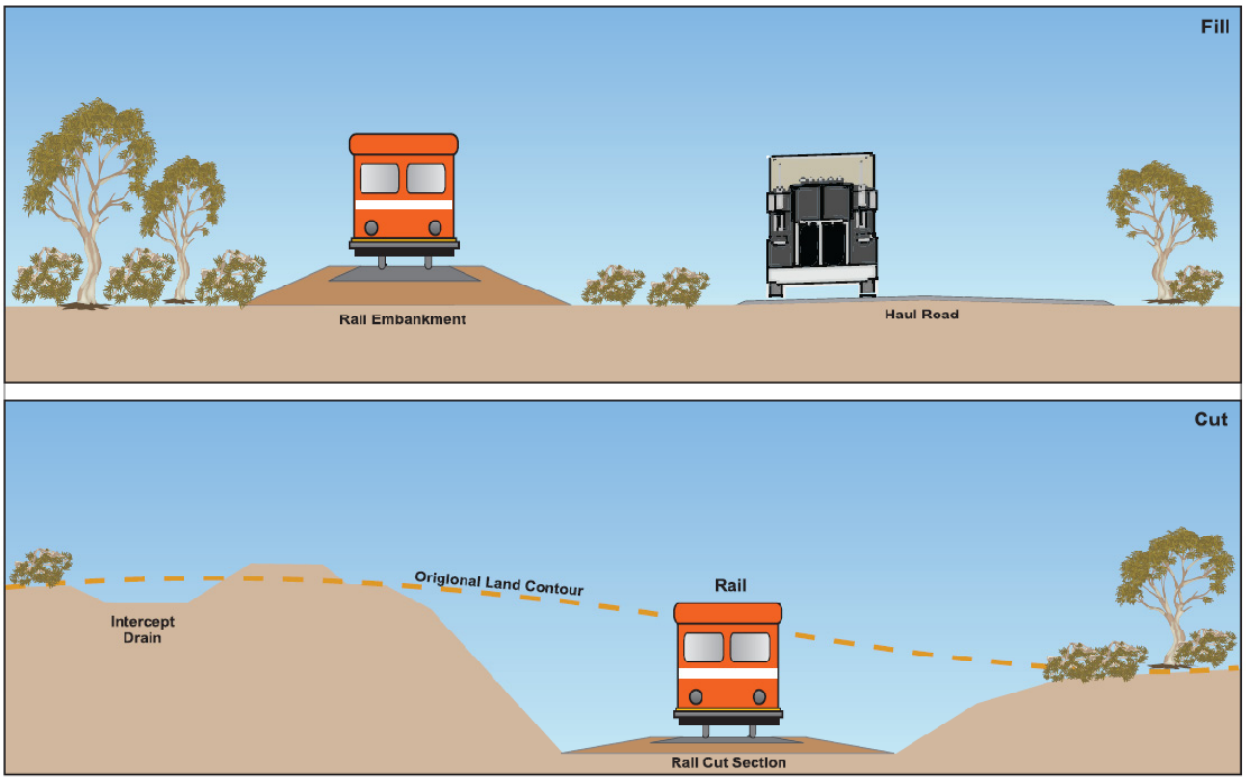
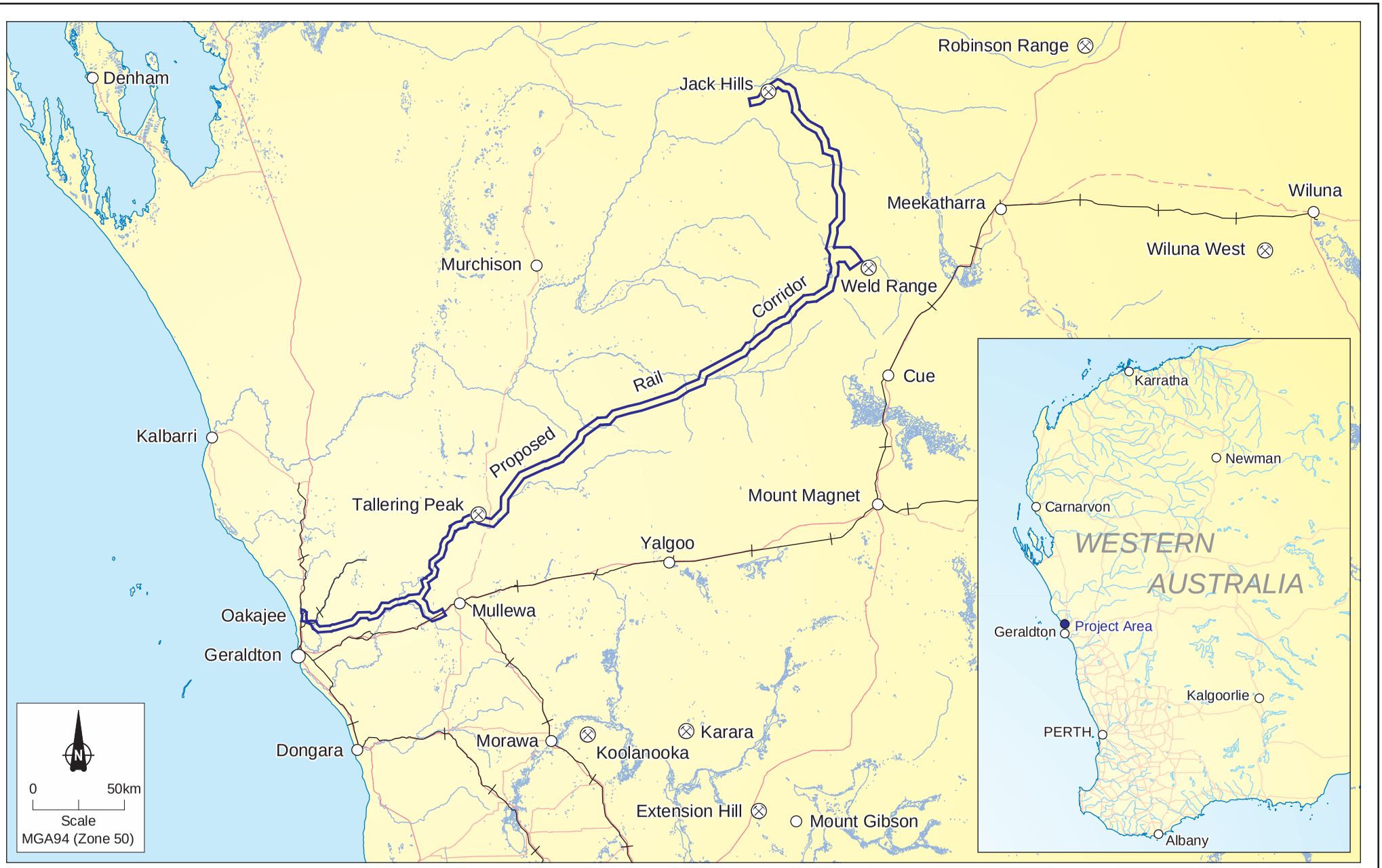
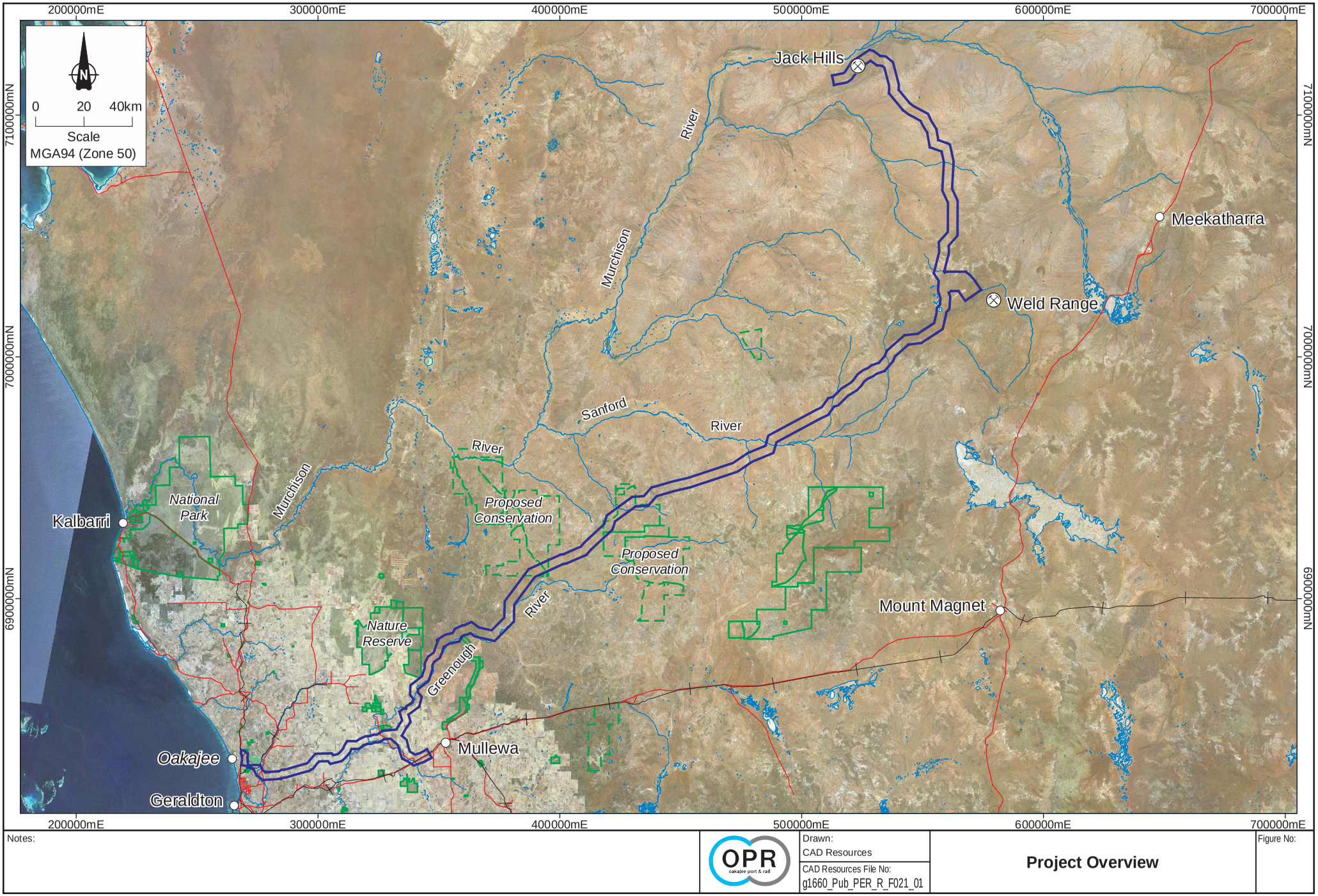


Figure 4-1 Indicative fill and cut cross sections of the Rail Corridor

Figure 4-2 Overview of Proposal Area



	Drawn: CAD Resources	**Location of Proposed Rail Alignment**	Figure No:
	CAD Resources File No: g1660_Pub_PER_R_F001.dgn		



Notes:

OPR oakajee port & rail

Drawn: CAD Resources

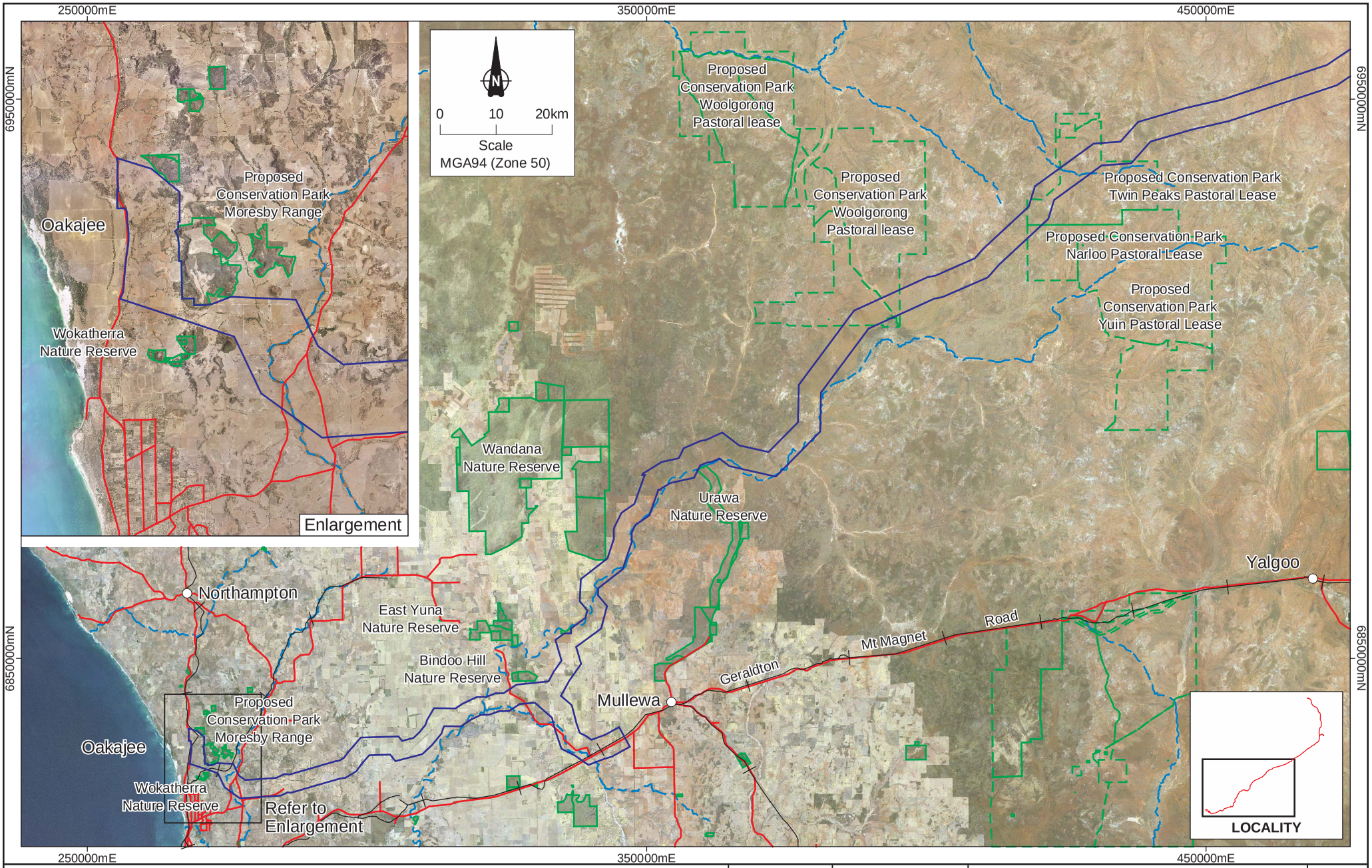
CAD Resources File No: g1660_Pub_PER_R_F021_01

Project Overview

Figure No:

Figure 4-3 General arrangement plan of the Proposal (1 of 2)

Figure 4-4 General arrangement plan of the Proposal area (2 of 2)



Notes:
DEC Estates data supplied by Department of Environment and Conservation

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_P_F021_02

Project Overview
Freehold / Pastoral Interface

Figure No:

4.3 LAND TENURE

The Proposal Area traverses the following seven local Government areas, the City of Geraldton/Greenough, and the Shires of Chapman Valley, Mullewa, Murchison, Yalgoo, Cue and Meekatharra (Figure 4-5).

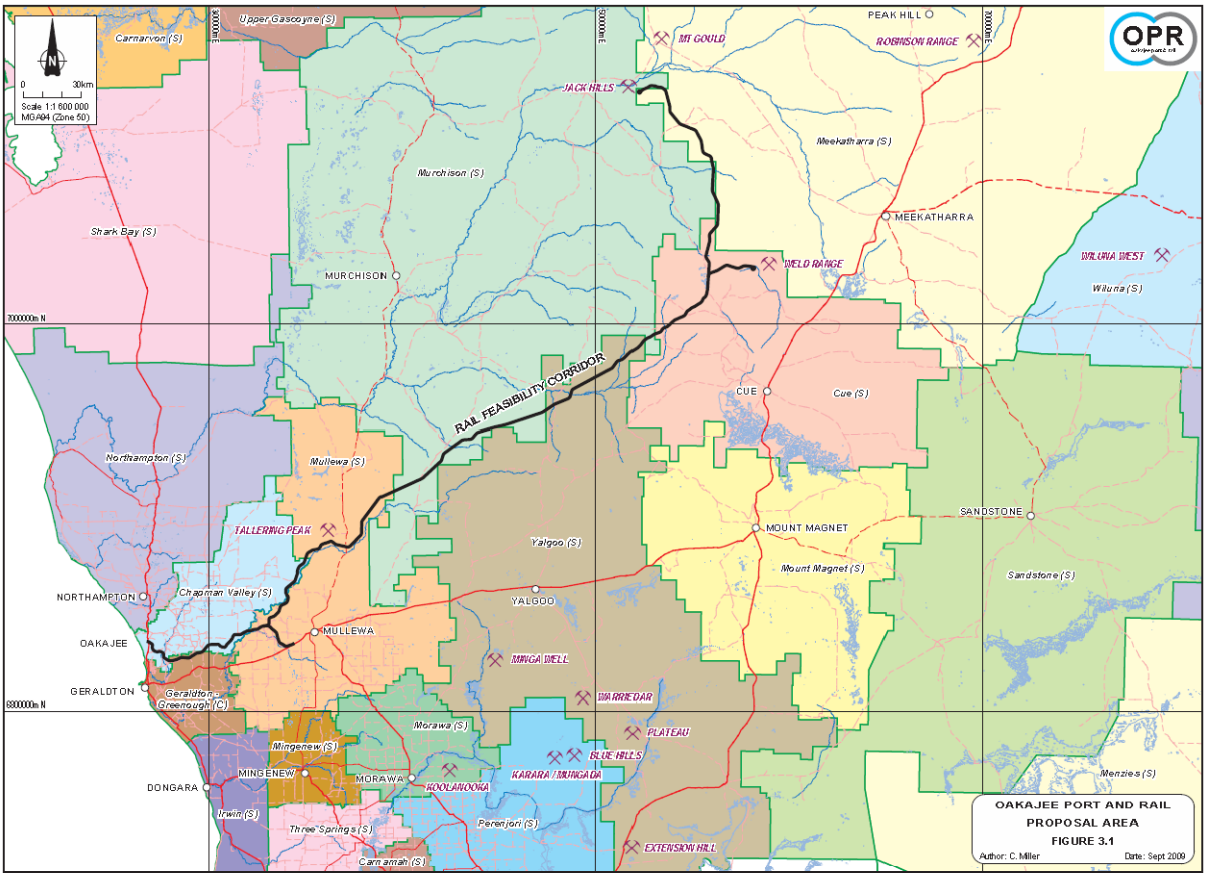


Figure 4-5 Local Government Areas

Approximately 25% of the Proposal Area comprises rural freehold land, which has been largely cleared for agriculture, and the remainder is predominantly pastoral land, which is dominated by grazing and mining activities.

The primary stakeholders potentially impacted by the Proposal are 249 land parcels held by 79 freehold parties and 17 pastoral leases.

Land use and zoning varies within the Proposal Area. In the north eastern portion, the Rail Corridor traverses a mixture of exploration and mining tenements and pastoral land. As the corridor extends south, land use progresses from predominately cattle or sheep pastoral stations, to broad scale cropping, to more intense horticultural and orchard areas and lifestyle lots (hobby farms) adjacent to the coast.

4.4 PROPOSAL COMPONENTS

The principal components of the Proposal are summarised in Table 4-1, and are further discussed in Sections 4.4.1 to 4.4.7.

4.4.1 Trains

The Proposal entails the use of trains of up to 2.2 km in length, comprising up to approximately 200 wagons with two standard gauge locomotives. The locomotives will be diesel electric units.

It is anticipated that approximately 20,000 tonnes will be carried per fully-laden train.

The maximum train speed for (locomotives hauling wagons) is anticipated to be 80 km/hr, with 100 km/hr possible for locomotives without any wagons. Grade restrictions for a loaded train are 0.36% (1 in 275).

Train movement frequency will depend on the tonnage output from each mine, and will vary depending on location. In defining the Proposal, train movements have been estimated at up to 18 train movements (nine return trips) per day. Lower train movements will occur in the eastern sections of the Proposal.

A potential rail route to the southern mines including Koolanooka, Karara and Extension Hill could connect to the proposed alignment but is not included in the scope of the Proposal and is therefore not addressed in the PER.

The railway as proposed is capable of servicing between 80 and 100 million tonnes per annum. To assist in accommodating this tonnage, the track has been designed to allow for larger trains and potentially increased wagon axle loading. These tonnage rates are in excess of what is currently proposed by OPR and therefore does not form part of this PER.

4.4.2 Rail Formation and Track

The Proposal includes the development of up to approximately 570 km of rail formation, track (including rail embankments and cuttings) and associated infrastructure.

The rail formation comprises the following:

- approximately 530 km mainline from OIE to Jack Hills Mine including mine loop;
- at approximately 410 km from the port; a 10 to 15 km link to the Weld Range iron ore deposit including mine loop (known as the Weld Range Spur); and
- at approximately 90 km from the port; a 20 km link to the existing WestNet rail to Mullewa (known as the Mullewa Spur).

The overall Proposal Area alignment is shown on Figure 4-2, while cross sections of the typical rail formation are shown on Figure 4-1.

The key aspects of the rail formation and track are summarised below:

- the earthworks for the railway will require balancing cut to fill along the rail route where feasible, to minimise the creation of spoil or the need to import fill. Rail embankment construction material will be sourced from borrow pits and rail cuttings as summarised in Section 4.4.3. The sub-ballast capping will require superior earthwork materials sourced from selected borrow pits;
- the majority of the rail line will require earthworks less than 2 metres (m) deep;
- the average height of the railway embankment for the fill section is approximately 1.8 m;

- in the cut section of the railway the average depth to the top of the rail is approximately 2.3 m;
- typical widths will also vary, particularly where additional area is required for sidings, stockpile of material and laydown areas;
- the haul road / permanent rail maintenance access road will generally run adjacent to and parallel to the rail formation. A fibre optic cable corridor and water pipeline will run parallel to the railway line at the edge of the Rail Corridor;
- signalling structures and road crossings will be provided where necessary. Signals will be powered by solar energy;
- concrete railway sleepers are expected to be manufactured at existing WA sleeper plants and/or at a new sleeper factory to be established on site; and
- rail will be shipped into Geraldton in individual lengths and then trucked to the two rail welding depots. Rail will then be welded together for stringing into the track. The sleepers will be hauled by work trains along sections of the completed rail to the track construction front.

4.4.3 Rail Construction Materials

The earthworks for the railway will require balancing cut to fill along the rail route where practical, to minimise the creation of spoil or the need to import fill. Where there is a shortfall of fill material from cuttings, borrow pits will be used to supply material. Total fill requirements are approximately 11 million cubic metres (m^3), with cut material providing up to 4 million m^3, although not all cut material will be suitable. Borrow areas will therefore be required to supply approximately 7 million m^3.

4.4.3.1 Borrow Areas

Approximately 11 million m^3 of construction material is required for the rail embankments. It is expected that over half of this material will be sourced from borrow areas situated along the Rail Corridor (with the exception of areas constrained by environmental or heritage values). The number and size of pits developed within each borrow area will vary depending on the volume of borrow material required for each section of the railway formation.

The exact locations of the borrow pits within the larger Proposal Area are subject to ground-truthing and further geotechnical investigations. Again, until the further studies have been completed, the specific biophysical impacts of the pits cannot be quantified. Nevertheless, OPR have committed to several environmental constraints to be applied when selecting borrow pit areas, and management measures to ensure that the borrow areas are adequately managed and rehabilitated. These constraints are discussed in detail in Section 7.

Some borrow pits will need to be retained along the rail formation to meet ongoing maintenance requirements. The retained sites will be at intervals of approximately 20 km or will be high quality/high yield borrow pits in the vicinity of rail formation sections that contain substantial embankments.

4.4.3.2 Ballast Quarries

Rail ballast will sourced from a minimum of two (most likely three) quarries. Rock will be quarried, crushed and screened at each of the sites to produce ballast of the required specification, and will be transported by road to the rail formation. OPR is also investigating alternative sources of material

suitable for the production of ballast to the specification required, including waste rock from mining operations near Cue.

The exact location of the quarry areas is the subject of further geotechnical investigations, however it is possible that some or all of the three quarries will fall outside of the SAC. These areas and potential groundwater supply areas represent the only locations where the Proposal Area extends outside of the boundaries of the SAC.

Potential locations of those quarries located outside the SAC are shown in Appendix 10, however it should be noted that not all of these locations will be used (a maximum of three). The areas shown in Appendix 10 are a boundary within which a quarry(ies) and all access tracks may be located, i.e. only a small portion of the areas shown will be cleared (approximate total of 150 hectares (ha), approximately 50 ha per quarry).

Potential quarry locations will be subject to flora and fauna surveys prior to disturbance to ensure environmental impacts do not exceed that which is approved.

The ballast quarries will either be new operations (developed by OPR), or private licensed operations.

Based on Proposal requirements, it is anticipated that output from the quarries will be approximately 1.5 million tonnes of ballast during the Proposal construction phase, resulting in a disturbance footprint (including access to the respective sites) of about 50 ha per quarry (i.e. a total disturbance footprint of approximately 150 ha will result from establishment of three quarries if all three quarries are developed).

Additional rock requirements (separate to ballast) will be sourced from railway cutting materials (refer to Section 4.4.2) and borrow areas (refer to Section 4.4.3).

Quarrying contracts will include provision of surplus ballast for rail maintenance but depending on the quantities of viable hard rock remaining on completion of construction, one or both of the ballast quarries will need to be retained to meet ongoing maintenance ballast requirements.

4.4.4 Drainage Structures

The Study Area contains both episodic creeks and rivers and sheetflow zones. There is the potential for flooding across much of the Study Area which is usually the result of tropical cyclone activity.

DoW uses guiding principles to ensure that proposed development in flood prone areas is acceptable with regards to major flooding. The proposed development is required to have adequate protection from 100 year Average Recurrence Interval (ARI) flooding, and it also must not detrimentally impact on the existing 100 year ARI flooding regime of the general area. These principles have been incorporated into the design of the rail, bridges, culverts and associated infrastructure.

4.4.4.1 Bridges

As the Rail Corridor traverses various watercourses and waterways, the Proposal will necessitate construction of a number of bridges. Preliminary assessments indicate that up to nine bridges will be required (Figure 4-7). Bridge locations have been chosen to minimise the hydraulic impact of the bridge and the associated earthworks. Typical bridge design is illustrated on Figure 4-6. Table 4-2 summarises current anticipated bridge structures and locations. Additional bridges may be required pending final engineering design.

Table 4-2 Potential bridge requirements

Crossing Name	Minimum Structure	Foundation Type
Chapman River	70 m Bridge	Spread footings / Piled
Chapman River East 1	60 m Bridge	Piled
Chapman River East 2	60 m Bridge	Spread footings / Piled
Greenough River 1	105 m Bridge	Spread footings / Piled
Greenough River 2	105 m Bridge	Piled
Bangemall Creek	60 m Bridge	Spread footings
Sanford River South	100 m Bridge	Piled
Sanford River North	100 m Bridge	Piled
Ilkabiddy Creek	60 m Bridge	Piled

The bridges will be designed for a 100 year ARI flood and a 2000 year ARI design flood without structural damage.

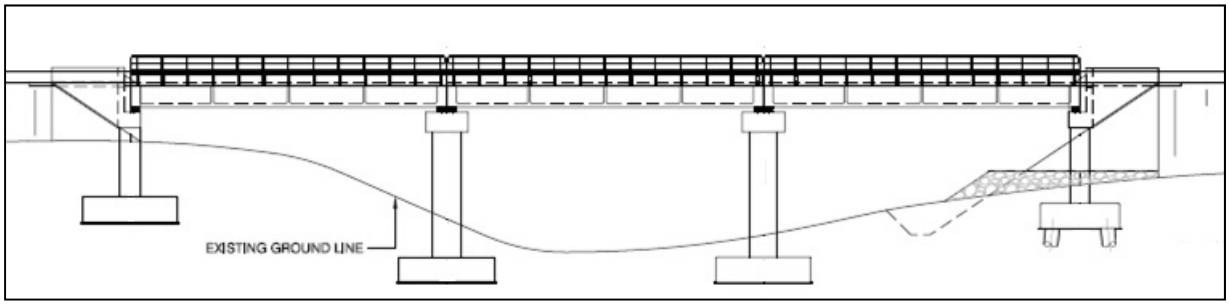


Figure 4-6 Typical bridge design

Two vehicular bridges will be constructed to separate road and rail traffic. These bridges will be located at the current NWCH and near the intersection of Chapman Valley and Morrell Road. These bridges are discussed further in Section 4.4.5.

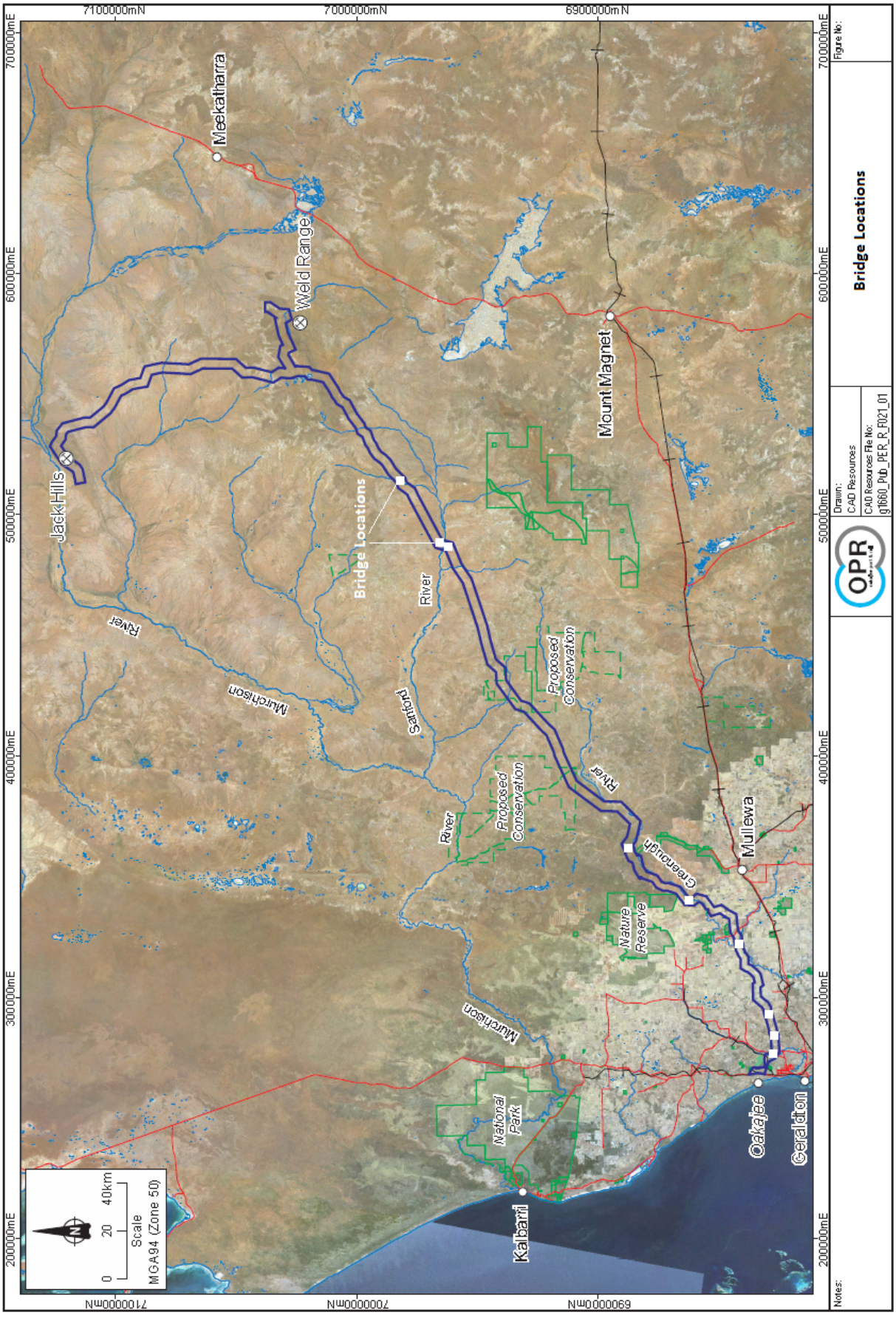


Figure 4-7 Potential bridge locations

4.4.4.2 Culverts

The Proposal will require culverts at all significant drainage crossings that do not require a bridge structure (over 1000 in total). All culverts will be designed for 100 year ARI design flow capacity, with the rail alignment not to be overtopped below a 100 year ARI flow event.

A combination of corrugated steel pipes and reinforced box culverts will be used. Engineering culverts will be a minimum of 900 millimetre (mm) diameter. Where the potential for erosion is high, appropriate infrastructure for erosion control, such as gabions, rip rap rock protection or reno mattresses will be installed. A typical cross section of the culverts to be installed along the rail is illustrated in Figure 4-8.

In addition to culverts at defined water courses, a significant number of 'environmental' culverts are proposed to allow sheetflow of water that may otherwise be interrupted by the railway formation. These will be typically 600 mm in diameter and installed at regular intervals along the length of the railway to maintain these drainage flows and minimise drainage shadow effects.

In addition to their drainage function, these 'environmental' culverts may also function as small fauna underpass points (refer to Section 7.3).

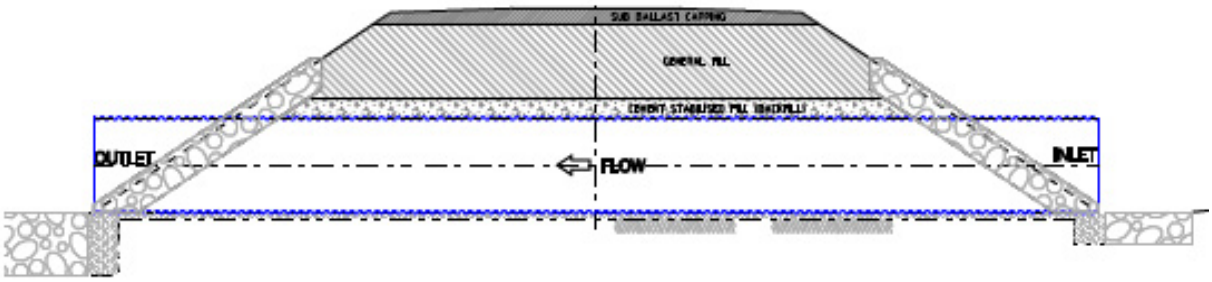


Figure 4-8 Cross section of a culvert

4.4.4.3 Road drainage

It is proposed drainage across roads will be maintained by allowing the road to follow the natural contours of the landscape, and it will resemble a typical floodway in most instances.

4.4.5 Vehicular Bridges

The current alignment of the NWCH traverses Reserve 16200. OPR proposes to realign the highway within the designated Road Reserve so that it skirts the eastern boundary of Reserve 16200. Road traffic on the NWCH will be grade separated from the rail traffic, with a two lane (one in each direction) vehicular bridge to be constructed over the rail formation.

A similar vehicular bridge will be constructed where the Proposal intersects with Chapman Valley Road.

4.4.6 Supporting Infrastructure

4.4.6.1 Engineering Facilities

Construction

The following engineering facilities will be required for construction:

- Rail welding depots – one of these depots will be located close to the construction depot, and if another is required it is expected to be located near the midpoint of the rail alignment;
- a new sleeper factory may be established at the construction depot, or sleepers will be transported from existing factories;
- sleeper and ballast stockpile areas will be created at suitable locations;
- a track construction depot; and
- construction offices.

These facilities will be located within the Proposal Area and will be sited in accordance with environmental and heritage criteria set in Section 7. The sleeper construction plant will be required to comply with the Environmental Protection (Concrete Batching and Cement Product Manufacturing) Regulations 1998. These regulations will ensure that potential environmental impacts associated with this facility are appropriately managed.

Operation

The following engineering facilities will be required for operations:

- a track maintenance depot – including a workshop, ablutions facilities, crib room, hardstand areas and small dangerous goods facilities;
- rolling stock maintenance workshop and rail yard – sized to accommodate the required fleet; and
- a shed at the rail loop for minor servicing of trains.

These facilities are expected to be located on land previously cleared for construction.

4.4.6.2 Construction and Maintenance Camps

It is anticipated that the Proposal will involve the construction of up to six temporary construction camps along the rail alignment. These will mostly be within the SAC, within close proximity to existing shire roads and will be sized to accommodate a total of 3000 personnel across all camps at peak occupancy.

The specific camp locations will be confirmed through further field investigations during the contract stage. Environmental and heritage constraints will apply to the selection of the camp locations.

Each construction camp will be subject to Local Government approvals and comprise the following infrastructure:

- sewage treatment plant (subject to Part V approvals under the EP Act if throughput exceeds 20 m^3/day);
- single person accommodation units with private ensuite facilities;
- communication facilities;
- recreational facilities;
- mess rooms;

- containerised diesel generator;
- fuel storage area (subject to Dangerous Goods licence);
- waste storage area;
- water supply system and water tanks;
- laundry facilities;
- first aid room; and
- office facilities.

All camp landscaping will use local flora and vegetation species.

Upon completion of rail construction, one or two of the camps will be partially retained for maintenance purposes during operation as required.

4.4.6.3 Access Roads

A permanent rail maintenance access track will be constructed adjacent to the rail. This maintenance track will initially be developed as a haul road corridor approximately 20 m wide, suitable for bulk haulage of earthworks materials and for general construction traffic. Upon completion of the rail construction work, the haul road will be upgraded to form a 10 m wide road and associated shoulders and embankments. The final width of this road corridor will be within the initial 20 m disturbance width. To reduce the permanent impact footprint, separation between the road and rail formation will be minimised consistent with safety and operational requirements (e.g. to ensure suitable visibility and accommodate rail and river crossings).

Other temporary roads and tracks will be established to provide access to camp sites, borrow pits, construction water facilities, laydown areas and other temporary infrastructure facilities. All such roads and tracks not required for rail operation will be decommissioned and rehabilitated on completion of construction.

4.4.6.4 Laydown Areas

Laydown areas will be established along the Rail Corridor at strategic locations (bridge sites, passing loops etc) for the storage of construction materials such as ballast, sleepers and culvert pipes. Areas not required to be retained for operational purposes will be rehabilitated following the completion of construction.

Additional laydown areas may be required to accommodate the construction and operation of site offices and workshops.

4.4.6.5 Power and Fuel

Fuel will be stored in accordance with Dangerous Goods Licences and Australian Standard AS1940 - *The storage and handling of flammable and combustible liquids.*

Rail Construction

Power for rail construction will be provided by a series of diesel fired generators located where required. Total estimated diesel fuel consumption for the construction phase of the Proposal is approximately 48 million litres (ML), based on engineering modelling of proposed activities. This will include requirements for the construction camps, vehicles, earthmoving equipment and generators over the estimated 36 month construction period.

Rail Operation

OPR anticipates purchasing Tier 2 emission level locomotives, as these meet more stringent emission standards than the Tier 1 locomotives currently required under Australian regulations. These locomotives emit lower NOx and SOx emissions and are more fuel efficient. Modelling undertaken to date indicates that the fuel efficiency will be approximately one litre per tonne of ore from Jack Hills, which is comparable to fuel efficiency levels on Pilbara train operations, which also operate under more stringent emissions standards. Further modelling will be undertaken prior to operation to increase the accuracy of preliminary estimations.

Accommodation Camps

The construction and permanent (maintenance) camps will not be located in close proximity to existing power supplies. Power requirements will be met by containerised diesel generators at each camp site.

Based on an average occupancy of 200 - 800 personnel per camp for six camps over a period of around 36 months, the total fuel consumption at the construction camp sites will be around 4 ML of diesel fuel, using one containerised diesel generator at each site.

4.4.6.6 Water Supply

Establishment of a secure, short-term water supply is essential for the construction of the Proposal. Water supplies will be required to service the entire length of the Proposal for compaction of fill material and dust suppression along the access road. In addition, high quality water supplies will be required for concrete batching and for each of the construction camps that will be established. The following water supply characteristics will apply to the Proposal:

- Water quality along the Study Area is generally brackish. The quality of groundwater is highly variable throughout the area and increased salinity is observed towards drainage lines. All water quality parameters for groundwater sampled were within the ANZECC (2000) Livestock Watering Guidelines, except for one monitoring bore (102_MB1). It is considered that this water quality will be appropriate for construction activities. Water for construction camps will be treated to meet the required quality levels for potable water.
- The Proposal includes a water supply pipeline that will run the length of the Rail Corridor. This pipeline will allow a continual water supply to all areas of construction, including those areas where groundwater supplies are limited. This water will be pumped to turkeys nests, which will be located at regular intervals along the Rail Corridor
- It is anticipated that up to 200 bores will be drilled, developed and operated to meet Proposal construction water requirements. It is expected that some bores and turkeys nests will be retained for use during maintenance operations
- Due to the potential for high costs and risks associated with developing isolated water supply points along the Proposal Area, future rail construction water supply investigations will also investigate areas with greater supply potential located up to 50 km away from the Proposal Area, such as concentrating on potential groundwater resources located approximately 300 km inland from the coast. Access to these groundwater sources will form part of the Proposal.
- OPR may also investigate potential water supply sources in the areas around 150 km inland from the coast. OPR are initiating discussions with existing users in this area, such as Mt Gibson Iron, regarding potential 'excess' water available from their operations (such as dewatering). There also remains the potential to equip existing bores, such as the

Kingstream bores (which are located outside the Proposal Area), however further investigations into sustainable yield of these bores would be required.

- There is the potential to use water sourced from the desalination plant at the Oakajee Port for the western sections of the Proposal. The desalination plant does not form part of this PER.
- Earthworks will account for the bulk of water demand, with most of the water used for conditioning of fill materials, maintenance of haul roads and dust suppression
- Proposal construction water requirements are anticipated to equate to a total water demand of 3.5 Gigalitres (GL) over the estimated 36 month construction period.
- Operational water requirements will be relatively low and primarily relate to track maintenance and embankment repair works. An annual water demand of 140 ML is estimated and will be sourced from groundwater.
- Construction Camps – potable water will be required for operation of the construction camps and for concrete batching for rail sleepers and bridge construction. It is estimated that total potable water consumption over the construction period will amount to approximately 350 ML per year and will be sourced from the closest suitable production bores.
- Permanent Maintenance Camp – annual operational potable water demand is expected to decrease to around 8 ML per year for maintenance camp purposes and will be primarily sourced from the closest suitable Proposal production bores. Rainfall tanks may also be used as a supplement water source when available.

4.4.6.7 Communication/Signals

Communication and signalling requirements include a fibre optic cable (for signalling, internet and telephony) and signalling (operation of trains, asset protection and rail crossings).

Installation of fibre optic cable (approximately 10 m from the edge of the operational corridor) will be required for the full length of the rail. Disturbance areas caused by these activities will generally be allowed to regenerate or will be rehabilitated, following installation and commissioning. Permanent access will however be retained to all cable pits.

4.4.7 Workforce and Operations

Operations will occur 24 hours a day, seven days a week. Construction is expected to primarily occur during daylight hours; however in some cases construction may be required on a 24-hour basis.

OPR is developing and implementing a local content policy to encourage local participation in supply and contracting activities, as well as direct workforce. Both construction and operation require specialist and skilled workers, and OPR will apply the local content policy where those skills are locally available. Additional staff are likely to fly in and out from Perth or Geraldton.

A key to attracting and retaining personnel is to provide suitable accommodation. OPR plans to provide comprehensive facilities (including recreation facilities) to help maintain construction and operation workforce morale.

4.5 CONSTRUCTION SEQUENCE

Table 4-3 summarises the anticipated sequence of construction for the rail and associated infrastructure. Final timing will depend on a range of factors, including financing and further investigation work.

Table 4-3 Indicative sequence of construction

Construction Activity	Description
Detailed Surveying and Investigation	**Quarter (Q) 2 2011 – Q3 2012** Engineering, environmental, hydrological and heritage investigations are used to determine routing constraints and specific construction techniques. Once the route is finalised, final engineering details will be confirmed. Continuous geotechnical surveys and investigations will be conducted along the rail line (not part of this Proposal). Clearing and grubbing will occur progressively, approximately one month prior to these investigations.
Clear and Grubbing	**Q3 2011 – Q4 2012** Areas of environmental or cultural significantce will be demarcated. Graders, bulldozers and scrapers will be used to clear the Rail Corridor prior to construction. Vegetation and topsoil cleared and stockpiled for rehabilitation purposes. This will occur continuously along the rail line.
Temporary Facilities	**Q2 2011 to Q3 2012** Temporary facilities such as construction camps, workshops, sleeper factory and laydown areas will be established to support construction of the rail.
Bulk Earthworks and Rail Formation Construction (including culverts and bridges)	**Q4 2011 – Q2 2013** Following clearing and grubbing, earthmoving equipment (e.g. graders, scrapers, loaders, rollers and water carts etc) will be mobilised for construction of the rail embankment and formation, culverts and bridges. Construction material will be sourced from quarries and borrow areas and placed in a manner to withstand the eventual weight of rail operations.
Blasting	**Q2 2011 – Q3 2012** Blasting will be required in traversing areas of rock and in the construction of cuttings. This will occur progressively along the rail formation.
Borrow Pits and Quarries	**Q3 2011 – Q2 2013** A number of borrow pits and at least three quarries are required to provide material for Proposal construction.
Bridge construction	**Q4 2011 – Q1 2013** Nine bridges will be constructed along the rail. Independent bridge construction crews will be engaged for this work.
Sleeper and Track Laying	**Q2 2012 – Q3 2013** Sleeper and track laying will occur progressively from the 34 km point of the Proposal. Pre-welded track in lengths of approximately 440 m will be transported by train via the progressively extended track. Rehabilitation will occur progressively in conjunction with track laying.
Signs, communication and signals (including cable laying)	**Q1 2012 – Q4 2013** Signals and communications will be incorporated into the track during and after construction and will include signal lights at level crossings and switch pads.
Commissioning	**Q2 2013 to Q1 2014** Commissioning will comprise the trial running of light high-rail vehicles, followed by a series of incrementally loaded trains until fully loaded trains are run and the rail track is opened for full operation.
Demobilisation and Final Rehabilitation	**Q1 2014** Rehabilitation of all excess disturbed areas will have been commenced within 12 months of construction completion.

5 EXISTING ENVIRONMENT

5.1 REGIONAL SETTING

As the Proposal Area extends some 570 km north east from Oakajee to Jack Hills, environmental conditions within the Rail Corridor vary considerably. The main factors contributing to this change are distance from the coast, drainage patterns, geology and soils. In the following sections, descriptions generally relate to 'coastal' or 'inland' to cover the range of conditions.

5.1.1 Climate

Bureau of Meteorology (BoM) data indicates that the Mid-West region experiences a Mediterranean type climate, with hot dry summers and mild wet winters near the coast, becoming progressively drier and warmer inland (BoM, 2009). Climatic data from Geraldton and Meekatharra meteorological stations represents the climatic extremes for the Proposal Area (Figure 5-1 and Figure 5-2)

5.1.1.1 Rainfall

Data from the BoM indicates that Geraldton's rainfall averages 460 mm per annum, peaking during the winter months (Figure 5-1). Being further inland, Meekatharra's rainfall is more variable over the year but generally averages 237 mm (Figure 5-2).

5.1.1.2 Temperature

Maximum temperatures in summer average between 30°C near the coast and 38°C inland with the hottest months being January and February, while in winter maximums average 19°C across the Proposal Area during June and July (BoM, 2009).

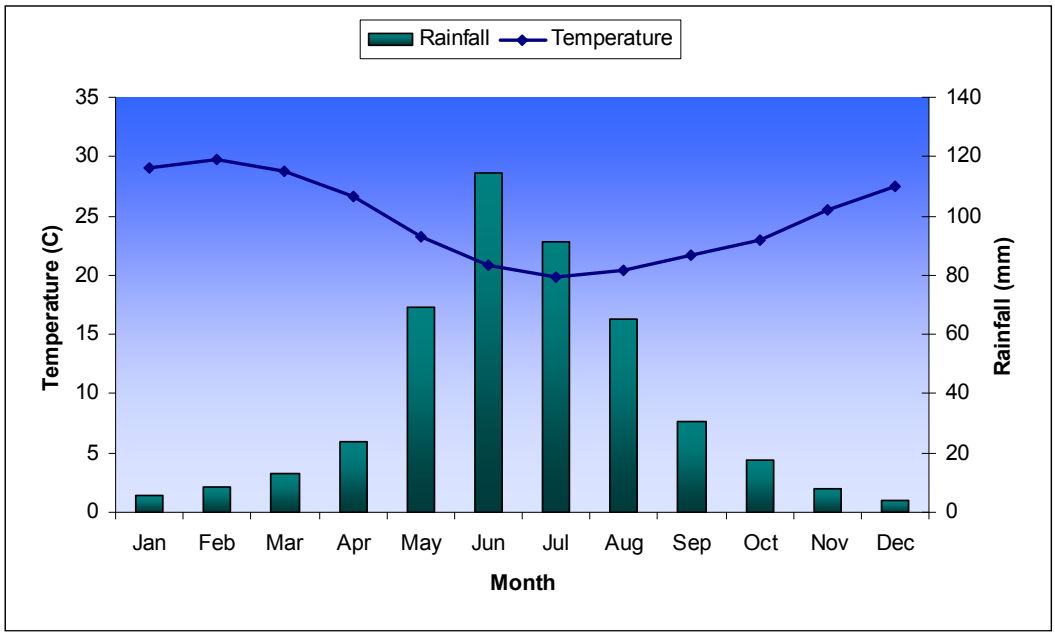


Figure 5-1 Mean annual rainfall and temperature for Geraldton (BoM 2009)

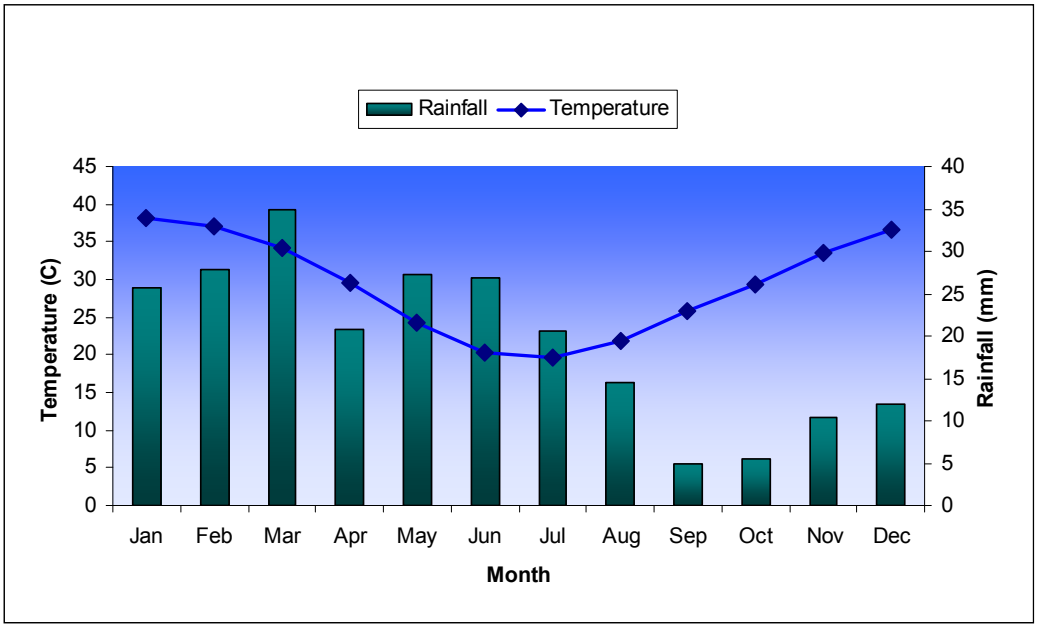
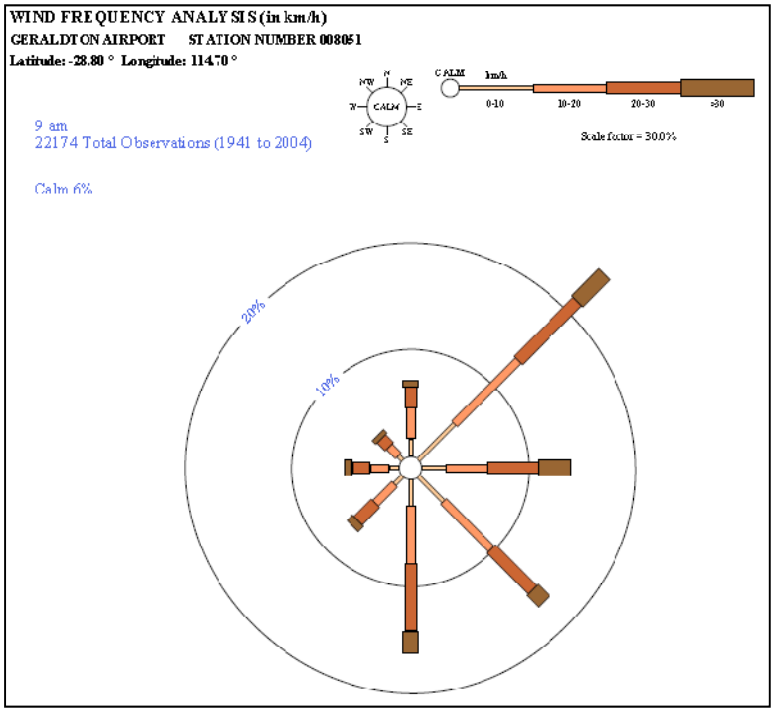


Figure 5-2 Mean annual rainfall and temperature for Meekatharra (BoM 2009)

5.1.1.3 Wind

Geraldton's wind climate is dominated by the effects of the land-sea interface where offshore land breezes are common in the morning, whilst afternoon sea breezes are common in the warmer months. Meekatharra also experiences land breezes from the interior, with a tendency to be drying and hot in the summer and without the relief of the coastal sea breeze (BoM, 2009). Wind roses for Geraldton and Meekatharra are presented in Figure 5-3 and Figure 5-4 respectively.



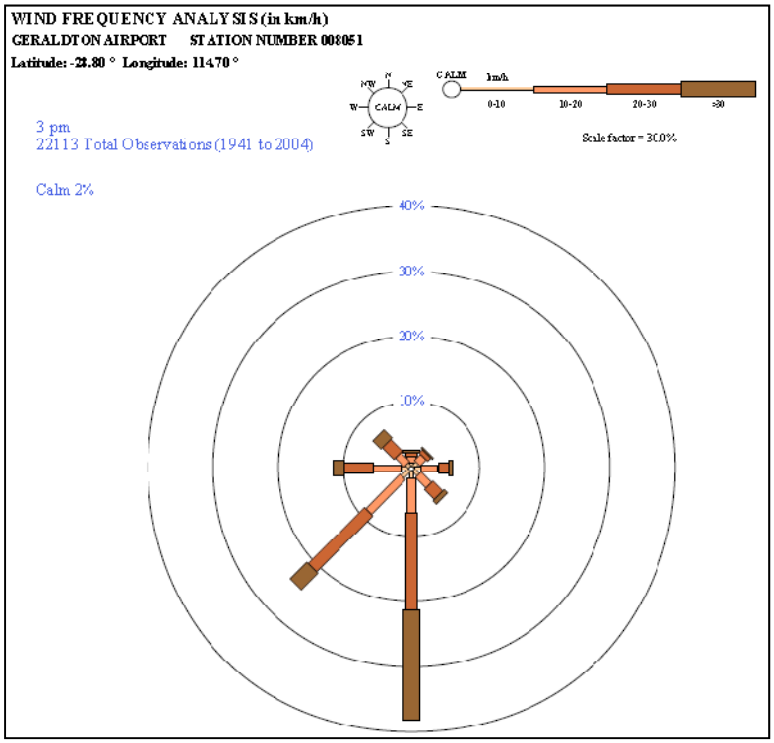


Figure 5-3 9am and 3pm wind roses from Geraldton weather station

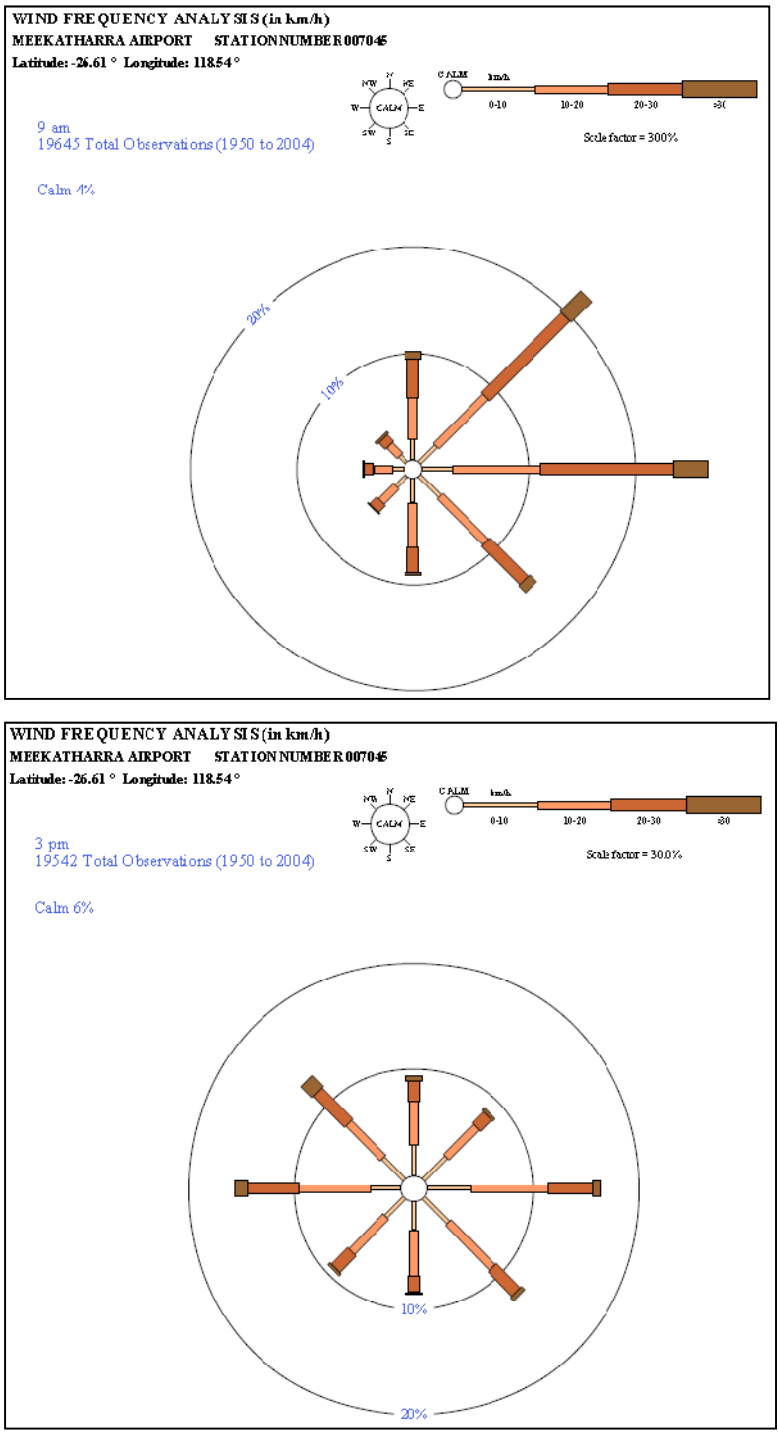


Figure 5-4 9am and 3pm wind roses from Meekatharra weather station

5.1.2 Biogeography

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the continent into regions (bioregions) of similar geology, landform, vegetation, fauna and climate (Department of Environment, Water, Heritage and the Arts, 2009). According to IBRA (Version 6.1) the Proposal Area intersects the Geraldton Sandplains (GS2), the Yalgoo (YAL2) and the Murchison bioregions. Each of the IBRA regions is further divided into sub-regions as described below and mapped on Figure 5-5.

5.1.2.1 Geraldton Sandplains

Near the coast, the Proposal traverses the Geraldton Hills sub-region of the GS2 Bioregion. The sub-region comprises mainly proteaceous scrub-heaths, rich in endemics, with the small regional reserves along the coast and inland. Extensive York Gum and Jam woodlands occur on outwash plains, and heaths with emergent Banksia, Actinostrobus and York Gum woodlands on alluvial plains. Dominant land uses are dry land agriculture (65.8% by area), conservation (13.8% by area) and rural residential (DEC, 2002). This subregion has approximately 16% of its pre-European vegetation remaining (Shephard 2002).

5.1.2.2 Tallering

The Proposal traverses the central YAL2 sub-region where the grazing of native pastures is the predominant land use (approximately 77% by area). The sub-region is characterised by low woodland or tall shrublands of mulga (*Acacia aneura*) on red loams. The undulating sandplains support scattered mulga and mallee (*Eucalyptus kingsmills*) over hummock grasslands. Mixed communities of low open woodlands of mulga and bowgada with heath and spinifex are characteristic of the sandplains (Payne, *et. al.*, 1998). The YAL2 sub-region has 719 recorded plant species, 27 of which are listed as Declared Rare Flora or Priority species. This subregion has approximately 98.9% of its pre-European vegetation remaining (Shephard 2002).

5.1.2.3 Western Murchison

The easternmost portion of the Proposal, including the Jack Hills Loop and the Weld Range Link, extends into the Western Murchison sub-region. The vegetation of the sub-region comprises low mulga woodlands, often rich in ephemerals (usually with bunch grasses), with saltbush shrublands occurring on calcareous soils. Hummock grasslands are common on the Sandplains (DEC, 2002). Pastoralism is the dominant land use (96% coverage by area) and although Shephard (2002) indicates that effectively all of the sub-region retains native vegetation, degradation is widespread as a result of grazing by pastoral stock and other introduced herbivores. This subregion has approximately 100% of its pre-European vegetation remaining (Shephard 2002).

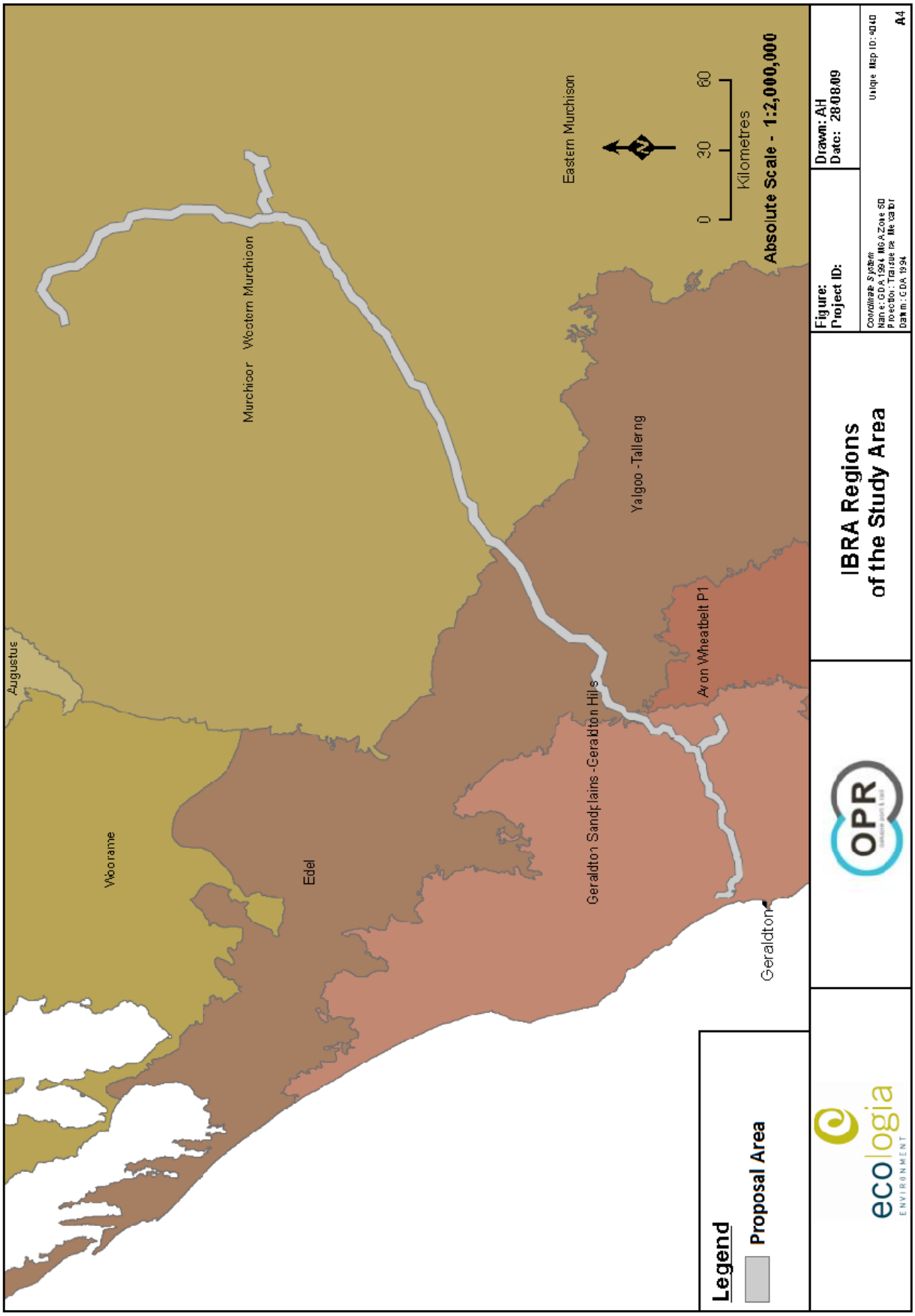


Figure 5-5 IBRA Regions associated with the Proposal

5.1.3 Land Systems

Rogers (1996) conducted an inventory of soil and land resources of the Geraldton Agricultural Region. 51 soil-landscape systems were described, based on geology, landform and soil characteristics. The Proposal Area incorporates eleven of Rogers' soil-landscape systems. Table 5-1 identifies these systems and the proportion of their total extent that occurs within the Study Area.

Table 5-1 Soil landscape systems occuring within the Proposal Area

Soil Landscape system	Total Area (ha)	Area in Proposal Area (ha)	Percent of Total System (%)
Binnu	138843	8947	6.44
Casuarina	70117	430	0.61
Dartmoor	115013	15678	13.63
Eradu	145118	7183	4.95
Greenough	17976	4620	25.70
Moresby	26697	2144	8.03
Mt Horner	29451	395	1.34
Northampton	83511	5348	6.40
Quindalup	3077	564	18.32
Sugarloaf	57582	2021	3.51
Tamala	13572	2156	15.89

A comprehensive inventory of the land systems of the Murchison region has been developed based on biophysical characteristics such as geology, landforms, vegetation and soils. The methodology was initially applied by Curry *et al* (1994) in the Murchison River Catchment and surrounds, and then by Payne *et al*. (1998) in the Sandstone-Yalgoo-Paynes Find area. Each land system is classified into a particular land type defined by the landforms and vegetation it contains. As the technique has been applied only within the Murchison region, the portion of the Rail Corridor beyond this region is described using soil landscape systems, as described above.

The Study Area encompasses 30 land systems, all of which are considered to be well represented beyond the Study Area. All land systems within the Study Area and the proportion of each land system being affected are shown in Table 5-2.

The most common land systems within the Proposal Area, each comprising over 10% of the entire area, are the Challenge, Tindalarra and Yanganoo systems. At approximately 10% each of their overall extent, the Weld and Yarrameedie land systems are proportionally the most represented within the Study Area.

5.1.1 Topography

The Mid-West Region can broadly be divided into a coastal plain, a coastal plateau, and an interior plateau, and the Proposal Area spans all three. The coastal plain is approximately 20 kilometres wide and is characterised by undulating sand-dunes. The coastal plateau ranges from approximately 50 m to 300 m above sea level, and is a fairly flat sandplain, with some ridges and mesas. The interior plateau is generally of lower relief, and is more variable, with paleodrainage valleys between escarpments.

Table 5-2 Land systems occurring within the Study Area

Land System	Total Area (ha)	Area in Proposal Area (ha)	Percent of total Land System (%)
Belele	578,300	4,352	0.7
Beringarra	262,436	1,422	0.5
Challenge	1,010,000	17,211	1.7
Cunyu	329,933	1,545	0.5
Ero	215,007	3,907	1.8
Flood	159,252	2,999	1.9
Gabanintha	251,455	2,688	1.1
Joseph	464,045	809	0.2
Jundee	660,224	4,363	0.7
Kalli	1,115,901	16,124	1.4
Koonmarra	569,874	11,997	2.1
Mileura	261,223	1,454	0.6
Millex	47,825	2,867	6.0
Millrose	109,649	1,317	1.2
Mindura	440,593	3,156	0.7
Mulline	19,688	89	0.4
Nerramyne	250,958	5,752	2.3
Norie	211,177	2,393	1.1
Pindar	151,876	646	0.4
Sherwood	1,579,691	9,636	0.6
Tallering	32,949	1,045	3.2
Tindalarra	713,173	29,231	4.1
Violet	584,096	1,981	0.3
Waguin	317,146	586	0.2
Weld	37,235	3,604	9.7
Wiluna	258,978	814	0.3
Yandil	494,525	3,055	0.6
Yanganoo	2,019,907	35,446	1.7
Yarrameedie	68,324	7,045	10.3
Yewin	45,709	1,692	3.7

5.1.2 Geology

The Proposal Area traverses two major geomorphologic units, the northern Perth Basin and the Yilgarn Craton which are separated by the Darling Fault. The Perth Basin is a north to north-northwest trending, onshore and offshore sedimentary basin extending about 1,300 km along the south-western margin of the Australian continent (Geoscience Australia, 2008). The Yilgarn Craton is the oldest and largest craton in Australia and comprises a gently undulating landscape characterised by rock of Archaean origin, chiefly granite with north to northwest belts of greenstone rock formation.

The greenstone formations comprise ranges of hills widely separated by flat plains derived from colluvium and alluvium. Prevailing topography is a result of extensive weathering of the underlying geological provinces (Anand and Paine, 2002). Weld Range and Jack Hills are two of the greenstone belt ridges representing the northern extent of the Yilgarn Craton and these feature comprise mainly haematite, magnetite and silica Banded Iron Formation (BIF)

rock. BIF is relatively erosion resistant and thus has resulted in the rocky outcrops and steep ridges characteristic of the area (Anand and Paine, 2002).

Most of the Mid-West region lies within the Murchison Province, which is the most western of the three granite-greenstone terrains in the Archaean Yilgarn Craton. In the north and northwest, the Murchison Province is in tectonic contact with the Narryer Gneiss of the Western Gneiss Terrain, whilst to the northeast the granite-greenstone rocks are overlain by Proterozoic sediments of the Nabberu Basin. Overlying the basement rocks, in particular along the palaeodrainages, are alluvial, colluvial and valley calcrete deposits of Cainozoic age (Johnson and Commander, 2006).

The geology is characterised by northwest to northeast trending granite-greenstone belts that display low to medium-grade metamorphism, which have been intruded by east-west dolerite dykes of Proterozoic age. The greenstones are comprised of metamorphic, igneous and sedimentary rocks that have been highly sheared and fractured. The granites tend to be relatively massive, except for local shearing along margins or joints. These basement rocks are poorly exposed in the Study Area due to the low relief, widespread superficial cover, and extensive deep weathering (Aquaterra, 2009b).

Sedimentary rocks of the Northern Perth Basin underlie the western portion of the Mid-West region. The inland extent of these sediments is marked by the Darling Fault. In the west, sediments of both the Perth and Carnarvon Basins flank the granitic Northampton Block (Johnson and Commander, 2006).

The Northampton Block is a relatively small area of Proterozoic crystalline basement that occurs in the west. The metamorphosed granulite, granite and migmite rocks form part of a linear ridge that separates the Perth and Carnarvon Basins.

The sediments of the North Perth Basin occur to the west of the Darling Fault and Yilgarn Craton. The Phanerozoic sediments, including the Yarragadee Formation, Parmelia Formation and Tumblagooda Sandstone, are deposited as a series of interbedded sandstone, siltstone, claystone and shale (Johnson and Commander, 2006).

The Permian sediments of the Carnarvon Basin consist of a series of sandstone, conglomerate, siltstone, claystone, carbonaceous shale and some tillites. At the coast and in the southern part of the Carnarvon Basin, there are prominent outcrops of the Silurian Tumblagooda Sandstone (Johnson and Commander, 2006).

Further details of the regional geology of the Mid-West region are presented in Appendix 4 (Aquaterra, 2009b). Hydrogeology is discussed in Section 5.2.4.1

5.1.3 Soils

The dominant soil types in the Mid-West are shallow loams with a red-brown hardpan. These are associated with yellow earth in the Murchison areas, and rocky stony soils. Soils overlay red-brown hardpan to 1.5 m depth, others overlay remnants of lateritic profiles and frequently have limestone gravel. Soils on hard rock are stony.

5.1.3.1 Acid Sulfate Soils

To assist in clarifying the potential for acid sulfate soils (ASS) occurrence along the rail alignment, Oakajee Port and Rail (OPR) commissioned a desk-based investigation of ASS risk along a potential alignment (GHD, 2010). A low to moderate ASS risk was determined for the majority of Study Area, with moderate to high risk areas (predominantly associated with

alluvium, and isolated salt pans) also identified at several locations. The full results (including detailed maps) can be found in Appendix 5, and are summarised as follows:

- 41.9% of areas no to low risk: Areas with this classification comprise strata that are not known to normally pose significant ASS risks. Examples from the site include igneous rocks (granite, gabbro), meta-sedimentary rocks (migmatite, schist), and sedimentary rocks (sandstone);
- 42.0% of areas low to moderate risk**:** Areas with this classification are comprised mostly of low risk strata, along with limited areas of strata that are known to pose potential ASS risks (for example alluvium/salt pan deposits). Examples from the site include areas of exposed basement rocks (e.g. granite) interspersed with colluvium, or minor quantities of alluvium; and
- 16.1% of areas moderate to high risk: Areas with this classification comprise significant quantities of strata that are known to pose significant potential ASS risks. Examples from the site include large areas of superficial deposits such as colluvium that contain extensive areas of alluvium materials and/or salt pan deposits.

With consideration of the anticipated excavation depths along the alignment (based on preliminary cut and fill data provided by OPR dated 12 January 2010), the risks were revised as follows:

- 91.2% no to low risk;
- 7.5% low to moderate risk; and
- 1.3% moderate to high risk.

5.1.4 Conservation Estates / Significant Areas

Of the IBRA subregions crossed by the Proposal Area, 0.01 - 5% of the Tallering and Western Murchison subregions are protected under the national reserve system, while the Geraldton Hills subregion has a much higher percent of 15 - 30% protected (DEWHA, 2008).

The Department of Environment and Conservation (DEC) announced new conservation lands in the Gascoyne, Murchison and south west regions in September 2007. These included the pastoral land area (whole or part) of the 'Gascoyne-Murchison Strategy' and the freehold land area in the south west. Most of the acquired pastoral leases and a few of the freehold areas are proposed to be reserved as unclassified conservation parks under the *Conservation and Land Management Act 1984*.

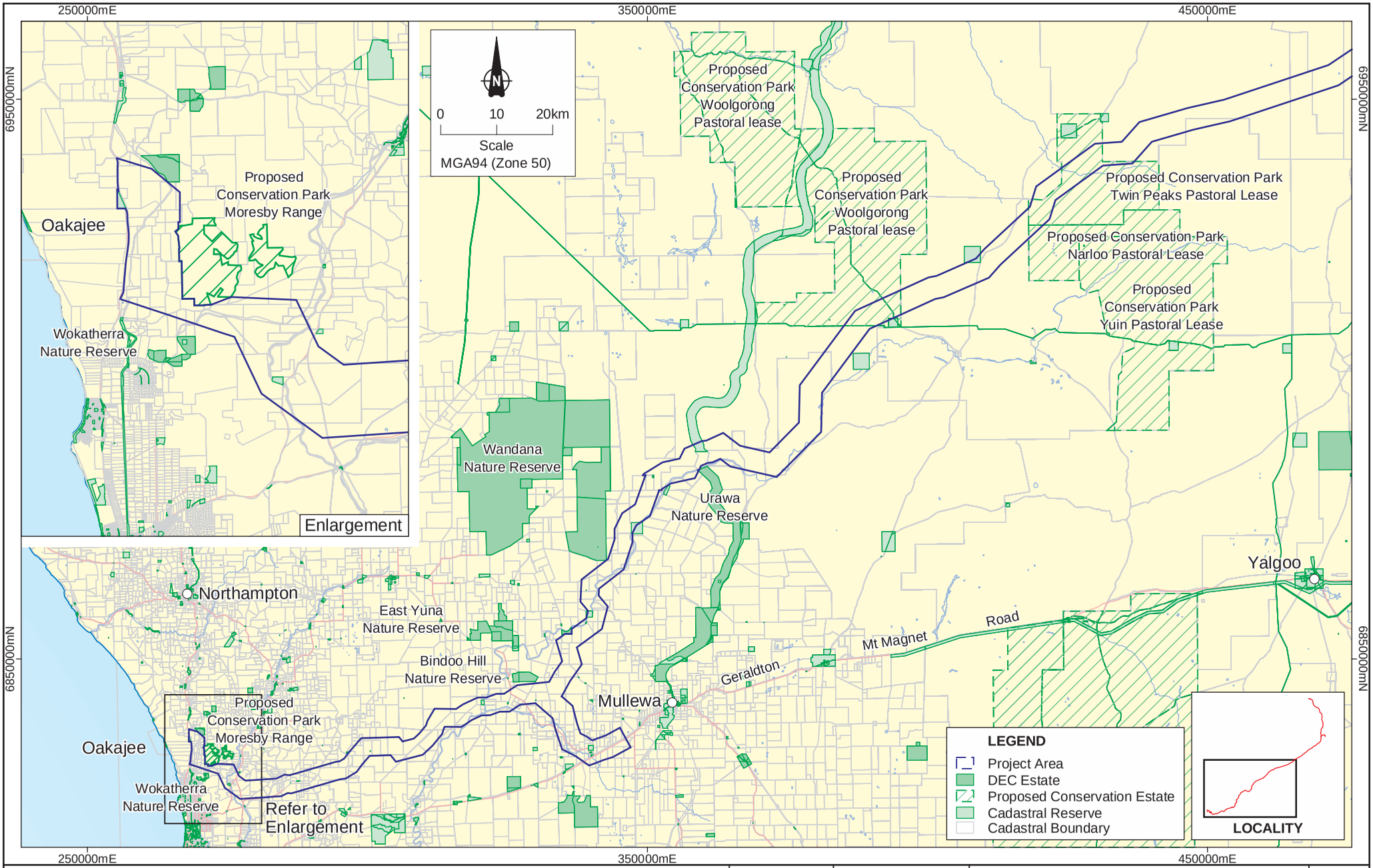
The Proposal Area crosses four current or proposed conservation reserves listed in Table 5-3 (Figure 5-6). Four others have been recently excised from the Proposal Area (are no longer part of the Proposal Area).

The Proposal Area does intersect the Moresby Range Strategy Area, approximately six km from the coast, but the Moresby Range Strategy (WAPC 2009) makes an allowance for an infrastructure corridor through this area.

Table 5-3 Conservation estates within the Proposal Area

Conservation Estate	Within Proposal Area
Ex Woolgorong (former leasehold)	Yes
Ex Twin Peaks (former leasehold)	Yes
Ex Narloo (former leasehold)	Yes
Reserve 16200	Yes
Moresby Range Nature Reserve	No, has been excised from Proposal Area
Un-named Nature Reserve	No, has been excised from Proposal Area
Urawa Nature Reserve	No, has been excised from Proposal Area
Wokatherra Nature Reserve	No, has been excised from Proposal Area

Figure 5-6 Conservation estates



Notes:
DEC Estates data supplied by Department of Environment and Conservation
Topographic & Cadastral data supplied by Landgate

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_P_F011.dgn

Current & Proposed Conservtion Estates

Figure No:

5.2 SUMMARY OF ENVIRONMENTAL INVESTIGATIONS

In developing the Proposal Public Environmental Review (PER), OPR has commissioned a range of specialist environmental investigations, including:

- vegetation and flora;
- fauna;
- surface hydrology;
- groundwater;
- acid sulfate soils; and
- noise.

Further information about the environmental investigations undertaken specifically for the PER process is provided below. Information derived from these investigations has been incorporated into the discussion of potential environmental impacts arising from the Proposal, and the management of these impacts presented in Section 7 of the PER. The reports documenting outcomes from the investigations form appendices to this PER.

5.2.1 Vegetation and Flora

Vegetation and flora surveys were conducted during 2009 to describe vegetation communities in and around the Study Area, and identify any conservation significant flora or communities and their regional significance. The surveys undertaken had the following objectives:

- to develop an inventory of vascular plant species;
- to describe and map plant communities;
- to review plant species considered to be rare and endangered, or geographically restricted, which are known to, or may occur, within the Study Area;
- to develop an inventory of exotic plants, including declared weeds; and
- to determine the significance of the plant communities in a local, regional and State context.

5.2.1.1 Previous Vegetation and Flora Surveys in the Region

Several vegetation surveys have been undertaken within the broader region encompassing the Study Area. Beard (1976) mapped the vegetation associations of the Murchison region at a scale of 1:1,000,000. The vegetation associations of the Geraldton area were mapped by Beard & Burns (1976) at a finer-scale of 1:250,000 and ten vegetation systems were described in the South-western Botanical Province and two in the Eremaean Botanical Province.

Ecologia undertook a number of surveys between 2006 and 2009 at Weld Range, Jack Hills and along previously proposed rail alignments. In addition DEC, Markey & Dillon, Meissner & Caruso and Mattiske conducted surveys within the region between 2004 and 2008. The results of these previous surveys have been used to inform the flora and vegetation assessments for this PER.

5.2.1.2 Ecologia Vegetation and Flora Survey Methodology

Vegetation surveys were performed during April - June 2009 in accordance with relevant Environmental Protection Authority (EPA) Position Statements and Guidance Statement No. 51 *Assessment of Environmental Factors for Terrestrial Flora.*

Database Searches

Before the field surveys were conducted, searches of the following databases were undertaken to determine species of conservation significance previously recorded in the Study Area:

- DEC's Threatened (Declared Rare) Flora Database;
- DEC's Declared Rare and Priority Flora List (Atkins (2008) (2));
- DEC's WA Herbarium Specimen Database (WA Herbarium);
- DEC's Threatened and PEC Database; and
- DEWHA's Protected Matters Database.

Field Methodology

Field surveys were conducted from May to August 2009 and were undertaken in accordance with relevant EPA Position Statements and Guidance Statement No. 51 *Assessment of Environmental Factors for Terrestrial Flora*.

The survey approach involved the establishment of 20 m by 20 m quadrats approximately every km along the rail alignment within pastoral areas, and in vegetation remnants within the freehold area. Where access to freehold lands was denied (only for a small number of properties), the nearest similar vegetation was surveyed to determine significance. Transects were also walked targeting Declared Rare and Priority species. In addition to systematic sampling, opportunistic sampling was also carried out.

Vegetation Mapping

The vegetation of the Study Area was mapped to classify the vegetation communities based on groups with similar species composition. This was acheived through a combination of statistical cluster analysis, field observation and aerial photography. The Study Area was mapped at a scale of 1:30,000, except the area from the Moresby Ranges to the western end of the Study Area which was mapped at a scale of 1:10,000.

Survey Adequacy

141 person days were spent on the flora and vegetation surveys**.** The adequacy of the sampling undertaken during the field surveys was analysed using Species Accumulation Curves.

The analysis showed that approximately 81% of the flora species potentially present within the pastoral section, and approximately 77% of the flora species potentially present within the freehold section were recorded during the survey based on species recoded in quadrats only.

Inclusion of taxa collected opportunistically during the surveys suggests that approximately 110% (freehold section) and 98% (pastoral section) of the flora species potentially present within the Study Area were recorded during the survey. The full details of sampling effort and survey adequacy calculations can be found in Appendix 1.

5.2.1.3 Vegetation recorded within the Study Area

Two data sets were used to interpret vegetation communities within the Study Area; Beard (1976) vegetation association mapping, and Ecologia (2010) vegetation unit mapping. The vegetation communities of each are summarised in Table 5-4 below.

Beard Vegetation Associations

A description of the vegetation associations recorded by *Ecologia* is provided in Table 5-4. Mapping of these units is included in Appendix 1.

Table 5-4 Beard vegetation associations within the Study Area

Code	Description	Extent and Distribution	Total pre-European extent in WA (ha)	% of Study Area	Associated *Ecologia* vegetation units
a1,14Si	*Acacia aneura* and *Acacia quadrimarginea* scrub.	Moderate to large and widespread, the regional distribution includes many of the BIF ranges in WA	448,700	1.1	Mh1, Mh2, Mh3, Mh4, Mh5, Mh6, Mh7, Mh8, Mc3, Mc4.
a1,8Sr k1,2Ci	*Acacia aneura* and *Acacia sclerosperma* with *Atriplex* and *Maireana* spp. succulent steppe.	Small to moderate and restricted, the regional distribution includes the floodplains from a number of different land systems	199,534	1.5	Mf1, Mf2, Mf3
a1,9Li	*Acacia aneura, Acacia ramulosa* var. *ramulosa* and *Acacia ramulosa* var. *linophylla* low woodland.	Small and restricted	94,031	3	Mr2
a10,11Si k1,2Ci	*Acacia victoriae, Acacia xiphophylla* and *Acacia eremaea* with *Atriplex* and *Maireana* spp. succulent steppe.	Small and restricted	65,169	1	Yf3, Mc1
a14Si	*Acacia quadrimarginea* scrub.	Very small and restricted	10,387	0.1	Yh1
a1Li	*Acacia aneura* low woodland.	Largest and most widespread.	24,751,239	24	Mc5, Mh5, Mh9, Mh10, Mh14, Mp1, Mp2, Mp5, Mp8, Mp6, Mp9, Mp11, Mp12, Mr3
a1Li a9,17Si	*Acacia aneura* low woodland with understory of *Acacia ramulosa* var. *ramulosa*, *Acacia ramulosa* var. *linophylla* and *Acacia grasbyi*.	Very large and widespread. Widespread and common in WA	1,136,021	13.4	Yp5, Yp6
a1Lp	*Acacia aneura*, trees in groves or patches.	Very large and widespread. Large potential distribution in WA	7,914,567	16.3	Mp2, Mp3, Mp4, Mr1, Mr2, Mr3.
a1Si	*Acacia aneura* scrub.	Very large and widespread	6,666,951	3.5	Mh10, Mh11, Mh12, Mh15, Mh16, Mp6, Mp9, Mp10
a33Sc	*Acacia rostellifera* thicket.	Very small and restricted. Has half of its known distribution in the Geraldton Sandplains region and is moderately endemic.	3,478	0.5	Gc2
a8,9Sr k1,2Ci	*Acacia sclerosperma*, *Acacia ramulosa* var. *ramulosa* and *Acacia ramulosa* var. *linophylla* with *Atriplex* and Maireana spp. succulent steppe.	Small to moderate and restricted	119,058	0.05	-
a8Sr k1,2Ci	*Acacia sclerosperma* with *Atriplex* and *Maireana* spp.	Small and restricted	15,539	0.8	Yc1, Yf4 and Yf5

Code	Description	Extent and Distribution	Total pre-European extent in WA (ha)	% of Study Area	Associated *Ecologia* vegetation units
	succulent steppe.				
a9,19Si	*Acacia ramulosa* var. *ramulosa*, *Acacia ramulosa* var. *linophylla* and *Acacia acuminata* scrub.	Large and widespread	756,674	1.6	Yp2 and Yp6
a9,20Si	*Acacia ramulosa* var. *ramulosa*, *Acacia ramulosa* var. *linophylla* and *Acacia murrayana* scrub.	Moderate to large and fairly widespread	206,457	1.4	Yp2 and Yy1
a9Si	*Acacia ramulosa* var. *ramulosa* and *Acacia ramulosa* var. *linophylla* scrub.	Very large and widespread	1,331,779	3.4	Yy1 and Mr2
acSc	*Acacia* - *Casuarina* spp. thicket.	Moderate to large and widespread	495,385	0.2	Yp3 and Gf2
anSi	Mixed *Acacia* spp. scrub.	Moderate to large and widespread	368,979	8.1	Yp1, Yp2, Yp5 and Yf5
ceLr a9Si	*Acacia ramulosa* var. *ramulosa* and *Acacia ramulosa* var. *linophylla* scrub with *Callitris columellaris* and *Eucalyptus* spp.	Large and widespread	511,008	1.3	Yp2 and Yp3
e6c5Mr a9,19Si	*Acacia ramulosa* var. *ramulosa*, *Acacia ramulosa* var. *linophylla* and *Acacia acuminata* scrub with scattered *Eucalyptus loxophleba* and *Casuarina huegeliana*.	Small and restricted	56,427	2.7	Gf2
e6Mr a19Si	*Acacia acuminata* scrub with scattered *Eucalyptus loxophleba*.	Small to moderate and fairly restricted. Uncommon locally and regionally and is endemic to the Geraldton Sandplains region	184,571	3.8	Gp1 and Gf2
e6Mr eaSi	*Eucalyptus* spp. (mallee) and *Acacia* spp. scrub with scattered *Eucalyptus loxophleba*.	Small and restricted. Likely to be uncommon locally and regionally and is almost endemic (99%) to the Geraldton Sandplains region.	97,368	3.6	Gp1, Gf1 and Gf2
k3Ci	*Tecticornia* spp. and other samphires succulent steppe.	Very large and widespread	2,078,904	0.01	-
mhSc	*Melaleuca* - *Hakea* spp. thicket.	Small and restricted. Uncommon locally and is regionally endemic to the Geraldton Sandplains region.	51,880	0.9	Gh1, Gh2 and Gh3
x2SZc	Scrub heath coastal association.	Moderate to large and widespread.	328,738	2.9	Gy1
x3SZc	Scrub heath inland association.	Large and widespread. Highly endemic to the Geraldton Sandplains region	580,547	1.7	Yp3 and Gf2
x3SZc/ acSc	*Acacia* - *Casuarina* spp. thicket with scrub heath inland association.	Small and restricted. Endemic to the Geraldton Sandplains region	82,081	2.6	Gy2 and Gp2

Ecologia Vegetation Units

72 vegetation units, incorporating 48 sub-units were mapped in the Study Area. Some vegetation units were indistinguishable from others on the aerial photographs and consequently were mapped as one unit incorporating a number of sub-units. These units are summarised below and described in detail in Appendix 1.

A general description of the vegetation communities in each of the bioregions is given below. The vegetation communities of the Study Area are described based on IBRA region and landform. Each community has a unique code where the first capital letter indicates the IBRA region in which it is mapped (G = Geraldton Sandplains, Y = Yalgoo and M = Murchison), the next lower case letter indicates the landform type (see codes under each bioregion), and the number indicates the vegetation community (i.e. 1 = Vegetation Community 1). Where sub-units occur in a vegetation community, these are identified by an additional letter (e.g. /a). For example, Gh2/a is sub-unit a of Geraldton Sandplains rocky hill slope community 2.

Geraldton Sandplains IBRA

The freehold section of the Study Area occurs completely within the Geraldton Sandplains IBRA region (Figure 5-5). While most of this section has been cleared, some areas of remnant vegetation are still in good condition. Twelve vegetation communities, incorporating eight sub-units, were mapped along the Geraldton Sandplains section of the Study Area.

The vegetation of the Geraldton Sandplains (G) bioregion has been grouped into:

- Rocky hill slope vegetation of the Moresby Range (h);
- Yellow sand plain and dune vegetation (y);
- Red sand plain vegetation (p);
- Floodplain vegetation (f); and
- Creek line and minor drainage channel vegetation (c).

Yalgoo IBRA

The Yalgoo IBRA region extends approximately 100 km east from the eastern extremity of the freehold section of the Study Area (Figure 5-5). The region has not been cleared and with the exception of the western 10 km of the section which is dominated by open *Eucalyptus* species woodlands, regional vegetation is dominated by *Acacia* species woodlands. 17 vegetation communities, incorporating 10 sub-units, were recorded in the Yalgoo region.

The vegetation of the Yalgoo region has been grouped into:

- Rocky hill slope vegetation (h);
- Yellow sand plain vegetation (y);
- Red sand plain and sandy-clay vegetation (p);
- Floodplain vegetation (f); and
- Creek line and minor drainage channel vegetation (c).

Murchison IBRA

The northern half of the Study Area occurs in the Murchison IBRA region (Figure 5-5). This region is characterised by hard red clay pans that support *Acacia aneura* and varying *Eremophila* species. 44 vegetation communities, incorporating 30 sub-units were recorded in the Murchison section of the Study Area.

The vegetation of the Murchison bioregion has been grouped into:

- Rocky hill slope vegetation of Jack Hills, Weld Range and other areas (h);
- Red sand plain vegetation (r);
- Red sand-clay plain and hard clay pan vegetation (p);
- Salt lake and floodplain vegetation (f); and
- Creek line and minor drainage channel vegetation (c).

A description of the vegetation units recorded by Ecologia is provided in Table 5-5. Mapping of these units is included in Appendix 1.

Table 5-5 Ecologia vegetation units recorded within the Study Area

Code	Description
Gh1	Isolated *Eucalyptus loxophleba* subsp. *loxophleba* low mallee trees, over *Melaleuca megacephala* and *Hakea pycnoneura* closed mid shrubland, over *Hibbertia hypericoides, Acacia lasiocarpa* var. *lasiocarpa, Gastrolobium plicatum, Gastrolobium triangulare* sparse low shrubland, over *Lepidosperma tenue* open sedgeland.
Gh2	Mixed *Acacia* spp. and *Melaleuca* spp. sparse to open tall shrubs, over *Verticordia chrysanthella* and *Gastrolobium plicatum* low shrubland.
Gh3	*Allocasuarina campestris* closed tall to mid shrubland, over *Lepidosperma tenue* sparse sedgeland.
Gy1	*Eucalyptus* spp., *Xylomelum angustifolium, Actinostrobus arenarius* and *Banksia* spp. sparse to open low woodland, over mixed Myrtaceae spp. open low to mid shrubland.
Gy2	Mixed *Eucalyptus* spp. open low woodland, over *Acacia* spp. and *Melaleuca* spp. sparse mid shrubland.
Gp1	*Acacia tetragonophylla* and *Hakea recurva* subsp. *recurva* (+/-*Eucalyptus loxophleba* subsp. *Loxophleba, Acacia acuminata* and *Acacia burkittii)* low woodland, over *Ptilotus obovatus* sparse low shrubland, over **Avena fatua* and **Bromus diandrus* tussock grassland.
Gp2	*Melaleuca adnata* sparse low woodland, over *Calothamnus quadrifidus* and *Acacia acuminata* open tall to mid shrubland, over *Ptilotus obovatus* open low shrubland, over *Amphipogon caricinus* var. *caricinus* open tussock grassland.
Gf1	Isolated *Hakea preissii* tall shrubs, over *Tecticornia indica* subsp. *bidens* and *Atriplex amnicola* (+/- *Tecticornia lepidosperma, Tecticornia pergranulata* subsp. *pergranulata* and *Frankenia setosa*) low Chenopod shrubland, over **Avena fatua* and *Eragrostis dielsii* sparse tussock grassland.
Gf2	*Eucalyptus loxophleba* subsp. *loxophleba* open low woodland, over *Acacia acuminata* and *Acacia burkittii* sparse tall shrubland, over *Acacia tetragonophylla* and *Enchylaena tomentosa* sparse mid shrubland, over *Acacia andrewsii* and *Ptilotus obovatus* sparse low shrubland.
Gc1	*Eucalyptus camaldulensis* var. *obtusa* mid to low woodland (+/- *Casuarina obesa* and *Melaleuca rhaphiophylla)* isolated to open tall shrubland, over *Atriplex amnicola* and *Chenopodium gaudichaudianum* sparse low shrubland, over *Cyperus gymnocaulos* sparse sedgeland and **Avena fatua* and **Bromus diandrus* tussock grassland.
Gc2	*Grevillea* spp., *Acacia* spp. and *Melaleuca* spp. tall shrubland.
Yh1	*Allocasuarina dielsiana* sparse mid woodland, over *Acacia quadrimarginea* and *Acacia ramulosa* var. *Linophylla* sparse tall shrubland, over *Ptilotus obovatus* sparse low shrubland.
Yh2	*Acacia ramulosa* var. *linophylla* sparse tall shrubland, over isolated *Thryptomene decussata, Eremophila latrobei* subsp. *latrobei* and *Sida ectogama* mid shrubs, over *Eriachne pulchella* subsp. *pulchella* and *Aristida contorta* sparse tussock grassland.
Yh3	Isolated *Acacia aneura, Acacia ramulosa* var. *linophylla, Acacia quadrimarginea* and *Acacia grasbyi* low trees, over *Thryptomene costata* and *Thryptomene decussata* open mid to low shrubland, over *Aristida contorta* open tussock grassland.
Yy1	Acacia *ramulosa* var. *linophylla* and *Acacia ramulosa* var. *ramulosa* open tall shrubland.
Yp1	*Acacia coolgardiensis* tall shrubland to low woodland, over isolated *Eremophila forrestii* mid to low shrubs.
Yp2	*Acacia ramulosa* var. *linophylla* (+/- *Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla)* tall to mid shrubland, over *Enchylaena tomentosa* var. *tomentosa* sparse low shrubland.
Yp3	Mixed *Eucalyptus* spp. low woodland, over sparse *Acacia* spp. mid shrubland.
Yp4	*Eucalyptus kochii* subsp. *amaryssia* open mid woodland, over isolated *Acacia ramulosa* var. *ramulosa* tall shrubs, over isolated *Acacia andrewsii, Ptilotus obovatus* and *Maireana* spp. low shrubs, over isolated *Eriachne helmsii* tussock grasses.
Yp5	*Acacia ramulosa* var. *linophylla, Acacia grasbyi, Acacia burkittii* and *Acacia aneura* open tall shrubland.

Code	Description
Yp6	*Acacia burkittii, Acacia quadrimarginea, Acacia aneura* (+/- *Acacia* aff. *rhodophloia*) over isolated *Hakea preissii* and *Senna* spp. mid shrubs, over *Ptilotus obovatus* and *Acacia scleroclada* sparse low shrubland, over *Cymbopogon ambiguus* and *Aristida contorta* open tussock grassland.
Yf1	*Acacia burkittii* and *Acacia grasbyi* and (+/- *Acacia ramulosa* var. *linophylla)* sparse tall shrubland over *Acacia tetragonophylla* sparse tall to mid shrubland, over *Aristida contorta* sparse tussock grassland.
Yf2	Isolated *Acacia synchronicia* tall shrubs, over isolated *Senna* sp. Meekatharra (E. Bailey 1-26), *Acacia synchronicia, Acacia tetragonophylla* and *Eremophila galeata* mid shrubs, over *Aristida contorta* tussock grassland.
Yf3	*Acacia victoriae* sparse tall shrubland, over *Atriplex bunburyana* open mid shrubland, over *Atriplex bunburyana* sparse low shrubland, over *Aristida contorta* and *Eragrostis dielsii* sparse tussock grassland.
Yf4	*Tecticornia disarticulata, Rhagodia eremaea, Frankenia laxiflora, Sclerolaena cuneata* and *Cratystylis subspinescens* low shrubland.
Yf5	*Acacia eremaea* sparse tall shrubland, over mixed Chenopod spp. low shrubland.
Yc1	*Casuarina obesa* open to sparse low forest, over *Duboisia hopwoodii* sparse tall shrubland, over *Atriplex amnicola, Tecticornia indica* subsp. *bidens* and *Tecticornia lepidosperma* open low Chenopod shrubland, over **Hordeum glaucum* and **Avena fatua* tussock grassland.
Yc2	*Acacia burkittii* (+/-*Acacia acuminata*) mid woodland, over *Acacia burkittii, Hakea preissii* and *Acacia tetragonophylla* low woodland to sparse tall shrubland, over *Ptilotus obovatus* sparse low shrubland, over *Cyperus bifax* sparse sedgeland, over *Monachather paradoxus* and **Setaria verticillata* tussock grassland.
Mh1	*Acacia rhodophloia, Acacia ramulosa* var. *linophylla* and *Acacia cuthbertsonii* subsp. *cuthbertsonii* open tall shrubland, over *Eriachne aristidea* sparse tussock grassland.
Mh2	Sparse *Acacia aneura* and/or *Acacia rhodophloia* low woodland, over *Ptilotus obovatus* sparse low shrubland.
Mh3	Isolated *Acacia aneura* (+/- *Acacia ramulosa* var. *linophylla* and *Acacia cuthbertsonii* subsp. *cuthbertsonii)* low trees, over isolated *Aristida contorta* tussock grasses.
Mh4	*Acacia aneura* and *Acacia citrinoviridis* open low woodland, over *Acacia ramulosa* var. *linophylla* sparse tall shrubland, over *Sida cardiophylla* and *Ptilotus obovatus* open low shrubland, over isolated *Monachather paradoxus* tussock grasses.
Mh5	*Acacia aneura* (+/- *Acacia ramulosa* var. *linophylla)* sparse to open low woodland, over mixed *Eremophila* spp. mid shrubland.
Mh6	Isolated *Acacia pruinocarpa* low trees, over *Acacia aneura* sparse tall shrubland, over *Thryptomene decussate* (+/- *Prostanthera petrophila, Dodonaea petiolaris, Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *brucei*) mid shrubland, over *Ptilotus obovatus* low shrubland, over *Eriachne mucronata* and *Cymbopogon ambiguus* sparse tussock grassland.
Mh7	*Acacia* sp. Weld Range (A. Markey & S. Dillon 2994) and *Acacia aneura* open tall shrubland, over *Eremophila macmillaniana* and mixed *Senna* spp. open mid shrubland, over *Ptilotus obovatus* open low shrubland.
Mh8	*Acacia aneura* open low woodland, over *Eremophila macmillaniana* open mid shrubland, over *Sida atrovirens* scattered low shrubs, over *Aristida contorta* open tussock grassland.
Mh9	*Acacia aneura* open low woodland, over *Grevillea obliquistigma* subsp. *obliquistigma* and *Eremophila spathulata* sparse mid shrubland, over *Eremophila latrobei* subsp. *latrobei* sparse low shrubland, over *Eriachne pulchella* subsp. *pulchella* sparse tussock grassland.
Mh10	*Acacia* spp., sparse tall shrubland, over *Eremophila* spp. sparse mid shrubland.
Mh11	*Acacia* aff. *rhodophloia* open tall shrubland, over *Dodonaea petiolaris* sparse mid shrubland, over *Pluchea dentex, Stemodia viscosa, Solanum lasiophyllum* and *Hibiscus coatesii* sparse low shrubland, over *Aristida contorta* and *Cymbopogon ambiguus* tussock grassland.
Mh12	*Eremophila platycalyx* subsp. *platycalyx* and *Acacia tetragonophylla* sparse tall shrubland, over isolated *Dodonaea viscosa* subsp. *spatulata* low shrubs, over *Cymbopogon ambiguus* sparse tussock grassland.
Mh13	*Acacia* sp. Weld Range (A. Markey & S. Dillon 2994) sparse mid shrubland, over *Dodonaea pachyneura* and *Philotheca* aff. *tubiflora* sparse low shrubland, over isolated *Eragrostis* sp. tussock grasses.
Mh14	Isolated *Acacia aneura* low trees, over *Thryptomene decussata* sparse mid to low shrubland, over isolated *Monachather paradoxus* tussock grasses.
Mh15	*Acacia aneura* open low woodland, over *Sida* spp. and *Ptilotus obovatus* sparse low shrubland.
Mh16	*Acacia aneura* open low woodland, over *Acacia synchronicia* and *Acacia tetragonophylla* sparse tall shrubland, over *Maireana triptera* and *Ptilotus obovatus* sparse low shrubland, over *Aristida contorta* open tussock grassland.

Code	Description
Mh17	*Acacia aneura* open low woodland, over *Acacia ramulosa* var. *linophylla* open tall shrubland, over *Aluta aspera* subsp. *hesperia* and *Eremophila forrestii* open mid shrubland, over *Monachather paradoxus* sparse tussock grassland.
Mh18	*Acacia* spp. sparse tall shrubland, over *Eremophila latrobei* subsp. *latrobei* and mixed Myrtaceae spp. open low shrubland.
Mr1	*Acacia aneura* sparse low woodland, over *Eremophila compacta* subsp. *compacta* mid shrubland, over *Mirbelia rhagodioides* and (+/-*Hemigenia virescens)* sparse low shrubland, over *Aristida holathera* var. *holathera, Eriachne aristidea* and *Eragrostis desertorum* tussock grassland.
Mr2	*Acacia aneura* open low woodland, over *Acacia ramulosa* var. *linophylla* open tall shrubland, over *Eremophila forrestii* (+/- *Eremophila simulans* subsp. *simulans)* open mid shrubland, over *Eriachne helmsii* and *Monachather paradoxus* open tussock grassland.
Mr3	*Acacia aneura* open tall shrubland, over *Eremophila forrestii* (+/- *Eremophila fraseri* and *Senna* spp.) open mid shrubland, over *Ptilotus obovatus* open low shrubland, over *Monachather paradoxus* open tussock grassland.
Mp1	*Eremophila spathulata* and/or *Eremophila macmillaniana* sparse mid shrubland.
Mp2	*Acacia aneura* sparse low woodland, over *Eremophila fraseri* (+/- *Eremophila macmillaniana*) and *Senna artemisioides* subsp. *helmsii* open mid shrubland, over *Ptilotus obovatus* sparse low shrubland, over *Eriachne pulchella* subsp. *pulchella* and *Aristida contorta* sparse tussock grassland.
Mp3	Isolated *Acacia aneura* low trees, over open *Senna artemisioides* subsp. *helmsii, Senna glaucifolia* and *Senna* sp. Meekatharra (E. Bailey 1-26) mid shrubland, over *Ptilotus obovatus* sparse low shrubland, over *Aristida contorta* sparse tussock grassland.
Mp4	Isolated *Acacia pruinocarpa* low trees, over *Acacia aneura* and *Acacia craspedocarpa* x *aneura* sparse tall shrubland, over isolated *Eremophila fraseri* mid shrubs, over *Ptilotus obovatus* sparse low shrubland.
Mp5	*Acacia aneura* open low woodland, over isolated *Acacia demissa* tall shrubs, over *Senna artemisioides* subsp. *helmsii* sparse mid shrubland, over *Ptilotus obovatus* sparse low shrubland.
Mp6	Isolated *Acacia aneura* low trees, over *Ptilotus obovatus* and mixed *Maireana* spp. low shrubland.
Mp7	*Acacia aneura* sparse low woodland, over *Acacia craspedocarpa* tall shrubland, over *Acacia tetragonophylla* sparse mid shrubland, over *Eremophila punicea, Solanum lasiophyllum* and *Ptilotus obovatus* sparse low shrubland, over *Aristida contorta* sparse tussock grassland.
Mp8	*Acacia aneura* isolated low trees to open woodland, (+/- *Acacia tetragonophylla, Acacia craspedocarpa* and *Acacia ramulosa* var. *linophylla)* tall shrubs, over *Eremophila fraseri, Ptilotus obovatus* and *Solanum lasiophyllum* sparse low shrubland, over *Aristida contorta* open tussock grassland.
Mp9	Isolated *Acacia aneura* and *Eremophila platycalyx* low trees, over *Eremophila fraseri* subsp. *fraseri, Eremophila platycalyx, Senna artemisioides* subsp. *helmsii* and *Senna* sp. Meekatharra (E. Bailey 1-26) open mid shrubland, over *Eremophila alternifolia* sparse low shrubland, over *Aristida contorta* sparse tussock grassland.
Mp10	*Aristida holathera* var. *holathera, Eragrostis cumingii, Eriachne flaccida, Eriachne pulchella* subsp. *Pulchella* and *Eragrostis setifolia* tussock grassland, over *Bulbostylis barbata* and *Fimbristylis dichotoma* sedgeland.
Mp11	*Acacia aneura* sparse to open low woodland, over *Eremophila forrestii, Eremophila fraseri* and *Senna* spp. sparse mid shrubland, over *Aristida contorta* tussock grassland.
Mp12	*Acacia aneura* low woodland, over *Acacia aneura* x *craspedocarpa* and *Acacia tetragonophylla* open tall shrubland, over isolated *Eremophila forrestii* and *Eremophila fraseri* mid shrubs, over *Aristida contorta* and *Eragrostis dielsii* open tussock grassland.
Mf1	*Melaleuca stereophloia* open to closed mid shrubland, over mixed Chenopod spp. low shrubland.
Mf2	*Eucalyptus striaticalyx* subsp. *striaticalyx* and *Eucalyptus trivalva* open mid to low forest, over *Maireana georgei, Frankenia laxiflora* and *Atriplex bunburyana* sparse low shrubland.
Mf3	*Tecticornia pruinosa* low shrubland, over *Fimbristylis dichotoma* and *Eragrostis pergracilis* open tussock grassland.
Mc1	*Casuarina pauper* sparse low woodland, over *Tecticornia* spp. low shrubland.
Mc2	*Eucalyptus victrix* open mid woodland, over *Acacia burkittii* and *Acacia aneura* sparse low woodland, over *Acacia burkittii* and *Dodonaea viscosa* subsp. *spatulata* open mid shrubland, over *Cyperus bifax* sparse sedgeland and *Eriachne helmsii* sparse tussock grassland.
Mc3	*Eucalyptus victrix* and *Acacia cyperophylla* var. *cyperophylla* closed low to mid woodland.
Mc4	*Acacia aneura* and *Acacia ramulosa* var. *linophylla* open to closed low woodland, over mixed *Eremophila* spp. open mid shrubland, over *Ptilotus* spp. sparse low shrubland.
Mc5	*Acacia aneura* and *Acacia tetragonophylla* (+/- *Acacia kempeana)* low woodland.

Code	Description
Mc6	Mixed *Acacia aneura, Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla* low woodland.
Mc7	*Acacia ramulosa* var. *ramulosa* open low woodland, over *Acacia burkittii* and *Acacia craspedocarpa* x *aneura* sparse low woodland, over *Acacia tetragonophylla* sparse mid shrubland, over *Monachather paradoxus, Eragrostis leptocarpa* and *Eriachne flaccida* sparse tussock grassland.
Mc8	*Acacia acuminata* and *Acacia aneura* open low woodland (+/-*Casuarina pauper*), over *Acacia acuminata,* *Grevillea obliquistigma* subsp. *obliquistigma, Callistemon phoeniceus* and *Senna artemisioides* subsp. X *artemisioides* open tall to mid shrubland, over *Cyperus* spp. sparse sedgeland.

5.2.1.4 Vegetation Condition

Vegetation condition within the Study Area was noted at each quadrat, based on factors such as the presence of weeds, tracks, litter, grazing and any other ground disturbances. Vegetation condition was also compared against the vegetation scales in Bush Forever Volume 2 (Bush Forever, 2000). Vegetation condition within the Study Area varied along its length. Table 5-6 shows the vegetation condition level recorded in the freehold and pastoral sections of the Study Area. The freehold area results do not include areas devoid of native vegetation as these areas were not surveyed. Therefore it is an assessment of the remaining native vegetation in that area.

Table 5-6 Vegetation condition assessment

Vegetation Condition	Level	Freehold Land Area (%)	Pastoral Land Area (%)
Pristine	No disturbance	4.7	0
Excellent	Minimal disturbance	33.1	19.3
Good	Moderate disturbance	36.2	47.4
Poor	Significant disturbance	22.8	31.6
Degraded/Fully Cleared	Very high disturbance	3.2	1.7

Farming has affected the condition of the vegetation in the freehold section of the Study Area. Factors affecting the vegetation include clearing, the introduction of weeds, the proliferation of species that are resistant to grazing, and salinity. Recent low intensity, localised fires have also adversely affected vegetation condition in some areas. Vegetation condition in remnants along the freehold section of the Study Area was largely determined by size. The smaller areas were more susceptible to the disturbance factors considered and therefore tended to be more degraded.

Disturbance within the pastoral section of the Study Area was moderate. The main factor affecting vegetation condition is grazing pressure from cattle and introduced fauna.

Cleared areas devoid of native vegetation encompass 16.6% (37,414 ha) of the entire Study Area.

5.2.1.5 Vegetation of Conservation Significance

Vegetation communities may be protected at a National level under the EPBC Act. No communities listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been recorded in the Study Area.

Vegetation communities in WA may be protected at State level by the Minister for the Environment, through listing as a Threatened Ecological Community (TEC) or Priority Ecological Community (PEC), or may be declared as an Environmentally Sensitive Area (ESA).

No TECs or ESAs have been recorded within the Study Area (DEC 2010), however four PECs have been recorded within the Study Area, all of which are categorized as Priority 1 PECs. These are described in Table 5-7.

Priority 1 PECs are poorly-known ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range (DEC 2007).

Table 5-7 PEC recorded within the Study Area

PEC Community	Description
Jack Hills Vegetation Complexes	Banded Iron Formation. Upland Spinifex community with *Acacia cockertoniana*.
Moresby Range Vegetation Association	*Melaleuca megacephala* and *Hakea pycnoneura* thicket on stony slopes, *Verticordia dominated* low heath and *Allocasuarina campestris* and *Melaleuca uncinata* thicket on superficial laterite, on Moresby Range
Tallering Peak Vegetation Complexes	Tallering Peak in the northwest is a massif of banded ironstone and jaspilite, with outcropping masses or rock along the spine. Vegetation is sparse and includes shrubs of only 1.2 m of *Acacia quadrimarginea*, *Acacia coolgardiensis*, *Eremophila leucophylla*, *Thryptomene johnsonii*, a small Baeckea sp. or *Thryptomene* sp. and *Ptilotus obovatus*.
Weld Range Vegetation Complexes	Banded Iron Formation.

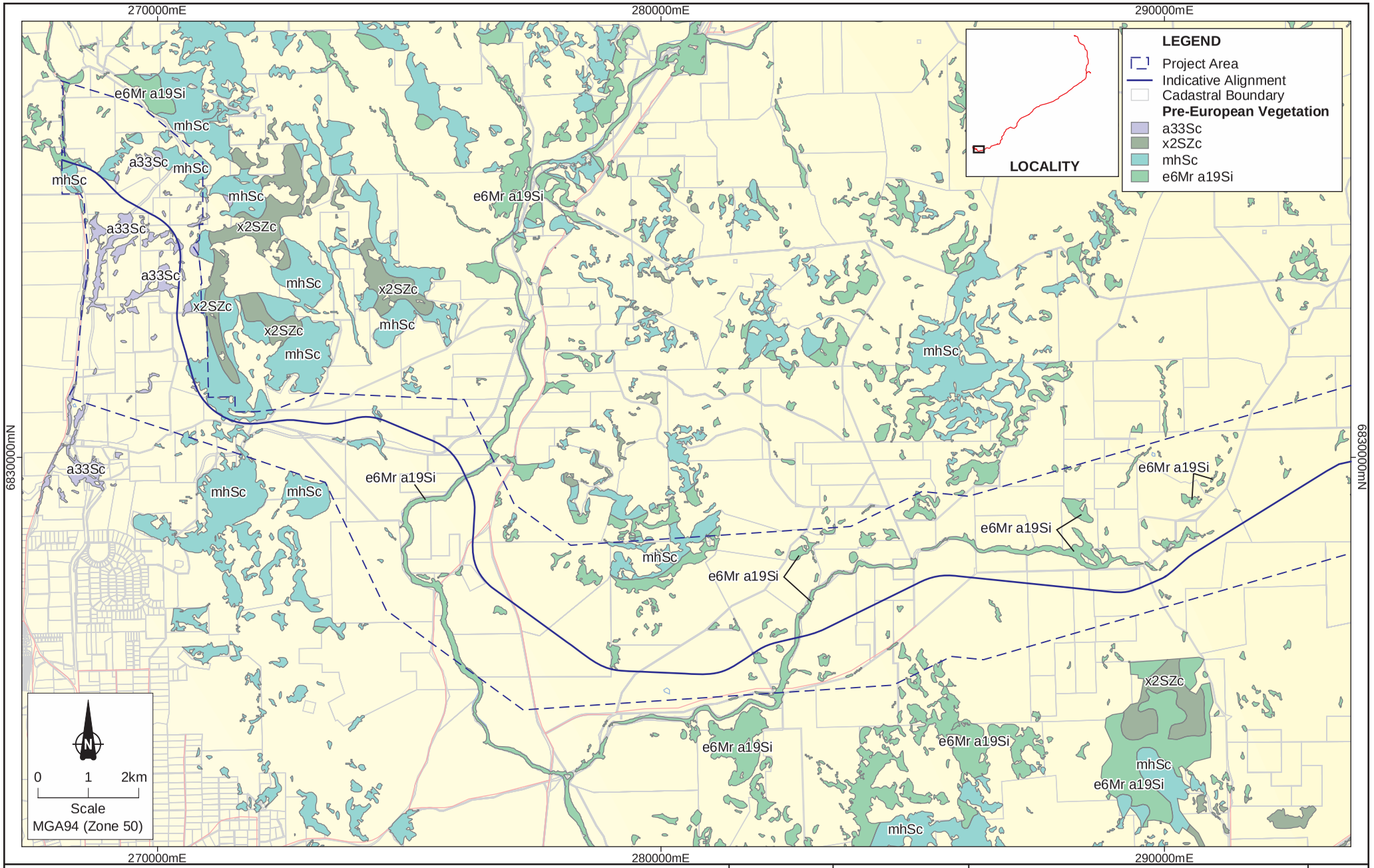
Significant Vegetation Associations

Beard vegetation mapping was used to determine significant vegetation associations. A vegetation association was determined to be significant if less than 30% of the communities' pre-European extent remained. As the freehold area has been extensively cleared and clearing is limited in the pastoral area, only the freehold area contained vegetation associations with less than 30% of their pre-European extent remaining. The freehold area is contained within the boundaries of the Geraldton Sandplains IBRA region.

Table 5-8 Beard vegetation associations within the Study Area with <30% of their pre-European extent remaining

Unit Code	Pre-European extent in WA (ha)	Pre-European extent in IBRA Region (ha)	Current extent remaining in the IBRA region	% of original extent remaining in the IBRA region
a33Sc*	3,478	1,749	370	21.1
acSc*	495,385	118,103	6,422	5
ceLr a9Si*	511,008	1,248	0	0
e6,8Mi	796,448	2,194	117	5.3
e6c5Mr a9,19Si*	56,427	17,554	4,617	26
e6Mr a19Si*	184,571	184,571	31,410	17
e6Mr eaSi*	97,368	96,821	7,470	8
k1, 3Ci	64,719	4,454	1,145	25.7
mhSc*	51,880	51,880	14,221	27
x2SZc*	328,738	328,738	43,126	13
x3SZc*	580,547	507,874	52,364	10.3
x3SZc/acSc*	82,081	82,081	9,276	11

Figure 5-7 Location of significant vegetation associations (1 of 3)



Notes:
Significant Vegetation Associations derived from Pre-European Vegetation
Cadastral Data Supplied by Landgate

OPR oakajee port & rail

Drawn:
CAD Resources

CAD Resources File No:
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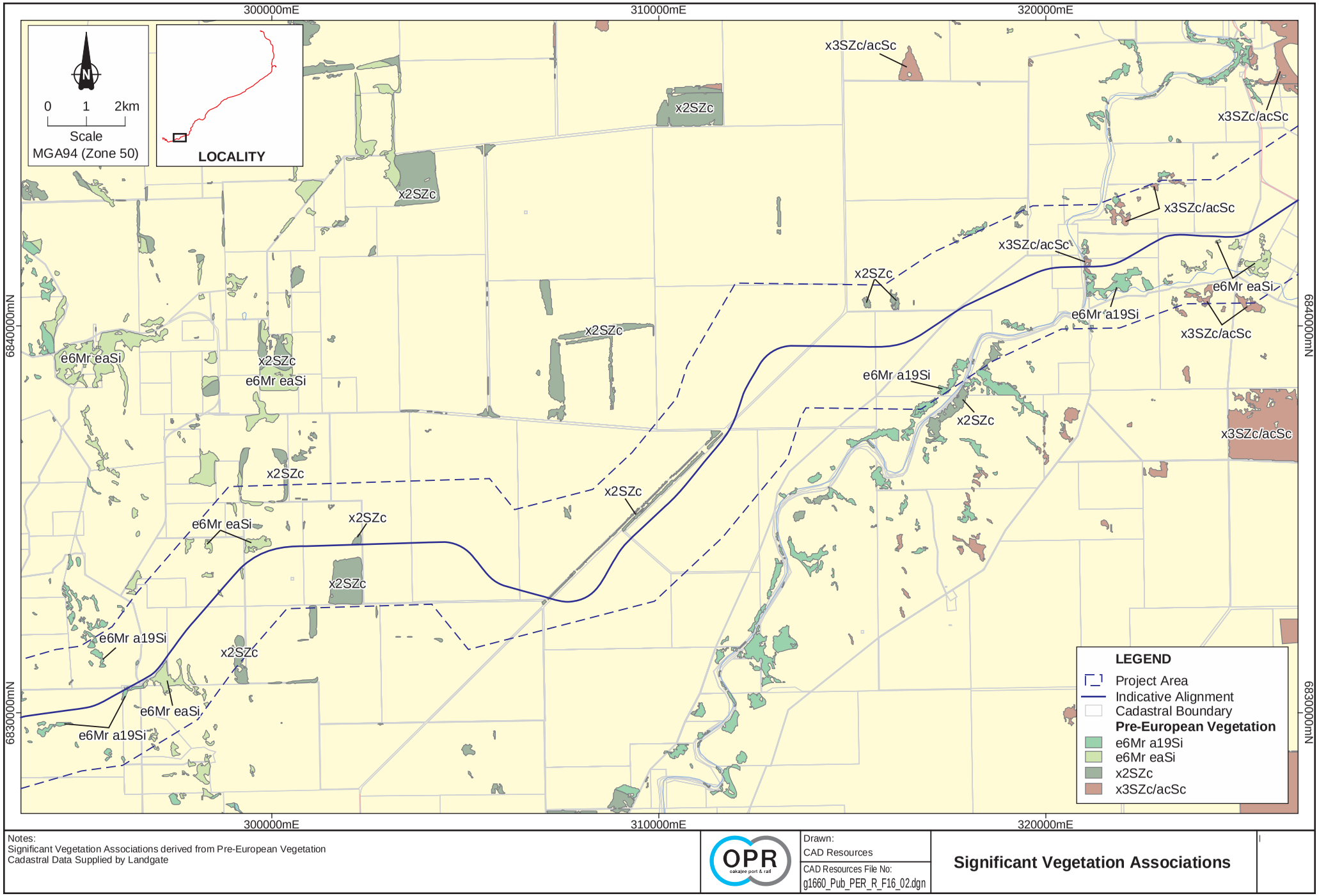
Significant Vegetation Associations



Notes:
Significant Vegetation Associations derived from Pre-European Vegetation
Cadastral Data Supplied by Landgate

OPR oakajee port & rail

Drawn:
CAD Resources

CAD Resources File No:
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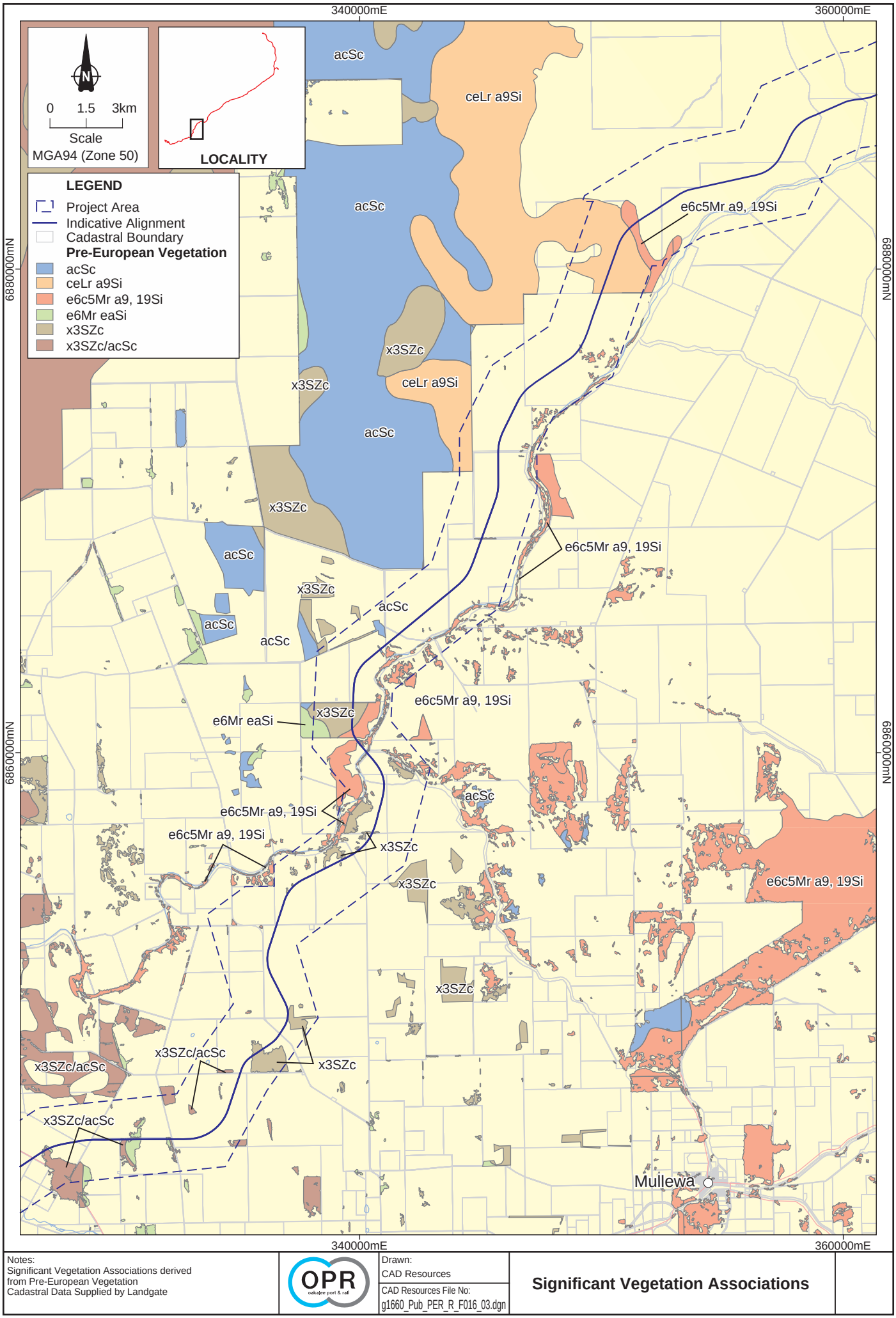
Significant Vegetation Associations

Figure 5-8 Location of significant vegetation associations (2 of 3)



Notes:
Significant Vegetation Associations derived from Pre-European Vegetation
Cadastral Data Supplied by Landgate

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_R_F016_03.dgn

Significant Vegetation Associations

Figure 5-9 Location of significant vegetation associations (3 of 3)

Significant Vegetation Units

Of the vegetation units mapped by Ecologia within the Study Area and surrounds, 23 units have been identified by Ecologia as being of high or very high conservation significance, with a combined area accounting for 7.6% of the Study Area. Significance was assessed using a number of factors, such as extent of the community remaining, association with significant fauna, how restricted the vegetation association is, PEC status, and whether the association contains any Priority flora. The extent of each significant vegetation unit is detailed in Table 5-9 and Figure 5-10 to Figure 5-15 below.

Table 5-9 Extent of significant vegetation units within Study Area

IBRA region	Code	Within Study Area (ha)	% of Study Area covered
Geraldton Sandplains	Gc1	916	0.42
	Gc2	12	0.006
	Gh1	9	0.004
	Gh2	350	0.16
	Gh3	29	0.01
	Gp2	39	0.02
	Gy1	476	0.22
	Gy2	956	0.44
Murchison	Mc3	424	0.20
	Mf1	529	0.24
	Mf2	20	0.009
	Mf3	568	0.26
	Mh1	384	0.18
	Mh2	225	0.10
	Mh3	3,632	1.68
	Mh4	426	0.20
	Mh5	2,069	0.96
	Mh6	71	0.03
	Mh7	94	0.04
	Mh8	750	0.35
	Mh13	526	0.24
	Mh18	103	0.05
Yalgoo	Yf4	63	0.03
	Yh1	928	0.43

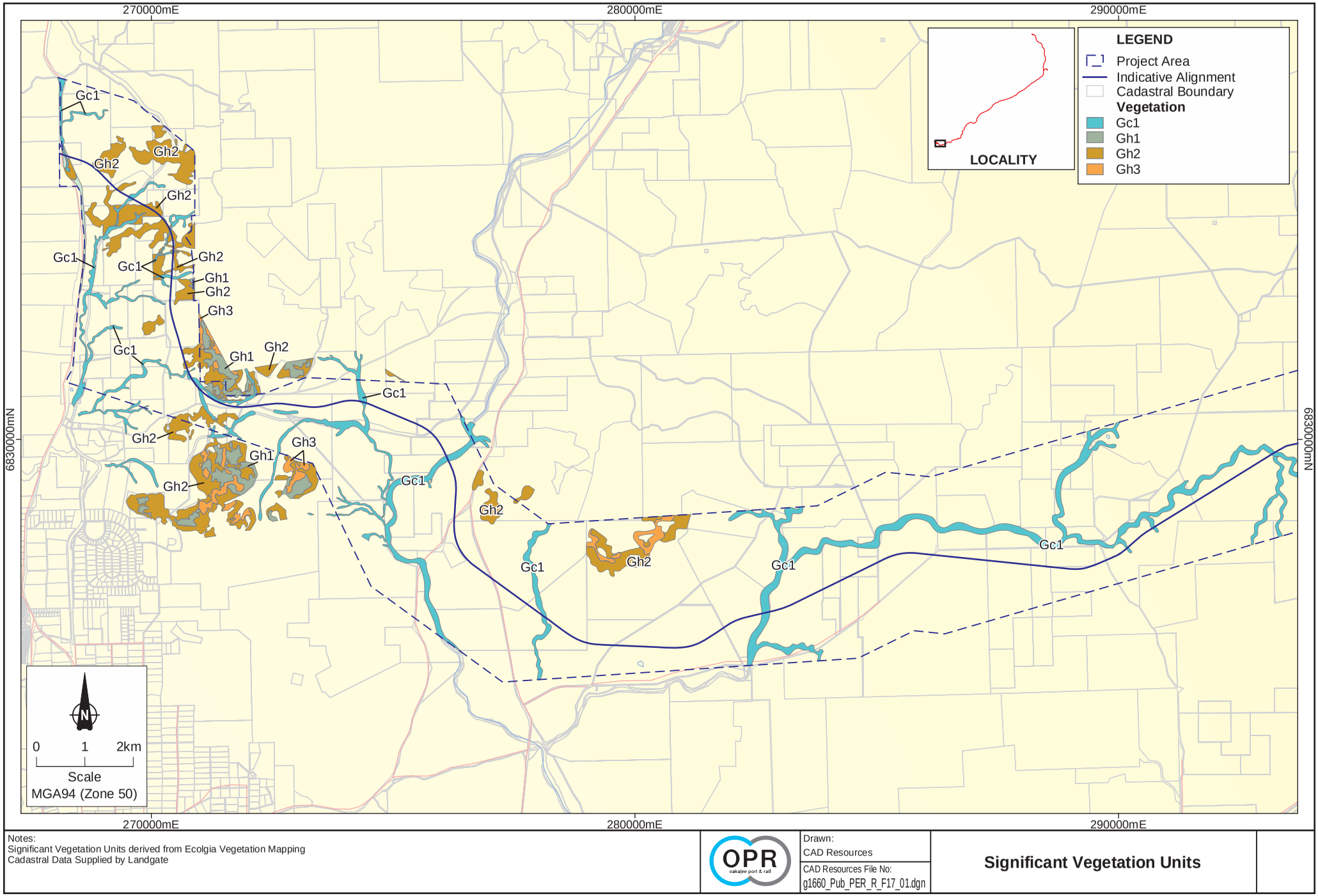


Figure 5-10 Location of significant vegetation units within the Proposal Area (1 of 6)

Notes:
Significant Vegetation Units derived from Ecolgia Vegetation Mapping
Cadastral Data Supplied by Landgate

OPR oakajee port & rail

Drawn:
CAD Resources

CAD Resources File No:
g1660_Pub_PER_R_F17_01.dgn

Significant Vegetation Units

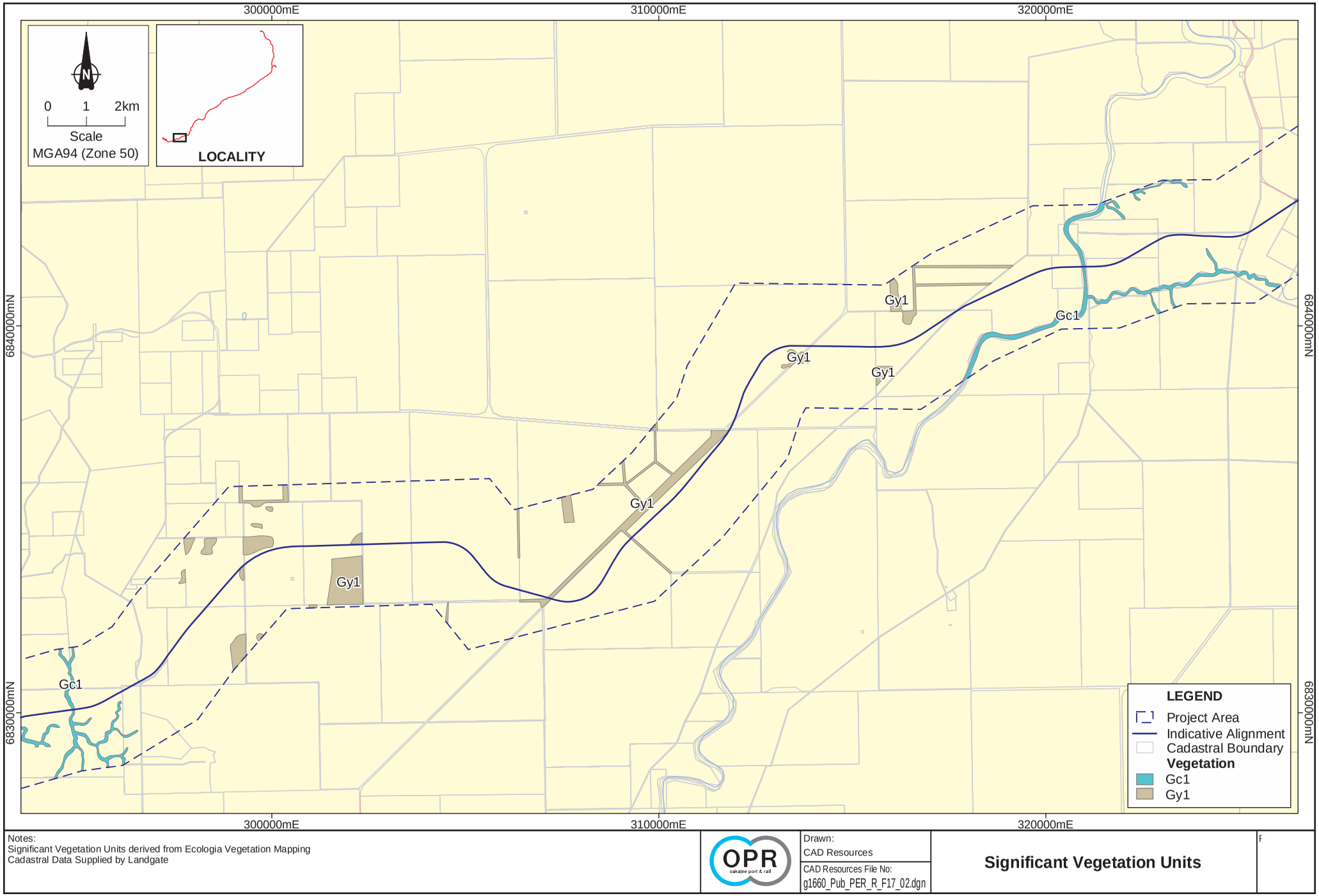


Figure 5-11 Location of significant vegetation units within the Proposal Area (2 of 6)

Notes:
Significant Vegetation Units derived from Ecologia Vegetation Mapping
Cadastral Data Supplied by Landgate

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_R_F17_02.dgn

Significant Vegetation Units

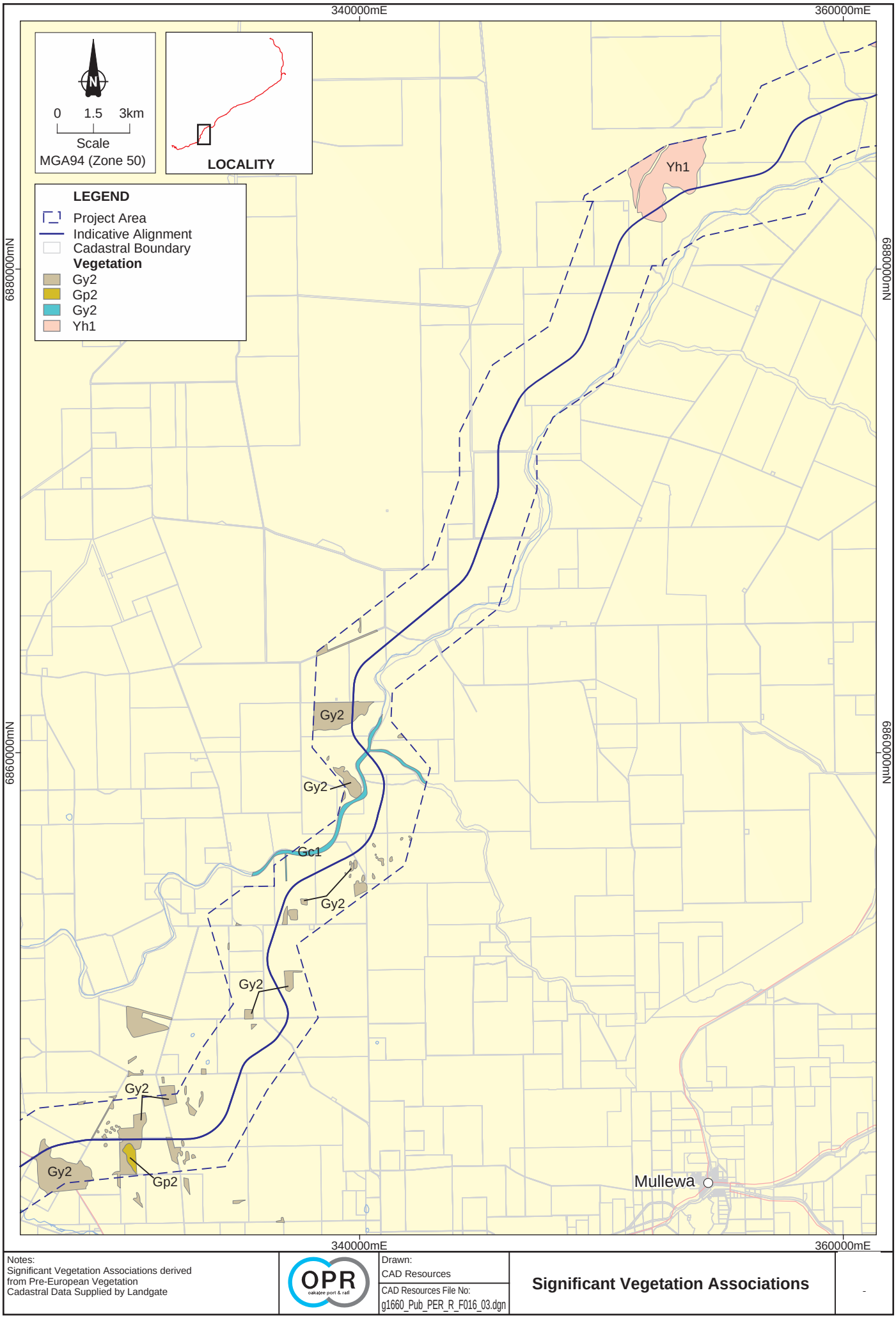


Figure 5-12 Location of significant vegetation units within the Proposal Area (3 of 6)

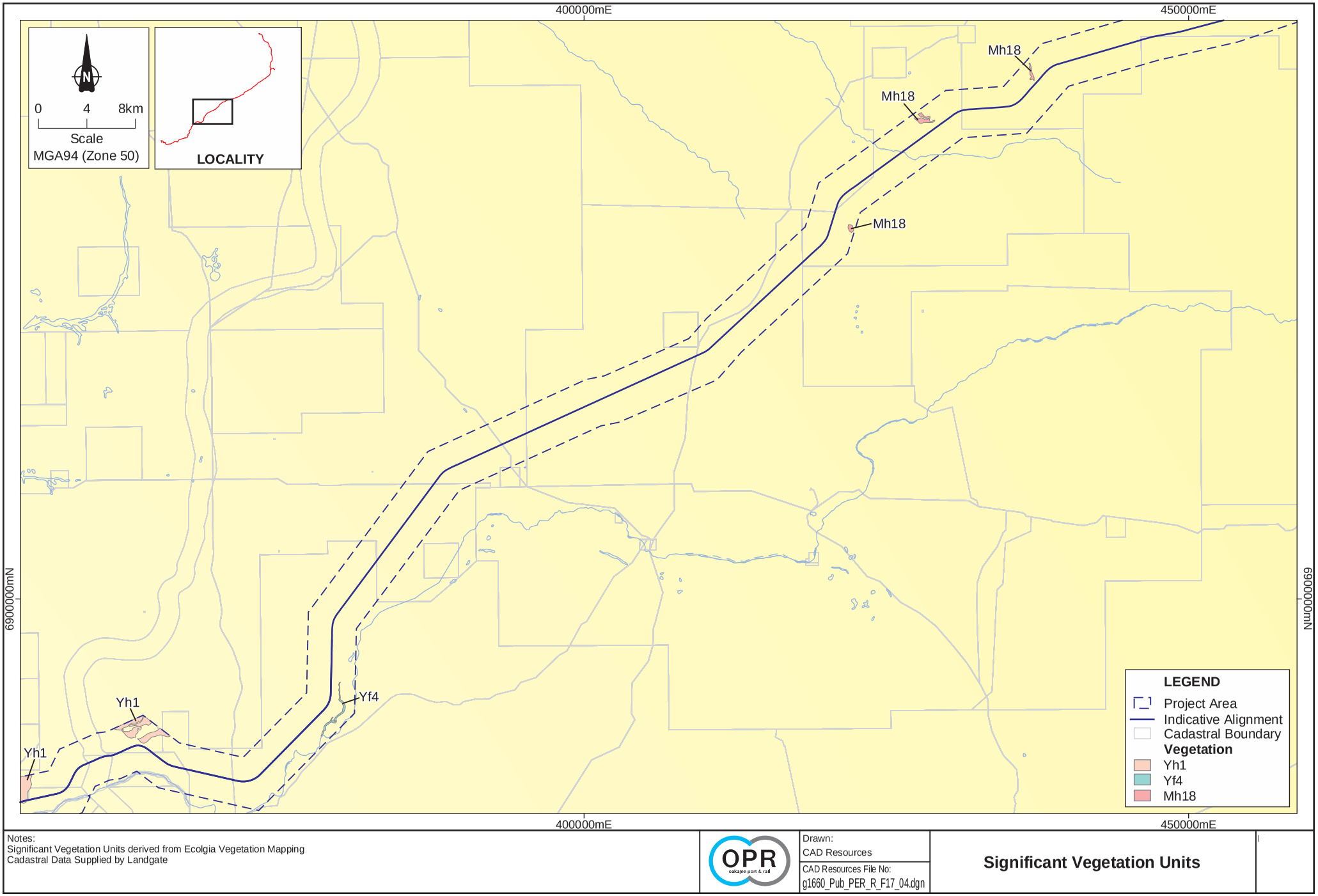
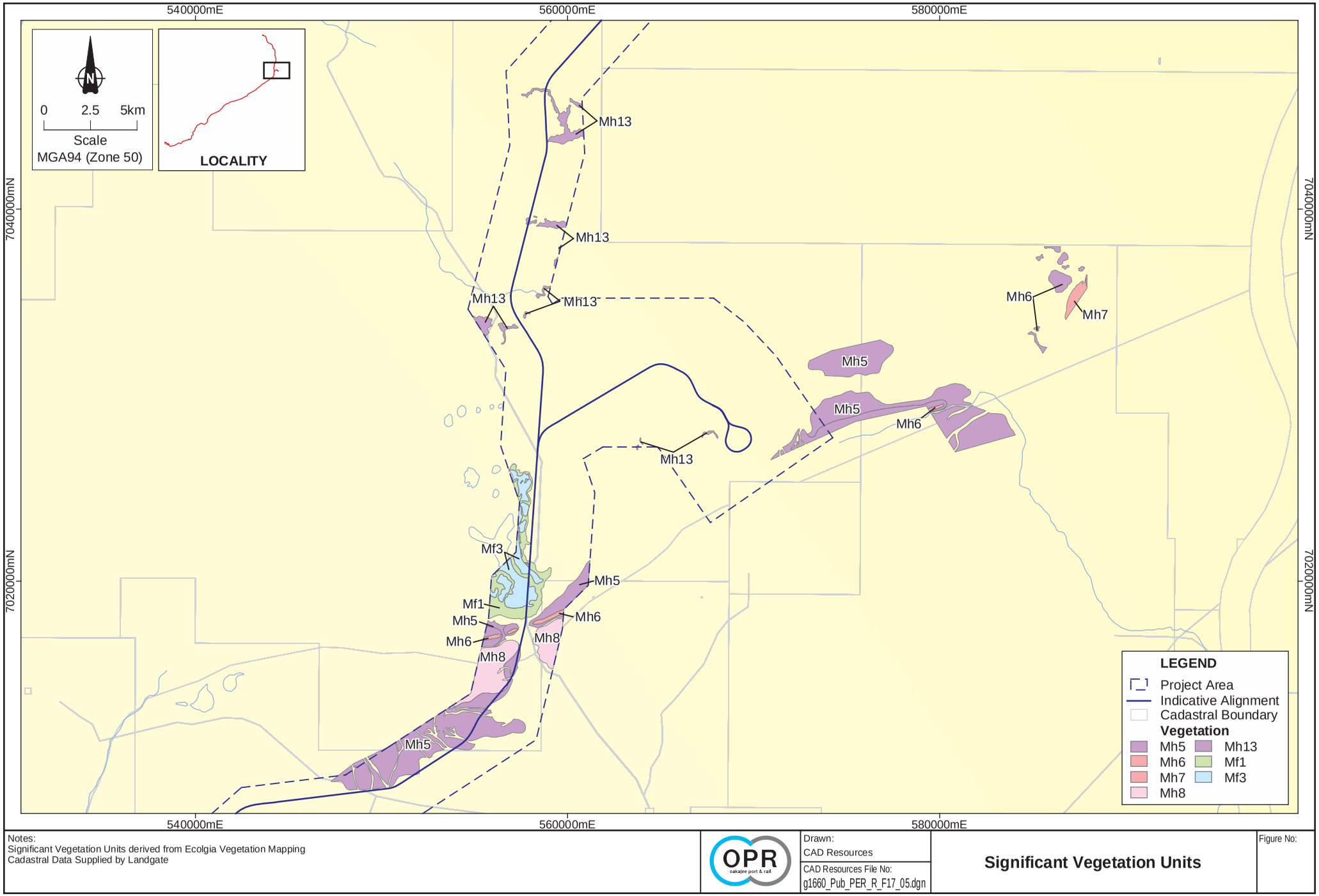


Figure 5-13 Location of significant vegetation units within the Proposal Area (4 of 6)



Notes:
Significant Vegetation Units derived from Ecolgia Vegetation Mapping
Cadastral Data Supplied by Landgate

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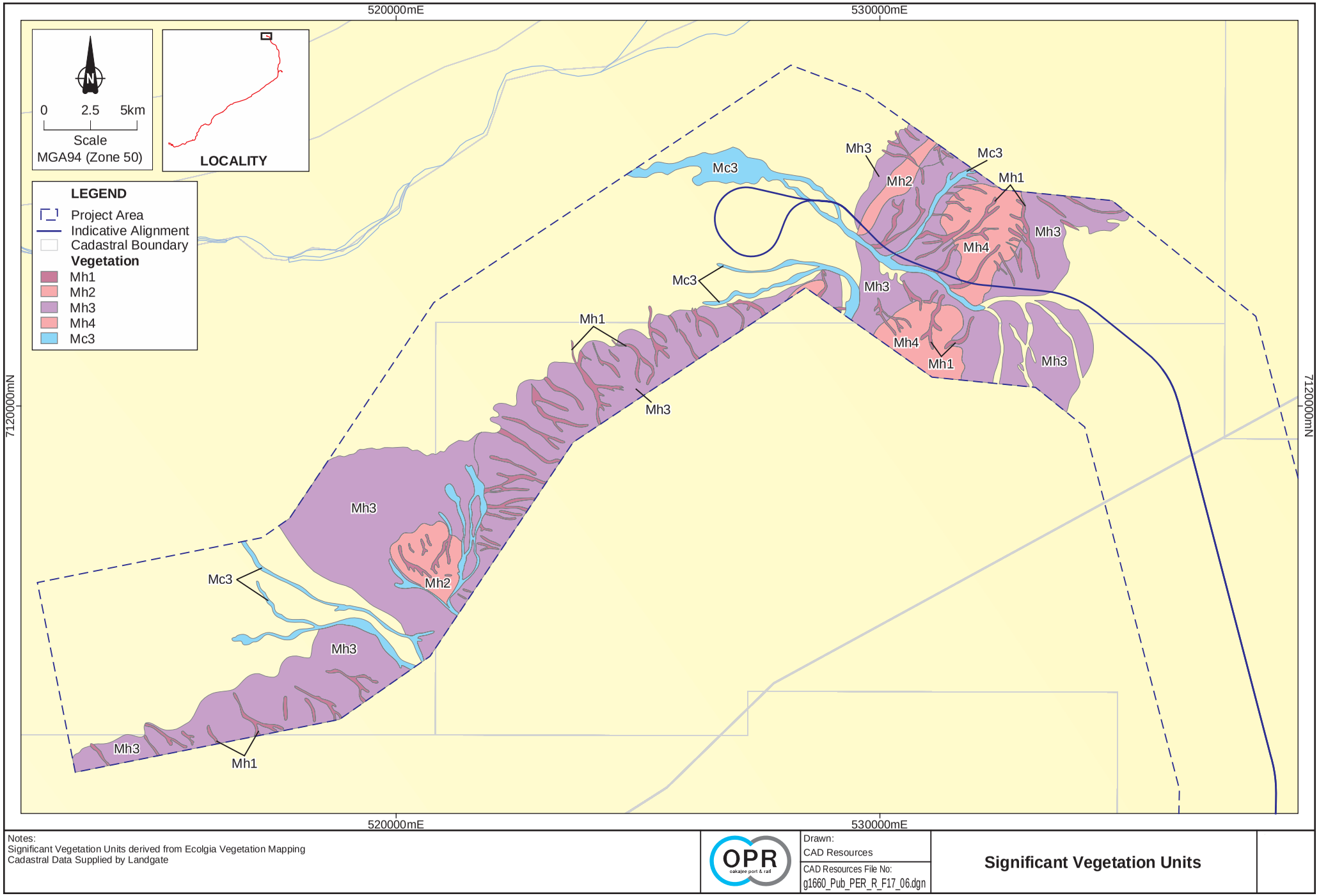
Significant Vegetation Units

Figure No:

Figure 5-14 Location of significant vegetation units within the Proposal Area (5 of 6)



Notes:
Significant Vegetation Units derived from Ecolgia Vegetation Mapping
Cadastral Data Supplied by Landgate

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Significant Vegetation Units

Figure 5-15 Location of significant vegetation units within the Proposal Area (6 of 6)

5.2.1.6 Additional vegetation of interest to the Proposal

Mulga Communities

Mulga (*Acacia aneura*) woodlands are widespread throughout the Murchison IBRA region (Figure 5-16). It should be noted that not all Mulga identified within the Study Area is sheetflow dependant.

Mulga is a bushy shrub or tree ranging in height from 2-10 m, and comprises a range of taxa with considerable variation in growth form and phyllode morphology. Mulga communities may occur in patches in valleys, in sheltered sites associated with hills and breakaways, or in distinctive grove arrangements. Mulga occurs on a variety of soils and in a variety of habitats across the semi-arid shrublands of Australia (Paczkowska and Chapman, 2000).

Mulga has a root system that is adapted for taking up water from thin surface soils and has adaptations that concentrate soil water near the plant and conserve water within the plant.

Salt Lake Vegetation Communities

Vegetation communities Mf1, Mf2 and Mf3 (refer to Section 5.2.1.5) are associated with the dry salt lakes near the Weld Range. These areas are dominated by varying low chenopod shrublands. Figure 5-17 shows the location of these communities.

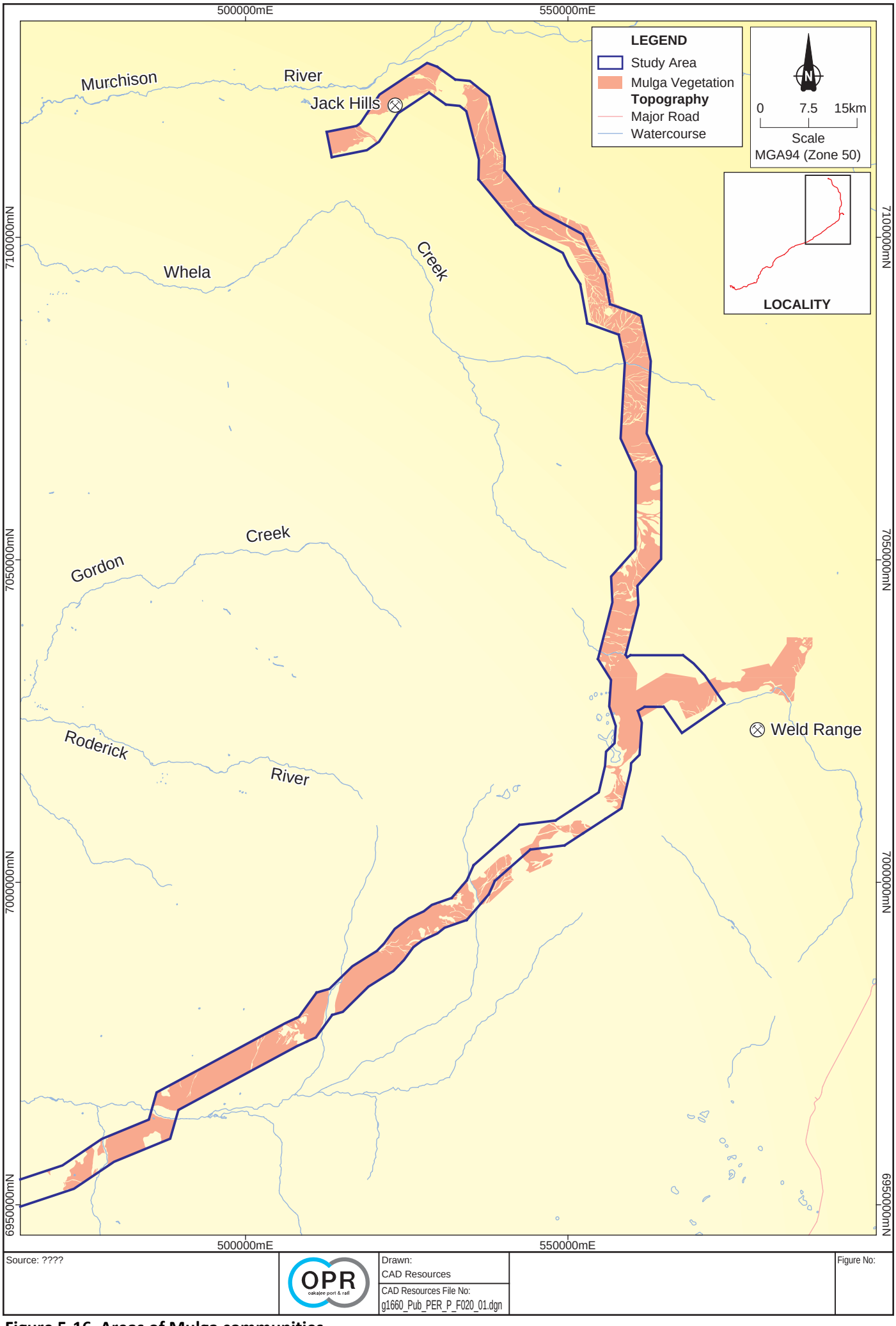
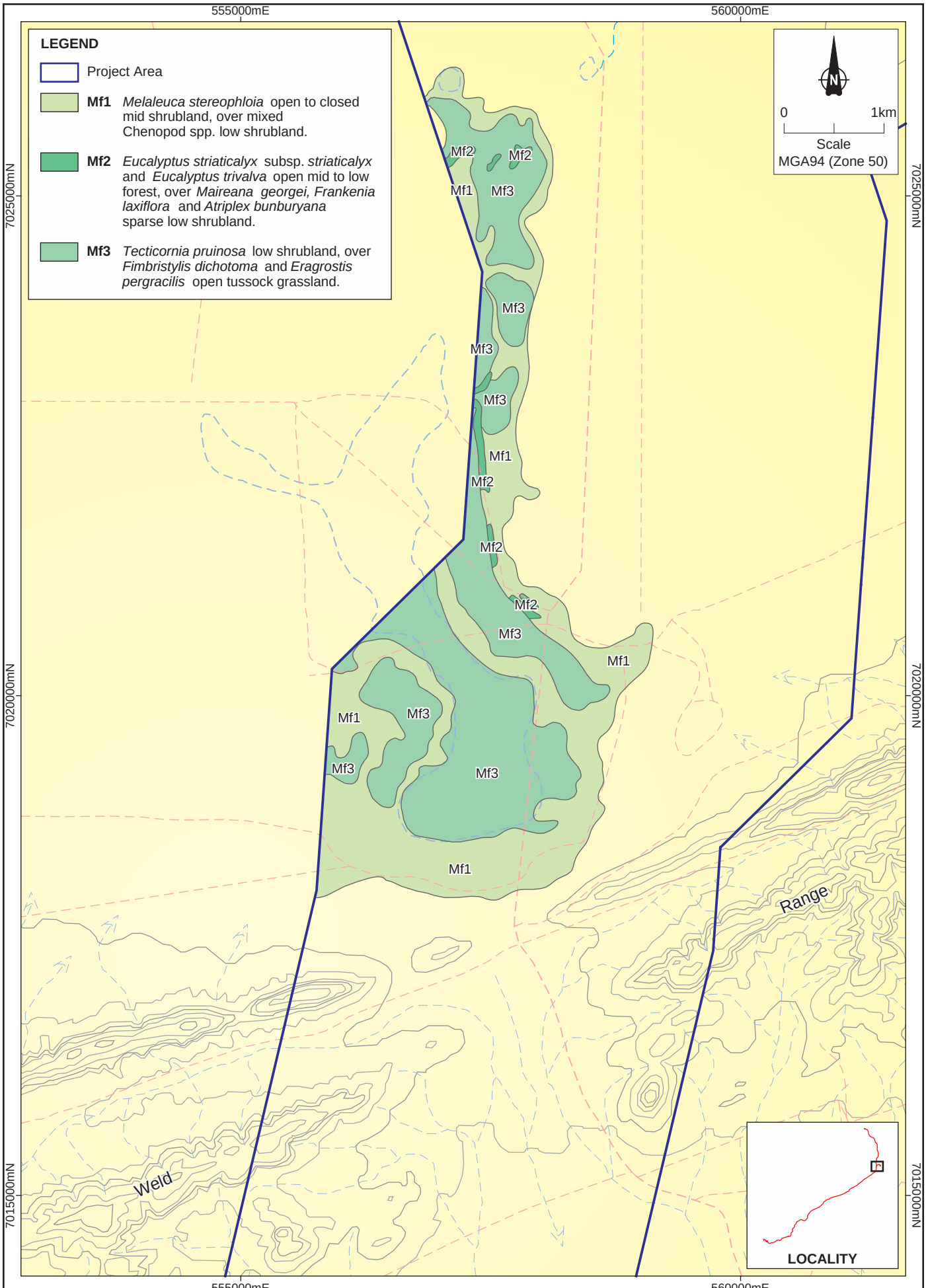


Figure 5-16 Areas of Mulga communities



Note:
Vegetation mapping supplied by Ecologia Environment

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Vegetation Communities Mf1, Mf2 and Mf3

Figure 5-17 Areas of salt lake vegetation communities

5.2.1.7 Flora Recorded within the Study Area

A total of 1015 flora taxa were recorded in the Study Area, including species, subspecies and varieties. 145 of these taxa were recorded from opportunistic collections.

The total diversity of the flora is summarised in Table 5-10. A full species list is available in Appendix 1.

Table 5-10 Flora diversity of the Study Area

Quadrats Surveyed	Taxa Recorded	Families	Genera	Families represented by a single taxon	Genera represented by a single taxon	Annual Taxa	Perennial Taxa
614	1015	84	322	20	182	220 (21.7%)	795 (78.3%)

19 taxa could not be confirmed due to insufficient collection material; however they were included in the total counts because they were the only specimens from either the genus or species recorded during the survey and therefore were likely to be a new species.

60 additional taxa were excluded from the total counts as the specimens could not be identified to species level due to insufficient collection material and were likely to be a species already recorded. Eight of these specimens were identified to family level only and 52 to genus level only.

The diversity of the flora recorded separately in the freehold and pastoral areas during the quadrat and transect surveys is summarised in Table 5-11.

Table 5-11 Flora diversity within the freehold and pastoral land areas.

Land Area Surveyed	Date Surveyed	Quadrats Surveyed	Taxa Recorded	Families	Genera	Annual Taxa	Perennial Taxa
Freehold - Quadrat	Aug 2009	127	515	68	241	123 (23.9%)	392 (76.1%)
Pastoral - Quadrat	Nov 2006, Apr 2007, Jun & May 2009	487	439	61	170	106 (24.2%)	333 (75.8%)
Freehold - Transect	Aug & Sep 2009	-	301	48	124	22 (7.3%)	279 (92.7%)
Pastoral - Transect	Sep 2009	-	171	36	69	32 (18.7%)	139 (81.3%)

The families represented by the greatest number of taxa in the combined species list were the Fabaceae (151 taxa), Myrtaceae (125 taxa), Asteraceae (63 taxa), Poaceae (61 taxa) and Scrophulariaceae (58 taxa). Genera represented by the greatest number of taxa were *Acacia* (87 taxa), *Eremophila* (56 taxa), *Grevillea* (32 taxa), *Eucalyptus* (25 taxa) and *Melaleuca* (21 taxa).

5.2.1.8 Flora of Conservation Significance

EPBC Act

Flora species are protected at a National level under the EPBC Act. The EPBC Act contains a list of species that are considered either 'Critically Endangered', 'Endangered', 'Vulnerable', 'Conservation Dependent', 'Extinct' or 'Extinct in the Wild'. An explanation of conservation categories is in Appendix 1.

Of the ten EPBC Act listed flora that potentially occur within the Study Area (refer to Appendix 1), two were recorded during field surveys; *Caladenia hoffmanii* (Endangered) and *Eucalyptus blaxellii* (Vulnerable) each recorded in two locations within the freehold land

areas. A further species, *Drummondita ericoides (*Endangered*),* was confirmed as occurring in the Study Area using DEC records. The location of these taxa is shown in Figure 5-18, and a description of their biological characteristics and known distribution is provided below.

- ***Caladenia hoffmanii* (ORCHIDACEAE) - Endangered**

C. hoffmanii is a tuberous perennial herb growing from 0.13 m to 0.3 m high. The flowers of this spider orchid are produced from August to October and are green, yellow and red. Long, fine hairs grow along the bracts, leaves and stems. *C. hoffmanii* is generally found growing on clay-loam soils, laterite and granite rocky outcrops, ridges, swamps and gullies (WA Herbarium, 2009).

C. hoffmanii was recorded at two locations in the Freehold section of the Study Area (Figure 5-18).

- ***Eucalyptus blaxellii (MYRTACEAE) - Vulnerable***

Eucalyptus blaxellii is one of four species in the Loxophlebae series of the eucalypts. It is characterised by buds with fully inflexed stamens, geniculate (strongly elbowed) staminal filaments and a style that tapers basally. The leaves are sparsely reticulate, and the adult leaves are glossy green. The fruit is small and obconical in shape. One of the four species within this series is the very common *E. loxophleba. E. blaxellii* is distinguished from *E. loxophleba* by smooth bark and a mallee growth habit (Johnson & Hill, 1992).

Eucalyptus blaxellii was recorded from 143 locations in the freehold section of the Study Area (refer to Section 8).

- ***Drummondita ericoides (RUTACEAE) – Endangered***

Drummondita ericoides is a shrub growing 5 to 20 cm tall on ridges, or from 50 cm to 1 m tall in sheltered gullies. It has scattered simple leaves which are terete, glabrous and approximately 8 mm long. Yellowish-white flowers are green at the tips, with 5 short sepals and 5 erect concave petals. The 10 staminal filaments are united into a narrow hairy tube which protrudes beyond the petals and is white to violet. A crimson style projects beyond the stamens. Flowers are usually solitary and occur at the end of branchlets

Drummondita ericoides is currently known over a range of approximately 20 km, in an area north of Geraldton. It grows amongst low heath on sandstone and laterite slopes, ridges and gullies of the Moresby Range, in brown loam or sandy loam and clay soils. It is associated with *Melaleuca megacephala*, *M. cardiophylla*, *Acacia blakelyi*, *Hakea pycnoneura* and *Gastrolobium spinosum*.

DEC has recorded this species within the Study Area, close to its western boundary (Figure 5-18).

WC Act

Flora of conservation significance in WA is determined under the WC Act. Currently, DRF species are protected under the *Western Australian Wildlife Conservation (Rare Flora) Notice 2008(2)* of the *Wildlife Conservation Act 1950* (WC Act). This notice lists flora taxa that are extant and considered likely to become extinct or rare, defined as “taxa which have been adequately searched for and deemed to be either rare, in danger of extinction, or otherwise in need of special protection in the wild”. These taxa are legally protected and their removal or impact to their surroundings cannot be conducted without Ministerial approval, obtained specifically on each occasion for each population.

Caladenia hoffmanii and *Drummondita ericoides* described above are also listed as DRF under the WC Act and were the only DRF recorded within the Proposal Area boundaries (Figure 5-18). *Eucalyptus blaxellii* has recently been delisted as a DRF species and is now a Priority 4 species due to recent survey results (see below).

Priority Flora

DEC maintains a list of Priority Flora taxa which are considered poorly known, uncommon or under threat but for which there is insufficient justification, based on known distribution and population sizes, for inclusion in the DRF schedule. A Priority Flora taxon is assigned to one of four priority categories depending on their distribution and population status:

- Priority 1: *Poorly Known Taxa*. Taxa, which are known from one or a few (generally <5) populations, which are under threat;
- Priority 2: *Poorly Known Taxa*. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat;
- Priority 3: *Poorly Known Taxa*. Taxa which are known from several populations, at least some of which are not believed to be under immediate threat; and
- Priority 4: *Rare Taxa*. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

55 Priority Flora taxa were recorded in the Study Area during the Ecologia surveys (Table 5-12). Of these, 22 Priority Flora taxa have not been recorded in the Study Area before.

Database searches indicate that 123 Priority Flora occur within a 2 km buffer of the Study Area, or have been recorded in the vicinity of the Study Area, and results of previous searches indicate that an additional 31 Priority Flora not produced by the DEC database searches could potentially occur within the Study Area (Appendix 1).

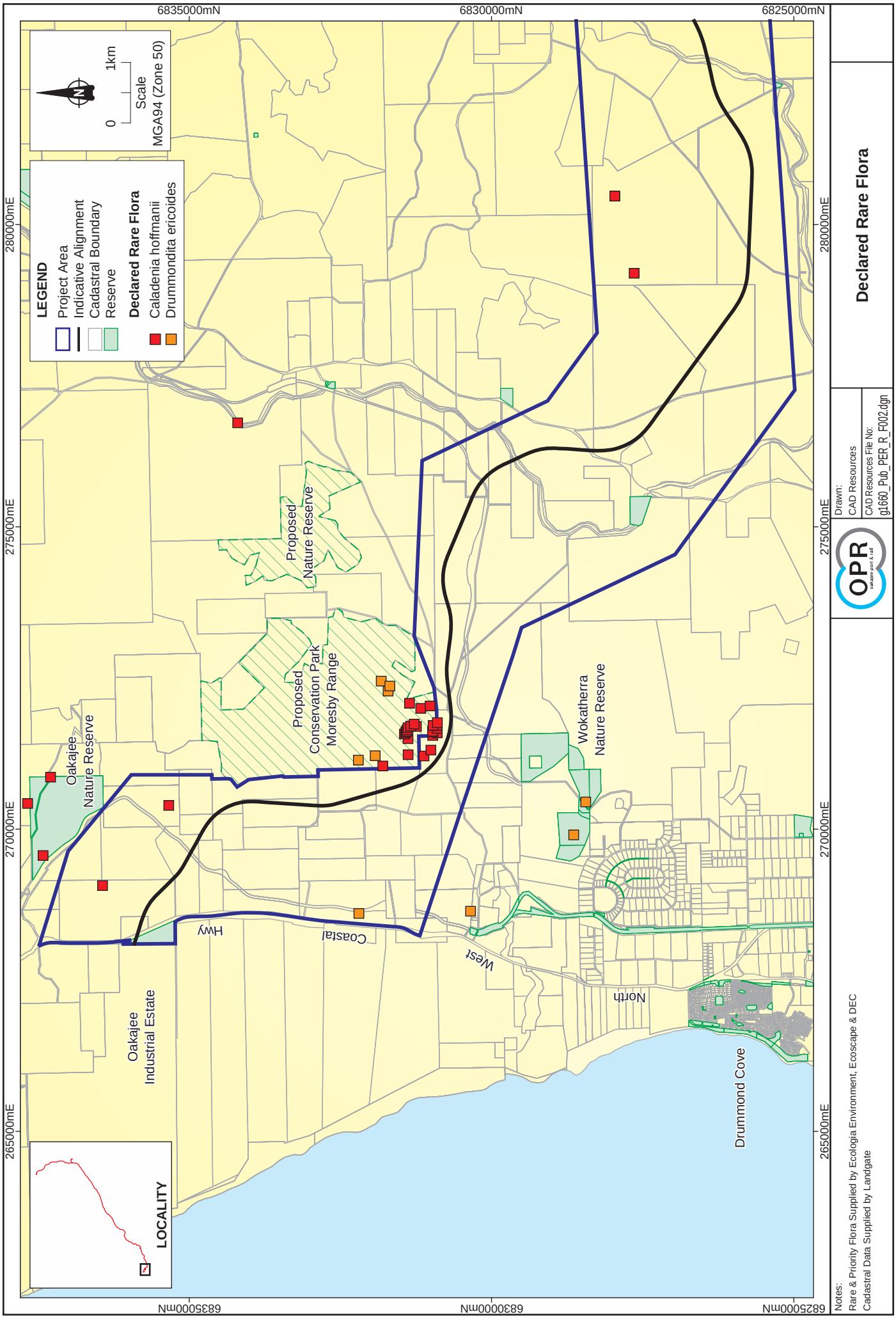


Figure 5-18 Location of DRF recorded within the Proposal area

Table 5-12 Priority flora species recorded in the Study Area

Conservation Code	Family	Species	No. of Locations Recorded	No. of Plants Recorded
Priority 1	Aizoaceae	*Gunniopsis divisa*^	1	1000
	Cyperaceae	*Lepidosperma* sp. Moresby Range (R.J. Cranfield 2751)	28	149
	Euphorbiaceae	*Euphorbia sarcostemmoides*^	67	254
		Sauropus sp. Woolgorong (M. Officer s.n. 10/8/94)^	18	43
	Fabaceae	*Acacia lineolata* subsp. *multilineata*	1	1
		Mirbelia ternata^	3	3
	Myrtaceae	*Chamelaucium* sp. Yalgoo (Y. Chadwick 1816)^	2	3
		Melaleuca huttensis	1	1
		Scholtzia ?sp. Binnu (M.E. Trudgen 2218)^	1	20
		Thryptomene ninghanensis	3	80
	Proteaceae	*Petrophile vana*	16	145
Priority 2	Ericaceae	*Leucopogon borealis*	2	10
		Leucopogon sp. Howatharra (D. & N. McFarland 1046)	7	52
	Frankeniaceae	*Frankenia confusa*^	12	245
	Myrtaceae	*Homalocalyx inerrabundus*	16	151
		Scholtzia sp. East Yuna (A.C. Burns 6)	4	23
		Thryptomene sp. East Yuna (J.W. Green (4639)	4	23
		Thryptomene stenophylla	2	2
Priority 3	Amaranthaceae	*Ptilotus beardii*	52	2272
	Dasypogonaceae	*Acanthocarpus parviflorus*^	6	15
	Fabaceae	*Acacia leptospermoides* subsp. *psammophila*	4	4
		Acacia speckii	101	256
		Acacia subsessilis^	17	48
		Indigofera gilesii subsp. *gilesii*^	1	1
	Lamiaceae	*Dicrastylis linearifolia*	28	274
		Hemigenia tysonii	161	3189
		Hemigenia virescens	117	2306
		Microcorys tenuifolia	5	5
		Prostanthera petrophila	27	151
	Myrtaceae	*Calytrix erosipetala*	10	79
		Calytrix formosa	2	3
		Calytrix uncinata	6	18
		Calytrix verruculosa	68	860
		Homalocalyx echinulatus	13	187
		Thryptomene sp. Moresby Range (A.S. George 14873)	18	334
		Verticordia chrysostachys var. *pallida*	4	5
		Verticordia densiflora var. *roseostella*	3	7
		Verticordia jamiesonii	9	31
	Proteaceae	*Grevillea stenostachya*	132	235
		Grevillea triloba	139	2444
		Petrophile pauciflora	16	64
	Rhamnaceae	*Blackallia nudiflora*	1	22

Conservation Code	Family	Species	No. of Locations Recorded	No. of Plants Recorded
		Serichonus gracilipes	6	11
	Rutaceae	*Geleznowia verrucosa* subsp. Kalbarri (L.M. Broadhurst123)	1	1
	Sapindaceae	*Dodonaea amplisemina*	27	106
	Scrophulariaceae	Eremophila arachnoides subsp. arachnoides^	1	1
		Eremophila muelleriana	195	560
Priority 4	Fabaceae	*Acacia guinetii*	33	121
		Jacksonia velutina	1	1
	Goodeniaceae	*Goodenia berringbinensis*	3	70
	Myrtaceae	*Baeckea* sp. Melita Station (H. Pringle 2738) ^	13	75
		Verticordia capillaris	71	197
		Verticordia penicillaris	104	2698
	Orchidaceae	*Diuris recurva*	3	5
	Proteaceae	*Grevillea inconspicua*	3	3

Note ^ = not recorded in the Study Area by the database searches

The total abundance and number of occurrences of each species was estimated by examining the collections notes of DEC records, combined with the data from surveys by Ecologia (Ecologia, 2010a) and Ecoscape, for which accurate plant counts were available.

DEC records vary considerably in the amount of detail available, ranging from accurate counts or broad abundance descriptions, to no detail of abundance. Therefore the following assumptions were made:

- where multiple records at the same location were available, the highest numeric estimate was utilised;
- where only descriptions of abundance or cover were available, numbers were inferred according to Table 5-13; and
- where no estimate of abundance was available, it was assumed only one plant was present. This is likely to be an underestimate in many instances, and hence the final estimates of total abundance of each species are likely to be conservative.

Table 5-13 Assumptions of number of plants

Abundance Description or % Cover	No. of Plants Assumed
No indication	1
Very rare	1
Several	3
Infrequent, uncommon, scarce, one small group, a few scattered	5
Occasional, moderately common, locally frequent, very localised	10
Common here, locally common, locally frequent, locally abundant	20
Frequent, common, plentiful, abundant, dominant	50
<2% cover	5
2-10% cover	10
10-30% cover	20

The final total of all Priority flora species (including DEC and Ecologia recorded species) is 87 species.

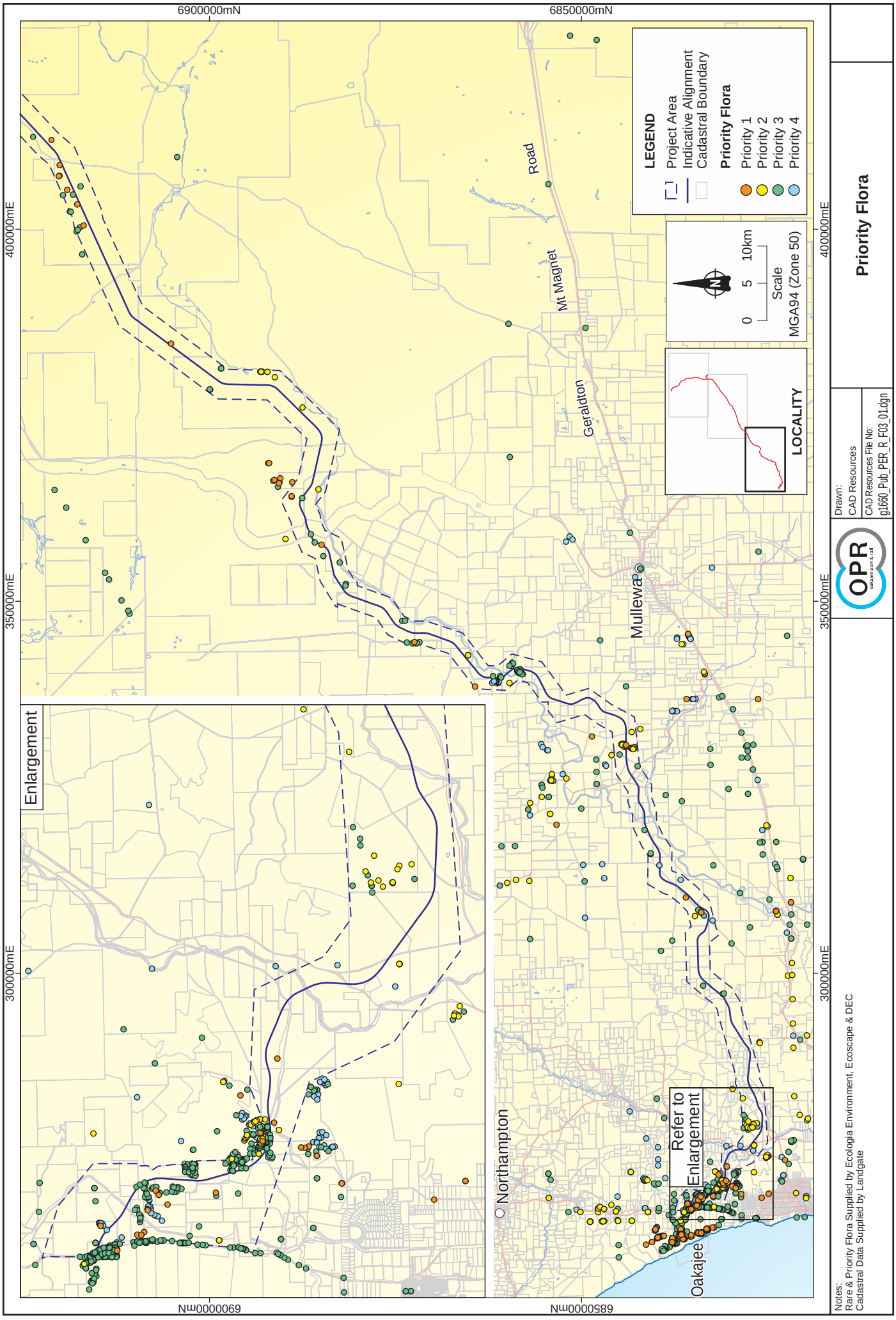


Figure 5-19 Location of Priority Flora within the Study Area (1 of 3)

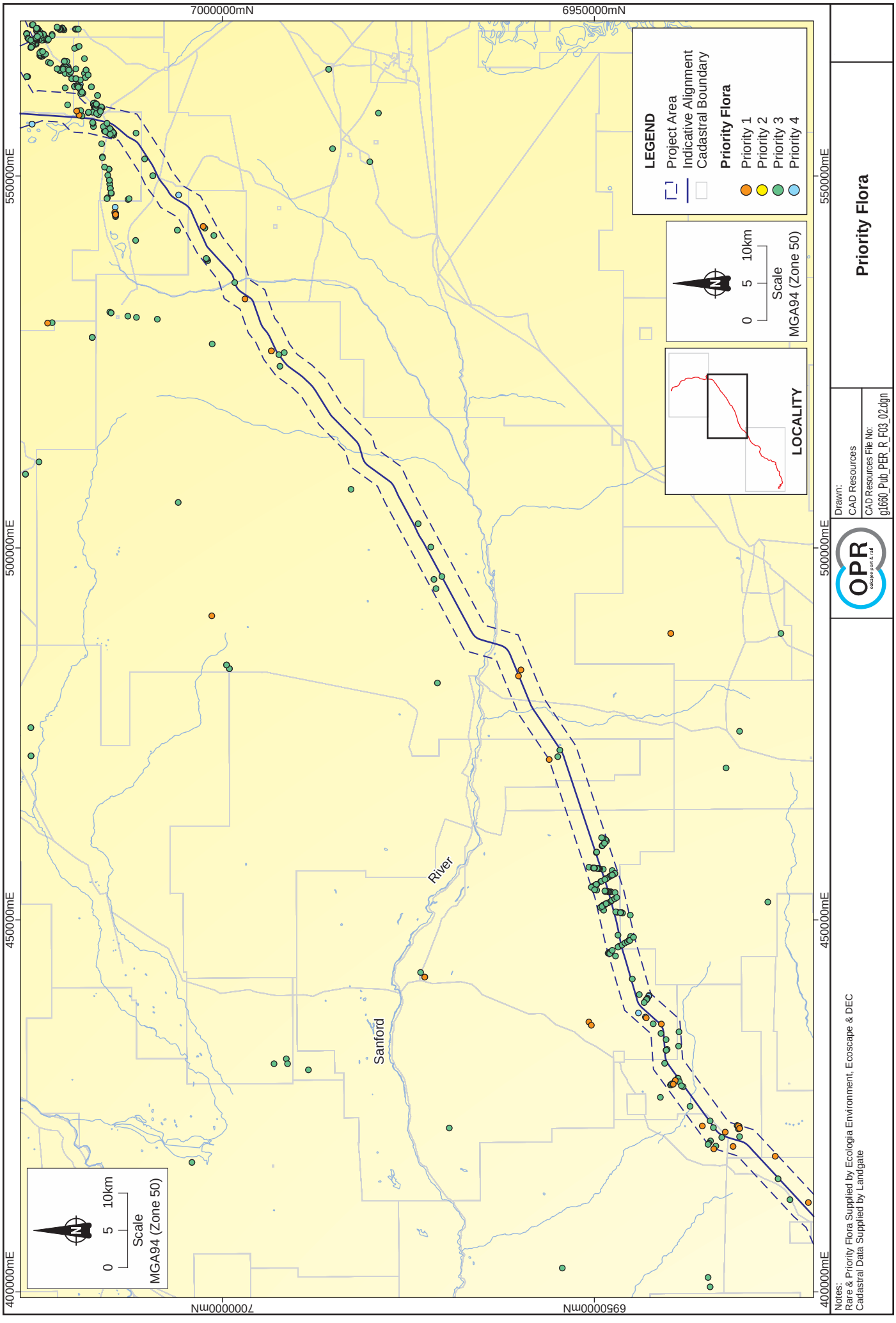
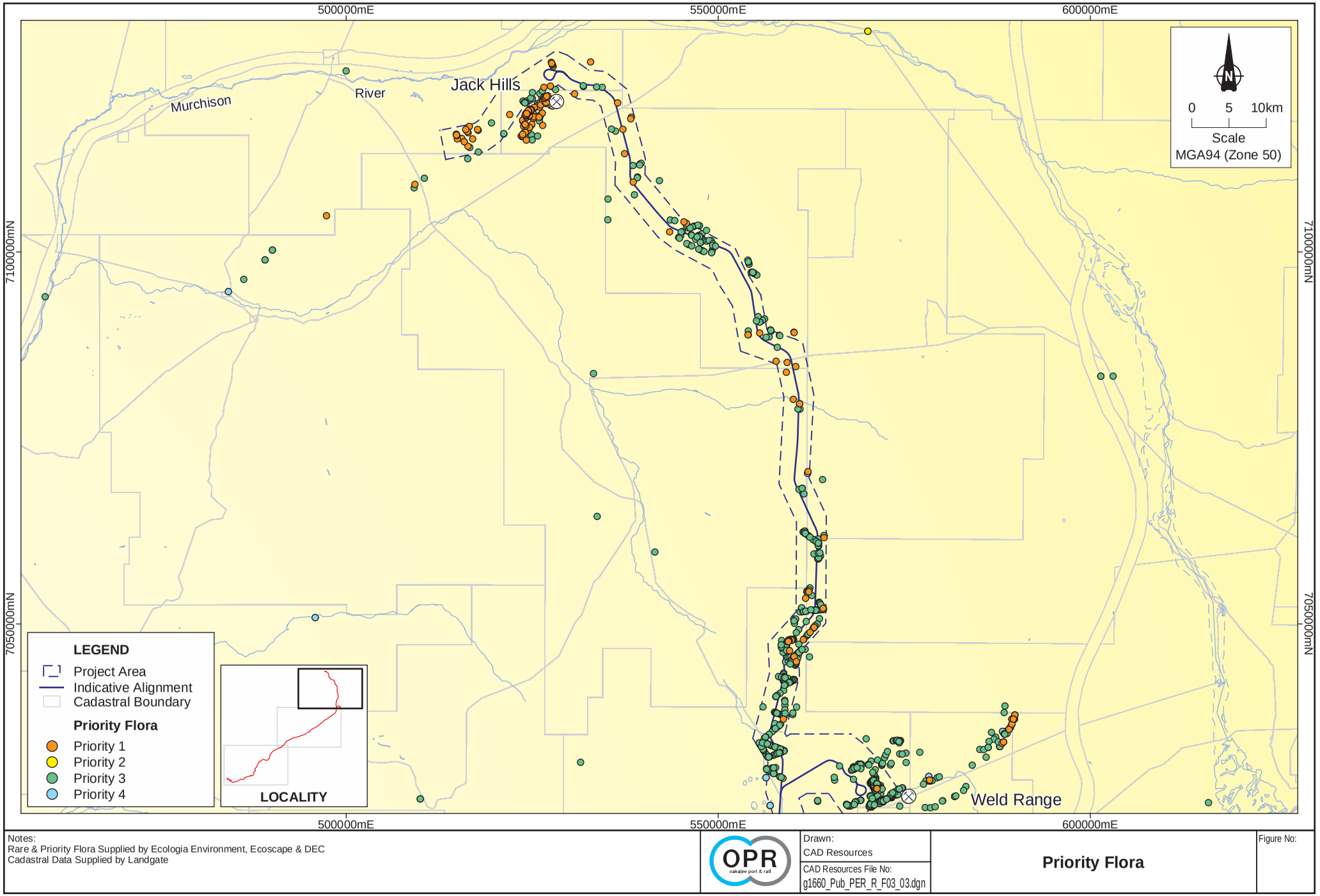


Figure 5-20 Location of Priority Flora within the Study Area (2 of 3)

Figure 5-21 Location of Priority Flora within the Study Area (3 of 3)



The location of the Priority flora within the Study Area is shown in Figure 5-19 to Figure 5-21. The biological characteristics, known distributions and photographs (where available) of the Priority Flora recorded are detailed in Appendix 1.

Other Flora of Interest

Two species of interest; Acacia aff. *rhodophloia* and *Philotheca* sp. nov. (aff. *tubiflora*), were recorded within the Study Area and are summarised below:

- *Acacia* aff. *rhodophloia* is similar to *Acacia rhodophloia*, but has been poorly collected previously and appears to represent a unique taxon (B Maslin 2009, pers. comm). Further work is required to fully determine the taxonomic status of this apparently undescribed species. Flowering and fruiting material is needed to fully describe the taxon; and
- *Philotheca* sp. nov. (aff. *tubiflora)* was found on lateritic and granite breakaways north of Weld Range. It resembles *Philotheca tubiflora*, a shrubby species that is restricted to the Laverton area; however the leaves differ in that they are semi-circular and much bigger. As no flowers or fruits were on the specimens collected, the species could not be fully described.

Flora Taxa Range Extensions

Based on records lodged at the WA Herbarium (WA Herbarium, 2009), 29 species identified within the Study Area represent range extensions for the species. These are listed in Appendix 1.

5.2.1.9 Introduced Flora

62 introduced flora taxa (weeds) were recorded within the Study Area at 466 locations. Weeds were more prevalent within the freehold land area (51 weed species recorded from 423 locations) than the pastoral area (15 weed species recorded from 43 locations). Four of these species were recorded in both the pastoral and the freehold area. The location of introduced species within the Study Area is shown in Figure 5-22, and the full list of weed species recorded can be found in Appendix 1.

No weeds of National significance were found within the Study Area.

Three Declared Plants listed under the WA *Agriculture and Related Resources Protection Act 1976 (*ARRP Act) were recorded during the survey; *Carthamus lanatus*, *Echium plantagineum* and *Emex australis,* which are summarised below. Indicative locations are shown in Figure 5-22, with detailed locations provided in Appendix 1.

Carthamus lanatus (Saffron Thistle) is an erect, spiny annual growing originating from southern Europe, which is now distributed in WA from the south coast to Geraldton, and inland to Kalgoorlie (Hussey *et al.*, 2007). *Carthamus lanatus* is listed as a Priority 1 Declared Plant in WA, which prohibits the movement of plants or their seeds within the State, and is also listed as a Priority 4 weed in the Murchison region. This species was recorded twice in the Pastoral land area and once in the Freehold land area.

Echium plantagineum (Paterson's Curse) is an erect, bristly annual, growing to 0.1 m to 0.6 m in height (WA Herbarium 2009), and also originating from southern Europe. It is widely distributed throughout agricultural land in south-west Australia particularly in the Geraldton Sandplains, Avon Wheatbelt and Swan Coastal Plain Bioregions (Hussey *et al*., 2007). *Echium plantagineum* is listed as a Priority 1 Declared Plant in WA, and is listed as a Priority 3 and

Priority 4 weed in the wheatbelt. This species was recorded at seven locations in the freehold land area only.

Emex australis (Doublegee) is a hairless, prostrate annual plant, growing to 0.1 m to 0.6 m in height (WA Herbarium 2009), and originating from South Africa. It is now widely distributed throughout agricultural and waste land in south-west Australia particularly in the Geraldton Sandplains and Avon Wheatbelt (Hussey *et al*., 2007; WA Herbarium 2009). *Emex australis* is listed as a Priority 1 Declared Plant in certain regions in the south west of WA, and is also listed as a Priority 3 and Priority 4 weed (DAF, 2009). This species was recorded at seven locations in the freehold land area only.

5.2.1.10 Summary of vegetation and flora

- 25% of the corridor occurs in the freehold area and the remaining 75% is in the pastoral area as mapped by Shephard *et al*, (2002);
- The Study Area extends into three local Government districts within the freehold area, and the extent of remnant vegetation remaining within the respective districts is as follows:
  - Chapman Valley – 10.6%;
  - Greenough (former) – 15.7%; and
  - Mullewa – 7.2%.
- Within the pastoral area the original extent of native vegetation largely remains, however, the structure and floristic composition has been substantially altered since European settlement through grazing by introduced animals such as sheep, cattle, goats and rabbits, and changed fire regimes (Shephard et al, 2002);
- The flora of the Study Area is diverse, with approximately 830 recorded vascular species;
- The Study Area contains a high proportion of rare and endemic plants that have been recorded from the Murchison, Geraldton Sandplains and Yalgoo bioregions;
- Mulga (Acacia aneura) and Cotton bush (Ptilotus obovatus) are the most common perennials (Curry et al., 1994) and arid shrub-lands make up the considerable majority of vegetation types encountered in the region; and
- The Study Area contains:
  - 26 vegetation units (Beard, 1976);
  - 72 vegetation associations (Ecologia 2010a);
  - No TECs (nationally listed);
  - No TECs or ESAs (WA);
  - four PECs (WA);
  - three EPBC listed flora species;
  - two DRF species;
  - 87 Priority flora taxa; and
  - 62 weed species, including three Declared Plant species.

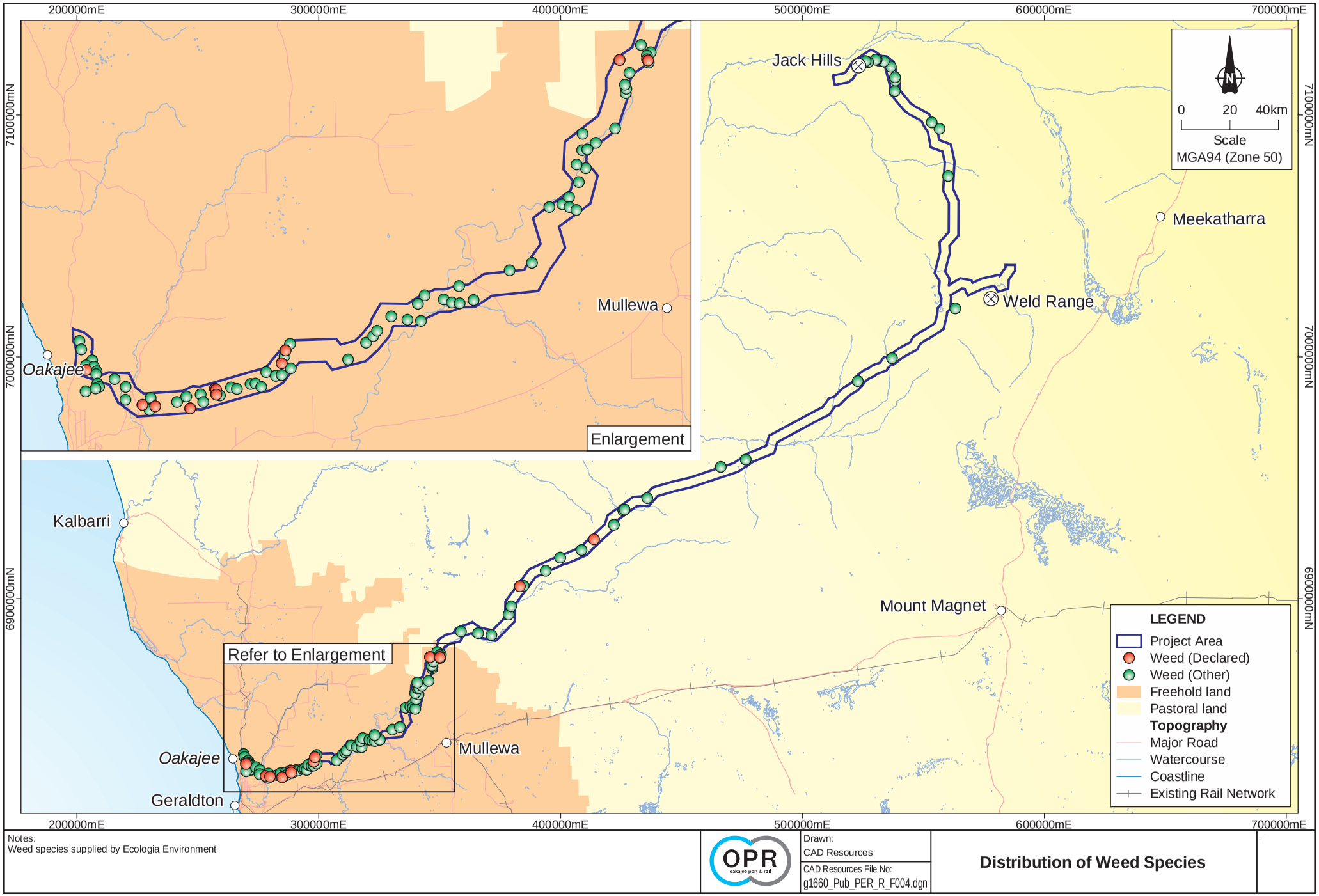


Figure 5-22 Location of weed species within the Study area

5.2.2 Fauna

Fauna surveys were conducted to satisfy the requirements of EPA Guidance Statement No. 56 and Position Statement No. 3. The surveys aimed to provide:

- a review of background information (including literature and database searches);
- an inventory of vertebrate fauna species occurring in the Study Area, incorporating recent published and unpublished records;
- an inventory of species of biological and conservation significance recorded or likely to occur within the Study Area and surrounds;
- a description of fauna habitats occurring in the Study Area;
- a description of the characteristics of the faunal assemblage;
- an appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area that is relevant to the current study; and
- a review of regional and biogeographical significance, including the conservation status of species recorded.

5.2.2.1 Vertebrate Fauna Survey

A review of EPA Guidance Statement No. 56 showed that based on the level of disturbance, a two-phase Level 2 survey was recommended. Level 2 two-season trapping survey was carried out for the main line (Sections OPR-A – OPR-F, OPR-MD, and OPR-WR). Level 1 surveys were determined to be sufficient for areas that had been previously extensively surveyed, which included the OPR-MD section, and the Weld Range spur.

During surveys priority was given to searching for evidence of Scheduled or Priority species under the WC Act, and species listed under the EPBC Act. A species listed as 'Endangered" under the EPBC Act (the black form of *Egernia stokesii badia*) was identified during the Level 2 survey and a targeted survey for this species was consequently conducted during March, September and November 2009 (Ecologia, 2009d; Appendix 2, and Ecologia, 2009e; Appendix 6). A regional survey was also conducted in May 2010 to determine the current extent of the black form of *Egernia stokesii badia.* This distribution results is shown in Figure 8-3.

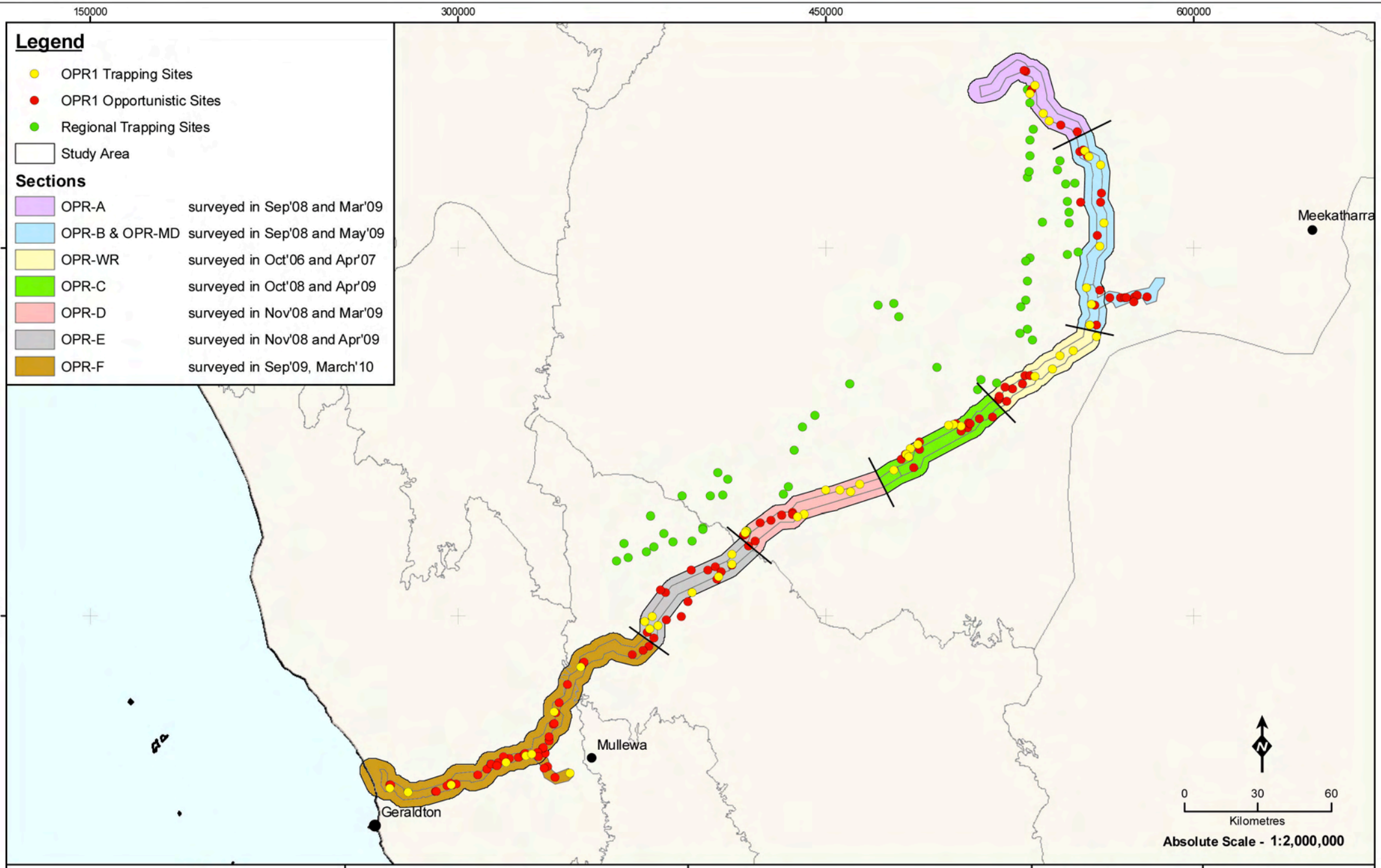
Several surveys of previous rail alignment options situated approximately 10 – 80 km west of the current alignment, were carried out by Ecologia in spring 2006, autumn 2007, and spring 2007. The results from 57 trapping locations and numerous opportunistic sites from these previous alignments were incorporated in the analysis of survey data to enhance the regional context.

Vertebrate Fauna Survey Site Selection

Selection of trapping sites was based on a review of the land systems and soil-landscapes present within the Study Area and an on-ground reconnaissance of the fauna habitats present. Survey sites (both trapping and opportunistic) were placed in 87% of all land systems and soil-landscapes present within the Study Area, with trapping sites placed in 80% of all major (i.e. that comprised over 1.5% of the Study Area) land systems and soil-landscape areas.

The survey sections and the resultant sampling sites are shown in Figure 5-23. Site descriptions and additional information is provided in Appendix 2.

Figure 5-23 Fauna survey sections and sampling locations



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Location of Study Area
Survey Sections and Sites

Figure: 3.2
Project ID: 1126

Drawn: AH
Date: 26/10/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A025

A4

Vertebrate Fauna Survey Methodology

Four fauna databases (DEWHA Protected Matters, DEC Threatened and Priority Fauna, DEC NatureMap and Birds Australia Birdata) and 15 previous publications (see Appendix 2) were consulted to determine the fauna species (in particular conservation significant species) likely to occur within the Study Area. Based on the results, species lists were prepared and areas to be surveyed targeted.

The survey was undertaken using a variety of sampling techniques, both systematic and opportunistic. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between sites. The systematic sampling included traps, avifauna surveys and bat echolocation recordings.

Eight trapping sites were established in five Rail Corridor sections (OPR-B & OPR-MD, OPR-C, OPR-D, OPR-E, and OPR-F). Four trapping sites were established in OPR-A and five trapping sites were established in OPR-WR, giving a total of 49 trapping sites.

Opportunistic sampling includes data collected non-systematically from both fixed sampling sites and as opportunistic records from chance encounters with fauna. Opportunistic sampling methods included nocturnal searching (transects and ground searches), diurnal searching (e.g. beneath bark and stones, investigating burrows etc.), and opportunistic sightings (including tracks, scats nests etc). All opportunistic surveys were conducted in areas containing fauna habitats not sampled by trapping sites and areas that were considered prospective for conservation significant fauna. Up to 16 opportunistic surveys were carried out within each section of a potential Rail Corridor.

Targeted surveying to determine the presence of Conservation Significant Fauna was also carried out on the basis of habitats observed during surveying. Specific searches were undertaken, using both systematic and opportunistic survey methodology, for Malleefowl, Western Spiny-tailed Skink, Slender-billed Thornbill, Rufous Fieldwren, Southern Heathwren, Bush-stone curlew, and *Lerista eupoda.*

All site locations, including trapping and opportunistic sites, plus regional trapping locations, are mapped in Figure 5-23.

The level of survey adequacy was estimated using Species Accumulation Curves. An examination of the Species Accumulation Curves generated from the trapping data indicates that the majority (82% – 97%) of fauna in each taxonomic group occurring in the region had been recorded. Further information about sampling adequacy calculations can be found in Appendix 2.

5.2.2.2 Vertebrate Fauna Survey Results

Fauna Habitat

Three primary fauna habitat types were identified within the freehold land area, and six within the pastoral land area which were largely based on vegetation structure and landforms.

These habitat types predominantly follow the vegetation units described by Beard (1976) and Beard and Burns (1976), although some (e.g. granite outcrops) occur at a finer habitat scale than what was previously mapped. A description of each of the habitats is summarised below.

Table 5-14 Description of fauna habitats of the Study Area

Land area	Habitat	Description
Freehold	Eucalypt woodland	This habitat type was relatively common within the remnant vegetation in the freehold land area and consisted of vegetation dominated by Eucalypts (usually York Gum, *Eucalyptus loxophleba*) but with varying understorey constituents and soil types.
	Eucalypt mallee	This habitat was represented by a single site within the freehold land area.
	Heath	This habitat is predominantly associated with the mesas of the Moresby Range and further inland to a more limited extent. The habitat is limited in distribution within the Study Area and therefore represents a vulnerable habitat type.
Pastoral	Mulga Woodland	Mulga woodland is the dominant habitat type in the Study Area, varying slightly from east to west as a result of changes in climate, soil type, and the presence of emergent granite. Dead wood, stumps and peeling bark provide habitat for geckos and other small reptiles.
	River and Halophyte Vegetation	River vegetation consisted of acacia woodland over moderate to dense understorey, often containing salt bush or other halophytic (saline-adapted) and succulent plant species. Mats of leaf litter and dead vegetation had accumulated along some watercourses resulting in habitat for reptiles. Many bird species exist in flood plain habitat, particularly areas containing river gums.
	Mixed Wattle Scrub	This habitat type occurred within the Yalgoo subregion, in a transition zone between the Eremaean and South Western Botanical Provinces. Here, Mulga is less abundant and other acacia species are dominant. The vegetation structure is lower and more dense (Beard 1976).
	Sandy or Stony Plain	This habitat type consists mostly of stony plains, although one trapping site was situated within a sandy salt flat.
	Granite Outcrops	Granite outcrops were recorded throughout the Study Area, typically surrounded by mulga woodland. They provide unique habitats for rock-dwelling fauna.
	Rocky Ranges and Hillslopes	This habitat type occurs on the small range which runs SW to NE and includes both Jack Hills and Weld Range. The Study Area extends through gaps in this range and along the foot-slopes. No surveys were carried out in this area, as the Study Area impinges on only a small area of this habitat type and previous surveys have been conducted within this habitat (*Ecologia,* 2009c).

Fauna Assemblages

Table 5-15 below summarises the fauna assemblages expected with the potential to occur (devised through literature and database review), and the fauna assemblages recorded during the Ecologia surveys. All species recorded in the Ecologia surveys are listed in Appendix 2a.

Table 5-15 Fauna species within the Study Area (potential and recorded)

	Native mammals	Introduced mammals	Native birds	Introduced birds	Native reptiles	Native amphibians
Total potential fauna assemblages	36	13	277	1	130	18
Total recorded during current survey (Ecologia, 2010b)	20	11	125	1	83	11
Potential Conservation Significant Fauna (based on database searches and the results of previous biological surveys in the surrounding region)	6	-	22	-	5	0
Recorded (or high-medium likelihood of occurrence) Conservation Significant Fauna (see below for more details)	1	-	15	-	5	0

Vertebrate Fauna Species Recorded

Table 5-16 summarises the vertebrate fauna species recorded within the Study Area.

Table 5-16 Vertebrate fauna species found within the Study Area

	No. of Species	Species	Comment
Mammals (Total of 20)			
Dasyurids	6	4 species of dunnart (*Sminthopsis*), one false antechinus (*Pseudantechinus*), and the Kultarr (*Antechinomys laniger*)	Although no species of conservation significance were found, Woolley's False Antechinus (*Pseudantechinus woolleyae*) is worth noting as it is a specialist rock-dwelling species that is sparsely distributed throughout its range.
Macropods	3	Euro (*Macropus robustus*), Red (*Macropus rufus*) and Western Grey (*Macropus fuliginosus*) Kangaroos	-
Native rodents	2	Sandy Inland Mouse (*Pseudomys hermannsburgensis*) and Spinifex Hopping Mouse (*Notomys alexis*)	-
Bats	8	5 species of the family Vespertilionidae, two Molossidae, and one Emballonuridae	Bats were identified by call. The Little Broad-nosed Bat (*Scotorepens greyii*), recorded from the OPR-A section (Figure 5-23), is at the southern extent of its range in this location. One of the Molossid species recorded was the Inland Free-tailed Bat (*Mormopterus* sp. 3). It was distinguished from the sympatric South-western Free-tailed Bat (*Mormopterus* sp. 4) on the basis of call frequency. The genus *Mormopterus* is currently under review and the designations are based on Adams *et al*. (1988).
Echidna	1	Short-beaked Echidna	Short-beaked Echidnas were only recorded in 2 locations. This low capture rate is typical of this widespread but secretive species.
Birds (Total of 125)			
Various	125	125 species spread over 50 families	Recorded birds included several migratory and nomadic species. The IBRA lists 7 bird species as indicators of ecosystem health in the Western Murchison and Yalgoo bioregions (Thackway *et al.* 1995). 6 of these species were recorded, the Emu, Australian Bustard, Banded Lapwing, White-browed Treecreeper, Hooded Robin, and Grey-crowned Babbler. The Jacky Winter was the only indicator species not recorded, although the Study Area lies at the northern edge of its range.
Reptiles (Total of 82)			
Geckos	17	-	Noteworthy records include Ornate Crevice Dragon (*Ctenophorus ornatus*), Pygmy Python (*Antaresia perthensis*) and Pebble Dragon (*Tympanocryptis cephalus*) which were all found at the extremes of their range. The Spotted Mulga Snake (*Pseudechis butleri*) is locally endemic to a small area north of Yalgoo, and was recorded at several sites.
Pygopods	6	-	
Skinks	33	-	
Dragons	10	-	
Varanids	6	-	
Elapids	9	-	
Python	1	-	
Amphibians (Total of 5)			
Frogs	5	3 Hylidae species were recorded - Main's Frog (*Cyclorana maini*), Water-Holding Frog (*Cyclorana platycephala*) and Desert Tree Frog (*Litoria rubella*). 2 Myobatrachids were recorded - Centralian Burrowing Frog (*Platyplectrum spenceri*) and Russell's Toadlet (*Uperoleia russelli*).	The majority of individuals were observed during and directly after rainfall events.
Introduced Species (Total of 11)			
Mammals	10	House Mouse, Red Fox, Cat, European Rabbit, Goat, Cow, Sheep, Dog, Donkey, Horse and Pig	Much of the Study Area has been adversely affected by introduced species. Grazing impacts are evident in all areas with some areas severely degraded.
Birds	1	Laughing Dove	

5.2.2.3 Conservation Significant Fauna Legislation

Commonwealth

Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of National Environmental Significance (NES) require approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts (the Minister). The EPBC Act provides for the listing of nationally threatened native species. Fauna species of national conservation significance may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent'.

Two EPBC Act migratory bird species were found during the Ecologia surveys; the Common Greenshank (*Tringa nebulari*), and the Rainbow Bee-eater (*Merops ornatus*).

One EPBC listed reptile species was found during Ecologia surveys, the Western Spiny Tailed Skink (*Egernia stokesii badia*).

The EPBC Act is also the enabling legislation for protection of migratory species under international agreements including:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn); and
- Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).

State

Native species in WA which are under identifiable threat of extinction are protected under the WC Act.

Under the WC Act, the *Wildlife Conservation (Specially Protected Fauna) Notice 2008* recognises four classifications of rare and endangered fauna:

- Schedule 1: Fauna that is rare or is likely to become extinct;
- Schedule 2: Fauna presumed to be extinct;
- Schedule 3: Birds protected under an international agreement; and
- Schedule 4: Other specially protected fauna.

One bird species and three reptile species were recorded that are protected under the WC Act:

- Peregrine Falcon (*Falco peregrines*) – Schedule 4;
- Western Spiny Tailed Skink (*Egernia stokesii badia*) – Schedule 1;
- Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) – Schedule 1; and
- *Lerista yuna* – Schedule 4.

In addition, DEC produces a list of Priority species that have not been assigned statutory protection under the WC Act. Species on this list are considered to be of conservation priority because there is insufficient information to make an assessment of their

conservation status or they are considered to be rare but not threatened and are in need of monitoring. DEC Priority Fauna List categories are (refer to Appendix 2a for definitions):

- **Priority 1:** Taxa with few, poorly known populations on threatened lands;
- **Priority 2:** Taxa with few, poorly known populations on conservation lands;
- **Priority 3:** Taxa with several, poorly known populations, some on conservation lands;
- **Priority 4:** Taxa in need of monitoring – considered not currently threatened but could be if present circumstances change; and
- **Priority 5**: Taxa in need of monitoring – considered not currently threatened but subject to a conservation program, the cessation of which could result in the species becoming threatened.

Five bird species and two reptile species of Priority status were recorded within the Ecologia surveys:

- Australian Bustard (*Ardeotis australis*) – Priority 4;
- Bush Stone-curlew (*Burhinus grallarius*) – Priority 4;
- White-browed Babbler (western wheatbelt subspecies) (*Pomatostomus superciliosus ashbyi*) – Priority 4;
- Crested Bellbird (southern subspecies) (*Oreoica gutturalis gutturali*)- Priority 4;
- Rufous Fieldwren (western subspecies) (*Calamanthus campestris montanellus*) – Priority 4;
- *Lerista yuna* – Priority 3; and
- *Lerista eupoda* – Priority 1.

5.2.2.4 Conservation Significant Fauna of the Study Area

A total of twelve conservation significant species were recorded within the Study Area (Figure 5-24 and Figure 5-25) and a further nine species were considered to have a high or medium likelihood of occurrence in the area.

Twelve additional conservation significant species with the potential to occur in the Study Area were assessed as having a low likelihood of occurrence due to factors such as suitable habitat, distribution of species, and use of Study Area (for details of assessment see Appendix 2). These are:

- Greater Bilby (Macrotis lagotis);
- Black-flanked Rock-wallaby *(Petrogale lateralis);*
- Brush-tailed Mulgara *(Dasycercus blythi);*
- Ghost Bat *(Macroderma gigas);*
- Western Pebble-mouse *(Pseudomys chapmani);*
- Ground Parrot *(western subspecies) (Pezoporus wallicus flaviventris);*
- Shy Heathwren *(western subspecies) (Hylacola cauta whitlocki);*
- Fork-tailed Swift *(Apus pacificus);*

- Cattle Egret *(Ardea ibis);*
- Grey-tailed Tattler *(Tringa brevipes);*
- Common Sandpiper *(Actitis hypoleucos);* and
- Sharp-tailed Sandpiper *(Calidris acuminata).*

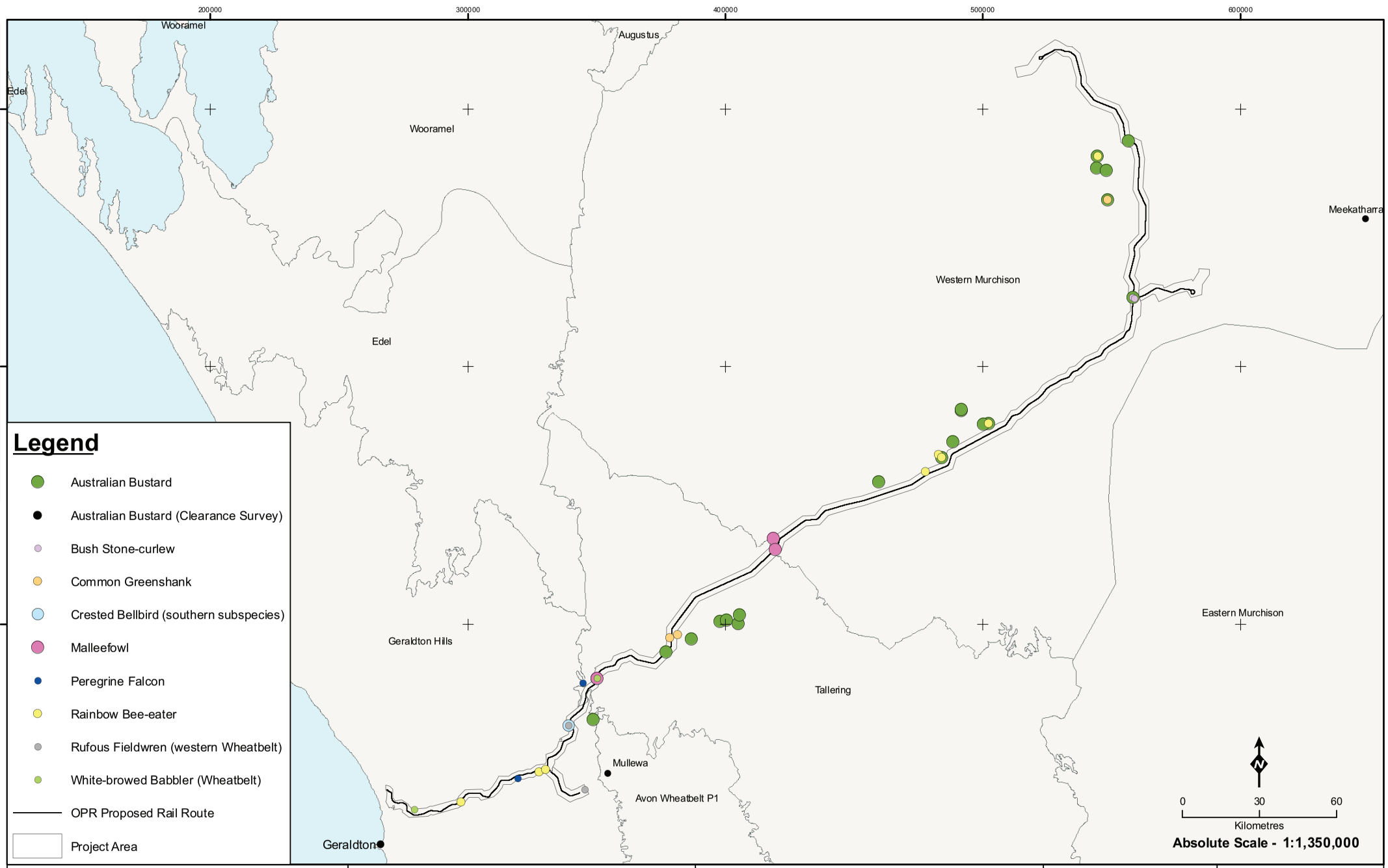
Table 5-17 lists the conservation significant fauna found in the Study Area, and Table 5-18 lists the conservation significant fauna that were not recorded but are likely to occur within the Study Area. Detailed descriptions of conservation significant fauna recorded within the Study Area are provided in Appendix 2. Species of NES listed under the EPBC Act are also described further in Section 8.

Table 5-17 Conservation significant fauna recorded

Species	Conservation Significance	Comment
Birds		
Common Greenshank (*Tringa nebulari*)	EBPC Act Migratory	Found near permanent water in the OPR-E sections of the Study Area (Figure 5-24), and there are local records from the Murchison River and Lake Austin. This species is likely to occasionally visit water bodies throughout the Study Area. Suitable habitat for foraging includes along creeklines and water bodies when they contain water
Rainbow Bee-eater (*Merops ornatus*)	EPBC Act Migratory	This species was recorded within the OPR-C and OPR-Fsection of the Study Area (Figure 5-24) and there are numerous records from the previous rail alignment and the surrounding region. They are likely to occur throughout the Study Area. Suitable nesting and hunting habitat was found in all sections of the survey. Suitable habitat includes open country, most vegetation types, dunes, banks. Although typically a migratory visitor to the Murchison they may breed in suitable conditions.
Peregrine Falcon (*Falco peregrinus*)	WC Act Schedule 4	Recorded within the freehold land area at OPR-F (Figure 5-24). Also recorded from the surveys of previous rail alignments, approximately 15 km west of Mileura Suitable nesting habitat was found in ranges and rocky breakaways of the Study Area and most of the Study Area provides suitable hunting ground. Peregrine Falcons have frequently been recorded in the surrounding area.
Australian Bustard (*Ardeotis australis*)	DEC Priority 4	Australian Bustards were recorded in all sections of the Study Area and appear to be moderately common although with a scattered distribution. There are extensive records of the Australian Bustard occurring in both the local and wider area. Suitable habitat for breeding and foraging exists throughout much of the Study Area, which includes open grasslands, chenopod flats and low heathland
Bush Stone-curlew (*Burhinus grallarius*)	DEC Priority 4	Bush Stone-curlews were recorded in the OPR-B section of the Study Area (Figure 5-24), and there are numerous records from the surrounding region. Likely to occur along the entire length of the corridor where suitable mulga woodland habitat occurs. May utilise the Study Area for both foraging and breeding
White-browed Babbler (western wheatbelt subspecies) (*Pomatostomus superciliosus ashbyi*)	DEC Priority 4	Species possibly recorded from OPR-F (Figure 5-24); however, conservation significant subspecies is very difficult to discriminate from other subspecies in the field. Several records from 30 km northwest of Mullewa (1980-1992; DEC records) This subspecies intergrades with the nominate subspecies between Dongara-Geraldton and so much of its distribution is south of the Study Area Preferred habitat is eucalypt woodlands, acacia shrublands
Crested Bellbird (southern subspecies) (*Oreoica gutturalis*	DEC Priority 4	Species possibly recorded from OPR-F (Figure 5-24); however, conservation significant subspecies is very difficult to discriminate from other subspecies in the field.

Species	Conservation Significance	Comment
gutturali)		Suitable habitat available within Study Area, including variety of habitats presenting a shrub layer (e.g. acacia scrubs, eucalypt, casuarina woodlands, saltbush and heath shrubland). Crested Bellbirds were recorded from low eucalypt mallee and moderately dense low mulga.
Rufous Fieldwren (western subspecies) (*Calamanthus campestris montanellus*)	DEC Priority 4	Species possibly recorded from OPR-F (Figure 5-24); however, conservation significant subspecies is very difficult to discriminate from other subspecies in the field. This subspecies is endemic to the south-west of the WA wheatbelt and in lower densities, in some coastal heathlands (Blakers *et al.* 1984). Suitable habitat available in Moresby Range. Prefers heath and low shrublands (including halophytic vegetation) on sandplains and lateritic ridges Recorded in the Study Area from two habitat types; (i) low eucalypt mallee over moderately dense sedges and shrubs, and (ii) open eucalypt woodland over moderately dense shrubs and sedges. Other suitable habitat was noted during the survey of this section (OPR-F), particularly the heath associated with the Moresby Range and areas of halophytic vegetation surveyed. Single record from 35 km south-east of Weld Range (NatureMap)
Reptiles		
Western Spiny-tailed Skink (*Egernia stokesii badia*)	EPBC Act Endangered, WC Act Schedule 1	Black form of the Western Spiny-tailed Skink recorded throughout much of the southern sections (OPR-C – OPR-F) (Figure 5-25) of the Study Area where suitable granite outcrop habitat occurs. Previously recorded from numerous locations in the surrounding region. Occupies rock crevices in granitic landforms.
Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*)	WC Act Schedule 1	The Gilled Slender Blue-tongue was recorded from the OPR-E survey (Figure 5-25) in acacia woodland. The acacia woodland habitat in which the individual was recorded occurs in several locations within the Study Area, and low numbers of individuals may occur towards the western end of the Study Area. Preferred habitat is semi-arid shrublands on heavy red soils. Recorded from 15 km north-east of Mullewa in 1998 (DEC records)
Lerista yuna	WC Act Schedule 4, DEC Priority 3	2 records during the OPR –F survey (Figure 5-25). The Study Area intersects with the southern distribution range of *Lerista yuna* and it is likely that several populations occur west of Mullewa in their preferred habitat of pale sand plains.
Lerista eupoda	DEC Priority 1	Recorded within the Study Area as well as numerous other records from Weld Range (e.g. Ecologia 2009d). Regional recordsplace *L. eupoda* within approximately 50 km of Weld Range. Based on all capture records, *Lersita eupoda* appears to be restricted to a 10,000 km^2 range located to the south and east of Weld Range. Its range is therefore highly restricted to this area, occurring in mulga and acacia woodland on the plains surrounding Weld Range. Recorded from OPR-WR and within the Study Area along the Weld Range Spur (Figure 5-25). Also recorded previously from Weld Range, 35 km north-west of Cue (DEC records), and 15 km north of Cue (NatureMap) Prefers open mulga areas on loamy soils.

Figure 5-24 Conservation significant bird species recorded



ecologia ENVIRONMENT

OPR oakajee port & rail

Bird Species of Conservation Significance Recorded During Surveying

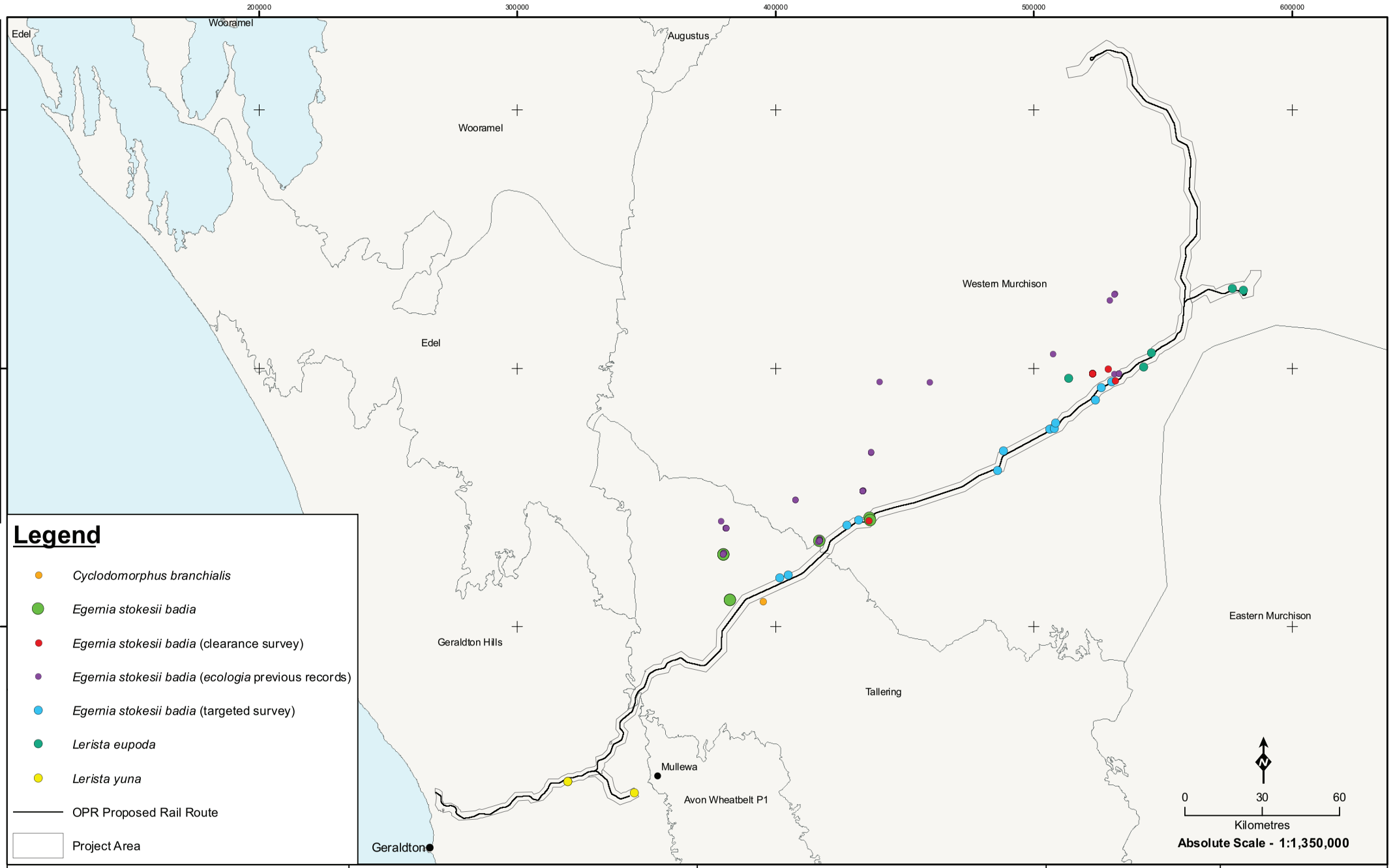
Drawn: AH
Date: 29/10/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A031

A3

Figure 5-25 Conservation significant reptile species recorded



ecologia ENVIRONMENT

OPR oakajee port & rail

Reptile Species of Conservation Significance Recorded During Surveying

Figure: 5.2
Project ID: 1126

Drawn: AH
Date: 29/10/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A073

A3

Table 5-18 Conservation significant fauna not recorded but may potentially occur within Study Area

Species	Cons status	Habitat	Species distribution	Records	Likelihood of occurrence in Study Area
Mammals					
Long-tailed Dunnart	DEC Priority 3	Rocky habitat with grass hummocks or open mulga habitats	Long-tailed Dunnarts are patchily distributed across much of central WA and southern parts of the Northern Territory, restricted to rocky ridge-top and hillslope areas.	Several records of this species from previous surveys at Jack Hills and Weld Range (MBS 2005b; Ecologia 2009c, d).	**ALMOST CERTAIN – RESIDENT** Likely to occur within Study Area in areas of suitable habitat associated with Jack Hills and Weld Range. Not recorded outside these areas and unlikely to occur away from the ranges.
Birds					
Carnaby's Black-Cockatoo	EPBC Act Endangered WC Act Schedule 1	Sandplain woodland, proteaceous scrub, heath, mallee.	Geraldton Hills subregion	Howatharra (10 km NNE) and Geraldton (20 km S) of the Study Area (Birdata, EPBC Database).	**POSSIBLE – FEEDING VISITOR** This species' presence within the Study Area would be limited to the western extent in the Geraldton Hills subregion. Some nearby records, but there is limited suitable feeding habitat within the Study Area.
Malleefowl	EPBC Act Vulnerable, EPBC Act Migratory, WC Act Schedule 1	Dry inland scrub, mallee	Occupies semi-arid mallee scrub on the fringes of the relatively fertile areas of southern Australia, where it is now reduced to three separate populations: the Murray-Murrumbidgee basin, west of Spencer Gulf along the fringes of the Simpson Desert, and the semi-arid fringe of WA's fertile south-west corner	Malleefowl tracks and a recently used mound were found in a small area of low, dense acacia scrub located just outside the Study Area. A targeted Malleefowl survey adjacent to this location yielded an abandoned nest mound that had not been used for several years. Targeted searches were also conducted in the wider area but did not yield any further evidence of Malleefowl. A Malleefowl call was heard at OPR-F1 some distance from the location of the trapping grid. A transect was walked toward the direction of the call but failed to record further evidence of the species.	**ALMOST CERTAIN** Malleefowl tracks and a recently used mound were found in a small area of low, dense acacia scrub with accumulated leaf and wood debris on sandy soil, located just outside the Study Area. A targeted Malleefowl survey along 4.7 km of the Proposal centreline adjacent to this location yielded an abandoned nest mound that had not been used for several years. Targeted searches were also conducted in the wider area but did not yield any further evidence of Malleefowl.
Slender-billed Thornbill	EPBC Act Vulnerable	Treeless or sparsely wooded flatlands, samphire and low melaleuca scrubs	Specific habitat requirements such as the halophyte vegetation around the salt flats to the north of Weld Range. These areas are patchily distributed in the Murchison and the Slender-billed Thornbill is generally uncommon.	Slender-billed Thornbills were recorded during a previous survey of Weld Range in the chenopod shrubland to the north of the Weld Range Gap (Ecologia 2009c). Slender-billed Thornbills have also been recorded along the Sandford River, 30 km south-east of Wooleen Lake, and during the survey of the previous rail alignment.	**ALMOST CERTAIN – RESIDENT** Few local records, although has been recorded previously from within Study Area. Habitat is at Weld Range and associated with wide reticulated drainage systems of Sanford River near OPRC sites 7 and 8, which are 43 km upstream from regional site M2 (Figure 5-24). Suitable habitats also available in Section F of the Rail.

Species	Cons status	Habitat	Species distribution	Records	Likelihood of occurrence in Study Area
Eastern Great Egret	EBPC Act Migratory	Floodwater, rivers, shallows of wetlands, intertidal mudflats.	Numerous records from Murchison River and surrounding waterways (Birdata)	Recorded from C and J sites (Figure 5-24). This species was recorded regionally in previously proposed rail alignments surveys.	**ALMOST CERTAIN – TRANSIENT VISITOR** Recorded close to the Study Area. Likely to be a transient visitor to waterways within the Study Area when they contain water
Wood Sandpiper	EBPC Act Migratory	Mainly shallow fresh waters; occasionally brackish swamps, rarely salt lakes and estuaries	Various coastal locations throughout WA and the eastern states	Records from Wooleen Lake (BAWA) and 25 km north-west of Mileura Station (NatureMap) Records from Wooleen Lake (BAWA) and 25 km NW of Mileura Station (NatureMap)	**POSSIBLE – MIGRATING VISITOR** Few local records. May occasionally visit water bodies within Study Area when they contain water
Glossy Ibis	EBPC Act Migratory	Shallows and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds	Migratory species utilising water features in the region	Records from Murchison River and surrounding waterways (Birdata)	**POSSIBLE – TRANSIENT VISITOR** May occasionally visit waterways within the Study Area when they contain water
Major Mitchell's Cockatoo	WC Act Schedule 4	Arid to semi-arid lightly wooded country near water and tall eucalypts.	Major Mitchell's Cockatoos have been recorded breeding along the Murchison River and may occasionally utilise tall eucalypts along the larger rivers, such as the Greenough River, within the Study Area and surrounding areas for feeding and breeding.	Several previous records from Mileura (DEC records), Mullewa (BAWA) and along the Murchison River (BAWA, Birdata)	**LIKELY – VAGRANT** Numerous local records. May occasionally visit waterways within the Study Area. Generally restricted to large creeks and rivers
Reptiles					
Western Carpet Python	WC Act Schedule 4 DEC Priority 4	Banksia woodland, eucalypt woodland, rocky outcrops.	It occupies all the regions of Southwest Australia, a typical mediterranean climate, and into the central arid and semi arid regions. The northern extent is to Geraldton and it is found as far east as Eyre.	Buller River (6 km S), Geraldton (20 km S), and Drummond Cove (10 km S): DEC threatened fauna database, Moresby Range (10 km SSE; Desmond and Heriot 2002). Also located at Moresby Range (Maryan *pers. comm*., May 2007).	**POSSIBLE – RESIDENT** Several records of the species from coastal areas but far fewer inland. Some suitable riverine habitat exists in the Study Area.

5.2.2.5 Short Range Endemic Invertebrate Fauna Survey

Endemism refers to the restriction of species to a particular area, whether it is at the continental, national or local level (Allen *et al*, 2002). Short range endemics (SREs) are those species that exhibit tight local range restrictions. SRE species typically have poor dispersal capabilities (i.e. flightless) and display specific or specialised environmental preferences (Harvey, 2002).

An extensive, reliable taxonomic evaluation of these species has begun only recently and thus the availability of literature and surveys relevant to SREs is relatively scarce, particularly within the Study Area.

Due to historical clearing in the freehold area, vegetation remnants may function as refuges for invertebrates with restricted distributions and may be important for their long-term survival (Main 1987, 1991, 1996). SRE's, including millipedes (Diplopoda), centipedes (Chilopoda), land snails (Mollusca) and trapdoor spiders (Mygalomorpha) have been recorded in the Mid-West region (Bamford, 2006; *Ecologia,* 2008 & 2010d).

Site Selection

The primary habitat focus of SRE surveys was isolated (island) habitats along a potential Rail Corridor. Island habitats may be any areas that maintain higher levels of moisture in the surrounding environment, such as southern facing slopes, areas of deep leaf litter accumulation and under logs and rocks under permanent shade, in caves and their entrances, and in and around springs and permanent water bodies.

Aerial photographs were initially inspected for likely habitats that would support SREs. These formed the basis for site selection, which was further refined by ground-truthing of selected sites.

Figure 5-26 shows the location of the sites surveyed for the SRE assessment, and detailed information of each site is discussed in Appendix 2b. No sites were located in permanent water bodies or in caves as none were found within the Study Area.

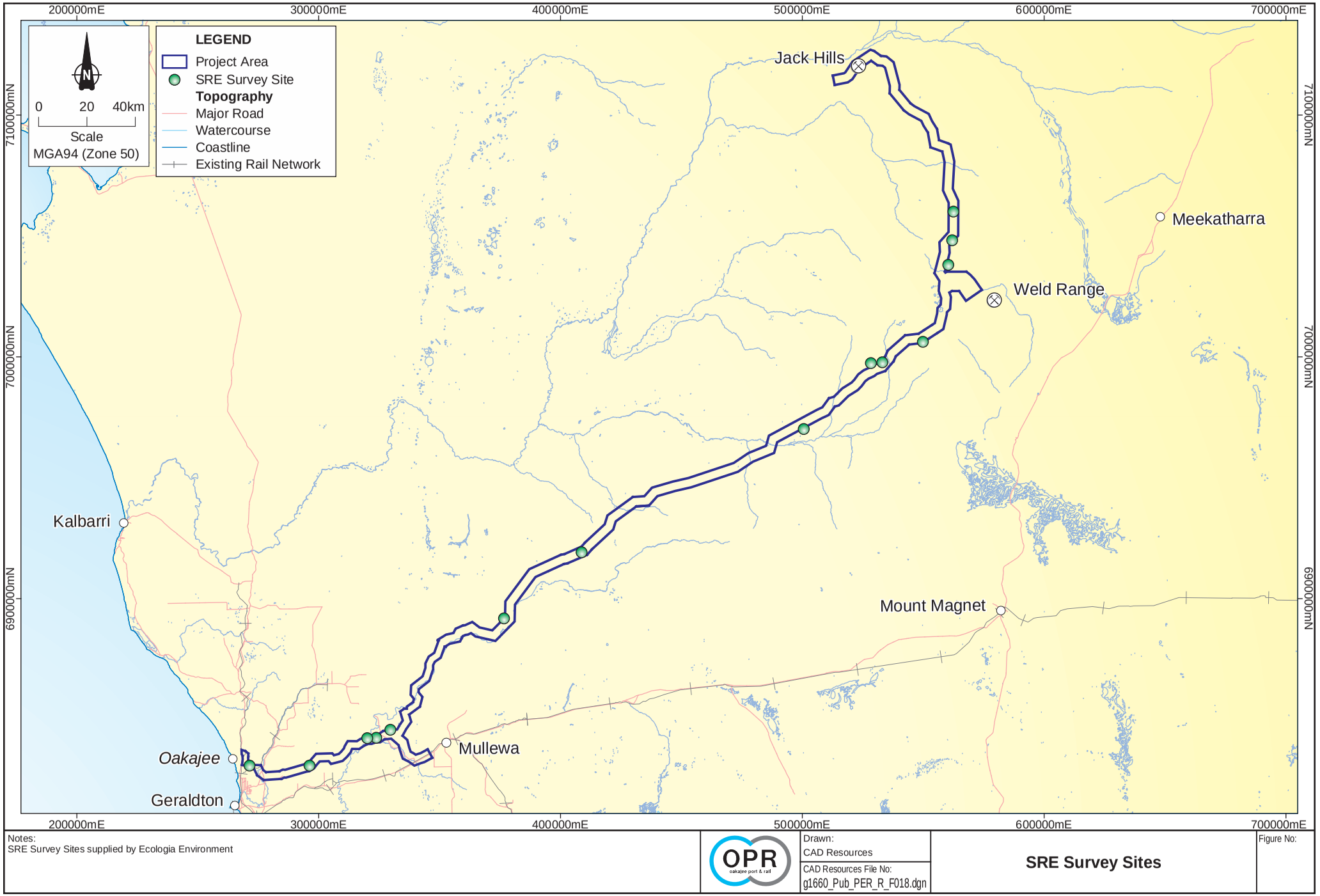
Methodology

OPR engaged *Ecologia* to undertake a baseline survey of the SRE occurring within the Study Area during 2009.

The methodology for the SRE survey was developed based on the principles outlined in EPA Guidance Statement 20: *Sampling of SRE Invertebrate Fauna for EIA in WA* (EPA 2009b). The only exception was the use of wet pitfall traps in nine out of 14 sampling sites. Guidance Statement No. 20 discourages the use of wet pitfall trapping (EPA 2009a: 15); however, the technique is amongst the most reliable methods for detecting SRE trapdoor spiders, this is indicated in the guidance statement (EPA 2009a: 10). Following discussion with DEC and WA Museum experts on SRE invertebrates, it is Ecologia*'s* position that wet pitfall trapping forms an important part of SRE invertebrate surveys, particularly for the detection of trapdoor spiders.

Pitfall traps, hand foraging, and litter sifting were used to collect specimens from a wide range of taxa. Further information on survey methodology including adequacy, laboratory methods and species identification methods is included in Appendix 2.

Figure 5-26 Location of SRE survey sites



Notes:
SRE Survey Sites supplied by Ecologia Environment

OPR oakajee port & rail

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SRE Survey Sites

Figure No:

5.2.2.6 Short Range Endemic Survey Results

In total, over 100 specimens representing more than eight families were recorded during the survey. Of these, two Mygalomorph spider species are considered to be SRE, *Idiosoma* 'MYG018' and *Missulena* 'MYG045'. Four species have undetermined SRE status due to a lack of taxonomic knowledge from a paucity of data, the spiders, *Kwonkan* and *Teyl,* and the isopods *Austrohorus* sp. and *Beierolpium* spp. (4 morphospecies). Taxonomic identification of snails is currently pending, which will increase the number of families. No comment can be made on the SRE status of pending snails until identifications are forthcoming.

The information in Table 5-21 summarises the taxa collected during the survey and their SRE status.

Sites containing SRE Species

Of the 14 sites sampled, twelve had confirmed or potential SRE species (Table 5-19). Figure 5-26 shows the locations of the sampling sites.

Table 5-19 Sites where determined or potential SRE species were located

Species	Confirmed SRE Species?	Site													
		1	2	3	4	5	6	7	8	9	10	11	12	13	15
MYG018	Yes						2								
MYG045								1							
Kwonkan sp.	Unable to determine						1								
Teyl sp.									3						
Austrohorus sp.		1									2	1		3	
Beierolpium sp.		4	1	2	4	6	2		1	2	4	12		1	

Associated Habitat

Based on the data collected the habitat types that form potential SRE habitat for the species listed above are listed in Table 5-20, and shown in Figure 5-27 to Figure 5-29.

Table 5-20 Habitat types associated with SRE species

SRE Species	Habitat types
MYG018	Found in vegetation community Mh15 which is dominated by *Acacia aneura* open low woodland, over *Sida* spp. and *Ptilotus obovatus*, sparse low shrubland
MYG045	Found in vegetation community Mp12 which is dominated by *Acacia aneura* low woodland, over *Acacia aneura x craspedocarpa* and *Acacia tetragonophylla* open tall shrubland, over isolated *Eromophila forrestii* and *Eromophila fraseri* mid shrubs, over *Aristida contorta* and *Eragrostis dielsii* open tussock grassland.
Kwonkan sp.	Found in vegetation community Mp15 which is dominated by *Acacia aneura* open low woodland, over *Sida* spp. and *Ptilotus obovatus*, sparse low shrubland
Teyl sp.	Found in vegetation community Yp2 which is characterised by *Acacia ramulosa* var. *linophylla (+/- Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla)* tall to mid shrubland, over *Enchylaena tomentosa* var. *tomentosa* sparse low shrubland
Austrohorus sp.	Found in vegetation communities Gf2, Gy1, and Mp6
Beierolpium sp.	Found in Gf2, Gy1, Mh11, Mh15, Mp4, Mp5, Mp6, Yc2 and Yp2

Table 5-21 Species found during SRE survey within the Study Area (Ecologia, 2010d)

		Considered a SRE Species?	Species description	Survey results
Arachnids				
Idiopidae	*Idiosoma* 'MYG018'	Yes	Spiders in the genus *Idiosoma* have a thick, rugose and hard abdomen which is used by the spiders as a plug against burrow invaders. Three species are currently known from WA, *I. sigillatum* from the Swan Coastal plain, *I. hirsutum* from a small area around South Perth, and *I. nigrum* from the Avon Wheatbelt and the Geraldton Sandplain (Main 1952, 1957). *I. nigrum* is listed on Schedule 1 ("Fauna that is rare or likely to become extinct") of the Wildlife Conservation Notice 2010 (Specially Protected Fauna) and is considered Vulnerable. *Idiosoma* 'MYG018' has very close morphological affinities to *I. nigrum* based on the rugosity of the abdomen. However, it differs significantly in male pedipalp morphology (and somewhat in its smaller size) and must be considered a different species (V. Framenau, WAM, pers. comm. 2009).	Two males were collected at Glen Station. The only other location from which this species has previously been recorded is Albion Downs Station (outside of Study Area).
	Sp. 'Indet'. (juv)	Not possible to determine	Without examination of mature males it is not possible to determine whether this species is a SRE	One juvenile specimen of sp. 'indet.' (juvenile) was recorded at Mileura station (pitfall site 1). It is not possible to identify to species level.
	Eucyrtops 'MYG131'	No	The genus *Eucyrtops* currently includes 3 named species, all from WA, although it is believed to also occur into SA and north-western QLD (Main 1985). With 7 or 8 species recorded, *Eucyrtops* was very diverse and abundant in the Carnarvon Basin of WA (Main 2000). The specimen collected belongs to a widespread complex of very similar morphotypes that putatively belong to a single species.	Collected at Meka Station. The group was the most commonly collected morphospecies in the WA Museum/CALM Carnarvon Basin survey and has been found at a number of sites during the DEC Pilbara survey (B. Durrant, pers comms). Additional collections are from Albion Downs station, the Barlee Ranges and Honeymoon Well.
Actinopodidae	*Missulena 'MYG045'*	Yes	*Missulena* is a spider of the actinopodid genus *Missulena* also commonly known as "Mouse spiders". Males are often strikingly coloured red and black. Emergent juveniles of *Missulena* are known to disperse via ballooning, a mechanism using silk to lift them off a surface or using the silk as an anchor in mid air, potentially allowing them to disperse over large distances and in some instances, reducing the predisposition for short-range endemism.	A single male was recorded at Meka Station. This species has been found at few locations in the northern Avon Wheatbelt south-east of Geraldton including Pintharuka, Mt Gibson and Mt Manning and is currently considered a SRE.
Nemesiidae	Juveniles (possibly of the genera *Teyl* and *Kwonkan)*	Without examination of mature males it is not possible to determine	This taxa are represented in WA by several genera, including *Kwonkan, Teyl, Aname, Chenistonia, Yilgarnia,* and *Stanwellia*.They usually dig burrows of soil and do not cover their burrow entrances with lids (Raven 1981). However, several WA species are known to construct trapdoors (Main 1986).	It is not possible to confidently identify the juvenile nemesiids found during the survey to genus level. They may represent *Kwonkan* and / or *Teyl* (or even *Aname*), based on some somatic characters such as tarsal spination (*Kwonkan*) and cuspule

		Considered a SRE Species?	Species description	Survey results
				pattern on the maxillae (*Teyl*).
Pseudoscorpions				
Atemnidae	*Oratemnus*	No	Atemnids are frequently found under the bark of trees in WA, but the systematics of the group, particularly of the genus *Oratemnus*, is uncertain and the taxonomy of individual species unclear. However, based upon current evidence, it seems that most species will eventually be found to be widely distributed.	A single female *Oratemnus* was collected at Meka Station.
Olipiidae	*Austrohorus*	Not possible to determine	The systematic status of members of this genus has not been fully assessed (Ecologia 2010). Based on current levels of knowledge, it is not possible to state whether this species is a SRE.	A single male of *Austrohorus* was collected at Mileura Station.
	Beierolpium	Not possible to determine	The systematic status of members of this genus has not been fully assessed. At present it is not possible to firmly establish the identity of these species until a complete systematic revision of the WA members of *Beierolpium* is undertaken.	At least 4 morphospecies of *Beierolpium* were collected at a number of sites during the survey: *Beierolpium* sp.large, *Beierolpium* sp.small, *Beierolpium* sp.8/2 and *Beierolpium* sp.8/4.
	Indolpium sp.	No	The specimens comprise a single species and extremely similar specimens have been collected from other regions of WA, suggesting that only a single species is involved.	Two specimens of *Indolpium* sp. were collected at Madoonga station. Similar specimens have been collected from other regions of WA
Scorpions				
Buthidae	*Lychas 'splendens'*	No	*L.'splendens'* is widespread throughout the Midwest and Wheatbelt regions. This species does not represent a SRE.	Two specimens were recorded from foraging site 2 on Mileura Station.
Millipedes and Centipedes				
Scolopendridae	Numerous	No	All species recorded belong to the family Scolopendridae which is not known to contain SRE species (pers. com. V.W. Framenau and M.S. Harvey, WA Museum). No millipedes were collected.	Numerous centipedes were collected during this survey
Crustaceans				
Armadillidae	*Acanthodillo* sp. 1	No	*Acanthodillo* are rarely encountered and most likely occupy the upper soil profile and some leaf litter. They are also commonly found under rocks and logs.	This species of A*canthodillo* has previously been collected from the Jarrah forest and drier areas NE of Perth. It now appears that its distribution extends northward.
	Acanthodillo sp. 2	No	This species of *Acanthodillo* is similar to species 1. However, it lacks the distinctive dorsal tuberculation and has different interlocking lobes on the first epimeron and different shaped epimera. It closely resembles a species found in the northern jarrah forest which is almost exclusively associated with logs. There are a few small differences between these species and further investigation over the entire distributional range would be needed to make a definite determination.	Notably, this species co-occurs with *Acanthodillo* sp.1.
	Buddelundia sp. 1	No	This species (probably undescribed) is common in the drier areas of WA. *Buddelundia* is the most encountered genus of the drier areas.	No accurate distributional data are available but it is widespread.

		Considered a SRE Species?	Species description	Survey results
	Spherillo sp. index	No	These are an undescribed species of *Spherillo* which is common in southern WA.	No species of Spherillo are yet described from WA but the genus is widespread, particularly in drier areas.
Molluscs				
Pupillidae	*Gastrocopta bannertonensis* (Gabriel 1930)-	No	The specimens exhibit shell characters most consistent with those of the tiny dextral species *Gastrocopta bannertonensis* (Gabriel 1930). This species has a wide geographic distribution in southern Australia, having been recorded from the southern regions of WA; SA and NSW. There is also an isolated record of its presence in an area to the NW of Alice Springs (Pokryszko 1996). *G. margaretae* (Cox 1868) differs only slightly in shell aperture characters and is reported to have a similar distributional range. It is sometimes difficult to distinguish *G.bannertonesis* and *G.margaretae* on shell characters alone.	Collected from Bindoo Hill Nature Reserve
Punctidae	*Westralaoma*	No	Species of the family Punctidae are not well known in WA because of the small to minute size of many of its species. Collecting methods used have generally been unsuitable for detecting such tiny organisms. There has been a lack of published research on this group since Iredale's (1939) descriptions of some new species within the WA snail fauna. Of these two inland punctid species, the four tiny shells collected from Bindoo Hill Nature Reserve more closely resemble the species *W. aprica*. Its shells are slightly larger; more translucent, smoother and with less obvious radial ribbing than those of *W. expicta*. Both of these species were described by Iredale (1939) from specimens taken in the Nangeenan area and both forms have recently been found to be sympatric over a fairly wide area of the Eastern Goldfields. The occurrence of *W. Aprica* during this survey is evidence that the distribution of this species, at least, extends to the northern wheatbelt of WA.	Shells collected from Bindoo Hill Nature Reserve. Apart from some punctid species described from the coastal areas, only two species - *W. aprica* (Iredale, 1939) and *W. expicta* (Iredale, 1939) - are currently recognized from the Great Southern, Eastern Wheatbelt and the Eastern Goldfields Regions.

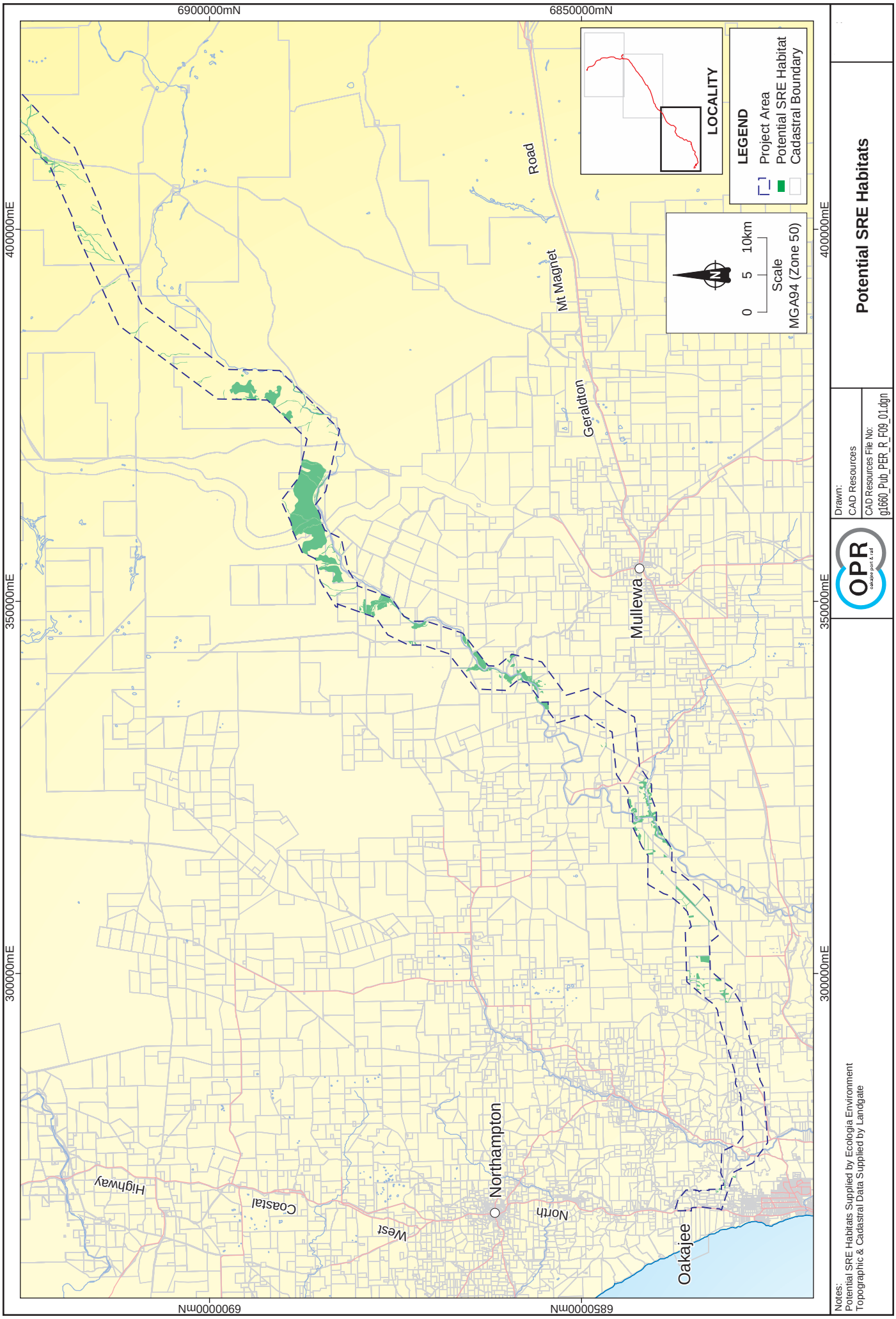
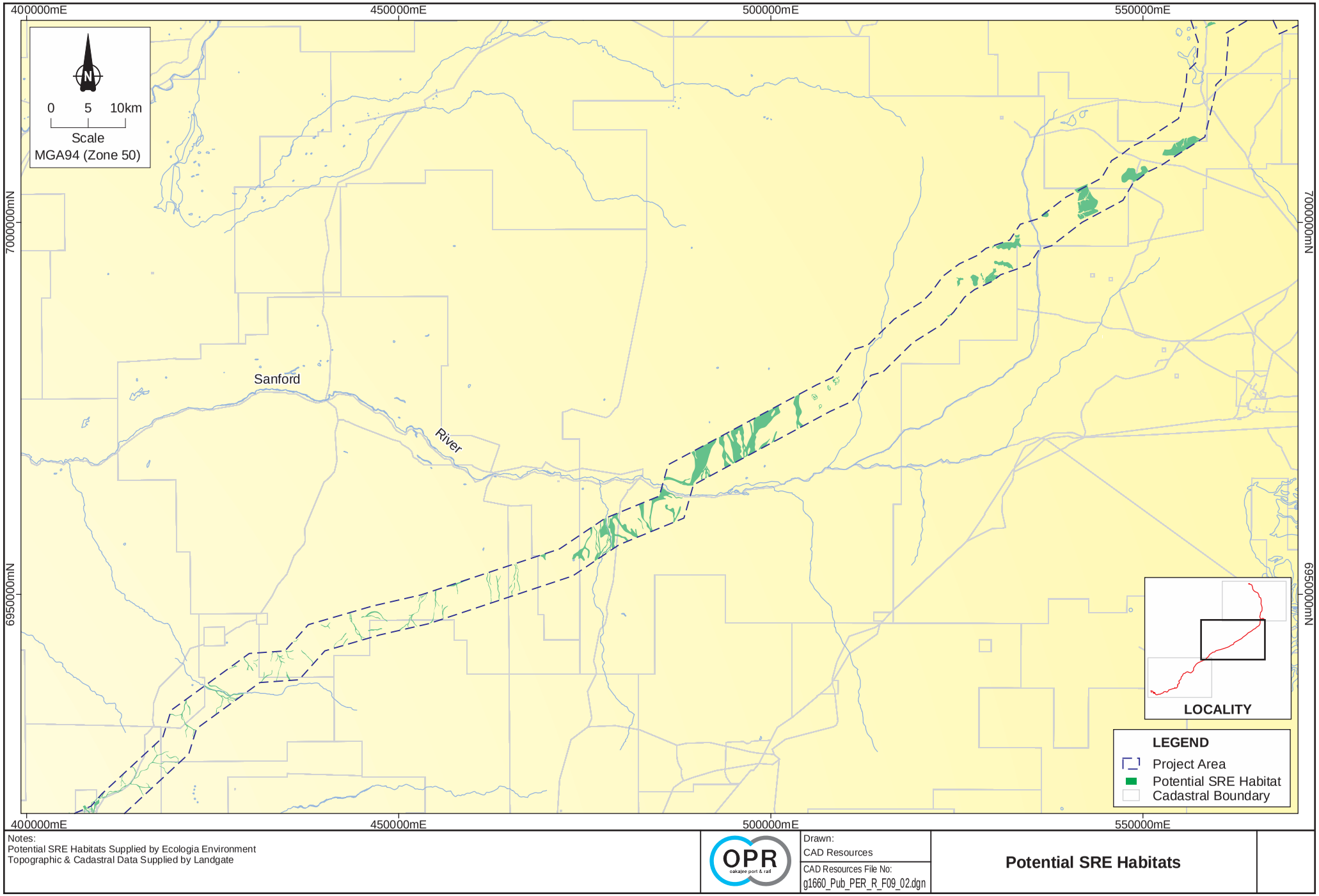


Figure 5-27 Potential SRE species habitat (1 of 3)

Figure 5-28 Potential SRE species habitat (2 of 3)



Notes:
Potential SRE Habitats Supplied by Ecologia Environment
Topographic & Cadastral Data Supplied by Landgate

OPR oakajee port & rail

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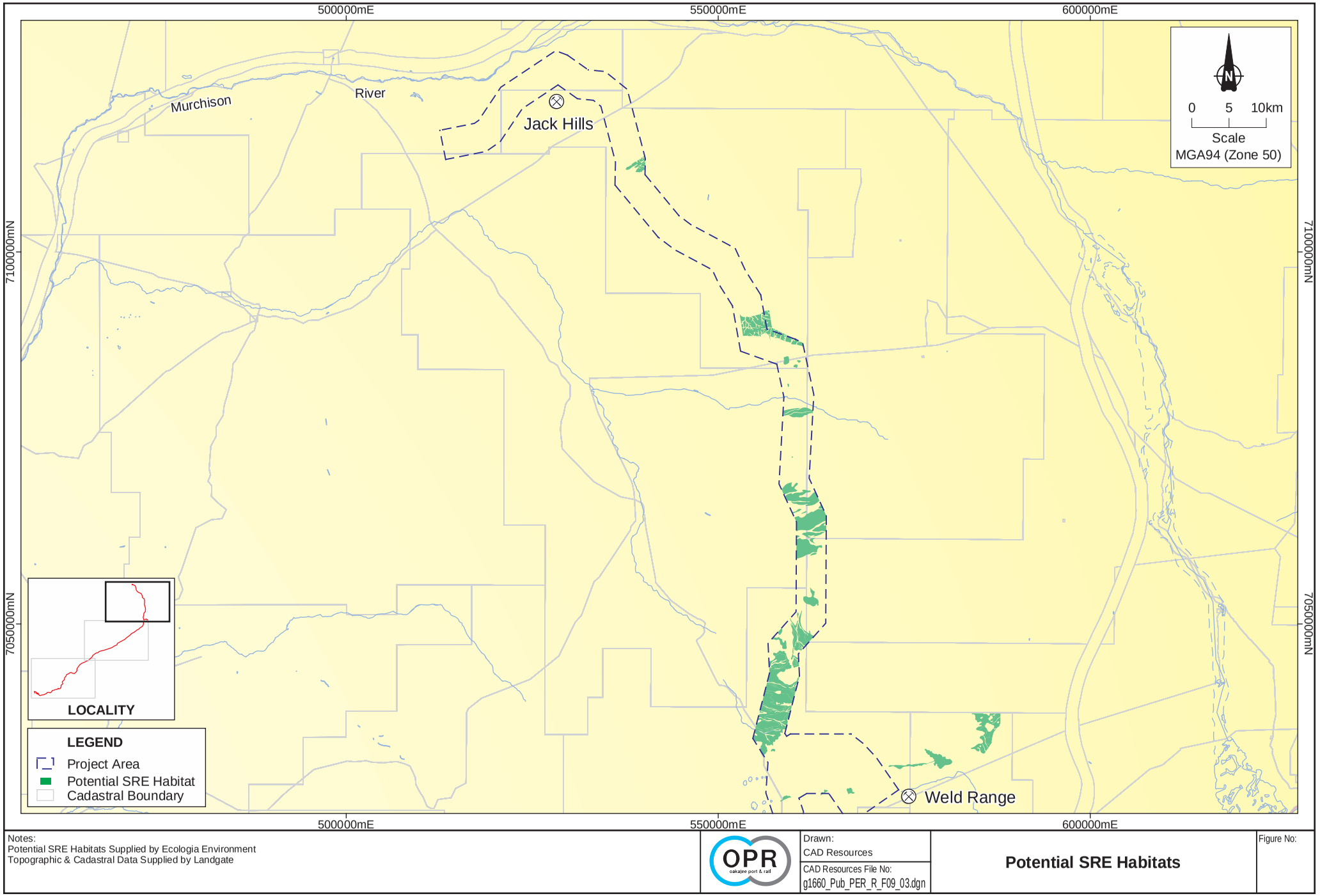
Potential SRE Habitats

Figure 5-30 Potential SRE species habitat (3 of 3)



Notes:
Potential SRE Habitats Supplied by Ecologia Environment
Topographic & Cadastral Data Supplied by Landgate

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Potential SRE Habitats

Figure No:

5.2.2.7 Subterranean Invertebrate Fauna – Background Information

Subterranean fauna are predominately invertebrate animals that have adapted to survive in underground habitats, and include stygofauna and troglofauna. Subterranean fauna are often characterised by their lack of eyes and body pigments (EPA, 2003).

Stygofauna are aquatic, obligate groundwater-dwelling fauna known to be present in a variety of rock types including karst limestone, fissured rock (e.g. granite) and porous rock (e.g. alluvium) (Mamonier *et al.* 1993). The presence of stygofauna in WA has been well documented, especially from regions such as Pilbara, Kimberley, mid-west and south-western WA (De Laurentiis *et al.* 2001; Humphreys 2001; Wilson and Keable 2002; Eberhard 2004; Karanovic 2004; Cho *et al.* 2005).

Troglofauna are terrestrial subterranean animals that inhabit air chambers in underground caves or small, humid voids. The presence of troglofauna in WA is still poorly documented. To date, troglofauna have been recorded from karst limestone systems at Cape Range, Barrow Island and in the Kimberley (Harvey 1988; Humphreys 2001; Biota 2005), pisolitic mesa formations in the Pilbara (Biota 2006) and in the cave systems of Yanchep (EPA 2005), Margaret River (Eberhard 2006) and across the Nullarbor (Moore 1995). The recent discovery of troglobitic species within the iron ore rich mesa landforms of the Pannawonica area, the Banded Ironstone Formations at Blue Hills and on Barrow Island suggests that troglofauna is likely to be found in a wider variety of landforms, geologies and regions within WA than previously thought.

5.2.2.8 Subterranean Invertebrate Assessment Methodology

A literature review was carried out to determine the species previously recorded in the vicinity of the Study Area. The review incorporated a search of the WA Museum database, information from previous Ecologia surveys and published information from journal articles and DEC reports.

Additionally, as the geology, geomorphology and drainage of an area can affect the distribution of subterranean fauna, the land systems and soil landscape systems within the Study Area were described and the location of previously recorded subterranean fauna have been mapped against the location of the Study Area. All additional land systems and soil landscape systems in the Mid-west with records of subterranean fauna were described in order to compare their characteristics to those systems within the Study Area. This strategy was adopted because a lack of subterranean fauna records in some areas could be the result of a lack of sampling effort rather than a true indication of subterranean fauna distribution in WA.

5.2.2.9 Subterranean Invertebrate Fauna Assessment Results

Figure 5-30 shows all records of subterranean fauna collected in the Mid-West and Geraldton areas compiled from previous Ecologia surveys, the WA Museum database, DEC reports and other published journal articles.

Subterranean fauna have been found in 16 of the 30 land systems occurring within the Study Area (Table 5-22). Subterranean fauna have also been found in 12 additional land systems within the Mid-West that do not occur within the Study Area (refer to Appendix 2c). The Mileura system harboured the largest subterranean fauna records (146 records), followed by Cunyu (44 records), both land systems of which are within the Study Area.

Subterranean fauna were also recorded from three of the ten soil landscape systems that occur within the Study Area (Table 5-22). Of these ten soil landscape systems, the Tamala soil landscape system had the most records, with four records of stygofauna and four records of caves where subterranean fauna have been collected. Subterranean fauna were also found in four additional soil landscape systems within the Geraldton area that do not occur within the Study Area (refer to Appendix 2c). However, most of these records were from within caves where subterranean fauna

had been collected but did not include the accurate number of species as the numbers included cave-dwelling fauna that is not obligate troglofauna or stygofauna.

Most of the records reviewed for both the land systems and soil landscape systems were of stygofauna, with 270 records compared to 43 troglofauna records. Of these, 219 stygofauna records and 40 troglofauna records were from land systems/soil landscape systems occurring within the Study Area. Nine records referred to caves where subterranean fauna had been collected and possibly consisted of both troglofauna and stygofauna (Table 5-22).

Table 5-22 Subterranean fauna records from land and soil landscape systems within Study Area

	Description	Records of Stygofauna	Records of Troglofauna
Land System			
Challenge	Gently sloping gritty and sandy-surfaced plains with granite outcrops and minor breakaways, supporting mulga and some halophytic shrublands.	2	
Cunyu	Calcreted drainage zones on hardpan; alluvial plains with raised calcrete platforms dissected by major flow zones and channels, supporting variable mostly non-halophytic shrublands and calcareous shrubby grasslands.	36	8
Gabanintha	Ridges, hills and footslopes of various metamorphosed volcanic rocks (greenstones), supporting sparse acacia and other mainly non-halophytic shrublands.	12	
Joseph	Undulating yellow sandplain system supporting dense mixed shrubland with patchy mallees	1	
Jundee	Hardpan wash plains with variable dark gravely mantling and weakly groved vegetation; minor sandy banks; supports scattered mulga shrublands	1	
Kalli	Elevated, gently undulating red sandplains edged by stripped surfaces on laterite and granite; tall acacia shrublands and understorey of wanderrie grasses (and spinifex locally).	5	
Mileura	Saline and non-saline calcreted river plains, with clayey flood plains interrupted by raised calcrete platforms supporting diverse and very variable tall shrublands, mixed halophytic shrublands and shrubby grasslands.	131	15
Nerramyne	Undulating plains of sandy-surfaced laterite and weathered granite with low remnant plateaux, breakaways and rises supporting acacia shrublands.	1	
Pindar	Loamy plains surrounded by sandplain supporting York gum woodlands.	1	
Sherwood	Extensive, gently sloping stony and sandy plains on granite and gneiss below saline footslopes of lateritised breakaways and outcrops of weathered rock; mainly supports scattered mulga shrublands with understorey non-halophytic and halophytic shrubs.	2	
Tallering	Prominent ridges of banded ironstone, dolerite and sedimentary rocks supporting bowgada and other *Acacia* shrublands.	2	2
Tindalarra	Very gently inclined hardpan wash plains with narrow drainage lines and fairly saline narrow tributary drainage floors; supports tall mixed acacia shrublands with patchy wanderrie banks and narrow tracts of snakewood and bluebush; a major wash system in the Greenough River catchment	11	
Violet	Gently undulating gravely plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supports mulga and bowgada-dominate shrublands, with dense mulga groves and patchy halophytic shrublands	2	
Weld	Rugged ranges and ridges of mainly Archaean metamorphosed sedimentary rocks; supports acacia shrublands; major system of the Weld Range and Jack Hills.		8
Yandil	Flat hardpan wash plains, extensively uniform and carrying light to moderate mantles of small pebbles and gravels; occasional wanderrie banks and groves; supports mulga shrublands, but widely degraded.	3	
Yanganoo	Almost flat hardpanwash plains, with or without small wanderrie banks and showing variable development of weak groving; supports mulga shrublands; the most extensive system in survey area.	4	
Soil Landscape System			
Dartmoor	Level to gently undulating plain and weakly dissected long slopes, much as a relic drainage network	1	7
Northampton	Narrow valleys with gently undulating to rolling rises and low hills with an integrated drainage pattern. Rocky outcrops common on hillcrests with long gentle slopes and alluvial terraces associated with local rivers. Forms much of drainage basin of Chapman, Bowers, Oakajee and Buller Rivers	1	
Tamala	Low hills parallel to the coast, extending 4 km inland and 3 to 7 km wide. Western units are moderately inclined to steep, sometimes cliffed to the sea. South of Geraldton they form low hills with relic dune lobes and some limestone outcrop. No drainage lines except on lithified western faces. Units have been breached by rivers and streams at several locations	4	4 caves where species been collected

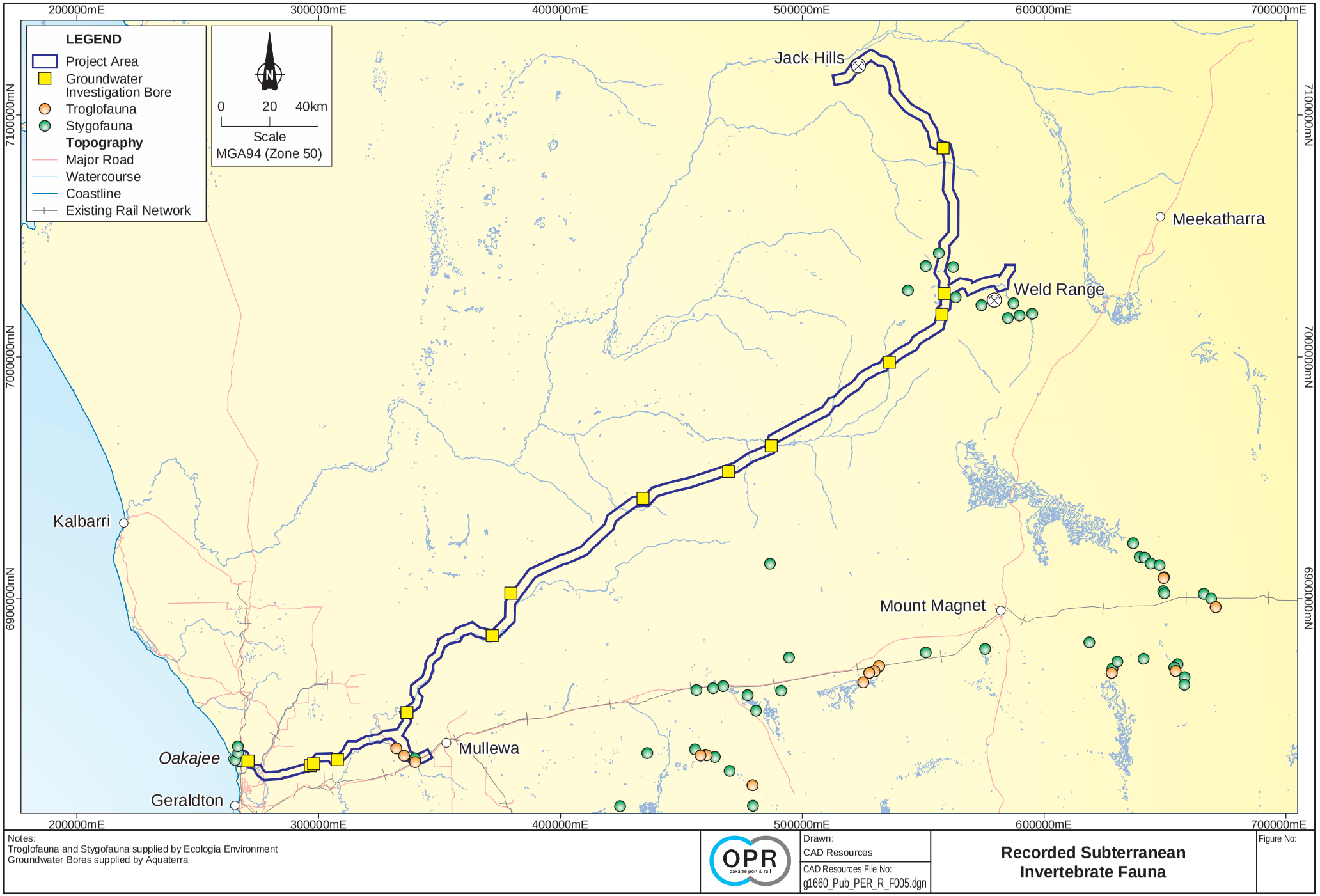
5.2.2.10 Suitability of groundwater for stygofauna

Aquaterra installed eight monitoring bores within the Study Area to measure water chemistry and quality (Aquaterra 2009b). Based on the pH levels and conductivity of the groundwater in each monitoring bore, predictions have been made as to whether the groundwater within the bores may provide suitable habitat for stygofauna. All bores were within 100 km of existing records of subterranean fauna and most bores showed pH and conductivity (EC) levels suitable for stygofauna. Table 5-23 summarises the water chemistry results of the eight monitoring bores.

Table 5-23 Monitoring bores that may contain subterranean fauna

Bore ID	Field EC (mS/cm)	pH	Likelihood of stygofauna	Reasons
52_MB1	7.9	8.2	Possible	pH & conductivity are within suitable parameters
102_MB1	12.2	4.2	Unlikely	Conductivity is within suitable parameters, however pH is comparatively low
249_MB1	2.5	8.5	Possible	pH & conductivity are within suitable parameters
300_MB1	>39	7.0	Possible	Conductivity is high, however pH is suitable
368_MB1	2.9	-	Unable to comment	Insufficient data
400_MB1	-	-	Unable to comment	Insufficient data
400_MB2	-	-	Unable to comment	Insufficient data
408_MB1	3.5	7.4	Possible	pH & conductivity are within suitable parameters

Figure 5-30 Location of recorded subterranean invertebrate fauna



Notes:
Troglofauna and Stygofauna supplied by Ecologia Environment
Groundwater Bores supplied by Aquaterra

OPR oakajee port & rail

Drawn:
CAD Resources

CAD Resources File No:
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Recorded Subterranean Invertebrate Fauna

Figure No:

5.2.3 Surface Hydrology

5.2.3.1 Surface Hydrology Assessment

A desk-based review of surface hydrology was completed in 2009 by Aquaterra (2009a; Appendix 3), which involved the following:

- reviewing available aerial photography, published reports and data on surface water resources, and reconciling this information with rail alignment options; and
- defining surface water drainage patterns and characteristics within the Study Area.

5.2.3.2 Surface Hydrology Assessment Results

Surface hydrology within the Study Area can be categorised as follows:

- external – drainage from catchments discharging to the Indian Ocean via rivers or other watercourses; and
- internal – drainage that, under normal flow conditions, discharges to the inland regional system of salt lakes.

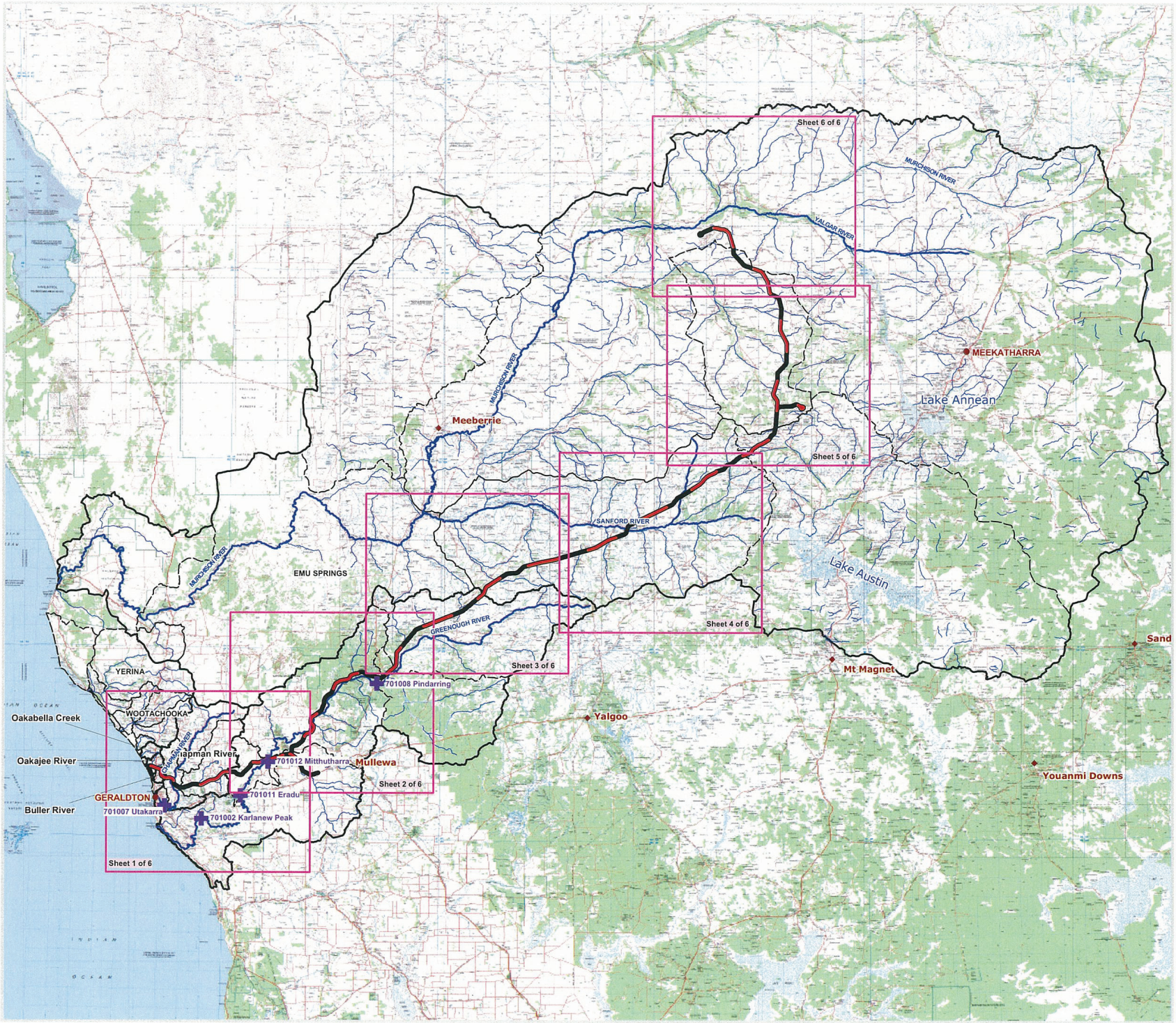
External drainage is more typical of the western sector of the Study Area, while internal drainage is more typical in the east. For example, between Meekatharra and Wiluna, a system of generally north south drainage lines, creeks and other watercourses drain surface flows into numerous salt lakes (Aquaterra, 2009a, Appendix 3) (Figure 5-31).

The northern portion of the Study Area is characterised by an ephemeral drainage pattern within the Murchison River catchment. This comprises an extensive drainage network covering an area of about 82,000 km^2 (Figure 5-31). The Murchison River discharges into the ocean at Kalbarri, 110 km north of Oakajee. Water quality during flooding is fresh, but turbid, while low flows are brackish and saline (Aquaterra, 2009a).

The Study Area extends over a number of episodic rivers and creeks including the Chapman River, Greenough River, the Bangemall Creek, the Sanford River, and Ilkabiddy Creek, which flow only in direct response to rainfall events. Flows in the smaller stream channels are typically of short duration, and cease soon after the rainfall passes. In the larger river channels draining the more extensive catchments, runoff can persist for several weeks and possibly months following major rainfall events such as those resulting from tropical cyclones.

The catchments within the Study Area have been considerably modified by pastoralism, damming of watercourses and mining practices (EPA, 2007c).

Figure 5-31 Overview of surface water drainage within the Study Area



aquaterra

APPENDIX B

OPR SURFACE WATER MAPPING OVERVIEW

AUTHOR:	RW	REPORT NO:	...
DRAWN:	MS	REVISION:	...
DATE:	07/10/09	PROJECTION:	GDA94 Z50
JOB NO:	1088B	SCALE:	1:1,700,000

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5.2.3.3 Significant Surface Hydrology Characteristics of the Study Area

Flood Events[1]

The most intense rainfall and flooding events within the Study Area result from tropical cyclones. Flooding is therefore sporadic and usually occurs in the cyclone season (summer). Several significant flood events have occurred in recent years, including Cyclones Clare and Dominic in January 2009. Widespread storms and flooding were experienced in the region resulting in the closure of several roads, regional airstrips and the flooding of Yuin Station and some houses in Meekatharra. It is estimated that these two events had an ARI in excess of 1000 years (Aquaterra, 2009a). The magnitude of the consequent flooding was therefore also extremely rare.

Sheetflow

Overland flows occurring in areas where there are no defined channels, resulting in widespread flooding of uniform depth, known as sheetflow. Sheetflow zones occur at various locations across the Study Area with some vegetation communities, particularly Mulga (*Acacia aneura*) woodland, being dependent on seepage from these surface water flows (Figure 5-16) (ANRA, 2009). Mulga woodlands are common throughout the northern sectors of the Study Area.

Defined areas of sheetflow were not able to be determined without more detailed site investigations. These investigations will be conducted prior to construction to determine culvert requirements (refer to Section 7.5).

5.2.4 Groundwater

Initial desktop assessments and field groundwater investigations of water demand, potential yield and water quality available for construction purposes were undertaken in 2009 (Aquaterra 2010b; Appendix 4). The objective of the desktop assessment was to identify water requirements during Proposal construction and operation, and assess groundwater availability for this demand.

The groundwater potential along most of the Proposal Area in the interior zone of the Mid-West is low to moderate. Establishment of successful production bores with acceptable yields (1-3 L/s) within the Study Area will demand significant investment in exploration drilling, requiring access to as many exploration targets as possible. The limited drilling programme conducted during Phase 1 in 2009 has shown approximately a 50% success rate for bores delivering above 3 L/s, but the prospect exists that local supplies may not be found along some portions. In addition, a limited number of targets exist within the Study Area and there is substantial risk that exploration holes will not be successful in some areas. Therefore, groundwater investigations will also concentrate on developing water supply borefields in areas of moderate to high groundwater yield potential, within approximately 50 km of the Proposal Area (Aquaterra, 2010c).

5.2.4.1 Regional Hydrogeology

From a hydrogeological perspective, the Study Area may be divided into two broad zones – coastal and interior, which includes the Northampton Block, the northern extent of the Perth Block, and the Murchison Basin (Figure 5-32).

In the coastal zone aquifers have been identified in weathered Proterozoic basement, consolidated sediment and coastal limestone. The Tamala marine limestone and associated alluvial deposits are highly permeable and have the potential to form significant aquifers. Groundwater in the coastal

[1] A 100 year ARI flood is a definition of a flood that has a 1% chance of occurring in any given year. Therefore an ARI in excess of 1000 years refers to a flood that has a 0.1% chance of occurring in any given year (BoM, 2001).

zone is mainly brackish ranging from 1,000-3,000 mg/L of Total Dissolved Solids (TDS). Although bores in the Tamala limestones offer supply potential, this aquifer system may already be over-allocated, this may constrain or complicate licensing approvals required to abstract this water.

The interior zone extends east from 85 km from the western edge of the Proposal, representing a relatively remote and, from a groundwater perspective, poorly explored terrain. Geologically, this area is characterised by two distinct Archaean geological terrains, gneiss and granitoid-greenstone (metavolcanics).

The lower Proterozoic basement outcrops extensively, but is overlain in places by relatively thin Tertiary and Quaternary deposits, which are associated with both modern and palaeo-drainages. Small scattered areas of calcrete (Tertiary age) are exposed in depressions between drainage divides and drainage channels. The greenstone belts generally trend in a north-west to north-north-east direction and are surrounded by several granitoid (mafic and ultramafic rocks) intrusions. These intrusive rocks are highly deformed by structural features (e.g. faults and shears).

Calcrete, colluvium and valley-fill alluvium form the main shallow aquifers in the area. Depths to groundwater are typically shallow near the river channels and creeks, and there are a few semi-permanent pools where the groundwater table daylights in the Murchison River channel. Alluvial streambed aquifers receive groundwater recharge during creek flow events (generally associated with cyclones). Due to the relatively thin accumulations of alluvium, the groundwater storage capacity is limited resulting in their quick replenishment and subsequent surface water runoff volumes will be high.

Alluvial sediments derived from the ancient course of the rivers (palaeo-channels) are often located some distance from the current creek channel. Most of this older alluvium is unsaturated with the water table occurring close to its base or in the underlying bedrock. Where they do extend a reasonable depth below the water table, these older alluvial deposits can be significant aquifers.

The Archaean and Proterozoic basement has low intrinsic permeability. The groundwater potential of basement rocks is typically associated with, and limited to, the development of weathering profiles and/or structural deformation (e.g. faults, fractures). The contact of highly deformed dykes and fractured basement may be a source of groundwater in some parts of the Study Area. The quality of groundwater is highly variable throughout the area and increased salinity is observed towards drainage lines. The groundwater salinity is expected to vary between 2,000-7,000 mg/L (TDS) along the Study Area, except for a few hypersaline areas.

In general, the groundwater yield potential is low to moderate along most of the Study Area in the interior zone. The success rates of individual bores at exploration targets can be expected to be low and the prospect exists that local supplies may not be found along some portions of the route.

The regional aquifer productivity and aquifer type for the Mid-West Region is presented in Figure 5-33 (Aquaterra, 2010b).

5.2.4.2 Existing Bores

A data search was conducted through the Department of Water (DoW) Water Resource Information database in 2008 and 2009, for hydrogeological information, such as drilling depths, lithological logs, water levels and water quality data, along the proposed rail alignment. This search returned a considerable number of bores within the Study Area (Figure 5-34), which mostly provide water for station supplies.

The majority of bores in the area are either investigation, domestic or stock bores (current and historic), and most of these exploit the groundwater reserves within the shallow alluvial aquifers, utilising shallow, low-yielding bores.

A DoW data search was also conducted, to assess current licensed groundwater allocations in the area (Figure 5-35).

The largest groundwater allocation is from a fractured rock aquifer located south of Meka Station and along the Sanford River, at the Western Queen Mine (owned by Mt Magnet Gold). It is understood that the licensed allocation for this site is 3.7 GL/yr, however this mine is not currently operational.

The remaining licences have average licence abstraction allocations of between 0-20 L/s and, according to the data supplied, tap the fractured rock, sedimentary rocks and alluvial sediments.

Existing groundwater abstraction information in the Perth Basin and Northampton Block has not been assessed as part of Aquaterra's report (2009b; Appendix 4), due to delays in receiving data from DoW. However more recently DoW has advised that groundwater remains available for allocation within both the Arrowsmith and Jurien Groundwater Areas of the Northern Perth Basin. In relation to the East Murchison and Gascoyne Groundwater areas, these resources have a nominal allocation limit and licences to access these resources are assessed on an impact basis using the department's state-wide strategic and operational licensing policies and mining guidelines.

5.2.4.3 Groundwater Field Surveys

Phase 1 Survey

OPR implemented the first phase of its groundwater investigation programme on 4th November 2009. Nine targets were investigated at which a total of 21 exploration holes were drilled including six production bores and eight as monitoring bores (Figure 5-36).

Where a production bore was installed, an adjacent stygofauna and water quality monitoring bore was also constructed.

Yield and water quality results from these groundwater investigations are detailed in Appendix 4.

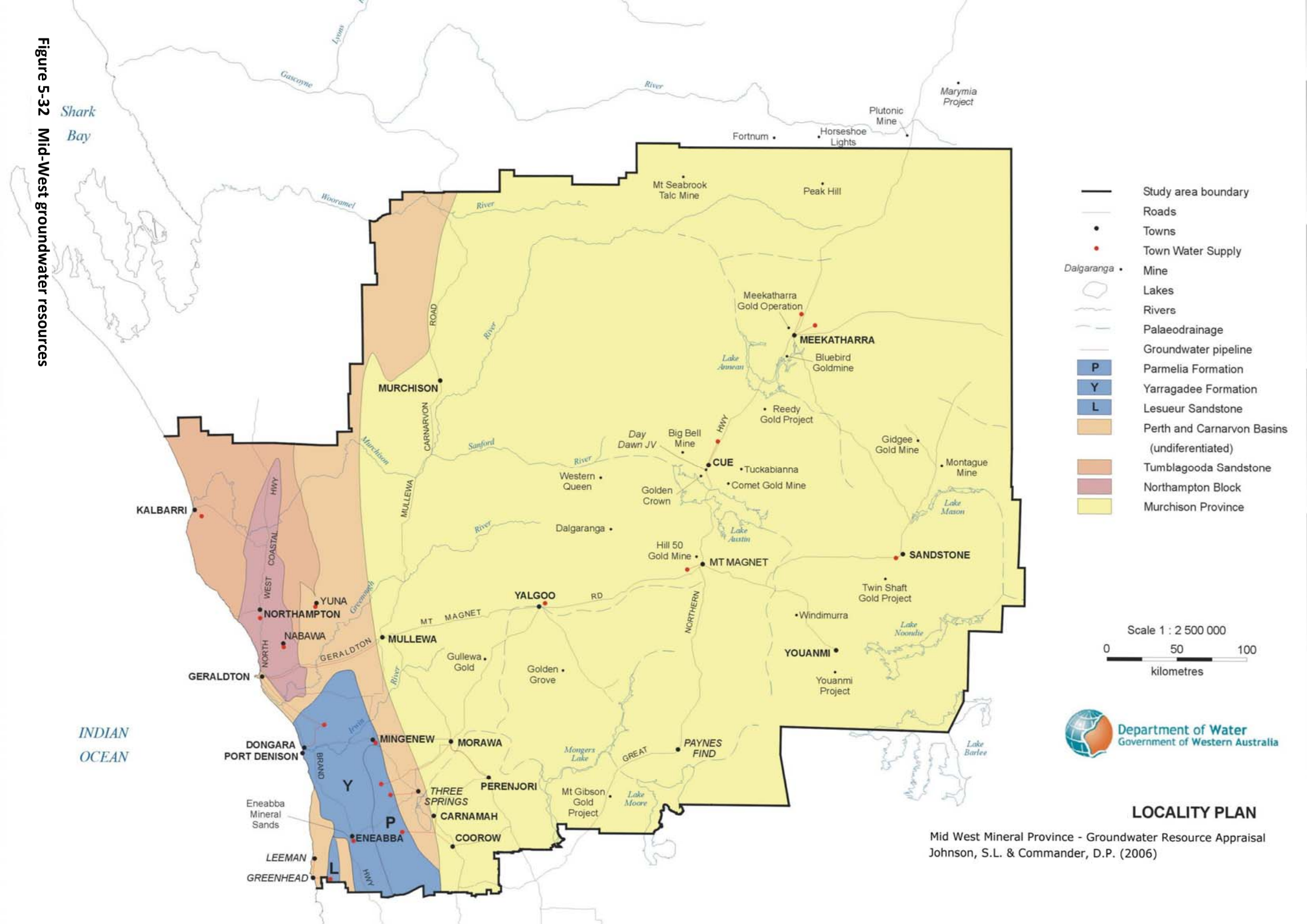
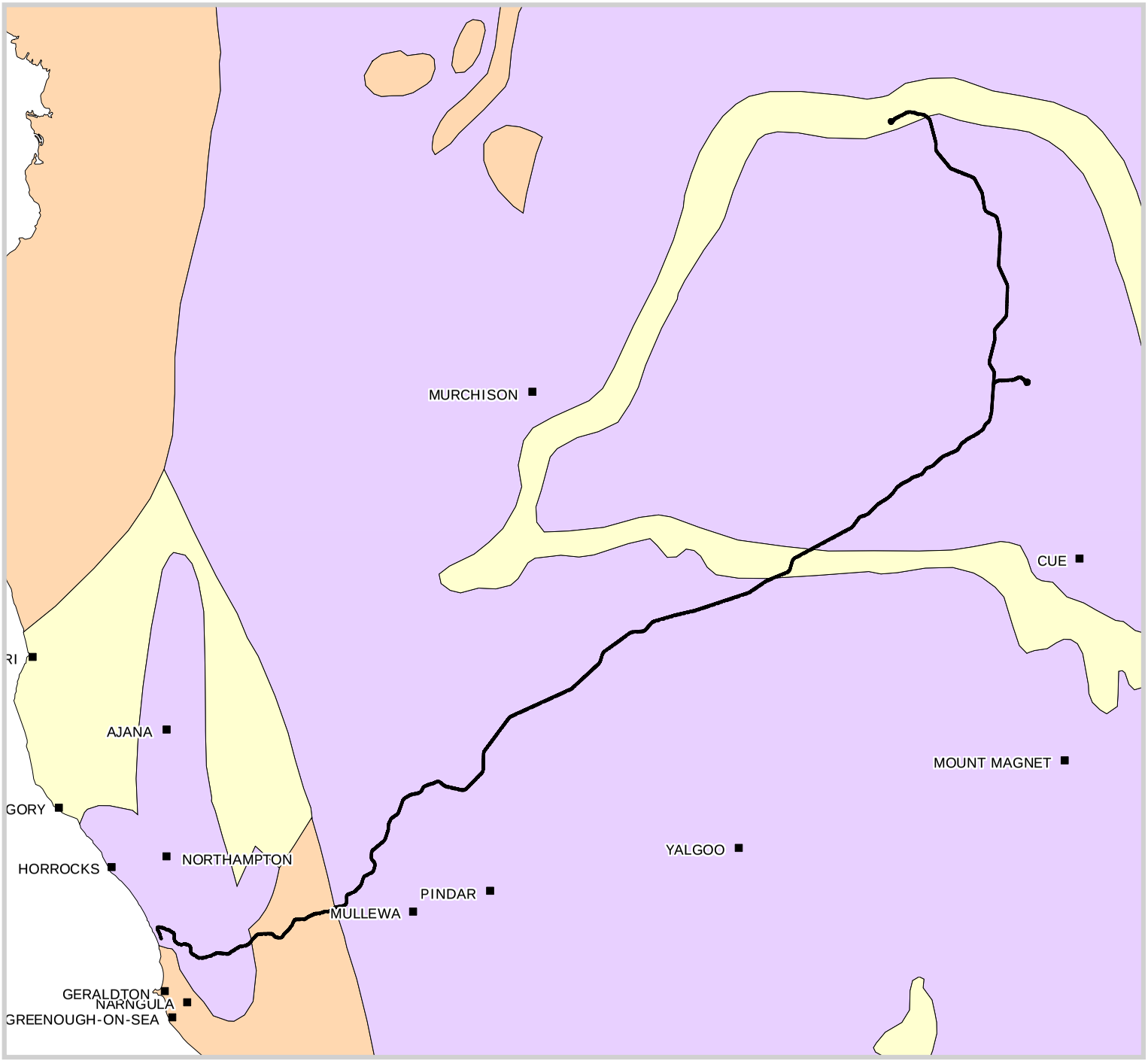
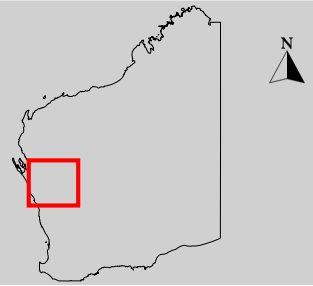


Figure 5-32 Mid-West groundwater resources

Figure 5-33 Regional aquifer type and productivity



LOCATION MAP



LEGEND

OPR01 Rail

Aquifer Type

- Local aquifers of general low productivity
- Porous, extensive highly productive aquifers
- Porous, extensive aquifers of low to moderate productivity
- Fractured or fissured, extensive aquifers of low to moderate productivity
- Fractured or fissured, extensive highly productive aquifers

DATA SOURCE

40 0 40 80

Kilometres

aquaterra

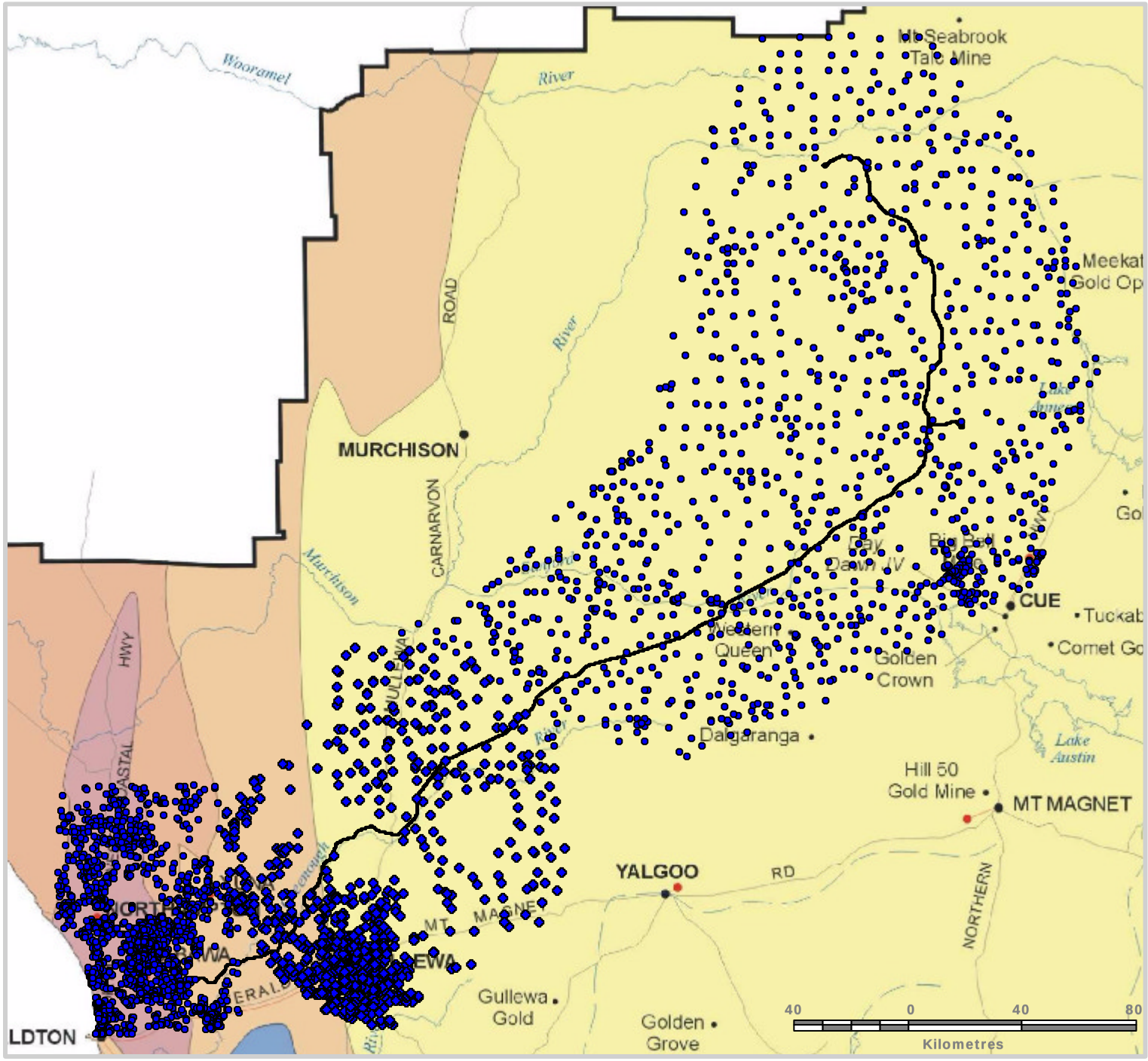
FIGURE 3.2

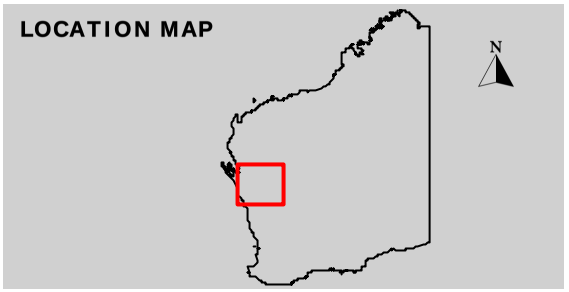
REGIONAL HYDROGEOLOGY PLAN

AUTHOR:	KMH	REPORT NO:	617
DRAWN:	KMH	REVISION:	...
DATE:	9/12/09	PROJECTION:	MGA94 (Z50)
JOB NO:	715J\J5	SCALE:	1:2,000,000

Location: F:\Jobs\715\J\MapInfo\617 Figures\617_Figure3.2.wor

Figure 5-34 Groundwater bores within the Study Area





LEGEND

- Study area boundary
- Roads
- Towns
- Town Water Supply
- Dalgaranga • Mine
- Lakes
- Rivers
- Palaeodrainage
- Groundwater pipeline
- P Parmelia Formation
- Y Yarragadee Formation
- L Leseuer Sandstone
- Perth and Carnarvon Basins (undifferentiated)
- Tumblagooda Sandstone
- Northampton Block
- Murchison Province
- DoW Bores
- OPR01 Rail

DATA SOURCE

DoW WIN Database (2008) & (2009)
Johnson and Commander 2006, Mid West Minerals Province Groundwater Appriasal HG17

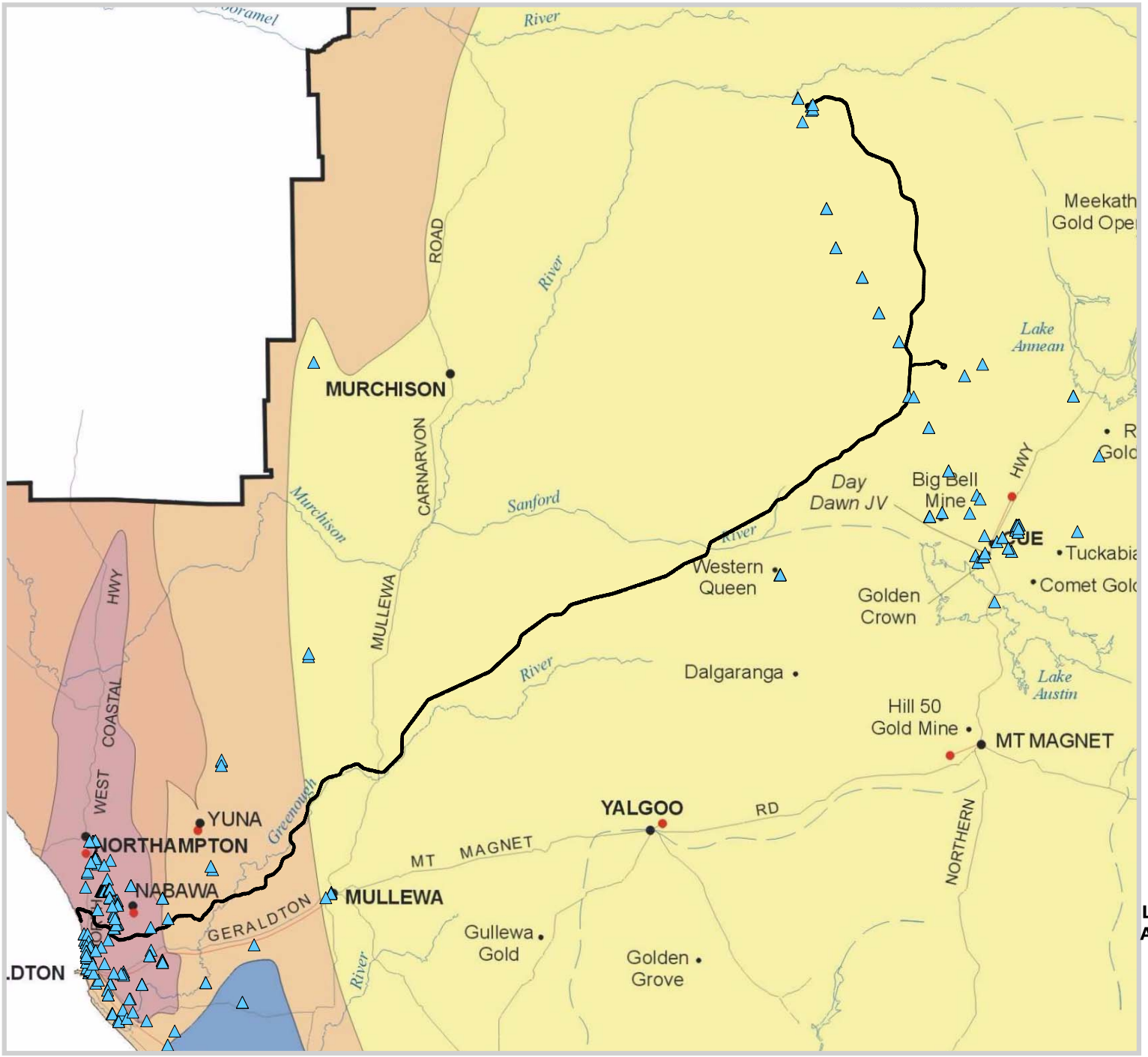
aquaterra

FIGURE 4.1
LOCATION OF EXISTING BORES

AUTHOR:	KMH	REPORT NO:	617
DRAWN:	KMH	REVISION:	...
DATE:	21/12/09	PROJECTION:	MGA94 (Z50)
JOB NO:	715J\J5	SCALE:	1:2,000,000

Location: F:\Jobs\715\J\MapInfo\617 Figures\617b_Figure4.1.wor

Figure 5-35 DoW licensed bore locations



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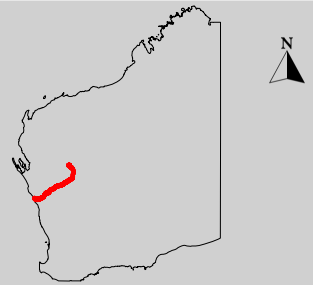
LOCATION MAP



LEGEND

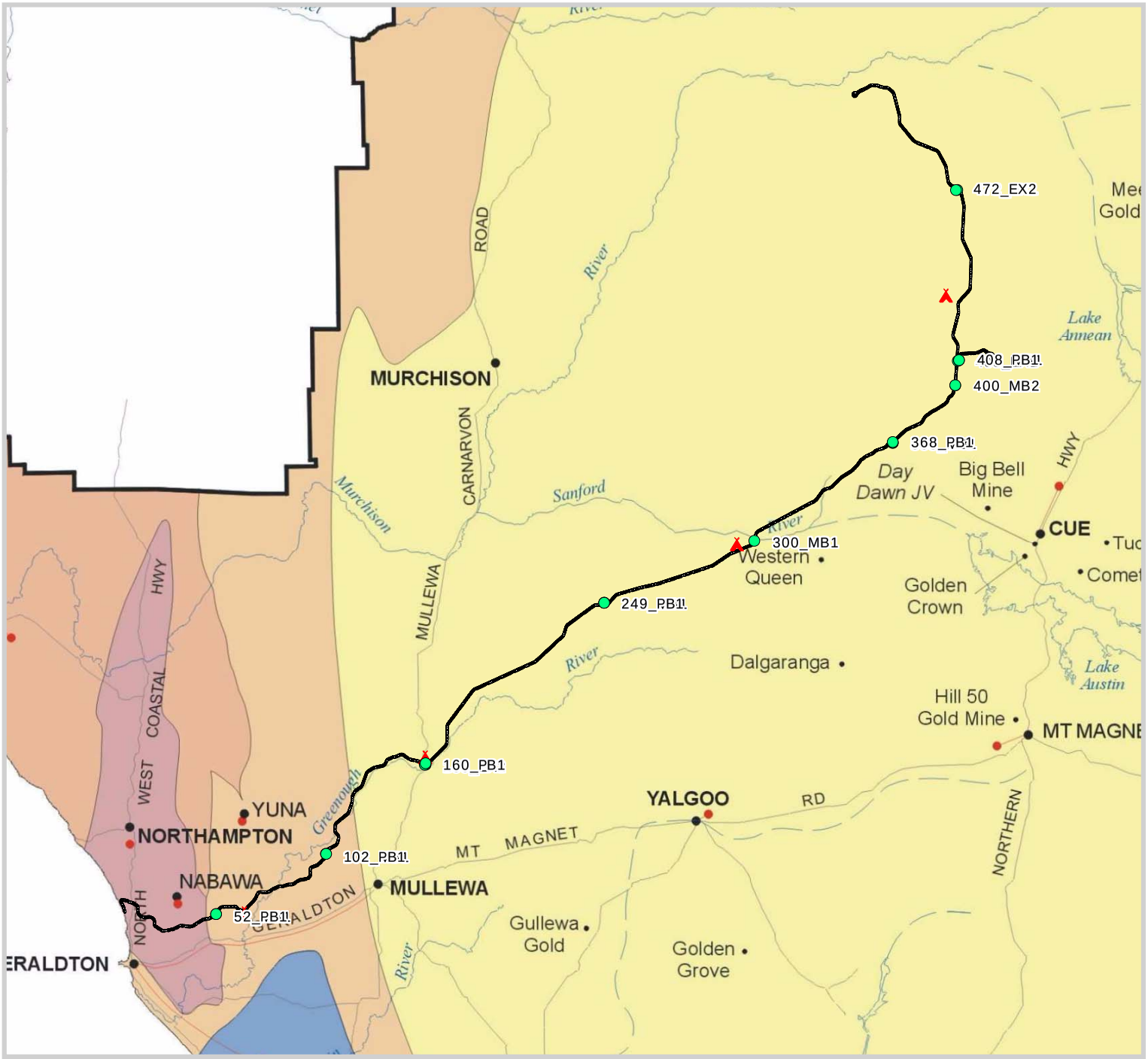
- GWL Licence Allocation
- OPR01 Rail

aquaterra

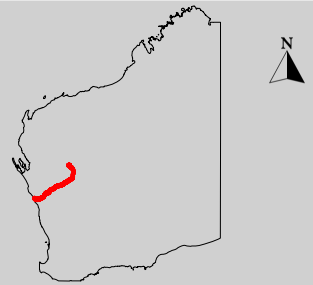
FIGURE 4.2
LICENSED GROUNDWATER ABSTRACTION LOCATIONS

AUTHOR:	KMH	REPORT NO:	617
DRAWN:	KMH	REVISION:	B
DATE:	21/12/09	PROJECTION:	MGA94 Z50
JOB NO:	715J	SCALE:	1:2,000,000

Figure 5-36 Groundwater investigation areas



LOCATION MAP



LEGEND

- Phase 1 Drilling Locations
- Camp Locations
- OPR01 Rail

40 0 40 80

Kilometers

aquaterra

FIGURE 5.2

OPR PHASE 1 DRILLING RESULTS

AUTHOR:	KH	REPORT NO:	617
DRAWN:	KH	REVISION:	...
DATE:	21/12/09	PROJECTION:	MGA94 Z50
JOB NO:	715J	SCALE:	1:2,000,000

Location: F:\Jobs\715\J\MapInfo\617 Figures\

Construction water supply investigations

Following the Phase 1 groundwater supply investigations (Aquaterra, 2010b), Aquaterra identified 24 potentially high-yielding groundwater resources located up to 50 km outside of the Proposal Area.

Three of the 24 potential resources have been selected for further investigation, aimed at meeting the construction water demand for the areas 155 – 530 km east of the western boundary of the Proposal Area; namely:

- Area AET-2, which stretches along 84km of the Pindabarn Creek between the 424 km point and the Jack Hills Mine;
- Areas AET-6 to AET-9, which extends along approximately 120 km of the Sanford River and its tributaries; and
- AET-12, located between the 185 and 215 km point, and extending along approximately 34 km of the Greenough River.

The anticipated yield capacity of the three selected groundwater supply areas has been estimated by:

- 'siting' potential exploration targets within each area using existing 250K-scale geological and regional aeromagnetic maps to obtain a total number of potential production bores per area, assuming an 80% success rate; and
- multiplying the number of potential production bores by the estimated average sustainable bore yield (Aquaterra, 2010b), which is based upon analysis of existing bore yield information in these, and other similar, areas.

The total yield potential of groundwater supply areas AET-2, AET-6 to -9 and AET-12 is estimated at 120 L/s, 160 L/s and 3 8L/s, respectively.

Eleven exploration targets located within the Proposal Area are proposed to be investigated in the Phase 2 drilling programme. It is proposed that these exploration targets (listed in Table 5-24) be drilled and, if successful, test pumped, as they fall within or along the edges of the three selected groundwater supply areas, and would therefore provide useful, preliminary hydrogeological information on these areas.

Table 5-24 Estimated yield potential of selected 'alternative' groundwater supply areas

Groundwater Supply Area	Estimated Number of Production Bores	Average Sustainable Yield of Bore (L/s)	Potential Capacity of Borefield (L/s)	Associated Exploration Targets within Rail Alignment	Description of Target Aquifer Systems
AET-2	40	3.0	~120	T424 T441 T449 T465	Unconsolidated to semi-consolidated Quaternary alluvium with minor surficial calcrete and underlying fractured bedrock.
AET-7 to -9	36	4.5	~160	T295 T300 (Ph1_78) T326 T341	Unconsolidated to semi-consolidated Quaternary and Tertiary (palaeochannel) alluvial material, underlain in places by highly fractured bedrock. Saturated surficial calcrete deposits in area AET-7.
AET-12	15	2.5	~38	T172 T193 T198	Unconsolidated Quaternary alluvium and metamorphosed bedrock of the Tallering Fm.
TOTAL			**~318**	**11**	

It should be noted that these anticipated borefield yields are indicative only and are based on available information, as well as Aquaterra's experience in similar hydrogeological environments. These total potential yields do not account for aquifer heterogeneity, boundaries, cumulative drawdown impacts, etc. Exploration drilling and test pumping is required to determine the aquifer boundaries and potential bore yields.

5.2.5 Contaminated Sites

Historical land use throughout the area is predominantly broad scale agriculture and pastoralism, which reduces the likelihood of contamination occurring within the Study Area. A preliminary search of DEC's contaminated sites register does not identify any known contaminated sites within the Study Area (DEC, 2009b). The possibility that contaminants could be encountered during the Proposal cannot, however, be discounted although the risk of such would be low and adequately addressed through construction management procedures.

Unexploded Ordnance is known to be an issue in the Geraldton locality and the southern extremity of the Rail Corridor traverses a known live firing target area. Although available information indicates the likelihood of encountering Unexploded Ordnance is low, surveys will be undertaken in accordance with advice from the Fire Emergency Services Authority of WA (FESA) prior to ground disturbing activities within areas of potential risk.

5.3 SOCIAL SETTING

5.3.1 Population and Demographics

In 2006, the population of the Mid-West Region was 51,748 (Table 5-25), with Geraldton's population of 35,022 equating to 67.7% of the total regional population (Mid West Development Commission (MWDC), 2006).

Continued regional population growth is expected to be driven by resource development, although to some extent it will merely compensate for losses in other sectors, such as farming and fishing, which have declined significantly since 2000 (MWDC 2006).

Table 5-25 Mid-West population distribution 2006 (MWDC 2006)

LGA	2006	Proportion of 2006 Population %	Annual growth 2005 – 2006 (%)	Average Annual Growth Rate 2000- 2005 (%)
Chapman Valley	957	1.8	-2.6	1.8
Cue	359	0.7	2	-1.8
Geraldton/Greenough	35,022	67.7	7.4	1.3
Meekatharra	1296	2.5	-16.4	-2.3
Morawa	888	1.7	3.4	-2.1
Mullewa	1,011	2	-4.4	-2
Murchison	127	0.2	-21.6	-4.5
Yalgoo	271	0.5	-17.1	-3.6
Other Mid-West LGAs	9,465	18.3	-3.2	-1.4
Mid-West (total)	**51,748**	**100**	**3.5**	**0.5**

5.3.2 Industry and Employment

In the coastal sector, agriculture and fishing are dominant, while further inland, mining and pastoral activities dominate. In the financial year (FY) 2007, the Mid-West economy delivered the third greatest Gross Regional Product (GDP) per capita ($67,354) in WA, behind only the State's two major mining regions, the Pilbara and Goldfields/Esperance (Department of Local Government and Regional Development (DLGRD), 2009).

Mining is the greatest contributor to the Mid-West economy, generating approximately 50% of the region's GDP in 2007 (Economics Consulting Services, 2007). Cue, Mount Magnet and Yalgoo were a focus of gold prospecting and mining in the late 1880s (MWDC, 2006) and a range of mineral-related activity, including mineral sands, gold, nickel, zinc-copper, talc, lead, gypsum, lime sands, garnet and iron ore, now occurs within the Mid-West Region.

Although the Mid-West Region encompasses almost one third of WA's agricultural land (29.2%), the region only produced 11.3% ($581.6 million) of the State's total agricultural output in FY 2005.

The Mid-West has dominated the State's fishing industry for over a decade due largely to the economically valuable rock lobster industry. Although mollusc and finfish catches were commercially valuable leading up to FY 2005 (DLGRD, 2009), in the decade to the end of FY 2005, the rock lobster industry consistently contributed over 80% of the combined value of production from the region's fisheries. In FY 2007, the Mid-West fishing industry contributed 42.85% ($145.256 million) of the combined catch value from all WA fisheries (DLGRD, 2009).

Although Agriculture and Fishery industries are important contributors to the regional economy, between 2001 and 2006, their contribution to regional employment levels decreased by 18.6% (Australian Bureau of Statistics, (ABS) 2001; ABS, 2006). Since the 2001 Census, this decline has been offset by significant employment growth in the mining (183.7%), construction (135.9%) and transport sectors (148.8%) (ABS, 2001; ABS, 2006). In 2006, the farming and agricultural sector was proportionally the largest employer (26.0% of the total regional workforce), with education and mining the next most significant employers in the region.

5.3.3 Facilities and Infrastructure

5.3.3.1 Recreation and Tourism

Regionally, recreational activity focuses on facilities in Geraldton, the outlying towns, and the coastal sector. In the vicinity of the Proposal Area, the coastal sector between the Buller River and Coronation Beach is popular recreational destination. Coronation Beach is the most popular coastal recreation area in this coastal sector and is accessed via a bitumen road from the North West Coastal Highway (NWCH). The beach is on a safe and protected section of the coast and is used for activities such as windsurfing, swimming, snorkelling, beach fishing and reef harvesting.

As the regional centre, Geraldton offers a wide range of active and passive recreational and sporting facilities. All outlying centres within the region also offer similar facilities, although the extent of such facilities in these centres is obviously more limited.

Tourism activity also focuses on the coastal sector and is centred within Geraldton and the larger outlying coastal towns. During the wildflower season however, tourism activity is more widespread throughout the region and areas of local cultural, historic and landscape interest attract tourist traffic.

5.3.3.2 Transport

The broader Northwest Region is serviced by an established network of primary and lesser roads, and in the vicinity of the Proposal Area, the principal routes are:

- NWCH;
- Great Northern Highway;
- Geraldton Mount Magnet Road; and
- Carnarvon Mullewa Road.

The region is also serviced by narrow gauge rail lines originally established to haul grain from the surrounding agricultural area to the Geraldton Port. Proposals for upgrading of the narrow gauge rail link to Morawa as an adjunct of mining Proposals east of the town have been raised and a connection to this link forms part of the Proposal.

The Mid-West region is serviced by the Geraldton Airport. Approximately 98,325 passengers passed through the airport in FY 2008, approximately 90% of whom flew into Geraldton on business (City of Geraldton/Greenough, 2009). A new airport terminal was built in 2001 and is currently regarded as adequate to meet passenger demands in spite of average annual growth rates of 18% (City of Geraldton Greenough, 2009).

5.3.3.3 Communications

Mobile telephone and wireless broadband internet coverage is available within the coastal portions of the Mid-West region. However, level of service decreases further inland with only a few population centres such as Mount Magnet, Cue and Meekatharra receiving coverage. The City of Geraldton-Greenough is the only population centre with access to other communication service providers.

5.3.3.4 Power

There is no significant power supply other than for domestic customers in the vicinity of the Proposal Area, and therefore OPR is proposing that the rail development will independently produce its own power, using containerised diesel fuelled generators, during both Proposal construction and operation.

In 2008, the Energy Minister noted that current facilities were not capable of coping with projected growth in the Mid-West Region. Through the 2008 May State Budget, the Minister for Energy authorised Western Power to build a 330 kV transmission line from Perth to Geraldton to meet the growing demands of the Mid-West. This service has not yet been developed. One of the iron ore mining Proposals to the east of Morawa is seeking extension and augmentation of an existing Western Power high voltage transmission line as its power supply but this does not represent a potential source of supply for the Proposal.

5.3.3.5 Water

There is no significant water supply other than for domestic customers in the vicinity of the Proposal Area, and OPR is proposing that the Proposal will independently source water from groundwater reserves, during both Proposal construction and operation.

During FY 2009 the Water Corporation supplied the Mid-West with over 20 GL of water through a mains pipeline network that spans 2,673 km (Water Corporation, 2009). The mains water supply connects a significantly lower proportion of the Mid-West properties (68.8%) compared with broader WA (89.3%). The average property consumption in the Mid-West is typical of consumption patterns for all WA regions to the north of Perth (Water Corporation, 2009).

5.3.3.6 Port

Ore was first exported through the Geraldton Port in 1966. Iron ore production and export is of increasing importance to the Mid-West, with predictions that the region's iron ore exports may reach 70 Mtpa by 2013 (DLGRD, 2006). This would make the region the second largest exporter of iron ore in Australia, behind the Pilbara.

The Geraldton Port is one of Australia's busiest regional ports and provides a gateway to WA's diverse Mid-West Region. In 2007-2008, exports accounted for 96% of the Port's total trade, with more than half of the Port's exports being generated from iron ore and other minerals[2]. It is also Australia's second largest grain exporter. A recent upgrade to Berth 5, a dedicated iron ore facility, has expanded the export capability of the Port; however this is not expected to be sufficient for the future proposed exports of the area.

5.3.3.7 Educational, Medical and Retail Facilities

As the regional centre, Geraldton offers a wide range of educational, medical and retail facilities and services. Such are also available in outlying centres within the region, although the specific services and the level of the available facilities are variable.

5.3.4 Native Title

The Proposal Area intersects a total of four registered and one unregistered native title claims. A summary of these claims is provided in Table 5-26.

Table 5-26 Native Title claims

Claimants	Claim No.	Registered	Rail/Claim intersection (approx)	Overlapping claims
Naaguja Peoples	WC97/73	Yes	80 km	2
Amangu People	WC04/02	Yes	110 km	2
Mullewa Wadjari Community	WC96/93	Yes	200 km	4
Wajarri Yamatji	WC04/10	Yes	300 km	2
Widi Mob	WC97/72	No	100 km	3

The claimant areas in relation to the Proposal Area are presented in Figure 5-37. OPR intends to negotiate a Comprehensive Agreement with each group to outline opportunities for indigenous involvement in the Proposal and the wider OPR Proposal, including employment, training and contract arrangements.

5.3.5 Heritage

5.3.5.1 Aboriginal Heritage

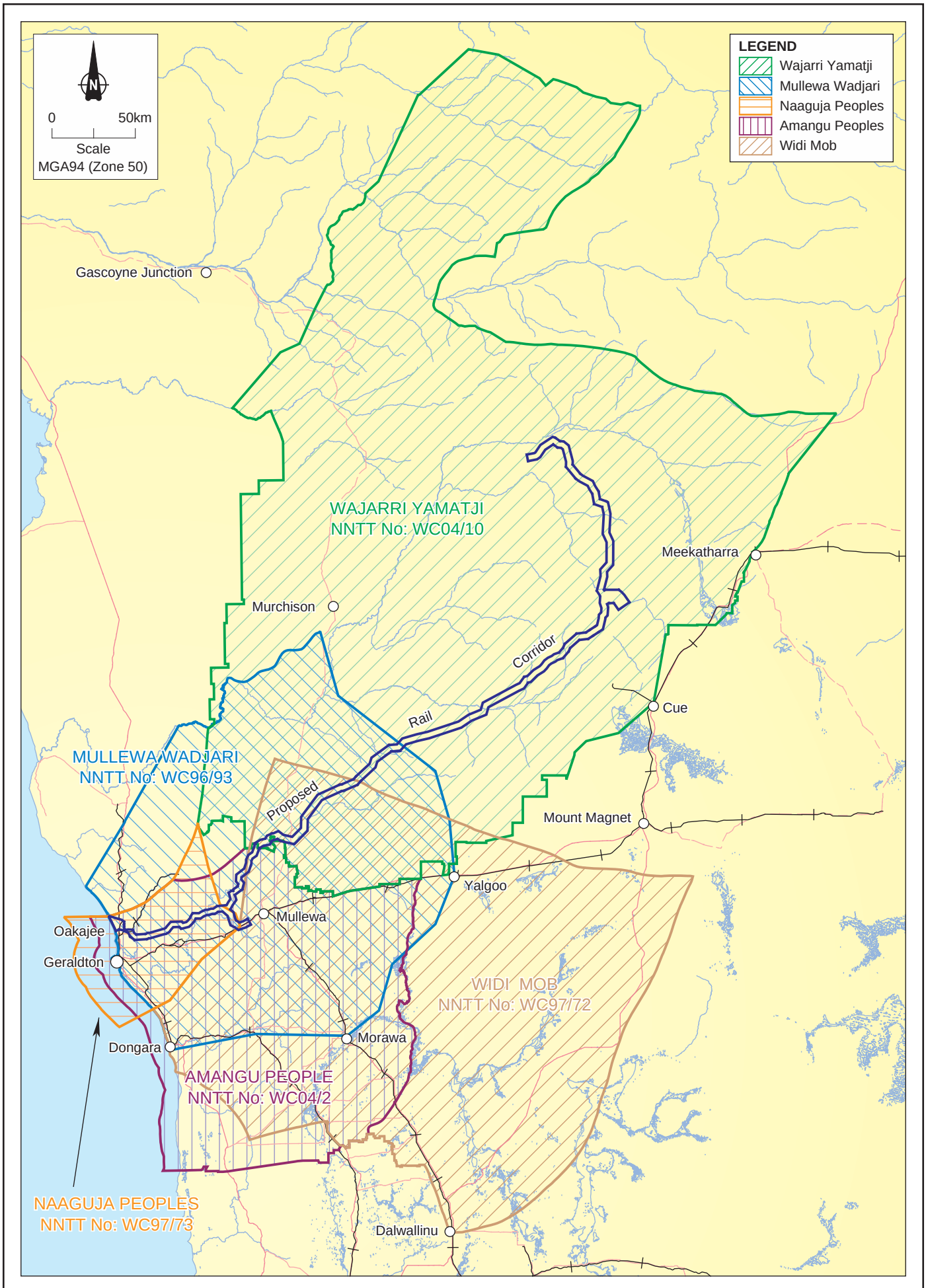
A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System (DIA, 2009) indicates that there are presently 69 Aboriginal heritage sites within the vicinity of the Proposal Area (Figure 5-38). Of these the majority (59) are in the Oakajee area with another cluster associated with breakaways on Madoonga Station. The recorded sites include artefact scatters, paintings, ceremonial areas, mythological sites and several burial sites. It is anticipated that more sites will be located as comprehensive ethnographic and archaeological surveys of the Proposal Area are currently underway to identify all Aboriginal sites that might be impacted by the construction of the Proposal.

[2] Department of infrastructure, Transport And Regional Development, http://www.regionalaustralia.gov.au/Info-geraldton

5.3.5.2 European Cultural Heritage

The Murchison and Mid-West regions have a rich European Heritage. Pastoralists moved into the area during the 1870s and settled large tracts of land for sheep grazing. The areas of Cue, Mount Magnet and Yalgoo prospered rapidly during the 1890s gold rush with the towns developing as service centres to settlers and prospectors. Much of the local colonial architecture within the towns is preserved and heritage listed (Heritage Council of WA, 2009).

A search of the Heritage Council of WA 'Places' database indicates that the Mt Wittenoom, Murgoo, Twin Peaks, Yuin, Woolgorong, Wandina and Tallering Station Homesteads are State Heritage listed (Heritage Council of WA, 2009). Although the Proposal Area intersects these Stations, all of the listed homesteads are outside the Proposal Area.



Source: Landgate - Native Title Spatial Services

OPR oakajee port & rail

Drawn: CAD Resources

CAD Resources File No: g1660_Pub_PER_R_F010.dgn

Native Title Claims

Figure No:

Figure 5-38 Registered Native Title claimant areas in relation to the Proposal Area

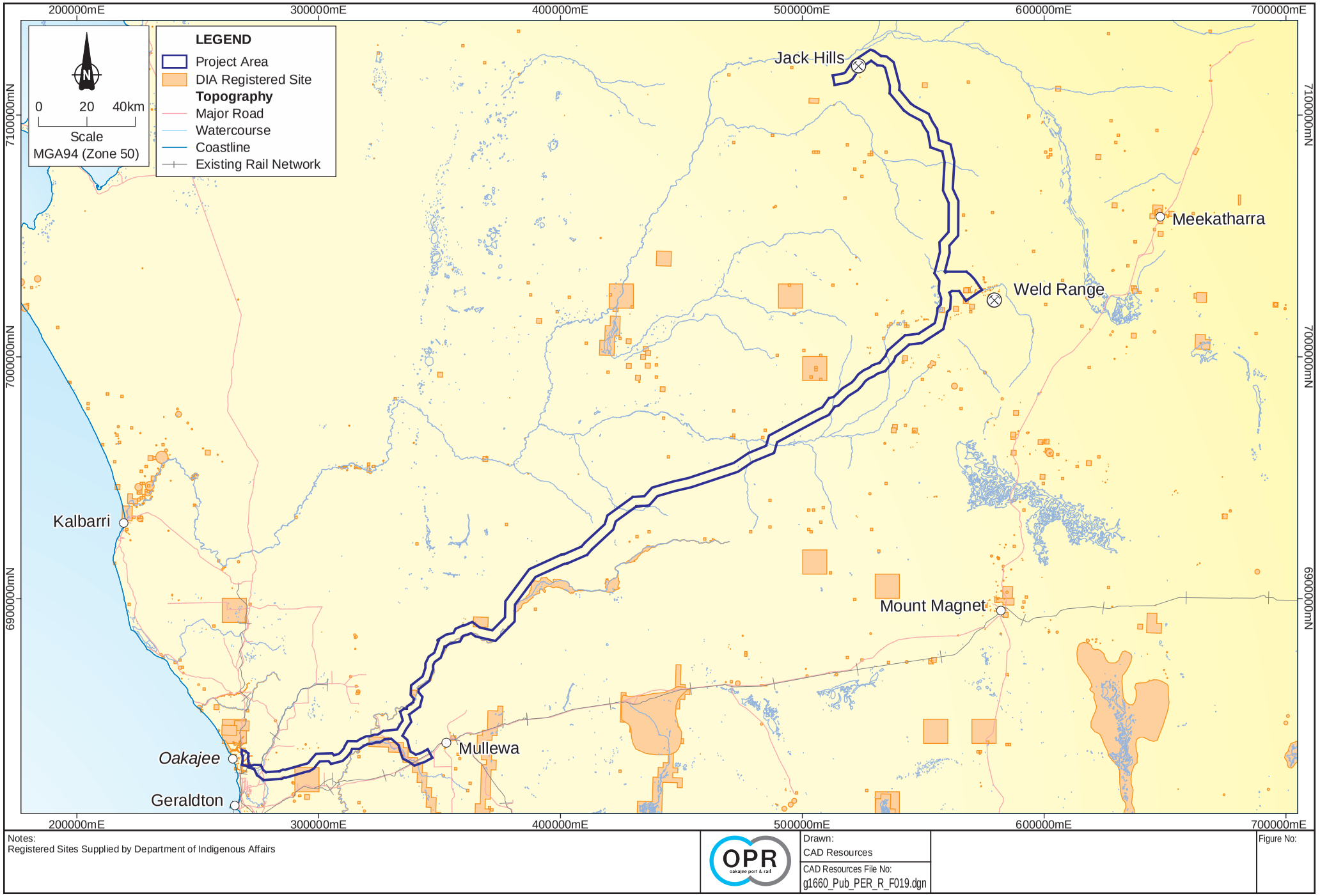


Figure 5-38 Location of DIA registered heritage sites

6 STAKEHOLDER ENGAGEMENT

Oakajee Port and Rail (OPR) is committed to ongoing stakeholder and community engagement, including open and transparent communication, and recognises the importance of genuine stakeholder involvement in the identification of potential issues and concerns, as well as appropriate management of construction and operations.

OPR defines stakeholders as people or organisations with a direct interest in or are directly affected by its operations and activities. An understanding of key stakeholder attitudes and issues is crucial for OPR to support effective stakeholder engagement, and to respond to community concerns and to guide management of issues.

6.1 COMMUNITY RELATIONS AND ENGAGEMENT STRATEGY

OPR has taken a proactive approach to liaising with stakeholders and interested parties. OPR's understanding of local attitudes and community issues has been primarily guided by an ongoing program of research, communication and consultation with key stakeholders and the broader community.

To date, mechanisms for engagement with and provision of information to stakeholders have included:

- meetings with regulatory agencies, including Local Government Authorites (LGAs);
- personal stakeholder meetings and visits;
- briefings and presentations;
- functions, including luncheons and sundowners;
- hosting visits to the proposed OPR deep water port site, and conducting site briefings;
- community access and visits to the OPR Mid-West Community Office (opened on 14th April 2009 at 260 Foreshore Drive, Geraldton);
- regular contact and communications via correspondence, email and telephone;
- media relations, including briefings, media site visits, news releases, advertising, and monthly community updates;
- direct mail via letterbox drops (e.g. OPR newsletter 'Oakajee Quarter', Project updates, Fact Sheets and press releases);
- information resources – display, posters, fact sheets, and websites;
- community consultation initiatives and interviews;
- social impact assessment (SIA) workshops;
- sponsorship and partnership projects;
- display and information booth at local agricultural shows; and
- presentations at industry and business conferences and events.

Figure 6-1 summarises OPR's stakeholder engagement process, demonstrating a system of communication, engagement, response, feedback and monitoring.

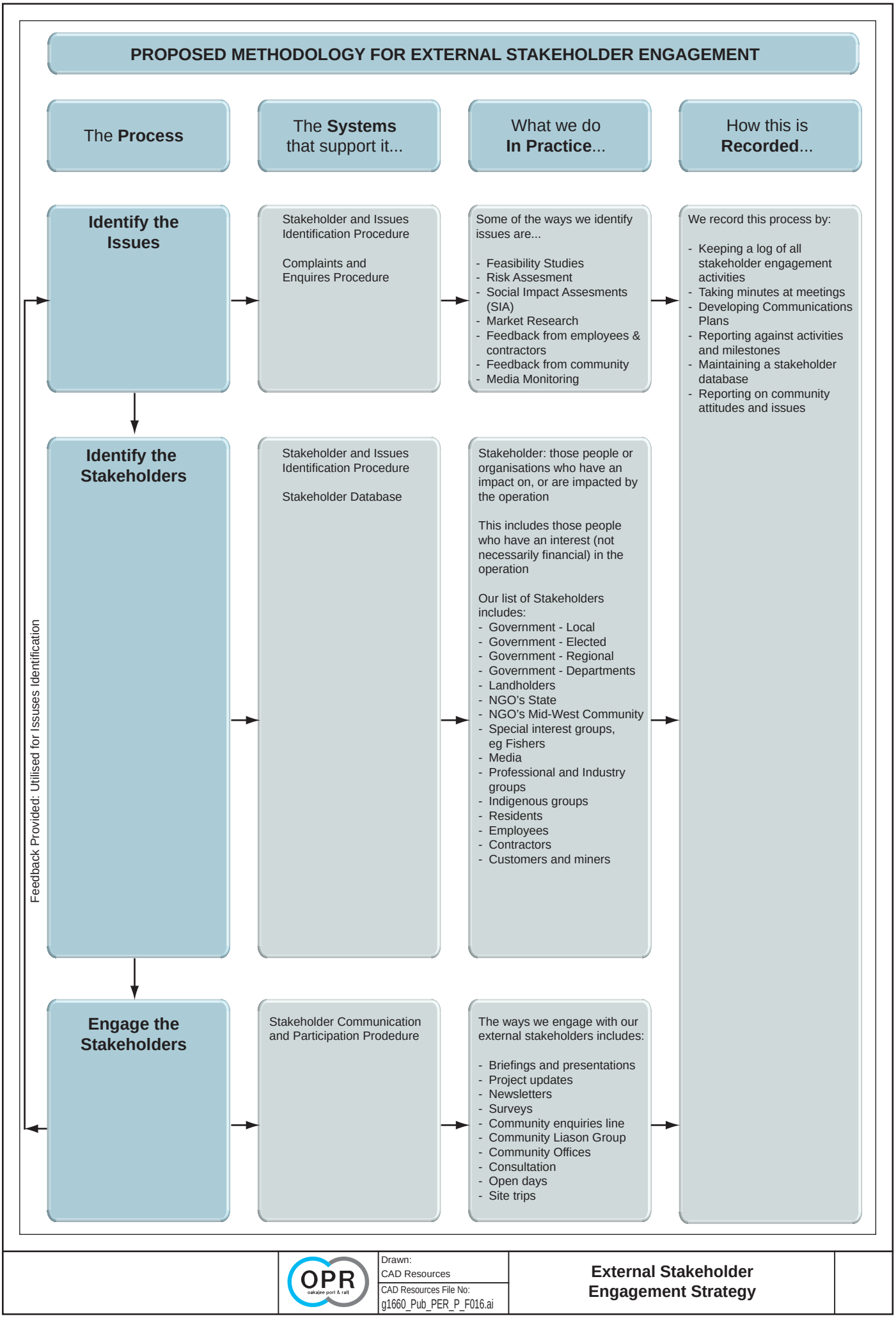


Figure 6-1 External stakeholder engagement strategy

6.2 ENGAGEMENT TO DATE

In developing the Proposal, OPR has worked closely with the Western Australian (WA) Government's Oakajee Policy Team, relevant government agencies, the Geraldton Iron Ore Alliance (GIOA) and Mid-West stakeholders. Additionally, as summarised in Table 6-1, OPR has participated in a number of conferences and other forums during 2009 as a means of disseminating information about the Proposal.

Table 6-1 OPR 2009 conference/forum participation

Date	Forum
24 - 25 February 2009	Mining in the Mid-West Conference, Perth
4 March 2009	Asia Pacific Port Infrastructure Conference 2009, Perth
23 - 26 March 2009	Australian Journal of Mining's 12th Annual Global Iron Ore and Steel conference; Perth
12 May 2009	Committee for Economic Development of Australia Business Breakfast – OPR Project
25 - 26 June 2009	Biennial WA Port Authorities Association conference, Geraldton
22 July 2009	Mid-West Resources Forum, Geraldton
9 September 2009	WA Transport Summit, Langley
8 December 2009	Mid-West Mining Development Conference, Fremantle
10 December 2009	Chamber of Commerce and Industry (CCI) WA Resource and Energy Projects Service Sundowner: OPR Project, Burswood
31 May – 2 June 2010	Transfield Worley Services Leading Practices Forum – West Coast 2010, Perth

In addition to meeting with individual stakeholders, OPR has also undertaken a range of stakeholder engagement/consultation initiatives. Table 6-2 outlines the presentations, briefings and consultation OPR has undertaken in relation to the Proposal.

Table 6-2 Summary of stakeholder consultation

Organisation	Date(s)
Local Government	
City of Geraldton – Greenough	Ongoing, including Council meetings in April, September and October 2009, and June 2010 General Meetings in January, April and August 2009 SIA consultation in July 2009 Attendance at the Social Impact Assessment (SIA) / Environmental Impact Assessment (EIA) workshops in October 2009 and February 2010
Shire of Chapman Valley	Ongoing, including Council meeting in October 2009 and June 2010 General Meetings in April, July, August and October 2009 SIA consultation in July 2009 Attendance at the SIA / EIA workshops in October 2009 and February 2010
Shire of Cue	Council meetings in September and October 2009 G10A Board Meeting in June 2009 SIA Consultation in July 2009
Shire of Meekatharra	Ongoing correspondence Murchison Zone Meeting in November 2009
Shire of Murchison	Council meeting in October 2009 SIA Consultation in July 2009
Shire of Mullewa	Ongoing, including Council meetings in September and October 2009, and June 2010 General Meetings in February, April and June 2009 SIA consultation in July 2009 Attendance at the SIA workshop in February 2010
Shire of Yalgoo	Council meeting in October 2009 and June 2010 SIA Consultation in July 2009
State Government Agencies	
Office of the Environmental Protection Authority (EPA) / EPA Service Unit	General Meetings in December 2008, February and November 2009, March 2010 Briefing in August 2009 Site visit in May 2010 and April 2010
Department of Environment and Conservation (DEC)	Ongoing, including meetings with and briefings to the Geraldton Regional Office and Perth-based Environmental Management Branch, Threatened Species and Communities and Air Quality Branch throughout 2009. Site visit in May 2010
Department of Commerce	Ongoing correspondence
Department of Agriculture and Food	Meeting in September 2009 and May 2010 SIA consultation in July 2009
Department of Indigenous Affairs	Ongoing, including meetings and briefings in Perth in October and December 2009, and May 2010 SIA consultation and workshop in July and October respectively
Department of Planning (DoP)	Ongoing SIA consultation in July 2009
Department of State Development (DSD)	Meeting in January and May 2009
Department of Transport (DoT)	Ongoing SIA consultation in July 2009
Department of Water	Meeting in September 2009 and June 2010 (both in Geraldton and Perth) SIA consultation in July 2009
Department of Education and Training	July and August 2008 and July 2009 meetings
EPA	Ongoing, including meeting with the Chairman in January 2009. EPA Board meeting in February 2010. EPA Board Site Visit in May 2010.
Oakajee Rail Infrastructure Group (DSD, Public Transport Authority (PTA), DoT, DoP, Department of Regional Development and Lands)	Ongoing fortnightly meetings

Organisation	Date(s)
Legal Subcommittee - Oakajee Rail Infrastructure Group (OPR, DLA Phillips Fox, PTA, State Solicitor's Office)	Ongoing monthly meetings
WA Local Government Association (Murchison Zone)	Zone Meeting 06/11/09 Attendees: Shires of Cue, Meekatharra, Mt Magnet, Murchison, Sandstone and Yalgoo, and The Hon Norman Moore MLC, Mr Ian Blayney MLA, Mr Barry Haase MP, The Hon Wendy Duncan MLC.
Main Roads WA	Ongoing
Mid-West Development Commission	Ongoing Meeting in October 2009 and May 2010 SIA consultation in July 2009
Mid-West Strategic Infrastructure Group	Meeting in July 2009
LandCorp	Ongoing
Northern Agricultural Catchments Council	Meeting in September 2009 and May 2010 SIA Consultation in July 2009
Water Corporation	Ongoing
Western Power	Ongoing
Yamatji Land and Sea Council (represent Wajarri Yamatji, Amangu and Naaguja Peoples – see additional detail below)	Ongoing Meetings in November 2008, January and May 2009, and May 2010 SIA Consultation in July 2009
Office for the Minister for the Environment	Briefing in August 2009
Office of Premier and Cabinet	Ongoing
PTA	Ongoing
Federal Government Departments	
Department of Environment, Water, Heritage and the Arts (DEWHA)	Briefing in August 2009 and May 2010.
Elected Members	
State Member for Geraldton, Greenough Region (Mr. Ian Blayney MLA)	Meeting in June and July 2009 Briefing in October 2009 Attendance at SIA / EIA workshops in October 2009
Speaker Legislative Assembly. State Member for Moore. (The Hon Grant Woodhams MLA)	October and November 2009 and May 2010 meetings
State Members for the Agricultural Region: (The Hon Brian Ellis MLC, The Hon Mia Davies MLC, The Hon Max Ternorden MLC)	Meetings in November and December 2009 SIA consultation in July 2009
Mining and Pastoral Region Member (The Hon Wendy Duncan MLC)	Ongoing Correspondence Meeting in November 2009
Legislative Assembly, Member for North West (Mr Vince Catania MLA)	Formal engagement commenced in January 2010
Federal Member for O'Connor (Wilson Tuckey)	Ongoing Correspondence
Community	
Recreational Groups (e.g. Great Northern Football League, netball clubs, Geraldton 4WD Club, Midwest Caravan Club of WA)	Ongoing Correspondence
Mid-West Employment and Economic Development Aboriginal Corporation	Meeting in July 2009 SIA consultation in July 2009 Attendance at SIA / EIA workshops in October 2009
Mid-West Indigenous Employment Meeting	Ongoing, including meetings in November 2008, March and April 2009
Mullewa Wadjari Community	Ongoing, including meetings throughout 2008 and 2009. Heritage protocol and negotiation framework meetings in February and March 2009 August 2009 Heritage Protocol and Negotiation Framework Agreement Signing

Organisation	Date(s)
	April 2010 Heritage Surveys for feasibility works
Naaguja Peoples	Ongoing, including heritage protocol and negotiation framework meetings. September 2009 Heritage Protocol and Negotiation Framework Agreement Signing February and April 2010 Heritage Surveys for feasibility works
Wajarri Yamatji	Ongoing, including meetings in April, May and August 2009
Amangu People	Ongoing, including heritage protocol and negotiation framework meetings. September 2009 Heritage Protocol Signing February and April 2010 Heritage Surveys for feasibility works
Conservation Council	Pending
Wildflower Society	Meeting in June 2010
World Wildlife Fund – Australia	Pending
Professional / Industry	
Mid-West Chamber of Commerce and Industry	Meeting in October 2009 and May 2010 SIA consultation in July 2009 Attendance at SIA Workshop in October 2009
GIOA	Community briefing in June 2009 SIA consultation in July 2009
Regional Service Providers including training and employment providers	SIA consultation in July 2009 Attendance at SIA workshops in October 2009
Health Services Providers	SIA consultation in July 2009 and May and June 2010 Attendance at SIA workshops in October 2009
Geraldton Property Team	Meeting in July 2009 and May and June 2010 SIA consultation in July 2009 Attendance at SIA workshops in October 2009
Chamber of Mineral and Energy WA	September 2009 Regional Council Meeting
Customers	Ongoing, including meetings with Sinosteel Midwest Corporation, Crosslands Resources, Karara Mining/Gindalbie Metals, Golden West Resources, Cliffs Natural Resources, Cashmere Iron, Extension Hill, Ferrowest, Emergent Resources, Giralia and Royal Resources.
Media	
Main-stream WA and Mid-West media (including Yamatji News, Geraldton Guardian, Mid-West Times, Radio MAMA (Mid-West Aboriginal Media Association), Shire publications, WA Business News, The West Australian, GWN TV, ABC Radio, Batavia Coast FM)	Ongoing, including March 2009 Media Conference and June and November 2009 Media site tour.
Others	
Farmers Federation	Meeting in October 2009
Landholders	Ongoing consultation regarding land access
OPR Reputation Survey (300 people in Geraldton Greenough and WA's Mid-West)	August 2009
Interested parties	OPR sundowner in February 2010

6.3 ISSUES RAISED

Issues of interest to stakeholders and the community were categorised into themes, based on an analysis of the OPR stakeholder engagement register (from May 2005 to present), information from the Chapman Valley Coastal Management Strategy (developed in 2007) and SIA investigations undertaken for OPR (by Coakes Consulting and Environmental Resources Management in 2009).

The social profiling entailed the review of secondary data and interviews with local members of each of the affected municipal Councils relating specifically to the Proposal. Although the specific issues varied between the communities, all cited a need for a greater focus on the attraction and retention of a skilled workforce within their municipal district, as well as strategies to assist in addressing alcohol and substance abuse (Coakes Consulting, 2008, Reputation Survey, 2008/09).

Stakeholder comments relating to environmental impacts associated with the Proposal are summarised in Table 6-3. A summary response to each item is provided, with a reference to the section of this document which addresses the comment in more detail. Responses to these concerns will also be raised in future stakeholder engagements (refer to Section 6.4).

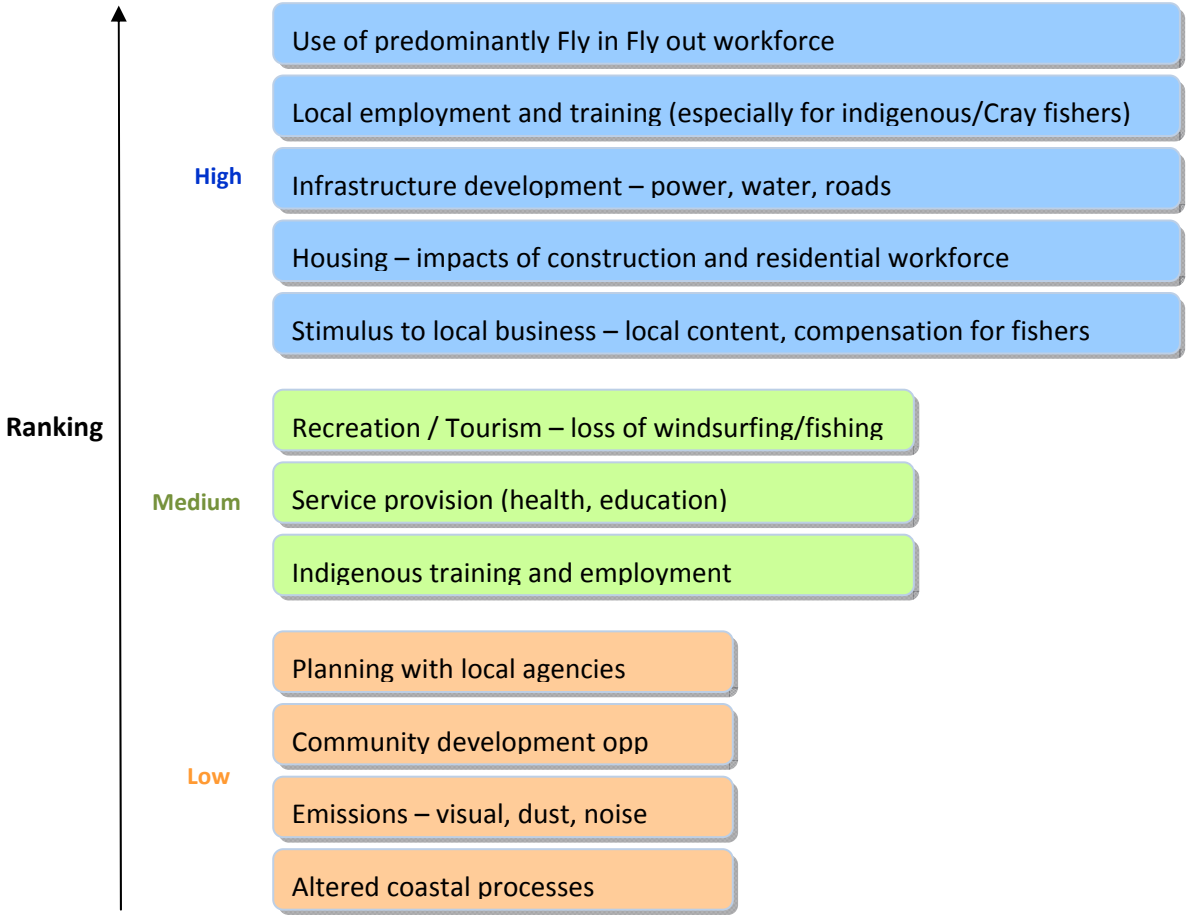


Figure 6-2 Stakeholder themes

Table 6-3 Summary of stakeholder interests

Stakeholder concern	Stakeholder	Response	PER Section
Potential impact on surface water flows, particularly in areas where vegetation is dependent on sheetflow.	Farmers / Landholders	Surface hydrology assessments have been conducted along the Study Area. In addition potential sheetflow dependent vegetation has been mapped. Engineering design including the location of bridges and culverts will maintain the existing natural environmental flows.	7.5
Salinity	State Government	The Proposal is not expected to cause any significant salinity impacts due to the long linear nature of the proposed clearing	7.2
Potential groundwater overuse, water sources (desalination, groundwater)	State Government	OPR is investigating groundwater availability along the Study Area and abstraction will be licensed by DoW pursuant to the *Rights in Water and Irrigation Act 1914* (RIWI Act). Other potential sources include dewatering of ballast quarries or the OPR desalination plant (for western sections (desalination plant does not form part of this Proposal)).	7.6
Systemic planning of regional water use	Farmers / Landholders, Community	The water source for the Proposal will be from groundwater bores and potentially dewatering of ballast quarries or the OPR desalination plant (for western sections (desalination plant does not form part of this Proposal)). At present it is expected that there will not be excess groundwater pumped for landowners, however this may be negotiated on a case by case basis. Also negotiations may occur over access to water sources already developed by the landowner if required.	7.6
Disruption of the natural variation in flora/SREs	State Government	Planning of land disturbance locations has minimised the impact to significant flora species and short range endemic (SRE) habitat.	7.2, 7.3
Potential to ruin pristine areas and bushlands	Community	The Proposal will result in the clearing of approximately 6000 ha of native vegetation, however the Proposal been designed to avoid significant vegetation and flora where practicable.	7.2
Weed control; concerns about introducing weeds to areas that currently do not have them (e.g.: Patterson's curse) via soil movement.	State Government	Weed hygiene will be enforced on site. Topsoil movement will be managed to ensure that weed seeds are not transported into previously unaffected areas. Vehicles will also be washed to ensure seeds are not transported via tyres or undercarriage.	7.2
Potential for ores such as uranium being exported through the port	Community	The Proposal will service operating and proposed mining operations within the Mid-West Region. Future mining operations that may use Proposal infrastructure will need to obtain all relevant environmental and other approvals prior to development.	1.5.5
Indigenous cultural heritage. Impacts on sites of importance, rock art, song lines, camping and burial grounds.	State Government	OPR is undertaking surveys to identify sites of cultural and heritage significance within the Proposal Area. Sites will be avoided if practicable but if not, approval will be obtained under the *Aboriginal Heritage Act 1972* prior to disturbance	7.12
Increase in traffic volumes and railway noise	Farmers / Landholders, Community	Increased traffic on local roads will be confined to the Proposal construction phase and all Proposal-related traffic will comply with relevant statutory requirements. Construction of the Proposal will reduce heavy transport related pressures on the regional road network. Railway noise emissions will comply with State Planning Policy 5.4 and negotiations with affected landowners will occur to ensure that the noise levels in this policy can be met.	7.14, 7.7
Interaction between the rail and North West Coastal Highway	Community	It will be a road over rail arrangement. A bridge will be constructed and then the road will be realigned to meet the bridge, allowing minimal disruption to those using the North West Coastal Highway. Having the road over rail situation will increase safety.	4.4.5
Community group involvement	Community	OPR will rehabilitate construction areas no longer	7.2, 9.2.3

Stakeholder concern	Stakeholder	Response	PER Section
in environmental projects		required during Proposal operation. It is likely that external parties may be involved in this process.	
Level and adequacy of vertebrate surveys to be conducted within the freehold land areas	State Government	A level 1 reconnaissance survey was recommended as the appropriate level of survey within freehold area. Targeted surveys were recommended in potential habitat for conservation significant fauna.	5.2.2
EPBC Act listed species – surveys undertaken, management actions, assessment process.	Commonwealth Government	A referral was submitted to DEWHA for consideration. DEWHA is satisfied with level of assessment and WA bilateral agreement process for the Proposal.	8
Flora and fauna surveys have not been conducted outside the SAC	State Government	Surveys of proposed disturbance areas which occur outside the Special Act Corridor (SAC) (such as some quarries and water supplies) will occur prior to disturbance	7.2, 7.3
Depth of excavation of ballast quarry sites.	State Government	Ballast quarries may extend below the groundwater table. A risk assessment for the potential impact on troglofauna and stygofauna will be undertaken in consultation with DoW as part of the RIWI Act approval process.	4.4.3
Ballast quarry operation and locations	State Government	It has not yet been determined whether the ballast quarries will be operated by OPR or a third party (contractor). Regardless of the operator the quarries will be managed in accordance with the commitments in this Public Environmental Review. Quarry locations will be determined after detailed geotechnical surveys are completed. Final decisions on the locations will take into account any environmental and heritage constraints.	4.4.3
Moresby Range Priority Ecological Community (PEC) – level of flora survey outside the SAC	State Government	To date flora surveys have focused on where the Study Area intersects the PEC.	5.2.1
Impact of the Proposal on the Moresby Range PEC.	State Government	Due to the engineering requirements for the Proposal alignment (predominantly grade) the Proposal will not significantly impact on the Moresby Range PEC (or any other PEC).	7.2
Likelihood of the rail being used for agricultural purposes – grain/livestock	Farmers / Landholders	It is unlikely in the early stages of the Proposal that the rail will be utilised for grain and stock movements. Nevertheless the Proposal is common user infrastructure; therefore it may occur in the future if deemed economically viable.	-
Increased potential for fire from rail wagons	Farmers / Landholders	Due to the dry and hot climate of the area fire control is an issue that needs to be managed. Management measures have been developed and will be implemented throughout the construction and operational phases of the Proposal	7.2
Impact to visual amenity	Farmers / Landholders	Impacts on visual amenity are expected to be minimal due to the Proposal alignment predominantly following low points in the landscape.	7.13
Alienation of land/farm infrastructure (may increase operating costs for farmers, require additional fencing)	Farmers / Landholders	Landholders will be informed of the final Rail Corridor alignment and any potential issues will be discussed. Any concerns will be addressed at this stage.	7.9
OPR would not care about the environment	Community	OPR operates under an Environmental Policy and is in the process of developing an Environmental Management System (EMS) to ensure protection of the environment. OPR is committed to management measures aimed at minimising the impact of the Proposal on the surrounding environment, landowners and indigenous heritage sites.	7, 9

6.4 FUTURE ENGAGEMENT STRATEGY

OPR will continue to consult with stakeholders as identified in Table 6-2 and other relevant stakeholders, including regulatory authorities, throughout the Proposal construction and operational phases on a range of environmental issues.

OPR is currently implementing a Community Stakeholder Engagement Plan, to ensure that future communication and consultation will take place with key stakeholders through mechanisms as described in Table 6-4.

Table 6-4 Future stakeholder engagement and consultation

Mechanism	Frequency of Use
Council meetings	As per Proposal milestones / approvals-based
Stakeholder meetings and briefings	As per Proposal milestones / approvals-based
Briefings, including presentations	As needs for relevant stakeholders
OPR luncheons and sundowners	Up to 4 per year
OPR Mid-West Community Office	Open 5 days per week
OPR Mid-West Community Office Open Days	2 per year
Community Informational Sundowner	Annual
Visits to the proposed Proposal site and site briefings	As needed for relevant stakeholders
Community consultation and interviews	As needed, up to 3 consultations per primary stakeholder group
SIA Workshops	As required, 3 workshops conducted in February 2010
Direct mail via letterbox drops, e.g. OPR newsletter and Proposal update	Monthly/quarterly
OPR Newsletter 'Oakajee Quarter'	Quarterly
Media advertorials, OPR Proposal Updates	Monthly
OPR Media releases	3 – 6 per year
Media relations including briefings and media site visits	Briefings as required, one media site visit per year
OPR Fact Sheets	Update as per Proposal milestones
Mid-West Liaison Group	Commencing Q4/2010 - quarterly
Sponsorship and partnership Proposals	Ongoing
Information resources – displays, posters and websites;	Ongoing
Attendance at Mid-West functions	Ongoing
Display and information both at local agricultural shows	Annual
Presentations at industry and business conferences and events	Ongoing
Information/reporting line	Ongoing

OPR will maintain an enquiries/reporting line, which will allow the complaint to be directed to the appropriate person. All complaints will be investigated as an incident, with the complainant informed of the outcome of the investigation once it has concluded. Exact details of each complaint response will differ on a case-by-case basis.

7 ENVIRONMENTAL IMPACTS AND MANAGEMENT

7.1 IDENTIFICATION OF RELEVANT FACTORS

Oakajee Port and Rail (OPR) has identified the key environmental factors that are relevant to the assessment of this Public Environmental Review (PER) in consultation with the Department of Environment, Water, Heritage and the Arts (DEWHA), the Environmental Protection Authority (EPA) and the Department of Environment and Conservation (DEC). Key environmental factors are those that are considered likely to be materially impacted by construction and/or operation of the Proposal. These key factors, and the associated scope of the PER with respect to the relevant factors, was agreed via the EPA Board and DEWHA approved Rail Development Scoping Document (OPR, 2010), as discussed in Section 1.2.

The following environmental factors are considered to be the key factors relevant to the Proposal:

- vegetation and flora (including Declared Rare Flora (DRF), Threatened Ecological Communities (TECs), Priority Flora and Priority Ecological Communities (PECs));
- fauna (including vertebrate, short range endemics (SREs) and subterranean invertebrate fauna);
- surface hydrology;
- groundwater;
- noise, light and vibration;
- air quality;
- soil quality;
- waste;
- greenhouse gases;
- visual amenity; and
- other social and economic factors.

For each issue, the EPA objectives, applicable standards and legislation, potential impacts, proposed management and mitigation measures, and the likely outcomes are identified. In some cases the management measures may be similar; when this occurs the measures will be discussed in the factor section where the potential impact is the greatest. An example of this is vegetation clearing, where the impact on vegetation and flora can also have a potential impact on fauna (habitat disturbance).

OPR has completed baseline environmental surveys appropriate to the nature and scale of the Proposal and has used the proposed Special Act Corridor (SAC) as its Study Area. With more detailed investigations and planning some minor variations to the proposed SAC have been identified.

The level of survey work has significantly increased the regional data set and produced additional location data for many species. In areas where the final SAC alignment varies from the current Study Area, OPR will complete additional survey work to the required standard.

The findings of these surveys will be used to ensure that the impacts are not in excess of what is described in this PER. If an increase in potential impact is unavoidable, an application to amend the approval will be submitted. All management measures detailed in the PER will apply to all areas of the final alignment.

7.2 VEGETATION AND FLORA

7.2.1 Overview

As detailed in Section 5.2.1, the following vegetation and flora characteristics apply to the Study Area:

- the flora of the Study Area is diverse, with approximately 1016 recorded vascular species;
- 26 Beard vegetation associations were recorded in the Study Area. Seven of these associations have potentially been cleared to less than 30% of their pre-European extent. All of these are located in the freehold area, within the Geraldton Sandplains IBRA region;
- 72 vegetation units were recorded by *Ecologia* in the Study Area. Vegetation units of interest include the Mulga woodlands in the Murchison region and the salt lake communities near Weld Range;
- within the pastoral area the original extent of native vegetation largely remains, however it has been altered through grazing, changed fire regimes, etc;
- within the freehold area there has been extensive clearing;
- no nationally or state listed TECs were recorded in the Study Area. Four Priority 1 PEC communities of state significance were recorded:
    1. Jack Hills vegetation complexes;
    2. Plant assemblages of the Moresby Range;
    3. Tallering Peak Vegetation complexes; and
    4. Weld Range Vegetation complexes.
- two *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed flora species were recorded within the Proposal Area boundaries, *Caladenia hoffmanii* (Endangered) and *Eucalyptus blaxellii* (Vulnerable), and a further species, *Drummondita ericoides (*Endangered*),* was confirmed as occurring in the Proposal Area using DEC records;
- a total of two DRF and 87 Priority Flora taxa have been recorded in the Proposal Area; and
- 62 weed species were recorded in the Study Area, including three Declared plant species (WA): *Carthamus lanatus*, *Echium plantagineum* and *Emex australis*. Invasive species are more prevalent within the freehold land area than in the pastoral area.

7.2.2 Key statutory requirements, environmental policy and guidance

7.2.2.1 EPA Objectives

The EPA objective for the management of flora and vegetation is to maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

7.2.2.2 EPA statements and guidelines

The following EPA statements are applicable to the Proposal:

- EPA Position Statement No. 2 - *Environmental Protection of Native Vegetation in Western Australia;*
- Position Statement No. 3 - *Terrestrial Biological Surveys as an Element of Biodiversity Protection;*

- Guidance statement 51 - *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia;* and
- EPA Guidance Statement No. 6 - *Rehabilitation of Terrestrial Ecosystems* (EPA, 2006).

EPA Position Statement No. 2

EPA Position Statement No. 2 provides an overview of the EPA's position on the clearing of native vegetation in Western Australia (WA). In assessing a proposal, the EPA's consideration of biological diversity includes the following basic elements:

- comparison of development scenarios or options on biodiversity at the species and ecosystems level;
- no known species of plant or animal is caused to become extinct as a consequence of the development and the risks to threatened species are considered to be acceptable;
- no association or community of indigenous plants or animals ceases to exist as a result of the proposal;
- there is a comprehensive, adequate and secure representation of scarce or endangered habitats within the project area, and/or in areas which are biologically comparable to the project area, protected in secure reserves;
- if the project is large (in the order of 10 ha to 100 ha or more, depending on where in the State) the project area itself should include a comprehensive and adequate network of conservation areas and linking corridors whose integrity and biodiversity are secure and protected; and
- the on-site and off-site impacts of the project are identified and the proponent demonstrates that these impacts can be managed.

EPA Position Statement No. 3

EPA Position Statement No. 3 presents the principles the EPA apply when assessing proposals which may impact on biodiversity values in WA. The intended outcomes of this Position Statement are:

- to promote and encourage all proponents and their consultants to focus their attention on the significance of biodiversity and therefore the need to develop and implement best practice in terrestrial biological surveys; and
- to enable greater certainty for proponents in the environmental impact assessment process by defining the principles the EPA will use when assessing proposals which may impact on biodiversity values.

EPA Guidance Statement No. 51

EPA Guidance Statement No. 51 provides guidance on standards and protocols for terrestrial flora and vegetation surveys, particularly those undertaken for the environmental impact assessment of proposals

7.2.2.3 Applicable Legislation and Policy

State legislation

The conservation of vegetation and flora is covered primarily by the following legislation:

- *Wildlife Conservation Act 1950* (WC Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Conservation and Land Management Act 1984.*

In WA, all flora native to the State are protected under the WC Act and threatened flora must be 'declared' and listed in the *Wildlife Conservation (Rare Flora) Notice 2008*. DRF are species that have been adequately searched for, and are deemed to be either rare, in danger of extinction, or otherwise in need of special protection.

DEC maintains a list of TECs and PECs. Possible TECs that do not meet survey criteria or that are not adequately defined are listed as PECs under Priorities 1, 2 and 3. Ecological communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation Dependent ecological communities are placed in Priority 5.

National legislation

The conservation of vegetation and flora is addressed primarily by the EPBC Act.

In 1974, Australia became a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). An official list of endangered species was prepared in response to this signing and is regularly updated. This listing is administered through the EPBC Act. The current list differs from the various State lists though some listed species are common.

Strategies and policies

The State and Commonwealth governments have endorsed the National Strategy for the Conservation of Australia's Biological Diversity (Commonwealth of Australia 1996) and the National Strategy for Ecologically Sustainable Development (Commonwealth of Australia 1992). The strategies address the conservation of Australia's biological diversity by defining several guiding principles.

Other applicable policies and strategies for the management of flora include:

- Environmental Weed Strategy for WA (DEC, 1999); and
- Conservation and Land Management (CALM) Policy Statement No 9, Conserving Threatened Species and Ecological Communities (CALM, 1999).

7.2.3 Aspects and Impacts

The environmental aspect identified as posing the most significant risk to both general and conservation significant vegetation and flora within the Proposal Area is vegetation clearing.

Potential impacts as discussed within this section refer to both direct impacts on flora and vegetation from vegetation clearing, and indirect impacts on sheet-flow dependant vegetation as a result of changes to surface water hydrology as a result of the Proposal.

The Proposal is expected to require the disturbance of approximately 7000 ha of land. It is expected that 6000 ha of native vegetation will need to be cleared, of which a maximum of 100 ha is within the freehold area, and the remainder is in the pastoral area.

Other environmental aspects identified as being of less risk to vegetation and flora include:

- ore haulage (dust emissions);
- groundwater extraction;
- vehicle, machinery activity; and
- hydrocarbon storage and management.

Impacts to vegetation associated with Proposal activities may include:

- **Direct removal of vegetation:** Loss of vegetation due to clearing;
- **Increase in weeds**: Weeds may be transported to unaffected areas by moving seeds between locations as a result of construction activities such as topsoil movement and storage, earthmoving equipment and light vehicles. This decreases vegetation condition, can reduce native vegetation cover and diversity, and alter population dynamics within vegetation communities;
- **Loss of condition due to increase in erosion or sedimentation**: Erosion is predominantly caused by vegetation clearing, as the vegetation plays a role in reinforcing the soil structure. Changed drainage/surface water characteristics can also lead to erosion;
- **Impacts on local drainage causing impacts on vegetation (including sheetflow dependent vegetation)**: Rail Corridors and borrow pits can impede the flow of surface water (including sheetflow) down slope, resulting in a runoff water reduction on the downstream side, thus affecting downstream vegetation. Mulga trees are particularly susceptible to subtle changes in surface water distribution patterns;
- **Damage to vegetation from uncontrolled or unintentional fire**: The Proposal Area is predominantly dry for most of the year and therefore fire events can start easily and quickly, and construction and operational works increase fire risk e.g. from sparks, vehicles, cigarettes, flammable liquids, or welding; and
- **Fragmentation:** Clearing increases fragmentation of vegetation and flora populations, therefore reducing the strength of the populations and increasing edge effects. Loss of diversity, cover and/or condition of vegetation can result; and
- **Loss of condition due to dust settlement:** Dust during construction or operation may cause increased dust settlement on vegetation immediately surrounding construction or operational areas.

7.2.4 Vegetation and Flora Impact Assessment

For this assessment, the significance of the loss or disturbance of vegetation and flora by the Proposal was determined by considering:

- regional abundance of the vegetation communities;
- representation in existing or proposed conservation reserves;
- the presence of Priority or Declared Rare Flora species; and
- the presence of threatening processes (e.g. weeds).

The assessment of the significance of impacts (following the application of management measures) on significant flora was on the basis of change in the distribution and abundance of EPBC Act listed, Declared Rare and Priority Flora species, and compliance with the *Wildlife Conservation Act* 1950.

The impact assessment within the following section is based on the following sources scales of survey data:

- detailed scale - Study Area surveys undertaken by Ecologia (2010a) incorporating findings from previous flora surveys; and
- regional scale Beard and Burns (1976) vegetation mapping, which is the only data available for comparison at a regional scale (Geraldton Sandplains Bioregion).

Indicative Proposal component disturbance areas are detailed in Table 7-1. It is estimated that up to 100 ha of native vegetation will need to be cleared through the freehold area.

Table 7-1 Estimated area of disturbance

Component	Main Line (ha)	Weld Range Spur (ha)	Mullewa Rail Spur (ha)
Rail formation	1850	100	70
Construction Camps	600	0	0
Borrow Areas	1100	70	50
Quarries	150	0	0
Access Roads	2100	100	80
Water Bores	100	10	10
Laydown Areas	320	10	10
Fibre Optic Cable	300	20	10
Total Disturbance Areas	**6510**	**310**	**230**

7.2.4.1 Priority Ecological Communities

Four Priority 1 PECs occur within the Proposal Area; Jack Hills, Moresby Range, Tallering Peak and Weld Range vegetation complexes (see Table 5-7 for details).

PECs will not be directly impacted by the Proposal as they have been considered a non-negotiable constraint for Rail Corridor alignment. All PECs will be avoided and a 50 m buffer will be put in place around these areas for both construction and operation.

As all PECs are associated with ranges and peaks, it is unlikely they will be significantly impacted by the Proposal through indirect effects such as changes to surface water flows, erosion, sedimentation, or exposure to wastes or hydrocarbon leaks. The buffer area will also minimise potential direct impacts to PECs from fire, weed spread, and dust.

7.2.4.2 Significant vegetation communities

Both Beard (1976) vegetation association mapping and Ecologia vegetation unit mapping were used to determine significant vegetation communities, in conjunction with data for the IBRA subregions.

Beard vegetation associations

A systematic survey of native vegetation was undertaken in the 1970s, which described vegetation systems in WA. The Geraldton area was mapped at 1:250,000 scale by Beard and Burns (1976), with the dataset being converted to a digital form by DAFWA (2006). This vegetation association dataset has been used to determine the significance of vegetation at the Geraldton Sandplains Bioregion scale.

A vegetation association was determined to be significant if less than 30% of the communities' pre-European extent remained, based on the following criteria provided in EPA Position Statement 2:

i. The "threshold level' below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being a level of 30% of the pre-clearing extent of the vegetation type

ii. A level of 10% of the original extent is regarded as being a level representing "endangered"

iii. Clearing which would put the threat level into the class below should be avoided

iv. From a biodiversity perspective, stream reserves should generally be in the order of at least 200 m wide

As clearing is limited in the pastoral area, only the freehold area contained vegetation units with less than 30% of their pre-European extent remaining. The freehold area is entirely within the boundaries of the Geraldton Sandplains Interim Biogeographic Regionalisation of Australia (IBRA) region.

Four vegetation associations mapped in the Proposal Area have been identified as endangered, that is, having less than 10% of their pre-European extents remaining within the Geraldton Sandplains (GS) IBRA region (EPA, 2000a and WAPC, 2010). A further eight vegetation associations mapped in the Proposal Area have been identified as vulnerable, that is, having greater than 10% but less than 30% of their pre-European extents remaining within the IBRA region (EPA, 2000a and WAPC, 2010). Table 7-2 lists the twelve significant vegetation associations within the Geraldton Sandplains IBRA region.

Table 7-2 Beard vegetation associations within the Proposal Area with <30% of their pre-European extent remaining

Unit Code	Pre-European extent in WA (ha)	Pre-European extent in GS region (ha)	Degree of endemism (% of total pre-European extent within GS region)	Current extent remaining in the GS region	% of original extent remaining in the GS region
a33Sc*	3,478	1,749	Moderate (50)	370	21.1
acSc*	495,385	118,103	Low (24)	6,422	5
ceLr a9Si*	511,008	1,248	Low (0.24)	0	0
e6,8Mi	796,448	2,194	Low (0.28)	117	5.3
e6c5Mr a9,19Si*	56,427	17,554	Moderate (31)	4,617	26
e6Mr a19Si*	184,571	184,571	High (100)	31,410	17
e6Mr eaSi*	97,368	96,821	High (99)	7,470	8
k1, 3Ci	64,719	4,454	Low (7)	1,145	25.7
mhSc*	51,880	51,880	High (100)	14,221	27
x2SZc*	328,738	328,738	High (100)	43,126	13
x3SZc*	580,547	507,874	Moderate-High (87)	52,364	10.3
x3SZc/acSc*	82,081	82,081	High (100)	9,276	11

As all vegetation units presented in Table 7-2 have less than 30% of their pre-European extent remaining within the Geraldton Sandplains IBRA region, they are all considered to be vulnerable regionally. However, due to the narrow linear nature of the Proposal, it is unlikely that the Proposal will result in a significant impact to any one vegetation association. The Proposal will avoid all native vegetation in the freehold area where practicable (there are some sections of the Rail Corridor that cannot avoid some vegetated areas).

Associations a33Sc, acSc, ceLr a9Si, e6,8Mi and e6c5Mr a9,19Si are present within the Geraldton Sandplains bioregion but also occur extensively outside the bioregion. The extent to which these

associations have been cleared elsewhere in the state is not available; therefore the current extent cannot be determined. It is assumed that since the degree of clearing diminishes further to the east, due to the lower levels of agricultural and urban development, these associations have a higher level of preservation, albeit in variable condition due to grazing, than is reported in Table 7-2.

Vegetation associations acSc, ceLr a9Si, e6Mr a19Si, mhSc, x2SZc and x3SZc all have more than 95% of their current extent located outside of the Proposal Area, and a very small fraction of these associations within the Proposal Area will be impacted.

The distribution of e6,8Mi shows that the association is large and widespread, and of the total area of the Beard association, only 0.04% of its current extent occurs within the Proposal Area.

Based on the known current extent of e6c5Mr a9,19Si in the Geraldton Sandplains region, 24% occurs within the Proposal Area, however this association is not endemic to this region (31% of the total area is in the Geraldton Sandplains).

k1,3Ci is a small and restricted Beard association that is mapped as 0.2% of the Proposal Area. Of the total pre-European extent of the Beard unit, 0.7% occurs within the Proposal Area. This unit is not endemic to the Geraldton Sandplains region (7% of its total is in the Geraldton Sandplains region).

e6Mr eaSi and x3SZc/acSc are more endemic to the Geraldton Sandplains Region, and considered to be two of the most significant associations when it comes to finalising the rail alignment and managing impacts.

a33Sc is a very small and restricted Beard association that is mapped as 0.5% of the Proposal Area. Of the total pre-European extent of the Beard association, 50% occurs within the Proposal Area. This vegetation is very significant in the Proposal Area as such a large percentage of its total is mapped. a33sc occurs at the western end of the Proposal Area. Most of this vegetation association is skirted by the indicative rail alignment (Figure 5-7).

e6Mr eaSi is a small and restricted Beard association that is mapped as 3.6% of the Proposal Area. This association is very restricted and is likely to be uncommon locally and regionally and is almost endemic (99%) to the Geraldton Sandplains region. Based on the known current extent of this vegetation association in the Geraldton Sandplains region, 10% occurs within the Proposal Area. The indicative alignment crosses only one patch of this vegetation association (Figure 5-9).

x3SZc is a large and widespread Beard association that is mapped as 1.7% of the Proposal Area. Of the total pre-European extent of the Beard association, 0.6% occurs within the Proposal Area. Based on the known current extent of this vegetation association in the Geraldton Sandplains region, 1% occurs within the Proposal Area. This association is highly endemic to the Geraldton Sandplains region (87% of its total area). The indicative rail alignment crosses some patches of x3SZc (Figure 5-9).

Table 7-3 below lists the significant vegetation associations that are expected to be impacted by the Proposal, and the proportion of the association expected to be impacted. As native vegetation clearing will be avoided where practicable through the freehold area, disturbance will be only from the Rail Corridor (average of up to 100 m width in these vegetated areas). Descriptions of each code are listed in Section 5.2.1. Figure 5-7 to Figure 5-9 shows the location of these vegetation associations.

Table 7-3 Conservation significant vegetation associations within the Proposal Area

Unit Code	Pre-European extent in WA (ha)	Pre-European extent in GS region (ha)	Current extent remaining in GS region	% of Pre-European extent remaining	Extent remaining within conservation reserves (ha)	Current extent expected to be impacted (ha)	% Impact to current extent	Corresponding change to current extent (assumes 100 m Rail Corridor width through these areas)
a33Sc	3,478	1,749	370	21.15	0	3.6	0.97	Reduction of current extent from 21.15% to 20.95%
e6Mr a19Si	184,571	184,571	31,410	17.02	766.2	5.7	0.018	Reduction of current extent from 17.02% to 17.017%
e6Mr eaSi	97,368	96,821	7,470	7.72	328.8	20.3	0.27	Reduction of current extent from 7.72% to 7.70%
mhSc	51,880	51,880	14,221	27.41	351.2	9.7	0.068	Reduction of current extent from 27.41% to 27.39%
x2SZc	328,738	328,738	43,126	13.12	643.8	1.1	0.0026	Reduction of current extent from 13.12% to 13.1197%
x3SZc	580,547	507,874	52,364	10.31	3037.9	18.8	0.036	Reduction of current extent from 10.31% to 10.307%
x3SZc/acSc	82,081	82,081	9,276	11.30	2242.9	7.4	0.08	Reduction of current extent from 11.30% to 11.291%

As can be seen from Table 7-3, at the Geraldton Sandplains IBRA region level the Proposal will not reduce the current extent of any vegetation association by greater than 1%. In all cases, the proposed impact does not result in the remaining extent in the Geraldton Sandplains IBRA region falling into a more critical category of conservation significance (EPA, 2000a). Although the remaining associations are considered to be conservation significant and should be protected, it is considered that the Proposal's small area of vegetation clearing will not significantly reduce the current extent of these communities. Nevertheless, as OPR finalises the design for the Proposal and moves into the construction phase it will continue to look for opportunities to reduce the requirement for native vegetation clearing. Furthermore, to ensure that indirect impacts on vegetation are managed OPR will implement controls to ensure that dust, pathogens, weeds and erosion issues are appropriately managed.

Ecologia vegetation units

The local conservation assessment of the Ecologia vegetation units recorded in the Study Area was assessed using a number of factors, such as extent remaining, association with significant fauna, how restricted the vegetation unit is, PEC status, and whether the unit contains Priority flora. As a result, vegetation units were assigned a conservation significance rating of very high, high, moderate or low (Ecologia 2010a).

Of the 72 vegetation units mapped by *Ecologia* within the Study Area, 23 units were identified as being of high or very high significance (Table 7-4), with a combined area accounting for 7.6% of the Study Area (Section 5.2.1.7). These units have the potential to be impacted by the Proposal as a result of alignment and borrow pit requirements.

Table 7-4 Significant vegetation units

Significance	IBRA region	Habitat category	Units	Area (ha) in Study Area	% of Study Area
Very High	Geraldton Sandplains	rocky hillslope vegetation of the Moresby Range	Gh1	129 ha	0.1%
			Gh2	586 ha	0.3%
			Gh3	88 ha	<0.1%
		yellow sand plain and dune vegetation	Gy1	489 ha	0.2%
			Gy2	1755 ha	0.8%
	Murchison	rocky hillslope vegetation of Jack Hills, Weld Range, and other areas	Mh6	71 ha	<0.1%
		salt lake and floodplain vegetation	Mf2	20 ha	<0.1%
High	Geraldton Sandplains	red sand plain vegetation	Gp2	39 ha	<0.1 %
		creek line and minor drainage channel vegetation	Gc1	996 ha	0.4 %
			Gc2	13 ha	<0.1 %
	Yalgoo	rocky hill slope vegetation	Yh1	928 ha	0.4%
		floodplain vegetation	Yf4	63 ha	<0.1%
	Murchison	rocky hillslope vegetation of Jack Hills, Weld Range, and other areas	Mh1	384 ha	0.2%
			Mh2	225 ha	0.1%
			Mh3	3632 ha	1.6%
			Mh4	426 ha	0.2%
			Mh7	94 ha	<0.1%
			Mh8	750 ha	0.3%
			Mh13	526 ha	0.2%
			Mh18	102 ha	0.1%
		salt lake and floodplain vegetation	Mf1	529 ha	0.2%
			Mf3	568 ha	0.3%
		creek line and minor drainage channel vegetation	Mc3	424 ha	0.2%

Very High Significance

Gh1, Gh2 and Gh3 are all associated with the hill slopes of the Moresby Range and are assumed to be part of the Moresby Range Priority 1 PEC. Gh1 is restricted to the rocky mid slopes and flat mesa tops of the Range, while Gh2 and Gh3 were recorded on the foot and mid slopes of the Moresby Range, especially in rocky areas. These communities are restricted to the Range and are not widespread.

The Proposal Area has been modified to avoid the Moresby Range Nature Reserve, however the Proposal Area does intersect part of the Moresby Range through the Wokatherra Gap, including the boundary of the PEC.

Vegetation units Gh1 and Gh3 are not intersected by the current indicative alignment. As Gh2 is the largest of the three areas impact on this unit is unavoidable as it is present in a large part of the Proposal Area, especially in the most westerly five km in a zone where gradients are steep and there is little flexibility in rail alignment.

Gy1 and Gy2 were mapped on the yellow sand plains of the Geraldton Sandplains region, with Gy1 occurring on areas of deep yellow sands, and Gy2 on areas of yellow/orange sand. Gy1 and Gy2 provide habitat for one and thirteen Priority flora species respectively. These units are restricted to small areas of remnant vegetation in the freehold section of the Proposal Area east of the Moresby Range. The indicative alignment avoids nearly all Gy1 vegetation, and the majority of Gh2 vegetation (Figure 5-10 to Figure 5-15).

Mh6 is restricted to the Weld Range Banded Iron Formation ridge tops of the Weld land system and is part of the Weld Range PEC. Mh6 is very restricted in the Proposal Area and in WA, and provides significant habitat for two Priority Flora species. Mh6 is restricted to upper slopes and ridgetops at Weld Range. The indicative alignment avoids all Mh6 vegetation (Figure 5-10 to Figure 5-15).

Mf2 is an uncommon vegetation community mapped in depressions that surround the dry salt lakes around the Weld Range, restricted to the floodplains bordering salt lakes of the Mileura land system. No Priority flora was recorded in this association. Mf2 is very restricted in the Proposal Area and the region, and is likely to be different to other salt lake vegetation communities in the area. The indicative alignment may intersect a small area of Mf2 vegetation (Figure 5-10 to Figure 5-15).

High Significance

The indicative alignment intersects the following vegetation units of high significance:

- creek line and minor drainage channel vegetation: Gc1, Mc3
- rocky hill slope vegetation: Yh1, Mh13, Mh1, Mh2, Mh3, Mh4, Mh8
- salt lake and floodplain vegetation: Mf1, Mf3

Assessment of Indicative Alignment

Based on the indicative rail alignment calculations of disturbance were made for significant vegetation units. Excess numbers of borrow areas were used in the calculations to ensure a conservative estimate. The alignment of the Rail Corridor and the exact location of borrow areas may change, however the impacts shown should not change significantly.

The results show that there is a minor impact on several sensitive vegetation units, however in all cases more than 92% of the mapped extent will remain after implementation of the Proposal. Table 7-5 presents the calculated disturbances. As this is a conservative estimate it is expected that the impacts of the Proposal will be less than presented.

Table 7-5 Estimated impact on vegetation units using indicative disturbance areas

Code	Total area mapped within Study Area (ha)	Area expected to be impacted by Proposal (ha)	% unit not impacted by Proposal
Freehold Area			
Gc1	996	17.6	98.2
Gc2	13	0.8	93.8
Gh1	129	0	100
Gh2	587	13.8	97.7
Gh3	88	0	100
Gp2	39	0	100
Gy1	489	4.1	99.2
Gy2	1,755	44	97.5
Pastoral Area			
Mc3	424	6	98.6
Mf1	529	14	97.4
Mf2	20	1	95.0
Mf3	568	17	97.0
Mh1	384	28	92.7
Mh2	225	2	99.1
Mh3	3,632	244	93.3
Mh4	426	5	98.8
Mh5	4,298	141	96.7
Mh6	71	0	100
Mh7	94	0	100
Mh8	750	10	98.7
Mh13	526	33	93.7
Mh18	103	5	95.1
Yf4	63	0	100
Yh1	928	15	98.4

7.2.4.3 EPBC Listed and Declared Rare Flora

One species of DRF, *Caladenia hoffmanii*, was recorded in the Proposal Area during the recent Ecologia survey, and an additional DRF has been previously recorded within the area, *Drummondita ericoides*. These two species are also EPBC listed species, as is *Eucalyptus blaxelii*, which was also a DRF species but has now been listed as a Priority 4 species due to recent surveys. Full descriptions of these species, as well as their locations, are detailed in Section 5.2.1.

None of the known locations for the species listed above will be disturbed by the Proposal. OPR has committed to avoiding these species and was able to do so during design of the rail alignment through the Moresby Range area.

7.2.4.4 Priority Flora

Table 5-12 (Chapter 5) describes the 87 species of Priority flora that have been recorded within the Study Area. These species were assessed against the conservation significance ratings performed by *Ecologia* (Ecologia 2010a, Appendix 1), which rated the significance of each species based on factors such as endemism, numbers within the Study Area and details of previous studies.

Assessment of Conservation Significance

Each taxon was assigned a conservation significance of; Very High, High(a), High(b), Moderate, Low(a) or Low(b), defined as follows.

Very High: The percentage of the taxon impacted is high as it is only common in the local area and is locally significant.

High(a): It is a poorly known and collected taxon that has been recorded from few locations that are widespread in the region, but because of the low total numbers, a high total percentage is within the Study Area, however as it is unknown any impact could be significant.

High(b): It is a poorly known and collected taxon that has only been recorded in the local area, but because the species is undescribed it is likely to be more widespread than what is known, however as this is unknown, any impact could be significant.

Moderate: >10% of the total individuals were recorded in the Study Area, but is likely to be widespread as the current collections indicate this.

Low(a): <10% of the total individuals were recorded in the Study Area.

Low(b): Large percentages of the total population have been recorded in the Study Area but this is due to the targeted survey which has increased the total known numbers within the Study Area substantially and these taxa are therefore likely to be very common in the region also.

Species with Low conservation significance have not been assessed further for impacts from the Proposal, and the following assessment focuses on Priority species within the Proposal Area categorised as having a conservation significance of Moderate, High, or Very High, as rated by *Ecologia* (Appendix 1).

Table 7-6 Priority Flora species found within the Proposal Area

Species	Total known number of plants	No. of plants within Proposal Area	% within Proposal Area	Conservation significance within Proposal Area (*Ecologia,* 2010a)
Priority 1				
Acacia lineolata subsp. *multilineata*	85	10	12	Moderate
Baeckea staminosa	5	1	20	High
Chamelaucium sp. Yalgoo	22	3	14	Moderate
Eremophila sp. Tallering	123	25	20	High
Goodenia lyrata	56	40	71	High
Gunniopsis divisa	1168	1000	86	High
Harperia ferruginipes	29	4	14	High
Lepidosperma sp. Moresby Range	176	139	79	High
Leucopogon psammophilus	72	10	14	Moderate
Mirbelia ternata	7	3	43	High
Petrophile vana	230	144	63	High
Ptilotus tetrandrus	2	2	100	High
Scholtzia sp. Valentine Road	13	13	100	High
Tricoryne sp. Geraldton	28	11	39	High
Vittadinia cervicularis var. *occidentalis*	6	2	33	High
Priority 2				
Homalocalyx inerrabundus	253	151	60	Moderate
Leucopogon borealis	418	314	75	High
Leucopogon sp. Howatharra	91	70	77	High
Malleostemon sp. *Moonyoonooka*	51	51	100	High
Scholtzia sp. East Yuna	52	20	38	High
Verticordia aereiflora	54	51	94	High
Priority 3				
Eremophila arachnoids subsp. *arachnoides*	261	40	15	Moderate
Geleznowia verrucosa subsp. *Kalbarri*	403	78	19	Moderate
Grevillea candicans	75	10	13	Moderate
Homalocalyx echinulatus	862	218	25	Moderate
Serichonus gracilipes	76	36	47	High
Tecticornia cymbiformis	66	11	17	Moderate
Thryptomene sp. Moresby Range	1808	1459	81	Very High
Thryptomene sp. Wandana	747	684	92	Moderate
Verticordia chrysostachys var. *pallida*	262	86	33	Moderate
Verticordia densiflora var. *roseostella*	378	146	39	Moderate
Priority 4				
Eucalyptus blaxellii	2948	696	24	EPBC Listed
Eucalyptus ebbanoensis subsp. *photina*	219	54	25	Moderate

Assessment of Predicted Impact

Through Proposal design OPR has endeavoured to avoid remnant vegetation within the freehold area, with the unavoidable exception for areas where the Rail Corridor is constrained by engineering requirements (grade, inundation etc). Based on these constraints 22 of the 33 Priority Flora species listed in Table 7-6 will not be impacted by the Proposal (no individual plants disturbed).

The majority of the remaining eleven species are located within the pastoral area, with the exception of *Thryptomene* sp. Moresby Range and *Thryptomene Wandana*. These Priority species have the potential to be impacted by the Proposal.

Potential impacts on these species have been predicted based on the current indicative rail alignment (Table 7-7). Of the Priority Flora taxa listed in Table 7-7 one is considered to have high local significance; *Thryptomene* sp. Moresby Range (Ecologia 2010a). Three of the Priority Flora listed in Table 7-7 are considered to have high regional significance, as they are endemic to one bioregion (Ecologia 2010a). These are *Chamelaucium* sp. Yalgoo*, Thryptomene* sp. Wandana, and *Thryptomene* sp. Moresby Range.

Table 7-7 Predicted impact on Priority Flora species based on indicative alignment

Species	Regional information			Local information				Plants potentially impacted based on preliminary alignment (number and % of total)
	Known distribution (km)	Total number of plants	Total number of locations	No. plants recorded within Proposal Area	% of population within Proposal Area	No. of locations recorded within Proposal Area	% all locations within Proposal Area	
Priority 1								
Chamelaucium sp. Yalgoo	184	22	7	3	14%	2	29%	0 (0)
Eremophila sp. Tallering	74	123	9	25	20	2	22%	0 (0)
Goodenia lyrata	620	56	10	40	71	3	30%	0 (0)
Gunniopsis divisa	125	1168	9	1000	86	1	11%	0 (0)
Petrophile vana	100 (outlier 150 km)	230	14	144	63	8	57%	0 (0)
Ptilotus tetrandrus	350	2	2	2	100	2	100%	0 (0)
Priority 3								
Eremophila arachnoids subsp. *arachnoides*	580	266	10	45	17	4	40%	10 (3.8%)
Homalocalyx echinulatus	620	862	51	218	25	11	22%	2 (0.23%)
Tecticornia cymbiformis	290	66	8	11	17	2	25%	0 (0)
Thryptomene sp. Moresby Range	30	1834	61	1459	80	38	62%	10 (1%)
Thryptomene sp. Wandana	130 (outlier 330km)	747	22	684	92	8	36%	20 (2.7%)

Thryptomene sp. Moresby Range and *Thryptomene* sp. Wandana are located within the freehold area and cannot be avoided by the Rail Corridor. However, predicted impacts are not estimated to be significant, with disturbance of 1% and 2.7 % of their known populations respectively.

Eremophila arachnoids subsp*. Arachnoides* is located within the pastoral area however based on current alignments there are ten plants that may not be able to be avoided. However this represents only 3.8% of the known population.

As the rail and borrow area locations within the pastoral area require a degree of flexibility due to a lack of geotechnical investigations, targeted surveys of the species listed in Table 7-7 will be carried

out for all proposed areas of disturbance. If significant numbers of these species are found the following actions will be taken:

- avoidance of the species if possible (for example borrow areas may be located elsewhere); and
- further surveys outside of the Study Area (as shown in Figure 5-21 the majority of Priority flora in the pastoral area has been found during current surveys, and it is likely that further populations will be found elsewhere).

The actions above will be used to maintain OPR's commitment of no significant impacts to Priority flora species.

7.2.4.5 Weeds

The pursuit of agriculture in the western portion of the Proposal Area has led to significant weed burdens (see Section 5.2.1). Despite the generally heavy weed burden, some agricultural weeds are known to occur on some properties and not on others. Infrastructure developments can represent a significant threat to individual farm biosecurity (Planfarm, 2010).

Some weed species have seed dormancy and other dispersal mechanisms that are sensitive to soil movements. Similarly, ground disturbance creates new germination opportunities for weed species and can lead to a proliferation of weeds. Weed management is generally controlled by farmers within and between farms. Key weeds of concern to farmers in the region identified by Planfarm (2010) include:

- Skeleton weed;
- Pattersons Curse;
- Caltrop;
- Doublegees;
- Saffron Thistle; and
- Walkaway Burr.

Earthmoving, vehicle and soil movements are expected to be the construction activities that pose the greatest risk of increasing weed dispersal. With appropriate weed hygiene methods enforced it is anticipated that weed dispersal will not significantly increase as a result of the Proposal.

7.2.4.6 Erosion/Sedimentation

There may be some localised erosion within cleared areas during rainfall event that may cause an increase in sedimentation and a potential impact to vegetation. These impacts are expected to be minor, as the Proposal is a narrow feature and in most cases clearing will run perpendicular to major flows. Clearing within drainage lines will therefore in most cases only consist of a narrow area (approximately 100 m), resulting in a minor impact on a regional scale.

Further information on surface hydrology management is included in Section 7.5.

7.2.4.7 Surface water dependant vegetation

The Proposal Area lies predominantly in Beard's (1976) Murchison region of the Eremaean Botanical Province. The Murchison region is well known for the dominance of mulga (*Acacia aneura*) woodlands, and the extensive flats and plains provide optimum conditions for these woodlands.

Mulga trees are susceptible to subtle changes in surface water distribution patterns and disturbance to surface drainage flow, as they usually rely on sheetflow from surrounding areas. Rail Corridors and associated infrastructure have the potential to impede the flow of sheet flow along the slope, resulting in a runoff water reduction on the downstream side, thus potentially causing tree deaths.

Where there are run-off dependant ecosystems downstream of Proposal infrastructure, bridges and culverts will ensure that water distribution shadows are limited. The spacing and size of culverts will be determined after an assessment of the characteristics and slope of each area along the Proposal alignment.

After implementation of the Surface Water Management Plan the predicted outcome for sheetflow dependant vegetation is that there may be some loss of sheetflow dependant vegetation in areas of sheetflow shadow. However the environmental culverts will be spaced such that the shadow remains within the construction disturbance footprint. This may require environmental culverts to be placed at 50 m intervals in some areas.

The likelihood of loss of sheetflow dependant vegetation outside of the Proposal disturbance footprint is minimal. Monitoring of vegetation health will ensure that the surface hydrology management measures are suitable.

7.2.4.8 Fire

Fires may be accidently started from works such as welding and track grinding, through careless behaviour (e.g. incorrect disposal of cigarette butts) or poor management of fuel storage and handling.

The implementation of an Emergency Response Management Plan will ensure fire risks to be minimised. OPR (or their contractor) will also be operating additional fire response vehicles and equipment in the area, which will be available for other fire events that occur (not caused by the Proposal). It is anticipated that this may lead to an overall increase in fire response capabilities in the region.

7.2.4.9 Vegetation Fragmentation

Within the freehold area vegetation has been extensively cleared and as such the remaining vegetated areas are highly fragmented. The Proposal is not expected to significantly increase the level of fragmentation in this area due to the low amount of native vegetation to be cleared (up to 100 ha for approximately 180 km of rail).

Due to the long narrow nature of the proposed ground disturbance there is a possibility that once rehabilitated, the Proposal may increase ecological corridors between fragmented vegetation areas.

7.2.4.10 Dust Impacts

Dust may affect plants by blocking stomata and reducing photosynthetic ability. Vegetation immediately adjacent to active construction and operational areas such as the Rail Corridor, roads and borrow areas is at greatest risk of dust deposition.

Dust emissions during construction are expected to be short-term (as the construction face will continually advance) and easily managed using simple construction dust controls such as water trucks and staged clearing.

Dust impacts during train operations are not expected to significantly impact surrounding vegetation. Train wagons will be open, and there may be some minor amounts of dust emitted, however there will be a contractual arrangement between OPR and Mid-West mining operations outlining that the ore is to be at a specified moisture content, which will minimise the dust lift from the ore in the

wagons. The dust levels emitted are not expected to cause dust deposition at levels that may be a risk to surrounding vegetation. Iron ore dust is not toxic and dust deposition is expected to be much lower than what is experienced at the edge of gravel roads in the area.

Further information regarding dust management is included in Section 7.8.

7.2.5 Proposed Mitigation and Management Measures

7.2.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for vegetation and flora (Table 7-8).

Table 7-8 Vegetation and flora management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Protect conservation significant vegetation and flora.	No impact to significant vegetation and flora beyond the disturbance areas described within this PER	Use of and compliance with the Ground Disturbance Permit system.
Minimise the extent of native vegetation disturbance required for construction and operation of the Project.	Total vegetation clearing does not exceed that described within this PER.	Use of and compliance with the Ground Disturbance Permit system. Vegetation health monitoring.
Control the introduction and spread of weed species and protect unaffected areas from invasion of exotic noxious weeds.	No new weed species introduced as a result of Proposal construction. No increase in weed distribution throughout the Proposal Area.	Compliance with weed hygiene procedures. Weed survey results
Reinstate an acceptable abundance, species diversity and productivity of any previously vegetated areas disturbed during construction but not required for operation.	Rehabilitate any areas temporarily disturbed for construction in line with approved completion criteria.	Completion criteria successfully applied to rehabilitation areas. Monitoring of rehabilitated areas to determine success
Minimise the potential and consequence of a fire event occurring.	No significant fire events as a result of the Proposal.	Fire events reported and recorded in the incident reporting system

7.2.5.2 Management Strategies

The primary measure used to minimise the disturbance of significant vegetation communities, DRF and Priority flora is the suitable selection of disturbance areas within the Proposal Area. As mentioned throughout this document, the Proposal Area consists of a corridor of up to 4 km width, inside which construction will occur.

The Rail Corridor alignment and the location of facilities such as borrow pits and turkey's nests will be informed by flora and vegetation restraints, and significant areas will be avoided in the design and planning stages. In addition, clearing of native vegetation will be reduced to a minimum in the freehold area.

A Vegetation and Flora Management Plan (VFMP) will be prepared, and implemented during construction and operation. In addition, a Construction Rehabilitation Management Plan (CRMP) will be developed in consultation with landholders. A Surface Water Management Plan (SWMP) and Emergency Management Plan will also be prepared and implemented which will contribute to protecting vegetation and flora. Impacts to sheetflow are managed under the surface water factor (Section 7.5). Environmental offset packages may be considered for potential environmental loss within the freehold areas. Environmental offset measures will be discussed in conjunction with DEC and EPA.

Table 7-9 summarises the mitigation and management strategies proposed to minimise the impact on vegetation and flora, including conservation significant vegetation and flora.

Table 7-9 Proposed vegetation and flora management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Vegetation clearing will occur within clearly defined boundaries	VFMP	Design & Construction	Construction Manager
All conservation significant locations will be avoided where possible and will be visually marked with restricted access	VFMP	Design & Construction	Project Engineer, Construction Manager
Required clearing will be minimised, for example: • material from cut rail sections will be used where practicable in preference to material sourced from borrow pits to minimise clearing; and • pre-disturbed areas will be used wherever possible for temporary infrastructure.	VFMP	Design & Construction	Project Engineer, Construction Manager
Throughout the freehold area native vegetation will not be cleared except for the purposes of the rail alignment and access tracks where alternative routes are not practicable	VFMP	Design & Construction	Project Engineer, Construction Manager
The rail alignment will be restricted to an average disturbance width of 100 m in width when it passes through areas of native vegetation in the freehold area	VFMP	Design & Construction	Project Engineer, Construction Manager
PECs will be avoided and a 50 m buffer will be put in place around these areas	VFMP	Design & Construction	Project Engineer, Construction Manager
The impact on active creek beds will be minimised through the use of bridges and culverts, to help protect riparian vegetation. For more information see surface water section	SWMP	Design & Construction	Project Engineer, Construction Manager
All proposed disturbance areas that are to be located outside of the Study Area will be surveyed for all potential TEC, PEC, DRF and Priority Species to the same level as the remainder of the Study Area. The results of these surveys will be used to perform the same vegetation and flora impact assessments as detailed in Section 7.2 of the PER.	VFMP	Design & Construction	Environment Manager
All final proposed disturbance areas will be subject to detailed targeted surveys for DRF and the following Priority Flora species prior to disturbance: • *Chamelaucium* sp. Yalgoo (P1) • *Eremophila* sp. Tallering (P1) • *Goodenia lyrata* (P1) • *Gunniopsis divisa* (P1) • *Petrophile vana* (P1) • *Ptilotus tetrandrus* (P1) • *Eremophila arachnoids* subsp. *arachnoids* (P3) • *Homalocalyx echinulatus* (P3) • *Tecticornia cymbiformis* (P3) • *Thryptomene* sp. Moresby Range (P3) • *Thryptomene* sp. Wandana (P3) The survey information will be included in OPR databases and documentation to ensure that OPR will not disturb beyond the areas approved in the PER.	VFMP	Design & Construction	Environment Manager
Significant disturbance (>5% of remaining species) of these eleven species will be avoided throughout the design and construction phases where practicable. Where significant disturbance is unavoidable, OPR will liaise with DEC prior to disturbance.	VFMP	Design & Construction	Environment Manager
The Proponent will report the results of further vegetation and flora studies to the EPA in accordance with approval conditions	VFMP	Design & Construction	Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Records of the areas and prescriptions used for clearing and rehabilitation will be maintained in a Rehabilitation Register	VFMP	Construction	Environment Manager
Rehabilitation prescriptions will be developed for different vegetation types and soil types to include local native species with seed sourced locally where possible. A Construction Rehabilitation Management Plan will be prepared and implemented in consultation with the landowners.	VFMP	Construction	Environment Manager
A clearing control system will be implemented to restrict the number and extent of cleared areas to the minimum needed for safe and efficient implementation of the Proposal. The system shall include: • checks that clearing requirements are consistent with approvals; • GIS information identifying significant flora, fauna and heritage locations will be kept on an Environmental Constraints database for use when planning Proposal activities; • a communication and approval system that requires Management signoff; and • specifications for clearing.	VFMP	Construction	Construction Manager
Temporary construction areas will be rehabilitated as soon as practicable after construction	VFMP	Construction	Construction Manager
Completion criteria and monitoring methods will be developed for the assessment of rehabilitation progress	VFMP	Construction	Environment Manager
Topsoil management procedures will ensure that suitable topsoil and cleared vegetation is salvaged and stored for use in rehabilitation	VFMP	Construction	Construction Manager
Direct seeding and/or planting will be undertaken to stabilise surfaces and integrate landforms into the surrounding landscape and ecosystems	VFMP	Construction	Environment Manager
Weed assessments will be made along the corridor prior to significant ground disturbance. The assessments will continue on a regular basis and include reviews of hygiene controls and weed risks for all clearing and rehabilitation activities	VFMP	Construction	Construction Manager. Environment Manager
Movement of topsoil between sites where declared or significant weeds could be spread to new locations will be restricted	VFMP	Construction	Construction Manager
Initial clearing will occur as close as practicable to first construction activities	VFMP	Construction	Construction Manager
Stockpiled vegetation and topsoil will be stored away from water courses to prevent sedimentation	VFMP	Construction	Environment Manager
A Conservation Significant Flora Register will be maintained throughout Proposal activities which will include information such as distribution, abundance and relevant biological information	VFMP	Construction	Environment Manager
Weed hygiene: • machinery hygiene procedures will be implemented to manage the risks of weed introduction and export to and from the site; • all ground engaging equipment will be required to arrive on site clean of plant and soil material from other sites or hygiene work areas; • vehicles will be inspected at random and contract clauses will ensure that dirty equipment is compliant with the system; and • ground disturbance hygiene areas will include different hygiene work areas according to weed risks.	VFMP	Construction & Operation	Environment Manager
The majority of the weed control effort will be at the boundary of the pastoral area due to the low concentration of weeds within these areas.	VFMP	Construction & Operation	Environment Manager
Equipment and vehicles used in a weed risk area shall be cleaned down and a weed inspection form completed before the equipment is remobilised to other parts of the Proposal Area	VFMP	Construction & Operation	Environment Manager
Washdown areas and rumble grids are to be located at key locations	VFMP	Construction & Operation	Environment Manager
Declared weed identification sheets are to be developed, displayed in site offices and communicated through site inductions	VFMP	Construction & Operation	Environment Manager
Maintain the Emergency Management Plan such that weed inspection reports, records of weed hygiene certificates and weed survey data is recorded and assessed. The Weed Hygiene Program will include workforce education to increase weed awareness.	Emergency Management Plan	Construction & Operation	Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
An incident will be raised and investigated if there is a non-compliance with the Weed Hygiene Program, or if weed survey results confirm that the Proposal is causing an increase in population or distribution of weeds	VFMP	Construction & Operation	Environment Manager
The Weed Hygiene Program will be regularly reviewed to ensure that the likelihood of reoccurrence is minimised	VFMP	Construction & Operation	Environment Manager
Weed surveys will be conducted as soon as practicable after construction to determine whether construction of the Proposal has increased the population or distribution of weeds. If determined that the Proposal has caused an increase in the population or distribution of weeds corrective actions (spraying, removal etc) will occur after consultation with relevant government authorities and weed experts as to the preferred course of action.	VFMP	Post-construction	Environment Manager
Off road traversing of vehicles will be prohibited unless authorised by the Site Environmental Manager	VFMP	Construction & Operation	Environment Manager
Monitoring of vegetation health will be undertaken ensure that the surface hydrology management measures are suitable.	VFMP	Construction & Operation	Environment Manager
An Emergency Management Plan will be prepared and implemented to limit the risk of inadvertent fire ignition. The Fire Management Plan will include controls regarding vehicle movement and maintenance, firebreaks, fire restrictions, fire fighting equipment, hot work procedures and training.	FMP	Construction & Operation	Safety Manager
There will be no unauthorised access to constraint areas including areas of conservation significance or heritage value	VFMP	Construction & Operation	Environment Manager
Implementation of measures to offset environmental loss, particularly related to the clearing of native vegetation in the freehold area. Such measures may include: • support of the Moresby Range Regional Strategy; and • investigation of targeted rehabilitation requirements along the Rail alignment. Final offset measures will be determined in consultation with EPA and DEC.	-	Construction & Operation	Environment Manager

7.2.6 Predicted Outcome

Within the freehold area OPR has committed to avoidance of native vegetation with Proposal design wherever practicable. There will be some areas that will be required to be cleared for the Rail Corridor, however all borrow pits and other supporting infrastructure will not impact on native vegetation.

Vegetation within the pastoral area is more evenly spread across the Proposal Area. The clearing of a narrow linear feature through the landscape is therefore unlikely to cause a significant impact to any of the significant vegetation units in this area.

The impact assessment has identified that after mitigation and management measures have been applied, the Proposal is expected to result in the following outcomes:

- no PECs will be impacted by the Proposal as PECs will be actively avoided, and indirect impacts reduced through the provision of buffer zones. The Proposal Area does not contain any TEC's;
- no DRF will be impacted by the Proposal;
- no disturbance to vulnerable Beard and Burns (1976) vegetation associations of greater than 0.2% of pre-European extent;
- impacts to significant vegetation units within the Proposal Area will be minor, with a minimum of 92% of each unit remaining unaffected by the Proposal. Small areas of significant vegetation associations will be impacted;

- impacts on Priority species are all estimated to be low, based on a preliminary indicative Rail Corridor alignment, with the highest predicted population impact being 3.8% (*Eremophila arachnoids* subsp*. arachnoides)*. OPR has committed to undertaking further surveys of disturbance areas for this species and other nominated Priority flora species before the corridor is finalised;
- strict controls to prevent the introduction and/or spread of weeds within the Proposal Area will be implemented, in order to minimise the risk to vegetation from weeds;
- sheetflow dependant Mulga will not be significantly impacted due to the installation of environmental culverts; and
- consideration will be given to the potential for an offset package for residual environmental impacts.

7.3 FAUNA

7.3.1 Overview

This section addresses vertebrate, short range endemic and subterranean fauna separately.

7.3.1.1 Vertebrate Fauna

The existing environment section (Section 5.2.2) contains further details on fauna within the Study Area.

The following vertebrate fauna were recorded in the Study Area:

- 20 mammal species;
- 125 bird species;
- 82 reptile species;
- 5 amphibian species; and
- 11 introduced species.

A total of 13 conservation significant species were recorded (or evidence was recorded) within the Study Area, including four EPBC listed species, five species protected under the WC Act, and seven Priority species (note: some of these overlap).

A further eight conservation significant species were considered to have a high or medium likelihood of occurrence in the area although they were not recorded in surveys.

Throughout the pastoral area the fauna habitat is continuous with low levels of disturbance. This means that fauna habitat within the pastoral area is well represented within the region. In the freehold area, the fauna habitat associated with remnant native vegetation is highly fragmented.

7.3.1.2 SRE Invertebrate Fauna

Determined or possible SRE species within the Study Area

Two confirmed and four to six possible SRE species were found within the Study Area.

Potential SRE habitat for the species listed above are described in Table 7-10. The location of SRE habitat in relation to the Proposal is shown in Figure 5-27 to Figure 5-29

Table 7-10 SRE species and potential SRE species

Species	SRE status	Habitat types
MYG018 (mygalomorph spider)	confirmed	Mh15
MYG045 (mygalomorph spider)	confirmed	Mp12
Kwonkan sp. (mygalomorph spider)	Possible	Mp15
Teyl sp. (mygalomorph spider)	Possible	Yp2
Austrohorus sp. (pseudoscorpion)*	Possible	Gf2, Gy1, and Mp6
Beierolpium sp. (pseudoscorpion)*	possible	Gf2, Gy1, Mh11, Mh15, Mp4, Mp5, Mp6, Yc2 and Yp2

*Note: the pseudoscorpions may represent up to 4 morphospecies

7.3.1.3 Subterranean Invertebrate Fauna

Stygofauna

Stygofauna have been recorded from 16 of the 30 land systems in the Study Area, although none of these records were taken within the Study Area. Stygofauna have been found in three soil landscape systems, Tamala (4 records), Dartmoor and Northampton (1 record each).

Given the wide occurrence of stygofauna records throughout the region it is likely that other land systems and soil landscape systems within the Study Area may also contain stygofauna.

Troglofauna

Three land systems of the Study Area have records of troglofauna (Mileura, Cunya and Weld, and Tallering). Two soil landscape systems of the Study Area have records of troglofauna (Dartmoor and Tamala).

Based on experience in recent years within the Pilbara where troglofauna are now being found to be quite widespread, it is likely that the majority of the land and soil landscape systems in the Study Area will support troglofauna.

7.3.2 Key statutory requirements, environmental policy and guidance

7.3.2.1 EPA Objective

The EPA objective for management of terrestrial fauna is to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem level through the avoidance or management of adverse impacts and improvement in knowledge.

7.3.2.2 EPA statements and guidelines

The following EPA statements are relevant to fauna in relation to the Proposal, with Position Statement No.3 and Guidance Statement No. 56 considered the most relevant, and discussed in more detail below.

- EPA Position Statement No. 3 - *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002);
- EPA Guidance Statement No. 20 - *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA, 2005);
- EPA Guidance Statement No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005);
- EPA Guidance Statement No. 54 - *Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia* (EPA, 2004);
- EPA Draft Guidance Statement No. 54a - *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA, 2007); and
- EPA Guidance Statement No. 56 - *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

EPA Guidance Statement No. 56

As described in the EPA Position Statement No. 3, the EPA determined that a series of guidance statements were warranted to provide an easy-to-use decision-making guide to the level of biological survey required. EPA Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental*

Impact Assessment in Western Australia" (EPA 2003a), provides guidance on standards and protocols for terrestrial fauna surveys, particularly those undertaken for the environmental impact assessment of proposals.

7.3.2.3 Applicable Legislation and Policy

The preservation and conservation of fauna is covered primarily by the following legislation:

- EP Act (WA);
- WC Act (WA);
- EPBC Act (Commonwealth); and
- *Conservation and Land Management Act 1984* (WA).

In WA, rare or endangered species are protected by the *Wildlife Conservation (Specially Protected Fauna) Notice 2005*, under the WC Act. Schedules 1 and 4 in this notice are relevant to this assessment, providing a listing of those species protected by this Notice.

The WA DEC Priority Fauna List also nominates conservation species, from Priority level 1 to 4. The list includes species that are not considered Threatened under the WC Act, but are still considered in need of protection. Although the Priority Fauna List does not confer any additional legal protection it is expected that potential impacts from a proposal on these Priority listed species should be managed so that the species do not meet the International Union for the Conservation of Nature and Natural Resources (IUCN) criteria for threatened species (see below).

The Commonwealth EPBC Act protects species listed under Schedule 1 of the Act. In 1974, Australia signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora. As a result, an official list of endangered species was prepared and is regularly updated. This listing is administered through the Commonwealth EPBC Act. The current list differs from the various State lists but there are some species that are common to both. The EPBC Act utilises 'significance levels' for fauna, which are recommended by the IUCN.

The EPBC Act lists migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals).

7.3.3 Aspects and Impacts

Aspects with the potential to impact vertebrate fauna and SREs in the Proposal Area have been identified as:

- vegetation clearing;
- dust emissions;
- noise, light, vibration;
- vehicle, machinery activity;
- Proposal infrastructure; and
- development of quarries and borrow pits.

Aspects with the potential to impact stygofauna include:

- groundwater pollution;
- reduced infiltration/recharge of the underlying aquifer(s) due to surface sealing, resulting in a reduction or loss of the available stygofauna habitat; and
- development of quarries and borrow pits.

Aspects with the potential to impact troglofauna include development of quarries and borrow pits.

The primary impact on fauna as is expected to be related to clearing of habitat. Habitat clearing and other disturbance from the aspects listed above has the potential to impact fauna directly and indirectly, and may result in changes to fauna numbers, health, assemblages, population dynamics and ecological function. Proposal infrastructure may act as a barrier to the dispersal of terrestrial mammals and reptiles. Noise, vibration and lightspill may cause fauna to move out of areas adjacent to the rail line. An increase in the potential for weeds and fire may also have impacts on fauna and fauna habitat.

7.3.4 Fauna Impact Assessment

7.3.4.1 Vertebrate Fauna

Impacts on Biodiversity

Due to the mostly linear nature of the habitat disturbance the diversity of fauna assemblages within the region are unlikely to be significantly affected by the Proposal. Most terrestrial fauna are expected to be able to move to adjacent areas of suitable habitat.

Ultimately, biodiversity and ecological function are expected to recover to a large extent as vegetation communities regenerate in rehabilitated areas and stabilise, allowing native fauna to re-colonise from adjacent areas. However, adequate weed management, including regular monitoring for exotic weeds, is important for revegetation to succeed in re-creating as close as possible the original fauna habitats disturbed by the Proposal.

Those vegetation types that take the longest to fully regenerate are the ones containing mature eucalypts with hollows. In the Proposal Area these occur primarily along the larger creeklines, which will only have a small area impacted by the Rail Corridor. In these locations proposed management strategies will ensure that creekline disturbance is restricted to the immediate area of the bridge or culvert structures.

Granite outcrop habitat suitable for Western Spiny-tailed Skink (*Egernia stokesii badia*) cannot be replaced. OPR has therefore designed the Proposal to avoid this habitat, thus avoiding direct impacts to this species.

Impacts to Fauna Habitat Types

The most significant potential impact identified is the direct impart of clearing of habitat for construction of the Rail Corridor. Most of the disturbance of native vegetation (5900 ha) is in the pastoral area. The freehold land area contains fragmented fauna habitats whereas habitat types in the pastoral land area are generally more widespread. Table 7-11 summarises the characteristics of each habitat type and the potential impact of the Proposal.

Indirect impacts on fauna habitat may also occur within and immediately adjacent to the Rail Corridor and ancillary features from interference with local drainage patterns.

Table 7-11 Impact to fauna habitat types within the Proposal Area

Area	Habitat type	Potential impact
Freehold	Woodland with heath	Clearing of native vegetation through the freehold area has been avoided where possible through the design phase. Clearing of fauna habitat will be required for some portions of the Rail Corridor where avoidance is not practicable; however this is expected to be less than 100 ha within approximately 180 km of the western portion of the Proposal Area. Due to the small nature of this clearing the Proposal is not expected to have a significant impact on fauna populations within the freehold area.
	Sandy eucalypt woodland	
Pastoral	Mulga woodland	Occurs adjacent to and is likely to extend well beyond the Proposal Area. Consequently the Proposal is unlikely to significantly impact fauna that occur in this habitat.
	Sandy or stony plains	Occurs adjacent to and likely to extend well beyond the Proposal Area. Consequently the Proposal is unlikely to significantly impact fauna that occur in this habitat.
	Halophyte vegetation	A significant portion of this habitat type is located to the north of Weld range and the Proposal will only impact on a small portion of a much larger area of this habitat that extends beyond the Proposal Area. Although disconnected this habitat type is expected to occur beyond the Proposal Area in low lying damp areas within the surrounding landscape. Nevertheless, OPR will ensure that impacts to this habitat type are minimised as much as practicable. This will ensure that impacts to the Slender-billed Thornbill (EPBC Act Vulnerable), a specialist of this habitat type, are also minimised.
	River Vegetation	The Rail Corridor construction corridor widths will be reduced as much as practicable within proximity to watercourses and will be perpendicular to flow, which will ensure that significant impacts to this vegetation type are unlikely.
	Mixed wattle scrub	This habitat type is extensively represented beyond the Proposal Area in the surrounding region. Consequently the Proposal is unlikely to significantly impact fauna that occur in this habitat.
	Mulga shrubland	This habitat type is extensively represented beyond the Proposal Area in the surrounding region. Consequently the Proposal is unlikely to significantly impact fauna that occur in this habitat.

Conservation Significant Vertebrate Fauna

Of the 21 conservation significant fauna that occur or are likely to occur in the Proposal Area, a low likelihood of regional impacts from the Proposal was predicted for 14 species, based on factors such as preferred habitat, distribution of species, and use of Proposal Area (see Appendix 2). DEWHA will assess three of these species as Matters of National Environmental Significance; Malleefowl, Western Spiny-tailed Skink and Slender-billed Thornbill. DEWHA will receive advice from the EPA as part of this assessment. A more detailed assessment of these species can be found in Chapter 8. The remainder of conservation significant species will be assessed at the State level.

Five conservation species are identified as being potentially impacted by the Proposal:

- Crested Bellbird (*Oreioca gutturalis*) (southern subspecies) DEC Priority 4;
- Rufous Fieldwren (*Calamanthus campestris*) (western subspecies) DEC Priority 4;
- Western Spiny-tailed Skink (*Egernia stokesii badia*) (Black form) EPBC Act endangered, WC Act schedule 1;
- Yuna Broad-blazed slider (Lerista yuna) WC act schedule 4; and
- Lerista eupoda (no common name) DEC Priority 1.

The Western Spiny-tailed skink is also discussed in Section 8 as a Matter of NES.

Crested Bellbird (southern subspecies)

The distribution of the southern subspecies has been contracting largely due to habitat fragmentation through clearing. The Crested Bellbird (southern subspecies) inhabits the shrub-layer of eucalypt woodland, mallee, acacia shrubland, triodia hummock grassland, saltbush and heath, where they feed on a variety of insects and seeds.

Based on this subspecies' distribution it has potential to be present in the westernmost portion of the Proposal Area. This also represents the northernmost portion of the subspecies' distribution. Given the already fragmented nature of the habitat in the freehold land area, further fragmentation has the potential to have an impact.

Indirect impacts to the species could occur through possible increases in the frequency of fires and potential increases in feral animal activity.

Within the freehold area habitat for this species has mostly been avoided as part of the design phase of the Proposal. The clearing required through the freehold area includes only a small percentage of the remaining habitat for this species. On this basis, the regional population is not expected to be significantly impacted.

Indirect impacts to the species are expected to be managed by controlling the likelihood of increases in feral animal activity and the frequency of fires.

Rufous Fieldwren (western subspecies)

The western subspecies of the Rufous Fieldwren is endemic to the south-west of the WA wheatbelt and in lower densities, in some coastal heathlands. The distribution of the subspecies has been contracting largely due to habitat fragmentation in the wheatbelt.

The Rufous Fieldwren was recorded in the Proposal Area from two habitat types including low eucalypt mallee over moderately dense sedges and shrubs and open eucalypt woodland over moderately dense shrubs and sedges. Other suitable habitat was noted, particularly the heath associated with the Moresby Range and areas of halophytic vegetation surveyed. The heath habitat of the Moresby Range is likely to represent some of the best coastal habitat available within the subspecies' distribution.

Within the freehold area habitat for this species has mostly been avoided as part of the design phase of the Proposal. The Proposal has been designed to avoid remnant vegetation within the proposed Moresby Range conservation reserve.

Small impacts on preferred habitat may result in a minor impact on the subspecies, if present. At a regional level population is not expected to be significantly impacted.

Indirect impacts to the species are expected to be managed by controlling the likelihood of increases in feral animal activity and the frequency of fires.

Western Spiny-tailed Skink

Surveys by Ecologia (2009) of alternate proposed Rail Corridors that are described within this PER, and a recent regional survey have substantially increased the known distribution and population of this species, with over 50 new populations identified outside of the Proposal Area. These new populations have been clustered around emergent granite formations ranging in size from hills to low rises.

The Western Spiny-tailed Skink has a patchy distribution throughout the dry to semiarid habitats of WA and has recently declined across much of the central wheatbelt (Storr *et al.* 1999; How *et al.* 2003). However, the skinks observed within and surrounding the Proposal Area are a melanic (black) form, previously only known from a handful of locations including Woolgorong Rock and 4 km east of

Yalgoo. This subpopulation occurs only on granite outcrops and may represent a regionally distinct form (How *et al.* 2003) or potentially a new species (Hamilton 2003).

A total of 12 individual populations of Western Spiny-Tailed Skinks (black form) were found inhabiting granite outcrops within the Proposal Area to the southwest of Weld Range, sheltered in the horizontal rock crevices that had formed in these landforms. Granite outcrop habitat suitable for Western Spiny-tailed Skink (*Egernia stokesii badia*) cannot be replaced. On this basis, OPR has designed the Proposal to avoid the majority of Western Spiny-tailed Skink habitat.

For all but two of the twelve populations the rail line has been deviated to provide a 200 m buffer zone between populations and the rail line. While the two remaining populations will potentially be bisected by the rail line, a buffer of 50 to 60 m will be maintained so that no granite outcrops will be directly impacted. For the remaining ten populations within the Proposal Area, the rail will be located more than 200 m from known granite outcrop habitat. The remaining known populations are located outside of the Proposal Area (refer to Section 8).

Western Spiny-tailed Skinks live in colonies predominantly within the same rocky outcrop and movement between outcrops is thought to be low. Evidence of low dispersal rates has been found from genetic analysis and recapture studies populations (Gardner et al. 2001; Gardner et al. 2007). Studies in E. cunninghami, a species closely related to E. stokesii and showing a similar life history strategy, found that 92% of individuals had moved less than 11 m when recaptured (Stow and Sunnucks 2004). A low dispersal rate may be expected based on the patchy nature of the black *E. Stokesii badia'*s preferred habitat; rocky outcrops often separated from each other by large expanses of flat, often sparsely vegetated land.

Indirect impacts to the species are also expected to be low due to the low dispersal rate and limited movement of individuals. A minimum 50-60 m buffer zone is considered sufficiently protective to ensure known populations and individuals are not impacted. While limited movement between outcrops is anticipated, fauna passages will be established below the rail line to allow for any movement. Skinks have been observed climbing and jumping between rocks when moving between crevices within an outcrop and are therefore considered also to be capable of crossing train tracks (Ecologia, 2010). While up to 18 train movements are predicted each day, and this may present a strike risk, noise and vibration from approaching trains will be a likely deterrent at these times.

All borrow areas will be located outside of the 200 m buffer area for these species which will ensure habitat is not impacted. 200 m was considered to be a suitable buffer as the skinks are predominantly sedentary and confined to discrete granite outcrop habitats (Appendix 2). This buffer was recommended by fauna specialists (Ecologia, 2010).

Although it is thought that the skinks can move up to 500 m (based on genetic studies), this is thought to be rare. The maximum distance an individual Western Spiny-tailed Skink has been known to travel is 350 m from its original location (Ecologia 2010).

Furthermore, this species is considered likely to colonise areas of disturbance associated with rock quarries if suitable crevices are created (*Ecologia* 2010b). It is therefore anticipated that there may be a potential increase in suitable habitat for this species as a result of the Proposal's ballast quarry developments.

Other indirect impacts to the species are expected to be managed by controlling the likelihood of increases in feral animal activity and the frequency of fires.

On the basis of the above information, the Proposal is considered unlikely to significantly impact upon the population dynamics of this species.

Additional information on this species in included in Section 8.2.2.2.

Yuna Broad-blazed slider

Yuna Broad-blazed slider is a moderately small, slender skink which is found in pale sand plains in the vicinity of Yuna in semi-arid lower western interior where it shelters in soft soil under leaf litter at the bases of shrubs. Yuna Broad-blazed slider has a restricted range of approximately 100 km long by 30 km wide, in the area surrounding Yuna station, east of Yuna.

The Proposal Area occurs in the southern range of distribution of Yuna Broad-blazed slider. Twelve individuals of this species were recorded from three locations during the OPR–F survey. The species has a limited distribution, so there is the potential for a moderate impact to this species. Indirect impacts to the species are expected to be managed by controlling the likelihood of increases in feral animal activity and the frequency of fires.

Due to the narrow nature of the Proposal and the limited percentage loss of habitat (<0.5%), regional populations of this species are not expected to be significantly impacted.

Lerista eupoda

Lerista eupoda is a moderately large skink species, which is confined to the arid interior of WA around Weld Range and between Meekatharra and Cue, where it inhabits open mulga areas on loamy soils. The species was only described in 1996 (Smith 1996) and relatively little is known about the ecology of this species.

Approximately 3.7% of the known population range for this species occurs within the Proposal Area. This species has a limited distribution, occurring in mulga and acacia woodland on the plains surrounding Weld Range.

Within the Proposal Area, two records of the *Lerista eupoda* came from the OPR-WR survey, while three individuals were recorded from two sites during the Level 1 survey of the Weld Rail Spur and another individual was recorded from site W7 of the previous alignments. Records from the previous alignments and other regional records all place *L. eupoda* within approximately 50 km of Weld Range.

The Proposal has been located to mostly avoid habitat associated with this species which is located on the slopes of hills within the Weld Range. Indirect impacts to the species are expected to be managed by controlling the likelihood of increases in feral animal activity and the frequency of fires.

Due to the narrow nature of the Proposal and the limited loss of habitat, regional populations of this species are not expected to be significantly impacted.

7.3.4.2 SRE Invertebrate Fauna

The most significant threat to local SRE invertebrate fauna biodiversity as a result of the Proposal is vegetation clearing, which can reduce the habitat available to these species as well as physically remove them from the landscape. Secondary impacts include vibration, which could disturb SRE and potentially reduce the viability of some SRE populations, and fire and dust, which could reduce the quality or health of habitat.

For the majority of the Proposal Area there are large areas of potential SRE habitat, and a narrow linear feature is unlikely to cause a significant impact on the regional population of these species. Of particular note are the design refinements to avoid remnant vegetation clearing in the freehold area where practicable. This will reduce the disturbance of the vegetation communities Yp2, Gf2, Gy1, Yp2, Gf2, Gy1, which are represented throughout remnant vegetation in the freehold area and which have been identified as potentially supporting SRE species. *Teyl* sp., *Austrohorus* sp., *Beierolpium* sp.8/2 and *Beierolpium* sp.8/4 were all identified as utilising these vegetation communities. Furthermore, implementation of the management strategies in Section 7.2.5, which relates to

protection of remnant vegetation within the freehold area will minimise impacts to SRE species that may occur in this area.

7.3.4.3 Subterranean Invertebrate Fauna

Stygofauna

The most significant potential threat to stygofauna biodiversity is the reduction in the quantity and/or quality of groundwater available. Stygofauna may be impacted as a direct result of construction water drawdown abstraction, or as a result of changes in groundwater chemistry (Eberhard 2004).

Groundwater abstraction is expected to be the primary water source for the construction phase of the Proposal. Abstraction is expected to occur at regular intervals along the Rail Corridor, with a total abstraction of 3.5 GL over the 36 month construction period. Significant sources of groundwater for construction are likely to come from deeper confined or semi-confined aquifers which are unlikely to impact on stygofauna.

All groundwater abstraction will be carried out in accordance with licences issued by the Department of Water under the *Rights in Water and Irrigation Act 1914* (RIWI Act), which will ensure the sustainable use of water supplies and protection of stygofauna and their habitat. On this basis, it is unlikely that the Proposal presents a significant risk to stygofauna. Further groundwater investigations and water abstraction modelling will be completed as a part of the Department of Water (DoW) licensing process. These investigations will ensure that any licences issued will reduce potential impacts to these subterranean species.

Furthermore it is considered that stygofauna habitat and populations extend well beyond the Proposal Area.

Vegetation clearing may indirectly impact stygofauna communities present within the Proposal Area as vegetation plays a vital role in the transport of nutrients into subterranean systems. However given the narrow clearing footprint and subsequent rehabilitation in any single locality this activity is unlikely to present a significant risk.

Troglofauna

The Proposal has very limited potential to impact upon troglofauna due to the narrow linear footprint of the Proposal and minimal excavation requirements.

7.3.5 Proposed Mitigation and Management Measures

7.3.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for fauna (Table 7-12).

Table 7-12 Fauna management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Protect fauna, including conservation significant fauna.	No disturbance to conservation significant fauna and their habitats beyond the disturbance areas described in the PER.	• Ground Disturbance Permits • Fauna habitat constraint maps • Conservation Significant Fauna Database • Pre-disturbance fauna surveys • Fauna injury/death register • Incident Register • Rehabilitation criteria
Prevent the introduction or spread of introduced fauna, and control species currently present.	• No introduction of domestic animals or pets. • No introduction of feral animals or increase in numbers of existing feral animal species.	• Incident Register • Success of feral animal controls • Landfill inspections

7.3.5.2 Management Strategies

Vertebrate Fauna

Management measures relating to the minimisation of habitat disturbance are addressed in Section 7.2. Specific management measures that relate to the conservation significant species that may potentially be impacted by the Proposal are identified in Table 7-13 below.

Impacts to the Crested Bellbird (southern subspecies) and Rufous Fieldwren (western subspecies) are expected to be minimised by remnant vegetation protection measures in the freehold land area (specified in Section 7.2). The protection of remnant vegetation in the freehold area will ensure suitable habitat is available for these species. Therefore no additional management measures are proposed for these species.

SRE Invertebrate Fauna

As many of the impacts to SRE fauna relate to the clearing of vegetation, management of vegetation clearing will in turn minimise the potential impacts on SRE fauna. Management actions relating to vegetation clearing are detailed in Section 7.2. Of particular note is the commitment to minimise remnant vegetation clearing in the freehold area, which will protect areas of potential SRE habitat.

Subterranean Invertebrate Fauna

Management of subterranean invertebrate fauna will be limited to the direct management of groundwater abstraction activities being implemented in accordance with licences issued under the RIWI Act (refer to Section 7.6).

Table 7-13 lists the summarised management measures proposed to minimise the impact on fauna during construction and operation of the Proposal.

Table 7-13 Proposed fauna management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat.	Fauna Management Plan (FMP)	Design & Construction	Construction Manager
With the exception of the Rail Corridor, no disturbance will occur within a 200 m buffer of known *Egernia stokesii badia* habitat. If the Rail Corridor must pass through these areas, a 50-60m buffer will be maintained between the rail line and outcrops, and the construction disturbance width will be limited to an average of 100 m. Individuals will be relocated if found within construction areas, and additional culverts will be installed in these areas to act as fauna underpasses.	FMP	Design & Construction	Project Engineer, Construction Manager
Any handling of *Egernia stokesii badia* will be undertaken by a suitably licensed reptile handler	FMP	Construction	Environment Manager
Borrow pits or turkeys nests in the Weld Range area will be avoided where practicable, and the Rail Corridor will be restricted to an average 100 m in width.	FMP	Design & Construction	Project Engineer, Construction Manager
No active Malleefowl nests will be disturbed. Where a nest is discovered that cannot be avoided the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for Ministerial permission to disturb.	FMP	Construction	Construction Manager
Minimise trench length where practicable. Should trenching be required for distances in excess of 1000 m, inspect trenches and excavations outside of construction envelopes regularly and where any trenching is to remain open overnight, provide fauna ramps and inspect before work resumes the next morning to remove any trapped fauna	FMP	Construction	Construction Manager, Environment Manager
All disturbance areas have or will be surveyed for Priority Fauna and EPBC protected species prior to disturbance. The survey information will be included in OPR databases and documented to ensure that OPR will not disturb species or their habitat beyond the disturbance areas approved in the PER. Should these species be found during construction in locations where impacts are unavoidable, OPR will minimise the disturbance in those areas and will seek permission to disturb.	FMP	Construction	Construction Manager, Environment Manager
Turkeys nest dams will be fenced to restrict access by fauna. Fauna escape methods such as wire mesh will be fixed within turkeys nests to allow fauna egress.	FMP	Construction & Operation	Construction Manager, Operations Manager
No domestic animals or pets will be permitted on site	FMP	Construction & Operation	Construction Manager, Operations Manager
Feral animal controls will be specified in the FMP. Control strategies will be developed consistent with regional and local feral animal control initiatives.	FMP	Construction & Operation	Environmental Manager
The Rail Corridor will be fenced throughout the freehold area to prevent livestock death from train strikes	-	Operation	Construction Manager
The design and construction of the rail crossing of the State Barrier Fence of WA will be in consultation with relevant government authorities	-	Design & Construction	Project Engineer, Construction Manager, Environment Manager

7.3.6 Predicted Outcome

After mitigation and management measures have been applied, the Proposal is expected to result in the following outcomes in relation to fauna:

- Approximately 6,000 ha of potential fauna habitat will be cleared. The majority of fauna habitat within the Proposal Area is well represented beyond the Proposal footprint and throughout the surrounding region. The most significant and limited habitats within the freehold area will be predominantly avoided.
- The Rail Corridor alignment has been designed to avoid all but two of the more than 50 populations of the Western Spiny-tailed Skink recorded in surveys undertaken within the Study Area. The Rail Corridor has been deviated to provide at least a 200 m buffer between most populations and the Rail Corridor. Only two populations will potentially be bisected by the proposed rail centreline. A buffer of 50 - 60 m will be maintained between disturbance and outcrop locations so that no known habitat will be directly impacted. As such there are not expected to be any significant impacts to the Western Spiny-tailed Skink.
- Impacts to the remaining conservation significant vertebrate fauna are expected to be negligible given that the habitat types are extensively represented beyond the Proposal Area and the minimal disturbance of the habitat through avoidance and minimisation.
- As threats to SRE relate to the clearing of vegetation, the narrow linear nature of the Proposal and management of vegetation clearing will minimise the potential impacts on SRE fauna. Given that SRE habitat is well represented throughout the Proposal Area there is not considered to be a significant threat to the viability of known or potential SRE species.
- Given the short-term nature of peak water demand required for construction and the results of subterranean invertebrate fauna studies in the region (species are expected to be found extensively through groundwater reserves), there are not expected to be any significant impacts to subterranean invertebrate fauna.
- There may be some direct loss of fauna due to accidental vehicle strikes.
- There may be some localised movement of fauna away from the rail construction and operational corridor due to increased presence of people and machinery and the resulting increase in ambient noise and vibration.

With the implementation of the identified management measures, potential impacts on fauna are expected to be minor.

7.4 CONSERVATION ESTATES

7.4.1 Overview

OPR has excluded declared conservation reserves from the Proposal Area with one exception which is Reserve 16200. Four conservation reserves or proposed conservation reserves have now been excluded from the Proposal Area; Moresby Range, Urawa and Wokatherra Nature Reserves, as well as one un-named nature reserve. As the boundaries of the Proposal Area have been altered to avoid these reserves the edge of the reserves are therefore at, or near to, the boundary of the Proposal Area (Figure 5-6)

The Proposal will intersect three proposed conservation reserves (Figure 5-6):

- former Woolgorong Pastoral Lease;
- former Twin Peaks Pastoral Lease; and
- former Narloo Pastoral Lease.

7.4.2 Key statutory requirements, environmental policy and guidance

7.4.2.1 EPA Objective

The EPA objective for management of potential impacts to conservation estates is to protect the environmental values of areas identified as having significant environmental attributes.

7.4.2.2 EPA statements and guidelines

EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005)

7.4.2.3 Applicable Legislation and Policy

Conservation reserves are covered primarily by the following legislation:

- *Conservation and Land Management Act 1984*;
- *Land Administration Act 1997*; and
- *Soil and Land Conservation Act 1945.*

The majority of conservation reserves are managed by DEC under the *Conservation and Land Management Act 1984*. Under this act, land is vested in the Conservation Commission of WA and set aside as a national park, conservation park or nature reserve.

Conservation reserves managed by other bodies may be created and manages under the *Land Administration Act 1997 or the Soil and Land Conservation Act 1945*, or come under the management of local government.

7.4.3 Aspects and Impacts

The main aspect of the Proposal with the potential to impact conservation estates is clearing. Potential impacts are loss of values of conservation areas due to loss of vegetation and flora, and consequently fauna habitat.

7.4.4 Conservation Estate Impact Assessment

A considerable amount of planning and consultation has been used to define the Proposal Area to avoid conservation estates. There is a cluster of conservation estate adjacent to the western end of the Proposal Area, centred around the Moresby Range. Further conservation estate exists near the

edge of the freehold area and proposed conservation estate (recently acquired pastoral leases) in the pastoral area.

A summary of the potential impacts are detailed in Table 7-14.

Table 7-14 Potential impacts on conservation and proposed conservation reserves

Reserve	Reserve Purpose	Management Body	Potential impact	Area potentially impacted (ha)
16200	Water supply and conservation of flora and fauna	Minister for Water	The Proposal will require the Rail Corridor to pass through this reserve. The width of the Rail Corridor will be minimised through this area, as it will through all areas of native vegetation in the freehold area. No borrow areas will be located within this reserve.	Up to approximately 2.5 ha out of a total of 17.1 ha (up to 14.6%)
Woolgorong ex-pastoral station	Unoccupied Crown Land proposed for conservation purposes	DEC	The Proposal fully intersects these proposed reserves and therefore will require the Rail Corridor to pass through. Some borrow areas will need to be located within the proposed reserve due to large transport distances to the edge of the reserves.	Up to approximately 260 ha out of a total of 116,350 ha (up to 0.2%)
Twin Peaks ex-pastoral station				Up to approximately 350 ha out of a total of 27,250 ha (up to 1.3%)
Narloo ex-pastoral station			This proposed reserve boundary corner intersects with the Proposal Area. The Proposal may pass through this proposed reserve; although it will be avoided if practicable. Borrow areas will not be located within the proposed reserve.	Up to approximately 31 ha out of a total of 14,750 (up to 0.2%) but expected to be fully avoided (based on current Rail Corridor alignment).

The Proposal is not expected to have any indirect impacts on other conservation reserves or proposed conservation reserves. Surface water hydrology into those areas will not be significantly impacted (refer to Section 7.5), and other indirect impacts such as dust will have a minimal impact.

All potential impacts within the proposed conservation reserves will be subject to management measures as defined throughout this PER.

7.4.5 Proposed Mitigation and Management Measures

7.4.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for conservation estates (Table 7-15).

Table 7-15 Conservation estate management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Avoid disturbance to conservation estates for construction and operation of the Project where practicable.	Disturbance within conservation reserves does not exceed what is described within this PER.	Use of and compliance with the Ground Disturbance Permit system.

7.4.5.2 Management Strategies

Table 7-16 details OPR's proposed management strategies for current and proposed conservation estates.

Table 7-16 Proposed conservation estate management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Impacts on conservation reserves or areas proposed for conservation reservation will be avoided during Proposal design wherever practicable. Where disturbance is unavoidable, the width of the Rail Corridor and the size and location of borrow areas will ensure that the area of disturbance within current or proposed reserves will be minimised as much as possible.	N/A	Design	Project Engineer
The implementation of temporary construction infrastructure such as turkey nests, borrow pits, lay down areas and construction roads will be minimised as much as possible within proposed and gazetted nature reserves.	N/A	Design & Construction	Project Engineer, Construction Manager
No accommodation areas will be established within proposed or gazetted nature reserves.	N/A	Design & Construction	Project Engineer, Construction Manager
Consideration to ongoing management requirements for these areas will be incorporated into the design and construction phase to ensure that matters including continued access requirements, weed control, feral animal control are appropriately addressed. OPR will liaise with DEC to ensure that their requirements are addressed.	N/A	Design & Construction	Project Engineer, Construction Manager

7.4.6 Predicted Outcome

OPR has designed the rail infrastructure to avoid the conservation estate as much as possible. The Proposal Area has been amended to exclude the Moresby Range, Urawa and Wokatherra Nature Reserves, and an un-named nature reserve.

The recently acquired pastoral leases of Narloo, Woolgorong and Twin Peaks have been proposed as nature conservation reserves. 0.2%, 0.2% and 1.3% of the former Narloo, Woolgorong and Twin Peaks pastoral leases respectively will be potentially impacted by the Proposal.

14.6% of Reserve 16200, vested in the Minister for Water, will be impacted by the Proposal as it enters the Oakajee Industrial Estate. This is a small reserve, and due to its proximity to the Proposal impacts are unavoidable.

7.5 SURFACE HYDROLOGY

7.5.1 Overview

The Proposal Area lies principally within the catchments of the Chapman, Greenough and Murchison Rivers. The Proposal follows the Greenough River for most of its length, utilising the relatively even gradient associated with its valleys.

Most of the creeks and rivers within the Proposal Area (including nine that will require a bridge) are episodic and major flows are the result of cyclone and major storm events. The Proposal Area does not contain any wetlands of significance.

The Proposal Area intersects one RIWI Act Surface Water Management Area; the Greenough River and Tributaries.

Significant surface hydrology characteristics of the Proposal Area include the Greenough River and tributaries, sheetflow in areas of sheetflow dependant vegetation (such as Mulga) and stormwater drainage of major drainage channels (Figure 5-31).

The surface drainage of the Proposal Area is described in detail in Section 5.2.3.

7.5.2 Key statutory requirements, environmental policy and guidance

7.5.2.1 EPA Objectives

The EPA objectives for management of potential impacts to surface water are:

- to maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected;
- to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards; and
- to maintain the integrity, ecological functions and environmental values of wetlands.

7.5.2.2 EPA statements and guidelines

EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005) provides guidance on surface water impacts and management in Western Australia.

7.5.2.3 Applicable Legislation and Policy

The EP Act is the principal statute relevant to environmental protection in WA. The Act makes provision for prevention, control and abatement of pollution and for the conservation, preservation, protection, enhancement and management of the environment.

Surface water discharges and potentially polluting activities affecting surface water are managed under work approvals and environmental licences issued to prevent environmental harm or pollution under Part V of the EP Act.

Other applicable guidelines and policies for surface water are the Australian New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ ARMCANZ, 2000), and the Environmental Water Provisions for WA; Statewide Policy No. 5 (WRC, 2000).

While the EP Act is the primary environmental legislation, the RIWI Act also provides regulation of activities associated with surface and groundwater aspects of the Proposal. Licences issued by DoW under the RIWI Act for the interference of Bed and Banks of surface water resource within the

Proposal Area will be required for the proposed river crossings which fall within the Greenough River and Tributaries Surface Water Management Area.

ANZECC/ARMCANZ Guidelines

In 1996 the Australian and New Zealand Environment and Conservation Council (ANZECC) together with the Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) developed the National Principles for the Provision of Water for Ecosystems (1996). These national principles aimed to improve the approach to water resource allocation and management, and to incorporate the needs of the environment in the water allocation process. The overriding goal of the principles is to provide water for the environment to sustain, and where necessary restore, ecological processes and biodiversity of water dependent ecosystems.

ANZECC and ARMCANZ have also released a set of water quality guidelines for the protection of marine and freshwater ecosystems (ANZECC/ARMCANZ 2000). The ANZECC/ARMCANZ guidelines provide a comprehensive list of recommended low-risk trigger values for physical and chemical stressors in water bodies, broken down into five geographical regions across Australia and New Zealand.

State Policy on Environmental Water Provisions

In WA, the Statewide Policy on Environmental Water Provisions (WRC 2000) protects ground and surface water dependent ecosystem values through the establishment of ecological water requirements. The policy was guided by State water and environmental legislation, the National Strategy on Ecologically Sustainable Development and the National Principles for the Provision of Water for Ecosystems (ANZECC/ARMCANZ 1996).

Ecological water requirements are determined on the basis of the best scientific information available. A conservative approach is taken to the estimation of ecological water requirements in allocation planning and licensing processes where scientific knowledge of ecosystem requirements is limited. Soil water requirements are elements of the existing or historic water flow regime that are required to sustain key social values such as recreation and Aboriginal heritage and culture.

- Australian New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ ARMCANZ, 2000);
- State Water Quality Management Strategy No. 1 Framework for Implementation (WA Government, 2001);
- Environmental Water Provisions for WA; Statewide Policy No. 5 (WRC, 2000); and
- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2008).

7.5.3 Aspects and Impacts

The main aspect of the proposal with the potential to impact surface water hydrology is the Rail Corridor itself, and the linear nature of the infrastructure. Other aspects include vegetation clearing and the use and storage of hydrocarbons.

Potential impacts to surface hydrology include:

- interruption to existing surface water flow patterns, including sheet flow;
- erosion and sedimentation; and
- contamination of surface waters.

7.5.4 Surface Hydrology Impact Assessment

Route planning for the Proposal has considered surface hydrology as a critical factor. Placing of long life infrastructure within significant flood areas is avoided for cost and risk reasons, leading to a reduction in the potential impacts to surface hydrology.

The Proposal will unavoidably require the construction of approximately nine bridges over waterways and a number of culverts along the alignment. There may be increased stream bed or bank erosion near these drainage crossings. Details of bridges and culverts have been provided in Sections 4.4.4.1 and 4.4.4.2 respectively.

Pooling upstream of Proposal infrastructure is unlikely to occur during significant rainfall events as bridges or culverts will be installed at all drainage lines. In extreme rainfall events there may be some pooling however these events are expected to coincide with flooding of most drainage lines within the region. The installation of culverts and bridges will also ensure downstream hydraulic capacity is maintained. The creation of minor, localised ponding areas may provide additional soil water to promote plant growth. While this may create local impacts on vegetation and stock carrying capacity, these events will be episodic and small in scale.

Bridges will generally be designed such that they are perpendicular to the watercourse. This will reduce the likelihood of stream diversions. Culverts will be aligned in the same direction as the drainage lines; therefore the likelihood of diversion is reduced.

DEC will be consulted during the detailed design phase for the Rail Corridor to ensure any impacts on conservation vegetation areas are minimised. The spacing and size of culverts in conservation areas would be determined after a visual assessment of each of these areas and combined with the outputs of the above sheet flow assessment.

OPR has generally located the indicative rail alignment to avoid sheetflow areas as much as possible. In some cases the alignment has been relocated tens of km to locate it on gently sloping ground where the drainage features are more incised. This has occurred within proximity to the Weld Range on Jundal Station.

The preliminary drainage design of the railway makes provision for approximately 650 environmental culverts based on CEJV/BGE (unpublished) *Summary of Bridge and Drainage Design Studies for OPR rail* (see Appendix 3), however this figure is a preliminary estimate only.

It is nominally proposed to install environmental culverts between larger engineered culverts, so that the spacing between consecutive culverts does not exceed 400 m. However, where there are run-off dependant ecosystems downstream of culverts consideration will be given to water distribution to ensure that water drainage shadows do not result outside of the original construction footprint. It is expected that spacings as low as 50 m may be required in some locations.

Figure 7-1 demonstrates the indicative design for sheetflow drainage mechanisms and the expected drainage shadow. The drainage shadow was calculated using a 45° angle for the expected flow direction of the sheetflow once it exits the culverts. To achieve this angle the flow will need to be spread using various spreader mechanisms, which OPR will install at each culvert.

Significant rainfall events during construction are likely to cause short-term localised erosion and potential increases in sediment loads. Within a regional context this erosion or any subsequent impacts on surface water is not expected to be significant.

All waterway crossings will be implemented in accordance with the specific conditions set in 'Bed and Banks' Permits to be issued by DoW under the RIWI Act. Compliance with DoW requirements will ensure that surface water hydrology is not significantly impacted.

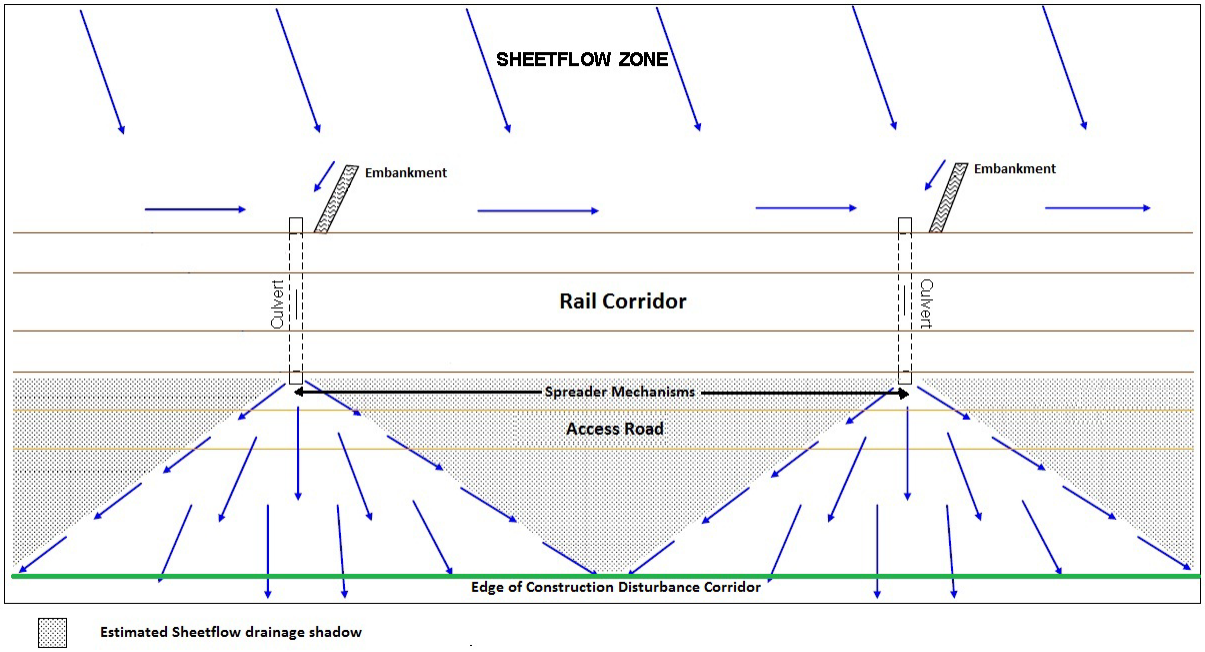


Figure 7-1 Sheetflow drainage culvert design

During construction there is the risk of surface water contamination from hydrocarbon or other spills. Compliance with the Hazardous Materials & Contamination Management Plan will ensure that surface hydrology is not significantly impacted.

Detailed consultation with landholders to assist in the design of rail and road drainage design will ensure that any potential impacts on farm and pastoral productivity is not significantly impacted due to altered drainage conditions.

7.5.5 Proposed Mitigation and Management Measures

7.5.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for surface hydrology (Table 7-17).

Table 7-17 Surface water management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
To avoid any significant disturbance to surface water hydrology regimes and ensure the protection of riparian vegetation.	• All RIWI Act permits obtained for named streams, water courses and embankments requiring disturbance • No visible pooling upstream of Project infrastructure • No visible diversion or restriction of flow downstream of Project infrastructure • No vegetation loss outside of approved disturbance footprint through alteration to surface water hydrology. • No significant scouring or erosion on downstream waterways.	• Compliance with Bed and Banks Permits. • Visual surface water hydrology observations during flow events • Riparian vegetation monitoring downstream of the Proposal • Incident reporting
Ensure the protection of sheetflow dependent vegetation.	• No visible restriction of flow downstream of Project infrastructure • No vegetation loss outside of approved disturbance footprint through alteration to surface water hydrology.	• Visual surface water hydrology observations during flow events • Mulga vegetation monitoring in sheetflow areas • Incident reporting
To maintain the quality of surface water and minimise the potential for erosion and sedimentation.	• No significant increase in sedimentation downstream of Proposal infrastructure. • No significant decline in water quality downstream of Proposal infrastructure.	• Water quality monitoring data. • Incident reporting • Compliance with Hazardous Materials and Contamination Management Plan

7.5.5.2 Management Strategies

To maintain the sheetflow regime in sensitive vegetation areas the Proposal will include a significant number of 'environmental' culverts to ensure that sheetflow dependant vegetation such as some areas of Mulga are not significantly impacted. There will be some drainage shadow effects in sheetflow areas, however the drainage shadow is expected to remain within the initial construction disturbance envelope and therefore will not result in any significant additional impacts to vegetation.

In this regard OPR will complete further detailed assessments of the corridor to identify sheetflow dependant vegetation. In these locations OPR will incorporate culverts at an appropriate spacing to restrict sheetflow impacts to within the original construction footprint.

DEC will be consulted during the detailed design phase for the Rail Corridor to ensure any impacts on conservation vegetation areas are minimised. The spacing and size of culverts in conservation areas would be determined after a visual assessment of each of these areas and combined with the outputs of the above sheetflow assessment.

OPR will undertake detailed consultation with landholders to assist in the design of rail and road drainage design, land access arrangements and land management measures.

Proposed management of surface hydrology is summarised in Table 7-18.

Table 7-18 Proposed surface hydrology management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Prepare and implement a Surface Water Management Plan (SWMP) to contain the following actions: • water from wash down bays will be collected, treated and released or recycled where possible; • identify relevant surface water monitoring points schedules and frequencies, together with trigger levels and responses for implementation of investigations and corrective actions where appropriate; • contain, monitor and appropriately treat (if required) any potentially contaminated stormwater prior to reuse or release to the environment; and • maintain all stormwater infrastructure to their designed capacity or function. The SWMP will be developed in consultation with DoW.	SWMP	Design, Construction & Operation	Construction Manager, Operations Manager
OPR will perform further detailed investigations to refine the current understanding of areas of sheetflow dependant vegetation that may be impacted by the Proposal. A hydrology assessment will be performed for these areas to determine the suitable drainage measures required to maintain sheetflow and restrict drainage shadows to within the area originally disturbed by the construction footprint.	SWMP	Design & Construction	Project Engineer, Environment Manager
Beds and Banks permits will be sought for activities which have the potential to interfere with named streams, water courses and embankments are to be obtained prior to construction activities.	SWMP	Construction	Environment Manager
The basis of design for bridges is to withstand 1 in 100 year average recurrence flooding without damage and 1 in 2,000 year average recurrence flooding without structural damage.	SWMP	Design & Construction	Project Engineer
Design and install culverts, bridges or water crossings at drainage crossings, and at those areas of vegetation identified as surface water dependent, according to the following commitments: • minimise interference to overland flow and maintain sheet flow, and reduce the risk of shadow effects; • reduce pooling alongside the rail which may attract fauna; • includes appropriate erosion protection e.g. rip rap rock protection and reno mattresses; • where infrastructure may cause drainage to flow parallel to the rail formation, place culverts at regular intervals together with small interceptor banks to direct runoff and reduce ponding; • where practicable, construct bridges and major crossings at right angles to major drainage channels; • a risk audit should be completed to ensure these designs are appropriate to meet environmental and safety objectives; and • monitoring will occur to ensure surface water flows are maintained.	SWMP	Design & Construction	Project Engineer, Construction Manager, Environment Manager
Suitable drainage mechanisms (such as culverts) will be installed in areas of sheetflow dependant vegetation at defined low points.	SWMP	Design & Construction	Project Engineer
Locate camps and other supporting rail infrastructure away from creeks and waterways and at least 0.5 m above the 100yr ARI flood level for the area.	SWMP	Design & Construction	Project Engineer
Standard controls for hydrocarbon and waste management to be implemented to minimise the risk of spills and contamination.	Hazardous Materials & Contamination MP	Construction & Operation	Safety Manager, Construction Manager, Operations Manager

7.5.6 Predicted Outcome

After mitigation and management measures have been applied, the Proposal will result in the following outcomes in relation to surface hydrology:

- no significant impacts on surface hydrology are expected as bridge and culverts will be designed to maintain surface flows;
- minor, localised impacts may occur in some areas including drainage shadow effects in sheetflow areas, and localised ponding along drainage lines but will be minimised through the use of environmental culverts. The drainage shadow is expected to be within the general construction disturbance envelope and therefore will not result in any significant indirect impacts to vegetation. This is discussed further in Section 7.2;
- significant rainfall events during construction may cause short-term localised erosion but risks will be minimised as constructions sediment controls will be established as soon as practicable. Within the regional context, erosion or subsequent impact are not expected to be significant;
- minimal risk of contamination of surface water as standard hydrocarbon and waste management controls are implemented; and
- impacts on farm and pastoral productivity are not expected to be significant with the implementation of detailed surface water management measures.

7.6 GROUNDWATER

7.6.1 Overview

The Proposal Area intersects two RIWI Act Groundwater Management Areas; the Gascoyne and East Murchison. The Proposal does not intersect any Public Drinking Water and Supply areas. No groundwater dependent vegetation was identified within the Study Area.

Groundwater resources vary within the Proposal Area. There is generally a low prospectivity of significant aquifers, with greatest potential in those areas closest to the coast. Recent groundwater investigations have indicated that water quality along the alignment is generally brackish with electrical conductivity ranging from 2.2 mS/cm to 18.7 mS/cm. The water quality within granite and dolerite formations tends to be neutral to alkaline (pH 7.2 - 8.5) (Aquaterra 2009b; Appendix 4). Groundwater is discussed in detail in Section 5.2.4.

The two primary uses of water during the construction of the rail line are to consolidate fill and suppress dust. In addition, the construction program will require the establishment of a number of construction camps, a sleeper factory and several workshops and depots which will require a temporary water supply.

The Proposal includes a pipeline along the length of the Rail Corridor so that water can be pumped from supply locations to where it is required. OPR is also investigating the use of water from abandoned or active mines, and if feasible will pump or cart water to the Proposal for use.

It is anticipated that approximately 200 groundwater bores will be drilled, developed and operated as production bores to meet the construction water requirements. Some bores are expected to be retained for use during operation. The Proposal is expected to require 3.5 GL of groundwater over the 36 month construction period, and 130 ML/yr during operation.

The prospect of yields of sufficient volume for Proposal construction are considered moderate to good with the optimal distance between bores being 15 km (Aquaterra, 2009b).

Groundwater impacts from construction will be short term (maximum 36 months) during which time aquifers may be drawn down. Operational use will be at a low level.

7.6.2 Key statutory requirements, environmental policy and guidance

7.6.2.1 EPA Objectives

The EPA objectives for management of groundwater are:

- to maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected; and
- to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

7.6.2.2 EPA statements and guidelines

EPA Guidance No. 33 *Environmental Guidance for Planning and Development* (EPA, 2005) provides guidance for groundwater issues and management.

- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2008); and
- EPA Guidance No. 48 (Draft) - *Groundwater Environmental Management Areas* (EPA, 1998).

7.6.2.3 Applicable Legislation and Policy

The RIWI Act makes provision for the regulation, management, use and protection of water resources. The Act provides for the sustainable use and development of water resources to meet the needs of current and future users, and the protection of water-dependent ecosystems and other environmental values, including the regulation of activities detrimental to them.

The abstraction of groundwater is subject to licensing by the DoW under the RIWI Act. Licences specify the maximum abstraction rate and include conditions for monitoring. Permits to interfere with bed and banks of a watercourse are also issued by the DoW under the RIWI Act to identify issues that may impact on watercourses and identify/approve suitable management strategies to address these impacts.

Potentially polluting activities are managed under environmental harm and pollution control provisions of the EP Act and licences are issued under the EP Act. Stormwater management, surface water discharges and potentially polluting activities are managed under an environmental licence issued under Part V of the EP Act. Other legislative devices pertinent to the handling and storage of potential (hazardous) contaminants such as hydrocarbons:

- *Dangerous Goods Safety Act 1961* and associated regulations; and
- Australian Standard AS 1940-1993 – The Storage and Handling of Flammable and Combustible Liquids.

Other applicable standards and guidelines include:

- Australian New Zealand Guidelines for Fresh and Marine Quality Water (ANZECC / ARMCANZ, 2000);
- State Water Quality Management Strategy;
- Environmental Water Provisions for Western Australian; Statewide Policy No. 5 (WRC, 2000); and
- Department of Health (Draft) Guidelines for the Use of Recycled Water in WA.

ANZECC/ARMCANZ 1996 Guidelines

In 1996 the Australian and New Zealand Environment and Conservation Council (ANZECC) together with the Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) developed the National Principles for the Provision of Water for Ecosystems (1996). These national principles aimed to improve the approach to water resource allocation and management, and to incorporate the needs of the environment in the water allocation process. The overriding goal of the principles is to provide water for the environment to sustain, and where necessary restore, ecological processes and biodiversity of water dependent ecosystems.

ANZECC and ARMCANZ have also released a set of water quality guidelines for the protection of marine and freshwater ecosystems (ANZECC/ARMCANZ 2000). The ANZECC/ARMCANZ guidelines provide a comprehensive list of recommended low-risk trigger values for physical and chemical stressors in water bodies, broken down into five geographical regions across Australia and New Zealand.

State Water Quality Management Strategy

The Government of WA developed the State Water Quality Management Strategy in 2001 with the objective “to achieve sustainable use of the Nation’s water resources by protecting and enhancing their quality while maintaining economic and social development.”

The State Water Quality Management Strategy requires that a Water Conservation Plan will be developed before a water allocation licence is issued or renewed. The plan must outline water efficiency objectives and timeframes.

Statewide Policy on Environmental Water Provisions

Statewide Policy No. 5 (2000) describes the principles and processes to be applied in determining how much water should be retained for the environment when allocating and reviewing water use rights. The primary objective of this policy is to provide for the protection of water-dependent ecosystems while allowing for the management of water resources for their sustainable use and development to meet the needs of current and future users.

Ecological water requirements are determined on the basis of the best scientific information available. A conservative approach is taken to the estimation of ecological water requirements in allocation planning and licensing processes where scientific knowledge of ecosystem requirements is limited. Soil water requirements are elements of the existing or historic water flow regime that are required to sustain key social values such as recreation and Aboriginal heritage and culture.

7.6.3 Aspects and Impacts

The main aspect of the Proposal with the potential to impact groundwater is groundwater abstraction. Other aspects include the storage, transport and disposal of hydrocarbons, waste, and other hazardous materials.

Potential impacts on groundwater include reduction of groundwater quantity through abstraction, and reduction in groundwater quality through pollution of the groundwater if contaminated wastes are not suitably controlled. The affects of drawdown could include impacts on stygofauna and other groundwater users.

Impacts on pastoral water supply are not expected from peak water use during the construction phase as pastoral water supplies are low flow and generally based on shallow fresh lenses. Construction water bores will need to yield significantly more water and hence are likely to be sourcing water from deeper aquifers. In the event that a pastoral water supply is clearly impacted by construction water abstraction, OPR will make arrangements directly with the pastoralist to make sure they still have access to adequate water supplies.

The Proposal is not expected to have a significant impact on groundwater quality or quantities in the area. Groundwater will either be sourced from numerous bores with small extraction requirements or from a smaller number of larger supply bores that have been selected due to the adequate supplies they contain. Groundwater extraction will be managed in accordance with DoW requirements and licenses issued under the RIWI Act, which will ensure that the groundwater source is sustainably managed.

7.6.4 Proposed Mitigation and Management Measures

7.6.4.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for groundwater (Table 7-19).

Table 7-19 Groundwater management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
To maintain the quantity and quality of groundwater so that existing and potential environmental values, including ecosystem maintenance, are protected.	• All appropriate DoW licences are obtained. • Compliance with DoW licence conditions.	Acceptable groundwater monitoring results (quantity and quality).

7.6.4.2 Management Strategies

OPR will undertake detailed and ongoing consultation with landholders to include water supply aspects. Any impacts on pastoral water supply due to the Proposal will be addressed and rectified by OPR.

OPR has also undertaken a detailed desktop assessment for stygofauna within the Proposal Area and all groundwater abstraction will be carried out in accordance with licences issued under the RIWI Act, which will ensure the sustainable use of water supplies and protection of stygofauna and their habitat.

Management objectives for groundwater have been guided by the *Pilbara water in mining guidelines* (2009) as requested by DoW. The guidelines will inform the Groundwater Management Plan, with considerations including water access, exploration, alternative sources, abstraction and pumping rates, water use efficiency, water-dependent ecosystems and other water dependent values, water quality and cumulative impacts.

The groundwater licensing assessment process requires the Proponent to demonstrate that the proposed groundwater abstraction will not have a detrimental impact on the environment or existing users, or if an impact is likely, that effective mitigating measures will be implemented (e.g. supply water to these users, deepen existing wells, etc).

Water supply investigations

The main focus of future investigations will be to assess construction and accommodation camp water supply.

It is expected that when it comes to palaeo-channel and calcrete (alluvial) investigations for water supply borefields, DoW will require detailed investigations to demonstrate that an adequate and available resource exists, prior to approving licensing applications. This can include:

- geophysical surveys and detailed drilling programmes to delineate aquifer geometry and boundaries;
- adequate test pumping durations to demonstrate sustainable pumping rates and areas of impact;
- water chemistry analysis (which may need to include isotopes) to assess recharge rates to the aquifer;
- installation of monitoring bores for stygofauna monitoring;
- development of a robust conceptual model based on the exploration programme;

- numerical modelling to assess potential impacts and extent of impact on existing users and the environment (e.g. stygofauna);
- proposed monitoring network and management programme; and
- mitigation measures and trigger levels.

Accommodation camp water supply

It is assumed that groundwater quality will be outside of Australian Drinking Water Standards and as such, water will require treatment before use as potable water in the accommodation camps

It is proposed that camp water supply investigations would include the following tasks:

- drilling site selection, following confirmation of camp locations;
- site visits to carry out ground-truthing and ground-based geophysical surveys;
- relevant approvals for drilling investigations;
- hydrogeological exploration drilling and test-pumping at each camp location;
- analysis and Reporting, including recommendations for bore infrastructure; and
- DoW abstraction licensing applications.

In order to ensure security of supply, it will be necessary to develop additional 'standby' production bores at each camp.

Construction water supply

Eleven exploration targets located within the Proposal Area are proposed to be investigated in the Phase 2 drilling programme. It is proposed that these exploration targets (refer to Section 5.2.4) be drilled and, if successful, test pumped, as they fall within or along the edges of the three selected groundwater supply areas, and would therefore provide useful, preliminary hydrogeological information on these areas.

It is envisaged that the construction water supply investigations would include the following components:

- airborne geophysical surveys to assist in delineating aquifer boundaries and drilling target selection;
- ground-based gravity geophysical surveys (to be done by others) to assist in mapping the basement geology and finalise drill sites outside the Rail Corridor;
- ground-truthing site visit(s);
- relevant approvals for drilling investigations;
- exploration drilling investigations and test pumping within the Rail Corridor (eleven targets listed above);
- further exploration drilling and production bore installation (in selected areas outside the corridor);
- numerical modelling to assess potential impacts (the requirement for a numerical model will be assessed during the hydrogeological exploration programme; and
- reporting and DoW Licensing applications.

Proposed management of groundwater is detailed in Table 7-20.

Table 7-20 Proposed groundwater management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Continue to investigate potential water sources for the Proposal in consultation with DoW and DEC	Groundwater MP	Prior to Construction	Environment Manager
Groundwater sources will be investigated and licensed under the RIWI Act which will ensure that groundwater abstraction is sustainably managed to protect groundwater quantity and quality such that Groundwater Dependant Ecosystems, subterranean invertebrate fauna and seasonal pools will not be significantly affected.	Groundwater MP	Construction	Environment Manager
All bores no longer required will be rehabilitated in accordance with Section 18 of the document 'Decommissioning of Bores (abandonment) of the Minimum construction of groundwater bores' (Land and Water Biodiversity Committee 2003).	Groundwater MP	Construction & Operation	Construction Manager, Operations Manager
All groundwater bore construction and groundwater abstraction will be licensed under the RIWI Act and managed in accordance with licence conditions and associated management measures. Management measures will determine appropriate trigger levels for contingency actions. Associated monitoring will be conducted to compare results against these trigger levels.	Groundwater MP	Construction & Operation	Environment Manager

7.6.5 Predicted Outcome

After mitigation and management measures have been applied, the Proposal will result in the following outcomes in relation to groundwater:

- the majority of groundwater abstraction will be short-term and/or relatively small volumes over a number of locations, which will significantly reduce the likelihood of unacceptable impact;
- groundwater use will be licensed under the RIWI Act which will ensure sustainable use;
- compliance and implementation of the Hazardous Materials & Contamination Management Plan will reduce the risk of groundwater contamination; and
- impacts on pastoral water supply are not considered likely.

7.7 NOISE, VIBRATION AND LIGHT

7.7.1 Overview

7.7.1.1 Noise

The approach to noise impact assessment involves consideration of noise sources, activities and locations of those activities to identify areas for assessment. The key considerations for this proposal are centred around short term construction noise, and longer term noise from rail operations.

The use of earthmoving machinery, light vehicles, tracklaying and construction equipment are likely to be sources of noise during the construction phase of the Proposal. Blasting may be necessary in isolated locations where continuous rock is encountered.

Construction noise will be relatively short term at any one receptor, as the construction face will continuously advance along the corridor. Construction noise sources are expected to be more mobile as machinery will be accessing areas of borrow and access roads that may be away from the rail centreline. The logical basis for identifying noise sensitive premises however, relates to the rail centreline. To incorporate the possible variations in the rail centreline, consideration has been given to the extremities of possible rail alignment within the Proposal Area.

Receivers within the Proposal Area are generally clustered in the western end of the Proposal Area within freehold land, as there is a higher density of residences in this area than in the pastoral area. Due to the isolated nature and sparse settlement of the pastoral land area, a smaller number of residences will be exposed to noise from the Proposal.

In order to assess the potential noise impacts associated with the operation of the Proposal, OPR commissioned Lloyd George Acoustics to undertake preliminary noise investigations along the length of the rail (Appendix 6, Lloyd George Acoustics, 2010) in accordance with Preliminary Draft Guidance No. 14 – Road and Rail Transport Noise, Version 3 (DEC, 2000). .

Ambient noise levels were measured at four locations at Oakajee and East Chapman Valley, which were chosen to represent a range of conditions along the railway, in order to provide baseline data for the noise assessment. The ambient background noise survey showed levels consistent with the rural setting - measured noise levels from the four locations varied from LA90 23 - 26 dB at night, while the day time levels ranged from LA90 27 - 30 dB. Noise events tend to be related to vehicle movements associated with agricultural activities and wind noise.

Ambient night time noise levels at the four locations ranged from L_{A90} 23 - 26 dB, while the day time levels ranged from L_{A90} 27 - 30 dB, indicating relatively low background noise consistent with a rural setting (Appendix 6, Lloyd George Acoustics, 2010).

Railway noise was predicted using modelling with inputs including topographical data and train configuration (e.g. speed, height, number of wagons, number of movements per day etc.). In addition, to accurately predict the effect of barriers (hills or buildings), the noise source height of the locomotive was raised from the standard 0.5 m above the railhead to 4.0 m (Lloyd George Acoustics, 2010a).

Noise modelling was completed for the proposed current centreline (2010a) and for two alternative scenarios (2010b). The preferred centreline of the proposed rail is not likely to change significantly unless further site investigations reveal potential obstacles. Hence the preferred centreline represents the most likely scenario for the generation of operational noise.

7.7.1.2 Vibration and light

Current vibration sources throughout the Proposal Area are restricted to minor and low level sources, almost primarily from rural activities.

There are few light sources throughout the Proposal Area, particularly in the pastoral area. Light sources are generally limited to farm houses, road traffic and occasional farming operations at night.

7.7.2 Key statutory requirements, environmental policy and guidance

7.7.2.1 EPA Objectives

The EPA objectives for the management of noise, light and vibration are:

- to protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards; and
- to avoid or manage potential impacts from light overspill and comply with acceptable standards.

7.7.2.2 EPA statements and guidelines

The following EPA statements are relevant to noise:

- EPA Guidance Statement No. 3 - *Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005);
- EPA Draft Guidance Statement No. 8 - *Environmental Noise* ;
- Preliminary Draft EPA Draft Guidance Statement No. 14 *(Version 3) - Road and Rail Transportation Noise*; and
- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

It should be noted that Guidance Statement No. 8 (Draft) *Environmental Noise* (EPA 2007) does not apply to road and rail infrastructure, and is used here only by way of providing guidance for methodology and to provide criteria to indicate the number of receptors for which train movements will be audible over background noise.

7.7.2.3 Applicable Legislation and Policy

The following WA legislation is relevant to noise

- EP Act; and
- Environmental Protection (Noise) Regulations 1997.

Sections 51, 62(4), 65 and 74(3)/50, 51 and 75 of the EP Act provide the legislative framework for managing noise impacts. The noise limits cited by the Act are assigned in the Environmental Protection (Noise) Regulations 1997 (Noise Regulations) and further guidance exists in EPA Guidance Statement No.8 (EPA 2007a). Regulation 7 of the Noise Regulations requires that noise emitted from any premises must comply with assigned noise levels when received at any other premises and must be free of the intrusive characteristics of tonality, modulation and impulsiveness. In addition, the noise emissions must not "significantly contribute" to an exceedance of the assigned levels.

The assigned levels are specified under regulation 8 of the Noise Regulations, according to the type of premises receiving the noise. For noise-sensitive premises, the assigned levels recognise the time of day and the presence of commercial and industrial land use zonings and major roads within a 450 m radius of the receiver. The Noise Regulations also specify requirements relating to tonality,

modulation and impulsiveness, and to emissions that may "significantly contribute" to an exceedance.

The "influencing factor" is calculated for each noise-sensitive premises receiving noise. It takes into account the amount of industrial and commercial land and the presence of major roads within a 450 m radius around the noise receiver.

WAPC's *State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (WAPC, 2009) (SPP5.4) is the policy that has been adopted by the WA Government when assessing nose from railways.

The Noise Regulations provide the framework for the management of construction noise. They provide guidance on acceptable noise levels for different times of day and days of the week. Construction activities conducted outside of those times are generally subject to a Construction Noise Management Plan to be approved under the Regulations.

7.7.3 Aspects and Impacts

Aspects of the Proposal that will contribute to noise include construction activities and operation activities, in particular train movements.

Potential noise impacts can be separated into those associated with construction activities (which will be short term and transient) and those associated with operations (which will be longer term).

Potential noise, light and vibration impacts from construction activities include:

- short term changes to amenity and living conditions in and around residences close to the rail centreline;
- nuisance noise or vibrations from the use of construction equipment;
- isolated noise and vibration events from blasting (if required);
- nuisance lights from construction activities where additional lighting is required; and
- short term impacts on fauna adjacent to the activities from noise, light or vibration.

Potential noise, light and vibration impacts from operations activities include:

- longer term changes to amenity and living conditions in and around residences close to the rail centreline;
- longer term changes to low level noise conditions at some distance from the rail centreline with occasional noise events depending upon ambient conditions;
- occasional nuisance noise or vibrations from the use of maintenance equipment;
- nuisance lights from trains, vehicles, road crossings or signals; and
- longer term impacts on fauna adjacent to the activities from noise, light or vibration.

7.7.4 Impact Assessment

7.7.4.1 Construction Noise

General construction noise will be short-term (weeks-months) as the construction face will continually advance along the Proposal Area.

Sources of ballast are not expected to come from the most noise sensitive areas around the Wokatherra Gap and Chapman Valley where the density of residences is highest. The activities

associated with ballast production will be subject to regulation under Part V of the EP Act and Local Government approvals.

Blasting may be necessary in isolated locations where continuous rock is encountered. In the case of blasting, the EPA notes that the DEC licensing process no longer addresses blast vibration criteria. Accordingly, the EPA policy in relation to assessments of proposals that involve blasting is that the criteria previously adopted in licence conditions should apply:

- Blasting during daytime (0700 – 1800 hours):
    a. no vibration level resulting from blasting on any premises or public place, when received at any other premises, may exceed a peak particle velocity of 10 mm/s; and
    b. the vibration levels for 9 in any 10 consecutive blasts (regardless of the interval between blasts) on any premises or public place, when received at any other premises, must not exceed 5 mm/s;
- Blasting out of hours (1800 – 0700 hours):
    a. no vibration level resulting from blasting on any premises or public place, when received at any other premises, may exceed a peak particle velocity of 1.0 mm/s; and
    b. the vibration levels for 9 in any 10 consecutive blasts (regardless of the interval between blasts) on any premises or public place, when received at any other premises, must not exceed 0.5 mm/s.

7.7.4.2 Operation Noise

Noise from rolling stock on rail curves is very dependent on the radius of curvature. The OPR rail uses broad curves with a minimum mainline radius of 1000 m; however, most curves are at or beyond the preferred radius of 2000 m. At 2000 m noise from trains is generally not greatly different from straight tracks.

The modelling results of the rail movements were assessed by Lloyd George Acoustics against SPP5.4 (WAPC, 2009). The External Noise Exposure Level Criteria for Noise Sensitive Land Uses as defined in SPP5.4 are:

- Day time (6 am – 10 pm):
    - Noise Target = 55 db
    - Noise Limit = 60 db
- Night time (10 pm – 6 am)
    - Noise Target = 50 db
    - Noise Limit = 55 db

The 5 dB difference between the outdoor noise “Target” and the outdoor noise “Limit represents an acceptable “margin” for compliance, provided that best practical efforts have been made to reduce noise (WAPC 2009).

The assessment assumed that all significant buildings are noise sensitive receptors. Based on OPR's modelling the results are as follows:

- three receptors are predicted to exceed the outdoor Noise Limit criteria at night (> 55 dBA), which refers to a level of outdoor noise exposure that is not generally regarded as acceptable for conventional residential or other noise-sensitive development. An additional three receptors that exceed the Noise limit criteria at night are owned by the WA Land Authority and have lease conditions that mean that they are not considered to be noise sensitive premises; and
- seven receptors would be exposed to night-time noise levels above the Noise Target category (50 dBA - 55 dBA), which refers to a level of outdoor noise exposure that would be acceptable for residential and other noise-sensitive development, and may require mitigation. An additional seven receptors in this category are owned by the WA Land Authority and have lease conditions that mean that they are not considered to be noise sensitive premises.

Details of receivers that exceed limit or target criteria, excluding WA Land Authority properties, can be found in Table 7-21. The location of these receptors is shown in Figure 7-2 and Figure 7-3. Noise level contours are provided for the overall alignment and within the Chapman Valley area, which has a higher density of population than the rest of the railway.

Table 7-21 Receivors and noise criteria

Receivers	Predicted Noise levels (dB $L_{Aeq\ (Night)}$)	SPP 5.4 Criteria Assessment
Lot 6088	62	Exceeds "Limit" Criteria of 55 dB $L_{Aeq\ (Night)}$
59 Eastough-Yetina Rd, Yetina	58	
479 Chapman Rd, East Chapman	56	
12 Newmarracarra Rd, Kojarena	54	Exceeds "Target" Criteria of 50 dB $L_{Aeq\ (Night)}$
2134 Valentine Rd, North Eradu	54	
150 Lorimer Rd, Durawah	53	
Lot 14	51	
694 Badgedong Rd, Wandana	51	
1682 Valentine Rd, North Eradu	51	
1183 Chapman Rd, East Chapman	51	

In addition to SPP 5.4 criteria, noise modelling results were also assessed in relation to the limits defined in Preliminary Draft EPA Guidance Statements No. 14 (Version 3) - *Road and Rail Transportation Noise.*

The results show that 55 receiver lo`cations are predicted to exceed the Preliminary Draft Guidance No. 14 "N1" rating, and therefore noise from the railway may result in some impact to residents. Although this noise level is below the SPP 5.4 "Target" criteria, it indicates trains may be audible from approximately 55 buildings in proximity to the rail line.

It should be noted that the building uses (residential or otherwise) of the noise receivers included in this assessment have not been verified.

Alternative alignments

In recognition of the possibility that the rail centreline could require adjustment if unforeseen constraints are identified, OPR requested Lloyd George Acoustics to model two alternative scenarios – a "Northern Alternative" and "Southern Alternative". These alternatives have not been the subject of any feasibility investigations and represent a significant deviation from what is planned. They have been included as seeing representative cases that provide for the outer bounds

of noise emissions to be established and allow for some flexibility in centreline location. The topographic constraints and already identified considerations through the Wokatherra gap area mean that the proposed rail centreline location is unlikely to change markedly. In effect, they represent "worst case" scenarios should detailed engineering investigations require significant changes to the proposed centreline.

Table 7-22 below presents the numbers of noise receptors that would be impacted at levels above the $L_{Aeq(night)}$ limit and target criteria as specified in SPP5.4.

Table 7-22 Noise modelling summary – comparison of results

Modelled Case	No. of sensitive receptors exceeding SPP5.4 night Limit criteria of 55dB $L_{Aeq(8hour)}$	No. of sensitive receptors exceeding SPP5.4 night Target criteria of 50dB $L_{Aeq(8hour)}$
Preferred Centreline	3	7
Northern Alternative	13	13
Southern Alternative	8	9

The location of noise receptors has already been considered in route selection to establish the preferred centreline – as can be seen from the assessment in Table 7-22 above. The preferred alignment will impact upon the least number of residences. It should be noted that the data above specifically excludes residences that are owned by Landcorp within the OIE and buffer area as the lease terms of these properties allow for developments such as the rail.

It should be noted that current ore haulage arrangements from Mid-West iron ore mines using truck haulage along main roads may also have noise impacts.

7.7.4.3 Vibration and Light Impact Assessment

Vibration during operation is not expected to be an issue beyond 20 m from the tracks. This assumption was based on recordings taken in the Pilbara on trains of similar characteristics.

Blasting may be a short-term source of vibration during construction however it will occur in accordance with Regulation 11 of the Environmental Protection (Noise) Regulations 1997. In addition consultation with nearby landholders will occur about the noise and vibration from blasting and compaction to determine suitable timing and/or mitigation for these events.

Based on the information above and the expected distances between the Proposal and residences, vibration is therefore considered unlikely to be an issue at any sensitive receiver (Appendix 6, Lloyd George Acoustics 2010). Vibration monitoring may be used if required to verify these predictions and has been included as a management action in Section 7.7.5.2.

During construction, lights may be used to support activities in poor light conditions in a limited number of locations for relatively short durations (weeks to months). During operations the key light source will be on the locomotives – a transient source that will be directed to the tracks, as well as road crossings and service vehicle headlights. Maintenance camps may also be a light source, however these camps are expected to be in remote locations away from residences. Given the above and the rural location of the Proposal, light spill has not been considered further as a factor.

Figure 7-2 Location of potentially noise impacted residences - entire Proposal

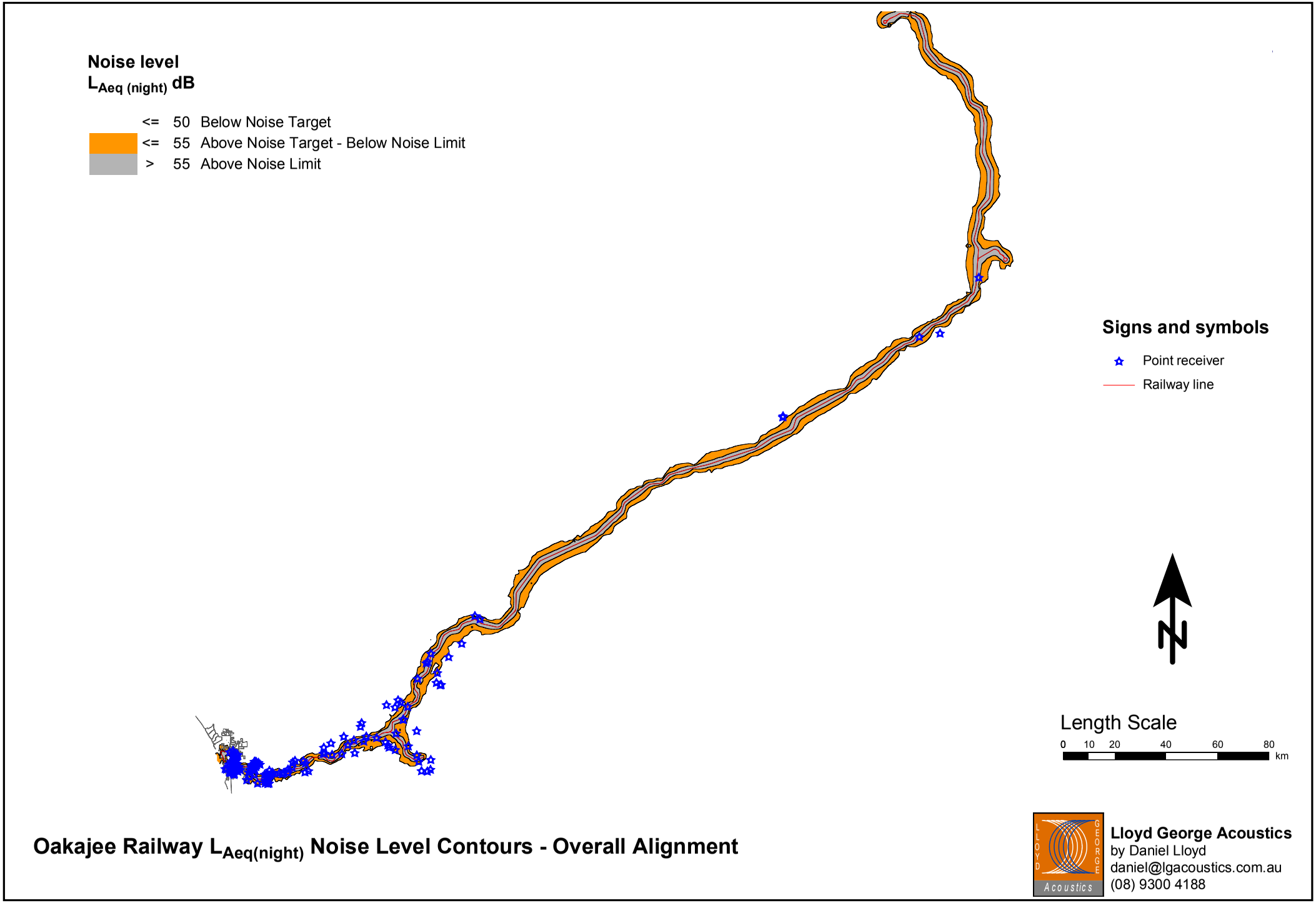
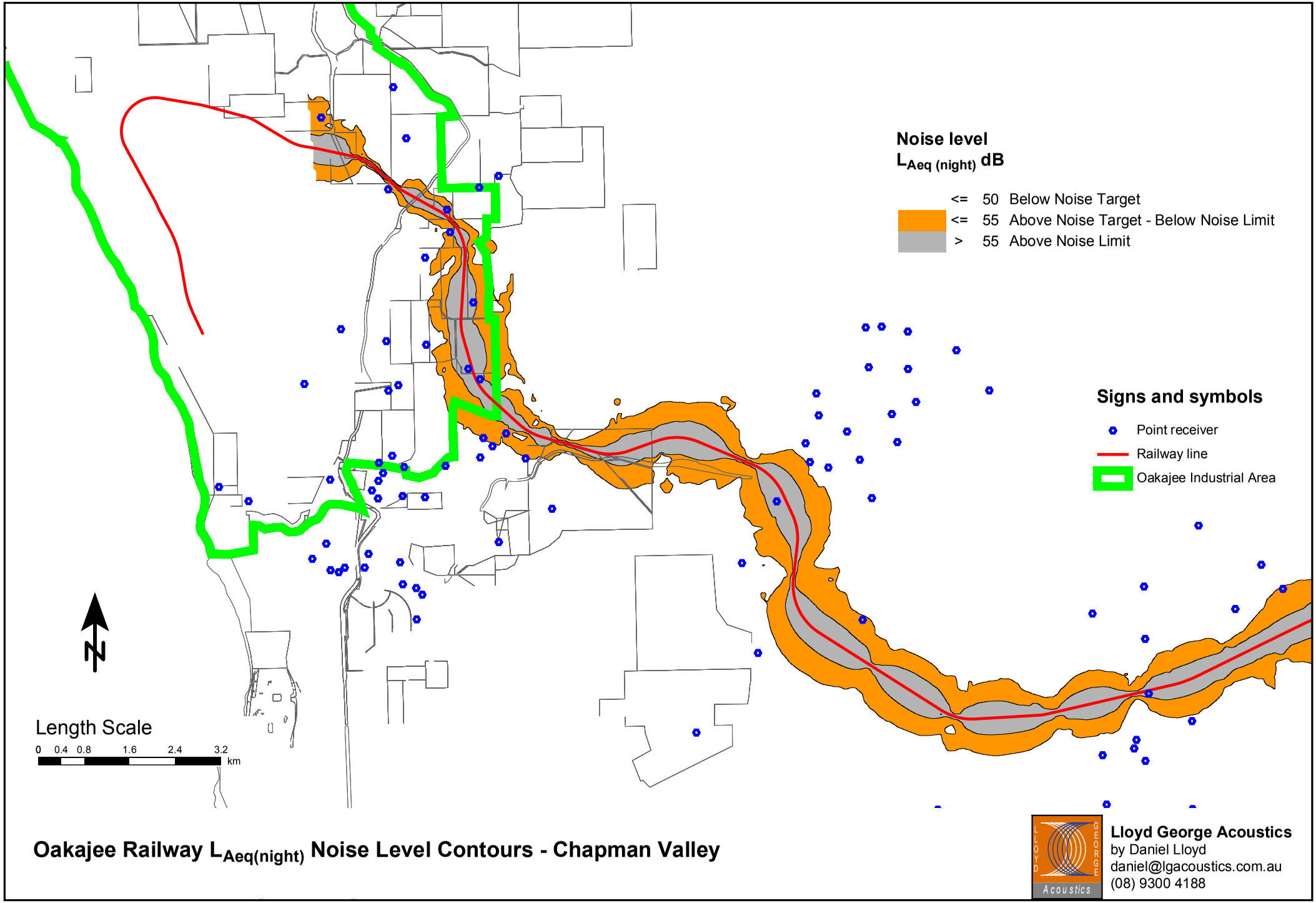


Figure 7-3 Location of potentially noise impacted residences - Chapman Valley



7.7.5 Proposed Mitigation and Management Measures

7.7.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for noise (Table 7-23).

Table 7-23 Noise and vibration management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Prevent adverse impacts on sensitive receptors.	• Noise levels at sensitive receptors do not exceed the targets set in SPP5.4. • Compliance with the construction section of the Noise Regulations.	• Noise monitoring shows compliance with SPP5.4 • Noise incidents logged in OPR's incident register.

7.7.5.2 Management Strategies

The preferred centreline has been selected to minimise both the number of receptors impacted and the degree of impact at those receptors.

Construction noise mitigation will be the subject of a Construction Noise Management Plan that will include relevant controls for any blasting activities that may be required. The Construction Noise Management Plan will be subject to approval by DEC under the Environmental Protection (Noise) Regulations 1997 prior to commencement of construction.

OPR will ensure that its rolling stock is based on Pilbara best practice and will be subject to regular maintenance, which will ensure that noise is managed. Whilst OPR will be using locomotives similar to those used in the Pilbara, it will investigate the possibility of further muffling; however, the feasibility of such controls is yet to be determined.

Operational Noise mitigation will be required for the residential premises predicted to exceed the SPP 5.4 criteria. It is anticipated that any noise control management will be determined following a visual assessment of each property and extensive discussions and negotiations with the property owners.

Investigations into the use of railway cuttings or noise barriers close to the residences will be undertaken with a view to achieve an external noise level at the facade of residential properties that is as low as reasonably practicable. Should the noise levels exceed the SPP 5.4 Target criteria, then upgrades to the building facades, in the form of window, roof and/or door treatments will be implemented. In cases where the SPP 5.4 Limit criteria are exceeded and cannot be practicably reduced, then property acquisition and relocation will be considered.

Visual surveys will help determine if barriers will be effective, as this is highly dependent on the geometry of the house and the geography of its surrounds

Landholder consultation processes will be completed (i.e. all affected landholders contacted) prior to commencement of construction, and will be ongoing in relation to operational noise. OPR will use a continuous improvement approach through its Environmental Management System to ensure that a complaints management system is in place, noise incidents are recorded, investigated and additional management measures considered. Annual reviews of performance will be completed, and it is expected that public annual reporting will provide evidence of noise emission levels and management performance.

Any future land use change or development close to the Proposal Area may require consideration of operational noise.

Table 7-24 below summarises the proposed noise, vibration and light management strategies.

Table 7-24 Proposed noise, vibration and light management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Consultation programme with affected landholders based around the preferred centreline to identify and agree upon mitigation options that may include external noise barriers, internal sound proofing, building relocation or property purchase.	-	Design, Construction & Operation	Regional Manager, Project Director, Operations Manager
A Construction Noise Management Plan will be submitted for approval in accordance with the Environmental Protection (Noise) Regulations 1997 prior to commencement of construction activities.	Construction Noise MP	Construction	Construction Manager
Design and place any construction lighting away from residents to reduce intrusion where practicable. Design and place lighting in accordance with AS4282-1997.	-	Construction	Construction Manager
Noise will be managed using a combination of noise reduction methods, and will comply with the Noise Regulations (construction) and SPP5.4 (rail operation) at all times. If the final alignment differs from what has been modelled, remodelling will be conducted to ensure that the relevant legislation can be met, and personnel will be made aware of noise related issues during inductions.	Operation Noise MP	Construction & Operation	Construction Manager, Operations Manager
Consultation with the occupants of affected premises regarding key construction activities such as blasting, haulage, compacting and pile driving will continue throughout construction periods.	Construction Noise MP	Construction & Operation	Public Relations Manager
Personnel will be made aware of noise related issues during inductions.	Construction Noise MP, Operation Noise MP	Construction & Operation	Construction Manager
Develop an EMS to ISO14001 standard to include commitments to continuous improvement, monitoring, reporting and incident management	-	Construction & Operation	Environment Manager
An Operation Noise Management Plan will be developed which will include detailed information on the following: • selection of equipment; • noise monitoring at designated sensitive receptors; • vibration monitoring to confirm expected levels at selected locations; • verification of noise modelling results; • monitoring to determine the success of noise mitigation measures; • contingency actions to be taken when the SPP5.4 target is exceeded, or a noise complaint is received; • incident management procedures including complaint management; • reporting requirements; and • specification of zones where future development will require residential development to consider “deemed-to-comply” measures.	Operation Noise MP	Operation	Environment Manager

7.7.6 Predicted Outcome

Ambient noise levels will increase during both the construction and the operational phases within adjacent areas. The preferred centreline has been specifically selected to minimise the number of receptors impacted and the degree of impact minimised where possible.

Compliance with noise regulations during construction criteria expected to be able to be achieved subject to a Construction Noise Management Plan under the Environmental Protection (Noise) Regulations (1997).

As currently planned, during operations the Proposal will result in three residences receiving noise in excess of the SPP5.4 limit, and an additional seven residences receiving noise in excess of the SPP5.4

target criteria. Up to 55 receptors are expected to occasionally experience noise levels that are clearly audible above background noise.

The impacts of rail noise are expected to be most evident on properties through which the rail traverses. OPR has commenced consultation with a view to negotiating suitable mitigation and land access packages in relation to use of the land and making consideration of factors such as noise. OPR is committed to consultation at the individual landholder level throughout the life of the Proposal. Properties for which the rail does not directly traverse, but which are exposed to noise levels above the target levels identified in SPP5.4 will also be consulted regarding noise exposure and mitigation options. The consultation process will be used to confirm the building use (residential or otherwise) with landholders. This consultation process and the associated mitigation packages are expected to result in compliance with SPP5.4.

A series of management measures designed to ensure consideration of noise in equipment selection, monitoring and verification of modelling, complaint and incident management, continuous improvement and workforce education are expected to assist OPR to manage noise to an acceptable level.

Light impacts are able to be managed under Australian Standard AS4282-1997, and vibration levels at sensitive receptors are expected to be insignificant.

7.8 AIR QUALITY (DUST)

7.8.1 Overview

Dust is a common feature through much of the Proposal Area due to the predominant rural and pastoral landuses in the surrounding area. Dust generated in these areas is currently restricted to localised, short-term events caused by the movement of cattle, and vehicle movements on unsealed roads. In addition, large scale episodic dust events caused by general dust lift during windy conditions occur occasionally and may lead to exceedances of NEPM levels.

Within freehold areas, dust is also generated from erosion processes due to agricultural activities such as ploughing prior to seeding and the summer grazing of stock (DAFWA, 2007).

7.8.2 Key statutory requirements, environmental policy and guidance

7.8.2.1 EPA Objectives

The EPA objective for the management of air quality is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

7.8.2.2 EPA statements and guidelines

- EPA Guidance Statement No. 3 - *Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005);
- EPA Guidance Statement No. 15 - *Emissions of Oxides of Nitrogen from Gas Turbines* (EPA, 2000);
- EPA Guidance Statement No. 18 - *Prevention of Air Quality Impacts from Land Development Sites* (EPA, 2000); and
- EPA Guidance Statement No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

7.8.2.3 Applicable Legislation and Policy

- EP Act and subsidiary regulations;
- PM_{10} – National Environmental Pollution Council (NEPC, 2007) Standard;
- Total Suspended Particles (TSP) – Kwinana Environmental Protection Policy (Area C Standard, EPA 1992); and
- Dust deposition – NSW EPA (2005) Standard.

National Environmental Protection Measure

In June 1998 a NEPM for Ambient Air Quality was endorsed by the National Environment Protection Council (NEPC). The desired environmental outcome of this Measure is ambient air quality that allows for the adequate protection of human health and well being (NEPC 1998). The measure included standards for air quality, including for particulates as PM_{10}. In 2003, the NEPM was amended to include advisory reporting standards for particles as $PM_{2.5}$ (NEPC 2003).

The NEPM standards and goals for particulates are shown in Table 7-25.

Table 7-25 NEPM for ambient air quality

Pollutant	Averaging period	Maximum concentration	Maximum allowable exceedences
Standards and goal for pollutants other than particulates as $PM_{2.5}$			
Particles as PM_{10}	1 day	50 µg/m^3	5 days a year
Advisory reporting standards and goal for particulates as $PM_{2.5}$			
Particles as $PM_{2.5}$	1 day	25 µg/m^3	Goal is to gather sufficient data nationally to facilitate a review of Advisory Reporting Standards

Other applicable guidelines and standards include:

- Land development sites and impact on air quality – *A guideline for the prevention of dust and smoke pollution from land development sites in WA* (DEC, 1996);
- *Dust Control; Best Practice in Environmental Management Series* (Environment Australia 1998b);
- *Air Quality and Air Pollution Modelling Guidance Notes* (DEC, 2000);
- *A guideline for the development and implementation of a dust management plan* (Draft, DEC 2008); and
- National Environmental Protection (Ambient Air Quality) Measure (NEPC, 2003).

7.8.3 Aspects and Impacts

Proposal activities or areas that may result in dust emissions include:

- exposed surfaces such as cleared land and construction sites;
- construction earthworks, haulage and topsoil stripping and stockpiling;
- blasting and crushing of rock from quarries and borrow areas;
- vehicle movements on unpaved roads; and
- ore transport.

All of these aspects may lead to increased levels of dust in the atmosphere, and entering the surrounding environment, both human and natural.

7.8.4 Dust Impact Assessment

Dust emissions are expected to be primarily generated during construction of the Proposal. There may be some minor dust emissions during operation due to vehicle movements and ore transport; however these events will be intermittent and are unlikely to significantly contribute to dust levels in the area.

Best practice dust controls (such as water trucks, chemical polymers (if required), vehicle speed limits, progressive clearing and rehabilitation etc) will ensure that dust emissions are minimised and avoided. Speed limits will be set and enforced and vehicle movements will be restricted to designated access tracks.

In addition the construction face will be constantly moving, meaning that impacts from dust on the surrounding environment will generally be short-term in nature. Progressive and staged clearing will ensure the number of open areas is limited at any one time and visual dust monitoring will be implemented during both construction and operation phases, to ensure fugitive emissions are compliant.

In accordance with contractual arrangements with its clients, all iron ore products transported by OPR along the rail line will have a specified moisture content. This requirement is expected to reduce dust emissions such that no further dust mitigation will be required for rail transport of ore. Furthermore, due to the considerable separation distance between the rail alignment and sensitive receptors it is unlikely that complaints from the community will be raised in relation to potential dust emissions. Nevertheless, in the unlikely circumstance that dust emissions from wagons becomes an issue, OPR will investigate and implement suitable contingency actions that may include the use of covers, surface sprays or chemical sealants.

7.8.5 Proposed Mitigation and Management Measures

7.8.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for air quality (Table 7-26).

Table 7-26 Air quality management objectives, targets and performance indicators

Management Objective	Target	Performance Indicators
Prevent dust impacts on human population, recreation areas, and surrounding habitats during construction.	No impacts to residential and recreation areas.	Dust monitoring Complaints Register
Prevent dust impacts on human population, recreation areas, and surrounding habitats during construction	No dust complaints attributable to rail construction from nearby residents or local recreational areas	Dust monitoring Complaints received and registered

7.8.5.2 Management Strategies

Table 7-27 outlines the proposed management strategies for air quality both during construction and operation of the Proposal.

Table 7-27 Proposed air quality management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Perform visual dust monitoring of construction and operations areas to ensure that fugitive emissions meet required standards. Dust management will include the following measures: • progressive and staged clearing of vegetation to limit the number of open areas; • restrict vehicle movements to designated access tracks; • revegetate cleared areas no longer being used; • surface with gravel/lump product; • apply water sprays; • use chemical polymers to stabilise surfaces; • set and enforce vehicle speed limits; • incident reporting and follow up system; and • continuous improvement. Chemical polymers may also be used to stabilise surfaces if required.	Air Quality Management Plan (AQMP)	Construction & Operation	Construction Manager, Operations Manager
Control occupational dust levels in accordance with the requirements of the Mines Safety and Inspection Regulations (1995) and *Occupational Health and Safety Act (1984)*	AQMP	Construction & Operation	Construction Manager, Operations Manager
Prepare and implement an AQMP that includes objectives, targets, and detailed management actions to minimise dust emissions at source, monitoring, incident management, and contingency measures	AQMP	Construction & Operation	Environment Manager, Construction Manager, Operations Manager

7.8.6 Predicted Outcome

Dust emissions are expected at low levels during both construction and operational phases of the Proposal. Emissions from construction will be short-term and subject to best practice dust controls. Emissions from operations will be longer term but are expected to be insignificant.

7.9 SOIL QUALITY

7.9.1 Overview

Soil quality is one of the most significant factors in farming practice and is central to agricultural productivity.

The Proposal Area intersects 30 land systems and 51 soil landscape systems. The dominant soil types are shallow loams with red-brown hardpan. There are two major geological terrains; the northern Perth Basin and the Yilgarn Craton.

Soils in the pastoral area are relatively undisturbed – they may have been influenced by broad scale grazing and isolated disturbance. In the agricultural area the soils have been subject to clearing, more intensive grazing and cropping. The areas of most productive farmland are based on loamy soils with good structure and water holding characteristics. Large areas of sandy soils have also been cleared for agriculture. The western portion of the agricultural area supports more reliable cropping and grazing activities. The intensity of this activity can influence soil structure. The eastern portion tends to be cropped opportunistically based on seasonal conditions and soil structure tends to reflect natural soil conditions rather than soil management practices.

Weeds are a consideration for environmental management in agricultural areas, having the potential to be spread through natural vectors as well as agricultural practice and vehicle and material movements. Weeds can have impacts on farm practice as well as on the natural environment. OPR has prepared a weed map on the basis of vegetation and flora survey work that shows that the freehold section of the Proposal Area has comparatively heavy weed burdens consistent with the more intensive agricultural activity. A further consideration in the freehold area is the presence of crop diseases. Two key crop diseases, rust (in wheat) and anthracnose (in lupins), have been identified as being potentially present within the Proposal Area and able to be transported by vehicles (Planfarm, 2010).

Disturbance of Acid Sulphate Soils (ASS) can lead to acid drainage water that can have both on-site and off-site impacts. No prior ASS risk mapping had been completed for the Proposal Area. A desktop review by GHD (2010) utilised geological information to assess ASS risk. The study concluded that there is a low to moderate risk of ASS prevalent along the majority of the main alignment. High risk areas are predominantly associated with alluvium and isolated salt pans occurring at several locations generally towards the eastern end of the Proposal Area.

The broad scale rural usage of the area and limited quantities of hazardous materials means that the risk of soil contamination is low, with isolated and small scale contamination from diesel and chemicals possible. Soils can also be influenced by farming and salinisation of soils from agricultural clearing and rising water tables is well documented. Farm management practices can also influence soil acidity.

Throughout the Proposal Area there is evidence of minor soil erosion from both water and wind.

7.9.2 Key statutory requirements, environmental policy and guidance

7.9.2.1 EPA Objectives

The EPA objectives for the management of soil quality are:

- to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards; and

- to maintain the integrity, ecological functions and environmental values of the soil and landform.

7.9.2.2 EPA statements and guidelines

- EPA Guidance Statement No. 4 - *Rehabilitation of Terrestrial Ecosystems;*
- EPA Position Statement No. 5 - *Protection and Ecological Sustainability of the Rangelands in Western Australia;*
- EPA Position Statement No. 8 - *Environmental Protection in Natural Resource Management*; and
- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

EPA Guidance Statement No. 4

EPA Guidance Statement No. 4 - *Rehabilitation of Terrestrial Ecosystems* (EPA 2006), recognises that a key aim of rehabilitation is to ensure the long-term stability of soils, landforms, and hydrology required for the sustainability of sites. When discussing abiotic factors, the Guidance Statement describes the maintenance of soil properties as being a key aspect of rehabilitation to ensure vegetation establishment and resistance to erosion. It also states that effective topsoil and subsoil management is essential to ensure adequate plant growth and normal root distribution patterns.

EPA Position Statement No. 5

EPA Position Statement No. 5 - *Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia* (EPA 2004) outlines the environmental attributes and values of rangelands, their pressures and environmental condition, management issues, principles and objectives for the environmental protection and ecological sustainability of the rangelands and management responses required. This Position Statement identifies grazing, horticulture (in the floodplains), fire, feral animals and weeds, mining and climate change as pressures on the rangeland environment.

EPA Position Statement No. 8

EPA Position Statement No. 8 - *Environmental Protection in Natural Resource Management* (EPA 2005) outlines the EPA's role in natural resource management with respect to evaluating environmental performance. The EPA has been given the task of environmental performance evaluation of natural resource management. This task will link closely with WA's State of the Environment Reporting Program.

7.9.2.3 Applicable Legislation and Policy

The following policy and guidelines are also relevant to soil as an environmental factor:

- Landform Design for Rehabilitation (Environment Australia, 1998);
- Identification and Investigation of Acid Sulfate Soils (DEC, 2004);
- General Guidance on Managing Acid Sulfate Soils (DEC, 2003);
- Planning Bulletin No. 64 - *Acid Sulfate Soils* (WAPC, 2004); and
- *Agriculture and Related Resources Act 1976.*

Acid Sulfate Soils Planning Bulletin No. 64

The WAPC Planning Bulletin No. 64 - *Acid Sulphate Soils* (WAPC 2003b), provides advice on matters that should be taken into account in the development of lands that contain ASS. The Bulletin provides planning guidelines for ASS and refers proponents to the ASS Guidelines Series, prepared by DEC, which assist developers and individuals to manage development in areas where ASS may, or will be affected.

7.9.3 Aspects and Impacts

Aspects of the Proposal with the potential to impact soil quality include clearing, topsoil stripping and storage, creation of borrow pits, vehicle access tracks, trenches, bunds and other drainage features, earth moving activities, vehicle movements, and use of hydrocarbons. The creation of a long, linear drainage obstruction for the rail embankment could impact indirectly on soils be causing localised changes in water flows leading to ponding or erosion.

The resulting potential soil quality impacts include:

- alterations to soil chemistry (particularly Acid Sulfate Soils);
- alterations to soil structure caused by disturbance;
- the impact of soil disturbance on productive farm land (including farm scale biosecurity);
- erosion by wind or water;
- soil contamination; and
- spread of weeds and diseases.

7.9.4 Soil Quality Impact Assessment

In this section, consideration is given to a range of soil related environmental issues throughout both the pastoral and freehold areas. OPR has commenced consultation with landholders who may be impacted directly by the Proposal. OPR recognises that individual landholder issues will be need to be addressed through one on one consultations with regard to land access and the localised impacts of the Proposal on an individual's landholding. Remediation and management of the impacts on the individual properties will need to undertaken in consultation with each landholder.

The rail embankment will be comprised of compacted soil material and is not expected to have any direct or indirect impacts on adjacent soils. The design and compaction specifications for the embankment mean that little erosion of this material is tolerable from an engineering perspective and hence no significant soil impacts are expected.

Although no compaction machinery is expected to be used on construction haul roads, construction equipment repeatedly traversing areas will lead to compaction of soils from construction machinery traffic within borrow areas and haulage routes to the Rail Corridor can be expected (Planfarm, 2010). Soil compaction can be alleviated using deep ripping which can be achieved using construction machinery. As the traffic areas are no longer required, it is expected that these areas will be deep ripped to alleviate any soil compaction.

The location of borrow areas is subject to further investigation and consultation with landowners. Borrow material will be sourced from as close as feasible to the rail centreline (certain soil characteristics and quantities are required to make a borrow area feasible). The economics of accessing borrow will tend to drive locations to be close to the rail centreline. It is expected that most borrow will be sourced from within the final operational corridor.

The access routes to and from borrow areas are also likely to have localised influence on surface water runoff which may cause localised erosion. Localised water erosion can be managed using small scale earthen drainage features to divert flows. In some cases, farms may have existing drainage systems that OPR's surface water management will integrate with.

Sandy textured soils are also likely to be prone to wind erosion from disturbance. Management of this risk is usually achieved by retention of organic matter on and in the soil surface, or with cover crops.

The majority of borrow material required is within the pastoral area where availability of water is the over-riding factor influencing farm productivity. The creation of areas of short term ponding and aggregation of water may lead to localised water erosion but may also create areas of localised increased soil moisture and vegetative growth. These areas can be attractive for weed establishment.

At a farm scale, individual biosecurity considerations and the unique nature of each farm and farm plan means that issues tend to be managed at an individual landholder down to a paddock scale. By matching the scale of planning to individual landholdings, issues such as weed management can also be considered in the context to the overall impact on farming operations and the farm plan.

Based on a preliminary assessment, only 16% of the Proposal length is expected to have a moderate to high potential to impact on ASS (GHD, 2010). Of these areas, only a small portion (1.3% of the Proposal) is expected to require excavation as in most cases excavation will be avoided. The higher inherent ASS risks tend to occur in the pastoral zone, however there is very little cutting work required for the rail, leaving a low residual risk. Borrow pits are relatively shallow features that are not located within areas where there is an elevated risk of sulphidic materials and are unlikely to generate any acid drainage.

No contaminated sites are known from the Proposal Area and the likelihood of soil contamination is limited to small scale contamination resulting from spillage of diesel or pesticides. The increase in use of diesel and potential for additional use of herbicides associated with the project implementation makes the likelihood of contamination higher. Standard controls for storage and use of hazardous materials are available to reduce the risk of contamination.

7.9.5 Proposed Mitigation and Management Measures

7.9.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for soil quality (Table 7-28).

Table 7-28 Soil quality management objectives, targets and performance indicators

Management Objective	Target	Performance Indicators
Minimise disturbance to ASS.	Avoid known PASS where practicable.	Comply with ASSMP Soil Testing.
Manage disturbed ASS to avoid adverse impacts on all aspects of the surrounding environment.	No contamination of surface water or soils with acidity and/or heavy metals.	Comply with ASSMP Soil testing.

7.9.5.2 Management Strategies

OPR has commenced consultation with affected landholders along the Proposal Area. As the proposed centreline for the rail is finalised, OPR will expand these consultations to consider more detail of the individual paddocks, drainage and farm management aspects, farming facilities and activities impacted by the Proposal. The basis of OPR's consultation will be broader than just

environmental issues and will include consideration of the means to manage, avoid, minimise or offset impacts on:

- Biosecurity;
- crop production;
- livestock production;
- soil disturbance and productivity;
- wind and water erosion;
- people/machinery movement issues and access;
- dissection of paddocks; and
- impact on wider land values.

Environmentally, two key areas of mitigation and management are identified for soil quality and related agricultural productivity:

- detailed construction planning to be integrated with individual farm plans and to address key agricultural environmental aspects such as:
    - biosecurity;
    - impacts on drainage;
    - rehabilitation of borrow areas and haulage routes; and
    - minimising construction impacts to seeding, harvesting and day-to-day farming operations.
- detailed investigation and management for the small areas of ASS.

In addition to these management areas, industry best practice in hydrocarbon and hazardous materials management will be used to reduce the risk of contamination of soils to insignificant.

Particular attention will be given to biosecurity and the requirements for vehicle hygiene. OPR is developing a generic weed management strategy for construction at a broader scale to manage the ecological risks of weed spread.

Borrow areas will be identified as the feasibility investigations proceed. A generic Borrow Area Rehabilitation Plan (BARP) will be prepared for borrow areas to be retained within the operational corridor. Where borrow areas will be returned to landholder control, detailed individual plans for each borrow area will be prepared in consultation with each landholder to ensure that outcomes are acceptable to the landowner. A small number of borrow areas will be retained for ongoing maintenance works.

Further ASS investigations will focus on the high risk areas and confirmation of likely behaviours. An ASS management plan will be developed to identify risks, appropriate controls and responsibilities prior to construction in the high risk areas. The plan will include details of further sampling to comply with DEC guidelines.

Table 7-29 describes management actions to be implemented to ensure that soil quality is protected and the small areas of potential ASS are appropriately managed.

Table 7-29 Proposed soil quality management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Design infrastructure to minimise disturbance of ASS	ASS Management Plan (ASSMP)	Design	Environment Manager, Construction Manager
Detailed individual rehabilitation plans for borrow areas and access tracks that will be returned to landholder control to be prepared in consultation with individual landholders prior to construction.	BARP	Prior to construction	Regional Manager
Consult with landholders to integrate farm plan aspects into construction management.	-	Prior to construction	Regional Manager
When excavation in areas of potential ASS is required a detailed survey will be completed in accordance with DEC guidelines (DEC, 2004).	ASSMP	Prior to construction	Environment Manager
Prepare and implement an ASSMP to manage construction activities in areas of known or suspected ASS.	ASSMP	Prior to construction	Environment Manager, Construction Manager
Management of hazardous materials to ensure that risks of contamination of soil is minimised as outlined in Section 7.10.	Hazardous Materials & Contamination MP	Construction & Operation	Safety Manager, Construction Manager, Operations Manager

7.9.6 Predicted Outcome

Soil disturbance and rehabilitation will be managed in accordance with plans agreed with individual landholders. Borrow areas will be rehabilitated (except for a small number that will be retained for maintenance) according to Borrow Area Rehabilitation Plans. The purpose of these plans will be to return the land to productive use.

No significant impacts are anticipated arising from disturbance of ASS as only 1.3% of the 16% of Proposal Area expected to have moderate-high risk of ASS requires excavation. With the implementation of these plans, minor and small scale impacts on soil structure and productivity are expected.

The application of individual landholder consultation and management controls through the land access negotiations for biosecurity, drainage management, and integration with farm planning is expected to result in impacts being acceptable.

7.10 WASTE AND HAZARDOUS MATERIALS

7.10.1 Overview

Due to the rural land use there are no hazardous materials stored and no contaminated sites registered within the Proposal Area. Some minor dumping of waste is apparent from historical rural activities. Nearby waste management facilities are limited to Shire landfills. Some hazardous materials may be transported along major roads such as the NWCH.

7.10.2 Key statutory requirements, environmental policy and guidance

7.10.2.1 EPA Objectives

The EPA objective for waste management is to ensure that project wastes do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

7.10.2.2 EPA statements and guidelines

- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

7.10.2.3 Applicable Legislation and Policy

- EP Act and subsidiary regulations (e.g. Environmental Protection (Controlled Waste) Regulations 2004);
- *Dangerous Goods Safety Act 2004* and subsidiary regulations;
- Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007;
- *Waste Avoidance and Resource Recovery Act 2007*; and
- *Health Act 1911.*

Other applicable standards and guidelines include:

- Water Quality Protection Guidelines No. 10 - *Mining and Mineral Processing Above-Ground Fuel and Chemical Storage* (DoW, 2000);
- Australian Standard 1940-2004 - *The storage and handling of flammable and combustible liquids;*
- Guidance Note S301 - *Storage of Dangerous Goods Licensing and Exemptions* (DoIR, 2004);
- *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Road Transport Commission and ACTDG, 2005);
- *Used Tyre Strategy for Western Australia*, Waste Management Board, 2005; and
- Health Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations (DoH, 1974).

7.10.3 Aspects and Impacts

The aspects of the Proposal with the potential to generate waste and hazardous materials include construction activities, construction camps, and servicing of machinery and vehicles.

Potential impacts associated with the generation of wastes and hazardous materials are generally associated with inappropriate storage, transport or disposal, leading to environmental pollution or contamination.

For example:

- burst hydraulic, fuel, oil or lubricant vehicle hoses;
- overflow of tanks due to overfilling;
- spills due to collisions or tipping;
- faulty or inadequate containers;
- faulty or inadequate secondary containment facilities; and
- poor vehicle maintenance.

7.10.4 Waste and Hazardous Materials Impact Assessment

Construction and operation activities associated with the Proposal will generate waste materials and require the transport, storage and handling of hydrocarbons and chemicals. The construction and operation of the Proposal will generate the following types of wastes:

- general domestic and office refuse;
- biological wastes (e.g. sewage);
- hazardous wastes (e.g. oils, grease, lubricants);and
- industrial wastes (e.g. tyres, packaging, infrastructure and machinery components).

The Proposal does not involve the storage or handling of large volumes of hazardous wastes. Waste production during both the construction and operational phases will be no different to similar construction sites and operational rail facilities located elsewhere in WA. Transport of hazardous materials along major traffic routes such as the North West Coastal Highway (NWCH) is not expected to be significant and the potential for vehicle/rail interaction has been eliminated by the selection of a grade separation bridges where the rail crosses the NWCH and the Chapman Valley Road.

The Proposal will require up to six waste water treatment plants (WWTPs) to accommodate the sewage and waste water from the construction workforce estimated at a maximum of 3,000 people. Some of these facilities will be retained for the operational phase of the Proposal.

Compliance with legislative requirements relating to waste management will ensure that no significant adverse impacts are experienced as a result of waste produced by the Proposal. The relatively small volumes of controlled and hazardous wastes (mainly hydrocarbons) will be managed and transported in accordance with the *Dangerous Goods Safety Act 2004* and the *Environmental Protection (Controlled Wastes) Regulation 2004.*

OPR will ensure that its management of waste complies with legislative requirements. OPR will also seek to reduce and minimise its waste production via the implementation of a Waste Management Plan that will be based on the hierarchy of waste Minimisation. On this basis it is considered that significant impacts on the environment from waste production will be avoided.

7.10.5 Proposed Mitigation and Management Measures

7.10.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for waste (Table 7-30).

Table 7-30 Waste and hazardous material management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Prevent waste or hazardous material discharges/contamination to the surrounding environment.	No waste or hazardous material discharges to the surrounding environment	Compliance with Dangerous Goods and Controlled Waste Licenses Incident reporting

7.10.5.2 Management Strategies

WWTPs will be constructed at each of the construction camps. Treated wastewater will be discharged at designated spray irrigation areas to be established near the camps, or the wastewater will be treated to a standard that is suitable for use for dust suppression (subject to DoH requirements). These facilities will be subject to licensing under Part V of the EP Act. Wastewater disposal will be spread over a large area (in accordance with WQPN – Irrigation with nutrient-rich wastewater) to ensure that nutrient loading will not significantly impact the receiving environment.

OPR will ensure putrescible waste is collected and stored appropriately in accordance with a Waste Management Plan. It is anticipated that there will be a requirement for a small number of Class II landfill sites along the Proposal Area for the disposal of putrescible waste. These are expected to be located relatively close to accommodation facilities, and may be subject to DEC licensing requirements depending on their size. Shire landfills may also be used where practicable.

If Class II landfill sites are constructed and utilised these will be in accordance with DEC requirements and a Part V Works Approval and Licence will be obtained. DEC will be consulted regarding suitable locations and proposed designs.

Hazardous wastes (such as used hydrocarbons, chemicals, explosives, batteries etc) will be stored and transported in accordance with Dangerous Goods and Controlled Waste legislation to ensure that there is no discharge to the environment.

Storage, transport and use of hazardous materials will be in accordance with Dangerous Goods legislation and Australian standards. Significant impacts from the use of hazardous materials during construction and operation of the Proposal are unlikely.

Risk management processes will be applied to hazardous materials and wastes. Hydrocarbon spills will be reported as incidents and responded to immediately. Spill kits will be kept in designated positions to allow the swift response to these events. Any contaminated soil or used clean up equipment will be taken to a licensed facility.

The management measures summarised in Table 7-31 are proposed to ensure that waste and hazardous materials are stored, handled and disposed of in a suitable manner to ensure that impacts are minimised.

Table 7-31 Proposed waste and hazardous material management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Hazardous material handling, storage and spill response will occur in accordance with Dangerous Goods Licences issued under the *Dangerous Goods Safety Act 2004* and Australian Standards.	Hazardous Materials & Contamination MP	Design, Construction & Operation	Environment Manager, Safety Manager
Prepare and implement a Hazardous Materials and Contamination Management Plan to document in detail how chemicals, hydrocarbons and hazardous goods or waste will be managed. Control measures will include: • storage compliant with AS 1940 and located away from watercourses; • Material Safety Data Sheets (MSDS) will be available for all chemicals used on site; • handling, use and storage of chemicals will be compliant with the relevant MSDS; • adequate fire control and spill response equipment will be available within work areas; • any hazardous materials required on site will be approved for use by the responsible manager prior to being transported to site; • all licences required for storage or handling of hazardous materials will be obtained, held on site and made available to all personnel; • hazardous waste will be removed from site by a licensed contractor for disposal in an approved facility in accordance with controlled waste regulations; • contractors handling or using hazardous materials will be required to be trained, to comply with applicable legislation and carry appropriate spill containment equipment; • used hazardous material containers will be labelled and stored appropriately for future use or disposal; • any fuel, oily waste storage, diesel generators and re-fuelling facilities will be constructed and regularly inspected to ensure compliance with all regulatory requirements; • a well drained wash down pad will be utilized for vehicles and equipment. An oil water separation system will be utilised to maintain water quality of any water emissions; and • remediate any contaminated sites in accordance with legal requirements.	Hazardous Materials & Contamination MP	Construction & Operation	Safety Manager, Construction Manager, Operations Manager
Prepare and implement a Waste Management Plan based on the hierarchy of waste minimisation: 1. Waste avoidance/reduction. 2. Reuse, recycling and reclamation. 3. Waste treatment. 4. Waste disposal. The plan will include the following actions: • prior to construction and prior to operation Proposal waste audits will be conducted to: - identify Proposal waste streams; - quantify and characterise the waste types; - establish how each waste stream is generated; and - identify options to minimise each of the waste streams; • ensure that litter is minimised, and waste disposal, storage or transport occurs in accordance with relevant waste legislation and guidelines; • appropriate containers (vermin-proof) will be provided for putrescible waste and these wastes will be disposed of at a licensed facility; • appropriate facilities will be provided for waste materials, with separate areas for recyclable materials. Facilities will be secure and clearly labelled for the various waste streams; • concrete wastes and concrete wash out will be contained in lined bunds; and • conduct a waste management audit every three years.	Waste MP	Construction & Operation	Environment Manager, Construction Manager, Operations Manager

7.10.6 Predicted Outcome

The waste or hazardous material issues to be managed by the Proposal are similar to those faced and managed by many other remote operations in WA. The application of industry standard preventative controls such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to significantly reduce risks to the environment. There are adequate legislative controls in place to ensure that these materials are managed to avoid impacts to the environment.

7.11 GREENHOUSE GAS EMISSIONS

7.11.1 Overview

The Greenhouse Effect is a natural phenomenon caused by atmospheric (primarily carbon based) gases where heat radiating from the earth's surface is trapped within the atmosphere. Greenhouse gases (GHG) include carbon dioxide (CO_2), water vapour, methane, nitrous oxide, carbon monoxide and non-methane volatile organic compounds. CO_2 is the main anthropogenic GHG emission which has increased in concentration in the atmosphere by approximately 31% in the last 200 years (EPA, 2002b). Activities such as farming, fuel usage in industry and vehicles, vegetation clearing and explosives generate CO_2.

Transport contributes 14.4% of Australia's total GHG emissions and is one of the fastest growing sectors. GHG emissions from total transport are proposed to increase by nearly 30% between 2005 and 2020.

Currently the majority of ore mined in the Mid-West is trucked from mine sites to the Geraldton port. Energy efficiency is directly related to CO_2 emissions and rail is significantly more energy efficient than other land-based transport modes. Rail transport requires between 3 - 5 times less energy per tonne carried than road (Railfuture 2004).

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a national system for reporting these GHG emissions, energy consumption and abatement actions. From July 2008, corporations are required to register and report if they emit greenhouse gases or consume energy at or above specified quantities in a financial year.

At present the Proposal Area is used for rural activities, and contains no industries that are required to report under the NGER Act and GHG emissions from the Mid-West are currently considered to be minor.

7.11.2 Key statutory requirements, environmental policy and guidance

7.11.2.1 EPA Objectives

The EPA objective for management of GHGs is to minimise emissions to levels as low as practicable on an ongoing basis and consider offsets to further reduce cumulative emissions.

7.11.2.2 EPA statements and guidelines

- EPA Position Statement No. 6 - *Towards Sustainability* (EPA, 2004);
- Guidance Statement No. 12 - *Guidance Statement for Minimising Greenhouse Gas Emissions* (EPA, 2002);
- Guidance Statement No. 18 - *Prevention of Air Quality Impacts from Land Development Sites* (EPA, 2000); and
- Guidance Statement No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

7.11.2.3 Applicable Legislation and Policy

- EP Act; and
- NGER Act.

Other applicable standards and guidelines include:

- *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks* 2002 Series (DEH, 2006); and
- *National Environmental Protection Measure for Ambient Air Quality* (NEPM, 1998).

Federal legislation/policies

The National Greenhouse Strategy (NGS) was released by the Australian Greenhouse Office (AGO) in 1998, and was prepared by the Commonwealth Government, State and Territory Governments. It sets out to provide the strategic framework for effective greenhouse response and for meeting current and future international commitments (AGO 1998). The NGS commits Australia to actively contribute to the global effort to stabilise greenhouse gas concentrations in the atmosphere.

The Greenhouse Challenge Program was established by the Federal Government in 1995, and is a voluntary program between government and industry to abate greenhouse emissions. In 2004, following a review of the Greenhouse Challenge Program, the Federal Government launched the Greenhouse Challenge Plus program. This program builds on the success of the original program and incorporates two industry focussed measures (Generator Efficiency Standards and Greenhouse Friendly initiative), and changes in the Federal Government's energy policy '*Securing Australia's Energy Future*'.

In 2004 the Federal Government released its new energy policy 'Securing Australia's Energy Future'. This policy recognised the importance of effective management of greenhouse gases by major energy users and indicated that the Greenhouse Challenge is to become a 'single entry point' for business reporting on greenhouse and energy.

The Kyoto Protocol is an international treaty designed to limit global greenhouse gas emissions. The agreement was reached in 1997 in Kyoto, Japan, and establishes individual quantified emissions limitations or reduction commitments (emissions targets) for each developed country based on 1990 emissions, for the commitment period of 2008 to 2012. The Federal Government has committed to meeting the target agreed at Kyoto of limiting GHG emissions to 108% of 1990 levels for the commitment period.

The NGER Act establishes a single, national system for reporting GHG emissions, abatement actions, and energy consumption and production by corporations. The NGER Act also lays the foundation for the Australian Emissions Trading System. As from 1 July 2008 it will be mandatory for corporations emitting above 125,000 tonnes carbon dioxide equivalents per annum (t CO_2-e per annum), or 25,000 t CO_2-e per annum for a facility, to register and report annually under the NGER Act.

State legislation/policies

Carbon rights legislation was passed by the Western Australian Parliament in 2003. The purpose of the Bill is to provide for the registration on land titles and a 'carbon right' and accompanying 'carbon covenant'. The Bill will give certainty to those wanting to trade in carbon rights and gain the credits or emission offsets which arise from sequestration.

The WA Greenhouse Strategy was released in 2004 and sets out the State government's response to climate change. The State recognises the weaknesses and limitations of the Kyoto Protocol, but believes the Protocol represents an essential step towards dealing with climate change. Key components of the Strategy include government leadership, reducing emissions, local government and community involvement, and national and international representation.

7.11.3 Aspects and Impacts

The most significant emissions will be direct emissions (Scope 1 emissions) from the Proposal. Direct emissions are expected to be produced as a result of fuel combustion and power generation. These emissions will contribute to atmospheric pollution as they are expected to contain CO_2, carbon monoxide, nitrogen oxides and benzene. The clearing and subsequent decomposition of vegetation will also contribute to emissions.

Indirect emissions (Scope 2 emissions) may result from the consumption of purchased electricity that may be used for the operation of the sleeper plant for the period of construction. These will be temporary and minor.

Other emissions are also expected from the following sources, but are not considered to produce significant volumes or have a major impact and include emissions from refrigerant gases, on-site landfill facilities and wastewater treatment.

GHG Impact Assessment

Estimated fuel consumption for the construction phase of the Proposal is approximately 48,000 kL of diesel. This fuel usage is associated with powering earthwork equipment, vehicles, construction camps and bore pumps.

Fuel usage associated with the maintenance camp and maintenance activities is estimated at approximately 4,000 kL per year. Fuel usage as a result of locomotives and train movements is still to be finalised, however, it has been estimated at approximately 45,000 kL/yr. An initial estimation of GHG emissions suggests approximately 250,000 t of $CO_{2\text{-}e}$ during the 36 month construction phase, and approximately 130,000 t of $CO_{2\text{-}e}$/yr during the operational phase (Table 7-32). This represents approximately 0.02 % of Australia's annual GHG emissions as at 2009.

Table 7-32 Estimated GHG emissions from diesel fuel usage

Proposal Component	Fuel Type kL	Energy Content Factor GJ/kL	Emission factor kg $CO_{2\text{-}e}$/GJ	Tonnes of $CO_{2\text{-}e}$
Construction – fuel use	48,000	38.6	69.2	128,213
Construction – clearing	See Note			122,080
Operation – fuel use (maintenance activities)	4,000/yr	38.6	69.2	10,684
Operation – trains	45,000/yr	38.6	69.2	120,200

Note:
Australian Department of Climate Change's National Greenhouse Accounts Factors (2009)
6000 hectares native vegetation clearing. Based on Figure 2 of CRC for Greenhouse Accounting report to the WA Greenhouse Taskforce (2003), with route divided as follows:

- 3/5 of the rail route (4200 ha) @ 2.4 tonnes CO_2/ha (Treagust, 2008) = 10080
- 1/5 of the rail route (1400 ha) @ 15 tonnes CO_2/ha (CRC for GH Accounting, 2003) = 21000
- 1/5 of the rail route (1400 ha) @ 65 tonnes CO_2/ha (CRC for GH Accounting, 2003) = 91000

Assuming 1L diesel / tonne @ 45Mtpa

7.11.4 Proposed Mitigation and Management Measures

7.11.4.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for GHG emissions (Table 7-33).

Table 7-33 GHG emissions management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Minimise CO_2 (GHG) emissions during construction.	Adopting of appropriate and clean technologies.	Monitor emission rates. Compliance with any future Commonwealth GHG legislation
Meet and continually strive to lower CO_2 (GHG) emissions targets during operation.	OPR CO_2 (GHG) emissions targets (to be determined).	Monitor emissions rates

7.11.4.2 Management Strategies

Table 7-34 details OPR's proposed management strategies for GHG's.

Table 7-34 Proposed GHG management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Energy use monitoring will be undertaken monthly and results reported to OPR Management.	GHG MP	Construction & Operation	Environment Manager
OPR will identify and comply with all energy usage and GHG reporting requirements, and any future Commonwealth GHG legislation.	GHG MP	Construction & Operation	Environment Manager
Construction and operations will be conducted with efficiency of energy use as a guiding principal to reduce unnecessary GHG emissions	GHG MP	Design, Construction and Operation	Project Engineer, Operations Manager, Environment Manager
Consider fuel efficiency and emissions profiles for all new locomotive purchases.	GHG MP	Construction & Operation	Operations Manager
Report GHG emissions in accordance with NGERS	GHG MP	Operation	Environment Manager
Participate in the Commonwealth Carbon Pollution reduction Scheme as required	GHG MP	Operation	Environment Manager
Benchmark greenhouse emissions targets for each major phase of the Proposal against best practice.	GHG MP	Operation	Operations Manager, Environment Manager
Conduct annual energy audits of operations	GHG MP	Operation	Operations Manager, Environment Manager
Implement energy saving strategies for the rail system addressing factors such as fuel type, equipment design, rail design, operational procedures, schedules, loading and unloading systems, and technology.	GHG MP	Construction & Operation	Operations Manager

In addition to the management strategies above OPR has also committed to using Tier 1 locomotives (refer to Section 4.4.1) which use 15% less fuel and utilise a cleaner burning process.

7.11.1 Predicted Outcome

The Proposal will generate carbon-based emissions representing approximately 0.02% of Australia's GHG emissions (based on 2008 data). Emissions at this level will require reporting under the NGER Act. The Proposal will result in more efficient use of fuel as ore rail transport has a lower emissions rate (when comparing tonnes of ore/L of diesel) in comparison to emissions associated with existing road based ore transport in the region. Additionally, OPR's locomotives will be a higher rating standard than those required by Australian regulation, resulting in a greater fuel efficiency and lower GHG emissions.

OPR is committed to reducing its greenhouse footprint as much as practicable and will implement strategies that aim to reduce the proposed emissions.

7.12 HERITAGE

7.12.1 Overview

The Proposal is within the external boundaries of the Naaguja, Amangu, Widi Mob, Mullewa Wadjari and Wajarri Yamatji native title claims.

OPR has consulted with the above Native Title claim groups and their representatives regarding the potential impacts of the Project since late 2008. Over that time a detailed heritage protocol has been agreed between the parties that sets out the heritage management requirements in detail. These agreements formed the cornerstone of OPR's Aboriginal Cultural Heritage Management Plan (ACHMP) that guide the implementation of Indigenous heritage management for the Project.

Aboriginal sites within the Project area that have been registered with DIA under the AH Act are shown in Figure 5-38. These include Weld Range and Jack Hills, which are known to have mythological associations to local Aboriginal people. Water courses, lakes, and prominent landscape features may all have ethnographic significance to Indigenous people. These same features are often found to have a higher density of archaeological material such as artefact scatters, middens. It is likely that unregistered sites of Aboriginal heritage also exist within the Proposal Area as some areas have had little survey work completed on them.

Indigenous Heritage survey work has commenced on key areas of the Proposal Area.

7.12.2 Key statutory requirements, environmental policy and guidance

7.12.2.1 EPA Objectives

The EPA objective for the management of heritage is to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.

7.12.2.2 EPA statements and guidelines

- EPA Guidance Statement No. 41 - *Assessment of Aboriginal Heritage* (EPA, 2004); and
- EPA Guidance No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

EPA Guidance Statement No. 41 (EPA 2004b) provides guidance on the process for the assessment of Aboriginal heritage as an environmental factor. This guidance statement also details those actions that may be pertinent to the factor of Aboriginal heritage, including undertaking surveys and consulting local Aboriginal people.

7.12.2.3 Applicable Legislation and Policy

- *Aboriginal Heritage Act 1972* (AH Act) (WA);
- EP Act (WA);
- *Native Title Act 1993* (Commonwealth); and
- *Heritage of Western Australia Act 1990.*

Aboriginal Heritage

The Minister for Indigenous Affairs is responsible for the administration of the AH Act. The Minister's responsibility is to ensure that all places that are considered to be sacred or of ceremonial significance to Aboriginal people are recorded and their importance evaluated on behalf of the community. It is an offence to disturb any Aboriginal site without consent from the Minister under section 18 of the AH Act. The Minister considers recommendations from the Aboriginal Cultural

Material Committee and the general interests of the community when making a decision on disturbance to a site, and may also impose conditions on the approval.

The Registrar of Aboriginal Sites is responsible for maintaining the Register of Places and Objects. The Department of Indigenous Affairs (DIA) has a database of all recorded sites. DIA also provides advice for developers in *Aboriginal Heritage and Development in Western Australia – Advice for Developers (DIA, 1999).*

Non-indigenous heritage

The Heritage Council of WA operates under the *Heritage of Western Australia Act 1990* (Heritage Act). The Heritage Council of WA maintains the State Register, which provides official recognition of a place's cultural heritage significance to WA. Protection is achieved through the requirement under the Heritage Act that all development proposals regarding a registered place be referred to the Heritage Council for advice.

The Australian Heritage Council is the principal adviser to the Australian Government on Australian heritage matters. The Council assesses nominations for the National Heritage List and the Commonwealth Heritage List and compiles the Register of the National Estate.

The Australian Heritage Database is maintained by the Council and contains a listing of natural, historic and Indigenous places listed in the World Heritage List, National Heritage List, Commonwealth Heritage List and the Register of the National Estate.

7.12.3 Aspects and Impacts

No known sites of non-indigenous Heritage significance are to be impacted by the Proposal.

Aspects of the Proposal with the potential to impact Aboriginal Heritage include:

- clearing;
- earth moving;
- increased number of people in the area;
- vehicle movements;
- infrastructure; and
- train movements.

Potential impacts to Aboriginal heritage sites relate primarily to direct disturbance and include:

- disturbance of sites during the construction of Proposal infrastructure;
- landscape level changes through the development of a visible linear feature through the landscape;
- accidental damage of artefacts by off-road vehicle use; and
- indirect disturbance to sites from changes in water flows, spillages, dust, or other indirect impacts.

7.12.4 Heritage Impact Assessment

The existing level of heritage survey shows that there are a number of sites likely to be impacted by the Proposal. More detailed survey work will add to this body of knowledge and provide a more complete picture of heritage prior to project implementation. Whilst there is some flexibility in the

location of the rail, there are also a number of practical and environmental constraints to be considered.

The patterning and historic use of the area by Indigenous people means that sites of Aboriginal heritage associated with watercourses within the Proposal Area are the most likely to be impacted. This will be mitigated to some extent by the avoidance of watercourses for borrow and construction materials where practicable. River crossings are the first areas being intensively surveyed by OPR. Some flexibility has been retained in the environmental and other statutory aspects of the Proposal to enable detailed design to avoid sites wherever practicable. Where it is not practicable to do so, OPR will consult with the native title claim groups in relation to the mitigation and salvage of any affected Aboriginal sites and seek the consent of the Minister for Indigenous Affairs pursuant to Section 18 of the AH Act.

OPR has agreed processes in place with each of the Native Title claim groups affected by the Proposal to facilitate the identification of unregistered Aboriginal sites and Aboriginal heritage surveys will be progressively conducted over the Proposal Area prior to commencement of construction. Impacts can be effectively minimised by using these processes.

7.12.5 Proposed Mitigation and Management Measures

7.12.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for heritage (Table 7-35).

Table 7-35 Heritage management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Ensure that OPR complies with the requirements of the AH Act and *Native Title Act 1993.*	Prevent disturbance to Aboriginal heritage sites unless consent has been granted under section 18 of the AH Act.	Consultation with the relevant Aboriginal native title claimant groups. No Aboriginal sites of significance adversely affected without consent being granted under section 18 of the AH Act. Utilisation and referral to the OPR Aboriginal Cultural Heritage Management Plan. This plan shall also be in force during operations at all times.
OPR will continue consulting with the relevant Aboriginal groups during the design of the Proposal and with respect to any future changes to the Proposal Area.	Ensure that the relevant Aboriginal groups/people are consulted at each stage of the development.	Heritage survey coverage. Compliance with the AH Act and any consent and conditions granted under Section 18.
Ensure that all OPR personnel and contractors are aware of their responsibilities under AH Act	All staff and contractors have undertaken Cultural Awareness Program	Cultural awareness training, appropriate inductions and accurate training records.

7.12.5.2 Management Strategies

In order to avoid, minimise and mitigate the impacts discussed in Section 7.12.4, management strategies outlined in Table 7-36 are proposed.

OPR will avoid Aboriginal sites wherever reasonably possible. Where it is not possible to do so, OPR will consult with the native title claim groups in relation to the mitigation and salvage of any affected Aboriginal sites and seek the consent of the Minister for Indigenous Affairs pursuant to Section 18 of the AH Act.

OPR has agreed processes in place with each of the native title claim groups affected by the Proposal to facilitate the identification of unregistered Aboriginal sites and Aboriginal heritage surveys will be progressively conducted over the Proposal Area prior to commencement of construction.

Table 7-36 Proposed heritage management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Aboriginal Heritage will be managed in accordance with the OPR ACHMP. The ACHMP will include the following commitments: • As part of the ongoing consultation with TOs regarding Heritage, inform TOs on relevant proposed works, work schedules, and potential impacts on sites throughout the life of the Proposal • Undertake indigenous heritage surveys within proposed disturbance envelopes using suitably qualified archaeologists and anthropologists as agreed with TOs • Determine the nature, extent and significance of sites within the potential disturbance envelope • Establish cultural heritage database with GIS records of indigenous heritage site locations within the Proposal Area • Consider indigenous cultural heritage in Proposal planning and detailed design, avoiding significant sites where practicable • Seek approval to disturb known sites under section 18 of the AH Act where a known Aboriginal site impact is unavoidable • Document the location of protected indigenous heritage areas and make available (acknowledging confidentiality issues) to relevant employees • Implement conditions of any s18 applications • Audit implementation of s18 conditions and ground disturbance procedures • Implement the OPR ground disturbance permitting procedure incorporating checks on heritage sites and exclusion zones • Implement procedures outlined in the ACHMP if a suspected heritage site is detected • If appropriate, mark and signpost sites to reduce the likelihood of inadvertent damage • Monitor clearing/earthworks activities with qualified site heritage monitors	ACHMP	Construction	Heritage Manager

7.12.6 Predicted Outcome

OPR acknowledge that the Proposal has aspects that have the potential to disturb sites of significance, either directly (through physical disturbance of sites) or indirectly by altering the quality of the environment where the heritage site is located (e.g. through changed surface water flows, dust, etc.). OPR has agreed processes in place to facilitate the identification of unregistered Aboriginal sites and where it is not possible to avoid Aboriginal sites, OPR will consult with each of the native title claim groups in relation to the mitigation and salvage of any affected Aboriginal sites and seek the consent of the Minister for Indigenous Affairs pursuant to Section 18 of the AH Act.

Any changes to the biophysical environment as a result of the proposal will be managed to protect historical and cultural associations, and comply with relevant heritage legislation.

7.13 VISUAL AMENITY

7.13.1 Overview

The Proposal passes through areas of gentle undulation in the freehold area, with largely cleared farming land and relatively low population concentrations. Population and exposure to visual impact is highest as the rail proceeds through the Wokatherra Gap (through the Moresby Range) and Chapman Valley at the western end of the Proposal Area. The Moresby Range has local iconic value as a viewscape from Geraldton and surrounds and is the subject of a specific planning activity by the Shire of Chapman Valley. In these undulating areas the topography creates both visual exposure and screening depending upon location. The rail will be unable to be seen from Geraldton town due to distance and screening by the Moresby Range.

In the pastoral area the land is relatively flat and vegetation is mostly intact. There are large distances between residential dwellings and these are limited to pastoral landholders. Vegetation and relatively flat topography results in limited visual exposure.

7.13.2 Key statutory requirements, environmental policy and guidance

7.13.2.1 EPA Objectives

The EPA objective for visual amenity management is to ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape to as low as reasonably practicable.

7.13.2.2 EPA statements and guidelines

EPA Guidance Statement No. 33 - *Environmental Guidance for Planning and Development* provides guidance on land use planning and development processes to achieve environmentally sound outcomes. Part D of the Guidance statement ('*Social surrounds*') provides advice in relation to visual amenity. Criteria relevant to the Proposal are as follows:

- retain natural landforms and vegetation in visually prominent places, as well as other parts of a site, in order to maintain local landscape character;
- avoid locating development where it would be visually obtrusive;
- adopt appropriate building design;
- rehabilitate disturbed natural areas; and
- carry out landscaping works to meet completion criteria.

7.13.2.3 Applicable Legislation and Policy

Guidance on the management of visul amenity can be found in:

- *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and Institute of Environmental Management and Assessment, 2002); and
- Visual Landscape Planning in WA (WAPC 2007).

7.13.3 Aspects and Impacts

Aspects of the Proposal with the potential to impact visual amenity include

- Clearing;
- construction activities;
- infrastructure; and

- lighting.

Potential impacts to visual amenity are related to a reduced level in scenic value of the Proposal Area. This is mainly considered to affect areas frequented by people such as residences, roads, lookouts, and townships.

7.13.4 Visual Amenity Impact Assessment

The Proposal Area does not traverse through any major settlements, townships or communities, however it will be a long linear feature with potential impacts to viewscapes from public and private locations through the freehold area. Viewscapes are more significant through the western sections of the freehold area as the route traverses the Chapman Valley and Wokatherra Gap in the Moresby Ranges. In undulating areas the topography will create both visual exposure and screening, depending on location.

Through the pastoral area the Proposal is not expected to have a significant visual impact as:

- the land remains relatively uncleared, and the vegetation will generally provide a visual barrier; and
- the land is relatively flat, therefore the number of visual vantage points is reduced.

7.13.5 Proposed Mitigation and Management Measures

7.13.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for visual amenity (Table 7-37).

Table 7-37 Visual amenity management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Minimise visual amenity impacts of the Proposal in the landscape.	Compliance with the Visual Amenity Management Plan.	Management of visual impacts to significant public viewscapes is implemented. Complaints Register.
Protect the scenic values of the Moresby Ranges in proximity to the Proposal.	Compliance with the Visual Amenity Management Plan	Management of visual impacts to significant public viewscapes is implemented. Complaints Register.

7.13.5.2 Management Strategies

The engineering constraints of the Proposal are expected to minimise the potential for visual impact. Due to grade restrictions, the Proposal will generally follow flat areas of the landscape, with low points chosen through hilly terrain. The height of the embankment will also be minimised as this reduces the quantity of fill material required, thereby minimising costs and reducing the visibility of the structure within the landscape.

OPR will complete visual amenity modelling for public viewscapes through the Wokatherra Gap and Chapman Valley areas. To ensure that visual impacts from public viewscapes are maintained OPR will prepare and implement a Visual Amenity Management Plan (VAMP) for the Proposal that considers the outcomes from the visual amenity modelling.

In order to avoid, minimise and mitigate the impacts discussed in Section 7.13.4, the VAMP containing the management strategies outlined in Table 7-38 will guide mitigation and management measures for this factor. These strategies will be developed further in consultation with the native title claimant groups and relevant landholders.

Over time, the Rail Corridor is expected to blend more with the landscape as rehabilitation of disturbed areas and natural regeneration occurs.

Table 7-38 Proposed visual amenity management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Undertake visual amenity modelling for public viewscapes through the Wokatherra Gap and Chapman Valley areas.	VAMP	Design	Environment Manager
OPR will develop a VAMP that will be prepared with reference to the following guidelines: • *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and Institute of Environmental Management and Assessment, 2002); • *Visual Landscape Planning in WA* (WAPC 2007); and • *Reading the remote: landscape characters of Western Australia* (CALM; 2004). The VAMP is to include the following elements: • identify and assess the visual landscape characteristics of the key public viewscapes, in particular through the Wokatherra Gap and Chapman Valley project areas; • identify the potential visual and amenity issues identified through the visual and amenity modelling; • identify mitigation measures, in particular to ensure that visual impacts from public viewscapes are maintained; • management and mitigation measures to minimise the exposure of residence locations to any lighting; • considerations of viewscapes from residences will be included in land access negotiations; • minimisation of the height of the rail embankment; and • minimisation of lighting exposure through compliance with Australian Standard AS4282-1997: Control of Obtrusive Effects of Outdoor Lighting.	VAMP	Design Construction Operations	Environment Manager
Undertake progressive rehabilitation of disturbed areas to minimise the visual effect of bare earth	FVMP	Construction	Construction Manager
Use local provenance species and matching local relative plant densities and strata in rehabilitation areas	FVMP	Construction	Construction Manager Environment Manager

7.13.6 Predicted Outcome

The design and alignment of the Proposal low in the landscape will ensure that there are no significant impacts to general visual amenity associated with the Moresby Range and both the freehold and pastoral landscapes surrounding the Proposal.

There will be no viewscape impacts on major settlements, townships or communities. Viewscapes around the Moresby Range (Wokatherra Gap) and Chapman Valley will be impacted but mitigated by visual modelling and mitigation measures to key public viewscapes. Visual impacts during construction will be short-term.

7.14 OTHER SOCIAL AND ECONOMIC

7.14.1 Overview

7.14.1.1 Consultation

As discussed within Section 6 OPR is committed to ongoing stakeholder and community engagement, including open and transparent communication, and recognises the importance of genuine stakeholder involvement in the identification of potential issues and concerns, as well as appropriate strategies for management of impacts. OPR has worked closely with the WA Government's Oakajee Policy Team regarding the development of the Proposal, as well as relevant Government agencies, the Geraldton Iron Ore Alliance and Mid-West stakeholders. Section 6 provides detail on OPR's public consultation process and its findings. Table 6-3 lists the key environmental issues raised and also provides a reference for where these issues are discussed within the PER.

7.14.1.2 Social Impact Assessment

OPR is also in the process of completing a Social Impacts Assessment (SIA) to understand community sentiment about the port and rail Proposal. The SIA study has taken into account the positive and negative impacts of project activities and of supply needs on local communities. The SIA has been through a feedback phase which has included presentations, information sessions, workshops and project updates. In July and August 2009, interviews for the SIA study were conducted with 82 Mid-West stakeholders. Interviewees were then invited to participate in an SIA validation workshop in October. 40 people attended the workshop including representatives from local government, health and education services, recreational groups and local business. The validation workshop aimed to discuss the impacts of the port and rail project activities and gain local insights into enhancing the potential benefits of the development. It was also designed to confirm that information gathered from stakeholders during the interviews was reported accurately.

A number of issues and concerns were identified through the feedback process for the SIA. In order of priority the key themes identified by this consultation included:

- economic development;
- employment;
- infrastructure;
- recreation and tourism;
- planning;
- environment;
- housing, health and education; and
- industry and business.

It is noted that other social and economic issues environmental issues rated higher than environmental issues. An important outcome from this consultation was that the overarching sentiment toward the port and rail development was positive, as stakeholders believed it would enhance development in the Mid-West.

OPR is continuing its engagement program and a separate report on social considerations will be finalised shortly.

Figure 6-2 shows that the highest ranking issues raised in the stakeholder engagement relate to social and economic issues such as:

- use of fly in fly out workforce;
- local employment and training;
- infrastructure development;
- housing; and
- stimulus to local business.

The management of these issues will be the subject of ongoing consultation with key Stakeholders as the details of the Proposal are defined.

The Proposal Area currently generates income largely from farming, mining and fishing. The Proposal represents an opportunity to further develop income from mining and provide greater diversity of income within the region. There will be social and economic impacts associated with the change in land use from farming to transport that will be the subject of land access negotiations with individual landholders.

The Proposal Area also does not contain or pass in close proximity to any major population centres. The land use is rural, and the Proposal Area contains numerous track and minor road crossings that may represent a risk to public safety.

Recreational use of the Proposal Area is minor as the cleared land is used largely for broad scale cropping and pasture, and the Pastoral Area for low intensity grazing. Within the region, some farmstay facilities have been developed.

7.14.2 Key statutory requirements, environmental policy and guidance

7.14.2.1 EPA Objectives

The EPA objectives for management of social factors are:

- to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards;
- to ensure that existing and planned recreational uses are not compromised; and
- to ensure that risk from the proposal is as low as reasonably achievable and complies with acceptable standards and EPA criteria.

7.14.2.2 EPA statements and guidelines

- EPA Guidance Statement No. 33 - *Environmental Guidance for Planning and Development* (EPA, 2005).

7.14.2.3 Applicable Legislation and Policy

- EP Act (WA); and
- *Dangerous Goods Safety Act 2004* (WA).

7.14.3 Aspects and Impacts

Aspects of the Proposal with the potential to impact social and economic factors include the construction and operation activities in general – including the workforce, its recreational activities and accommodation locations. Implementation of the Proposal will result in additional local

employment opportunities and infrastructure development. The change in land use from agricultural and pastoral to transport and the change in access arrangements may have impacts on public recreation and amenity, and at a local scale on individual landholders. The construction and operations also create the potential for risks to public safety largely via the use of machinery and transport crossings.

7.14.4 Other Social and Economic Factors Impact Assessment

Impacts on public recreation are expected to be minor based on the limited nature of current recreational use of the Proposal Area. Access is currently restricted in the freehold area by private property, so that recreation tends to be limited to public access locations or amenity associated with viewscapes. The change in access arrangements is not expected to be of significance based on these recreational values.

Individual landholders may be inconvenienced by the dissection of farm paddocks and disruption to farm operations. Land access negotiations with individual landholders have been commenced and will specifically address the social and economic issues associated with land agreements to facilitate the Rail Proposal as they are conducted at a more detailed level.

Increased recreational pressures associated with the workforce can be expected to be associated largely with the construction workforce. These pressures will be short term (less than three years) and spread along the 570 km of the Proposal Area. With workforce education programmes to outline recreational areas and responsible behaviours, the impacts associated with the short term influx of construction workers is expected to be manageable.

Risk assessment is commonly used in industry to assist in the development of controls appropriate to the risks. Risk assessment is part of OPRs approach to development of the proposal and will include risk to the public. OPR has already committed to using bridges to separate road and rail traffic on the North West Coastal Highway and Chapman Valley Road. The public will be excluded from all construction areas to reduce the risk to the public of interaction with construction vehicles. The use of industry standard controls for the transport, storage and use of hazardous materials such as diesel will further limit risks to the public. Numerous small roads will have rail crossings installed and operated in accordance with relevant legislation and in consultation with Local Government and local stakeholders.

While there may be additional construction traffic on public roads, these impacts are expected to be minimal as the Proposal Area itself will be used for access on most occasions, and on site construction accommodation will reduce the number of vehicles driving to and from site.

7.14.5 Proposed Mitigation and Management Measures

7.14.5.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for management of other social and economic factors for the Proposal Area (Table 7-39).

Table 7-39 Management objectives, targets and performance indicators for other social and economic factors

OPR Management Objective	Target	Performance Indicators
Uphold public safety within the Proposal Area.	No public safety incidents or hazards from construction and operation activities. No public amenity complaints.	Complaints Register Incident Register

7.14.5.2 Management Strategies

Table 7-40 details the proposed social and economic management strategies for the Proposal, which are designed to meet the objectives detailed in Table 7-39. Note that land access negotiations with individual landholders will provide the forum to identify and deal with issues such as dissection of farm paddocks.

Table 7-40 Proposed social and economic management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Rail Safety and Risk will be managed according to the *Rail Safety Act 1998* including risk assessment and safety provisions for all level crossings.	-	Design, Construction & Operation	Safety Manager
In accordance with access agreements and leases negotiated with the State, signage will be erected and maintained to alert members of the public to risks and hazards and exclude them from construction and operational areas.	Traffic MP	Construction & Operation	Public Relations Manager
Include Public Risk in Risk Assessment and Risk Management programmes	-	Construction & Operation	Public Relations Manager
Public notices shall be communicated prior to any works taking place that may affect public access.	-	Construction & Operation	Public Relations Manager
Prepare and implement a Traffic Management Plan that includes designated traffic areas, measures for safe traffic interactions with the public and arrangements with local government and Main Roads WA. The plan will include the following actions: • at intersections with public access roads, maintain a visual inspection and cleanup routine to minimise dust spill and spread onto public roads; • traffic will be minimised at public access areas; and • specify ongoing consultation arrangements with Local Shires and Main Roads WA.	Traffic MP	Construction & Operation	Construction Manager, Operations Manager, Public Relations Manager

7.14.6 Predicted Outcome

Risks to the public from rail/road interactions are expected to be managed to as low as reasonably achievable by using grade separation (bridges) at major crossings and industry standard safety warning systems at other crossings. The public will be excluded from construction areas.

Application of industry best practice preventative controls to hazardous materials such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to reduce risks to the public to a level that is insignificant.

Recreational use of the Proposal Area is minor. Workforce education processes are expected to reduce the risk of unacceptable workforce impacts on recreational assets to negligible. Increase in accessibility to areas is not expected to lead to significant recreational use pressures.

Dissection of farm paddocks and inconvenience for farm operations is expected to be managed via land access negotiations with individual landholders.

8 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

8.1 INTRODUCTION

8.1.1 Background

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's key environmental legislation and is administered by the Department of Environment, Water, Heritage and the Arts (DEWHA). The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna and ecological communities and places of heritage (DEWHA 2009).

There are seven matters of National Environmental Significance (NES) to which the EPBC Act applies:

- world heritage sites;
- national heritage sites;
- wetlands of international importance (Ramsar wetlands, named after the treaty in which they are listed);
- nationally Threatened Ecological Communities (TECs) and species;
- migratory species;
- commonwealth marine areas; and
- nuclear actions.

The objectives of the EPBC Act are to:

- conserve Australia's biodiversity;
- protect biodiversity internationally by controlling the international movement of wildlife;
- provide a streamlined environmental assessment and approvals process where matters of NES are involved;
- protect our world and national heritage; and
- promote ecologically sustainable development.

8.1.2 Assessment Process

Under the EPBC Act a project or proposal (referred to as an 'action') will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of NES.

A significant impact is one that has a notable consequence on the matter of NES. Whether or not an action is likely to have a significant impact depends upon the context, intensity, duration and geographic extent of the action, as well as the sensitivity, value and quality of the environment which is to be impacted.

The proponent must undertake a self assessment of the action to decide whether or not the action is likely to have a significant impact on any matters of NES, taking into consideration direct and indirect impacts and whether proposed mitigation is effective enough to reduce the level of impact below the significant impact threshold. The EPBC Act Policy Statement 1.1 - *Significant Impact Guidelines on Matters of NES* (2009b) provides direction to proponents in the form of criteria to assist in deciding whether a referral to the Minister is necessary.

Should the action be considered to have a significant impact upon a matter of NES, the proponent must make a referral to the Minister for approval. The referral must ascertain the location, nature and extent of any potential impacts, and any mitigation measures. This referral is then released to the public for comment, which is assessed and, if relevant to the EPBC Act, is taken into consideration. The Minister or his delegate will then decide whether the environmental impacts of the Proposal are such that it should be assessed under the EPBC Act. The referral process is illustrated in Figure 3-1.

If the Minister decides that the action is likely to have a significant impact and requires approval under the EPBC Act then the Proposal is considered a 'controlled action'. The Western Australian (WA) government has a bilateral agreement with the Commonwealth which allows the State to assess the action under the approval process accredited by the declaration.

If the Minister decides that the action is not likely to have a significant impact on a matter of NES, then the action does not require an approval under the EPBC Act (it is a 'not controlled action'). In this case the Minister may decide that an action does not require approval, because it will be undertaken in a particular manner that does not impact upon the matter of NES.

8.1.3 Summary of Proposed Action Relevant to EPBC Act Consideration

The Proposal may potentially impact on a number of EPBC Act listed threatened flora and fauna species. As a result Oakajee Port and Rail (OPR) has referred the action to DEWHA for consideration. OPR met with DEWHA in August 2009 and May 2010 to discuss the matters of NES relevant to the Proposal, the level of assessment undertaken and proposed management strategies. OPR considers that the Proposal is a controlled action due to the presence of threatened species within the Proposal Area, in particular the potential for impacts on the Western Spiny-tailed Skink.

8.2 LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

8.2.1 Identification of species

An EPBC Act Protected Matters search was conducted on 8 April 2010 for the Proposal Area which identified 26 threatened species. Of these, only 6 fauna species and 11 flora species have the potential to occur within the Proposal Area.

8.2.1.1 Fauna

Fauna species that may occur within the Proposal Area include:

- *Acanthiza iredalei iredalei* (Slender-billed Thornbill): Vulnerable;
- *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo): Endangered;
- *Macronectes giganteus* (Southern Giant-Petrel): Endangered;
- *Macronectes hallii* (Northern Giant-Petrel): Vulnerable;
- *Thalassarche cauta cauta* (Shy Albatross): Vulnerable; and
- *Egernia stokesii badia* (Western Spiny-tailed Skink): Endangered.

The remaining nine fauna species identified in the Protected Matters Report include three whale species, three turtle species and three shark species, none of which are relevant, as the Proposal is strictly terrestrial.

Fauna surveys (Ecologia 2009b & 2010b) recorded the following EPBC listed fauna within the Study Area (Figure 8-1):

- *Acanthiza iredalei iredalei* (Slender-billed Thornbill): Vulnerable;
- *Egernia stokesii badia* (Western Spiny-tailed Skink): Endangered; and
- *Leipoa ocellata* (Malleefowl) (secondary evidence only): Vulnerable.

Note that on Figure 8-1 the Slender-billed Thornbill is not shown as it was not recorded during the recent Ecologia surveys, but was recorded during a previous survey. The location of the sighting is shown on Figure 8-2.

No individuals of Southern Giant-Petrel, Northern Giant-Petrel and Shy Albatross have been recorded or are expected to occur within the Proposal Area due to the distance from the coast. Therefore, these species have not been considered any further.

Carnaby's Black Cockatoo was not recorded during Ecologia surveys. The species is endemic to south-west WA, but in coastal areas the distribution is understood to extend as far north as Kalbarri, which is approximately 100 km north of the Oakajee port.

Carnaby's Black-Cockatoo breeds almost exclusively in the wheatbelt in large hollows in eucalypt trees (Johnstone and Storr 1998; Shah 2006) and is not expected to breed in the coastal region around Oakajee (Barrett *et al.* 2003).

Although not recorded within the Study Area, Carnaby's Black-Cockatoo has been recorded near Oakajee, from Howatharra (10 km east of Oakajee in 1983), as well as more southern locations such as Geraldton and Dongara.

Heading east along the rail alignment from the Port, the known distribution therefore extends approximately less than 50 km inland, which is entirely within the freehold area of the corridor, and within the Geraldton Hills subregion. The Proposal Area therefore passes through the north-east extension of the range of Carnaby's Black Cockatoo.

Carnaby's Black Cockatoo is not expected to use the Proposal Area for breeding (Ecologia 2010), however there is the potential for this species to use the Proposal Area as a feeding visitor. In general feeding habitat within the Proposal Area is low quality, and is limited to a few small remnants which are unlikely to be a main food source for Carnaby's cockatoo.

Up to 100 ha of vegetation clearing will be required in the freehold area. Of the eleven Geraldton Sandplains vegetation units occurring in the Study Area, five contain plants of a genus known to be a food source of Carnaby's Black Cockatoo. These units combine to make up 1% (2308 ha) of the Study Area, and are as follows:

- Gh1 (contains hakea);
- Gy1 (contains banksia, sparse/ open);
- Gp1 (contains Hakea – degraded community);
- Gf1 (contains isolated hakea); and
- Gc2 (contains grevillia).

Based on the indicative rail alignment the following clearing of these vegetations units is predicted:

- Gh1 - 0% impacted;
- Gy1 - 0.8% impacted (4.1 ha);
- Gp1 - 1.9% impacted (17.2 ha);
- Gf1 - 1.0% impacted (7.2 ha); and
- Gc2 - 6.2% impacted (0.8 ha).

The above equates to a total predicted disturbance of 29.3 ha, or 1.3% of the total area within the Study Area suitable as a food source for Carnaby's Black Cockatoo. It is also expected that these

vegetation units would extend outside of the Study Area, however vegetation mapping at that scale is not available.

Woodland and heath, particularly amongst the Moresby Range, includes favourable food plants such as Dryandra, Hakea, and Banksia. The Proposal Area has been amended to avoid the Moresby Range Nature Reserve.

Section 7.2 includes details of how clearing of remnant vegetation will be avoided or minimised throughout the freehold area, which includes potential Carnaby's Black Cockatoo habitat.

Clearing within the freehold area will be restricted to an average disturbance width of 100 m when the corridor passes through areas of native vegetation, and vegetation will not be cleared except for the purposes of the rail alignment, and for access tracks if alternative routes are not practicable.

8.2.1.2 Flora

The flora species identified by the Protected Matters Search tool include:

- *Caladenia bryceana* subsp.*cracens* (Northern Dwarf Spider-orchid): Vulnerable;
- *Caladenia elegans* (Elegant Spider-orchid): Endangered;
- *Caladenia hoffmanii* (Hoffman's Spider-orchid): Endangered;
- *Caladenia wanosa* (Kalbarri Spider-orchid): Vulnerable;
- *Drummondita ericoides* (Moresby Range Drummondita): Endangered;
- *Eremophila viscida* (Varnish Bush): Endangered;
- *Eucalyptus blaxellii* (Howatharra Mallee): Vulnerable;
- *Eucalyptus cuprea* (Mallee Box): Endangered;
- *Hypocalymma longifolium*: Endangered;
- *Pityrodia augustensis* (Mt Augustus Foxglove): Vulnerable; and
- *Ptilotus fasciculatus* (Fitzgerald's Mulla-mulla): Endangered.

Of these, only the Hoffmans' Spider Orchid, Moresby Range Drummondita and Howatharra Mallee have been recorded in or near the Study Area (Figure 8-1).

Vegetation and flora surveys of the Study Area did not identify any individuals of Northern Dwarf Spider-orchid, Elegant Spider-orchid, Kalbarri Spider-orchid, Moresby Range Drummondita, Varnish Bush, Mallee Box, *Hypocalymma longifolium*, Mt Augustus Foxglove or Fitzgerald's Mulla Mulla. Further assessment of the potential for these species to occur within the Proposal Area using Florabase and DEC databases provides the following information in relation to these species.

The Northern Dwarf Spider-orchid is known from 15 populations which range from Northampton (southern point of distribution) to Kalbarri (northern most point of distribution). The Proposal Area is located approximately 50 km south of the known distribution of the species. It is therefore unlikely that the Northern Dwarf Spider-orchid occurs within the Proposal Area.

The Elegant Spider-orchid is known to occur in eight populations found west-northwest and east of Northampton. This distribution lies well outside the boundary of the Proposal Area and therefore is not likely to occur.

Despite extensive targeted surveys, the Kalbarri Spider Orchid has not been recorded within or around the Study Area. This species generally occurs on sandstone outcrops, often on the upper edges of gorges. Near Mullewa, the species inhabits deep, yellow loamy sand beneath tall shrubs of

Jam (*Acacia acuminata*) and hakea, with emergent mallee. Potential habitat for this species may include Gp1, Gp2, Gf2, Yp2, and Yf1, totalling 13, 879 ha within the Study Area.

The flowering time of the Kalbarri Spider Orchid is August to September. In 2009 phase one quadrat sampling was being carried out in the Study Area in August, and Phase two surveying which targeted threatened flora and unknown species was undertaken between August and October, covering the entire flowering period for this species. Phase 2 employed transects to cover large areas of the Study Area, with 1,250 km of transects walked, covering 2,364 ha of the Study Area. No individuals of this species were identified. Therefore it is considered highly unlikely that this species occurs in the Study Area.

The Moresby Range Drummondita occurs in the Moresby Range, north of Geraldton. The known populations occur over a linear range of approximately 20 km. These populations occur on a nature reserve, private property and a recent addition to the conservation estate. The preferred Moresby Range habitats are not intersected by the Proposal Area, therefore it is unlikely that the species occurs within the Proposal Area. In addition, no specimens were recorded by Ecologia (2010a) during its flora and vegetation survey for OPR.

Varnish Bush has a historical linear range of approximately 290 km between Pindar, the northern limit of distribution, to Carnamah, Latham, Ballidu, Koorda and Merriden at the southern limit. The Proposal Area is positioned north of Pindar, well outside of the northern limit of the species distribution. It is therefore unlikely that the species occurs within the Proposal Area.

Mallee Box is confined to a small area around Northampton, from north of Galena to south of Northampton. The distribution of the species is not intersected by the Proposal Area. It is therefore unlikely that the species occurs within the Proposal Area.

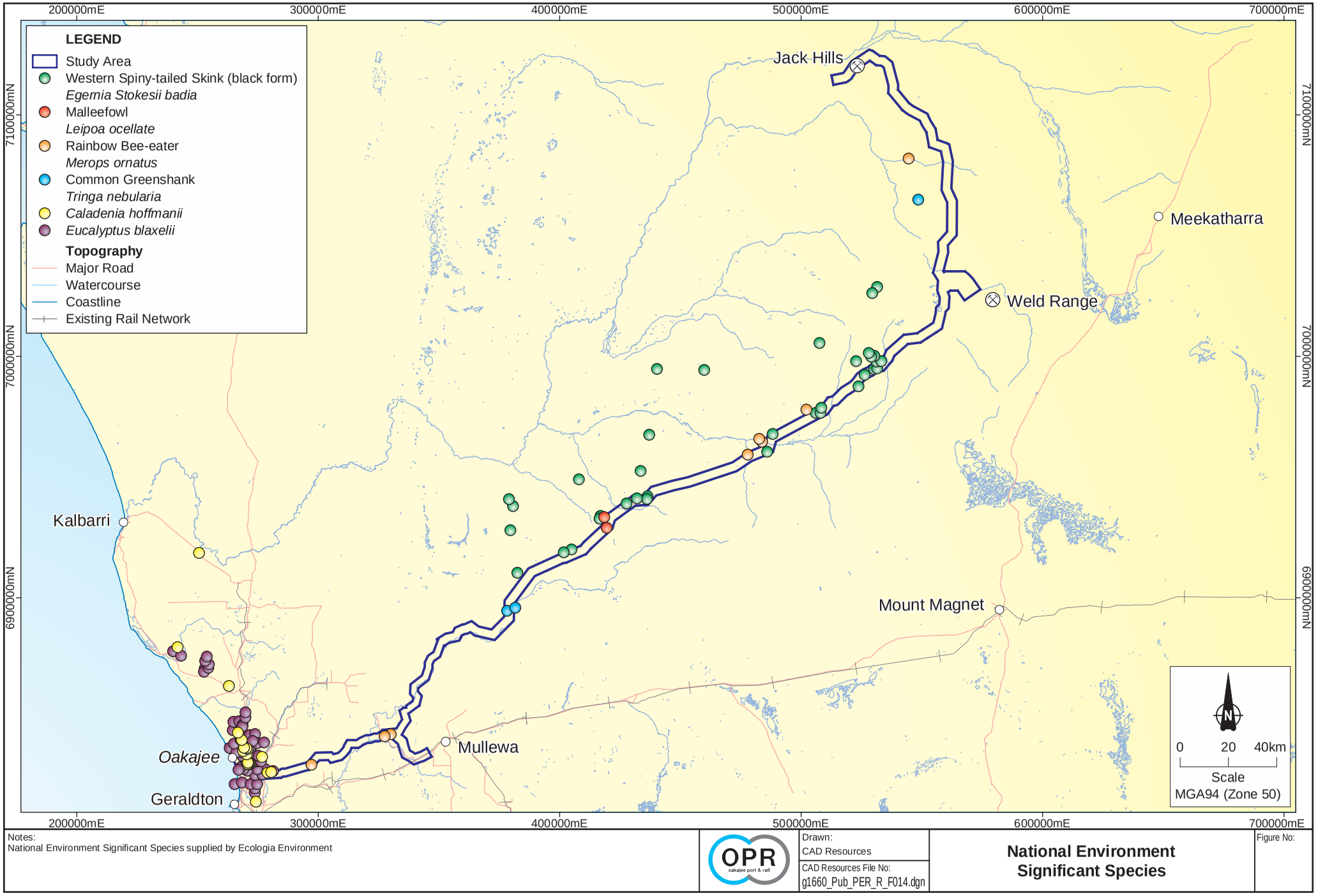
Hypocalymma longifolium is known to occur in five populations within a 60 km range between Yerina Spring (north-east of Port Gregory) and Murchison River (north of Kalbarri). The Proposal Area is located approximately 110 km south of the southern limit of the species' known distribution. It is therefore unlikely that the species occurs within the Proposal Area.

A search of Florabase indicates that the Mt Augustus Foxglove is known only to occur in two locations within the Gascoyne IBRA region, in the Mt Augustus area (northeast of Carnarvon) and Mr Fraser in the Robinson Range (northeast of Meekatharra). The nearest known location of this species is approximately 130 km from the Proposal Area. It is therefore unlikely that the species occurs within the Proposal Area.

Fitzgerald's Mulla Mulla occurs in a number of locations along a linear range from one location northeast of Geraldton, to multiple locations surrounding Carnamah, Coorow and Kondinin and the wheatbelt region of southern WA. A total of 11 sub-populations are known. With the exception of the one location to the northeast of Geraldton, identified on Florabase, all other locations lie well outside the boundary of the Proposal Area. While it is possible that the species occurs within the Proposal Area, it was not recorded during flora and vegetation surveys by Ecologia (2010a).

No nationally listed TEC exist in the Proposal Area (Ecologia, 2010a) and none were identified as potentially occurring using the Protected Matters Search Tool.

Figure 8-1 Matters of NES within the Proposal Area



Notes:
National Environment Significant Species supplied by Ecologia Environment

OPR oakajee port & rail

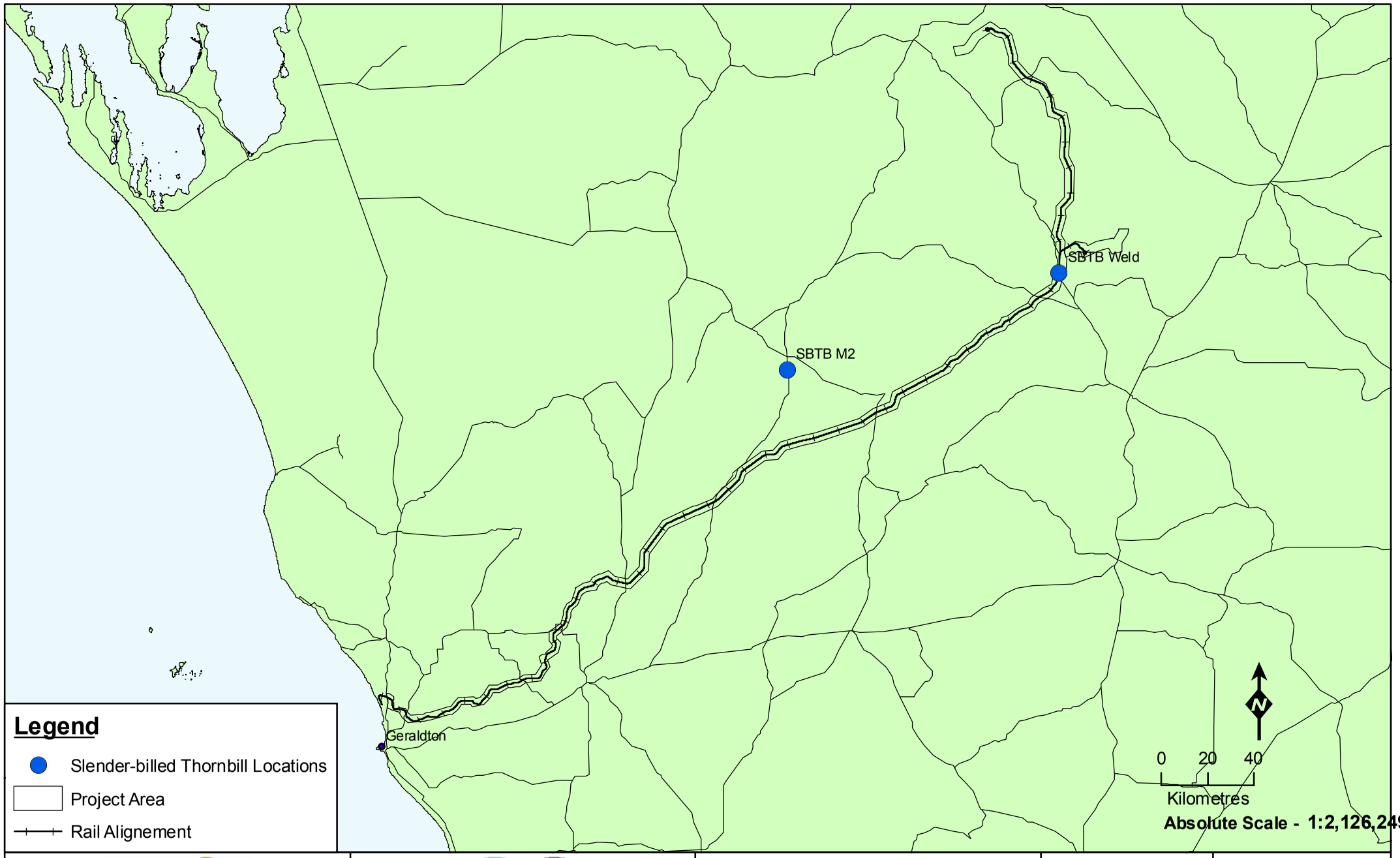
Drawn:
CAD Resources

CAD Resources File No:
g1660_Pub_PER_R_F014.dgn

National Environment Significant Species

Figure No:

Figure 8-2 Slender-billed Thornbill records



ecologia ENVIRONMENT

OPR

Location of Slender-billed Thornbills

Figure:
Project ID: 1126

Drawn: DC
Date: 08/07/10

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: MXXX

A4

8.2.2 Nature and extent of likely impact

8.2.2.1 Slender-billed Thornbill

The Slender-billed Thornbill (*Acanthiza iredalei iredalei*) is a small bird that occurs in the arid and semi-arid zones of southern WA and South Australia (SA). Its known distribution extends from near Carnarvon in WA, east through central WA, and across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in SA. Slender-billed Thornbills are uncommon, rare or extinct across most of their range, with the exception of populations on the Mid-West coast, where they are considered moderately common (Ecologia, 2010b). They are found mainly in chenopod shrublands, in treeless or sparsely wooded flatlands, and samphire and low melaleuca shrubs. Based on the habitat present in the Proposal Area, it is possible that the Slender-billed Thornbill occurs in the Proposal Area, as patches of salt flats with chenopod shrubland occur within the Proposal Area (Ecologia, 2010b).

Slender-billed Thornbills were not recorded during recent Ecologia surveys. Approximately 14 hours of bird surveys were conducted in areas of halophytic vegetation suitable for Slender-billed Thornbills, and transects for the species were conducted where potentially suitable habitat was encountered.

This species has previously been recorded in the Study Area near Weld Range, in the chenopod shrubland to the north of the Weld Range Gap (Figure 8-2).

Within the Study Area small patches of potential habitat may occur in Sections OPR-B, OPR-D, OPR-E and OPR-F of the Study Area, as well as the salt lake and floodplain vegetation of the Murchison Interim Biogeographic Regionalisation of Australia (IBRA) region (Mf1, Mf2, & Mf3, covering a total of 1117 ha), as these contain chenopod vegetation.

Figure 5-17 shows these vegetation units and Appendix 7 shows the indicative alignment in relation to these salt lake and floodplain vegetation types. Predicted clearing based on an indicative rail alignment (Table 7-9) estimates Mf1, Mf2 and Mf3 will have 14 ha (2.6%), 1 ha (5%), and 17 ha (3%) impacted respectively, equating to a total of 32 ha (2.9%) being potentially impacted. This calculation is based on an assessment of the habitat types only within the Study Area, as detailed vegetation mapping has not been conducted outside of the Study Area. It is therefore probable that there will be additional habitat outside of the Study Area.

Will the action lead to a long-term decrease in the size of an important population of a species?

While the species has previously been recorded in the Proposal Area, it was not observed in the most recent survey by Ecologia. In addition, the preferred habitat for the species is limited within the Proposal Area to the region north of Weld Range and only small patches elsewhere along the Rail Corridor. As the habitat is unlikely to support large numbers of this species, it is considered unlikely that the rail development will decrease the size of an important population of this species.

Will the action reduce the area of occupancy of an important population?

The area of suitable habitat within the Proposal Area is limited to chenopod shrubland north of Weld Range and small patches in OPR-B, OPR-D, OPR-E and OPR-F sections of the Proposal Area (Figure 5-23). It is therefore unlikely to support large numbers of the species. The Proposal development is unlikely to reduce the area of occupancy of an important population.

Will the action fragment an existing important population into two or more populations?

The Proposal Area is unlikely to support large numbers of the Slender-billed Thornbill due to the limited fraction of suitable habitat within its boundaries. Nevertheless, the impact area is narrow

and will not constrain movement of this species. As a result, the Proposal is unlikely to fragment an important population of this species.

Will the action adversely affect habitat critical to the survival of the species?

The Proposal is unlikely to affect habitat critical to the survival of the species as limited suitable habitat exists within the Proposal Area. Suitable habitat is limited to patches of chenopod shrubland north of Weld Range and in OPR-B, OPR-D, OPR-E and OPR-F sections of the Proposal Area (Figure 5-23) and are not likely to support significant populations of this species.

Will the action disrupt the breeding cycle of an important population?

It is unlikely that the Slender-billed Thornbill breeds along the majority of the Proposal Area due to limited suitable habitat. Chenopod shrubland in treeless or sparsely wooded flatlands and samphire and low melaleuca shrubs are the preferred habitat for this species. Suitable habitat as described occurs north of the Weld Range and in small patches in the OPR-B, OPR-D, OPR-E and OPR-F sections of the Rail Corridor. While it is possible that the species occurs in the area, it is unlikely that large numbers occur along the Proposal Area.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

It is unlikely that the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The Proposal Area is unlikely to support large numbers of Slender-billed Thornbill due to the limited availability of suitable habitat within the corridor. In addition, the patches of potential habitat that exist are in most parts towards the boundary of the Proposal rather than in the centreline. It is likely that most patches of chenopod shrubland that may serve as habitat will be avoided.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The main potential threat to the Slender-billed Thornbill is habitat degradation, caused by livestock and rabbits, which graze intensively on the chenopod shrublands that are the preferred habitat of the species. The historical decline in the distribution and numbers of the Slender-billed Thornbill has been mainly attributed to the impact of grazing. There is evidence that rabbit control may be an effective measure in protecting habitat for this species (DEWHA 2010a). The Proposal is unlikely to result in an increase in rabbit numbers that in turn may lead to habitat degradation.

Will the action introduce disease that may cause the species to decline?

The proposed action is unlikely to introduce disease that may cause the Slender-billed Thornbill to decline. The dominant threats to the species are degradation of chenopod shrubland by rabbits and livestock which is the preferred habitat. Disease is not considered a threat to the species.

Will the action interfere substantially with the recovery of the species?

The action is unlikely to interfere substantially with the recovery of the Slender-billed Thornbill as the area is unlikely to support large numbers of the species. In addition, there is limited potential habitat within the Proposal Area and those patches that do exist are likely to be avoided by the rail centreline.

8.2.2.2 Western Spiny-tailed Skink

The Western Spiny-tailed Skink (*Egernia stokesii badia*) is confined to WA and occurs in the Murchison region and in the Wheatbelt, from Mullewa south to Kellerberrin. The black or melanic form of the skink (Plate 8-1) shelters within crevices of large rocky outcrops and occasionally in hollow logs and semi arboreal habitats (Ecologia, 2010c) and has been found within the Proposal Area. Unlike the brown form of the species, the black form does not inhabit tree hollows (Ecologia, 2010c).

Plate 8-1 Western Spiny-tailed Skink (*Egernia stokesii badia*) (Ecologia, 2010c)

The Western Spiny-tailed Skink (black form) was formerly known from only a handful of locations including Woolgorong Rock and 4 km east of Yalgoo (Ecologia, 2010c). In relation to the proposed action this species was first recorded during comprehensive baseline fauna surveys undertaken along the Proposal Area in 2006. As a result of the discovery of numerous previously unknown populations, OPR commissioned two further targeted fauna surveys for the skink (black form). The first was designed to map the occurrence of the skink (black form) within the Proposal Area, and the second was designed to search for the skink within geotechnical feasibility study locations including proposed future quarry/borrow areas.

Threatening processes that are thought to be the cause of the decline of this species have been identified as a combination of overgrazing by stock and clearance of woodland habitat for agriculture, although clearance of woodland habitat is less of a threat to the black form as they use rock crevice habitat rather than tree hollows (Ecologia, 2010c). If it is assumed that the melanic form forages on plant material in a similar manner to that shown more widely for the Western Spiny-Tailed Skink (brown form), significant grazing of plant material by livestock is likely to be the most significant risk to the species, which reduces feeding habitat, and indirectly by reducing invertebrate prey.

Surveys by Ecologia (2009c) of alternate proposed Rail Corridors and the current Proposal Area have substantially increased the known population of the species with more than 50 new locations discovered, all clustered around emergent granite formations ranging in size from hills to low rises.

Numerous Western Spiny-Tailed Skinks (black form) were found inhabiting granite outcrops within the Proposal Area to the southwest of Weld Range, sheltered in the horizontal rock crevices that had formed in weathered granite outcrops. Figure 8-1 depicts the location of populations or individuals.

Ecologia recently commissioned a regional survey for the Western Spiny-tailed Skink (black form), publication pending. The preliminary findings of this survey have confirmed that this species has a much broader range than previously known, with new populations being identified up to 90 km north, and up to 130 km south of the Proposal Area (Figure 8-3).

OPR is committed to preserving the skink population in the area and as part of a management plan for the species, the route of the track will be diverted within the Proposal Area to avoid known habitat. A total of twelve separate populations of Western Spiny-tailed Skink were found inhabiting granite outcrops within the Proposal Area. For all but two of these known populations, the rail line has been deviated to provide a 200 m buffer zone between known populations and the rail line.

200 m was considered to be a suitable buffer as the skinks are predominantly sedentary and confined to discrete granite outcrop habitats (see Appendix 2). This buffer was recommended by fauna specialists (Ecologia, 2010c).

While the two remaining populations may potentially be bisected by the rail line, a buffer of 50 to 60 m will be maintained and no granite outcrops will be directly impacted. In addition, all borrow areas will be located outside of the buffer area.

Although it is thought that the skinks can move up to 500 m (based on genetic studies), this is thought to be rare. The maximum distance an individual Western Spiny-tailed Skink has been known to travel is 350 from its original location (Ecologia 2010c).

Studies of a closely related species to the Western Spiny-tailed Skink and showing a similar life history strategy, *E. cunninghami*, found that 92% of individuals had moved less than 11 metres when recaptured (Ecologia 2010). This contributes to the view that the Western Spiny-tailed Skink is generally likely to stay within a limited area.

Of note is that the species is considered to adapt well to disturbance by utilising waste rock as habitat (Ecologia, 2010c).

The species is therefore unlikely to be significantly affected by the Proposal.

Additional information on this species in included in Section 7.3.4.1.

Will the action lead to a long-term decrease in the size of an important population of a species?

It is unlikely that the Proposal will lead to a long-term decrease in the size of an important population of the species. Ecologia surveys have contributed substantially to the knowledge of the distribution and abundance of the species including identification of more than 50 new locations of the species (Ecologia, 2010c). Ecologia undertook a regional assessment survey in April 2010, which aimed at better defining the abundance and location of potential habitat in the region. The results of this survey have significantly increased the known abundance and distribution of the species (Figure 8-3).

Will the action reduce the area of occupancy of an important population?

Approximately twelve individual populations of Western Spiny-tailed Skink (black form) have been found along the Proposal Area.

In order to prevent impacts on these populations, the following strategies will be adopted:

- maintaining a 200 m buffer between the final rail centreline and any known colonies or individuals where practicable;
- maintaining a 50 – 60 m buffer between the final rail centreline and the two known colonies where a 200 m buffer is not possible;
- ensuring all supporting facilities such as borrow areas, turkeys nests, access tracks etc are located outside of the 200 m buffer area;
- provision of fauna passages below the rail line to allow movement between populations located within 50-60 m of the rail (only two locations); and
- translocation of individuals to habitats away from the development prior to construction, if required.

Will the action fragment an existing important population into two or more populations?

Western Spiny-tail Skinks live in colonies predominantly within the same rocky outcrop and movements between outcrops are thought to be low. Evidence of low dispersal rates has been found from genetic analysis and recapture studies of populations (Gardner *et al*. 2001; Gardner *et al*. 2007). Studies in *Egernia cunninghami*, a species closely related to the Western Spiny-tailed Skink (black form) and showing a similar life history strategy, found that 92% of individuals had moved less that 11 m when recaptured (Stow and Sunnucks 2004). A low dispersal rate may be expected based on the patchy nature of Western Spiny-tailed Skink's preferred habitat; rocky outcrops often separated from each other by large expanses of flat, often sparsely vegetated land.

As Western Spiny-tail Skinks live in colonies within predominantly the same outcrop it is unlikely that the proposed action will fragment an existing important population into two or more populations. Although no significant movement is anticipated between populations, provision will be made for fauna passages below the rail line to allow for potential movement. Skinks have also been observed climbing and jumping between rocks when moving between crevices within an outcrop and are therefore considered also to be capable of crossing train tracks (Ecologia, 2010).

Will the action adversely affect habitat critical to the survival of the species?

The proposed action is unlikely to adversely affect habitat critical to the survival of the Western Spiny-tailed Skink. The Proposal will maintain a 200 m buffer between the rail and any known colonies or individuals where practicable. In addition, culverts which will also serve as small fauna passages will be established along the designated sections of the rail line to allow for potential movement between areas of habitat.

Will the action disrupt the breeding cycle of an important population?

The proposed action is unlikely to disrupt the breeding cycle of an important population of Western Spiny-Tail Skinks as a 200 m buffer will be maintained between the rail centreline and any known colonies or individuals where practicable.

Will the action modify, destroy, remove or isolate or decrease the availability of quality of habitat to the extent that the species is likely to decline?

The proposed action is unlikely to decrease the availability or quality of habitat available to the Western Spiny-Tailed Skink, and may even create additional habitat, as occurred alongside the linear infrastructure of the Koolanooka power line.

A 200 m wide buffer will be maintained between the rail centreline and known colonies or individuals where practicable. Fauna passages will assist the movement of individuals across the rail centreline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action is unlikely to introduce invasive species that are harmful to the Western Spiny-tailed Skink. Invasive species are not a known threat to the Western Spiny-tailed Skink. The principle threatening process that has contributed to the decline of the black form of the species is overgrazing by livestock which reduces food availability or the species.

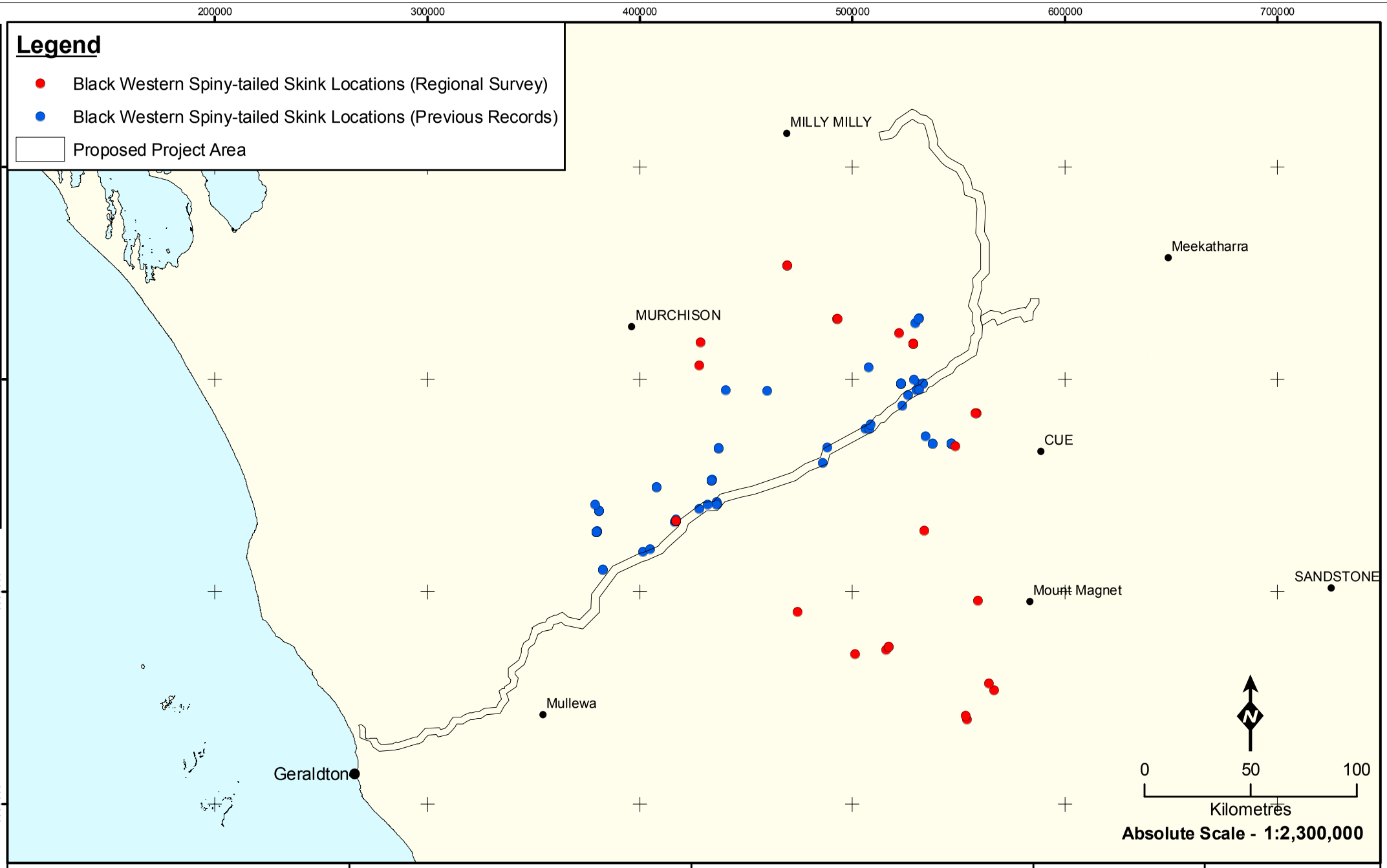
Will the action introduce disease that may cause the species to decline?

The proposed action is unlikely to introduce disease that may cause the Western Spiny-tailed Skink to decline. Disease is not a known threat to the Western Spiny-tailed Skink. The principle threatening process that has contributed to the decline of the black form of the species is overgrazing by livestock which reduces food availability or the species.

Will the action interfere substantially with the recovery of the species?

The action is unlikely to interfere substantially with the recovery of the Western Spiny-tailed Skink. Surveys conducted by Ecologia have significantly increased knowledge on the abundance and distribution of the black form of the skink. This knowledge will better inform the planning of recovery actions. Ecologia are undertook a regional assessment survey in April 2010 which intended to better define the abundance and location of potential habitat in the region.

Figure 8-3 Regional Western Spiny-tailed Skink survey results



ecologia ENVIRONMENT

Records and predicted Distribution of *Egernia stokesii*

Figure: 6 **Project ID:**	**Drawn: AH** **Date: 23/06/10**

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A205

A4

8.2.2.3 Malleefowl

Malleefowl (*Leipoa ocellata*) are ground dwelling birds, known for constructing large mounds of soil and vegetation in which they incubate their eggs (Plate 8-2). They are usually found in arid to semi-arid shrublands consisting of mallee or mallee heath communities and can sometimes occur in eucalyptus or mulga woodlands (DEWHA 2010b).

The Malleefowl is listed as Vulnerable under the EPBC Act and as fauna that is rare or likely to become extinct in WA. The decline of this species is due to loss and fragmentation of habitat due to agricultural clearing, degradation of remnant habitat and predation by foxes (Ecologia 2010b).

Plate 8-2 Malleefowl (*Leipoa ocellata*) (Benshemesh 2007)

Malleefowl tracks and a recently used mound were found in a small area of low, dense acacia scrub with accumulated leaf and wood debris on sandy soil, located a few kilometres northwest of the Proposal Area centreline (Ecologia 2010b). A targeted survey was undertaken adjacent to this location and identified an old nest that had not been used for several years. This nest mound was in an area considered to be no longer suitable for habitat due to its open nature and lack of accumulated debris.

A Malleefowl call was heard at OPR-F1 (Figure 5-23) some distance from the location of the trapping grid. A transect was walked toward the direction of the call but failed to record further evidence of the species. Habitat in the area where the call was heard was generally eucalypt woodland (although not mallee form), with some areas of thick leaf litter.

Further searches in the wider area surrounding the tracks did not identify any individuals or evidence of Malleefowl presence.

The preferred habitat of Malleefowl is large dense thickets of mallee or mulga on sandy soils, dry inland scrub, and shrubland communities. The species is also often recorded along tracks.

This habitat area contains both Yy1 (*Acacia ramulosa* var. *linophylla* and *Acacia ramulosa* var. *ramulosa* open tall shrubland) and Yf5 (*Acacia eremaea* sparse tall shrubland, over mixed Chenopod spp. low shrubland) vegetation, which are mapped over 4923 ha and 8049 ha of the Study Area respectively. It is unknown what percentages of these vegetation associations contain enough dense understory and leaf litter accumulation to provide potential habitat for Malleefowl (Ecologia 2010).

There is a possibility that Malleefowl utilise the Proposal Area, due to the evidence of tracks. However, suitable habitat is patchy and limited, and has been well surveyed for Malleefowl. This information combined with a lack of active mounds results in a low likelihood that this species is a breeding resident in the Proposal Area (Ecologia 2010).

Will the action lead to a long-term decrease in the size of an important population of a species?

While no individuals were observed during the fauna survey, a recently used mound was identified and a call was heard approximately 2.6 km from the centreline of the Proposal Area. The location of the recently used mound is therefore located well outside of the area of disturbance. It is possible that more than one pair of birds breed in an area of suitable habitat around OPR-D (Figure 5-23).

A targeted survey was undertaken along a 4.7 km length of the Proposal Area centreline adjacent to this location and identified an old nest that had not been used for several years.

Malleefowl are known to spend up to eleven months of the year in nest building and maintenance and as a result spend most of their time in the vicinity of the nest. As the male bird defends the mound, its range is usually smaller than that of the female. Some pairs may reuse the same mound for many years in succession while other pairs may move. Malleefowl may also move during the non-breeding season. The home range varies considerably from 0.5 km^2 to 4.6 km^2 (DEWHA 2010).

Given the low population size (100,000 individuals nationwide), scattered distribution and long generation length, impacts to individual birds could have far-reaching consequences. Land clearing may cause destruction of nest mounds, and adult birds may also be displaced or abandon nest mounds as a result of construction activities or train noise. If birds are displaced, their potential for future breeding will depend upon their ability to find suitable alternative habitat nearby. Should suitable alternative habitat not be found, this may impact on the population viability in the Murchison region.

OPR commits to not disturbing any active Malleefowl mound. Where a nest is discovered that cannot be avoided, the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for Ministerial permission to disturb.

Will the action reduce the area of occupancy of an important population?

It is possible that more than one pair of Malleefowl breeds in the area of suitable habitat identified in OPR-D (Figure 5-23). Nest destruction may reduce the area of occupancy of these breeding pairs, particularly if suitable alternative habitat is available.

OPR commits to not disturbing any active Malleefowl mound. Where a nest is discovered that cannot be avoided, the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for Ministerial permission to disturb.

Will the action fragment an existing important population into two or more populations?

The proposed action is unlikely to fragment an existing important population into two or more populations. Malleefowl will most likely be capable of crossing the rail embankment. There is a risk of potential train strike, however this is unlikely as the noise generated by approaching trains should act as a deterrent. Fauna passages and bridges along the length of the Rail Corridor will also enable opportunity for Malleefowl to cross the rail line.

Will the action adversely affect habitat critical to the survival of the species?

While a recently used mound was identified and a call was heard, there is limited potential habitat within the Proposal Area. It is possible that the small amounts of potential habitat within the Proposal Area may be adversely affected; however, OPR commits to not disturbing any active Malleefowl mound.

Will the action disrupt the breeding cycle of an important population?

The Proposal may potentially disrupt the breeding cycle of a small number of this species. OPR commits to not disturbing any active mound, however should land clearing cause the destruction of unused nest mounds that are used repeatedly by a mating pair, it is possible that the breeding cycle of that pair may be impacted. The viability of that breeding pair would then depend upon the availability of alternative suitable habitat. Noting the survey results and limited habitat potentially impacted, there is a low likelihood that an important population will be impacted.

Will the action modify, destroy, remove or isolate or decrease the availability of quality of habitat to the extent that the species is likely to decline?

Limited potential Malleefowl habitat is available within the Proposal Area. Should land clearing result in the destruction of mounds or habitat, it is possible that the viability of the population in the Murchison region may be impacted.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action is unlikely to introduce invasive species that are harmful to Malleefowl.

The decline of Malleefowl is largely due to:

- loss and fragmentation of habitat due to agricultural clearing;
- degradation of remnant habitat; and
- predation by foxes.

Construction of a Rail Corridor is not considered likely to result in an increase in the level of fox predation on Malleefowl that may be present in the Proposal Area.

Will the action introduce disease that may cause the species to decline?

The proposed action is unlikely to introduce disease that may cause the Malleefowl to decline.

Will the action interfere substantially with the recovery of the species?

The action may potentially impact on one or more breeding pairs of Malleefowl. Given that no Malleefowl were sighted within the Study Area, the determination of likelihood of their occurrence in

the Proposal Area is based upon the presence of a recently used mound (which the Proposal will not disturb), unused mounds, a call and tracks.

8.2.2.4 Hoffman's Spider Orchid

Caladenia hoffmanii is a tuberous perennial herb growing from 0.13 m to 0.3 m high usually found in clay, loam, laterite and granite, rocky outcrops, hillsides, ridges, swamps and gullies. Flowers are produced from August to October and are green, yellow and red (Ecologia 2010a). *C. hoffmanii* was recorded by Ecologia at two locations in the Freehold section of the Proposal Area in the vegetation communities Gh1 and Gh2 (refer to Appendix 1). Known individuals and populations of *C. hoffmanii* will not be impacted by the Proposal.

The locations of Hoffman's Spider Orchid are shown in Figure 8-1. The Proposal will not directly impact this species. The design of the Rail Corridor alignment will ensure that no indirect impacts (drainage, dust etc) will influence populations of this species.

8.2.2.5 Howtharra Mallee

Eucalyptus blaxelii is one of four species in the Loxophlebae series of Eucalyptus. *E. blaxellii* grows in sand over laterite, or brown clay on sandstone hills or creek flats which are widespread at the western end of the Proposal Area. 433 *E. blaxelli* plants were recorded at 143 locations in the freehold section of the Study Area, in association with vegetation communities Gh1, Gh2 and Gh3. A map showing locations of *E. blaxelli* can be found in Figure 8-1. A more detailed map can be found in Appendix 1. Coordinates for recorded locations of *E. blaxelli* can be found in Appendix 1.

As these habitats are moderately widespread in the region and as the percentage of total individuals is moderate (16.4%) in the Proposal Area, it indicates a low to moderate local endemism for this species. *E. blaxellii* does not appear to be locally restricted with records spanning 70 km and one outlier to 170 km.

Most known populations of the species are secure as they occur in areas that are unsuitable for farming due to the inaccessibility of the steep slope.

A nomination to remove this species from the listing of Declared Rare Flora was submitted to the WA Threatened Species Scientific Community and as a result it has now been altered to a Priority 4. Regardless, known locations of *E. Blaxelii* will be avoided by the Proposal. The design of the Rail Corridor alignment will ensure that no indirect impacts (drainage, dust etc) will influence populations of this species.

8.2.2.6 Moresby Range Drummondita

Drummondita ericoides is endemic to the Geraldton Sandplains bioregion and is known from 212 individuals at twelve locations and nine populations. 1.9% of the total numbers of plants were recorded inside the Proposal Area and 0.9% are in conservation reserves. It is estimated that the potential habitat recorded by Ecologia for this species covers 804 ha (vegetation units Gh1, Gh2 and Gh3) within the Study Area.

DEC's Moresby Range Drummondita Interim Recovery Plan (DEC, 2004) states that the main threats include inappropriate fire regimes and high levels of human activity.

D. ericoides grows on low heath on sandstone and laterite slopes, ridges and gullies of the Moresby Range in brown loam or sandy loam and clay soils in areas not suitable for agriculture and so has not been so highly cleared.

Known individuals and populations of *D. ericoides* will not be impacted by the Proposal.

8.3 MEASURES TO AVOID OR REDUCE IMPACTS

While the Proposal Area typically consists of a corridor up to 4 km wide, and approximately 200,000 ha, the actual disturbance will be much smaller, as the total area of disturbance (7000 ha) equates to approximately 3% of the total land area contained within the Proposal Area. Areas disturbed during construction, but not required for permanent operations will be rehabilitated following construction. This will include areas used for borrow and quarries.

OPR is committed to ensuring that all proposed disturbance areas have been suitably surveyed for NES species prior to disturbance. The survey information will be included in OPR databases and documentation to ensure that OPR will not disturb NES species or their habitat beyond the disturbance areas approved through the Commonwealth and State approval processes. Should NES species be found during construction in locations where impacts are unavoidable, OPR will seek Ministerial permission to disturb.

8.3.1 Performance Management

OPR has developed environmental management objectives, targets and performance indicators for NES fauna (Table 8-1).

Table 8-1 NES fauna management objectives, targets and performance indicators

OPR Management Objective	Target	Performance Indicators
Protect NES fauna.	No disturbance to NES fauna and their habitats beyond the disturbance areas described in the PER.	• Ground Disturbance Permits • Pre-disturbance fauna surveys • Fauna injury/death register • Incident Register • Rehabilitation criteria • Fauna habitat constraint maps • Conservation Significant Fauna Database
Prevent the introduction or spread of introduced fauna, and control species currently present.	• No introduction of domestic animals or pets. • No introduction of feral animals or increase in numbers of existing feral animal species.	• Incident Register • Success of feral animal controls • Landfill inspections

8.3.1 Management Strategies

OPR will implement the management strategies identified in Table 8-2 to reduce potential impacts on NES species.

Table 8-2 Matters of NES general management strategies

Management Strategies	Relevant EMP	Phase	Responsible Persons
Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat.	Fauna MP	Design & Construction	Construction Manager
Minimise trench length where practicable. Should trenching be required for distances in excess of 1000 m, inspect trenches and excavations outside of construction envelopes regularly and where any trenching is to remain open overnight, provide fauna ramps and inspect before work resumes the next morning to remove any trapped fauna	Fauna MP	Construction	Construction Manager, Environment Manager
All disturbance areas have or will be surveyed for EPBC protected species prior to disturbance. The survey information will be included in OPR databases and documented to ensure that OPR will not disturb species or their habitat beyond the disturbance areas approved in the PER. Should these species be found during construction in locations where impacts are unavoidable, OPR will minimise the disturbance in those areas and will seek permission to disturb.	Fauna MP	Construction	Construction Manager, Environment Manager
Turkeys nest dams will be fenced to restrict access by fauna. Fauna escape methods such as wire mesh will be fixed within turkeys nests to allow fauna egress.	Fauna MP	Construction & Operation	Construction Manager, Operations Manager
No domestic animals or pets will be permitted on site	Fauna MP	Construction & Operation	Construction Manager, Operations Manager
Feral animal controls will be specified in the Fauna Management Plan. Control strategies will be developed consistent with regional and local feral animal control initiatives.	Fauna MP	Construction & Operation	Environmental Manager
Include NES fauna protection specifications in all construction related contracts	Fauna MP	Construction	Construction Manager
Induct all workforce on NES fauna identification and encounter procedures (including feeding, littering, interaction etc)	Fauna MP	Construction & Operation	Construction Manager, Operations Manager
Apply and enforce speed limits to vehicles within potential NES fauna habitat	Fauna MP	Construction & Operation	Construction Manager, Operations Manager
Rehabilitation requirements will include the provision of suitable fauna habitat	Vegetation and Flora MP	Post-construction	Construction Manager

Following an assessment of matters of NES identified, it is considered that the impact of the proposed action upon populations of Western Spiny-tailed Skink and Malleefowl during the construction and operation of the Proposal are of most relevance and require additional management measures.

8.3.2 Western Spiny-tailed Skink

A mapping exercise (see Appendix 2a or 2d) was undertaken to identify potential habitats to ensure the Proposal does not significantly impact upon populations of Western Spiny-tailed Skink. During the design phase the rail alignment was deviated around known Western Spiny-tailed Skink populations where possible.

Measures to mitigate impacts to the species during construction and operation include:

- with the exception of the Rail Corridor, no disturbance will occur within a 200 m buffer of most known *Egernia stokesii badia* habitat. For the two known populations located close to the rail centreline, a buffer of 50 to 60m will be maintained and the construction disturbance width will be limited to an average of 100 m;

- any handling of *Egernia stokesii badia* will be undertaken by a suitably licensed reptile handler;
- all personnel involved in ground disturbing works are required to attend a site specific induction which will include guidelines in avoiding impacts to the species;
- OPR have developed fact sheets for all conservation significant flora and fauna species recorded along the rail including Western Spiny-tailed Skink with photographs of typical habitat and form;
- all known locations of Western Spiny-tailed Skink will be made available to personnel for upload into GPS equipment to ensure avoidance;
- fauna underpasses will be constructed under the rail line at the two locations where the Rail Corridor is located within 50 - 60 m of known populations. This will allow movement to be maintained between populations;
- provision of fauna passages below the rail lines to allow movement within the populations to continue in the two locations of centreline proximity identified during the survey; and
- translocation of individuals to habitats away from the development prior to construction, if required.

8.3.3 Malleefowl

Measures to mitigate impacts to Malleefowl during construction and operation include:

- OPR commits to not disturbing any active Malleefowl mound. Should a nest be discovered that cannot be avoided, the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for permission to disturb;
- all personnel involved in ground disturbing works are required to attend a site specific induction which will include guidelines in avoiding impacts to the species;
- OPR have developed fact sheets for all conservation significant flora and fauna species recorded along the rail including Malleefowl with photographs of typical habitat and form; and
- provision of fauna passages below the rail lines to allow movement across the Rail Corridor.

8.4 PREDICTED OUTCOMES

After mitigation and management measures have been applied, the Proposal is expected to result in the following outcomes in relation to matters of NES:

- no impacts to the Kalbarri Spider-orchid or Fitzgerald's Mulla Mulla as they have not been recorded within or in proximity to the Proposal Area;
- no direct or indirect impacts on the known locations of Hoffman's Spider-orchid, Moresby Range Drummondita or Howatharra Mallee as the predicted rail alignment allows for complete avoidance;
- low likelihood of significant impact on Carnaby's Black-Cockatoo, with only 1.3% of the potential feeding habitat within the Study Area expected to be impacted by the Proposal. Suitable habitat types are also extensively represented beyond the Study Area;
- low likelihood of significant impact on Slender-billed Thornbill, with only 2.9% of the potential habitat within the Study Area expected to be impacted by the Proposal. Suitable habitat types are also extensively represented beyond the Study Area;

- the Rail Corridor alignment has been designed to avoid all but two of the more than 50 populations of the Western Spiny-tailed Skink recorded in surveys undertaken within the Study Area. The Rail Corridor has been deviated to provide at least a 200 m buffer between most populations and the Rail Corridor. Only two populations will potentially be bisected by the proposed rail centreline. A buffer of 50 - 60 m will be maintained between disturbance and outcrop locations so that no known habitat will be directly impacted. As such there are not expected to be any significant impacts to the Western Spiny-tailed Skink; and
- there may be some localised movement of fauna away from the rail construction and operational corridor due to increased presence of people and machinery and the resulting increase in ambient noise and vibration.

With the implementation of the identified management measures, potential impacts on matters or NES are expected to be minor.

9 PROPOSAL ENVIRONMENTAL MANAGEMENT FRAMEWORK

9.1 PRINCIPLES OF ENVIRONMENTAL PROTECTION

Oakajee Port and Rail (OPR) recognises that environmental responsibilities go beyond those required for compliance and aims to encompass strong commitments to environmental management, leadership in sustainable development and social obligations.

The *Environmental Protection Act 1986* (EP Act) was amended in 2003 to include a core set of Principles that are applied by the Environmental Protection Authority (EPA) in formal assessments. As listed in Section 4A of the EP Act, these are:

- the precautionary principle;
- intergenerational equity;
- conservation of biological diversity and ecological integrity;
- principles related to improved valuation, pricing and incentive mechanisms; and
- waste management.

OPR has embraced the EPA's principles of environment protection as part of its Proposal engineering and design. The environmental objective of the Proposals design, in order of priority, is to:

1. Completely avoid the impact if possible
2. Substitute with a lesser impact
3. Include rehabilitation / engineering solutions to reduce the degree / risk of impact
4. Design operational controls and emergency response around reduction of impact

Demonstration of this approach is detailed within this Public Environmental Review (PER). OPR has applied these principles through consideration of alternative designs for the Proposal, comprehensive environmental investigations, stakeholder and community engagement and the commitment to local employment for construction and operation phases of the Proposal. Table 9-1 summarises OPRs consideration of the principles of environmental protection.

Table 9-1 Application of Principles of Environmental Protection

Principle	Consideration given to the Principle	Addressed in Section of PER
The Precautionary Principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the of the precautionary principle decisions should be guided by: a) Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment. b) An assessment of the risk-weighted consequences of various options.	OPR has undertaken detailed site investigations of the biological and physical environs. Where these investigations identify significant conservation issues, management measures have been and will continue to be incorporated into the Proposal design to avoid where practicable, or minimise any potential impacts.	See detailed assessment of factors in Sections 7 & 8
Intergenerational Equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	OPR recognises the responsibility it has to ensure that all land within its sphere of influence is preserved for future generations. This includes prompt and effective rehabilitation of disturbed land. OPR is committed to the principles of minimum resource use and emissions minimisation and will incorporate sustainability into Proposal design wherever practicable.	Section 7 & 8
Conservation of Biological Diversity and Ecological Integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	OPR will seek to minimise its footprint to avoid disturbance as far as practicable. OPR has sought alternative routes to avoid impacting recognised areas of conservation significance and is continuing biological investigations to identify other aspects of potential environmental significance of high preservation value.	See detailed assessment of factors in Sections 7 Rehabilitation and closure strategies in Section 9.2.3
Improved Valuation, Pricing and Incentive Mechanisms a) Environmental factors should be included in the valuation of assets and service. b) The polluter pays principle – those who generate pollution and waste should bear the costs of containment, avoidance or abatement. c) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. d) Environmental goals, having been established should be pursued in the most cost – effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to develop their own solutions and responses to environmental problems.	OPR acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles though out the feasibility phases. To date environmental factors have played a major role determining the Proposal design including decisions on route length and equipment selection to reduce pollution type impacts, and decision on route location to avoid environmental impact.	Section 7
Waste Minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	OPRs approach to waste management across all phases and components of the Proposal is in order of priority: avoid and reduce at source, reuse and recycle, and treat and/or dispose. The strategies for waste minimisation will be outlined within the Proposal Environmental Management System (EMS).	Section 7.10

9.2 ENVIRONMENTAL MANAGEMENT SYSTEM

OPR has developed an EMS to provide an over-arching structure by which the environmental management strategies and associated control measures have been developed. The OPR EMS has been developed in accordance with AS/NZS 14001 standard, with a focus on continuous improvement process, as outlined in Figure 9-1. To consolidate the strategies and control measures, a series of environmental objectives and targets have been developed within the EMS in accordance with the OPR Environmental Policy. To effectively address all potential environmental aspects and impacts, the OPR EMS has implemented the fundamental tools of risk identification and control to assist in developing the management strategies and control measures.

To ensure the implementation of all environmental objectives, targets and commitments during the delivery of the project, the OPR EMS will be finalised following final approval to implement procedures that integrate commitments within the procurement and construction programs. Routine audits of the system and a management review process will ensure the adherence to procedures and commitments during the delivery of the project. A detailed framework of the OPR EMS is presented in Figure 9-1.

A Safety Management System based on AS/NZS 4801 will be developed separately and aligned to the EMS framework. The OPR Incident Management System will be developed within the Safety Management System with procedures within the EMS instructing environmental teams and construction managers on managing environmental incidents via the Incident Management System. In addition, Emergency Response Procedures and Training, Competency and Awareness will be managed via the Safety Management System with procedures outlined within the EMS.

Table 9-2 outlines the proposed EMS management actions proposed.

Table 9-2 EMS management strategies

Management Strategies	Phase	Responsible Persons
Prepare and implement an EMS consistent with the Principles of ISO 14001 that includes the following elements: • incident management system; • targets and objectives; • promotion of continuous improvement; • compliance auditing; • environmental requirements in contracts; • environmental awareness and specific training (where relevant); and • obligations register.	Construction & Operation	Environment Manager
Inductions will be conducted for all employees and contractors to include information on: • the appropriate storage, handling and transport procedures for potential contaminants; • the importance of preventing contamination of all areas including marine waters; • emergency response procedures and responsibilities; • the importance of minimizing impacts on terrestrial fauna; • the procedures and protocols for fauna management; • methods of minimising power and water usage within the Proposal; • restricted access areas; • protection of significant flora and vegetation; • restriction of activities to approved areas; • the OPR clearing permit system; • waste management procedures including avoidance and minimisation, re-use and recycling, and appropriate disposal; • significance of Aboriginal heritage; • procedures to report potential new Aboriginal Heritage sites; • obligations under the *Aboriginal Heritage Act 1972* (AH Act); • requirements for the protection of known Aboriginal sites; and • other environmental management risks as identified through risk assessment procedures. The induction information may be tailored to particular positions so as to ensure that the information presented is relevant to the activities the position is responsible for.	Construction & Operation	Environment Manager
Prepare and implement an Emergency Response and Crisis Management Plans to include response to fire, hazardous material leaks or spillages, accidents and other key risks identified through OPR risk assessment and management processes (refer to Emergency Response Plans).	Construction & Operation	Environment Manager, Safety Manager
Prepare and implement a purchasing policy that includes: • preference for purchase of materials with low embodied energy; • energy efficiency of key energy using equipment; • appropriate communications; • spill protection as per regulation; • licences and other precautions regarding hazardous materials and safety risks; • key contractors to minimise waste by avoidance; and • reuse and recycling and ensuring safe waste disposal opportunities.	Construction & Operation	Construction Manager, Operations Manager

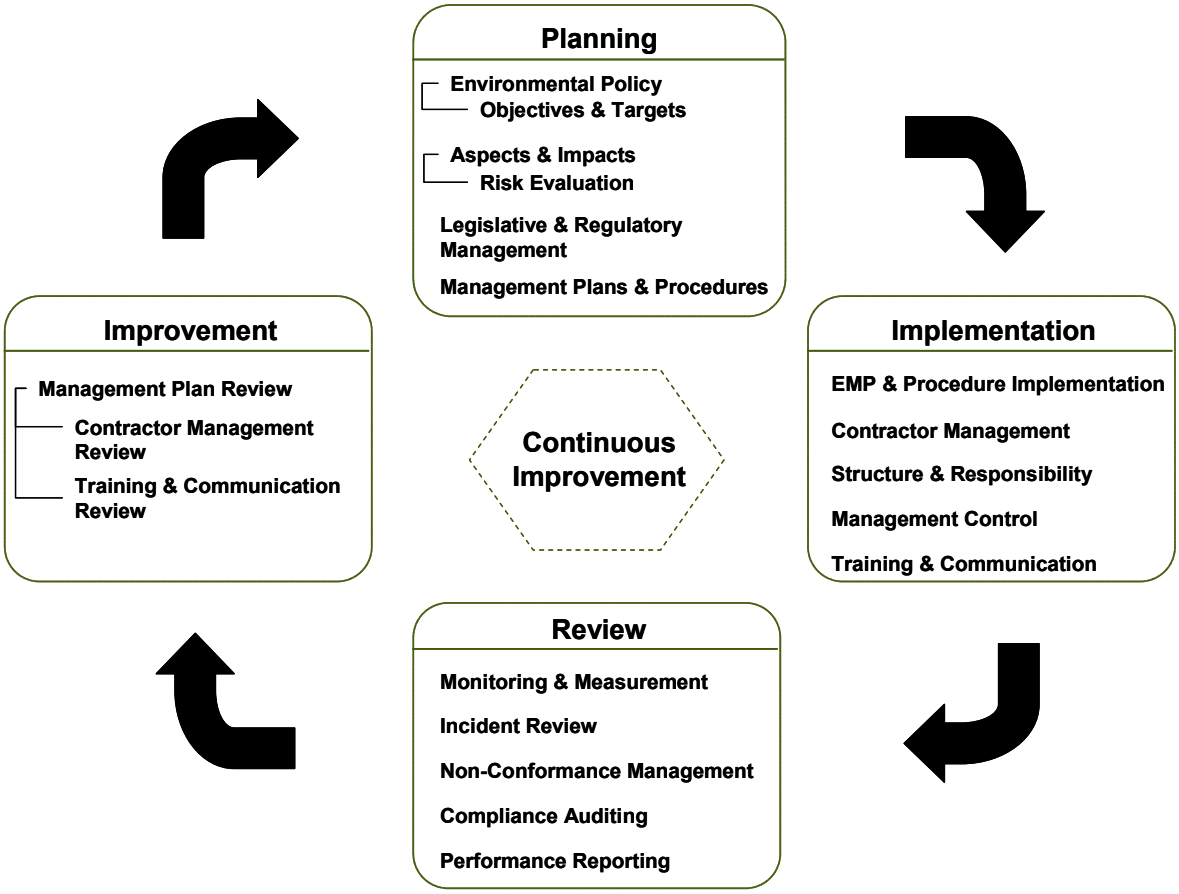


Figure 9-1 EMS process flowchart

A Safety Management System based on AS/NZS 4801 will be developed separately but will be aligned to the EMS framework, including emergency response procedures. Figure 9-2 demonstrates the proposed structure of the EMS.

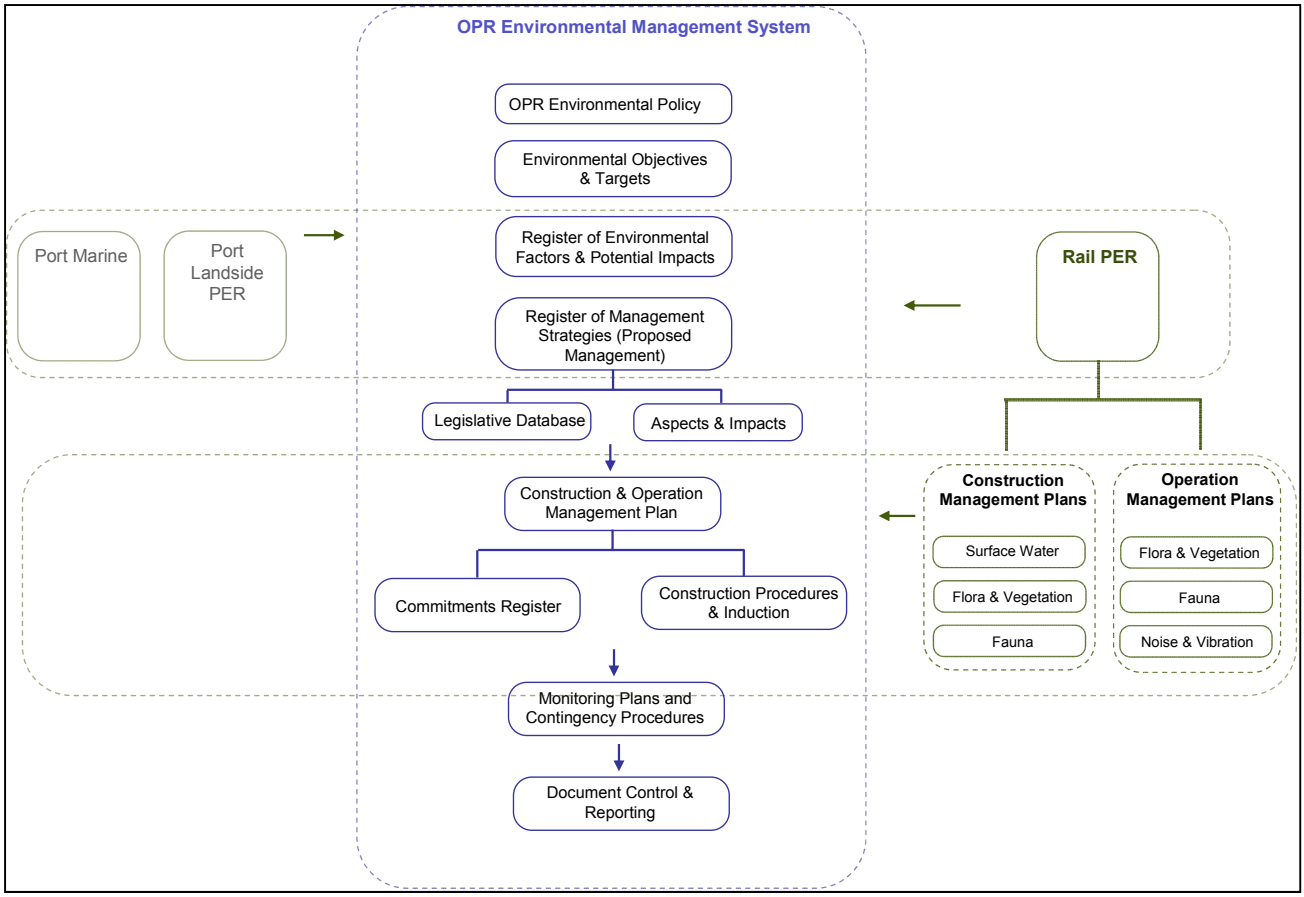


Figure 9-2 EMS structure

9.2.1 Environmental Management Plans

There are several significant environmental and social impacts expected as a result of this Proposal. OPR have developed Environmental Management Plans (EMPs) for these factors as a primary method of controlling, managing and monitoring the environmental impacts associated.

The EMPs are elements of the OPR EMS that will be used to achieve the environmental and social objectives, targets and commitments of the Proposal and the application of management and mitigation measures described in this PER.

An ISO 14001 based EMS will be finalised prior to commencement of construction, as will construction EMPs for the following:

- Aboriginal cultural heritage;
- acid sulfate soils (ASS);
- air quality;
- emergency response;
- vegetation and flora (including weed, clearing and rehabilitation);
- fauna, including terrestrial vertebrate and subterranean fauna;
- groundwater;

- surface water;
- hazardous materials and contamination;
- noise and vibration; and
- sustainable resource efficiency (including waste).

Operations EMPs will be finalised prior to operation, including management strategies relevant to:

- Aboriginal heritage;
- air quality;
- emergency response;
- fauna, including vertebrate, invertebrate and subterranean fauna;
- vegetation and flora;
- groundwater;
- surface water;
- hazardous materials and contamination;
- noise and vibration; and
- sustainable resource efficiency (including waste).

Table 9-3 contains a summary of significant management actions that will be included and in many cases expanded upon in the EMPs.

9.2.1 Consolidated Key Management Actions

Table 9-3 consolidates the key management actions proposed in this PER.

Table 9-3 Consolidated key management actions for the Proposal

Management Strategies	Relevant EMP	Phase	Responsible Persons
Vegetation and Flora			
Vegetation clearing will occur within clearly defined boundaries	Vegetation and Flora Management Plan (VFMP)	Design & Construction	Construction Manager
All conservation significant locations will be avoided where possible and will be visually marked with restricted access	VFMP	Design & Construction	Project Engineer, Construction Manager
Required clearing will be minimised, for example: • Material from cut rail sections will be used where practicable in preference to material sourced from borrow pits to minimise clearing; and • Pre-disturbed areas will be used wherever possible for temporary infrastructure.	VFMP	Design & Construction	Project Engineer, Construction Manager
Throughout the freehold area native vegetation will not be cleared except for the purposes of the rail alignment and access tracks where alternative routes are not practicable	VFMP	Design & Construction	Project Engineer, Construction Manager
The rail alignment will be restricted to an average disturbance width of 100 m in width when it passes through areas of native vegetation in the freehold area	VFMP	Design & Construction	Project Engineer, Construction Manager
Priority Ecological Communities (PECs) will be avoided and a 50 m buffer will be put in place around these areas	VFMP	Design & Construction	Project Engineer, Construction Manager
The impact on active creek beds will be minimised through the use of bridges and culverts, to help protect riparian vegetation. For more information see surface water section	Surface Water Management Plan (SWMP)	Design & Construction	Project Engineer, Construction Manager
All proposed disturbance areas that are to be located outside of the Study Area will be surveyed for all potential Threatened Ecological Communities, PEC, Declared Rare Flora (DRF) and Priority Species to the same level as the remainder of the Study Area. The results of these surveys will be used to perform the same vegetation and flora impact assessments as detailed in Section 7.2 of the PER.	VFMP	Design & Construction	Environment Manager
All final proposed disturbance areas will be subject to detailed targeted surveys for DRF and the following Priority Flora species prior to disturbance: • *Chamelaucium* sp. Yalgoo (P1); • *Eremophila* sp. Tallering (P1); • *Goodenia lyrata* (P1); • *Gunniopsis divisa* (P1); • *Petrophile vana* (P1); • *Ptilotus tetrandrus* (P1); • *Eremophila arachnoids* subsp. *arachnoids* (P3); • *Homalocalyx echinulatus* (P3); • *Tecticornia cymbiformis* (P3); • *Thryptomene* sp. Moresby Range (P3); and • *Thryptomene* sp. Wandana (P3). The survey information will be included in OPR databases and documentation to ensure that OPR will not disturb beyond the areas approved in the PER.	VFMP	Design & Construction	Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Significant disturbance (>5% of remaining species) of these eleven species will be avoided throughout the design and construction phases where practicable. Where significant disturbance is unavoidable, OPR will liaise with the Department of Environment and Conservation (DEC) prior to disturbance.	VFMP	Design & Construction	Environment Manager
The Proponent will report the results of further vegetation and flora studies to the EPA in accordance with approval conditions	VFMP	Design & Construction	Environment Manager
Records of the areas and prescriptions used for clearing and rehabilitation will be maintained in a Rehabilitation Register	VFMP	Construction	Environment Manager
Rehabilitation prescriptions will be developed for different vegetation types and soil types to include local native species with seed sourced locally where possible. A Construction Rehabilitation Management Plan will be prepared and implemented in consultation with the landowners.	VFMP	Construction	Environment Manager
A clearing control system will be implemented to restrict the number and extent of cleared areas to the minimum needed for safe and efficient implementation of the Proposal. The system shall include: • checks that clearing requirements are consistent with approvals; • GIS information identifying significant flora, fauna and heritage locations will be kept on an Environmental Constraints database for use when planning Proposal activities; • a communication and approval system that requires Management signoff; and • specifications for clearing.	VFMP	Construction	Construction Manager
Temporary construction areas will be rehabilitated as soon as practicable after construction	VFMP	Construction	Construction Manager
Completion criteria and monitoring methods will be developed for the assessment of rehabilitation progress	VFMP	Construction	Environment Manager
Topsoil management procedures will ensure that suitable topsoil and cleared vegetation is salvaged and stored for use in rehabilitation	VFMP	Construction	Construction Manager
Direct seeding and/or planting will be undertaken to stabilise surfaces and integrate landforms into the surrounding landscape and ecosystems	VFMP	Construction	Environment Manager
Weed assessments will be made along the corridor prior to significant ground disturbance. The assessments will continue on a regular basis and include reviews of hygiene controls and weed risks for all clearing and rehabilitation activities	VFMP	Construction	Construction Manager. Environment Manager
Movement of topsoil between sites where declared or significant weeds could be spread to new locations will be restricted	VFMP	Construction	Construction Manager
Initial clearing will occur as close as practicable to first construction activities	VFMP	Construction	Construction Manager
Stockpiled vegetation and topsoil will be stored away from water courses to prevent sedimentation	VFMP	Construction	Environment Manager
A Conservation Significant Flora Register will be maintained throughout Proposal activities which will include information such as distribution, abundance and relevant biological information	VFMP	Construction	Environment Manager
Weed hygiene: • machinery hygiene procedures will be implemented to manage the risks of weed introduction and export to and from the site; • all ground engaging equipment will be required to arrive on site clean of plant and soil material from other sites or hygiene work areas; • vehicles will be inspected at random and contract clauses will ensure that dirty equipment is compliant with the system; and • ground disturbance hygiene areas will include different hygiene work areas according to weed risks.	VFMP	Construction & Operation	Environment Manager
The majority of the weed control effort will be at the boundary of the Pastoral Area due to the low concentration of weeds within these areas.	VFMP	Construction & Operation	Environment Manager
Equipment and vehicles used in a weed risk area shall be cleaned down and a weed inspection form completed before the equipment is remobilised to other parts of the Proposal Area	VFMP	Construction & Operation	Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Washdown areas and rumble grids are to be located at key locations	VFMP	Construction & Operation	Environment Manager
Declared weed identification sheets are to be developed, displayed in site offices and communicated through site inductions	VFMP	Construction & Operation	Environment Manager
Maintain the Emergency Management Plan such that weed inspection reports, records of weed hygiene certificates and weed survey data is recorded and assessed. The Weed Hygiene Program will include workforce education to increase weed awareness.	Emergency Management Plan	Construction & Operation	Environment Manager
An incident will be raised and investigated if there is a non-compliance with the Weed Hygiene Program, or if weed survey results confirm that the Proposal is causing an increase in population or distribution of weeds	VFMP	Construction & Operation	Environment Manager
The Weed Hygiene Program will be regularly reviewed to ensure that the likelihood of reoccurrence is minimised	VFMP	Construction & Operation	Environment Manager
Weed surveys will be conducted as soon as practicable after construction to determine whether construction of the Proposal has increased the population or distribution of weeds. If determined that the Proposal has caused an increase in the population or distribution of weeds corrective actions (spraying, removal etc) will occur after consultation with relevant government authorities and weed experts as to the preferred course of action.	VFMP	Post-construction	Environment Manager
Off road traversing of vehicles will be prohibited unless authorised by the Site Environmental Manager	VFMP	Construction & Operation	Environment Manager
Monitoring of vegetation health will be undertaken ensure that the surface hydrology management measures are suitable.	VFMP	Construction & Operation	Environment Manager
An Emergency Management Plan will be prepared and implemented to limit the risk of inadvertent fire ignition. The Fire Management Plan will include controls regarding vehicle movement and maintenance, firebreaks, fire restrictions, fire fighting equipment, hot work procedures and training.	Emergency Management Plan	Construction & Operation	Safety Manager
There will be no unauthorised access to constraint areas including areas of conservation significance or heritage value	VFMP	Construction & Operation	Environment Manager
Implementation of measures to offset environmental loss, particularly related to the clearing of native vegetation in the freehold area. Such measures may include: • support of the Moresby Range Regional Strategy; and • investigation of targeted rehabilitation requirements along the Rail Corridor. Final offset measures will be determined in consultation with EPA and DEC.	-	Construction & Operation	Environment Manager
Fauna			
Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat.	Fauna Management Plan (FMP)	Design & Construction	Construction Manager
With the exception of the Rail Corridor, no disturbance will occur within a 200 m buffer of known *Egernia stokesii badia* habitat. If the Rail Corridor must pass through these areas, a 50-60m buffer will be maintained between the rail line and outcrops, and the construction disturbance width will be limited to an average of 100 m. Individuals will be relocated if found within construction areas, and additional culverts will be installed in these areas to act as fauna underpasses.	FMP	Design & Construction	Project Engineer, Construction Manager
Any handling of *Egernia stokesii badia* will be undertaken by a suitably licensed reptile handler	FMP	Construction	Environment Manager
Borrow pits or turkeys nests in the Weld Range area will be avoided where practicable, and the Rail Corridor will be restricted to an average 100 m in width.	FMP	Design & Construction	Project Engineer, Construction Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
No active Malleefowl nests will be disturbed. Where a nest is discovered that cannot be avoided the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for Ministerial permission to disturb.	FMP	Construction	Construction Manager
Minimise trench length where practicable. Should trenching be required for distances in excess of 1000 m, inspect trenches and excavations outside of construction envelopes regularly and where any trenching is to remain open overnight, provide fauna ramps and inspect before work resumes the next morning to remove any trapped fauna	FMP	Construction	Construction Manager, Environment Manager
All disturbance areas have or will be surveyed for Priority Fauna and *Environmental Protection and Biodiversity Conservation Act 1999* protected species prior to disturbance. The survey information will be included in OPR databases and documented to ensure that OPR will not disturb species or their habitat beyond the disturbance areas approved in the PER. Should these species be found during construction in locations where impacts are unavoidable, OPR will minimise the disturbance in those areas and will seek permission to disturb.	FMP	Construction	Construction Manager, Environment Manager
Turkeys nest dams will be fenced to restrict access by fauna. Fauna escape methods such as wire mesh will be fixed within turkeys nests to allow fauna egress.	FMP	Construction & Operation	Construction Manager, Operations Manager
No domestic animals or pets will be permitted on site	FMP	Construction & Operation	Construction Manager, Operations Manager
Feral animal controls will be specified in the Fauna Management Plan. Control strategies will be developed consistent with regional and local feral animal control initiatives.	FMP	Construction & Operation	Environmental Manager
The Rail Corridor will be fenced throughout the freehold area to prevent livestock death from train strikes	-	Operation	Construction Manager
The design and construction of the rail crossing of the State Barrier Fence of Western Australia will be in consultation with relevant government authorities	-	Design & Construction	Project Engineer, Construction Manager, Environment Manager
Conservation Estates			
Impacts on conservation reserves or areas proposed for conservation reservation will be avoided during Proposal design wherever practicable. Where disturbance is unavoidable, the width of the Rail Corridor and the size and location of borrow areas will ensure that the area of disturbance within current or proposed reserves will be minimised as much as possible.	N/A	Design	Project Engineer
The implementation of temporary construction infrastructure such as turkey nests, borrow pits, lay down areas and construction roads will be minimised as much as possible within proposed and gazetted nature reserves.	N/A	Design & Construction	Project Engineer, Construction Manager
No accommodation areas will be established within proposed or gazetted nature reserves.	N/A	Design & Construction	Project Engineer, Construction Manager
Consideration to ongoing management requirements for these areas will be incorporated into the design and construction phase to ensure that matters including continued access requirements, weed control, feral animal control are appropriately addressed. OPR will liaise with DEC to ensure that their requirements are addressed.	N/A	Design & Construction	Project Engineer, Construction Manager
Surface Hydrology			
Prepare and implement a SWMP to contain the following actions: • water from wash down bays will be collected, treated and released or recycled where possible; • identify relevant surface water monitoring points schedules and frequencies, together with trigger levels and responses for implementation of investigations and corrective actions where appropriate; • contain, monitor and appropriately treat (if required) any potentially contaminated stormwater prior to reuse or release to the environment; and • maintain all stormwater infrastructure to their designed capacity or function. The SWMP will be developed in consultation with the Department of Water (DoW)	SWMP	Design, Construction & Operation	Construction Manager, Operations Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
OPR will perform further detailed investigations to refine the current understanding of areas of sheetflow dependant vegetation that may be impacted by the Proposal. A hydrology assessment will be performed for these areas to determine the suitable drainage measures required to maintain sheetflow and restrict drainage shadows to within the area originally disturbed by the construction footprint.	SWMP	Design & Construction	Project Engineer, Environment Manager
Beds and Banks permits will be sought for activities which have the potential to interfere with named streams, water courses and embankments are to be obtained prior to construction activities.	SWMP	Construction	Environment Manager
The basis of design for bridges is to withstand 1 in 100 year average recurrence interval (ARI) flooding without damage and 1 in 2,000 year ARI flooding without structural damage.	SWMP	Design & Construction	Project Engineer
Design and install culverts, bridges or water crossings at drainage crossings, and at those areas of vegetation identified as surface water dependent, according to the following commitments: • minimise interference to overland flow and maintain sheet flow, and reduce the risk of shadow effects; • reduce pooling alongside the rail which may attract fauna; • includes appropriate erosion protection e.g. rip rap rock protection and reno mattresses; • where infrastructure may cause drainage to flow parallel to the rail formation, place culverts at regular intervals together with small interceptor banks to direct runoff and reduce ponding; • where practicable, construct bridges and major crossings at right angles to major drainage channels; • a risk audit should be completed to ensure these designs are appropriate to meet environmental and safety objectives; and • monitoring will occur to ensure surface water flows are maintained.	SWMP	Design & Construction	Project Engineer, Construction Manager, Environment Manager
Suitable drainage mechanisms (such as culverts) will be installed in areas of sheetflow dependant vegetation at defined low points.	SWMP	Design & Construction	Project Engineer
Locate camps and other supporting rail infrastructure away from creeks and waterways and at least 0.5 m above the 100yr ARI flood level for the area.	SWMP	Design & Construction	Project Engineer
Standard controls for hydrocarbon and waste management to be implemented to minimise the risk of spills and contamination.	Hazardous Materials & Contamination Management Plan (HMCMP)	Construction & Operation	Safety Manager, Construction Manager, Operations Manager
Groundwater			
Continue to investigate potential water sources for the Proposal in consultation with DoW and DEC	Groundwater Management Plan (GMP)	Prior to Construction	Environment Manager
Groundwater sources will be investigated and licensed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) which will ensure that groundwater abstraction is sustainably managed to protect groundwater quantity and quality such that Groundwater Dependant Ecosystems, subterranean invertebrate fauna and seasonal pools will not be significantly affected.	GMP	Construction	Environment Manager
All bores no longer required will be rehabilitated in accordance with Section 18 of the document 'Decommissioning of Bores (abandonment) of the Minimum construction of groundwater bores' (Land and Water Biodiversity Committee 2003).	GMP	Construction & Operation	Construction Manager, Operations Manager
All groundwater bore construction and groundwater abstraction will be licensed under the RIWI Act and managed in accordance with licence conditions and associated management measures. Management measures will determine appropriate trigger levels for contingency actions. Associated monitoring will be conducted to compare results against these trigger levels.	GMP	Construction & Operation	Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Noise, Vibration and Light			
Consultation programme with affected landholders based around the preferred centreline to identify and agree upon mitigation options that may include external noise barriers, internal sound proofing, building relocation or property purchase.	-	Design, Construction& Operation	Regional Manager, Project Director, Operations Manager
A Construction Noise Management Plan (NMP) will be submitted for approval in accordance with the Environmental Protection (Noise) Regulations 1997 prior to commencement of construction activities.	Construction NMP	Construction	Construction Manager
Design and place any construction lighting away from residents to reduce intrusion where practicable. Design and place lighting in accordance with AS4282-1997.	-	Construction	Construction Manager
Noise will be managed using a combination of noise reduction methods, and will comply with the Noise Regulations (construction) and SPP5.4 (rail operation) at all times. If the final alignment differs from what has been modelled, remodelling will be conducted to ensure that the relevant legislation can be met, and personnel will be made aware of noise related issues during inductions.	Operation NMP	Construction & Operation	Construction Manager, Operations Manager
Consultation with the occupants of affected premises regarding key construction activities such as blasting, haulage, compacting and pile driving will continue throughout construction periods.	Construction NMP	Construction & Operation	Public Relations Manager
Personnel will be made aware of noise related issues during inductions.	Construction NMP, Operation NMP	Construction & Operation	Construction Manager
An Operation NMP will be developed which will include detailed information on the following: • selection of equipment; • noise monitoring at designated sensitive receptors; • vibration monitoring to confirm expected levels at selected locations; • verification of noise modelling results; • monitoring to determine the success of noise mitigation measures; • contingency actions to be taken when the SPP5.4 target is exceeded, or a noise complaint is received; • incident management procedures including complaint management; • reporting requirements; and • specification of zones where future development will require residential development to consider “deemed-to-comply” measures.	Operation Noise MP	Operation	Environment Manager
Air Quality (Dust)			
Perform visual dust monitoring of construction and operations areas to ensure that fugitive emissions meet required standards. Dust management will include one or more of the following measures: • progressive and staged clearing of vegetation to limit the number of open areas • restrict vehicle movements to designated access tracks • revegetate cleared areas no longer being used • surface with gravel/lump product • apply water sprays • use chemical polymers to stabilise surfaces • set and enforce vehicle speed limits • incident reporting and follow up system • continuous improvement	Air Quality Management Plan (AQMP)	Construction & Operation	Construction Manager, Operations Manager
Control occupational dust levels in accordance with the requirements of the Mines Safety and Inspection Regulations (1995) and *Occupational Health and Safety Act 1984*	AQMP	Construction & Operation	Construction Manager, Operations Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Prepare and implement an AQMP that includes objectives, targets, and detailed management actions to minimise dust emissions at source, monitoring, incident management, and contingency measures	AQMP	Construction & Operation	Environment Manager, Construction Manager, Operations Manager
Soil Quality			
Design infrastructure to minimise disturbance of ASS	ASS Management Plan (ASSMP)	Design	Environment Manager, Construction Manager
Detailed individual rehabilitation plans for borrow areas and access tracks that will be returned to landholder control to be prepared in consultation with individual landholders prior to construction.	Borrow Area Rehabilitation Plans	Prior to construction	Regional Manager
Consult with landholders to integrate farm plan aspects into construction management.	-	Prior to construction	Regional Manager
When excavation in areas of potential ASS is required a detailed survey will be completed in accordance with DEC guidelines (DEC, 2004).	ASSMP	Prior to construction	Environment Manager
Prepare and implement an ASSMP to manage construction activities in areas of known or suspected ASS.	ASSMP	Prior to construction	Environment Manager, Construction Manager
Management of hazardous materials to ensure that risks of contamination of soil is minimised as outlined in Section 7.10.	Hazardous Materials & Contamination MP	Construction & Operation	Safety Manager, Construction Manager, Operations Manager
Waste and Hazardous Materials			
Hazardous material handling, storage and spill response will occur in accordance with Dangerous Goods Licences issued under the *Dangerous Goods Safety Act 2004* and Australian Standards.	HMCMP	Design, Construction & Operation	Environment Manager, Safety Manager
Prepare and implement a HMCMP to document in detail how chemicals, hydrocarbons and hazardous goods or waste will be managed. Control measures will include: • storage compliant with AS1940 and located away from watercourses; • Material Safety Data Sheets (MSDS) will be available for all chemicals used on site; • handling, use and storage of chemicals will be compliant with the relevant MSDS; • adequate fire control and spill response equipment will be available within work areas; • any hazardous materials required on site will be approved for use by the responsible manager prior to being transported to site; • all licences required for storage or handling of hazardous materials will be obtained, held on site and made available to all personnel; • hazardous waste will be removed from site by a licensed contractor for disposal in an approved facility in accordance with controlled waste regulations; • contractors handling or using hazardous materials will be required to be trained, to comply with applicable legislation and carry appropriate spill containment equipment; • used hazardous material containers will be labelled and stored appropriately for future use or disposal; • any fuel, oily waste storage, diesel generators and re-fuelling facilities will be constructed and regularly inspected to ensure compliance with all regulatory requirements; • a well drained wash down pad will be utilized for vehicles and equipment. an oil water separation system will be utilised to maintain water quality of any water emissions; and • remediate any contaminated sites in accordance with legal requirements.	HMCMP	Construction & Operation	Safety Manager, Construction Manager, Operations Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Prepare and implement a Waste Management Plan based on the hierarchy of waste minimisation: 1. Waste avoidance/reduction. 2. Reuse, recycling and reclamation. 3. Waste treatment. 4. Waste disposal. The plan will include the following actions: • prior to construction and prior to operation Proposal waste audits will be conducted to: - identify proposal waste streams; - quantify and characterise the waste types; - establish how each waste stream is generated; and - identify options to minimise each of the waste streams. • ensure that litter is minimised, and waste disposal, storage or transport occurs in accordance with relevant waste legislation and guidelines; • appropriate containers (vermin-proof) will be provided for putrescible waste and these wastes will be disposed of at a licensed facility; • appropriate facilities will be provided for waste materials, with separate areas for recyclable materials. Facilities will be secure and clearly labelled for the various waste streams; • concrete wastes and concrete wash out will be contained in lined bunds; and • conduct a waste management audit every three years.	Waste Management Plan	Construction & Operation	Environment Manager, Construction Manager, Operations Manager
Greenhouse Gases			
Energy use monitoring will be undertaken monthly and results reported to OPR Management.	Greenhouse Gas Management Plan (GHGMP)	Construction & Operation	Environment Manager
OPR will identify and comply with all energy usage and Greenhouse Gas (GHG) reporting requirements, and any future Commonwealth GHG legislation.	GHGMP	Construction & Operation	Environment Manager
Construction and operations will be conducted with efficiency of energy use as a guiding principal to reduce unnecessary GHG emissions	GHGMP	Design, Construction and Operation	Project Engineer, Operations Manager, Environment Manager
Consider fuel efficiency and emissions profiles for all new locomotive purchases.	GHGMP	Construction & Operation	Operations Manager
Report GHG emissions in accordance with National Greenhouse Emissions Reduction Scheme	GHGMP	Operation	Environment Manager
Participate in the Commonwealth Carbon Pollution Reduction Scheme as required	GHGMP	Operation	Environment Manager
Benchmark greenhouse emissions targets for each major phase of the Proposal against best practice.	GHGMP	Operation	Operations Manager, Environment Manager
Conduct annual energy audits of operations	GHGMP	Operation	Operations Manager, Environment Manager
Implement energy saving strategies for the rail system addressing factors such as fuel type, equipment design, rail design, operational procedures, schedules, loading and unloading systems, and technology.	GHGMP	Construction & Operation	Operations Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Heritage			
Aboriginal Heritage will be managed in accordance with the OPR Aboriginal Cultural Heritage Management Plan (ACHMP). The ACHMP will include the following commitments: • as part of the ongoing consultation with Traditional Owners (TOs) regarding Heritage, inform TOs on relevant proposed works, work schedules, and potential impacts on sites throughout the life of the Proposal; • undertake indigenous heritage surveys within proposed disturbance envelopes using suitably qualified archaeologists and anthropologists as agreed with TOs; • determine the nature, extent and significance of sites within the potential disturbance envelope; • establish cultural heritage database with GIS records of indigenous heritage site locations within the Proposal Area; • consider indigenous cultural heritage in Proposal planning and detailed design, avoiding significant sites where practicable; • seek approval to disturb known sites under section 18 of the AH Act where a known Aboriginal site impact is unavoidable; • document the location of protected indigenous heritage areas and make available (acknowledging confidentiality issues) to relevant employees; • implement conditions of any s18 applications; • audit implementation of s18 conditions and ground disturbance procedures; • implement the OPR ground disturbance permitting procedure incorporating checks on heritage sites and exclusion zones; • implement procedures outlined in the ACHMP if a suspected heritage site is detected; • if appropriate, mark and signpost sites to reduce the likelihood of inadvertent damage; and • monitor clearing/earthworks activities with qualified site heritage monitors.	ACHMP	Construction	Heritage Manager
Visual Amenity			
Undertake visual amenity modelling for public viewscapes through the Wokatherra Gap and Chapman Valley areas.	Visual Amenity Management Plan (VAMP)	Design	Environment Manager
OPR will develop a VAMP that will be prepared with reference to the following guidelines: • Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and Institute of Environmental Management and Assessment, 2002); • Visual Landscape Planning in WA (WAPC 2007); and • Reading the remote: landscape characters of Western Australia (CALM; 2004). The VAMP is to include the following elements: • identify and assess the visual landscape characteristics of the key public viewscapes, in particular through the Wokatherra Gap and Chapman Valley project areas; • identify the potential visual and amenity issues identified through the visual and amenity modelling; • identify mitigation measures, in particular to ensure that visual impacts from public viewscapes are maintained; • management and mitigation measures to minimise the exposure of residence locations to any lighting; • considerations of viewscapes from residences will be included in land access negotiations; • minimisation of the height of the rail embankment; and • minimisation of lighting exposure through compliance with Australian Standard AS4282-1997: Control of Obtrusive Effects of Outdoor Lighting.	VAMP	Design Construction Operations	Environment Manager
Other Social and Economic			
Undertake progressive rehabilitation of disturbed areas to minimise the visual effect of bare earth	VFMP	Construction	Construction Manager
Use local provenance species and matching local relative plant densities and strata in rehabilitation areas	VFMP	Construction	Construction Manager Environment Manager

Management Strategies	Relevant EMP	Phase	Responsible Persons
Rail Safety and Risk will be managed according to the *Rail Safety Act 1998* including risk assessment and safety provisions for all level crossings.	-	Design, Construction & Operation	Safety Manager
In accordance with access agreements and leases negotiated with the State, signage will be erected and maintained to alert members of the public to risks and hazards and exclude them from construction and operational areas.	Traffic Management Plan	Construction & Operation	Public Relations Manager
Include Public Risk in Risk Assessment and Risk Management programmes	-	Construction & Operation	Public Relations Manager
Public notices shall be communicated prior to any works taking place that may affect public access.	-	Construction & Operation	Public Relations Manager
Prepare and implement a Traffic Management Plan that includes designated traffic areas, measures for safe traffic interactions with the public and arrangements with local government and Main Roads WA. The plan will include the following actions: • At intersections with public access roads, maintain a visual inspection and cleanup routine to minimise dust spill and spread onto public roads • Traffic will be minimised at public access areas • Specify ongoing consultation arrangements with Local Shires and Main Roads WA.	Traffic Management Plan	Construction & Operation	Construction Manager, Operations Manager, Public Relations Manager
Matters of National Environmental Significance (NES)			
Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat.	FMP	Design & Construction	Construction Manager
Minimise trench length where practicable. Should trenching be required for distances in excess of 1000 m, inspect trenches and excavations outside of construction envelopes regularly and where any trenching is to remain open overnight, provide fauna ramps and inspect before work resumes the next morning to remove any trapped fauna	FMP	Construction	Construction Manager, Environment Manager
All disturbance areas have or will be surveyed for EPBC protected species prior to disturbance. The survey information will be included in OPR databases and documented to ensure that OPR will not disturb species or their habitat beyond the disturbance areas approved in the PER. Should these species be found during construction in locations where impacts are unavoidable, OPR will minimise the disturbance in those areas and will seek permission to disturb.	FMP	Construction	Construction Manager, Environment Manager
Turkeys nest dams will be fenced to restrict access by fauna. Fauna escape methods such as wire mesh will be fixed within turkeys nests to allow fauna egress.	FMP	Construction & Operation	Construction Manager, Operations Manager
No domestic animals or pets will be permitted on site	FMP	Construction & Operation	Construction Manager, Operations Manager
Feral animal controls will be specified in the Fauna Management Plan. Control strategies will be developed consistent with regional and local feral animal control initiatives.	FMP	Construction & Operation	Environmental Manager
Include NES fauna protection specifications in all construction related contracts	FMP	Construction	Construction Manager
Induct all workforce on NES fauna identification and encounter procedures (including feeding, littering, interaction etc)	FMP	Construction & Operation	Construction Manager, Operations Manager
Apply and enforce speed limits to vehicles within potential NES fauna habitat	FMP	Construction & Operation	Construction Manager, Operations Manager

9.2.2 Rehabilitation and Closure

It is the intention of the WA Government that the larger OPR Proposal will form a key link between Mid-West mining operations and export markets. Therefore the closure of the OPR Proposal is not expected to result in the closure of the land developed by the Proposal, as the WA Government (or others with the authority of the Government) will simply take over the rail operations.

There will be large areas of land that is required to be cleared for construction purposes but will not be required during operation. This may include land previously used for the following Proposal facilities:

- borrow areas – a majority of the borrow areas will not be required for maintenance purposes and therefore will be rehabilitated;
- turkey's nests – all turkey's nests not required for maintenance purposes will be drained and rehabilitated;
- quarries – Small portions of each of the quarries may remain open to provide access for rock material during maintenance, however the remainder of the quarries will be rehabilitated;
- access tracks – Access roads along the railway will remain open for maintenance purposes however many other access tracks (such as access to borrow areas etc) will be rehabilitated; and
- accommodation camps – Of the six accommodation camps proposed only one or two of the camps will remain open during operation of the Proposal. All others will be decommissioned and rehabilitated. In addition, portions of the remaining camps will also be decommissioned and rehabilitated.

These areas will be rehabilitated to form a safe, stable, self sustaining and not polluting landform.

Table 9-4 summarises the management strategies to be implemented for those areas to be rehabilitated.

Table 9-4 Rehabilitation management strategies

Management Strategies	Phase	Responsible Persons
Rehabilitation requirements will include the provision of suitable fauna habitat	Construction & Operation	Environment Manager, Construction Manager
Prepare and implement a VFMP which will include the following: • Records of the areas and prescriptions used for clearing and rehabilitation will be maintained in a separate Rehabilitation Register • Rehabilitation prescriptions for different vegetation types and soil types to include local native species with seed sourced locally where possible. • Initial clearing will occur as close as practicable to first construction activities • Direct seeding and/or planting will be undertaken to stabilise surfaces and integrate landforms into the surrounding landscape and ecosystems • Stockpiled vegetation and topsoil will be stored away from water courses and spread over disturbed areas that are no longer required • Rehabilitated areas will be constructed to blend in and allow suitable habitat for recolonising fauna. • Topsoil management procedures will be developed and implemented to ensure that suitable topsoil and cleared vegetation is available for rehabilitation of cleared areas • The impact on active creek beds will be minimised and any additional construction areas will be rehabilitated as soon as practicable after construction • Bores not required will be decommissioned. Remaining bores will be capped and locked for potential future use • Salvage and store topsoil so that rehabilitation of construction areas can be completed in a timely, effective and efficient manner • Develop completion criteria and monitoring methods for the assessment of rehabilitation progress	Construction & Operation	Environment Manager, Construction Manager, Operations Manager

10 SUMMARY AND CONCLUSIONS

The Proponent, Oakajee Port and Rail (OPR), has considered the potential environmental impacts, undertaken substantial investigations and taken the results of these into account when preparing this Public Environmental Review (PER). Given the Proposal design considerations and the implementation of management strategies outlined in this PER, OPR considers that the Proposal can be implemented consistent with Environmental Protection Authority (EPA) objectives and without risk to matters of National Environmental Significance (NES).

The development of the Proposal shall not impact upon any Threatened Ecological Community (TEC), Priority Ecological Communities (PEC) or Declared Rare Flora (DRF). Based on predictions of clearing using the indicative Rail Corridor alignment five out of the 87 species of Priority Flora recorded within the Study Area will be impacted, to a maximum of 3.8% of their known population. Additional surveys prior to disturbance will be commissioned for those species with the highest risk of being significantly impacted.

There will be minimal disturbance to significant vegetation communities. Significant Beard and Burns (1976) associations will be cleared by a maximum of 0.2% of their pre-European extent. A minimum of 92% of significant Ecologia (2010a) vegetation units will remain unaffected by the Proposal.

The Proposal does not impact upon any existing conservation reserves, with the exception of Reserve 16200, which has been vested in the Minister for Water for the conservation of water supply and conservation of flora and fauna. Approximately 14.6% of Reserve 16200 will be impacted.

The expected maximum disturbance to the Narloo, Woolgorong and Twin Peaks proposed conservation reserves, is 0.2%, 0.2% and 1.3% respectively.

The development of the Proposal may result in the direct loss of some fauna due to accidental strikes of trains; however it is likely that over time local fauna will avoid the immediate area. No significant impacts are expected to fauna listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *Wildlife Conservation Act 1950* (WC Act), including the Malleefowl and Western Spiny-tailed Skink. Significant impacts on SRE species is considered unlikely due to the linear nature of the infrastructure and the reduced disturbance footprint within the freehold area. No significant impacts are expected for subterranean fauna as no significant excavations or long term abstraction of large volumes of groundwater.

There may be minor, localised impacts to the surface hydrology in some areas, including drainage shadow effects in sheetflow areas, and localised ponding along drainage lines. The drainage shadow is expected to be limited to the general disturbance envelope, due to the use of environmental culverts. The predicted outcome is no significant indirect impacts to sheetflow dependent vegetation, such as Mulga.

The majority of groundwater abstraction within the Proposal Area will be short-term and/or relatively small volumes over a number of locations, which will substantially reduce the likelihood of unacceptable impact. All groundwater use will be licensed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) which will ensure sustainable use.

The preferred Rail Corridor alignment has been selected to minimise the number of receptors impacted. The Proposal will result in three residences receiving noise in excess of the limit set in State Planning Policy 5.4 (SPP5.4), and seven residences receiving noise in excess of target criteria (WAPC 2009b). Noise mitigation measures may include external noise barriers, internal sound proofing and building. Consultation with affected landholders will determine the appropriate mitigation measures to be taken.

Dust emissions are expected primarily during construction of the Proposal. Emissions will be short-term and subject to best practice dust controls.

The waste and hazardous material issues relating to this Proposal are similar to those faced and managed by many other remote operations in Western Australia (WA). Significant risk reduction will be achieved through the application of industry standard preventative controls, storage and handling standards, incident reporting and remedial capacity.

It is anticipated that the Proposal will contribute approximately 0.02% of Australia's annual Greenhouse Gas (GHG) emissions. Emissions will be reported under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), and OPR will be required to participate in the proposed Carbon Pollution Reduction Scheme.

Management measures will minimise the risk of inadvertent disturbance to registered and unregistered Aboriginal heritage sites; however the Proposal will directly impact a number of sites. Permission will be sought under the *Aboriginal Heritage Act 1972* (AH Act) for disturbance to any registered site. Management measures will minimise the risk of inadvertent disturbance to registered and unregistered sites. OPR will continue to liaise with Native Title claimants in the area and work towards creating sustainable opportunities for Aboriginal people.

The design, alignment, and position of the Rail Corridor on lower relief land will prevent significant impacts to general visual amenity in agricultural and pastoral landscapes and from the sensitive location of the Moresby Range. Disturbance minimisation and rehabilitation will minimise any impacts to visual amenity as a result of the Proposal.

Potential environmental and social impacts associated with the Proposal are summarised in Table 10-1, as well as proposed management strategies.

Table 10-1 Potential environmental and social impacts

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
BIOPHYSICAL					
Vegetation and Flora	Maintain the abundance, biodiversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance of adverse impacts and improvement of knowledge.	• Native vegetation subject to broad scale grazing with low levels of disturbance throughout the pastoral area in the eastern two thirds of the Study Area • Approximately 830 vascular flora species recorded within the Study Area. • Largely cleared land used for farming with small, detached remnants of native vegetation in the western third of the Study Area (freehold area). • 62 Weed species recorded within the Study Area, including 3 Declared Weeds occurring largely in the freehold area • 26 Beard vegetation associations recorded within Study Area. • 72 Ecologia vegetation units recorded within Study Area. • No TECs known from within the Study Area. • 4 PECs known from within the Study Area. • 3 EPBC Act listed flora species, 2 of which are DRF. 87 Priority Flora recorded within the Study Area. • Agricultural land use in the freehold area dominated by broad scale dryland farming with crops and pastures.	• The most significant potential impact identified is the direct impact of clearing of native vegetation for construction of the Rail Corridor. Most of the disturbance of native vegetation is in the pastoral area 5900 ha out of a total of 6000 ha). • Indirect impacts may also occur on vegetation within and immediately adjacent to the Rail Corridor and ancillary facilities from interference with local drainage patterns. • Spread of weeds, particularly from construction and maintenance activities • Indirect impacts through possible increases in the frequency of fire. • Increased risk of erosion and / or sedimentation impacting on vegetation. • Possible fragmentation of vegetation and flora populations, which may impact on population dynamics and increase edge effects	• Clearing control system will be implemented to restrict the number and extent of cleared areas to the minimum needed for safe and efficient implementation of the Proposal. • Vegetation clearing will be minimised and will occur within clearly defined boundaries. • All conservation significant locations will be avoided where possible and will be marked with restricted access. • Throughout the freehold area native vegetation will not be cleared except for the purposes of the Rail Corridor itself and access tracks where alternative routes are not practicable. • Rail Corridor restricted to an average 100 m disturbance width through areas of native vegetation in the freehold area. • PECs will be avoided and a 50 m buffer will be put in place around these areas. • More detailed weed assessments completed along the corridor prior to significant ground disturbance and hygiene controls based on this information and consultation with landholders. • Restricted movement of topsoil and machinery or hygiene controls between sites where weeds could be spread to new locations during construction. • Workforce education to include weed awareness and control information. • Maintain Weed Hygiene Program such that weed inspection reports, records of weed hygiene certificates and weed survey data is recorded, assessed and reported. The Weed Hygiene Program will be regularly reviewed. • Use incident reporting system to identify and rectify non-compliance with the Weed Hygiene Program, • Post-construction weed survey and weed control program to ensure that new weed infestations from construction activities are controlled. • Preparation and implementation of construction rehabilitation management plans	**Vegetation Clearing** • Approximately 6000 ha of native vegetation. • Up to 100 ha of vegetation clearing in the freehold area. • Sheetflow dependant Mulga will not be significantly impacted due to the installation of 'environmental' culverts • Weeds controlled by survey, hygiene and control measures. • Consideration of offset package for residual environmental impacts. **Significant communities:** • No impacts to TECs or PECs. • Reductions in vulnerable Beard and Burns (1976) mapped associations all less than 0.2% or pre-European extent and not considered significant. • >92% of significant Ecologia vegetation units within the Study Area to remain undisturbed by the Proposal **Significant Flora:** • No impacts to DRF • Majority of Priority Flora species will not be significantly impacted by the Proposal. 11 species subject to further surveys pre-disturbance to allow Proposal to avoid where practicable resulting in no threat to the viability of

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome

				in consultation with landholders.
				• Monitoring of vegetation health to ensure that surface hydrology management measures are effective.
				• Fire Management Plan implemented to limit the risk of inadvertent fire ignition and define fire fighting capability requirements.
				• All proposed disturbance areas located outside of the Study Area to be surveyed for all potential TEC, PEC, DRF and Priority Species to the same level as the remainder of the Study Area.
				• All final proposed disturbance areas will be subject to detailed targeted surveys for DRF and the following Priority Flora species:
				  • *Chamelaucium* sp. Yalgoo (P1)
				  • *Eremophila* sp. Tallering (P1)
				  • *Goodenia lyrata* (P1)
				  • *Gunniopsis divisa* (P1)
				  • *Petrophile vana* (P1)
				  • *Ptilotus tetrandrus* (P1)
				  • *Eremophila arachnoids* subsp. *Arachnoids* (P3)
				  • *Homalocalyx echinulatus* (P3)
				  • *Tecticornia cymbiformis* (P3)
				  • *Thryptomene sp. Moresby Range (P3)*
				  • *Thryptomene sp. Wandana (P3)*
					Priority Flora species.

				• Significant disturbance (>5% of remaining species) of Priority flora species will be avoided throughout the design and construction phases where practicable. Where significant disturbance is unavoidable OPR will liaise with the Department of Environment and Conservation (DEC) prior to disturbance. • Implementation of measures to offset residual environmental loss. Such measures may include support of one or more of: the Moresby Range Regional Strategy, acquisition of native vegetation areas for conservation management, support for further survey and scientific investigation. Final offset measures will be determined in consultation with EPA and DEC.	

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
Fauna	Maintain the abundance, biodiversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance of adverse impacts and improvement of knowledge.	• Continuous fauna habitat with low levels of disturbance throughout the pastoral area. • Highly fragmented fauna habitat associated with remnant native vegetation throughout the freehold area. • A total of 21 conservation significant fauna species have been identified as occurring or likely to occur within the Study Area, including 5 EPBC listed species. • Intensive survey work arranged by OPR on the Western Spiny-tailed Skink (Black form) has resulted in an increase of around 50% in the known populations and extended the known range. • 2 confirmed and 4-6 possible Short Range Endemic (SRE) species occur within Study Area. • Stygofauna and Troglofauna expected to be found throughout the Study Area.	**Fauna Habitat:** • The most significant potential impact identified is the direct impact of clearing of habitat for construction of the Rail Corridor. Most of the disturbance of native vegetation is in the pastoral area. • Indirect impacts may also occur on habitat within and immediately adjacent to the Rail Corridor and ancillary facilities from interference with local drainage patterns. **Significant Fauna** Of the 21 species identified, survey and assessment work has found that only 7 may potentially be impacted by the Proposal. ▪ Malleefowl ▪ Crested Bellbird (southern subspecies) ▪ Rufous Fieldwren (western subspecies) ▪ Western Spiny-tailed Skink (Black form) ▪ Gilled Slender Blue-tongue ▪ Yuna Broad-blazed slider ▪ *Lerista eupoda* • Incidental fauna impacts via vehicle strike. • Potential increase in feral animal activity. • Indirect impacts through possible increases in the frequency of fire. • Potential indirect impacts via noise, light spill and vibration. • Potential impacts on subterranean fauna via groundwater drawdown associated with water supply. • Potential impacts on SRE through habitat removal.	• Turkeys nest dams will be fenced to restrict access by fauna. • Minimise the length of open trench at any one time. • Inspect trenches and excavations regularly and remove any trapped animals promptly. • No domestic animals or pets will be permitted on site. • Feral animal control strategies will be developed and implemented consistent with regional and local feral animal control initiatives. • All disturbance areas have or will be surveyed for Priority Fauna and EPBC protected species prior to disturbance. • Where practicable, rocky outcrops and large trees will be left in situ for fauna habitat. • With the exception of the Rail Corridor, no disturbance will be permitted to occur within a 200 m buffer of known *Egernia stokesii badia* habitat. If the Rail Corridor must pass through these areas, a 50 - 60m buffer will be maintained between the rail line and specific habitat used for shelter (rock outcrops), and the construction disturbance width will be limited to an average of 100 m. Additional culverts will be installed in these areas as fauna underpasses. • Relocation of *Egernia stokesii badia* individuals if found within the disturbance envelope. • Any handling of *Egernia stokesii badia* will be undertaken by a suitably experienced reptile handler. • No active Malleefowl nests will be disturbed. Where a nest is discovered that cannot be avoided the nest will be disturbed only once all Malleefowl adults and chicks have left the nest. If this is not possible OPR will apply for permission to disturb. • Borrow pits or turkeys nests in the Weld Range area will be avoided where practicable, and Rail Corridor will be restricted to an average 100 m in width. • Exclude livestock from construction areas. • Consult with relevant agencies regarding the	**Fauna Habitat** • Approximately 6000 ha of potential fauna habitat will be cleared. • Majority of fauna habitat within the Proposal Area is well represented throughout the surrounding region through the pastoral area. • Fauna habitat is largely avoided in the freehold area. **Significant Vertebrate Fauna:** • Of the 7 species potentially impacted, the only species with known direct impacts to potential habitat is the Spiny-tailed Skink (Black form). The impact is expected to be restricted to the potential habitat surrounding 2 known populations out of more than 50 known populations hence is not considered a significant threat to the species. • Impacts on the remaining species are expected to be negligible due to habitat avoidance, broad distribution or minimal impact to defined habitat (e.g. where habitat is riparian, impacts are generally narrow and perpendicular to the habitat). **Significant Invertebrate Fauna:** • The narrow linear nature of the Proposal disturbance is unlikely to cause a significant impact on SREs. • Short term nature of peak water demand for

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				rail crossing of the State Barrier Fence	construction, abundance of suitable habitat and adaptation to dynamic water table conditions means no significant impact on stygofauna expected. • Limited potential to impact on troglofauna due to the narrow linear footprint of the Proposal and widespread habitat. **Fauna - General** • There will be some occasional direct loss of fauna due to vehicle strike. • There may be some localised movement of fauna away from the rail construction and operational corridor due to increased presence of people and machinery and the resulting increase in ambient noise and vibration. • Control measures for feral animals, fire, dam access, trenches, incident reporting and workforce education are expected to limit fauna impacts to negligible.
Conservation estates	Protect the environmental values of areas identified as having significant environmental attributes.	Conservation reserves in the freehold area tend to be small and fragmented. There is a proposal to create a larger reserve based around the values of the Moresby Range. There are a number of other small conservation reserves near to the Proposal Area throughout the freehold area. The Proposal crosses one reserve, Reserve 16200 which is vested in the Minister for Water Resources for the purposes of water supply and conservation of flora and fauna, In the pastoral area there are three areas proposed for conservation reservation:	• Reduction in the size of Conservation estate. • Clearing of native vegetation and potential fauna habitat in Conservation Estate. • Clearing of native vegetation and potential fauna habitat in proposed conservation estate (recently acquired pastoral leases) in the pastoral area. • Possible indirect impacts on Conservation Estate associated with introduction of weeds, disturbance of local drainage, increased risk of fire, introduction of feral animals.	• Conservation reserves or proposed conservation reserves have now been excluded from the Proposal Area where feasible (the Proposal Area boundaries have been altered to avoid these areas). A considerable amount of planning and consultation used to define the Proposal Area to avoid and minimise interaction with conservation estate and proposed conservation estate. • The boundaries of these reserves are therefore at, or near to, the boundary of the Proposal Area. Where disturbance is unavoidable, the width of the Rail Corridor and the size and location of borrow areas will ensure that the area of disturbance within proposed reserves will be minimised.	• Planning has avoided direct impact on existing conservation reserves with the exception of 14.6% of Reserve 16200 (2.5 ha) to enable separation of rail and road traffic for safety reasons. • No impact to the Moresby Range Nature Reserve • Planning has minimised the Intersection of the Proposal with three proposed conservation reserves. Expected maximum disturbance: o 0.2% of Woolgorong

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		• Former Woolgorong Pastoral Lease • Former Twin Peaks Pastoral Lease • Former Narloo Pastoral Lease.		• Temporary construction infrastructure such as borrow areas, construction access and water supply will be minimised within proposed conservation reserves. Accommodation camps and ballast quarries will not be located within proposed reserves. • Strict weed management procedures including vehicle hygiene, detailed weed surveys (pre and post construction) and weed control measures to be implemented in proposed nature conservation reserves. • Preparation and implementation of construction rehabilitation management plans in consultation with landholders. • Emergency Management Plan implemented to limit the risk of inadvertent fire ignition and define fire fighting capability requirements. • Other measures identified in Vegetation and Flora, and Fauna sections of this PER, implemented as appropriate within proposed conservation reserves.	Ex-Pastoral Station ○ 1.3% of Twin Peaks Ex-Pastoral Station ○ 0.2% of Narloo Ex-Pastoral Station. • Potential indirect impacts on Conservation Estate and Proposed Conservation Estate managed by the development and implementation of specific management plans to control weeds, feral animals, drainage and fire.
Surface Hydrology	Maintain the quantity and quality of surface water so that existing and potential environmental values, including ecosystem function, are protected. To maintain the integrity, ecological functions and environmental values of wetlands.	• Study Area lies within the catchments of the Chapman, Greenough and Murchison Rivers. • Most creeks and rivers within the Study Area are episodic and major flows are the result of cyclone and major storm events. • The Study Area does not contain any wetlands of significance. • The Study Area intersects one RIWI Act Surface Water Management Area; the Greenough River and Tributaries. • The most significant surface water features in the Study Area are the Greenough River and tributaries and sheetflow in areas of sheetflow dependant vegetation.	• Changes to surface water flow caused by altered drainage conditions. • Impacts on stream vegetation due to altered stream flow conditions. • Impacts on sheetflow dependent vegetation due to altered sheet flow conditions. • Approximately 9 bridges over waterways and a number of culverts. • Pooling of water during significant rainfall events. • Increases in sediment loads particularly during construction. • Contamination of surface water from hydrocarbon or other spills. • Increased stream bed or bank erosion near drainage crossings. • Impacts on farm and pastoral productivity due to altered drainage conditions.	• Prepare and implement a Surface Water Management Plan. • Beds and Banks permits are to be obtained prior to construction activities. • Culverts and bridges will ensure downstream hydraulic capacity is maintained. • Suitable drainage mechanisms (such as environmental culverts) will be installed in areas of sheetflow dependant vegetation and at defined low points. • Design and install culverts, bridges or water crossings at drainage crossings, and at those areas of vegetation identified as surface water dependent, according to the following commitments: ○ minimise interference to overland flow, maintain sheet flow and reduce shadow effects ○ reduce pooling alongside the rail ○ include appropriate erosion protection ○ Where infrastructure may cause drainage to flow parallel to the rail formation, place culverts at regular intervals together with small interceptor banks to direct runoff and reduce ponding ○ Where practicable, construct bridges	• No significant impacts on surface hydrology are expected as bridge and culverts will be designed to maintain surface water flows. • Minor, localised impacts may occur in some areas including drainage shadow effects in sheetflow areas, and localised ponding along drainage lines but will be minimised by the use of environmental culverts. • Significant rainfall events during construction may cause short-term localised erosion but risks will be minimised as construction sediment controls will be established as soon as practicable. Within regional context erosion or subsequent impacts not expected to be significant. • Minimal risk of contamination of surface

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				and major crossings at right angles to major drainage channels ○ Monitoring of selected waterways to occur to ensure surface water flows are maintained. • Bridges will generally be designed perpendicular to the watercourse to reduce the likelihood of stream diversions. Culverts will be in the same direction as drainage lines; therefore likelihood of diversion is reduced. • All waterway crossings will be implemented in accordance with conditions set by DoW. These requirements will ensure that surface water hydrology is not significantly impacted • Further detailed investigations to refine understanding of areas of sheetflow dependant vegetation that may be impacted. A hydrology assessment will be performed for these areas to determine more detailed drainage measures to maintain sheetflow and restrict drainage shadows to within the area originally disturbed by the construction footprint. • Detailed consultation with landholders to assist in the design of rail and road drainage design, land access arrangements and land management measures. • Standard controls for hydrocarbon and waste management to be implemented to minimise the risk of spills and contamination.	water as standard hydrocarbon and waste management controls are implemented. • Impacts on farm and pastoral productivity are not expected to be significant with the implementation of detailed surface water management measures.
Groundwater	Maintain the quantity and quality of groundwater so that existing and potential environmental values. Including ecosystem function, are protected.	• Low level use of shallow aquifers with no significant groundwater users or groundwater dependent vegetation identified within the Study Area. • The Study Area intersects two RIWI Act Groundwater Management Areas; the Gascoyne and East Murchison. • The Proposal does not intersect any Public Drinking Water and Supply areas.	• Potential drawdown on aquifers from up to 200 bores required for construction, with some being retained during operation • Drawdown impacts could include impacts on groundwater dependent vegetation, stygofauna and other groundwater users. • Possible impacts on pastoral water supply • Possible impact on groundwater quality or from hydrocarbon or other spillage or contamination.	• Continue to investigate potential water sources for the Proposal in consultation with DoW and DEC. • All groundwater sources will be investigated and licensed under the RIWI Act. • Groundwater bore construction and abstraction will be licensed under the RIWI Act and managed according to licence conditions and associated management measures which will include monitoring and reporting. • Specific investigations will determine appropriate trigger levels for contingency actions. Associated monitoring will be conducted to compare results against these trigger levels. • Bores no longer required will be rehabilitated in accordance with DoW guidelines. • Ongoing consultation with landholders to	• The majority of groundwater abstraction will be short-term and/or relatively small volumes over a number of locations, which will significantly reduce the likelihood of significant impact. • Groundwater use will be licensed under the RIWI Act which will ensure sustainable use. • Risks of groundwater contamination minimised by the implementation of standard controls for hydrocarbon storage. • Impacts on pastoral water

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				include water supply aspects. Any impacts on pastoral water supply due to the Proposal will be rectified by OPR.	supply not considered likely.
POLLUTION					
Noise, Vibration and Light Spill	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the Proposal by ensuring that noise levels meet statutory requirements and acceptable standards. To avoid or manage potential impacts from light overspill and comply with acceptable standards.	• Background noise levels consistent with rural setting - measured noise levels from 4 locations varied from LA90 23 - 26 dB at night, while the day time levels ranged from LA90 27 - 30 dB. • Vibration currently restricted to minor and low level vibrations from rural activities. • Few light sources, particularly in the eastern part of the Study Area. Light sources generally restricted to farm houses, road traffic and occasional farming activities at night.	**Construction** • Blasting may be necessary in isolated locations where continuous rock is encountered leading to noise and vibration. • Construction noise will be short term (weeks-months) as the construction face will continuously advance. • Activities such as compaction during construction may cause vibration but the proximity to residences means that this is unlikely to be felt and is expected to be short term. • Temporary lighting during construction activities. **Operation** • Increase in noise sources means 3 receptors may exceed the outdoor noise limit criteria at night (State Planning Policy 5.4). An further 3 receptors in this category are owned by LandCorp and are not considered noise sensitive premises. • An additional 7 receptors may exceed the outdoor noise target criteria at night. A further 7 receptors are owned by LandCorp (see above). • Train movements are expected to be audible at approximately 55 receptors (including those above). • Light impacts restricted to road crossings, signals and temporary illumination of tracks by trains and service vehicles at night. Light impacts from maintenance camps expected to be negligible due to their remote location. • Increases in vibration levels in close proximity to rail.	• The preferred Rail Corridor has been selected to minimise the number of receptors impacted and the degree of impact has been minimised by route selection where possible. • Consultation programme with affected landholders based around preferred centreline to identify and agree upon mitigation options that may include external sound barriers, internal sound-proofing and building relocation. • Use a combination of noise reduction methods to comply with the Noise Regulations (construction) and SPP5.4 (rail operation). • Modelling completed for the preferred centreline as well as practical extremities of the Special Act Corridor (SAC) to determine the range of possible noise outcomes and to cater for possible minor changes to preferred centreline. • Personnel will be made aware of noise related issues during inductions • Consultation with affected premises regarding key construction activities will commence before construction and continue throughout construction. • A Construction Noise Management Plan will be submitted for approval in accordance with the Environmental Protection (Noise) Regulations 1997 prior to commencement of construction. • Design and place any construction lighting to reduce intrusion to residences where practicable. Design and place lighting in accordance with Australian Standard AS4282-1997 Control of Obtrusive Effects of Outdoor Lighting. • An Operation Noise Management Plan will be developed which will include more detailed information on the following: o Selection of construction and operational equipment o Noise and vibration monitoring plans and results to be made publicly available o Verification of noise modelling o Monitoring to determine the success of noise mitigation measures	• Ambient noise levels will increase during both construction and operational phases within adjacent areas. • Compliance with SPP5.4 expected to be attained by consultation and negotiation with landholders regarding a range of mitigation measures at an individual landholder level. • Compliance with noise regulations during construction, criteria expected to be able to be achieved subject to a Construction Noise Management Plan under the Environmental Protection (Noise) Regulations (1997) • Occasional noise events from rail movements audible at up to 55 sensitive receptors largely throughout the freehold area. • Light impacts able to be managed using Australian Standard. • Vibration impacts expected to be insignificant as they will be restricted to within 20 m of the Rail Corridor.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				○ Monitoring to check on vibration levels at selected locations as required ○ Contingency actions to be taken when noise target is exceeded, or noise complaint is received ○ Incident management procedures ○ Reporting requirements ○ Specification of any zones where the operation of the rail will require further residential development to consider "deemed-to-comply" measures.	
Air Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Dust is currently restricted to localised, short-term events caused by the movement of cattle, and vehicle movements on unsealed roads. • Large scale episodic dust events caused by general dust lift during windy conditions occur occasionally and may lead to exceedances of NEPM levels. • Within freehold areas, dust is also generated from erosion processes due to agricultural activities such as ploughing prior to seeding and the summer grazing of stock.	• Activities or areas that may result in dust emissions include: ○ Exposed surfaces ○ Construction earthworks ○ Blasting and crushing of rock ○ Vehicle movements and ore transport • The construction face will be constantly moving, meaning that construction impacts will generally be short-term in nature.	• Best practice dust controls to ensure that dust emissions are minimised and avoided. • Perform visual dust monitoring of construction and operations areas to ensure that fugitive emissions meet required standards. • Progressive and staged clearing of vegetation to limit the number of open areas • Restricted vehicle movements to designated access tracks. • Apply water sprays and/or dust suppressants to exposed areas and unsealed roads during construction. • Set and enforce vehicle speed limits. • Contractual specification of Dust Extinction Moisture (DEM) levels for ore haulage. • Control occupational dust levels in accordance with the requirements of the Mines Safety and Inspection Regulations 1995 and *Occupational Health and Safety Act 1984*. • Prepare and implement an Air Quality Management Plan that includes objectives, targets, and detailed management actions to minimise dust emissions at source, monitoring, incident management, and contingency measures.	• Dust emissions will increase during both construction and operational phases but will be managed under an Air Quality Management Plan that will detail management actions for both phases. Impacts are not expected to be significant following management measures. • Emissions from construction will be short-term and subject to best practice dust controls. • Emissions from operations are expected to be insignificant. • Compliance with relevant Occupational Health and Safety air quality standards.
Soil Quality	Ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria	• 16% of Study Area expected to have moderate-high risk of acid sulfate soils (ASS). • Broadacre farming throughout the freehold area that includes cropping and grazing, with some more intensive land use towards the western end of the Study Area. Soils throughout this zone have been repeatedly cultivated and may be depleted in organic matter and nutrients. • Grazing on unimproved pasture	• Potential changes to soil chemistry through disturbance of ASS. • Alterations to soil structure from disturbance impacting on productivity and stability. • Potential increase in soil erosion. • Potential changes to soil productivity. • Contamination of soils from hydrocarbon or other spillage. • Indirect impacts (on soils and farm productivity) via spread of weeds and diseases.	• Potential ASS areas identified from geological mapping. • Design infrastructure to minimise disturbance of ASS. • When excavation in areas of potential higher risk ASS is required a detailed survey will completed in accordance with DEC guidelines (DEC, 2004). • Prepare and implement an ASS Management Plan to manage construction activities in areas of known or suspected ASS. • Detailed individual rehabilitation plans for areas disturbed for construction purposes.	• The application of individual landholder consultation and management controls through the land access negotiations for biosecurity, drainage management, and integration with farm planning is expected to result in impacts being acceptable. • No significant impacts are

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		(largely native vegetation) throughout the Pastoral Area • Soil erosion from occasional dust storms and intense rainfall events.		• Consultation with individual landholders completed as part of land access negotiations to include integration of farm plan aspects into construction management. This will include drainage management, biosecurity, vehicle hygiene, stock and cropping management during construction and operation. • Generic Borrow Area Rehabilitation Plan for other borrow areas to be retained within the operational corridor.	anticipated arising from disturbance of ASS as only 1.3% of the 16% of Proposal Area expected to have moderate-high risk of ASS requires excavation.
Waste and Hazardous Materials	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Minimal hazardous material stored and no registered contaminated sites within the Study Area due to rural land use. • Nearby waste management facilities are limited to Shire landfills that are significant distances apart. • Minor dumping of waste consistent with historic rural activities. • Some hazardous materials (particularly diesel) may be transported along major roads to service inland mining operations.	**Waste** • Solid and liquid wastes will be generated by the Proposal and may impact upon the environment by causing contamination, increasing the risk of disease and encouraging feral animals. • Up to 6 Wastewater Treatment Plants (WWTPs) required for a peak workforce of up to 3000. • Liquid hydrocarbon wastes will be generated during both construction and operational phases. • Inert and putrescible solid wastes will be generated during both phases of the Proposal. These will largely be associated with the accommodation requirements of the construction workforce. **Hazardous Materials** • Hazardous materials such as fuel, oils, lubricants, chemicals and explosives will be required for the construction (and some for operation) and may be stored inappropriately or spilt potentially casing contamination of soil or water, and exposing native animals and livestock to hazards. • Fuels oils are flammable and could lead to an increased risk of fire. • Transport of hazardous materials along major traffic routes is not expected to be significant and the potential for vehicle/rail interaction has been eliminated by the selection of a grade separation bridges where the rail crosses the North West Coastal Highway (NWCH) and the Chapman Valley Road.	• Inert and putrescible waste will be disposed of at licensed or registered landfills created along the Rail Corridor where distance to existing Shire Landfills is prohibitive. • Prepare and implement a Waste Management Plan based on the hierarchy of waste minimisation. • Treated wastewater from Construction and Operations Camps will be discharged at designated spray irrigation areas to be established near the camps, or the wastewater will be treated to a standard that is suitable for use for dust suppression (subject to DoH requirements). • WWTPs will be subject to licensing under Part V of the EP Act. • Wastewater will be spread over a large area (in accordance with Water Quality Protection Note – Irrigation with Nutrient Rich Wastewater). • Hazardous wastes will be stored and transported in accordance with relevant legislation to ensure that there is no discharge to the environment. • Hydrocarbons will be transported, stored and used in accordance with industry best practice to reduce the risk of spillage to the environment. • Hydrocarbon spills will be reported as incidents and responded to immediately. Spill kits will be kept in designated positions to allow swift response. Any contaminated soil or used clean up equipment will be taken to a licensed facility. • Hazardous material handling, storage and spill response will occur in accordance with Dangerous Goods Licences issued under the *Dangerous Goods Safety Act 2004* and Australian Standards. • Prepare and implement a Hazardous Materials	• The waste or hazardous material issues are similar to those faced and managed by many other remote operations in WA. The quantities of waste expected to be generated are not significant. • Application of industry best practice preventative controls such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to reduce contamination risks to the environment to a level that is insignificant. • Current legislative controls are expected to ensure that waste and hazardous materials are managed to avoid significant impacts to the environment.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				and Contamination Management Plan to document in detail how chemicals, hydrocarbons and hazardous goods or waste will be managed. This plan will ensure compliance with the *Contaminated Sites Act 2003*.	
GHG Emissions	To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.	• Greenhouse Gas (GHG) emissions from the Mid-West are currently minor. • Majority of iron ore in the Mid-West currently being transported by road. • No industries that are required to report under the NGER Act are currently located within the Study Area.	• 48,000 kL of diesel to be used during construction, estimated 45,000 kL during operation. • Estimates: 250,000 t of CO2-e during construction, 130,000 t /yr during operation. • Represents approx 0.02% of Australia's annual GHG emissions.	• Energy use monitoring will be undertaken monthly and results reported to OPR Management. • OPR will identify and comply with all energy usage and GHG reporting requirements, and any future Commonwealth GHG legislation. • Consider fuel efficiency and emissions profiles for all new locomotive purchases. • Implement energy saving strategies for the rail system addressing factors such as fuel type, equipment design, rail design, operational procedures, schedules, loading and unloading systems, and technology.	• The Proposal is not expected to make a significant contribution to Australia's annual GHG emissions (0.02% of Australia's annual GHG emissions will be generated). • The Proposal will increase the GHG efficiency of Mid-West mines hauling ore to port. • Reporting under the NGER Act will be required. • OPR is expected to participate in the proposed Carbon Pollution Reduction Scheme.
• SOCIAL SURROUNDS					
Heritage	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	• Indigenous heritage sites are known at a number of locations in the Study Area. • The Proposal is within the external boundaries of the Naaguja, Amangu, Widi Mob, Mullewa Wadjari and Wajarri Yamatji Native Title claims. • Department of Indigenous Affairs registered Aboriginal sites within the Proposal Area include Weld Range and Jack Hills, which are known to have mythological associations to local Indigenous people.	Potential impacts relate primarily to direct disturbance and include: • Disturbance of sites during construction • Landscape level changes • Collection and/or defacing of artefacts/artworks • Accidental damage of artefacts by off-road vehicle use • Indirect disturbance to sites from changes in water flows, spillages, dust, or other indirect impacts. • Sites associated with watercourses within the Proposal Area are the most likely to be impacted as the sites tend to be concentrated around water courses and the Proposal must cross a number of water courses.	• OPR will avoid Aboriginal sites wherever practicable. Where it is not practicable to do so, OPR will consult with each of the native title claim groups in relation to the mitigation and salvage of any affected Aboriginal sites and seek the consent of the Minister for Indigenous Affairs pursuant to Section 18 of the AH Act. • OPR has agreed processes in place with each of the Native Title claim groups affected by the Proposal to facilitate the identification of unregistered Aboriginal sites and Aboriginal heritage surveys will be progressively conducted over the Proposal Area prior to commencement of construction. • OPR has in place Heritage Protocols with Native Title groups. The implementation of these protocols will be via an Aboriginal Heritage Management Plan which includes: • Protection of sites in situ. • Consultation and Section 18 processes, if required, for those sites that cannot be avoided. • Earthworks management – including	• The Proposal will have an unavoidable impact on a number of Aboriginal heritage sites. Where practicable, significant heritage sites will be avoided. Ongoing consultation and indigenous participation in heritage survey work will assist OPR to ensure that impacts are acceptable. • With the implementation of management measures, the risk of inadvertent disturbance of sites is minimised and any unavoidable disturbance is authorised under the AH Act.

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				the use of monitors. • Salvage and storage management. • OPR will also implement procedures (as identified in the Heritage Protocol) for the identification and management of any additional sites located during the construction phase of the Proposal. • OPR intends to negotiate Comprehensive Agreements with each of the registered Native Title Claimant Groups. Such agreements would outline opportunities for Indigenous involvement e.g. employment, training and contracting arrangements.	
Visual Amenity	To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.	• Study Area includes areas of gentle undulation in the freehold area, with largely cleared farming land and relatively low population concentrations. • Population and exposure to visual impact is highest through the Wokatherra Gap (through the Moresby Range) and Chapman Valley at the western end of the Study Area. • The Moresby Range has local iconic value as a viewscape from Geraldton and surrounds and is the subject of a specific planning activity by the Shire of Chapman Valley. • The rail will be unable to be seen from Geraldton town due to distance and screening by the Moresby Range. • In the Pastoral Area the land is relatively flat and vegetation is mostly intact. There are large distances between residential dwellings and these are limited to pastoral landholders.	• The Proposal will be a long linear feature with potential impacts to viewscapes from public and private locations at the western end. • Viewscapes are more significant in the western part of the Proposal Area as the route traverses the Chapman Valley and Wokatherra Gap in the Moresby Ranges. • In undulating areas the topography creates both visual exposure and screening depending upon location. • Through the pastoral area the Proposal is not expected to have a significant visual impact as: ○ The land remains relatively uncleared, and the vegetation will generally provide a visual barrier ○ The land is relatively flat, therefore the number of visual vantage points is reduced.	• Route selection and engineering constraints related to grade and earthmoving mean that impacts on visual amenity are limited. • Prepare and implement a Visual Amenity Management Plan (VAMP) that will include visual amenity modelling for public viewscapes through the Wokatherra Gap and Chapman Valley. • The VAMP will outline mitigation measures that may include visual screening (rail or viewscape), rehabilitation, and use of local native species. • Progressive rehabilitation of disturbed areas (including the rail embankment) to minimise the visual effect of bare earth. • Using local provenance species and matching local relative plant densities and strata in rehabilitation areas. • Consideration of viewscapes from residence locations to be included in land access negotiations. • Minimisation of the height of the rail embankment • Minimisation of exposure to any lighting through compliance with Australian Standard AS4282-1997 Control of Obtrusive Effects of Outdoor Lighting.	No viewscape impacts on major settlements, townships or communities. Impacts to public viewscapes around the Moresby Range (Wokatherra Gap) and Chapman Valley will be mitigated via the use of measures that include rehabilitation screening. Visual impacts during construction will be short term.
Other social and economic	To ensure that existing and planned recreational uses are not compromised over the extent of the region. To ensure that risk from the proposal is as low as reasonably	• The Study Area and surrounds currently generates income largely from farming, mining and fishing. • The Study Area does not contain or pass in close proximity to any major population centres. The land use is rural, and the Proposal Area contains numerous track and minor road crossings.	• Possible impacts on public recreation via restrictions to access, opening up of new access, additional population pressure on recreational assets (particularly during construction). • Possible risks to public safety largely from road/rail interactions and from storage and transport of hazardous goods such as diesel. • Possible impacts to farming and pastoral	• Workforce inductions will include information about regional recreational assets (particularly relevant environmental information), management of public interactions with the Proposal and environmental management requirements for the Proposal. • Workforce inductions will include information on acceptable access, activities and behaviours relating to construction areas	• Risks to the public from rail/road interactions are expected to be managed to as low as reasonably achievable by using grade separation at major crossings and industry standard safety warning systems at other

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	achievable and complies with acceptable standards and EPA criteria.	• Due to the rural land use of the Study Area recreational activities are limited; however several landholders located within or near the Study Area offer accommodation to tourists.	operations.	through all freehold and pastoral properties. • Consultation with individual landholders completed as part of land access negotiations to include integration of farm plan aspects into construction management. This will include drainage management, biosecurity, vehicle hygiene, stock and cropping management during construction and operation. • The public will be excluded from all construction areas, therefore these areas are not expected to provide a public risk. • In accordance with access agreements and leases negotiated with the State, signage will be erected and maintained to alert members of the public to risks and hazards and exclude them from construction and operational areas. • Include Public Risk in Risk Assessment and Risk Management programmes • Public notices shall be communicated prior to any works taking place that may affect public access. • Prepare and implement a Traffic Management Plan that includes designated traffic areas, measures for safe traffic interactions with the public and arrangements with local government and Main Roads WA. • Rail Safety and Risk will be managed according to the *Rail Safety Act 1998* including risk assessment and safety provisions for all level crossings.	crossings. • Application of industry best practice preventative controls to hazardous materials such as risk assessment and the application of storage and handling standards, incident reporting and remedial capacity are expected to reduce risks to the public to a level that is insignificant. • Recreational use of the Proposal Area is minor. Workforce education processes are expected to reduce the risk of unacceptable workforce impacts on recreational assets to negligible. Increase in accessibility to areas is not expected to lead to significant recreational use pressures. • Dissection of farm paddocks and inconvenience for farm operations is expected to be managed via land access negotiations with individual landholders.

11 ACRONYMS

Term	Expansion/Definition
ABS	Australian Bureau of Statistics
ACHMP	Aboriginal Cultural Heritage Management Plan
AH Act	*Aboriginal Heritage Act 1972* (WA)
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council / Agricultural and Resource Management Council of Australia and New Zealand
AQMP	Air Quality Management Plan
ARI	Average Recurrence Interval
ARRP Act	*Agriculture and Related Resources Protection Act 1976*
ASS	Acid Sulfate Soils
BARP	Borrow Area Rehabilitation Plan
BAWA	Birds Australia Western Australia
BIF	Banded Iron Formation – BIF is the main iron source in the region.
BoM	Bureau of Meteorology
CCI	Chamber of Commerce and Industry
CRL	Crosslands Resources Limited
DAF	Department of Agriculture and Food
DEC	Department of Environment and Conservation
DEM	Dust Extinction Moisture
DEWHA	Department of Environment, Water, Heritage and the Arts
DIA	Department of Indigenous Affairs
DLGRD	Department of Local Government and Regional Development
DMP	Department of Mining and Petroleum
DoH	Department of Health
DoT	Department of Transport
DoW	Department of Water
DRF	Declared Rare Flora
DSD	Department of State Development
Ecologia	*ecologia* Environment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority
EPASU	EPA Service Unit
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESA	Environmentally Sensitive Area – as defined by declaration under section51B of the EP Act.
ESD	Environmental Scoping Document – sets the scope of investigations for the Proposal.
FESA	Fire Emergency Services Authority of WA
FMP	Fauna Management Plan

Term	Expansion/Definition
FY	Financial Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIOA	Geraldton Iron Ore Alliance
GPA	Geraldton Port Authority
IBRA	Interim Biogeographic Regionalisation of Australia
LGA	Local Government Authority
MDPL	Mitsubishi Development Pty Ltd
MML	Murchison Metals Limited
MRO	Murchison Radio-astronomy Observatory
MWDC	Mid West Development Corporation
NEPC	National Environmental Protection Council
NES	National Environmental Significance
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NWCH	North West Coastal Highway
NGER	*National Greenhouse and Energy Reporting Act 2007* (Commonwealth)
OEPA	Office of the EPA
OIE	Oakajee Industrial Estate
OPR	Oakajee Port and Rail Pty Ltd
PEC	Priority Ecological Community
PER	Public Environmental Review
PTA	Public Transport Authority
PW Act	*Public Works Act 1902*
RIWI Act	*Rights in Water and Irrigation Act 1914*
SAC	Special Act Corridor
SDA	State Development Agreement
SIA	Social Impact Assessment
SPP5.4	State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning
SRE	Short Range Endemic – species with very restricted geographic distribution
Statement 469	Ministerial Statement 469
SWMP	Surface Water Management Plan
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
The Proposal	OPR Rail Development
TOs	Traditional Owners
VAMP	Visual Amenity Management Plan
VFMP	Vegetation and Flora Management Plan
WA	Western Australia
WAPC	Western Australian Planning Commission

Term	Expansion/Definition
WATECSC	Western Australian Threatened Ecological Communities Scientific Committee
WC Act	*Wildlife Conservation Act 1950* (WA)
WRC	Waters and Rivers Commission
WWTP	Wastewater Treatment Plant

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APPENDICES

1. Vegetation and Flora Assessment
2. Terrestrial Fauna Assessments
    a. Vertebrate Fauna Assessment
    b. SRE Assessment
    c. Subterranean Invertebrate Fauna – Desktop Assessment
    d. Rail *Egernia stokesii badia* – Summary of Results
3. Surface Water Assessment
4. Groundwater Assessment
5. Acid Sulfate Soils Assessment
6. Railway Noise Assessment
7. Detailed Vegetation and Flora Figures
8. Relevant Draft EMP's
9. Proposal Area Boundary Coordinates
10. Potential Quarry Locations
11. Electronic Copy of PER