



DBNGP Stage 5 Expansion Looping Project

**DBPL00-501-0722-01 Construction
Environmental Management Plan**

CONTROLLED VERSION 2

401012-00624

17 August 2011



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D	Issued for approval	 J Gratten	 D Gratten	 D Ferguson	17-Aug-11

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Strategen Document Control of DBP Controlled Version 2 Revision C

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	Rev A	For client review	H Ventriss	Electronic	31 Dec 2010
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DBNGP STAGE 5 EXPANSION LOOPING PROJECT CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

REVISION RECORD

Controlled Version 1

Revision No and Date	Sections revised	Description of revision
Revision A 28 Feb 2007		CEMP document as approved by DoIR and Federal Minister for Environment with management plans approved by DEC.
Revision B 30 March 2007	Cover pages	Modified to acknowledge Alinta
	Ch 5 Section 5	Wetland Management Protocol modified to acknowledge need to flag 200 m buffer area around wetlands identified on ELL.
	Ch 5 Section 7	Acid sulphate soil management protocol revised with respect to treatment rates and approved methods of treating soil.
	Ch 7 Section 1 pp7-3 to 7-4	Reference list updated to acknowledge revised Matiske 2007 report.
	Appendices (CD-ROM)	Appendices 8 and 9 replaced with updated reports (Parson Brinckerhoff 2006c, 2006d) with approved revised treatment rates and methodologies.
Revision C 8 June 2007	Ch 5 Section 4.4	Changes to management actions related to dieback flagging, location of hygiene stations and heavily weed infestations.
	Ch 5 Section 14.4	Management action requirement for spill kits in all vehicles modified with more targeted approach.
	Ch 5 Section 15.4	Management action modified to enable use of on-site package wastewater treatment plants
	Ch 6 Section 2	Correction of minor typographical error
	Ch 7 Section 1 pp7-1 to 7-2	Correction of minor typographical error



Controlled Version 2

Revision No and Date	Sections revised	Description of revision
Revision A 22 October 2008	Overall	References to Alinta and Alinta Asset Management changed to DBP as appropriate. Project descriptions contemporised to reflect work previously undertaken in Stage 5A, and to clarify expected work to be undertaken under Stage 5B. Use of the words: easement, corridor and right-of-way reviewed and modified to ensure correctness and consistency. A number of minor editorial changes with no material effect on environmental actions, or requirements.
	Ch 1 Section 2.3	Section added outlining environmental features and issues associated with Stage 5A, including summary of environmental audits performed.
	Ch 1 Section 4.1	Occurrence of DRF on Loop 9 Stage 5B included following recent survey (from Mattiske 2008).
	Ch 2 Section 2.6	Diagram modified to represent overall generic management arrangements.
	Ch 3	Chapter 3 relating to EPBC Act Matters of National Significance removed as separate version to be prepared to specifically satisfy EPBC Act approval requirements. Chapter numbers adjusted accordingly.
	Ch 4 Section 2.7	Arrangements for identification and approval of off right-of-way facilities modified.
	Ch 4 Section 7	Text updated to acknowledge results of Parson Brinckerhoff 2007 report on Loop 8 ASS investigations and Loop specific ASS treatment requirements updated to include Stage 5B (Parson Brinckerhoff 2008a, 2008b).
	Ch 4 Section 7.4	Requirement to investigate Medium-Low or lower acid sulphate risk areas removed, consistent with DEC guidelines and requested s46C minor change to implementation conditions under the Ministerial Statement.
	Ch 4 Section 8.4	Requirement for construction contractor to forward fauna reports daily to DBP modified to weekly. Responsibility for forwarding weekly forwarded reports modified to be DBP responsibility. DEC regional offices and Compliance Monitoring Section included as report recipients. Details of CEO approvals for extensions to permitted times for trenches to remain open added.
	Ch 4 Section 9	Text modified to clarify arrangements for access and clear and grade through major watercourses.
	Ch 4 Section 10	Requirements for dune stabilisation modified to allow range of stabilisation methods to be employed.
	Ch 4 Section 14.4	Requirements to report under the <i>Western Australian Petroleum Act 1967</i> Schedule of Onshore Petroleum Exploration and Production Requirements 1991 removed, as it does not apply to pipelines licensed under the <i>Petroleum Pipelines Act 1969</i> .
	Ch 4 Section 16	Requirement for topsoil stripping modified to apply to limited areas. Management action modified to clarify arrangements for stockpiling soils associated with watercourse crossings.
	Ch 5 Section 4	Requirements to report under the <i>Western Australian Petroleum Act 1967</i> Schedule of Onshore Petroleum Exploration and Production Requirements 1991 removed, as it does not apply to pipelines licensed under the <i>Petroleum Pipelines Act 1969</i> .
	Ch 6 Section 1	Reference list updated to acknowledge Parson Brinckerhoff 2008 reports.
	Appendices (CD-ROM)	Appendix 4 supplemented with Parson Brinckerhoff 2007 report on Loop 8 ASS investigations. Appendix 10 supplemented with Parson Brinckerhoff 2008 ASS management plans for Stage 5B Loops 9 and 10. Appendix 14 added with current DBNGP risk model.



Revision No and Date	Sections revised	Description of revision
Revision B 22 December 2008	Ch 4 Section 2.7	Requirement for Construction Contractor to identify the proposed locations of off-construction-right-of-way facilities such as turkey nests and turnarounds, subject to approval by WestNet Energy, to ensure avoidance of unnecessary clearing in conservation areas.
	Ch 4 Section 16.4	Clarification of locations of areas where topsoil removal is required inserted.
Revision C 17 August 2011	Overall	References to Alinta Asset Management Pty Ltd and WestNet Energy as project manager replaced by DBP. Project descriptions contemporised to reflect work undertaken under Stage 5B and to acknowledge proposed completion of Fortescue River Crossing as final component of Stage 5B.. References to DoIR and DEWHA changed to DMP and SEWPaC respectively as appropriate. A number of minor editorial changes with no material effect on environmental actions, or requirements.
	Appendices	DoW approved watercourse crossing rehabilitation and wet crossing plan included in Appendix 14. DBP 2008 Risk Model added.
	Ch 1 Section 1.4	Text added outlining application to change Statement No. 735 regarding tenure and easement width at the Fortescue River crossing.
	Ch 1 Section 2	Discussion of <i>Key environmental features and issues of Stage 5A</i> and <i>CEMP implementation audits</i> removed as irrelevant to future sub-stages.
	Ch 1 Section 2	Section updated to acknowledge Fortescue River crossing will be completed using open-cut excavation.
	Ch 1 Section 2.1.2	Section updated to acknowledge completion of Stage 5B with exception of Fortescue River crossing.
	Ch 1 Section 2.2	Section updated with planned timing of Fortescue River crossing.
	Ch 2 Section 2	Section updated to describe the DBP environmental management framework/system.
	Ch 2 Section 3.1, 3.2	Sections updated to acknowledge application of revised (2008) DBP Risk Model.
	Ch 4 Section 1	References to risk model updated to apply the DBP 2008 risk classification system. Management actions modified to accommodate to the five-classification system. Reporting requirements under the <i>Petroleum Pipelines Act 1969</i> and Schedule of Onshore Petroleum Exploration and Production Requirements 1991 included.
	Ch 4 Sections 2 and 3	Sections restructured to place all references to management in areas of conservation value into the Conservation Area Management Protocol, and general issues relating to vegetation and flora only retained in the Vegetation and Flora Management Protocol.
Ch 4 Section 2	Definition of "habitat trees" included for clarity. Requirement to reduce CROW width to 20 m in association with Threatened Flora modified to clarify requirements and ensure relevance to protection of such flora. Requirements for on-ground marking of protection areas clarified. Three-cut method for branch pruning clarified. Provision made for agency approval of ex-CROW clearing of vegetation associated with DRF, Priority Flora, TECs or places listed on the Australian Heritage Data Base. Requirements for provision of photographic evidence and recording of GPS coordinates of on-ground delineation of areas conservation values inserted. Requirements inserted for recording of GPS coordinates of marked habitat trees.	



Revision No and Date	Sections revised	Description of revision
	Ch 4 Section 3	<p>Definition of "habitat trees" included for clarity.</p> <p>Requirements for on-ground marking of protection areas clarified.</p> <p>Requirement inserted to make pre-provision for campsite firebreaks in clearing area delineations, to ensure compliance with EP Act approval, if firebreaks required.</p> <p>Requirements inserted for provision of photographic evidence and recording of GPS coordinates of on-ground delineation of areas conservation values.</p> <p>Requirements for recording of GPS coordinates of marked habitat trees inserted.</p>
	Ch 4 Section 4	<p>References to European House Borer maps generalised as maps are regularly amended. Link to map website inserted.</p> <p>Specific requirements for weed hygiene on entering gazetted conservation areas included for clarity.</p> <p>References to requirements for 'declaration' of construction materials as weed and disease free amended to 'demonstration' as there are no formal provisions for any form of declaration.</p> <p>Requirement inserted for photographic evidence of reinstatement of infected or infested construction areas only from adjacent stockpiles of infected or infested material.</p> <p>Requirement inserted to record all pine material movement within Loop 9.</p> <p>Requirements inserted for maintenance of hygiene logs and registers.</p>
	Ch 4 Section 5	<p>Definition of "habitat trees" included for clarity.</p> <p>Requirements for recording of wetlands on ELL clarified to include all conservation category wetlands and all EPP wetlands.</p> <p>Requirements for clearing of wetland vegetation clarified to avoid need for reduced CROW width in areas with no vegetation.</p> <p>Wetland buffer zones and fuel storage prohibitions clarified.</p> <p>Refuelling requirements within wetland and associated buffer zones cross-referenced to Fuel and Chemical Storage, Spill and Emergency Response Protocol.</p>
	Ch 4 Section 6	<p>Site-specific management plans for acid sulphate soil and associated dewatering cross-referenced to relevant Appendix.</p>
	Ch 4 Section 7	<p>Requirements for pre-construction in-field ASS testing in MED-LOW risk areas modified to require testing prior to excavation (in accordance with Statement No. 735).</p> <p>Site-specific management plans for acid sulphate soil and associated dewatering removed and cross-referenced to relevant Appendix.</p> <p>Requirement inserted to maintain and record backfilling capability of available plant to achieve 48-hour backfilling requirement as required by Statement No. 735.</p>



Revision No and Date	Sections revised	Description of revision
	Ch 4 Section 8	<p>Definitions of "trench", "fauna" and "habitat trees" inserted.</p> <p>Requirements for marking habitat trees and consulting with DEC modified to clarify requirements.</p> <p>Requirements for pruning of habitat trees modified to clarify requirement for use of three-cut method, cross-referenced to Flora and Vegetation Management Protocol.</p> <p>Requirements for pre-pipe laying and backfilling trench inspections clarified.</p> <p>Requirements for daily weather forecast checks relating to potential trench flooding modified to require monitoring of daily flood forecasting as a more relevant approach.</p> <p>Monitoring and recording requirements for trenches expanded to include:</p> <ul style="list-style-type: none"> • locations of trench plugs • locations of bell holes • locations of rock excavation areas • break periods for laying and backfilling crews • register for holders of fauna handler licences • assistant fauna handler training register • pre-pipe laying and backfilling inspection register • digital photographic evidence of use of fauna handling equipment. <p>Contingency action triggers inserted to cover fauna interaction mortality rates.</p> <p>Requirement for development of trigger levels for mortality rates removed.</p> <p>Requirement inserted for experienced fauna handlers to hold DBNGP-specific Section 15 <i>Licence to take fauna for public purposes</i>.</p> <p>Assistant fauna handler training requirements clarified in terms of need for experienced fauna handlers to conduct fauna handler training.</p> <p>Ability of any personnel to carry out fauna inspections other than for the daily trench inspections clarified.</p> <p>Requirements for pre-pipe laying and backfilling fauna inspections clarified.</p>



Revision No and Date	Sections revised	Description of revision
	Ch 4 Section 9	<p>Requirement for watercourse crossings to be subject to <i>Rights in Water and Irrigation Act 1914</i> permits removed as project has been identified by DoW as exempt.</p> <p>Need for wider than normal construction right-of-way through watercourses to enable sufficient working surface and soil storage areas made explicit.</p> <p>Reference to previously approved watercourse crossing rehabilitation and wet crossing plan being available in Appendix 14 inserted.</p> <p>Requirements for marking and flagging access and construction areas associated with watercourses clarified.</p> <p>Requirement to use BoM forecasts to avoid construction in watercourses during times of wet weather removed because of limitations on such forecasting. Issue is covered by general requirement to schedule work in dry or low flow periods.</p> <p>Requirement to complete watercourse crossings "over the shortest time practicable to minimise the period of open trench" removed, as trench opening is subject to specific and auditable time limitations under the Fauna Interaction Protocol.</p> <p>Requirements for delineating riparian vegetation and consulting with DEC modified to clarify requirements.</p> <p>Watercourse buffer zones and fuel storage prohibitions clarified.</p> <p>Refuelling requirements within watercourses and associated buffer zones cross-referenced to Fuel and Chemical Storage, Spill and Emergency Response Protocol.</p> <p>Requirements for management of trenches in watercourses removed as covered under the Fauna Interaction Protocol and no special additional conditions apply to watercourses.</p> <p>Requirements removed for the following as issues covered in the required watercourse crossing rehabilitation and wet crossing plan:</p> <ul style="list-style-type: none"> • diversion berms or drains to divert surface water • erosion control devices during wet crossings. <p>Requirement for topsoil stockpiling associated with HDD generalised to apply to all areas of disturbance.</p> <p>Clean-up and rehabilitation requirements modified to address potential inconsistencies with the required watercourse crossing rehabilitation and wet crossing plan.</p> <p>Bank reinstatement using sandbags with river sand and cement modified to enable use of alternative methodologies as approved in the watercourse crossing rehabilitation and wet crossing plan (Appendix 14).</p> <p>Requirement for specific use of local river sand in bank reinstatement sandbags removed as some local river sands may not be suitable.</p> <p>Requirement for photographic evidence and GPS coordinates of watercourse disturbance area delineation inserted.</p>
	Ch 4 Section 11	<p>Requirement inserted to make pre-provision for campsite firebreaks in clearing area delineations, to ensure compliance with EP Act approval, if firebreaks required.</p> <p>Requirements inserted for fire fighting training of all welding crews, plant operators and supervisors, and recording in a training register.</p>



Revision No and Date	Sections revised	Description of revision
	Ch 4 Section 14	<p>Requirements inserted for designation and in-field marking of non-refuelling areas, and of areas where refuelling is subject to special conditions.</p> <p>Requirement inserted to mark boundaries of Water Reserves in the field.</p> <p>Requirement inserted to mark boundaries of Wellhead Protection Zones in the field as designated non-refuelling zones.</p> <p>Required volume of spill containment facilities defined.</p> <p>Specific requirements inserted for spill management equipment at bulk fuel storage/refuelling locations and on refuelling vehicles.</p> <p>Requirement inserted for fuel spill grate to be installed at bulk fuel storage/refuelling locations.</p> <p>Special provisions for refuelling proximate to watercourses and wetlands inserted.</p> <p>Requirement inserted for pipe coating to be carried out over spill containment facility.</p> <p>Requirements for reporting of spillages in Water Reserves extended to include Wellhead Protection Zones.</p>
	Ch 4 Section 15	<p>Requirements for provision of litter bins modified to apply to construction camps, storage yards and laydown areas.</p> <p>Requirements for litter bins and waste containers to be covered extended to cover fauna access, overfilling, and wind removal.</p> <p>Requirements for chemicals to be stored in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol extended to include waste fuels, hydrocarbons and other chemicals.</p>
	Ch 4 Section 16	<p>References to requirements for 'certification' of imported padding material as weed and disease free amended to 'demonstration' as there are no formal provisions of any form of certification.</p> <p>Requirement inserted requiring photographic evidence of retention of topsoil stockpiles immediately following backfilling, prior to reinstatement.</p>
	Ch 4 Section 18	<p>Definition of "Threatened Flora" inserted.</p> <p>Requirements for photo monitoring redefined to cover all situations.</p>
	Ch 5 Section 1	<p>Requirements for river crossing permits removed, as project is exempt.</p>



DBNGP STAGE 5 EXPANSION LOOPING PROJECT CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

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All appendices are contained on CD inside front cover.



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Chapter 1 Background and environment factors

1 INTRODUCTION

The Dampier to Bunbury Natural Gas Pipeline (DBNGP) extends almost 1600 km from the Pilbara region to the South-West of Western Australia (WA). It is one of the longest and largest capacity natural gas pipelines in Australia supplying natural gas to industrial, commercial and residential customers in Perth and major regional centres along the pipeline route.

DBNGP Nominees (WA) Pty Limited (DBP, the Proponent) as part of the Dampier Bunbury Pipeline group of companies, is proposing to construct a number of loops adjacent (and connected) to the existing underground gas transmission pipeline within the pre-existing DBNGP corridor. There are eleven separate loops proposed from the Dampier natural gas facilities to Wagerup West (Main Line Valve 144). Each of the eleven loops will extend the loops being constructed under the Stage 4 expansion to result in complete duplication of the existing DBNGP pipeline from Dampier to Wagerup. Stage 5 will raise the capacity of the system from 627 TJ/d (post Stage 4 capacity) to approximately 937 TJ/d.

Looping is a process of duplicating a pipeline by installing a new pipeline parallel to the existing line in order to provide an additional flow path for the transported gas. This process enhances the volumetric capacity of the system by reducing friction losses and allows increased gas deliveries to customers. The details of the construction and operation activities are set out in Chapter 1, Section 2.1.2. The proposed Stage 5 looping pipeline sections will be 660 mm (26") in diameter with a total length of approximately 1270 km.

The proposed pipeline sections will be constructed within a previously cleared corridor associated with the construction of the original DBNGP. The corridor is typically covered by pasture or 25 year-old regrowth native vegetation.

In 1981, the existing pipeline was constructed within a 30 m wide corridor and is located approximately 6 m from the eastern boundary of that corridor. Widening of the corridor to a width of 100 m from Dampier to Bullsbrook occurred in 2001. South of Bullsbrook the corridor remains 30 m wide. During future construction work, there will be a requirement to occasionally move out of the existing corridor to meet practical working conditions, e.g. truck turnarounds, campsites, excess spoil storage, and materials and equipment storage. This additional space in the 'construction right-of-way' will only be necessary during the construction period.

The proposal will be implemented by DBP in accordance with its corporate environmental policy (Appendix 1).

1.1 Project staging

The Stage 5 Looping Expansion project is being undertaken in stages, which commenced in early 2007. Details of the stages and scheduling are presented in Chapter 1 Section 2.2.

1.2 Purpose and scope of this document

Under the *Petroleum Pipeline Act 1969*, DBP is required to submit a Construction Environmental Management Plan (CEMP) to DMP for approval prior to the commencement of construction. This document forms this CEMP and aims to address potential environmental impacts that may be encountered during construction of the pipeline.

The document describes the environmental management program to be applied to the entire Stage 5 project, with particular reference to Stage 5B, planned to commence in early 2009. At the time of writing, Stage 5A had been completed under the requirements of a previous version of his plan (Controlled Version 1). This document is a modified version of that plan, based on the experience and learnings taken from the Stage 5A work, intended to improve the efficiency of environmental management and the environmental outcomes.



1.3 Location

The DBNGP traverses the State from Dampier in the North-West to Wagerup in the South-West, passing through the pastoral (Loops 0 to 6 inclusive), agricultural (Loops 7 and 8) and Swan Coastal Plain (Loops 9 and 10) regions of the State (Figure 1-1). At the landscape scale, the DBNGP traverses six biogeographical regions¹: Pilbara, Carnarvon, Gascoyne, Yalgoo, Geraldton Sandplains and Swan Coastal Plain (Figure 1-2). The loop lengths associated with the total Stage 5 Expansion as conceived in the project planning stage, and as approved under the *Environmental Protection Act 1986* and the *Environment Protection and Biodiversity Conservation Act 1999*, are between 62 km (Loop 10) and 142 km (Loop 7), totalling approximately 1270 km of pipeline to be constructed (Table 1-1). The length of Loop 0 has subsequently been reduced to 115.1 km.

Table 1-1 Loop location and lengths as approved under environmental legislation

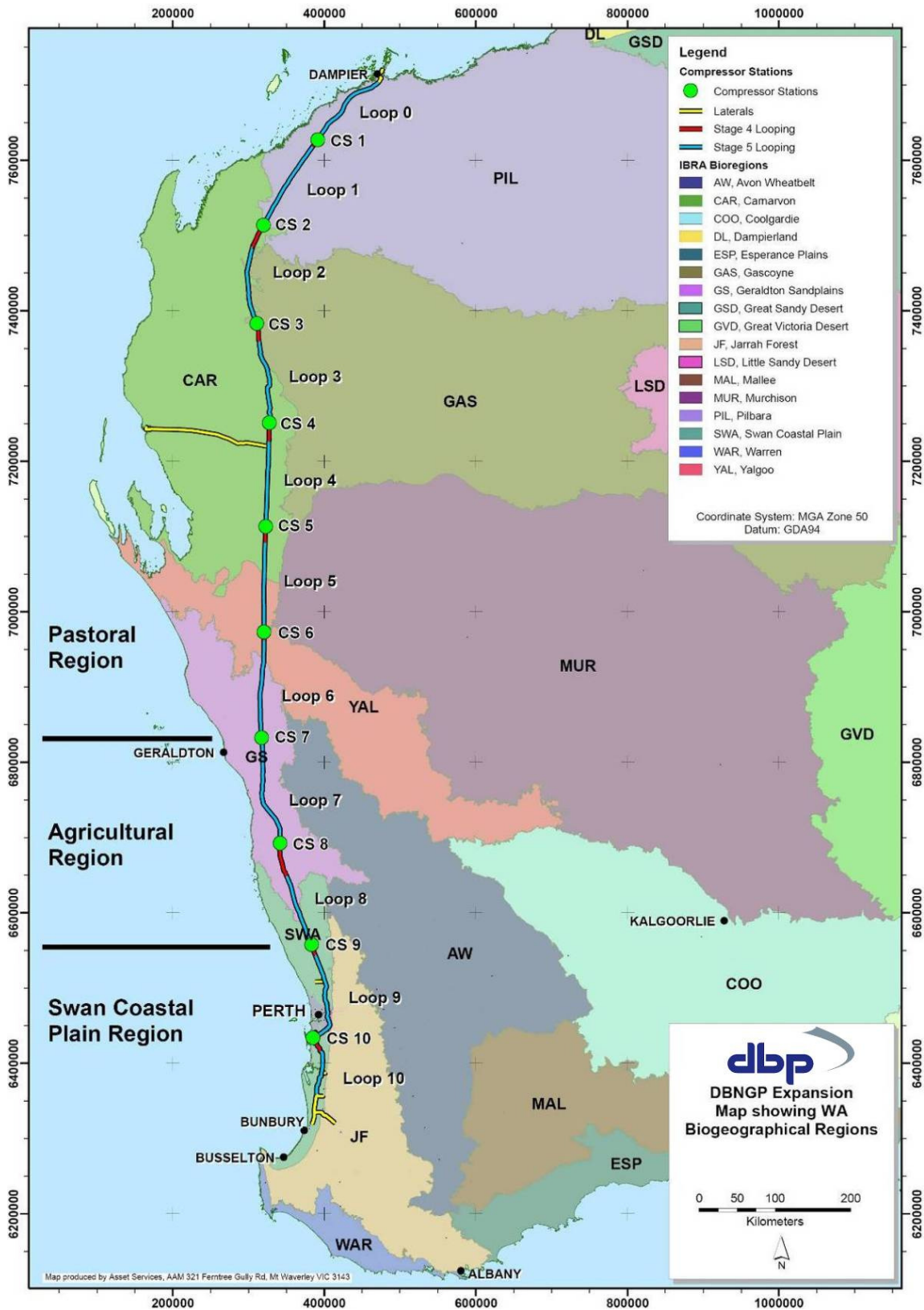
Loop	Length (km)	Start		Finish	
		Longitude	Latitude	Longitude	Latitude
0	137.2	116.729450	-20.764171	116.076076	-21.274065
1	123.3	115.835981	-21.598429	115.260631	-22.446138
2	104.9	115.101676	-22.733181	115.113972	-23.574772
3	113.0	115.174306	-23.890139	115.296799	-24.817004
4	112.9	115.278964	-25.072856	115.244225	-25.792191
5	119.0	115.207055	-26.441847	115.190587	-26.441847
6	131.0	115.183050	-27.522753	115.133227	-28.618888
7	142.4	115.137399	-28.688793	115.316853	-29.622154
8	96.8	115.443301	-30.287908	115.769318	-31.092429
9	127.7	115.838740	-31.268694	116.019579	-32.669887
10	61.5	115.900806	-32.401526	115.823622	-32.905901

¹ Around 80 biogeographical regions were first delineated across Australia in 1993-94 as part of the Interim Biogeographic Regionalisation for Australia (IBRA). IBRA was developed under the coordination of Environment Australia by the States and Territories to identify appropriate regions to assess and plan for the protection of biological diversity. Biogeographical regions, or IBRA regions, represent a landscape based approach to classifying the land surface and were delineated based on many variables including regional and continental scale data on climate, geomorphology, landform, lithology and characteristic flora and fauna (Environment Australia 2000).

Figure 1-1 Regional location of the DBNGP showing Stage 4 and Stage 5 Loops



Figure 1-2 Biogeographical regions traversed by the DBNGP





1.4 Land tenure

The looping pipeline sections will be constructed adjacent to the existing DBNGP within the existing corridor established in the early 1980s and gazetted under the *Dampier to Bunbury Pipeline Act 1997* prior to the privatisation of the pipeline. DBP is the owner of the DBNGP.

Construction activities may at times extend outside the existing corridor (e.g. for vehicle turnarounds and campsites), in which case access will be negotiated directly with the individual landowners. The tenure in these sections is typically Crown Leases and freehold land for agricultural purposes.

With regard to the Fortescue River Crossing, a s 45C application has been made to amend Statement No. 735 with respect to the tenure and Easement Width statement in Schedule 1 as per the Table. It is expected that this approval will be granted in early August 2011.

Table 1-2 Tenure and easement width at the Fortescue River crossing

Component	Current Description	Proposed description
Tenure	The pipeline will be constructed wholly within the existing DBNGP easement which is gazetted under the <i>Dampier to Bunbury Pipeline Act 1997</i> .	The pipeline will be constructed wholly within the existing DBNGP easement corridor which is gazetted under the <i>Dampier to Bunbury Pipeline Act 1997</i> or any easement granted for the purposes of the DBNGP.
Easement width	The existing easement is 30 metres wide. The area to be cleared and graded in the northern loops (Dampier to Muchea) will be approximately 30 metres and south of Muchea, the area cleared will be 20 to 30 metres. In environmentally sensitive areas, working widths will be 20 metres.	The existing easement DBNGP corridor is 30 metres wide. The area to be cleared and graded in the northern loops (Dampier to Muchea) will be approximately 30 metres and south of Muchea, the area cleared will be 20 to 30 metres. In environmentally sensitive areas, working widths will be 20 metres. Additional easements may vary in width and all clearing will be subject to the conditions of Statement.

1.5 Justification

DBP has received requests from major industrial customers for new capacity due to industrial growth in WA in the mining, manufacturing and domestic energy demand sectors. In order to address this demand, the previously completed Stage 4 expansion of the DBNGP is being augmented under a Stage 5 Expansion that will ultimately increase the pipeline capacity by approximately 375 TJ/day of gas. The combined Stage 4 and Stage 5 Expansions will effectively duplicate 90% of the length of the DBNGP.

1.6 Relevant environmental legislation and approvals

The following legislation is relevant to the Stage 5 Looping of the DBNGP:

- *Airports Act 1996*
- Environmental Protection (Clearing Of Native Vegetation) Regulations 2004
- Environmental Protection (Controlled Waste) Regulations 2004
- Environmental Protection (Noise) Regulations 1997
- Environmental Protection (Abrasive Blasting) Regulations 1998
- *Environmental Protection Act 1986 (EP Act)*
- Environmental Protection (Swan Coastal Plain Lakes) Policy 1992
- *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*
- *Land Administration Act 1997*
- *Petroleum Pipelines Act 1969*
- *Rights in Water and Irrigation Act 1914*
- Rights in Water and Irrigation Regulations 2000



- *Swan River Trust Act 1988*
- *Wildlife Conservation Act 1950 (Wildlife Act).*

The management protocols provided in Chapter 4 of this Construction Environmental Management Plan (CEMP) and the associated management plans to be prepared by the contractors are to ensure compliance with the relevant legislation and associated approvals. Table 1-3 outlines the general legislative requirements relevant to the pipeline and the associated agencies responsible for the legislation.

Table 1-3 Relevant environmental requirement, legislation and agencies

Factor	Legislation	Agency	Requirement
Overall environmental acceptability	<i>Environmental Protection Act 1986</i>	EPA and Minister [#]	Environmental impact assessment
	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	SEWPaC and Minister ^{##}	Environmental impact assessment
Corridor and additional land outside the corridor	<i>Dampier Bunbury Pipeline Act 1997</i>	DPI	S 34 Application (in place) S41 – approval for additional land within the DBP corridor
	<i>Land Administration Act 1997</i>	DPI	S91 approval
Construction	<i>Petroleum Pipelines Act 1969</i>	DMP	Pipeline Licence, Construction EMP Operation EMP
DRF/Priority flora	<i>Wildlife Conservation Act 1950</i>	DEC	Permit require to take if avoidance unavailable
Groundwater abstraction	<i>Rights in Water and Irrigation Act 1914</i>	DoW	Licence
Heritage sites	<i>Aboriginal Heritage Act 1972</i>	DIA	Approval under S 18
Perth Airport Environmental Precincts	<i>Perth Airport Act 1996</i>	DoT and Minister ^{###}	Major Development Plan
Watercourse crossings	<i>Rights in Water and Irrigation Act 1914</i> (in event of interference with bed and banks)	DoW	Permit
	<i>Swan River Trust Act 1988</i>	SRT	Permit
Wetland crossings	<i>Rights in Water and Irrigation Act 1914</i>	DoW	Permit

Minister [#]	State Minister for the Environment	DIA	Department of Indigenous Affairs (WA)
Minister ^{##}	Federal Minister for the Environment	DMP	Department of Mines and Petroleum (WA)
Minister ^{###}	Federal Minister for Transport	DoW	Department of Water (WA)
DEC	Department of Environment and Conservation (WA)	DPI	Department of Planning and Infrastructure (WA)
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cwlth)	EPA	Environmental Protection Authority (WA)
		SRT	Swan River Trust

Table 1-4 sets out the regulatory agencies responsible for approval of this CEMP, and for the various management protocols in Chapter 4.



Table 1-4 Construction Environmental Management Plan and management protocol approval matrix

Component	Approving agency(s)	Consultation agency(s)	Authority
Overall CEMP	DMP and Minister [#]		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence Decision to Approve the Taking of an Action (EPBC 2006/2813)
Environmental Incident Response Protocol (Chapter 4 Section 1)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Conservation Area Management Protocol (Chapter 4 Section 2)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Flora and Vegetation Management Protocol (Chapter 4 Section 3)	DMP, Requirements of Minister [#]	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence, <i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Wetland Crossing Management Protocol (Chapter 4 Section 5)	Requirements of Minister [#] , DoW	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735, <i>Rights in Water and Irrigation Act 1914</i> permit
Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6)	DMP	DoW	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Acid Sulphate Soil Management Protocol (Chapter 4 Section 7)	DMP	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Fauna Interaction Protocol (Chapter 4 Section 8)	Requirements of Minister [#]		<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Watercourse Crossing Protocol (Chapter 4 Section 9)	Requirements of Minister [#] , DoW	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735, <i>Rights in Water and Irrigation Act 1914</i> permit
Dune Crossing Management Protocol (Chapter 4 Section 10)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Fire Management Protocol (Chapter 4 Section 11)	DMP	FESA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Dust Management Protocol (Chapter 4 Section 12)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Noise Management Protocol (Chapter 4 Section 13)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14)	DMP	DEC, FESA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Waste Management Protocol (Chapter 4 Section 15)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Soil Management Protocol (Chapter 4 Section 16)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17)	DMP	DIA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Rehabilitation Management Protocol (Chapter 4 Section 18)	Requirements of Minister [#]	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Access and Safety Management Protocol Chapter 4 Section 19)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence



Minister [#]	State Minister for the Environment	DIA	Department of Indigenous Affairs (WA)
Minister ^{##}	Federal Minister for the Environment	DMP	Department of Mines and Petroleum (WA)
Minister ^{###}	Federal Minister for Transport	DoW	Department of Water (WA)
DEC	Department of Environment and Conservation (WA)	DPI	Department of Planning and Infrastructure (WA)
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cwlth)	EPA	Environmental Protection Authority (WA)
		SRT	Swan River Trust

The processes associated with review, revisions and approval of revisions are set out in Chapter 5 Section 3.



2 THE PROJECT

The Stage 5 Expansion is being constructed in stages, with Stage 5A completed in early 2008 and Stage 5B completed in early 2010, with the exception of the Fortescue River. The Fortescue River crossing was not completed during the Stage 5B works and is the portion of Loop 0 left outstanding. Crossing of the Fortescue River is scheduled for completion between August and December 2011 and will be constructed in accordance with this CEMP and Pipeline Licence 40 and pending new Pipeline Licence (Application No. STP-PLA-0008).. Any subsequent stage(s) will be constructed to match the increasing demand in fuel gas, and should be substantially completed by 2011. The scope and timing of each stage is being matched to provide the progressive upgrade of the pipeline system in looping length and augmentation of the existing compressor stations to match the incremental increasing gas flow requirements. Precise scheduling and definition of the individual stages proposed to be constructed subsequent to Stage 5B have not been finalised at this time. The details of the Stage 5A and 5B loops are presented in Chapter 1 Section 2.2.

The proposal comprises a number of construction activities described in the following sections.

2.1.1 Terminology

The following terminology applies to land tenure and access arrangements along the pipeline:

1. **Corridor** refers to the gazetted DBNGP corridor under the *Dampier to Bunbury Pipeline Act 1997* (includes the widened areas, larger areas at compressor station sites, access roads, etc.)
2. **Right of way** refers to the portion of the DBNGP corridor to which DBP holds access rights under the granted Section 34 access right and the PL40 licence area.
3. **Construction right-of-way** refers to the portion of the right of way designated for access for the construction of Stage 5B and has width restrictions on it in certain areas in relation to environment, heritage and other aspects.

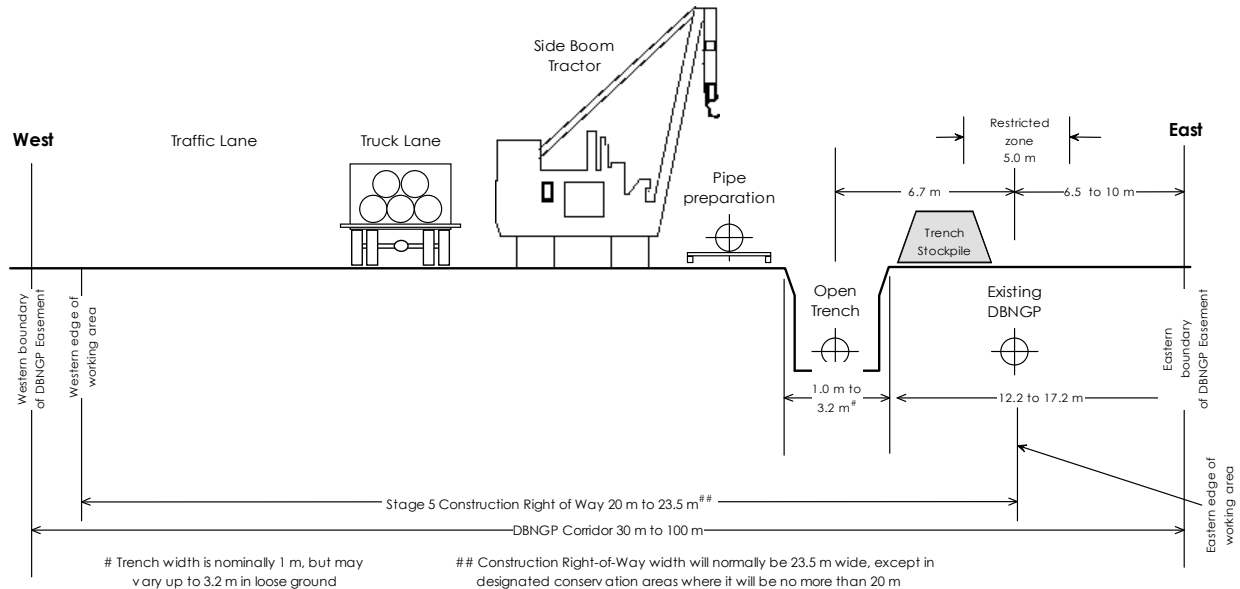
2.1.2 Pipeline construction

2.1.3 The construction right-of-way

For pipeline construction works in the northern loops (from the Dampier Loop to Muchea), construction will typically be carried out within a 30 m wide construction right-of-way using a production line approach, although a reduced corridor width will be implemented in specified areas to minimise environmental impacts. South of Muchea, a corridor width of 20 to 30 m will be utilised with the reduced corridor again used in designated areas.

An indicative cross-section of the construction right-of-way is shown in Figure 1-3. A comprehensive set of typical drawings is included in Appendix 7.

Figure 1-3 Indicative cross-section of construction right-of-way (diagrammatic – not to scale)



2.1.4 Pipeline construction activities within corridor


A number of specialised crews pass along the corridor, fabricating and installing the pipeline then backfilling and rehabilitating the construction right-of-way. The pipeline will be constructed and operated in accordance with the requirements of *AS2885 Pipelines – Gas and Liquid Petroleum* and the Australian Pipeline Industry Association (APIA) *Code of Environmental Practice (1998)*. Typical construction activities expected for the pipeline are described in Table 1-5.

Table 1-5 Typical pipeline construction activities

Activity	Description
Detailed survey	Engineering, environmental and cultural heritage surveys are used both in route selection and to determine if any special construction techniques or mitigation measures are required. Once the preferred pipeline route has been determined, the centreline is surveyed and engineering aspects are finalised. Markers (pegs) are placed to identify the pipeline route and construction right-of-way.
Fencing	Fences are severed construction gates installed to allow access through for both property boundary and internal fences.
Clear and Grade	Graders and bulldozers are used to clear a 22 m wide area to provide for construction activities. This clearing will be within the construction right-of-way (30 m in northern sections, 20 to 30 m in southern sections, and appropriately reduced in environmentally sensitive areas). The remaining 8 m wide area will be used to stockpile cleared vegetation. The cleared area may include excavations through sand dunes and riverbanks and beds to establish a construction right-of-way. For safety reasons, dependent on soil type (eg heavy sand), an additional 3 m may need to be cleared in limited areas to allow for trench and stockpile stability. Topsoil will typically be graded to a depth of 100 to 150 mm for a blade-width over the trench line, or the entire working side or the full construction right-of-way, depending on factors such as the soil type, terrain, construction requirements and weather conditions. Topsoil will be stockpiled separately. Overburden related to dune and river crossings will be stockpiled adjacent to the excavation, in areas with no, or limited vegetation cover, where practicable.



Activity	Description
Trenching	<p>After the route is cleared, a trench (minimum 1.5 m deep) is dug for the pipeline by either a trenching machine or an excavator in accordance with pre-defined depths of burial. The required depths are determined by the AS2885.1 risk assessment process and recorded on construction alignment sheets. Trench spoil is stockpiled on the construction right-of-way, usually on the non-working side. Trench spoil is stockpiled separately to topsoil. The trench will be monitored daily for fauna entrapment and refuges (hessian bags or similar) placed in the trench to provide protection for fauna that temporarily occupy the trench. The trenches will be ramped at regular intervals to allow larger fauna to escape.</p> <p>The period that any part of a trench will be left open will be minimised. Trenches will be stopped and started at regular intervals with “plugs” between these sections to allow for unimpeded movement of livestock and fauna. Where possible, trenching will be delayed until completion of the welding and joint coating as part of ensuring that the trench will be open for the minimum amount of time.</p>
Stringing	<p>Steel pipe is trucked to the construction site and sections, each approximately 18 metres long, are laid end-to-end next to the trench. The sections are placed on sandbags and raised on blocks of wood (timber skids) to protect the pipe from corrosion and coating damage.</p>
Bending	<p>Where required, pipe sections are bent to match changes in either elevation or direction of the route.</p>
Welding	<p>Pipe sections are welded together.</p>
Non-destructive weld testing	<p>The pipe welds are inspected using x-ray or ultrasonic equipment as per AS 2885.2.</p>
Joint coating	<p>The area around the weld is grit blasted and then coated with a protective coating to prevent corrosion.</p>
Padding	<p>Where required, padding machines are used to sift the excavated subsoil to remove coarse materials to prevent damage to the pipe coating. The remaining fine material is used to pad beneath and on top of the buried pipe. In some instances (e.g. rocky soils), imported sand or foam pillows are used for padding.</p>
Lowering-in	<p>Side booms or excavators are used to lower the welded pipe into the trench.</p>
Backfilling	<p>Trench spoil is returned to the trench and material compacted to minimise the likelihood of subsidence of material over the pipe.</p>
Watercourse crossings	<p>The pipeline alignment crosses a number of watercourses of varying size, some of which are ephemeral. The ephemeral streams are expected to be dry during construction and crossings will be constructed using standard open cut (trenching) construction. Erosion and sediment control measures will be implemented to ensure there are no significant impacts at these crossings.</p> <p>The Swan, Canning and Murray Rivers are perennial, and construction by horizontal directional drilling is planned to be used under the riverbed to minimise disturbance. Permits will be obtained from the Department of Water where crossings involve any interference to bed or banks.</p>
Pressure testing	<p>Pipeline integrity is verified using hydrostatic testing in accordance with AS 2885.5. During hydrostatic testing the pipeline is capped with test manifolds, filled with water and pressurised up to a minimum of 125% of design maximum operating pressure for a minimum of two hours. A minimum 24-hour duration leak test then follows. Providing it meets Department of Water water quality guidelines and has landholder approval, hydro-test water is discharged to the surrounding environment. Hydro-test water will be sourced from a variety of sources, including public water supply system standpipes, dams, local groundwater or streamflows, subject to licensing from the Department of Water. In general, it is expected that no chemicals will be added as the pipeline is internally coated. However, in some locations chemicals may need to be added if there is danger of aggressive water affecting the integrity of the internal coating. In these cases and where necessary, the water will be treated to neutralise alkaline elements to an appropriate standard before discharge to the environment. This discharge is a once-off discharge during commissioning of the pipeline and will be undertaken to the requirements of the Department of Environment and Conservation.</p>

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Activity	Description
Restoration and Rehabilitation	The construction right-of-way is re-contoured to match surrounding landform, and erosion controls constructed where necessary. Separately stockpiled topsoil is then respread evenly across the construction right-of-way and any stockpiled vegetation placed across the construction right-of-way, to assist in soil retention, provision of seed stock and fauna shelter. Reseeding or revegetation of the construction right-of-way, using appropriate species (i.e. crops/pasture or indigenous native species of the right provenance), will be undertaken to restore vegetation cover.
Signage	Information signs on the presence of the buried pipeline are erected in line of sight along the construction right-of-way as per AS 2885.1.

2.1.5 Watercourse crossings

Crossing of the Swan, Canning and Murray Rivers, and possibly other watercourses, is planned to be undertaken by horizontal directional drilling (HDD) under the riverbed to minimise disturbance subject to ground conditions being conducive to this methodology. Most other river crossings are expected to be by open-cut methods. Site-specific geotechnical conditions will determine the methodology to be used in each case.

At the sites where HDD is undertaken, an area will be required to temporarily house the drill rig. The drill site area for the HDD from an operational and safety perspective is usually 50 m x 50 m and incorporates an area for the positioning of the drilling rig, an area for the management of the drilling mud (i.e. mud pits) and a safe truck turnaround/manoeuvring area. The same topsoil removal and preservation methods used on the general construction right-of-way will be used when clearing the HDD pads.

The HDD drilling mud disposal requirements include the construction of evaporation dams at the HDD entry and exit locations where the mud will be stored until it is dry. At this point, the mud will then be loaded into tip trucks and disposed of at a suitable approved land fill/waste disposal site. The HDD pad will be rehabilitated.

The crossing of the Fortescue River will be completed by open-cut excavation. Open-cut excavation will require excavation of the banks and riverbed, to achieve the required minimum depth for pipe location at 2 m below the stable riverbed.

Open-cut excavations will require excavation of the banks and riverbed, to achieve the required 2 m below the stable riverbed. This will ensure flow events do not expose the pipeline, ensuring pipeline integrity. There will also be the need to extend this excavation through the riverbank profile for some distance away from the river channel. This will result in the requirement for an increased working width across each bank of the river crossing to enable safe excavation of the trench and installation of the pipeline.

2.1.6 Dune crossings

Several areas along the pipeline route require the crossing of potentially mobile sand dunes in Loops 0, 4 and 6. This will require excavation through the dunes deep enough to be below the stable dune formation to ensure sand movement does not expose the pipeline. An increased working width across the dune will be required in these areas to enable safe excavation of the trench and installation of the pipeline. Construction activities across mobile sand dunes will be managed in accordance with the Dune Crossing Management Protocol (Chapter 4 Section 10).

2.1.7 Borrow pits

Borrow pits to win suitable fine soils to place around the pipeline are unlikely to be required for the project. Should a borrow pit be required, the nearest existing pit (used during the initial construction of the DBNGP) will be considered where necessary. Should no existing borrow pit be suitable, the potential establishment of a suitable borrow pit will be discussed with the Department of Environment and Conservation (DEC)/Environmental Protection Authority (EPA) and relevant local authorities on a case-by-case basis.



2.1.8 Pressure testing

Pressure testing of the pipeline involves pumping water into the pipeline and maintaining a set pressure for a period (hydrotesting). Hydrotesting will require water to be sourced and following testing, appropriately disposed of.

Numerous wells along the pipeline route are currently being tested to determine their suitability for the hydro-test program. Licences for abstraction of water will be obtained as required under the *Rights in Water and Irrigation Act 1914*.

The hydro-test water will be discharged into evaporation ponds, dams, turkey nests or areas of the corridor in accordance with an approved protocol described in the *Dewatering and Water Disposal Management Protocol* (Chapter 4, Section 6).

2.1.9 Other infrastructure requirements

2.1.10 Construction camps

Construction camps will be erected along or near the pipeline at various intervals to service Loops 1 to 8 [no camp is required for Loops 0, 9 and 10 due to proximity to Karratha (Loop 0) or Perth Metropolitan area (Loops 9 and 10)]. The camps will be constructed of demountable buildings with individual sleeping quarters, toilet/showers, laundry, food mess, wet mess (bar) and recreation rooms. Caterers are contracted to cook and clean for the construction personnel.

Construction camps will, where possible, be located to minimise noise impacts on surrounding residences, and in areas that have been largely cleared.

Typical waste products generated from the camp include:

- food scraps and general domestic waste
- recyclables, such as aluminium cans, bottles, steel, cooking oil
- wastewater – black and grey streams are generally combined.

2.1.11 Water supply

Water will be required for potable uses (i.e. accommodation camps), dust suppression and hydrotesting. It will be sourced from local groundwater, surface water dams, or public water supply standpipes along the construction route. The required licences will be sought from the DoW prior to commencement of construction in any area.

2.2 Scheduling

The Stage 5 Expansion is being constructed in stages, with Stage 5A completed in early 2008, and Stage 5B completed in early 2010, with the exception of the Fortescue River crossing that is programmed for completion in late 2011. Subsequent stage(s) will be constructed to match the increasing demand in fuel gas. The scope and timing of each stage is being matched to provide the progressive upgrade of the pipeline system in looping length and augmentation of the existing compressor stations to match the incremental increasing gas flow requirements.

Details of the completed Stage 5A and 5B loops are set out in Table 1-6 and Table 1-7 respectively. At the time of writing, the loop lengths and timing of further stage(s) had not been defined.



Table 1-6 DBNGP Stage 5A Expansion loop lengths and locations

Loop	Length (km)	DBNGP KP	
		From	To
1	72.1	149.120	221.212
2	57	304.345	361.342
3	59	434.236	493.236
4	59	571.820	630.850
5	63	706.640	769.634
6	65	835.900	900.900
7	71	972.261	1,043.290
8	54	1,160.160	1,214.210
9	52	1,271.940	1,323.965
10	15.1	1,421.410	1,436.500
Total:	567.2		

Table 1-7 DBNGP Stage 5B Expansion loop lengths and locations

Loop	Length (km)	DBNGP KP	
		From	To
0	114.948	22.153	137.101
1	32.900	223.135	256.035
2	31.901	362.138	394.039
3	34.559	494.532	529.091
4	33.635	633.765	667.400
5	33.980	770.330	804.310
6	35.820	906.400	942.220
7	44.008	1,032.692	1,076.700
8	21.780	1,215.440	1,237.220
9	23.375	1,323.965	1,347.340
10	33.270	1,436.500	1,469.770
Total:	440.176		

2.3 Project inputs

2.3.1 Water supply

Up to approximately 513 ML of water will be required for construction purposes, campsites and hydrotesting of the pipeline (Table 1-8). Water will be reused where practicable, to minimise water requirements.



Table 1-8 DBNGP Stage 5 Expansion water supply requirements

Loop	Hydro-testing (ML)	Construction (ML)	Potable water (ML)	Total water supply required* (ML)
0	32.22	5.6	2.2	40.0
1	42.62	7.4	3.0	53.0
2	33.61	5.8	2.3	41.8
3	38.81	6.7	2.7	48.2
4	34.30	5.9	2.4	42.6
5	40.54	7.0	2.8	50.4
6	45.39	7.9	3.1	56.4
7	41.23	7.1	2.9	51.2
8	33.26	5.8	2.3	41.3
9	34.65	30.0	12.0	76.7
10	5.20	4.5	1.8	11.5
TOTAL	381.8	93.7	37.5	513.1

* Water supply assumptions:

Hydro-testing requires 330 m³ of water/km of pipeline

Pipeline constructed at a rate of 3 km/day for loops 0 to 8 and 0.5 km/day for loops 9 and 10

Construction water required is approximately 150 m³/day

Potable water supply required is approximately 200 L/day per person (assuming 400 people/camp/loop).

Water will be sourced from local groundwater, surface water dams, or public water supply standpipes along the construction route. Temporary dams may need to be constructed to store such water during the works. The required licences will be sought from the DoW prior to commencement of construction in any area.

2.4 Project outputs

2.4.1 Air (dust) emissions

Atmospheric dust will be the main component of air emissions during the construction phase of the pipeline, principally from clearing and grading, trenching, backfill and vehicle movement. Dust emissions are expected to be of short duration and intensity, and will be managed in accordance with a Dust Management Protocol (Chapter 4 Section 12).

2.4.2 Noise and vibration

Pipeline construction activity will result in a temporary increase in noise and vibration levels within the immediate vicinity of the alignment. This impact is expected to be of short duration and intensity and will be managed in accordance with a Noise and Vibration Management Protocol (Chapter 4 Section 13).

2.4.3 Waste water

Pipeline integrity is verified using hydrostatic testing in accordance with AS 2885.5. Providing it meets water quality guidelines and has landholder approval, hydro-test water is discharged to the surrounding environment. In general, it is expected that no chemicals will be added as the pipeline is internally coated. However, in some locations chemicals may need to be added if there is danger of the water affecting the integrity of the coating or the bare steel at the joints where the pipe lengths are welded together. In these cases and where necessary, the water will be treated to an appropriate standard before discharge to the environment. Disposal of this discharge, which is a once-off discharge during commissioning, will be managed in accordance with a Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6) prepared in consultation with the DEC.



Trench and excavation dewatering may be required in locations of shallow groundwater (e.g. river basins, wetlands and areas on the Swan Coastal Plain), with disposal of this water not expected to have a detrimental effect on the receiving environment. Disposal will be managed in accordance with the Dewatering and Water Disposal Management Protocol.

Sewage will be generated at campsites. Disposal will be undertaken by treatment in a package wastewater treatment plant, and the treated effluent disposed of via infiltration ponds in locations that will not cause pollution of the receiving environment.

2.4.4 Solid waste

Small amounts of domestic and industrial solid waste will be generated during construction and operation of the pipeline. The waste will be disposed of in accordance with the Waste Management Protocol (Chapter 4 Section 15), which will be consistent with relevant local authority requirements.



3 ENVIRONMENTAL FACTORS

The DBNGP Stage 5 Expansion follows the route of the existing DBNGP from Dampier to Wagerup across the pastoral, wheat belt, Perth Metropolitan and Peel region areas of Western Australia. Due to the length of the pipeline, the corridor intersects a number of different environments, which may require differing management actions.

The pastoral area (north of Northampton) is generally an uncleared sparsely vegetated arid landscape. Rocky outcrops and vegetated areas near water (including rivers) are the most significant habitats. Loop 0 (Dampier) to Loop 6 are mostly within the pastoral region.

The wheat belt area (between Northampton and Gingin) is mostly cleared with occasional large blocks of remnant vegetation. Most rivers, wetlands, and vegetated areas on private and public land are considered of conservation significance in this region and support threatened flora and fauna populations. Several Threatened Ecological Communities (TECs) are found in the southern extent of this area in small pockets of remnant vegetation on the eastern side of the Swan Coastal Plain. Loops 7 and 8 and the northern section of Loop 9 are within this area.

The Perth metropolitan area has been mostly cleared for agricultural and urban use, with both uses intensifying near the Perth CBD. The route is within 13 km of the Perth CBD at its closest point. Within the urban zone, there are numerous conservation reserves, urban bushland areas, conservation wetlands and two major rivers (Swan and Canning) near the proposed pipeline route through this area. The pipeline runs past Forestdale Lake, a Ramsar site, in this section. Loop 9 extends into the Perth metropolitan area.

The Peel region area near the proposed pipeline is almost entirely cleared with only small pockets of vegetation and wetland areas remaining. These remnant vegetation areas occasionally support threatened flora. The area is within the catchment of the Peel-Harvey Estuary, a Ramsar wetland, which is approximately 10 km away from the proposed route at its closest point. Loop 10 is within the Peel region area.

3.1 Scoping and key studies

The scoping process undertaken to identify key environmental issues associated with the Stage 5 Expansion has been discussed in the environmental impact assessment prepared for referral to the EPA (Strategen 2006), with an appended version provided below. The process was undertaken consistent with EPA guidelines and involved considerable stakeholder consultation. Table 1-9 provides the outcomes of the assessment undertaken to determine key environmental factors relating to the proposal. Other environmental factors not considered key relevant factors but requiring further consideration were also identified.

Despite the length of the pipeline and the various geographical regions and landforms that the pipeline traverses, the review found that the environmental factors requiring consideration were generally the same for the three regions. However, many of the factors on the Swan Coastal Plain (Loops 9 and 10) have the potential for greater significance of impacts.

The following studies have been undertaken to investigate key environmental factors and are contained in full in the appendices:

Terrestrial vegetation and flora studies to assess potential impacts on the conservation status of those species known or likely to occur along the pipeline corridor (Appendix 2).

A detailed vegetation and flora survey was undertaken for Loops 0 to 7 (inclusive) of the Stage 5 Expansion during the summer/autumn of 2006 (Mattiske 2006).

Detailed vegetation and flora surveys were previously undertaken along the entire lengths of Loops 9 and 10; these studies were considered relevant for this assessment (Mattiske 2003a, 2003b). Spring flora surveys have been undertaken in 2006 along Loops 8, 9 and 10 to identify and map locations of Priority and Declared Rare Flora species (awaiting reports).



Terrestrial fauna studies to assess the potential impacts on the conservation status of those species known or likely to occur along the pipeline corridor (Appendix 3).

A review of fauna interactions during some of the Stage 4 expansion construction works was undertaken to refine fauna interaction procedures for the Stage 5 Expansion (Bancroft and Bamford 2006a).

A review of relevant fauna datasets and publications was undertaken (including a reconnaissance survey) to identify conservation significant fauna and fauna habitats that may be affected by the Stage 5 Expansion (Bancroft and Bamford 2006b).

Fauna studies to establish the presence, or otherwise, of habitat supporting the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) within Loops 9 and 10 will be carried out prior to commencement of construction.

Fauna studies to establish the presence, or otherwise, of the Western Spiny-tailed Skink (*Egernia stokesii badia*) within Loops 5 and 6 will be carried out prior to commencement of construction.

Acid sulphate soil and hydrogeological studies to predict the likelihood of encountering acid sulphate soils, shallow groundwater, wetlands and river systems along the Stage 5 Expansion loops and to develop an investigation strategy (Parsons Brinckerhoff 2006) (Appendix 4).

Aboriginal heritage studies to investigate the presence and significance of Aboriginal heritage features along the pipeline corridor (AIC 2006) (Appendix 5).

An assessment of potential environmental impacts associated with the expansion has been undertaken with the outcomes discussed below.

Table 1-9 Environmental aspects of the proposal

Relevant factor	Proposal aspect	Potential impacts	Further assessment
Biophysical			
Vegetation and flora	Clear and grade	Loss of vegetation communities Weed infestation and disease spread Wildfire Damage by dust emissions	Key factor for all loops.
	Construction vehicular movement	Weed infestation and disease spread Damage by dust emissions Wildfire	
	Trench and excavation dewatering	Disturbance to groundwater dependent vegetation from drawdown and acid formation	
Wetlands	Clear and grade	Disturbance to wetland	Key factor for Loops 8 to 10.
	Trench and excavation dewatering	Loss of wetland attributes due to drawdown and acid formation	
	Fuel and chemical storage, handling and spills	Contamination of wetland	
Fauna	Clear and grade operations	Removal of habitat	Key factor for all loops.
	Trench and excavation dewatering	Alteration of habitat from drawdown	
	Trenching	Fatalities of trapped fauna	
	Construction vehicular movement	Road kills Wildfire	
	Noise emissions	Disturbance to nearby fauna	



Relevant factor	Proposal aspect	Potential impacts	Further assessment
Conservation areas	Clear and grade	Disturbance to conservation areas Weed infestation and disease spread	Key factor for all loops.
	Fuel and chemical storage, handling and spills	Contamination	
Soils and terrain	Clear and grade	Erosion (wind and rain) and sedimentation	Key factor for all loops.
	Construction vehicular movement	Soil compaction	
	Trenching and backfilling	Soil inversion	
	Trench and excavation dewatering	Soil contamination from acid formation	
	Fuel and chemical storage, handling and spills	Soil contamination	
	Test water disposal and waste generation	Soil contamination	
Groundwater	Trench and excavation dewatering	Water contamination from acid formation Altered groundwater regime	Key factor for Loops 8 - 10.
	Fuel and chemical storage, handling and spills	Water contamination	
	Test water disposal	Water contamination	
Watercourses	River and stream crossings	Disturbance to river and stream channels and banks	Key factor for all loops.
	Clear and grade	Increased sediment load or turbidity	
	Trench and excavation dewatering	Migration of acid formation	
	Fuel and chemical storage, handling and spills	Water contamination	
	Test water disposal and waste generation	Water contamination	
Pollution management			
Noise and vibration	Noise emissions and vibration from construction equipment and blasting	Disturbance to amenity Property damage	Key factor for Loops 9 and 10. Minor factor for Loop 0 to 8.
Air quality	Air emissions from vehicles	Negligible	Key factor for Loops 9 and 10. Minor factor for Loops 0 to 8.
	Dust emissions from exposed surfaces and construction vehicular movement	Disturbance to amenity and property damage Damage to vegetation	
Social surrounds			
Heritage	Clear and grade	Disturbance to shallow artefacts and subsurface material Damage to significant natural features of ethnographic significance (trees, watercourses and landscape)	Key factor for all loops.
	Trenching	Disturbance to subsurface material	



Relevant factor	Proposal aspect	Potential impacts	Further assessment
Land usage and services	Construction access and vehicular movement	Temporary loss of land utilisation and property access Temporary disruption to stock movement and land management Loss of soil productivity Spread of weeds Wildfire Increased local road traffic Damage to infrastructure and property Disruption of services	Key factor for all loops.
	Site preparation	Temporary loss of land utilisation and property access Temporary disruption to stock movement and farm management Loss of soil productivity Spread of weeds Wildfire Damage to infrastructure and property Disruption of services	
	Backfilled trench	Loss of soil productivity Permanent restrictions on land usage	
Public safety and risk	Pipeline failure	Property damage Injuries or fatalities	Key factor for Loops 9 and 10. Minor factor for Loops 0 to 8.

4 VEGETATION AND FLORA

4.1 Vegetation and flora overview

4.1.1 Pastoral Region (Loops 0 to 6)

Mattiske Consulting Pty Ltd (Mattiske) undertook a vegetation and flora survey of the Stage 5 Expansion pastoral region loops consistent with EPA Guidance Statement No. 51 (Mattiske 2006). The vegetation of Loops 0 to 6 is described below in broad terms according to the five biogeographical regions that the loops traverse:

1. Pilbara (Loops 0 and 1): Located within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard (1975). The vegetation is characterised by tree and shrub-steppe communities. Dominant genera of the area are *Eucalyptus*, *Acacia* and *Triodia*.
2. Carnarvon (Loops 2, 3, 4 and 5): Classified as the Carnarvon Botanical District as defined by Beard (1975). Dominant genera are *Acacia* and *Triodia* with occurrences of species from the *Chenopodiaceae* (Chenopods) family such as *Halosarcia*, *Atriplex* and *Maireana* on flats and claypans. The vegetation of the area is varied and is dominated by *Acacia* in the south and changes to *Triodia* dominated in the north.
3. Gascoyne (Loops 2 and 3): Classified as the Ashburton Botanical District as defined by Beard (1975). Different forms of *Acacia aneura* (mulga) with other *Acacia sp.* as shrubs on hills and woodlands on flats. Other dominant species include *Eremophila* and *Senna*. The mulga woodlands/shrublands may be continuous or interrupted with bare patches. Perennial grasses such as *Triodia* species (Spinifex) are usually confined to patches of sandy soil, where sands tend to occur in low, raised banks. Annual grasses and daises are common in spring and late winter or occur opportunistically after significant rainfall events.
4. Yalgoo (Loops 5 and 6): Dominated by *Acacia* shrublands, *Acacia* forests and woodlands, hummock grasslands and smaller areas of eucalypt woodlands and cheopod and samphire shrublands.
5. Geraldton Sandplains (Loop 6): Located in the Irwin Botanical District of the Southwest Botanical Province as defined by Beard (1976). Dominant plant families include Proteaceae, Myrtaceae, Mimosaceae, Casuarinaceae, Asteraceae, Chenopodiaceae and Poaceae. Scrub heath and *Acacia – Casuarina* thickets with occasional areas of *Acacia* scrub with scattered *Eucalyptus* trees are main characteristics.

Mapping and descriptions of the vegetation communities along Loops 0 to 6 are contained in Mattiske (2006). No TECs listed under the Commonwealth EPBC Act or by DEC were recorded (Mattiske 2006).

The river crossings supported a range of species and communities that are able to tolerate both high and low energy flows. There is a range of significant habitat trees near some of these river crossings, however only a few occur within the proposed alignment.

The condition of the vegetation was very variable from completely degraded in areas that have been subjected to heavy grazing pressures, to excellent condition in areas subjected to above annual rainfall in the northern loops near Dampier and Karratha. The introduced and weed species were scattered throughout the pastoral areas, with a greater concentration of weeds in the major valley systems.

4.1.2 Flora

A total of 501 taxa of native terrestrial vascular flora were recorded from along Loops 0 to 6. Twelve different Priority Flora species were recorded by Mattiske (2006) along Loops 0 to 6 (Table 1-10). No DRF was recorded. Eleven introduced species were recorded. The dominant weeds included *Cenchrus ciliaris* (Buffel Grass) (Loops 0 to 4), *Cenchrus setigerus* (Birdwood Grass) (Loops 2 and 4), *Malvastrum americanum* (Spiked Malvastrum) (Loops 0 and 3), and *Amaranthus mitchellii* (Boggabri Weed) (Loops 1 and 3).

Table 1-10 Priority Flora recorded along Loops 0 to 6

Loop	Species name	Conservation status
0	<i>Hibiscus brachysiphonius</i>	P3
1	<i>Goodenia pascua</i>	P3
2	<i>Olearia fluvialis</i>	P2
3	<i>Frankenia glomerata</i>	P3
4	<i>Grevillea stenostachya</i>	P3
	<i>Scaevola chrysopogon</i>	P2
5	<i>Dicrastylis linearifolia</i>	P3
	<i>Eremophila physocalyx</i>	P3
	<i>Grevillea stenostachya</i>	P3
6	<i>Acanthocarpus parviflorus</i>	P3
	<i>Dicrastylis incana</i>	P2
	<i>Dicrastylis linearifolia</i>	P3
	<i>Grevillea stenostachya</i>	P3
	<i>Microcorys tenuifolia</i>	P3
	<i>Philotheca kalbarriensis</i>	P2

Source: Mattiske (2006).

The DEC database has also been searched for the locations of DRF and Priority Flora occurring within or immediately adjacent (within 5 km either side) to the corridor. The field studies in Loops 0 to 6 concentrated on the areas within 30 to 100 m of the pipeline corridor. This list of species is provided in Mattiske (2006).

4.1.3 Agricultural Region (Loops 7 and 8)

Mattiske Consulting Pty Ltd (Mattiske) undertook a vegetation and flora survey of Loop 7 of the Stage 5 Expansion (Mattiske 2006). An overview of the findings is provided below.

A survey of Loop 8 is planned for the spring of 2006. A list of Threatened Flora and TECs that have been recorded near Loop 8 has been compiled from DEC datasets and an overview provided below.

4.1.4 Vegetation

The vegetation of Loops 7 and 8 are broadly described below in regards to the two biogeographical regions traversed by the loops:

6. Geraldton Sandplains (Loops 7 and 8): Located in the Irwin Botanical District of the Southwest Botanical Province as defined by Beard (1976). Dominant plant families include Proteaceae, Myrtaceae, Mimosaceae, Casuarinaceae, Asteraceae, Chenopodiaceae and Poaceae. Scrub heath and *Acacia* – *Casuarina* thickets with occasional areas of *Acacia* scrub with scattered *Eucalyptus* trees are main characteristics.
7. Swan Coastal Plain (Loop 8): Part of the Southwest Botanical province as defined by Beard (1981). Characterised by *Banksia* low woodland on leached sands with *Melaleuca* swamps in less drained areas.

The majority of Loop 7 has been cleared and modified by agricultural activities. Consequently, only localised remnants occur near the pipeline corridor. The values within these remnants are locally significant as so little is left of the original plant communities in the area.



A search of the DEC TEC database revealed that there is currently no known TEC located within Loops 7 and 8 (Woodman 2006). However, as noted by Woodman (2006), there is an occurrence of the priority ecological community known as '*Petrophile chrysantha* low heath on Lesueur dissected uplands' in the area. There are also occurrences of the Critically Endangered TEC 'Lesueur-Coomaloo Floristic Community (species rich low heath dominated by *Allocasuarina microstachya*)' and occurrences of the priority communities 'Ferricrete floristic community (Rocky Springs type)' and 'Lesueur-Coomaloo Floristic Community (*Melaleuca preissiana* woodland)' within 20 km of the pipeline corridor looping sections.

4.1.5 Flora

A total of 58 taxa of native terrestrial vascular flora were recorded from along Loop 7. No DRF or Priority Flora species were located during the survey. Three introduced species were recorded. These were *Avena barbata*, *Bromus* sp. and *Mesembryanthemum nodiflorum*.

The DEC database was searched for DRF and Priority Flora occurring within or immediately adjacent (within 5 km either side of the alignment) to the corridor. This list of species is provided in Mattiske (2006).

A range of DRF species is known to occur near Loop 8 and this area will be inspected closely during the spring flora survey. In addition, there are another 124 Priority Flora species that may occur within the area (Woodman 2006).

4.1.6 **Swan Coastal Plain Region (Loops 9 and 10)**

Mattiske Consulting Pty Ltd (Mattiske) undertook vegetation and flora surveys of the pipeline route in 2003 (Mattiske 2003a, 2003b). An overview of these reports has been provided below.

4.1.7 Vegetation

The survey area lies within the Darling Botanical District of the Southwest Botanical Province (Beard 1990) and thus exhibits characteristics of this province. Dominant plant families within the Drummond Botanical Sub-district of the Darling Botanical District include Proteaceae (*Grevillea*, *Banksia*), Myrtaceae (*Eucalyptus*, *Melaleuca*) and Mimosaceae (*Acacia*). The Drummond Botanical Sub-district is characterised by *Banksia* woodland on leached sands with *Melaleuca* swamps where ill-drained; woodland of tuart (*Eucalyptus gomphocephala*), jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) on less leached soils (Beard 1990).

Mattiske (2003a, 2003b) mapped and recorded the vegetation and flora occurring along the pipeline route on the Swan Coastal Plain at a detailed scale. A total of 69 vegetation communities along the pipeline route were recorded, including *Banksia* woodlands, *Corymbia calophylla* woodlands, *Eucalyptus* woodlands, *Melaleuca* woodlands, *Agonis flexuosa* woodlands and forests, *Kunzea ericifolia* subsp. *ericifolia* shrublands, heath communities, shrublands and sedgelands. Of these the heath communities, shrublands, sedgelands and *Agonis flexuosa* woodlands and forests were the least common (Mattiske 2003a, 2003b). The relatively high number of plant communities recorded in these loops reflects the large area surveyed and to some degree the diversity of landforms within the survey area. Many of the vegetation communities differ only slightly from one another and the contrasts are more than likely due to a loss of structure and diversity due to degradation from urban development (Loop 9) and intensive farming practises (Loop 10) (Mattiske 2003a, 2003b).

Threatened Ecological Communities

The survey by Mattiske (2003a) identified three occurrences of the TEC '*Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain' in Loop 9. All occurrences were within Bush Forever Site No. 320 (Hartfield Park, Forrestfield) and are not relevant to Stages 5A or 5B.

The condition of the vegetation of the two most northerly locations of this community was 'Good' to 'Very Good'. However, in the most southerly location, the community vegetation was recorded as being very degraded with only occasional *Corymbia calophylla* or *Kingia Australia* plants present (Mattiske 2003a).



Mattiske (2003b) also identified five localised areas of this same TEC in Loop 10 centred at the following locations:

- 1427.04 (recorded approximately 150 m from the pipeline corridor)
- 1432.6 (recorded approximately 100 m from the pipeline corridor)
- 1433.85 (recorded approximately 90 m from the pipeline corridor)
- 1438.06 (recorded within the pipeline corridor)
- 1438.25 (recorded within the pipeline corridor).

The community was very degraded and in most cases only the occasional *Corymbia calophylla* or *Kingia Australia* plants were present (Mattiske 2003b). The occurrences of these communities were considered to be fragmented, small and largely disturbed.

The TEC '*Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain' is categorised as 'Endangered' and is listed under the EPBC Act.

No other TECs were recorded in Loops 9 or 10 during the surveys. However, the DEC database identifies two further TECs at locations north of Bullsbrook (within Loop 9) occurring within 500 m of the pipeline corridor (Table 1-11). Both are located within the Stage 5A works area.

Table 1-11 TECs recorded on DEC database within 500 m of the pipeline corridor in Loop 9

TEC	Approximate location	Approximate distance from pipeline corridor (m)
Perth to Gingin ironstone association of the Swan Coastal Plain	East of the Pearce Flying Club	120
	3 km north of Timaru Road (approximately 10 km north of Muchea)	50
Communities of Tumulus Springs	South of Muchea (approximately 2 km south)	350
	West of Bullsbrook (near Neaves Road)	400
	West of Bullsbrook (near Neaves Road)	400

Vegetation condition

Mattiske (2003a, 2003b) rated the condition of each mapped vegetation community in Loops 9 and 10 according to the scale used for assessing Bush Forever Sites (Government of Western Australia 2000b). It ranged from Very Good² to Degraded and evidence of disturbance was largely associated with roads, railway lines, powerlines, housing developments and variable grazing pressures.

4.1.8 Flora

Mattiske (2003a, 2003b) recorded a total of 167 plant taxa (including varieties and subspecies) in Loop 9 and a total of 326 plant taxa in Loop 10 and determined that the low number of taxa recorded during surveys of such relatively large sizes, reflects the high degree of disturbance and the large area of cleared land. However, the reports also acknowledged that additional species would most likely be recorded if further survey work was undertaken during other seasons or in more favourable rainfall periods.

² Very Good: Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure covers repeated fire, aggressive weeds, dieback, logging, grazing.

Good: Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure covers frequent fires, aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded: Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure includes frequent fires, presence of very aggressive weeds, partial clearing, dieback and grazing.

A high number of weeds were found within the proposed pipeline corridor. The abundance of weeds exceeded the diversity of weed species recorded in both Loops 9 and 10 (Mattiske 2003a, 2003b). Several of the introduced plants were planted in paddocks and rehabilitation areas along the route.

Over 30 introduced plant species were recorded in Loop 9; however, none of these was listed as Declared Plants under Section 37 of the *Agriculture and Related Resources Protection Act 1976*. Over 70 introduced plant species were recorded in Loop 10. Five of these were listed as Declared Plants under Section 37 of the *Agriculture and Related Resources Protection Act 1976*:

- Arum Lily (*Zantedeschia aethiopica*) (P1 and P4 control requirements)
- Blackberry (*Rubus fruticosus*) (P1 and P4 control requirements)
- Cotton Bush (*Gomphocarpus fruticosus*) (P1 and P4 control requirements)
- Paterson's Curse (*Echium plantagineum*) (P1 and P3 control requirements)
- Prickly Pear (*Opuntia* spp.) (Declared Plant).

Rare and Priority Flora

Mattiske (2003a) identified four plant species in the vicinity of Loop 9 of the pipeline corridor as being restricted geographically or threatened by local processes (Table 1-12). One species of DRF (*Conospermum undulatum*) listed under the Wildlife Act, and three other species listed as Priority Flora were identified at Hartfield Park (Bush Forever Site 320) in Loop 9 (Table 1-12). *Conospermum undulatum* is also listed as Vulnerable under the EPBC Act.

Mattiske (2003b) did not identify any DRF or Priority Flora species within the pipeline corridor of Loop 10 that will be affected by the Stage 5 Expansion. However, a subsequent survey by Mattiske (2008) identified the occurrence of DRF (*Synaphea stenoloba*) near and within the pipeline corridor in the vicinity of the Alcoa bauxite refinery access road, north of Pinjarra, that falls within the limits of the Stage 5B project. These have been mapped and a permit to remove will be sought.

Table 1-12 DRF and Priority Flora species located in Loop 9

Location	Species Name	Conservation status	Stage
BFS 320 (Hartfield Park, Forrestfield)	<i>Conospermum undulatum</i>	DRF	Post 5B
	<i>Isopogon drummondii</i>	P3	Post 5B
	<i>Jacksonia ?sericea</i>	P3	Post 5B
	<i>Lambertia multiflora</i> var. <i>darlingensis</i>	P3	Post 5B
Alcoa bauxite refinery access road (KP1447.8)	<i>Synaphea stenoloba</i>	DRF	5B

4.2 Potential impacts

Project activities requiring vegetation clearing (e.g. clear and grade) have the potential to affect vegetation and flora values. Potential direct impacts that may result primarily from clearing activities include:

- change in the abundance, species diversity, geographic distribution and productivity of vegetation communities
- disturbance of DRF and Priority Flora species
- disturbance of species with significant range extensions.

Potential indirect impacts that may result from vegetation clearing and other construction activities, such as trenching and excavation, dewatering, hydro-testing, and stringing, welding and x-raying, include:

- smothering of vegetation by dust



- introduction or spread of weeds
- bushfire risk (associated with metal cutting, welding and grinding activities)
- alteration of groundwater and surface drainage regimes.

Weeds

Movement of vehicles and other vectors, such as the presence of cattle, has the potential to introduce weeds and/or spread existing populations of weeds. This may be compounded by many weed seeds remaining dormant in soil until the area is disturbed (APIA 1998). Areas that are particularly vulnerable to weed infestation include watercourses, where higher moisture levels may encourage rapid infestations, and areas where species competition is limited and soil disturbance high (e.g. stock grazing areas).

A range of aggressive agricultural weeds occurs in Loops 7 and 8. These include species with a wide tolerance of sites or that tend to occur on the deeper sandy soils in these areas. These species include *Eragrostis curvula* (South African Love Grass), *Eragrostis calyina* and *E. longiflora* (Veldt Grass), *Lupinus* species, and *Arctotheca calendula* (Cape Weed).

In addition, a high number of weeds are already present within the pipeline corridor along Loops 9 and 10.

Dust

Dust may have physical effects on plants such as blockage and damage to stomata, shading, abrasion of leaf surface or cuticle, and cumulative effects (e.g. drought stress on already stressed species). Vegetation adjacent to the pipeline corridor, or located close to access tracks and other sources of dust (e.g. stockpiles), is more likely to be subject to such impacts. In the pastoral region, areas of clay substrate have the potential to generate large amounts of dust from even light vehicle movement. The construction works will be scheduled to minimise the area of ground disturbance, including the number of access tracks, to reduce adverse impacts resulting from dust and erosion.

Fire

The potential for a bushfire to occur is associated with a number of construction activities including metal cutting, welding and grinding activities, as well as by the operation of equipment or vehicles in high risk areas/conditions. Clearing of the pipeline construction right-of-way will provide some separation between construction activities and surrounding vegetation and flora. All vehicles will be fitted with fire extinguishers, and welding crews will have additional water based fire fighting capabilities.

4.2.1 Pastoral Region (Loops 0 to 6)

Clearing

The total area of disturbance within the pipeline corridor required for construction of Loops 0 to 6 is around 2100 ha³ (Table 1-13), although the actual clearing requirements are expected to be less than 1000 ha as not all of the corridor is vegetated. There will also be a requirement to clear areas outside the corridor for infrastructure such as construction camps, turkey nests and turnarounds. Where practicable, existing turkey nests, construction camp sites and cleared and/or disturbed areas will be used in preference to disturbing new sites.

³ Based on a working width of 25 m and does not take into account reduced working width areas in areas of conservation value.



Table 1-13 Area of disturbance in Loops 0 to 6

Loop	Estimated total area of disturbance within pipeline corridor (ha)*	Estimated area of disturbance outside pipeline corridor (ha)
0	343	6
1	308	16
2	262	15
3	283	15
4	282	15
5	298	16
6	328	16
TOTAL	2104 ha	99 ha

* Based on a working width of 25 m. Not taking into account reduced working widths in areas of conservation value.

The vegetation within the DBNGP corridor is vegetation that has established subsequent to clearing of the corridor for installation of the majority of the original pipeline in 1982/83. Vegetation removal and subsequent rehabilitation within the pipeline corridor will occur sequentially as each individual loop is constructed; only the relevant length of the pipeline corridor will be cleared for each construction period. No TECs as defined under that EPBC Act or by DEC were found in the pipeline corridor within Loops 0 to 6. Of interest were several communities that supported a range of Priority species or species that occur as outliers from their main occurrence. In these areas, the communities could be considered locally significant. The river crossings also supported significant habitat trees either within or near the pipeline corridor (Mattiske 2006).

Occurrences of Priority Flora species within the pipeline corridor will most likely be cleared, however, there may be opportunities to avoid flora (e.g. through reducing corridor working width in nominated areas of rare or endangered flora), translocate flora to adjacent vegetation or use biological material from flora for propagation of plants for rehabilitation. Disturbance to these species outside of the pipeline corridor (e.g. for construction camps, turnarounds etc.) will be avoided, where practicable. In the event that DRF cannot be avoided, an application to take DRF will be prepared and submitted to DEC for approval by the Minister for the Environment in accordance with the Wildlife Act.

The loss of Threatened Flora through disturbance during the project is not expected to affect the conservation status of these species, as none of the threatened (Priority) species are restricted to the pipeline corridor.

Altered water regimes

Groundwater is typically at depth in Loops 0 to 6, except in river basins where groundwater levels can be relatively shallow. Therefore, trenching would typically be above the water table and would have no effect on groundwater regimes, except where dewatering may be needed at river crossings. It is also likely groundwater will be used as the main construction water source along Loops 0 to 6. Potential effects of altered groundwater regimes on vegetation and flora values is expected to be limited to areas near the watercourses and for limited times during construction activities. As many of these systems are perennial or intermittent, many of the plant species are able to tolerate extremes in soil moisture availability.

The presence of linear stockpiles of topsoil and excavation spoil, and modification to surface contours during construction may temporarily alter surface drainage patterns. This may affect vegetation dependent on such drainage systems. These communities are largely dominated by *Eucalyptus camaldulensis*, *E. victrix* and a range of *Melaleuca* and *Acacia* species. All of these larger tree and shrub species are dependent on intermittent groundwater levels and are generally adapted to massive water table fluctuations, providing they are not too extreme.

Construction on the northern loops will be undertaken in the winter, as far as practicable, when surface drainage will be minimal. Any disruption to surface flows will be temporary as all stockpiles will be removed and post construction earthworks will restore the pre-existing landform and drainage patterns.



4.2.2 Agricultural Region (Loops 7 and 8)

Vegetation clearing

The total area of disturbance within the pipeline corridor required for construction of Loops 7 and 8 is approximately 600 ha⁴, of which, approximately 120 ha in Loop 7 and 60 ha in Loop 8 is vegetated and will require clearing (Table 1-14). There will also be a requirement for infrastructure to be located outside of the pipeline corridor (e.g. turnarounds, turkey nests), with existing turkey nests and construction camp sites located in cleared and/or disturbed areas where practicable.

Table 1-14 Area of disturbance in Loops 7 and 8

Loop	Estimated total area of disturbance within pipeline corridor (ha)*	Estimated vegetated area within corridor (ha)*	Estimated area of disturbance outside corridor (ha)
7	356	120	16
8	242	60	15
TOTAL	598 ha	180 ha	31 ha

* Based on a working width of 25 m. Not taking into account reduced working widths in areas of conservation value.

The extent of vegetation within Loop 7 is negligible in view of the extent of agricultural clearing activities. In contrast, sections of Loop 8 occur within areas supporting uncleared shrubland and heath communities, which are locally and regionally significant as a result of the range of species, degree of endemism and previous clearing activities in the area.

Occurrences of DRF or Priority Flora within the pipeline corridor, should they occur, will most likely be cleared, however, there may be opportunities to avoid flora (e.g. through reducing corridor working width), translocate flora to adjacent vegetation or use biological material from flora for propagation of plants for rehabilitation. Disturbance to these species outside of the pipeline corridor (e.g. for construction camps, turnarounds etc.) will be avoided. In the event that DRF cannot be avoided, an application to take DRF will be prepared and submitted to DEC for approval by the Minister for the Environment in accordance with the Wildlife Act.

Based on currently available information, the loss of flora from disturbance during the project is not expected to affect the conservation status of these species. This will require further targeted work in the spring months of 2006.

Dieback

Dieback disease, caused by microscopic soil fungi of the genus *Phytophthora*⁵, affects a wide range of native flora species throughout the South-West of Western Australia. The pathogen requires a minimum of 400 mm annual rainfall to survive. These conditions are met in Loop 8. Dieback may be spread by surface or subsurface water flow, but the major vector of infection is the transport of infected soil and plant material, whether in fill or mulch or adhering to vehicles and machinery.

Mapping for dieback along Loop 8 will be undertaken as part of spring flora surveys, with the location of dieback infestations included on the Environmental Line List to indicate areas where dieback hygiene measures are to be implemented during construction. As construction will be occurring in predominantly dry seasons (where practicable), and a Hygiene Management Protocol will be implemented, the risk of spreading dieback will be minimal.

⁴ Based on a working width of 25 m and does not take into account reduced working widths in designated conservation areas.

⁵ Currently up to nine *Phytophthora* species are causing infestation in the South-West. This disease destroys the structure of native plant communities, reducing their floristic diversity, decimating primary productivity and destroying habitat for dependant native fauna (EPA 2000).



Altered water regimes

Groundwater is typically at depth in Loops 7 and 8, except in river basins where groundwater levels can be relatively shallow. Trenching would therefore typically be above the water table and would have no effect on groundwater regimes, except where dewatering may be needed at river crossings. It is also likely groundwater will be used as the main construction water source along Loops 7 and 8. Potential effects of altered groundwater regimes on vegetation and flora values is expected to be limited to areas near the watercourses and for limited times during construction activities. As many of these systems are perennial or intermittent, many of the plant species are able to tolerate extremes in soil moisture availability.

The presence of linear stockpiles of topsoil and excavation and trench spoil, and modification to surface contours during construction may alter surface drainage patterns. Construction of Loops 7 and 8 will be undertaken in the dry season, where practicable, when surface drainage will be minimal, however should there be any disruption to surface flows it will be temporary (Section 4.1.3).

4.2.3 Swan Coastal Plain Region (Loops 9 and 10)

Vegetation clearing

The total area of disturbance within the pipeline corridor required for construction of Loops 9 and 10 is around 473 ha⁶, of which approximately 75 ha⁷ in Loop 9 and 8.5 ha in Loop 10 is vegetated and will require clearing (Table 1-15). There may also be a requirement for infrastructure to be located outside of the pipeline corridor (e.g. turnarounds) although existing cleared and/or disturbed areas will be used where practicable. Disturbance outside the corridor could be around 2 ha for Loops 9 and 10 (Table 1-15).

Approximately 55 ha⁸ of the vegetation to be cleared in Loop 9 are located within Bush Forever Sites. Vegetation within Bush Forever Sites outside the pipeline corridor will not be cleared. Infrastructure such as turnarounds either will be located outside, or within previously cleared areas of Bush Forever Sites, where necessary.

Table 1-15 Area of disturbance in Loops 9 and 10

Loop	Total area of disturbance within pipeline corridor (ha)*	Estimated vegetated area within pipeline corridor (ha)**	Estimated area of disturbance outside of pipeline corridor (ha)
9	319	75	1.2
10	154	8.5	0.6
TOTAL	473 ha	83.5 ha	1.8 ha

* Based on a working width of 25 m. Not taking into account reduced working widths in areas of conservation value.

** Based on a working width of 20 m in Bush Forever Sites.

All the vegetation requiring clearing within the pipeline corridor in Bush Forever Sites is considered to be regionally significant. Mattiske (2003a) identified a number of specific plant communities as significant as they support DRF and/or Priority Flora or may be recognised as a TEC. These plant communities are all found within Hartfield Park (Bush Forever Site 320) in Loop 9. There were a number of other Bush Forever Sites, although not specifically regarded as significant by Mattiske (2003a), that contained relatively intact and well established vegetation (generally the result of controlling access) within the pipeline corridor including:

- Dundas Road bushland (Bush Forever Site 319)
- Denis de Young Reserve and Gibbs Road Swamp bushland (Bush Forever Site 344).

⁶ Based on a working width of 25 m and does not take into account reduced working widths in areas of conservation value.

⁷ Based on a 20 m working width in Bush Forever Sites and a 25 m working width outside of areas of conservation value (including Bush Forever Sites).

⁸ This figure has been calculated using information provided by the Department for Planning and Infrastructure. It was estimated using the 2001 native vegetation mapping dataset based on a working width of 25 m.



The pipeline corridor in other Bush Forever Sites, such as The Spectacles (Bush Forever Site 269), although predominantly cleared of vegetation, does contain a number of mature trees at the edge of the corridor that are likely to have considerable habitat value. In most Bush Forever Sites, much of the vegetation within the pipeline corridor is considerably disturbed, partially cleared and/or the corridor appears to be used as an informal access track.

No vegetation within areas of conservation value will be cleared in Loop 10 other than disturbance to those wetlands identified in Chapter 1 Section 9, and degraded areas supporting a TEC, described above. Construction activities for Stage 5 will be occurring immediately adjacent to one nature reserve (the Buller Nature Reserve) and may have the potential to indirectly affect the conservation values of this area through increased edge effects.

Construction of the Stage 5 Expansion pipeline within the corridor will most likely result in the direct impact on TECs in three separate locations in Loops 9 and 10:

- Loop 9, Muchea (TEC - Perth to Gingin ironstone formation on the Swan Coastal Plain)
- Loop 9, Hartfield Park, Forrestfield (TEC – *Corymbia calophylla* over *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain)
- Loop 10, KP location 1438-1439 (TEC – *Corymbia calophylla* over *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain).⁹

A reduced width of the working corridor (maximum 20 m) will be applied where TECs are mapped in Loop 9.

One species of DRF and three species of Priority Flora were located by Mattiske (2003a) within the pipeline corridor in Loop 9. These have all been mapped at Hartfield Park (Bush Forever Site 320). Reduced width of the working corridor (maximum 20 m working width) will also be applied in these areas. Where disturbance to these populations is unavoidable, there may be opportunities to translocate flora to adjacent vegetation or use biological material from flora for propagation of plants for rehabilitation.

Altered water regimes

Groundwater is typically shallow on the Swan Coastal Plain. However, Stage 5 Expansion construction will be timed for the summer months, where practicable, when the water table will be at its lower limits and seasonally inundated areas would be expected to be dry. The effect the Stage 5 Expansion may have on groundwater-dependent ecosystems is discussed in more detail in Chapter 1 Section 8.2.3.

The presence of linear stockpiles of topsoil, excavation and trench spoil, and modification to surface contours during construction may alter surface drainage patterns. This could affect vegetation dependent on such drainage. Construction on Stage 5 will be undertaken in the summer, where practicable, when surface drainage will be minimal. Any disruption to surface flows will be temporary as all stockpiles will be removed and post construction earthworks will restore the pre-existing landform and drainage patterns.

Dieback

The impact of *Phytophthora cinnamoni* presents a major threat to the ecology and conservation of susceptible vegetation communities in areas within Loops 9 and 10 of the pipeline corridor.

Mapping for dieback has been undertaken along Loops 9 and 10 (Mattiske 2008). The location of dieback infestations will be included on the Environmental Line List, being prepared as part of the CEMP, to indicate areas where dieback hygiene measures are to be implemented during construction. As construction will be occurring in predominantly dry seasons (where practicable), and a *Weed, Pest and Dieback Management Protocol* will be implemented, the risk of spreading dieback will be minimal.

⁹ Mattiske (2003b) recorded this community to be in a very degraded condition and to contain in most cases only the occasional presence of *Corymbia calophylla* or *Kingia australis* plants. Mattiske (2003a) regarded these communities to be so disturbed and fragmented (small) that they were unlikely to be sustainable and contain any value.



5 FAUNA

5.1 Fauna overview

5.1.1 Pastoral Region (Loops 0 to 6)

Bancroft and Bamford (2006a) undertook a review of fauna interactions during some of the Stage 4 expansion construction works to refine fauna interaction procedures for the Stage 5 Expansion. They also undertook a Level 1 fauna survey of the entire pipeline corridor in accordance with EPA Position Statement No. 3 (Bancroft and Bamford 2006b). An overview for the Stage 5 Expansion pastoral region loops is provided below.

5.1.2 Fauna habitat

The habitats found along the pastoral region loops is known to support a range of fauna species, including species listed for protection under State and Federal conservation legislation. It is likely that there will be areas along each of the pastoral region loops of relatively high value to fauna, particularly when compared with other areas within the region. Examples of these include:

1. National Parks, Conservation Parks, Nature Reserves and Conservation Reserves: areas that have been previously recognised as of high value for flora or fauna, or that have been set aside for conservation purposes (e.g. Cane River Conservation Park).
2. Drainage lines: in the arid and semi-arid regions, rivers, creeks and drainage lines often support higher quality, or more diverse, vegetation and this may concentrate fauna in these areas (e.g. Maitland, Robe, Cane and Lyons Rivers).
3. Kendrick and Stanley (2003) list the permanent pools (within 40 km of the coast) of coastal rivers (Maitland, Fortescue) as wetlands of subregional significance. These pools may be significant for large fish, waterbirds and invertebrates.
4. Desmond and Chant (2003) list the Minilya, Gascoyne and Wooramel Rivers as wetlands of subregional significance. Pools along these drainage lines may be important regional biological refugia.
5. Rare or unusual habitats: uncommon or unusual habitats (e.g. those driven by geological or hydrological factors such as freshwater springs or outlying hills) may support uncommon or outlying fauna populations, or may support a high degree of fauna endemism.

5.1.3 Fauna species

Fifty-one species recorded within Loops 0 to 6 were assessed as being of CS1 or CS2 (Table 1-16) (Bancroft and Bamford 2006b).

Table 1-16 Fauna of conservation significance potentially occurring along Loops 0 to 6

Species	Loop species likely to occur along	Species	Loop species likely to occur along
CS1 Species		CS2 Species	
Gilled Slender Blue-tongue*	6	Fortescue Grunter*	0, 1, 2
Western Spiny-tailed Skink*^	2, 3, 4, 5, 6	<i>Lerista lineata</i> *	2, 3, 4, 5
Woma*	2, 3, 4, 5, 6	<i>Lerista planiventralis maryani</i> *	0, 1
Pilbara Olive Python*	0, 1, 2	<i>Lerista yuna</i> *	6
Carpet Python*	6	Grey Falcon	0, 1, 2, 3, 4, 5
Malleefowl^	2, 3, 4, 5, 6	Australian Bustard	All
Great Egret	All	Bush Stone-curlew	All
Glossy Ibis	All	Barking Owl	6
White-bellied Sea-Eagle^	All	Thick-billed Grasswren	2, 3, 4, 5
Peregrine Falcon	All	Rufous Fieldwren	6
Little Curlew^	0, 1, 2	Slender-billed Thornbill^	2, 3, 4, 5, 6
Common Greenshank^	All	White-browed Babbler	6
Wood Sandpiper	All	Crested Bellbird	6
Common Sandpiper	All	Spectacled Hare-wallaby	0, 1
Red-necked Stint	All	Tammar	6
Sharp-tailed Sandpiper	All	Ghost Bat	0, 1, 2
Curlew Sandpiper	All	Short-tailed Mouse*	0, 1
Oriental Plover^	0, 1, 2, 3, 4, 5	Western Pebble-mound Mouse*	0, 1, 2
Oriental Pratincole^	0, 1, 2		
Caspian Tern	All		
White-winged Black Tern	All		
Carnaby's Cockatoo	5, 6		
Major Mitchell's Cockatoo	5, 6		
Night Parrot	0, 1		
Fork-tailed Swift	All		
Rainbow Bee-eater*	All		
Star Finch	0, 1, 2, 3, 4, 5		
Barn Swallow^	0, 1		
Mulgara^	0, 1, 2, 3, 4, 5		
Northern Quoll*^	0, 1		
Bilby*	2		
Black-footed Rock-wallaby*	0, 1, 2, 6		
Orange Leaf-nosed Bat	0, 1, 2		

Source: Bancroft and Bamford (2006b).

* Indicate species that, if present near the pipeline route, are at greatest risk of impact due to trench construction. While generally at lower risk of significant impact, the remaining species may still be directly or indirectly disturbed and, hence, affected by the construction process.

^ EPBC Act listed species (Threatened Fauna and Migratory Species).



5.1.4 **Agricultural Region (Loops 7 and 8)**

Bancroft and Bamford (2006b) undertook a Level 1 fauna survey of the entire pipeline corridor in accordance with EPA Position Statement No. 3. An overview for the Stage 5 Expansion for the agricultural region loops is provided below.

5.1.5 Fauna habitat

The habitats found along Loops 7 and 8 are known to support a diversity of fauna species, including species listed for protection under State and Federal conservation legislation. It is likely that there will be areas along each of the agricultural region loops of relatively high value to fauna, particularly when compared with other areas within the region. Examples of these include:

1. National Parks, Conservation Parks, Nature Reserves and Conservation Reserves: areas that have been previously recognised as of high value for flora or fauna, or that have been set aside for conservation purposes (e.g. Burma Road Nature Reserve).
2. Bushland remnants or fragments in cleared, developed or degraded areas: in areas where land use has removed or degraded much of the native vegetation (e.g. the agricultural region) the remaining zones of native vegetation may be important refugia for fauna. Impacts in such refugia will be disproportionately high in a local context because surrounding habitats are of such low value for fauna.
3. Drainage lines: in the arid and semi-arid regions, rivers, creeks and drainage lines often support higher quality, or more diverse, vegetation and this may concentrate fauna in these areas (e.g. Irwin and Moore Rivers).
4. Rare or unusual habitats: uncommon or unusual habitats (e.g. those driven by geological or hydrological factors such as freshwater springs or outlying hills) may support uncommon or outlying fauna populations, or may support a high degree of fauna endemism.
5. Threatened Ecological Communities: ecological communities that are recognised as environmentally significant under the EPBC Act.
6. Desmond and Chant (2003) note two TECs as occurring within this region: *Acacia rostellifera* low forest with scattered *Eucalyptus camaldulensis* on Greenough River alluvial flats, and clay flat assemblages of the Irwin River. One other ecosystem at risk within the Geraldton Hills (GS1) subregion is the *Eucalyptus macrocarpa* over Proteaceous sandplain community. It is unlikely that these TECs occur within Loop 7 due to this loop being largely cleared. Their occurrence within Loop 8 will be determined as part of the spring flora and vegetation survey planned along Loop 8.

5.1.6 Fauna species

Forty-seven species recorded within Loops 7 and 8 were assessed as being of CS1 or CS2. These species and their conservation rating have been provided in Table 1-17.

Table 1-17 Fauna of conservation significance potentially occurring along Loops 7 and 8

Species	Loop species likely to occur along	Species	Loop species likely to occur along
CS1 Species		CS2 Species	
Western Swamp Tortoise	8	Jewelled Ctenotus*	7, 8
Gilled Slender Blue-tongue*	7	<i>Lerista lineata</i> *	8
Western Spiny-tailed Skink* [^]	7, 8	<i>Lerista yuna</i> *	7
Woma*	7, 8	Black-striped Snake*	7, 8
Carpet Python*	7, 8	Black Bittern	8
Malleefowl [^]	7, 8	Australasian Bittern	8
Great Egret	7, 8	Australian Bustard	7, 8
Cattle Egret	8	Bush Stone-curlew	7, 8
Glossy Ibis	7, 8	Barking Owl	7, 8
White-bellied Sea-Eagle [^]	7, 8	Shy Heathwren	7, 8
Peregrine Falcon	7, 8	Rufous Fieldwren	7, 8
Common Greenshank [^]	7, 8	Slender-billed Thornbill [^]	7
Wood Sandpiper	7, 8	White-browed Babbler	7, 8
Common Sandpiper	7, 8	Crested Bellbird	7, 8
Red-necked Stint	7, 8	Brush-tailed Phascogale	8
Sharp-tailed Sandpiper	7, 8	Quenda*	8
Curlew Sandpiper	7, 8	Tammar	7
Hooded Plover	7, 8	Brush Wallaby*	7, 8
Caspian Tern	7, 8	Water-rat*	8
White-winged Black Tern	7, 8		
Carnaby's Cockatoo [^]	7, 8		
Baudin's Cockatoo [^]	8		
Major Mitchell's Cockatoo	7, 8		
Fork-tailed Swift	7, 8		
Rainbow Bee-eater*	7, 8		
Chuditch* [^]	7, 8		
Black-footed Rock-wallaby*	7		
Western Ringtail Possum*	8		

Source: Bancroft and Bamford (2006b).

* Indicate species that, if present near the pipeline route, are at greatest risk of impact due to trench construction. While generally at lower risk of significant impact, the remaining species may still be directly or indirectly disturbed and, hence, affected by the construction process.

[^] EPBC Act listed species (Threatened Fauna and Migratory Species).

5.1.7 Swan Coastal Plain Region (Loops 9 and 10)

Bancroft and Bamford (2006b) undertook a Level 1 fauna survey of the entire pipeline corridor in accordance with EPA Position Statement No. 3 (Bancroft and Bamford 2006b). An overview of the results of this survey for Loops 9 and 10 of the Stage 5 Expansion is provided below.



5.1.8 Fauna habitat

The habitats found along Loops 9 and 10 are known to support a range of fauna species, including several species that are listed for protection under State and Federal conservation legislation. It is likely that there will be areas along Loops 9 and 10 of relatively high value to fauna, particularly when compared with other areas within the region. Examples of these include:

1. National Parks, Conservation Parks, Nature Reserves and Conservation Reserves: areas that have been previously recognised as of high value for flora or fauna, or that have been set aside for conservation purposes.
2. Bushland remnants or fragments in cleared, developed or degraded areas: in areas where land use has removed or degraded much of the native vegetation (e.g. the agricultural region) the remaining zones of native vegetation may be important refugia for fauna. Impacts in such refugia will be disproportionately high in a local context because surrounding habitats are of such low value for fauna.
3. Bush Forever sites: Within the Perth Metropolitan Region, there are a large number of native vegetation remnants that have been recognised as important because of their ecological importance (relative to surrounding areas of development).
4. Wetlands: wetlands are often a concentration of resources (e.g. water, food and habitat) and are, therefore, of high value to fauna. In many cases, the density of fauna is higher near wetlands compared with surrounding areas. Wetlands may also support of suite of species that are specialised to this habitat.
5. Drainage lines: in the arid and semi-arid regions, rivers, creeks and drainage lines often support higher quality, or more diverse, vegetation and this may concentrate fauna in these areas (e.g. Swan and Canning Rivers).
6. Rare or unusual habitats: uncommon or unusual habitats (e.g. those driven by geological or hydrological factors such as freshwater springs or outlying hills) may support uncommon or outlying fauna populations, or may support a high degree of fauna endemism.
7. Threatened Ecological Communities: ecological communities that are recognised as environmentally significant under the EPBC Act.
8. Mitchell et al. (2003) note several TECs that occur on the Swan Coastal Plain, one of which will be affected by the DBNGP; *Eucalyptus calophylla* - *Kingia australis* woodlands on heavy soils, Swan Coastal Plain.

5.1.9 Fauna species

Forty species of conservation significance have been determined as potentially occurring within loops 9 and 10. These species and the relevant conservation significance have been provided in Table 1-18.

Table 1-18 Fauna of conservation significance potentially occurring along Loops 9 and 10

Species	
CS1 Species	CS2 Species
Western Swamp Tortoise	Jewelled <i>Ctenotus</i> *
Woma*	<i>Lerista lineata</i> *
Carpet Python*	Black-striped Snake*
Malleefowl [^]	Black Bittern
Great Egret	Australasian Bittern
Cattle Egret	Australian Bustard
Glossy Ibis	Bush Stone-curlew
White-bellied Sea-Eagle [^]	Barking Owl
Peregrine Falcon	Rufous Fieldwren
Common Greenshank [^]	White-browed Babbler
Wood Sandpiper	Crested Bellbird
Common Sandpiper	Brush-tailed Phascogale
Red-necked Stint	Quenda*
Sharp-tailed Sandpiper	Brush Wallaby*
Curlew Sandpiper	Water-rat*
Hooded Plover	
Caspian Tern	
White-winged Black Tern	
Carnaby's Cockatoo [^]	
Baudin's Cockatoo [^]	
Major Mitchell's Cockatoo	
Fork-tailed Swift	
Rainbow Bee-eater*	
Chuditch* [^]	
Western Ringtail Possum*	

Source: Bancroft and Bamford (2006b).

* Indicate species that, if present near the pipeline route, are at greatest risk of impact due to trench construction. While generally at lower risk of significant impact, the remaining species may still be directly or indirectly disturbed and, hence, affected by the construction process.

[^] EPBC Act listed species (Threatened Fauna and Migratory Species).

5.2 Potential impacts

Trenching, habitat disturbance and vehicle/equipment movements are the primary project activities with the potential to affect fauna values. Potential impacts include:

- loss or displacement of fauna habitat and habitat fragmentation (temporary, except in the case of habitat trees)
- injury or death through falling into and becoming trapped in open trenches or through accidental collisions with construction vehicles
- interruption to fauna behaviour from noise and light emissions and provision of artificial watering sites (temporary)
- increased predation from feral animals due to increased clearing and lack of cover, improved access for feral predators
- spread of weeds and bushfire risk.



Habitat disturbance and fragmentation

A total area of around 3175 ha¹⁰ will be required to be disturbed within the corridor for the construction of the Stage 5 Expansion, of which around 1264 ha is estimated to be vegetated (Chapter 1 Section 4). Up to a further 139 ha of disturbance outside the corridor may be required for infrastructure (e.g. turkey nests, truck turnarounds).

The removal or disturbance of vegetation has the potential to decrease faunal breeding and foraging grounds. Large trees may provide nesting hollows or shelter for animals. The corridor may also create a temporary barrier for fauna movement including between nesting and foraging grounds. For example, mammals and reptiles generally prefer not to cross large expanses of cleared land, where they are more vulnerable to predation. Clearing a 30 m wide corridor may fragment potential habitats for these species and/or create barriers to feeding and breeding ranges.

Corridors of native vegetation, such as those that exist along rivers/streams, can also be important for dispersal of species in otherwise cleared landscapes. The pipeline corridor has the potential to fragment these riverine corridors at several locations, also affecting ephemeral wetland vegetation.

The most significant impact to fauna in Loops 9 and 10 will result from the clearing of vegetation used as habitat. The Stage 5 Expansion pipeline route passes through and close to a number of bushland and vegetated wetland areas. A number of waterbird species (e.g. Australian Shelduck, Pacific Black Duck) nest in adjacent habitat and walk their young to the nearest wetland. Construction adjacent to wetlands may therefore create barriers to these species as well as potentially harming breeding areas through the removal of adjacent bushland.

See Bancroft and Bamford (2006b) in Appendix 3 for species specific impacts.

Clearing requirements will be minimised by reducing working widths in areas of conservation value, will avoid the clearing of habitat trees where practicable (pruning rather than removing), and will rehabilitate all disturbed areas to their pre-disturbance condition.

Injury or death of fauna

Conservation species descriptions that provide basic information, including the potential for the Stage 5 Expansion to affect these species, are presented in Bancroft and Bamford (2006b). Species vary in their likelihood of occurrence and sensitivity to impacts from the Stage 5 Expansion. There is the possibility for ground dwelling fauna to fall into open trenches becoming injured or perishing. Vehicle movements may also cause death to local fauna, and bushfires could potentially harm fauna values (e.g. death or loss of habitat). On this basis, it is predominantly ground-dwelling reptiles and mammals that are most at risk during the pipeline expansion.

The information gained from the Stage 4 works has indicated some of the susceptible species or groups. These are (Bancroft and Bamford 2006b):

1. Frogs: a group that travels along the ground surface and, therefore, is highly susceptible to falling into trenches. The group may occur in high to extreme densities in some localities or seasons, and is extremely susceptible to heat stress or desiccation if trapped in the trench.
2. Geckoes: a group that has many predominantly terrestrial members and, therefore, is highly susceptible to falling into trenches. Geckoes may occur in high densities in some localities or seasons, and are very highly susceptible to heat stress or desiccation if trapped in the trench.
3. Dragons: a group that has many predominantly terrestrial members that move quickly across the ground surface and are likely to encounter trenches. Dragons may occur in high densities in some localities or seasons and may be susceptible to heat stress or desiccation if trapped in the trench in some seasons.
4. Emus: a species that has a moderately high likelihood of injury if they fall into a trench.

¹⁰ Based on a working width of 25 m and does not take into account reduced working widths in areas of conservation value.



5. Nesting birds: a group that may occur in high densities in some localities or seasons and may be susceptible to disturbance or habitat clearing (e.g. waterbirds, honeyeaters).
6. Macropods (kangaroos, wallabies): species that have a moderate likelihood of injury if they fall into the trench.
7. Honey possum: a species that regularly travels across the ground, may occur in high densities in some areas or seasons and, therefore, may be trapped in the trench in large numbers.

A Fauna Interaction Protocol will be implemented which includes requirements for fauna handlers to inspect and clear trenches daily.

Feral animals

The Stage 5 Expansion may affect the movement of feral animals near the pipeline due to the presence of a cleared corridor and artificial watering sites. However, due to the temporary nature of disturbance it is unlikely that pipeline construction in these areas will cause any long-term changes to feral animal populations.

Bushfire

The risk of fire is increased due to construction activities. Fire has the potential to cause injury and death to fauna as well as removing habitat. A Fire Management Protocol will be implemented to ensure fire risks are reduced to as low as practicable.

Interruption to fauna behaviour

The effect of artificial light on fauna is not considered to be an issue as the majority of construction activities will be undertaken during daylight hours. A small amount of external lighting will be used at the temporary construction camps but any potential impact will be short term.

Construction activity may result in temporary, short-term disturbances to fauna from noise emissions (e.g., noise may discourage critical lifecycle stages such as breeding or nesting). However, due to the short duration of construction activities, noise emissions are not expected to have any prolonged effect on fauna.

Open artificial water sites associated with construction activities will include temporary 'turkey nest' dams that will be constructed at water source points (i.e. bores). There is the potential for fauna to become trapped in these dams and as such, they will be regularly inspected in accordance with the Fauna Interaction Protocol.



6 AREAS OF CONSERVATION VALUE

6.1 Areas of conservation value overview

The pipeline corridor traverses or is adjacent to areas designated to be of conservation significance. For the purpose of this management plan, areas of conservation value are defined as including:

- nature and conservation reserves
- places listed on the Australian Heritage Database
- Environmentally Sensitive Areas¹¹ (ESAs)
- those areas supporting DRF, Priority Flora or TECs
- conservation category wetlands (CCWs), resource enhancement wetlands and wetlands gazetted under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 (EPP Lakes).

The EPBC Act approval of the proposal has requirements that relate to areas of conservation value under that legislation. These are defined as:

- those areas supporting Listed Threatened Species, Listed Ecological Communities and Listed migratory species under the EPBC Act
- Listed Ramsar wetlands
- Places listed on the Australian Heritage Database.

It should be noted that the DBNGP corridor from Dampier to Bullsbrook has been excised from the conservation estate (A Class reserves and Conservation Parks) as a corridor by Parliament in 2003. Reserves that were not afforded "A" class status but were still reserved for Conservation of Flora and Fauna were referred to the Minister for Environment and consent was obtained to exclude these areas from such reserves. Although the pipeline corridor is so excised, such areas will be classified as "areas of conservation value" for the purpose of managing construction activities.

Mapping of conservation category wetlands, resource enhancement wetlands and EPP Lakes only covers Loops 9 and 10; therefore, this category of areas of conservation value does not apply to Loops 0 to 8 of the Stage 5 Expansion.

6.1.1 Pastoral Region (Loops 0 to 6)

Two conservation reserves (DEC estate) and one place listed on the Register of the National Estate occur along Loops 0 to 6 (Table 1-19). These sites are also recognised as ESAs. There were also several areas of conservation value at a distance from the pipeline corridor. No DRF or TECs were recorded along Loops 0 to 6 and discussion relating to Priority Flora in this area is contained in Chapter 1 Section 4.

The pipeline corridor also traverses a proposed conservation reserve in Loop 0. This comprises part of the Karratha and Mardie stations, which will be excluded from the pastoral leases when they expire in 2015 and included in the formal conservation reserve system. In addition, Cane River Station (Loop 1; Table 1-19) is bordered to the north and south by formal pastoral leasehold land (ex-Mt Minnie and ex-part Nanutarra), which are currently managed by DEC under Section 33(2) of the *Conservation and Land Management Act 1984*. This land is proposed for addition to the Cane River Station reserve.

In addition to the conservation values, these areas may also be of recreational value.

¹¹ ESAs are defined in Regulation 6(1) of the *Environmental Protection Act 1986*. ESAs include World Heritage property, areas registered on the Register of the National Estate, defined wetlands, rare flora, TECs, and Bush Forever sites.



Table 1-19 Areas of conservation value present along Loops 0 to 6

Loop	Name and description of area	Pipeline location in conservation area	Location (KP)	Reserve	Australian heritage	ESA
0	Coastal margin Cape Preston to Cape Keraudren. Area: ~60,000 ha	Passes through area (Post 5B)	0.12-14.978	-	Register of the National Estate (indicative place*)	Yes
1	Cane River Station ¹² This reserve is a de-stocked station that is currently held as a pastoral lease by DEC. The station is representative of the Pilbara pastoral areas and is a proposed addition to the State's National Parks. The Cane River flows through the reserve. Area: ~148,000 ha	Excised corridor passes through reserve (Stages 5A and 5B)	208.455-213.700 230.667-249.222	C Class Reserve	Not listed	Yes
5	Toolonga Nature Reserve This is the largest reserve representing the rangelands of the Carnarvon Basin. It was originally set aside for the conservation of flora and fauna of the region. The vegetation is typical of the Toolonga Plateau. Area: ~405,424 ha	Excised corridor passes through reserve (Stages 5A and 5B)	746.512-817.47	C Class Reserve	Not listed	Yes

* Data provided to or obtained by the SEWPaC has been entered into the database. However, a formal nomination has not been made and the Australian Heritage Council has not received the data for assessment.

6.1.2 Agricultural Region (Loops 7 and 8)

The corridor of Loops 7 and 8 of DBNGP traverse or are adjacent to four conservation reserves and one National Park (Table 1-20). One reserve and the National Park are also listed on the Register of the National Estate. ESAs that occur within Loops 7 and 8 correspond to the conservation areas and the location of rare and threatened flora and ecological communities; the occurrence of DRF, Priority Flora and TECs along Loops 7 and 8 is described and discussed in Chapter 1 Section 4. There were also several areas of conservation value at a distance from the pipeline corridor.

In addition to the conservation value, these areas, such as the National Park, may also be of recreational value.

¹² The Cane River station was converted to a Conservation Park in 2002. The DBNGP corridor has been excised from this reserve.



Table 1-20 Areas of conservation value present along Loops 7 and 8

Loop	Name and description of area	Pipeline location in conservation area	Location (KP)	Reserve	Australian heritage	ESA
7	<p>Burma Road Nature Reserve</p> <p>The reserve supports a wide variety of plant species and is dominated by a heath vegetation common to the Northern Sandplains.</p> <p>Area: ~6890 ha</p>	<p>Passes through eastern boundary (Stage 5A)</p>	<p>998.165-1006.67</p>	<p>A Class Nature Reserve</p>	<p>Register of the National Estate</p>	<p>Yes</p>
8	<p>Hill River Nature Reserve</p> <p>The vegetation of the reserve is described as mostly comprising woodland dominated by <i>Corymbia calophylla</i> with stands of <i>Eucalyptus rudis</i> on the river banks. There are also areas of open woodland of <i>Acacia acuminata</i>, <i>Eucalyptus loxophleba</i> and <i>Melaleuca</i> species with pasture understorey. The sandy soils away from the river itself support woodland of banksias and <i>Eucalyptus todtiana</i>, with a shrub understorey.</p> <p>Area: ~ 882 ha</p>	<p>Excised corridor passes through reserve (Stage 5A)</p>	<p>1165.54-1165.63</p>	<p>A Class Nature Reserve</p>	<p>Not listed</p>	<p>Yes</p>
	<p>Twyata Nature Reserve</p> <p><i>Kwongan</i> vegetation, to the south of Hill River.</p> <p>Area: ~154 ha</p>	<p>Excised corridor passes through reserve (Stage 5A)</p>	<p>1166.12-1166.63</p>	<p>C Class Reserve</p>	<p>Not listed</p>	<p>Yes</p>
	<p>Badgingarra National Park</p> <p>The vegetation within the Park is high quality shrublands with <i>Hakea flabellifolia</i>, <i>H. recurva</i>, <i>Banksia incana</i>, <i>Dryandra shuttleworthiana</i>, <i>D. stricta</i>, <i>Jacksonia densiflora</i>, <i>Calothamnus sanguineus</i> and <i>Dasypogon obliquifolius</i>.</p> <p>Area: ~13,121 ha</p>	<p>Excised corridor passes through reserve north-east corner (Stage 5A)</p>	<p>1169.74-1174.12</p>	<p>National Park</p>	<p>Register of the National Estate</p>	<p>Yes</p>
	<p>Minyulo Nature Reserve</p> <p>The principal value of the Nature Reserve is as a feeding and breeding habitat for bush birds. Vegetation in the reserve is dominated by two distinct types. <i>Eucalyptus wandoo</i> woodland dominates the creek bed with species such as <i>Hakea ruscifolia</i> and <i>Acacia saligna</i>. The hillsides are generally dominated by a species-rich heath land with scattered <i>Eucalyptus todtiana</i> trees.</p> <p>Area: ~200 ha</p>	<p>Excised corridor passes through reserve (Stage 5A)</p>	<p>1201.92-1202.65</p>	<p>A Class Nature Reserve</p>	<p>Not listed</p>	<p>Yes</p>



6.1.3 Swan Coastal Plain Region (Loops 9 and 10)

6.1.4 Loop 9

Most of the natural areas (including wetlands) with higher conservation values that are affected by the DBNGP in Loop 9 have been identified within Bush Forever Sites. The pipeline corridor traverses through 15 Bush Forever Sites and runs adjacent to a number of other Sites (Table 1-21). It should be noted that the pipeline corridor has been recognised by the Western Australian Planning Commission as being a pre-existing use, and this use takes precedence over the Bush Forever policy position.

Several natural places listed on the Register of the National Estate correspond to or are places that are part of Bush Forever Sites. These include:

- Melaleuca Park (part of Bush Forever Site 399)
- Ellenbrook National Estate Area (part of Bush Forever Site 399)
- Munday Swamp and Bushland (part of Bush Forever Site 386)
- Forrestfield Bushland (part of Bush Forever Site 386)
- Beeliar Regional Park (part of Bush Forever Site 269).

As the corridor was cleared approximately 24 years previously, some areas within the Bush Forever Sites remain disturbed and devoid of native vegetation (e.g. some areas parts of the corridor are used as an informal track). In other areas however, particularly where access has been controlled, high quality vegetation has re-established in the pipeline corridor.

Wetland values along Loop 9 are described in Chapter 1 Section 9 and Threatened Flora and TECs are described in Chapter 1 Section 4.

Table 1-21 Loop 9 sections identified in Bush Forever

Site no.	Bush Forever site name	Bush Forever policy coverage	Location (KP)	Stage
97	Kirby Road Bushland, Bullsbrook	Pipeline corridor within Bush Forever policy area Within 200 m	1318.15-1320.53 1321.28-1321.41 1320.98-1321.28	5A
6	Cooper Road Water Reserve and Adjacent Bushland, Bullsbrook	Within 50 m	1325.06-1326.06	5B
399	Melaleuca Park and Adjacent Bushland, Bullsbrook/Lexia	Pipeline corridor within Bush Forever policy area Within 50 m	1324.62-1328.72 1329.09-1335.15 1328.72-1329.09	5B
192	Wetherell Road Bushland, Lexia/Ellenbrook	Pipeline corridor within Bush Forever policy area on eastern side Within 200 m	1335.38-1335.49 1335.17-1335.38	5B
200	Caversham Airbase Bushland, West Swan/Whiteman	Pipeline corridor within Bush Forever policy area Abuts	1341.92-1343.42 1343.41-1343.52	5B
305	Bennett Brook, Eden Hill to West Swan	Pipeline corridor within Bush Forever policy area	1348.29-1348.37	Post 5B



Site no.	Bush Forever site name	Bush Forever policy coverage	Location (KP)	Stage
386	Perth Airport and Adjacent Bushland	Pipeline corridor within Bush Forever policy area on eastern side Within 200 m	1353.50-1354.09 1357.16-1357.43 1358.52-1358.65 1358.79-1359.08 1351.98-1352.22 1356.99-1357.16 1357.43-1357.80	Post 5B
319	Dundas Road Bushland, Forrestfield	Abuts Pipeline corridor within Bush Forever policy area	1359.56-1359.77 1359.77-1360.10	Post 5B
320	Hartfield Park Bushland, Forrestfield	Pipeline corridor within Bush Forever policy area	1361.45-1363.02	Post 5B
387	Greater Brixton Street Wetlands, Kenwick	Within 200 m	1363.02-1363.46	Post 5B
53	Clifford Street Bushland, Maddington	Within 200 m	1365.15-1365.57	Post 5B
246	Canning and Southern Rivers, Beckenham to Martin/Kelmscott	Pipeline corridor within Bush Forever policy area	1371.62-1371.89	Post 5B
255	Dallen Road Bushland, Southern River/ Gosnells	Pipeline corridor within Bush Forever policy area Within 50 m	1376.53-1376.58 1376.47-1376.72	Post 5B
260	Southern River and Adjoining Bushland, Westfield	Within 200 m	1376.56-1376.66	Post 5B
342	Anstey/Keane Dampland and Adjacent Bushland, Forrestdale	Pipeline corridor within Bush Forever policy area Within 200 m	1381.48-1381.53 1382.77-1383.05 1381.93-1382.77	Post 5B
345	Forrestdale Lake and Adjacent Bushland, Forrestdale	Pipeline corridor within Bush Forever policy area	1383.27-1384.18	Post 5B
344	Dennis De Young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale	Pipeline corridor within Bush Forever policy area	1385.34-1386.14 1386.25-1386.70 1386.96-1387.13	Post 5B
268	Mandogalup Road, Mandogalup	Pipeline corridor within Bush Forever policy area on eastern side	1393.78-1394.52	Post 5B
269	The Spectacles	Pipeline corridor within Bush Forever policy area on western side	1394.56-1396.38	Post 5B

6.1.5 Loop 10

The pipeline corridor passes adjacent to only one designated conservation area in Loop 10 during Stage 5 construction activities. This reserve, the Buller Nature Reserve, is vested for the purpose of 'conservation of flora and fauna' and is managed by the DEC. The pipeline corridor runs adjacent to the western side of this reserve at the following chainage locations, located within Stage 5A:

- 1478.62 – 1479.75 (within 50 m)
- 1479.74 – 1481.38 (within 200 m)

No vegetation within this reserve was required to be cleared for the purposes of Stage 5A construction.



The construction activities for Stage 5 do not affect any other areas of conservation value in or immediately adjacent (within 200 metres) to the pipeline corridor in Loop 10, other than those wetlands identified in Chapter 1 Section 9 and areas supporting TECs, which are described in Chapter 1 Section 4.

6.2 Potential impacts

Project activities requiring vegetation/habitat clearing, trenching and vehicle/equipment movements have the potential to affect the environmental values (e.g. vegetation and flora, and fauna values) of areas of conservation value. The potential impacts on vegetation and flora, and fauna values have been described and discussed in Chapter 1 Section 4. An overview of clearing requirements and recreational impacts is provided below.

6.2.1 Pastoral Region (Loops 0 to 6)

Environmental and recreational values

Around 115 ha¹³ of disturbance will occur within the three areas of conservation value (Table 1-22). This clearing will generally be restricted to the corridor. Clearing outside of the corridor will be avoided in areas of conservation value unless there are no practicable safe alternatives. The vegetation that exists within the pipeline corridor is vegetation that has established subsequent to the clearing of the corridor for the installation of the original pipeline 24 years earlier. All areas disturbed during construction will be rehabilitated to their pre-construction condition.

It is expected that there will be no long-term consequences for the values of the areas of conservation value due to the relatively small area of mostly regrowth vegetation disturbance required, and the prompt rehabilitation of all disturbed areas.

Recreational use, should it be actively pursued in the conservation areas identified, is unlikely to be restricted by the pipeline corridor, although the aesthetic value may be compromised by vegetation clearance (temporary) and signage.

Table 1-22 Area of conservation value present along Loops 0 to 6

Loop	Name	Approximate area of disturbance within excised corridor (ha)
0	Coastal margin Cape Preston to Cape Keraudren	30.3 (Post Stage 5B)
1	Cane River Station	48.3 (Stages 5A and 5B)
5	Toolonga Nature Reserve	35.0 (Stages 5A and 5B)

6.2.2 Agricultural Region (Loops 7 and 8)

Environmental and recreational values

Around 30 ha¹⁴ of clearing of vegetation will occur within the areas of conservation value (Table 1-23). The vegetation that exists within the pipeline corridor is vegetation that has established subsequent to the clearing of the corridor for installation of the original pipeline in 1982/83. All areas disturbed during construction will be rehabilitated to their pre-construction condition.

It is expected that there will be no long-term consequences for the values of the areas of conservation value due to the relatively small area of mostly regrowth vegetation disturbance required and the prompt rehabilitation of all disturbed areas.

¹³ Based on a reduced working width of 20 m and allowing for truck turnarounds every 2 km. The pipeline corridor has been excised from the DEC estate where it passes through Cane River Station and Toolonga Nature Reserve. Just over 1 ha of disturbance will be required for truck turnarounds outside the pipeline corridor within Cane River Station and Toolonga Nature Reserve. Does not include disturbance in areas proposed for inclusion in conservation reserves.

¹⁴ Based on a reduced working width of 20 m and allowing for truck turnarounds every 2 km.



Recreational use, should it be actively pursued in the conservation areas identified, is unlikely to be restricted by the pipeline corridor, although the aesthetic value may be compromised by vegetation clearance (temporary) and signage.


Table 1-23 Area of conservation value along Loops 7 and 8

Loop	Name	Approximate area of disturbance within excised corridor (ha)	Stage
7	Burma Road Nature Reserve	17.3	5A
8	Hill River Nature Reserve	0.2	5A
	Twyata Nature Reserve	1.0	5A
	Badgingarra National Park	8.9	5A
	Minyulo Nature Reserve	1.5	5A

* Based on a reduced working width of 20 m and allowing for truck turnarounds every 2 km.

6.2.3 Swan Coastal Plain Region (Loops 9 and 10)

Chapter 1, Section 4 provides a discussion of potential impacts to vegetation and flora values for Loops 9 and 10 as most of the vegetated areas on the Swan Coastal Plain affected by the Stage 5 Expansion in Loop 9 are located within Bush Forever sites.

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7 SOILS AND TERRAIN

7.1 Soils and terrain overview

7.1.1 Pastoral Region (Loops 0 to 6)

The pipeline corridor passes through a range of soil and terrain conditions in the pastoral region and these are broadly described below in relation to the five biogeographical regions that Loops 0 to 6 traverse.

1. Pilbara (Loops 0 and 1): The surface geology of the pipeline in the Pilbara region is dominated by largely unconsolidated Quaternary alluvial, colluvial, eluvial and aeolian deposits of sand, gravel, silt and clay. Outcrops of rock are rare, although the undulating topography indicates that rock lies at a relatively shallow depth. The soils closely reflect the origins and mineralogy nature of the underlying geology. Soils vary along the route and include cracking clays, hard alkaline red soils, ironstone gravels and loamy soils developed on calcrete (Dames and Moore 2000).
2. Carnarvon (Loops 2, 3, 4 and 5): The Carnarvon region lies entirely within the Carnarvon Basin, a large sedimentary basin whose superficial expression is dominated by Quaternary eluvium, alluvium, colluvium and sheet-flood deposits that overlie Permian to Cretaceous sedimentary rocks. In the northern Carnarvon region along the pipeline corridor, outcrops of granite occur together with Cretaceous shale, siltstone and laterite. The southern Carnarvon region is dominated by Permian siltstone, sandstone, shale and calcareous rocks. Shallow rock and outcrops also occur in the southern part of the region. The soils vary from hard red sandy soils in the north of the region to earthy sands in the south, with fixed dunes becoming common (Dames and Moore 2000).
3. Gascoyne (Loops 2 and 3): The pipeline corridor traverses the western extreme of the Gascoyne region, an area with extensive occurrences of Proterozoic sedimentary, metamorphic and granitic rocks. Unconsolidated Quaternary sheet-flood colluvium and alluvium occupy low lying areas between the basement rocks. Shallow rock occurs along most of the corridor in this region. Soils vary between red and yellow earth soils, which are often underlain by laterite, to the north and hard red duplex soils, which set hard when dry, to the south (Dames and Moore 2000).
4. Yalgoo (Loops 5 and 6): The region is characterised by sand and alluvial plains, lateritic breakaways, low ranges and salt lakes. Broad alluvial valleys separate the breakaways and low ranges (Land and Water Australia 2001).
5. Geraldton Sandplains (Loop 6): The region is entirely within the Perth basin, a deep linear trough of sedimentary rocks. The geology of the trough in Loop 6 is dominated by a late Carboniferous to Permian sequence of shallow marine and fluvial siliclastic rocks such as sandstone, siltstone and shale. The upper surface of the sediments has been weathered to form the Victoria Plateau, a gently undulating surface covered almost entirely by a lateritic duricrust overlain by Quaternary aeolian sand. The presence of small rock outcrops indicates that the laterite is typically shallow. The soils are dominated by earthy sands which are commonly underlain by ironstone gravels, laterite or an indurates mottled or pallid zone (Dames and Moore 2000).

7.1.2 Acid sulphate soils

Parsons Brinckerhoff undertook a desktop assessment to predict the likelihood of encountering acid sulphate soils along the DBNGP Stage 5 Expansion loops. An overview of the key findings of this report (Parsons Brinckerhoff 2006a) has been provided below.

The potential for occurrence of acid sulphate soils occurring within the proposed excavation footprint was assessed through the use of key indicators such as geology, wetlands, depth to groundwater, and vegetation and classified as high (almost certain), medium (likely), medium to low (possible in isolated circumstances), and low (unlikely). Results are contained in Table 1-24.

Table 1-24 Summary of potential for occurrence of acid sulphate soils in Loops 0 to 6

Loop	Acid sulphate soil risk ranking (no. of km's along pipeline)			
	Low	Medium to low	Medium	High
0	70	1	30	15
1	110	15	0	0
2	106	1	0	0
3	111	3	0	0
4	110	5	0	0
5	119	1	0	0
6	132	0.5	0	0

Approximately 15 km of high risk soils were identified at the northern end of Loop 0 in association with cracking clays (marine sediments) and a depth to groundwater less than 5 metres below ground level (mbgl). An additional 30 km of medium risk soils were identified in association with cracking clays where the depth to groundwater is predicted to be greater than 5 mbgl.

Medium to low risk soils were identified generally in association with hard setting loamy soils, red yellow earths, hard red duplex soils or earthy sands in areas intercepting near water bodies and rivers where groundwater was predicted to be generally shallow (e.g. 5-10 mbgl).

Where acidic soils occur above the natural watertable, excavation and backfilling of these soils is not expected to increase the risk of further acidification or release of metals. The protective trilaminate coating on the pipeline is acid resistant and the presence of acidic soils does not pose any threat to the integrity of the pipeline.

Field investigations of 7 km of the 45 km of Medium and High risk areas in Loop 0 were undertaken in 2006 and found to not have any acid generating potential (Parsons Brinckerhoff 2006b). The DEC subsequently waived the need to undertake further investigations in this Loop, provided no dewatering was to be undertaken.

7.1.3 Agricultural Region (Loops 7 and 8)

Loop 7 and most of Loop 8 are within the Geraldton Sandplains biogeographical region. Some of Loop 8 also traverses the Swan Coastal Plain biogeographical region.

1. Geraldton Sandplains (Loops 7 and 8): The noticeable difference in the terrain of the Geraldton Sandplains bioregion within Loops 7 and 8, compared to the area of the region traversed by Loop 6, is the erosion of the Victoria Plateau's upper surface to produce a dissected region of laterite capped hills and sand covered plains. The geology and soils of Loops 7 and 8 are essentially the same as that of Loop 6, although the underlying weathered sedimentary rocks become increasingly exposed (Dames and Moore 2000).
2. Swan Coastal Plain (Loop 8): Like the adjoining Geraldton Sandplains bioregion, the Swan Coastal Plain bioregion is entirely within the Perth Basin. The end of Loop 8 traverses the gently undulating surface of the Dandaragan Plateau. Laterite occurs throughout the area and is commonly seen in outcrop. Soils in this area are typically laterite and ironstone gravels (Dames and Moore 2000).

7.1.4 Acid sulphate soils

Parsons Brinckerhoff undertook a desktop assessment to predict the likelihood of encountering acid sulphate soils along the DBNGP Stage 5 loops. An overview of the key findings of this report (Parsons Brinckerhoff 2006) is provided below.

Less than 1 km of medium risk soils were identified along Loop 7 in association with an area of pipeline intercepting the Irwin River (Table 1-25). The Irwin River coal measures are potentially exposed in this area. Coal measures contain sulphides that have the potential to generate acid sulphate soils. A 1 km interval of medium risk soils was identified in association with areas intercepting the Moore River in Loop 8. This area was field investigated and found to not have any acid generating potential (Parsons and Brinckerhoff 2007).



Medium to low risk soils identified along Loop 7 were in association with an area within 500 m of an unnamed lake and the Irwin River.

Table 1-25 Summary of potential for occurrence of acid sulphate soils in Loops 7 and 8

Loop	Acid sulphate soil risk ranking (no. of km's)			
	Low	Medium to low	Medium	High
7	140	3	0.3	0
8	98	0	1	0

7.1.5 Swan Coastal Plain Region (Loops 9 and 10)

Loops 9 and 10 traverse the Swan Coastal Plain biogeographical region. This section of the Swan Coastal Plain is a low-lying area dominated by fixed dunes of Quaternary sand with subordinate alluvium, peat and lacustrine deposits. Neither the Mesozoic basement sedimentary rocks nor the laterite occur within the near-surface profile, although occurrences of cemented sands ('coffee rock') are likely to be encountered occasionally depending on local conditions. The soils of the Swan Coastal Plain are dominated by sandy acidic yellow mottled soils with associated leached sands and clays.

7.1.6 Acid sulphate soils

Parsons Brinckerhoff (2006) undertook an acid sulphate soil assessment of the pipeline corridor, which included a desktop assessment and detailed field investigations. An overview of the key findings of this report is provided below.

Around 80 km along Loop 9 and 43 km along Loop 10 have been classified as medium or high risk due to the presence of high water tables and wetlands on or adjacent to the line. All other areas have been classified as low or medium to low (Table 1-26).

Table 1-26 Summary of potential for occurrence of acid sulphate soils in Loops 7 and 8

Loop	Acid sulphate soil risk ranking (no. of km's)			
	Low	Medium to low	Medium	High
9	20	26.5	69	11.5
10	0	18.5	40	3.5

Field investigations of the Medium and High risk areas within Stage 5A of Loops 9 and 10 were undertaken during late 2006, both of which resulted in confirming the presence of acid generating material through the area. At the time of writing this plan, detailed acid sulphate soil and dewatering management plan for Stage 5A of Loops 9 and 10 had been developed by Parsons Brinckerhoff (2006d, 2006c respectively) for approval of the DEC (copies at Appendix 8 and 9).

7.2 Potential impacts

Project activities that result in disturbance to the landscape surface and sub-surface soil profiles have the potential to affect soil and terrain values. Such activities include clearing and grading, trenching and excavation, and vehicle movement in general. Potential impacts that may result from these ground disturbing activities are similar to those for the pastoral region and include:

- erosion (wind and rain) of the corridor and subsequent transport of material offsite
- soil compaction
- soil inversion whereby the topsoil is 'lost' through burial or mixing with other trench soil
- contamination of the soil from spills, disposal of hydro-test water and acid generating soils.



Erosion and sedimentation

Erosion and sedimentation are key potential impacts associated with the construction of the pipeline as construction activities will result in the removal of surface cover and disturbance to soil profiles. During rainfall events, the cleared and open surfaces may be subject to erosion by water and the subsequent transportation and deposition of this sediment off the corridor. Erosion may also result from wind action on soils where prolonged exposure occurs following clearing. Through implementation of drainage controls, erosion control devices, appropriate topsoil/spoil stockpile management, and effective rehabilitation, significant erosion and sedimentation impacts will be minimised.

Soil compaction

In addition to the requirement for compaction of the backfilled trench (to prevent subsidence), general vehicle movement on the construction right-of-way can lead to soil compaction, particularly in areas where heavy machinery and equipment frequently traverse. Soil compaction could change local drainage patterns and prevent effective plant growth. Soil compaction activities will be temporary and any compaction will be alleviated through the ripping or scarification of the soil prior to rehabilitation.

Soil inversion

Topsoil may be 'lost' during the construction process through burial beneath (or mixing with) trench spoil during stockpiling, or through return of topsoil and spoil to the trench in a sequence different to original profiles. The loss of topsoil can reduce the effectiveness of rehabilitation efforts. Through the implementation of topsoil handling procedures, soil inversion and the loss of topsoil is not expected to occur.

Soil contamination

Pastoral Region (Loops 0 to 6)

Construction of the pipeline will involve relatively small quantities of chemicals and likely volumes of spills are extremely low. The storage and handling of fuel on-site will be required which could result in leaks or spills, however, spill prevention measures will be implemented at all times and spill contingency actions will be developed. The hydro-test water discharge may contain trace chemicals; however, the quantity of such chemicals is likely to be extremely low and poses no significant risk to the contamination of soil and/or water resources.


Only a small area along the pipeline in Loops 0 to 6 was identified as having soils of high or medium acid generating risk (Table 1-24). The generation of acid soils can affect soil quality, water quality and land use. In areas of high or medium risk soils, an investigation strategy will be developed to validate the desktop assessment and will include soil and groundwater sampling and analysis. These investigations will enable the preparation of acid sulphate soil and dewatering management protocols to be included in the CEMP.

Areas of medium to low risk acid sulphate soils along Loops 0 to 6 were typically areas of high elevation and where the river intercepts the pipeline, and flows are seasonal and high. Therefore, the likelihood of deposition of sulphides is considered low (Parsons Brinckerhoff 2006).

Agricultural Region (Loops 7 and 8)


Only a small area of soils along the pipeline in Loops 7 and 8 were identified as being of medium or medium to low acid generating risk. The generation of acid soils can affect soil quality, water quality and land use. In areas of high or medium risk soils, an investigation strategy will be developed to validate the desktop assessment and will include soil and groundwater sampling and analysis. These investigations will enable the preparation of acid sulphate soil and dewatering management plans.

Areas of medium to low risk acid sulphate soils along Loops 7 and 8 were typically areas of high elevation and where the river intercepts the pipeline, and flows are seasonal and high. Therefore, the likelihood of deposition of sulphides is considered low (Parsons Brinckerhoff 2006).

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Swan Coastal Plain Region (Loops 9 and 10)

Over half the length of Loops 9 and 10 were identified as being of medium or high soil acid generating risk. The generation of acid soils can affect soil quality, water quality and land use. In areas of high or medium risk soils, an investigation strategy will be developed to validate the desktop assessment and will include soil and groundwater sampling and analysis. These investigations will enable the preparation of acid sulphate soil and dewatering management plans.

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8 WATER RESOURCES

8.1 Water resources overview

8.1.1 Pastoral Region (Loops 0 to 6)


8.1.2 Rivers and streams

The pastoral region loops will involve the crossing of many watercourses, several of which are major rivers (Table 1-27). In addition to major watercourses, there were a number of small watercourses, floodways and drainage gullies which will be crossed by the pipeline corridor and that do not have an identifiable name.

Rivers in the north of the State are generally broad, shallow, ephemeral drainage lines that support riverine woodlands of eucalypts such as *Eucalyptus camaldulensis* (River Red Gum) and other species such as *Melaleuca argentea* (Cadgeput). Streamflow is dominated by irregular and often infrequent summer rainfall, resulting in highly variable flow rates, and often with long no flow periods. However, pools sustained by groundwater may persist for significant periods of time (Dames and Moore 2000).

Table 1-27 Major watercourses that will be crossed in Loops 0 to 6

Loop	Name	Location of crossing (KP)	Stage
0	Maitland River	37.612, 37.627, 37.661, 37.677	5B
	Melford Creek	45.647	5B
	Yanyare River	47.411	5B
	Devil Creek	57.748, 58.095, 58.234	5B
	Du Boulay Creek	98.602	5B
	Fortescue River	108.696	5B
	Trevarton Creek	127.656	5B
1	Robe River	152.611, 153.061	5A
	Warrambo Creek	166.479	5A
	Peedamulla Creek	183.376	5A
	Cane River	209.471	5A
	Peepingee Creek	264.522	5B
2	Yannarie River	337.291	5A
	Lyndon River	400.528	Post 5B
	Monkey Creek	405.554, 406.086	Post 5B
3	Minilya River South	449.136	5B
	Newman Creek	495.059	5B
	Lyons River	534.897, 534.962, 535.140, 535.192, 535.219	5B
4	Jacobs Gully	597.267	5A
	Wooramel River	650.411	5B
5	No major watercourses will be crossed		
6	Murchison River	845.881	5A
	Greenough River	962.370	Post 5B

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8.1.3 Ephemeral wetlands

There are a number of ephemeral wetlands and claypans near the pipeline corridor in the pastoral region. These are typically associated with the floodplains of major rivers (Table 1-28). Most of the ephemeral wetlands are claypans that contain water only after substantial rainfall (Dames and Moore 2000).

Table 1-28 Ephemeral wetlands located in the vicinity of Loops 0 to 6

Loop	Name	Classification	Location (KP/chainage)	Stage
0	Roebourne Plains	Wetlands	22-60 (KP)	5B
1	South of Peepingee Creek	Ephemeral claypan wetlands	266.519-270.489 (KP)	Post 5B
3	Minilya River area	Ephemeral wetlands	434-460 (KP)	5A
6	North of Murchison River	Ephemeral claypan wetlands	843.717-845.881 (KP)	5A

8.1.4 Groundwater

Groundwater is generally deep (e.g. 10 to 140 mbgl) for most of the loops in the pastoral region, therefore trenching activities will occur mainly above the water table. The exceptions to this being river basins where groundwater is predicted to be shallow, 0-10 mbgl (Parsons Brinckerhoff 2006). Groundwater is also likely to be the main construction water source for Loops 0 to 6. Up to 332 ML of water is expected to be abstracted from existing groundwater wells or from installing caissons in river beds for Loops 0 to 6, however, water will be reused where practicable, reducing water abstraction requirements. The majority of this water is required for hydro-testing (approximately 268 ML) with smaller quantities required for construction activities and potable water supply (approximately 46 ML and 18.5 ML respectively).

Some pastoral region flora species are thought to have potential for groundwater dependence. These communities are largely dominated by *Eucalyptus camaldulensis*, *E. victrix* and a range of *Melaleuca* and *Acacia* species. All of these larger trees and shrub species are dependent on intermittent groundwater levels and generally are adapted to massive water table fluctuations, providing they are not too extreme (Mattiske 2006). For example, *M. argentea* is often associated with shallow water tables and as such, this species is often referred to as a true phreatophyte¹⁵ due to its apparent high dependency on groundwater (Muir Environmental 1995, Weston & Trudgen 1995) and *E. camaldulensis* is described as a vadophyte¹⁶ that can also function as a phreatophyte when water is readily available (Muir Environmental 1995). These species are typically associated with the riparian zone of watercourses where depth to groundwater is shallow compared to upland areas. These species were recorded in Loops 0 to 6 (Mattiske 2006).

8.1.5 **Agricultural Region (Loops 7 and 8)**

8.1.6 Rivers and streams

The agricultural region loops (Loops 7 and 8) will involve the crossing of several major watercourses and numerous minor watercourses. In addition to the major watercourses, there are several small streams, gullies and drainage lines crossed by the pipeline corridor without identifiable names.

Rivers in this section of pipeline have similarities to those in both the arid and temperate zones. The Irwin River has a broad sandy drainage lines supporting *Eucalyptus camaldulensis* (River Red Gum) characteristic of northern rivers. Further south, the watercourses in this region (e.g. Moore River) tend to be narrower, with steeper banks that are dominated by *Eucalyptus rudis* (Flooded Gum) and *Melaleuca* species.

¹⁵ Those species that rely on access to the water table or on a ready supply of surface water.

¹⁶ Those species that primarily utilise water held in the vadose zone (e.g. the unsaturated zone above the water table) and not necessarily dependent on the water table.



Table 1-29 Major rivers and streams that will be crossed by Loops 7 and 8

Loop	Name	Location of crossing (KP)	Stage
7	Irwin River	1036.97	5B
	Arrowsmith River	1080.87	Post 5B
	Donkey Creek	1086.69	Post 5B
	Eneabba Creek	1102.04	Post 5B
8	Boothendarra Creek	1164.48	5A
	Hill River	1165.58	5A
	Mullering Brook	1187.75	5A
	Minyulo Brook north	1202.18	5A
	Minyulo Brook south	1209.88	5A
	Caren Caren Brook	1226.22	5B
	Moore River	1241.44	Post 5B
	Red Gully	1254.27	Post 5B

8.1.7 Wetlands

There were no wetlands¹⁷ in Loop 7, and only one wetland traversed by the Stage 5 Expansion pipeline in Loop 8. This was an unnamed palusplain wetland associated with the Moore River (chainage crossed was 1241.51-1241.19). The unnamed wetland was not listed under any State, National or International policies, agreements or conventions.

8.1.8 Groundwater

Depth to groundwater along Loops 7 and 8 of the pipeline is generally predicted to be deep (e.g. greater than 20 mbgl), therefore trenching activities will occur mainly above the water table. The exception to this being river basins, where groundwater could be less than 10 mbgl (Parsons Brinckerhoff 2006). Groundwater is also likely to be the main construction water source for Loops 7 and 8. Up to 92.5 ML of water is expected to be abstracted from mainly existing groundwater wells with the possible use of caissons; however, water will be reused where practicable, reducing water abstraction requirements. The majority of this water is required for hydro-testing (approximately 74.5 ML) with smaller quantities required for construction activities and potable water supply (approximately 13 ML and 5 ML respectively).

Some flora species are thought to have potential for groundwater dependence, particularly riparian vegetation.

8.1.9 Swan Coastal Plain Region (Loops 9 and 10)

8.1.10 Rivers and streams

Several main rivers are crossed or are near the Stage 5 Expansion pipeline section in Loops 9 and 10. There are also a number of small streams in the vicinity that are not named and thus cannot be identified. In addition, a network of artificial drains has been developed to reduce waterlogging in the agricultural areas of the coastal plain. The pipeline corridor passes a number of these main drains, as well as numerous unnamed drains and small gullies.

¹⁷ The definition of a wetland that has been adopted in the Wetland Conservation Policy for Western Australia (DWECP 1997) is 'an area of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres'.



Table 1-30 Major watercourses that the pipeline crosses in Loops 9 and 10

Loop	Name	Location (KP)	Stage
9	Gingin Brook	1286.51-1286.72	5A
	Swan River	1348.32	Post 5B
	Helena River	1349.28	Post 5B
	Woodlupine Brook	1361.38	Post 5B
	Yule Brook	1362.87	Post 5B
	Bickley Brook	1366.55	Post 5B
	Ellis Brook	1369.03	Post 5B
	Canning River	~1371.83-1371.85	Post 5B
	Wungong River	1376.56	Post 5B
10	Dirk Brook	1426.8	5A
	North Dandalup River	1439.43	5B
	South Dandalup River	1445.25	5B
	Murray River	1457.18	5B
	Harvey River	1482.36	Post 5B

8.1.11 Wetlands

Determined to be a key factor in Loops 9 and 10 and have been addressed in Chapter 1 Section 9.

8.1.12 Groundwater

Depth to groundwater along Loops 9 and 10 is generally predicted to be shallow (0 to 10 mbgl), excluding a few isolated areas where the pipeline crosses topographical highs (Parsons Brinckerhoff 2006). The inferred groundwater flow for Loop 9 is generally westerly towards the Indian Ocean, however, groundwater flow direction changes to flow towards major watercourses (e.g. Swan and Canning Rivers) in areas close to these watercourses (Parsons Brinckerhoff 2006).

8.1.13 Water supply


Up to 88.2 ML (76.7 ML for Loop 9 and 11.5 ML for Loop 10) of water is expected to be required for hydro-testing, construction and potable water supplies, however, water will be reused where practicable, reducing water requirements. The majority of this water is required for hydro-testing (approximately 40 ML) and construction (mainly dust suppression) (approximately 34.5 ML) with smaller quantities required for potable water supply (approximately 14 ML).

This water is expected to be sourced from existing groundwater wells and possibly caissons in the more rural areas (e.g. northern sections of Loop 9 and Loop 10). Water supply is expected to be sourced from the public water supply in the Perth Metropolitan Area; however groundwater sources may be used in some locations.

8.2 Potential impacts

Project activities, such as excavation and trenching and hydrostatic testing, have the potential to affect watercourses and associated ephemeral wetlands. Potential impacts that may result from these activities include:

- physical disturbance to watercourses/ephemeral wetlands, banks and riparian vegetation
- alteration to surface water flow regimes
- deterioration in surface and groundwater quality
- groundwater drawdown.

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The degree of impact pipeline construction may have on a watercourse is dependent upon various factors, including the volume of water carried by the river or stream during the construction period, the construction methods used and the stability of the watercourse beds and banks.

8.2.1 Pastoral Region (Loops 0 to 6)

Physical disturbance to watercourses and ephemeral wetlands

There are a number of major watercourses that are required to be crossed by the pipeline in the pastoral region (Table 1-27). River crossings may be by open-cut excavation methods or by HDD. Site specific geotechnical conditions will determine the methodology to be used in each case.

At the sites where HDD is undertaken, an area will be required to temporarily house the drill rig. The drill site area for the HDD from an operational and safety perspective is usually 50 m x 50 m in area and incorporates an area for the positioning of the drilling rig, an area for the management of the drilling mud (i.e. mud pits) and a safe truck turnaround/manoeuvring area. The same topsoil removal and preservation methods used on the general construction right-of-way will be used when clearing the HDD pads.

HDD involves drilling beneath the river, minimising disturbance to the bed, banks and riparian vegetation, and to surface water flow, but may require approximately 3000 m² of disturbance adjacent to the banks, mainly to accommodate drilling activities (e.g. drill rig pads, drilling fluids pits).

The HDD drilling mud disposal requirements include the construction of evaporation dams at the HDD entry and exit locations where the mud will be stored until the mud is dry. At this point the mud will be loaded into tip trucks and disposed of at a suitable approved land fill/waste disposal site. The HDD pad will be rehabilitated.

Open-cut methods will require excavation through the banks and riverbed, deep enough to achieve the required minimum 2 m cover (subject to design) below the stable riverbed. This will ensure flow events do not expose the pipeline, ensuring pipeline integrity. The excavation will extend through the riverbank profile for some distance away from the river channel and require an increased working width across each bank of the river crossing to enable safe excavation and installation of the pipeline.

The installation of caissons in river beds for sourcing water will also result in the physical disturbance of river beds.

Post construction, there is potential for erosion of creek and riverbanks along the pipeline and access track alignments. The extent of sedimentation from erosion processes is determined by factors such as soil type, slope, run-off volume and velocity and vegetation cover.

Appropriate stabilisation techniques (e.g. geotextile and gabions) will be employed to ensure the integrity of riverbanks are maintained and, as with all sections of the pipeline corridor, crossings will be rehabilitated as soon as practicable after construction. Although large riparian trees will not be allowed to re-establish over the pipeline due to the risk of pipeline damage from tree roots, the extent of clearing prior to construction will be carefully planned to minimise the number of large riparian trees which need to be removed (e.g. overhanging trees will be pruned rather than cleared).

Construction through wetlands, including claypans, will be based on applying a reduced working width to minimise impacts on vegetation, where present.

Alteration to surface flow regimes

Construction of the northern loops will be undertaken in the dry season as far as practicable, to avoid wet conditions and river flow events. There may be the need to temporarily dam rivers upstream of trenching activities should flow persist at the time of construction. Alteration to stream flow will be for the duration of construction only, which may be up to several weeks for the large river crossings, as any damming structures will be removed after installation of the pipeline.



The disposal of water from dewatering and hydrostatic testing activities to watercourses will alter hydrological regimes through the potential introduction of large volumes of water. Disposal of such waters will be managed to avoid flooding and/or scouring. Water from these activities may also carry large volumes of sediment (see below).

The presence of linear stockpiles of topsoil and trench spoil and modification to surface contours during construction may temporarily alter surface drainage patterns, which may temporarily affect the hydrological regimes of ephemeral wetlands.

Deterioration in water quality

Deterioration in surface and groundwater quality may affect the integrity and functions of watercourses and the future use of groundwater resources. Sediments entering watercourses from erosional processes or disposal of water from dewatering may cause a temporary reduction in water quality. Other potential sources of surface and groundwater contamination are minor spills of hazardous material (e.g. hydrocarbons), disposal of saline groundwater from dewatering, leachate from acid sulphate soils and discharged hydro-test water (which may contain trace quantities of chemicals). Effects on water quality from these sources of contamination, should they occur, are expected to be temporary and not result in any long-term surface or groundwater quality impacts. Disposal of dewater product and hydro-test water will be undertaken in compliance with the DoW guidelines for dewatering (DoW 2006) to avoid contamination of any receiving waters.

Groundwater drawdown

Within the pastoral region, phreatophytic (groundwater dependent) vegetation is typically restricted to the major creek systems (e.g. riparian zone). Drawdown of groundwater levels close to the riparian zone as a result of dewatering (should it be required) or groundwater abstraction could affect some riparian tree species if they are accessing groundwater. The nature of the impact depends on the:

- presence of phreatophytic vegetation
- location, depth and extent of any drawdown cone
- rate of drawdown
- period of the drawdown.

Should groundwater drawdown occur from dewatering or groundwater abstraction, it is expected to be localised, of short duration and is not anticipated to result in any significant impact to vegetation and flora values. Pre-construction groundwater levels are expected to re-establish after dewatering ceases.

Groundwater abstraction is not expected to have any effect on the long-term viability of the resource, due to the short timeframe of abstraction and the relatively small quantities of groundwater abstracted. Water will be reused where possible.

8.2.2 Agricultural Region (Loops 7 and 8)

Physical disturbance of watercourses

There are several major watercourses that are required to be crossed by the pipeline in Loops 7 and 8 with either open-cut or HDD being used as determined by site conditions (as for Loops 0 to 6, above).

Should caissons in river beds be required for sourcing water, the installation of these will also result in the physical disturbance of riverbeds.

Post construction, there is potential for erosion of creek and riverbanks along the pipeline corridor, bank disturbance areas and access track alignments. Appropriate stabilisation and rehabilitation of the watercourses will occur as soon as practicable after construction, with all disturbed areas rehabilitated to pre-construction condition, except deep rooted vegetation will not be allowed to re-establish in the corridor.



Alteration to surface flow regimes

Construction of the agricultural region loops will be undertaken in summer, as far as practicable, to avoid wet conditions and river flow events. However, watercourse and surface flow regimes may be temporarily altered due to the potential installation of dams, dewatering, discharge of hydrostatic testing water and positioning of linear stockpiles. Any alteration to surface flow regimes will be temporary.

The intersection of shallow groundwater by the open trench has the potential to create localised disturbance to flow patterns, especially near the wetland area identified near the Moore River. The effects on local groundwater flow regimes are expected to be minimal due to the minor depth of the intrusion and the short period for which the trench is expected to be open.

Deterioration in water quality

Deterioration in surface and groundwater water quality may result from sedimentation, minor spills of hazardous material (e.g. hydrocarbons and chemicals), leachate from acid sulphate soils and discharged hydro-test water. The potential for acid generating soils in Loops 7 and 8 has been discussed in Chapter 1, Section 7. Effects on water quality from these sources of contamination, should they occur, are expected to be temporary and not result in any long-term water quality impacts. Disposal of dewater product and hydro-test water will be managed in compliance with the DoW guidelines for dewatering (DoW 2006) to avoid contamination of any receiving waters.

Groundwater drawdown

Within the agricultural region, phreatophytic (groundwater dependent) vegetation is typically restricted to the major creek systems (e.g. riparian zone). Drawdown of groundwater levels close to the riparian zone as a result of dewatering (should it be required) or groundwater abstraction could affect some riparian tree species if they are accessing groundwater. Dewatering is also preferred where the watertable is close to the surface, as is generally the case for wetlands. This may cause localised disturbance of shallow groundwater flow patterns, which may affect the health and viability of wetland systems

Should groundwater drawdown occur from dewatering or groundwater abstraction, it is expected to be localised, of short duration and is not anticipated to result in any significant impact to vegetation and flora, and wetland values. Pre-construction groundwater levels are expected to re-establish after dewatering ceases.

Groundwater abstraction is not expected to have any effect on the long-term viability of the resource, due to the short timeframe of abstraction and the relatively small quantities of groundwater abstracted. Water will be reused where possible.

8.2.3 Swan Coastal Plain Region (Loops 9 and 10)

Physical disturbance of rivers and streams

There are several major watercourses that are required to be crossed by the pipeline in Loops 9 and 10 with either open-cut or HDD being used as determined by site conditions (as for Loops 0 to 6, above) The Swan, Canning and Murray Rivers are expected to be crossed using HDD techniques.

Should caissons in river beds be required for sourcing water, the installation of these will also result in the physical disturbance of river beds.

Post construction, there is potential for erosion of creek and riverbanks along the pipeline and access track alignments. Appropriate stabilisation and rehabilitation of the watercourses will occur as soon as practicable after construction.

Alteration to flow regimes

Construction of Loops 9 and 10 will be undertaken in summer, as far as practicable, to avoid wet conditions and river flow events. However, flow regimes may be temporarily altered due to the potential installation of dams, dewatering and discharge of hydrostatic testing water.



Impact on groundwater flow regimes is expected to be minimal, as dewatering will be localised and temporary.

Deterioration in water quality

Deterioration in surface and groundwater quality may result from sedimentation, minor spills of hazardous material (e.g. fuel), leachate from acid sulphate soils and discharged hydro-test water, as outlined in Chapter 1 Section 7. The potential for acid generating soils in Loops 9 and 10 was discussed in Chapter 1 Section 7. Effects on water quality from these sources of contamination, should they occur, are expected to be temporary and not result in any long-term water quality impacts. Disposal of dewater product and hydro-test water will be managed in compliance with the DoW guidelines for dewatering (DoW 2006) to avoid contamination of any receiving waters.

Groundwater drawdown

Should groundwater drawdown occur from dewatering or groundwater abstraction, it is expected to be localised, of short duration and pre-construction groundwater levels are expected to re-establish after dewatering/abstraction ceases. Groundwater abstraction is not expected to have any effect on the long-term viability of the resource, due to the short timeframe of abstraction and the relatively small quantities of groundwater abstracted. Water will be reused where possible.



9 WETLANDS

9.1 Wetlands overview

Wetlands were not determined to be a key factor requiring consideration in Loops 0 – 8. The Stage 5 Expansion pipeline corridor in Loops 9 and 10 passes through over 100 mapped wetlands on the Swan Coastal Plain. This review focuses on those wetlands that are considered to be regionally significant.

The pipeline passes through over 40 conservation category wetlands (CCWs) and 7 wetlands gazetted under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 (EPP Lakes) mapped within Loop 9 and 10 CCWs and 10 EPP Lakes in Loop 10. All of these wetlands are considered to be of regional significance.

Loop 9 traverses within 200 m of Forrestdale Lake and Loop 10 runs north-south across the eastern side of the Swan Coastal Plain section of the catchment of the Peel-Harvey Estuary (the estuary is approximately 10 km away from the proposed route at its closest point). Forrestdale Lake and the Peel-Harvey Estuary are both part of Ramsar listed wetlands; 'Forrestdale and Thomsons Lakes' and the 'Peel-Yalgorup System' respectively.

Both Ramsar wetland systems are identified as wetlands of international importance, with Forrestdale and Thomsons Lakes meeting three Ramsar criteria (1a, 2b, 3c), and the Peel-Yalgorup System meeting four criteria (1a, 2c, 3a, 3c) (DEH 2003; 1998):

- **Criteria 1a:** It is a particularly good representative example of a natural or near-natural wetland, characteristic of the appropriate biogeographical region
- **Criteria 2b:** It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna
- **Criteria 2c:** It is of special value as the habitat of plants or animals at a critical stage of their biological cycle.
- **Criteria 3a:** It regularly supports 20,000 waterfowl
- **Criteria 3c:** Where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

9.2 Potential impacts

Project activities requiring vegetation clearing (e.g. clear and grade) and alteration to surface water or groundwater regimes (e.g. dewatering) have the potential to affect the conservation values of wetlands. The potential impacts that construction activities may have include:

- removal of fringing wetland vegetation that may be regionally significant and/or fauna habitat
- changes to the hydrological regimes of wetlands
- deterioration of surface water quality in wetlands.

9.2.1 Pastoral Region (Loops 0 to 6)

Wetlands were not determined to be a key factor requiring consideration in Loops 0 to 6.

9.2.2 Agricultural Region (Loops 7 and 8)

Wetlands were not determined to be a factor requiring consideration in Loops 7 and 8.

9.2.3 Swan Coastal Plain Region (Loops 9 and 10)

Removal of wetland vegetation

The construction of the pipeline in Loops 9 and 10 will directly affect (e.g. through clearing) up to 70 wetlands of regional conservation significance (CCWs or EPP Lakes). Wetlands of regional conservation significance are areas of conservation value and, as such, the working width of the corridor will be reduced to 20 m or less through all these areas.



Alteration to hydrological regimes

Species diversity and vegetation composition can potentially be affected if water regimes within wetland areas are altered over the long-term. Pipeline trenches have the potential to act as drainage lines and interfere with natural drainage by diverting water away from, or into wetland areas. The intersection of shallow groundwater by the open trench also has the potential to create localised disturbance to sub-surface flow patterns. However, due to the minor depth of the intrusion and the short period during which the trench is expected to be open, the effects on local drainage and groundwater flow regimes is expected to be minimal. Trench lengths in wetlands will be limited to ensure that the trench does not provide a direct connection between any two wetland water bodies.

Trench dewatering and groundwater abstraction for water supply (should groundwater be sourced along Loops 9 and 10) may have an effect on groundwater-dependent vegetation. Should groundwater drawdown occur from dewatering or groundwater abstraction, it is expected to be localised, of short duration and is not anticipated to result in any significant impact to vegetation and flora values. Pre-construction groundwater levels are expected to re-establish after dewatering or abstraction ceases.

Disposal of dewater product and hydro-test water can also affect hydrological regimes of wetlands. Pipelines will be laid in wet trenches through wetland areas where possible to minimise the impact trench dewatering may have on the hydrological regimes of nearby wetlands. Dewatering will only be undertaken if water in the trench is significantly restricting the ability to lay the pipe. Where dewatering is required, the time the trench is open will be minimised and the abstraction rates carefully monitored to reduce potential impacts on surrounding vegetation. Hydro-test water will not be discharged into wetland areas.

The presence of linear stockpiles of topsoil and trench spoil, and modification to surface contours during construction may alter surface drainage patterns around wetlands. Construction on Loops 9 and 10 will be undertaken in the summer where practicable when surface flows will be minimal. Any disruption to surface flows will be temporary as all stockpiles will be removed and post construction earthworks will restore the pre-existing landform and drainage patterns.

Water quality

There is the potential for contamination (e.g. fuel and chemical spills, acid generating soils) and sedimentation to occur, which could detrimentally affect the wetland system. The water quality may also be affected by the removal of any fringing wetland vegetation by reducing the capacity of the wetland to filter contaminants (including sediments and nutrients) in runoff. However, as the disturbed areas within the pipeline corridor will be rehabilitated with minimal delay, it is expected that the long term effect of the loss of vegetation on the water quality will be minimal.

Ramsar wetlands


Factors adversely affecting the ecological character of Forrestdale and Thomsons Lakes Ramsar wetland included:

- inputs of nutrients
- use of chemicals to control chironomids
- increasing area *Typha* spp. invading fringing vegetation (DEH 1998).


The three threatening processes identified are not expected to be exacerbated by Stage 5 Expansion construction activities nor the ongoing operation of the pipeline. Construction activities will occur around 200 m from the Forrestdale Lake water body. No dewater product, should it be generated, nor hydro-test water, will be discharged to the wetland.

Threatening processes identified for the Peel-Yalgorup System included:

- inputs of nutrients
- urban development (particularly canal development) and associated increased recreational use (DEH 2003).

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As the Stage 5 Expansion section of the Loop 10 is some 10 km from the wetland at its closest point, construction of the pipeline is not expected to exacerbate the threatening processes identified for the Peel-Yalgorup System.

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10 HERITAGE

10.1 Heritage overview

10.1.1 Aboriginal heritage

Australian Interaction Consultants (AIC) undertook an Aboriginal heritage assessment of the Stage 5 Expansion. An overview of this report (AIC 2006) is provided below.

Searches of the Register of Aboriginal Sites, which is maintained by the Department of Indigenous Affairs (DIA), indicated that over 260 archaeological and ethnographic sites have been recorded along or within 100 m either side of the pipeline corridor. These sites are comprised mostly of artefacts/scatters, which refers to locations where a range of activities has occurred such as the manufacture and maintenance of tools and the processing of foods. Some sites were associated with watercourses of mythological significance. A small number of sites consisted of grinding patches/grooves, quarries, modified trees, and man-made structures.

Most of the registered sites are covered by existing Section 18 consents with conditions relating to them. Of those for which consents have not been obtained, it is expected that many will lie outside the expected area of disturbance. Section 16 authorisations and Section 18 consents will be sought for those with potential for disturbance, following further investigation of each site.

10.1.2 European heritage

No European heritage sites are listed by the Heritage Council of Western Australia, Australian Heritage Commission or the National Trust of Australia as occurring within the entire pipeline corridor (Dames and Moore 2000). In addition, no sites listed on municipal heritage inventories maintained by the separate local government authorities occur in the pipeline corridor¹⁸. The Shire of Ashburton municipal inventory listed homesteads as occurring near the pipeline but at sufficient distance to ensure no impacts will result from pipeline construction. Lonely graves may occur on some pastoral stations traversed by the corridor but specific locations have not been recorded in municipal inventories (Dames and Moore 2000).

The City of Armadale noted two listed sites and one site under consideration for addition to the inventory within 1 km of Loop 9:

- Forrestdale Lake (listed)
- 'Haydock's Existing Home Site'; located on Allen Road near Forrestdale Lake (listed)
- 'Taylor's Old Home Site', located on Commercial Road near Forrestdale Lake (under consideration).

10.2 Potential impacts

Project activities requiring ground disturbance (e.g. clear and grade, trenching and excavation) have the potential to disturb archaeological material and effect ethnographic values, should they be present. Potential impacts include:

- disturbance to known heritage sites and previously undiscovered sites
- disturbance to significant features of the landscape/environment (e.g. modified/scarred trees).

Disturbance to land surface

Sites covered by existing Section 18 consents will be managed in accordance with the conditions applied to those consents. These conditions include avoidance of sites outside the corridor (which may include flagging and/or fencing sites), salvaging and recording sites prior to disturbance, monitoring of ground disturbance activities by qualified archaeologists near some sites and undertaking additional archaeological investigations prior to disturbance.

¹⁸ This was confirmed through correspondence with all local government authorities along the Stage 5 expansion pipeline route in June 2006.



Sites not covered by existing Section 18 consents will be further researched. This research will include detailed analysis of site records and may require some in-field investigations. From the results of these investigations, appropriate heritage management procedures will be implemented for these sites (e.g. submitting Section 16 authorisation or Section 18 consent applications, identifying sites for protection etc.).

Land disturbance activities during construction may uncover previously unrecorded heritage sites (e.g., sub-surface artefact scatters and skeletal material may be present). In hard ground formations, the potential for uncovering such material is low compared to more sandy formations. In areas where the potential for uncovering such material is high, qualified heritage consultants will be present during ground disturbance activities.

Where a heritage site cannot be avoided, DBP will seek the required approvals or authorisations under the *Aboriginal Heritage Act 1972*, in consultation with relevant Aboriginal groups. DBP will undertake disturbance in accordance with the conditions of any approvals or authorisations and will consult and involve relevant Aboriginal groups in mitigative heritage work prior to disturbance of the site.

Disturbance to significant features

Significant landscape or environmental features, such as trees and watercourses, may be of heritage or ethnographic importance, but not recognised as 'sites' *per se*. Construction of the pipeline corridor will require the removal of vegetation and in some areas outside the corridor and it will cross several watercourses, which will require disturbance to the bed and banks. Concern has also been expressed in the course of past heritage surveys about the possible loss of plants used by Aboriginal people as food and medicine (AIC 2006).

Clearing outside the corridor will avoid significant trees and other features where practicable. Pruning of large trees will also be undertaken in preference to removal where practicable. All disturbed areas will be rehabilitated to their pre-construction condition. Where required, DBP will consult with relevant Aboriginal groups to implement watercourse crossings.

The known European heritage sites are located over 150 m from the Loop 9 pipeline corridor and are not expected to be directly affected by the proposal. There is potential for indirect impacts, for example from vibration.



11 LAND USAGE AND SERVICES

11.1 Land usage and services overview

11.1.1 Pastoral Region (Loops 0 to 6)

Loops 0 to 6 are located in the Pilbara, Gascoyne and Midwest Regions as defined by the State Planning Strategy (WAPC 1997). The Loops traverse the Shires of Roebourne, Ashburton, Carnarvon, Upper Gascoyne, Shark Bay, North Hampton, Chapman Valley and Mullewa (Table 1-31).

The current land use within Loops 0 to 6 is varied due to the expansive length traversed by the pipeline (Table 1-31). The Loops are primarily within Crown Leases (pastoral) and an area within Loop 4 is used for cattle and tourism. Smaller proportions of the land are freehold, Crown Reserve and Crown Land. Loops 0 to 6 also traverse exploration and other tenements associated mainly with extractive industries such as iron ore, and oil and gas.

Loops 0 to 6 pass primarily through sparsely populated areas. The start of Loop 0 is approximately 2 km from the township of Dampier. There are no other townships near the pipeline corridor. Several homesteads, other buildings (e.g. sheds) and other third-party pastoral infrastructure (e.g. fencing, stock yards) are close to the pipeline corridor (Table 1-31).

Other third-party infrastructure near the pipeline corridor includes roads (major roads crossed being North West Coastal Highway, Onslow Road and Carnarvon Mullewa) and utility services (e.g. power transmission lines). The pipeline corridor also crosses the vermin proof fence to the east of Kalbarri.

Table 1-31 Local government authorities and land use along Loops 0 to 6


Loop	Local government authority	Description of land use*
0	Shire of Roebourne	Comprises mining activities, pastoral stations. There are no premises within 660 m of the pipeline corridor.
1	Shire of Ashburton	Land use consists of conservation reserves, Aboriginal lands, mining properties and crown land. There are no premises within 660 m of the pipeline corridor.
2	Shire of Ashburton	Predominant land use is pastoral stations. There are no premises within 660 m of the pipeline corridor.
3	Shire of Carnarvon	Predominant land use is pastoral stations. There are no premises within 660 m of the pipeline corridor.
4	Shire of Carnarvon, Shire of Upper Gascoyne	Land use includes pastoral stations and Aboriginal communities. There are no premises within 660 m of the pipeline corridor.
5	Shire of Shark Bay	Comprises nature/conservation reserves and leased pastoral lands. There are no premises within 660 m of the pipeline corridor.
6	Shire of Northampton, Shire of Chapman Valley, Shire of Mullewa	Land use includes numerous pastoral stations and crown land. Six sensitive premises were identified in this loop, the closest being within 165 m of the pipeline corridor.

*Sensitive premises identified during the Risk Assessment undertaken, incorporating areas within 660 m of the pipeline.

11.1.2 Agricultural Region (Loops 7 and 8)

Loops 7 and 8 are located in the Midwest Region and Coastal section of the Wheatbelt Region, as defined by the State Planning Strategy (WAPC 1997). A small end section of Loop 8 also traverses the Perth Metropolitan Area. The loops traverse the Shires of Mullewa, Irwin, Carnamah, Coorow, Dandaragan and Gingin (Table 1-32).

Loop 7 is primarily within freehold land. Smaller proportions of the land are Crown Reserve and Crown Land. Loop 8 is mostly freehold for the purpose of grazing and cropping with some Crown Reserve and Crown Land for conservation and other purposes (Table 1-32).

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Population density is low along the corridor. The closest town is Badgingarra, which is approximately 500 m east of the pipeline corridor.

Various third-party infrastructure is close to the pipeline including roads (e.g. Brand Highway), railways and public utilities (e.g. powerlines). A number of fences associated with agricultural properties are also crossed.

Table 1-32 Local government authorities and land usage along Loops 7 and 8

Loop	Local government authority	Description of main land uses*
7	Shire of Mullewa, Shire of Irwin, Shire of Carnamah	Loop comprises freehold and crown land, also containing Government reserves. There are four sensitive premises (all residences), the closest within 160 m.
8	Shire of Coorow, Shire of Dandaragan, Shire of Gingin	This loop contains a combination of freehold and crown land, including conservation reserves. Eleven sensitive premises were identified including residences, sporting complexes and road houses. The closest of these sensitive premises is within 112 m of the pipeline corridor.

*Sensitive premises identified during the Risk Assessment undertaken, incorporating areas within 660 m of the pipeline.

11.1.3 Swan Coastal Plain Region (Loops 9 and 10)

Loops 9 and 10 are in the Perth Metropolitan, Peel and South West Regions, as defined by the State Planning Strategy (WAPC 1997), and traverse numerous local government authorities, especially once the pipeline corridor enters the Perth Metropolitan Area (Table 1-33).

Loop 9, to the north of the city fringe, is mostly freehold for the purpose of grazing and cropping with some Crown Reserve and Crown Land for conservation and other purposes. This area has been experiencing increasingly intense land use pressures. Loop 9 also includes:

- freehold agricultural land on the city fringe
- public owned and freehold urban land
- regional and public open space.

Through the city, Loop 9 traverses a combination of vacant, rural, semi-rural and urban land, with private urban residences being within several metres of the corridor in some sections. There is a high population density along the corridor within the city area (Table 1-33).

Loop 10 is mostly freehold land for grazing and cropping and it is not close to any towns it passes by (Pinjarra and North Dandalup are approximately 1.6 km and 5 km from the pipeline corridor respectively). Consequently, there is a low population density along the corridor (Table 1-33).

Table 1-33 Local government authorities and land use along Loops 9 and 10

Loop	Local government authority	Description of land use and closest residences
9	Shire of Gingin	Predominantly rural with some houses within 70 m of the corridor.
	Shire of Chittering	Primarily rural with large expanses of unoccupied land.
	City of Swan	A combination of rural and urban areas, abutting a number of residential areas. Various sensitive premises were located adjacent to or near the pipeline corridor including schools, sporting venues and mining areas.
	City of Belmont	Comprises vacant land and conservation areas associated with the Perth Airport.
	Shire of Kalamunda	Semi-rural and urban areas comprise this municipality with some residential areas abutting the pipeline corridor. A few sensitive areas, incorporating sporting venues, were near the pipeline corridor.



Loop	Local government authority	Description of land use and closest residences
10	City of Gosnells	Predominantly vacant land, with some conservation and urban residential areas. The pipeline corridor borders two sensitive residential estates and crosses a recreational park that is currently unused. It also passes through the Orange Grove primary school.
	City of Armadale	Primarily rural with some houses within 65 m of the pipeline corridor. There were a number of sensitive areas near the corridor, including a sporting complex.
	City of Cockburn	Predominantly rural/semi-rural with some houses within 5 m of the pipeline corridor.
	Town of Kwinana	Primarily rural/semi-rural with some houses within 15 m of the pipeline corridor.
	Shire of Serpentine-Jarrahdale	Predominantly rural with eleven sensitive premises identified*, the closest of which is approximately 70 m from the pipeline corridor.
	Shire of Murray	Primarily rural with eighteen sensitive premises identified*, the closest is within 20 m of the pipeline corridor.
	Shire of Waroona	Predominantly rural, including crown and freehold land, with one conservation reserve. One sensitive premises was identified within 12 m of the pipeline corridor.

*Sensitive premises identified during the Risk Assessment undertaken, incorporating areas within 660 m of the pipeline.

A variety of infrastructure is near the pipeline corridor. Within the Perth Metropolitan Area the pipeline corridor crosses major transport corridors, including roads (Albany Highway, Roe Highway, Great Eastern Highway, Reid Highway) and railways (Perth urban passenger railway and freight railway), as well as other infrastructure (e.g. power transmission, property fences).

11.2 Potential impacts

During the construction of the pipeline, access to and use of land on the corridor by landowners and the public will be strictly prohibited. Construction activities will also require the crossing of roads, fences and other infrastructure, and may also contribute to ongoing land use issues. Potential impacts that may result from construction activities include:

- temporary loss of land for utilisation in pastoral/agricultural activities
- temporary impediment to property access and stock movement
- increased risk of wildfire and the introduction of weeds
- possible long-term loss in soil productivity
- disruption or damage to infrastructure, services and third party property
- localised traffic congestion or disruptions.

Access to and utilisation of land

Prohibition of access to and use of the pipeline corridor land will be temporary and will cease once the construction phase of the project has been completed and the corridor rehabilitated. Furthermore, as the pipeline is buried, existing land uses will be able to resume post-construction and rehabilitation. Existing land uses will generally not be restricted over the pipeline except those that will potentially cause harm to the pipeline or the public (e.g. deep ripping, fence installations and the planting of deep rooted plants). The Department for Planning and Infrastructure, on behalf of the DBNGP Land Access Minister, manages access and utilisation of the DBNGP corridor with advice from Section 34 access right holders, including DBP.

Soil productivity

Soil productivity, in terms of erosion, compaction, inversion and contamination, is discussed in Chapter 1 Section 7.

**Weeds and wildfire**

The introduction and/or the spread of weeds along the pipeline corridor can affect the productivity of the land, should this land be used for pastoral and agricultural activities, as too can fire incidences. Chapter 1 Section 4 discusses weeds and wildfire, including management measures.

Infrastructure, services and third-party infrastructure

Construction activities will not result in significant impacts to public infrastructure and services. All public utilities (services) will be identified prior to construction by the Stage 5 Expansion Land Management Team to enable protection and avoidance during construction. Construction near these utilities will be undertaken in accordance with relevant utility standards and guidelines.

Public infrastructure, such as roads, may require some level of disturbance. For example, road crossings will be undertaken using either open-cut or directional boring methods, and heavy vehicle and equipment movement on public roads may result in localised damage to road integrity.

Impacts on private property will be necessary as part of the normal construction process and will be communicated and discussed with the landowner by the Land Management team prior to construction commencing. All public and private infrastructure will be restored to its pre-construction condition in accordance with agreements made between DBP (or its agents) and landowners.

Traffic interruptions

When pipeline construction occurs in high-population density areas, particularly the Perth Metropolitan Region, there is the potential for traffic interruptions. These may be caused by transport of equipment or materials (e.g. trucks and the pipeline construction equipment), as well as regular vehicle movements associated with construction personnel commuting to and from the construction site. These effects would be localised, depending on the section of the pipeline being constructed, and temporary as pipeline construction progresses through the Perth metropolitan region. The intended construction hours of 7 am to 6 pm would result in construction personnel commuting outside the normal peak traffic times and thus is unlikely to contribute further to peak traffic congestion.



12 NOISE AND VIBRATION

12.1 Noise and vibration overview

Pipeline construction activity will result in a temporary increase in noise levels within the immediate vicinity of the corridor, associated with the operation of vehicles and equipment. Access to and from the relevant construction sites may also cause a temporary increase in local traffic noise levels. This impact is expected to be of short duration and intensity at any one location. Vibration may result from blasting, which may be required to enable excavation of the trench, compaction following backfilling the trench and the operation of heavy vehicles.

Noise and vibration were not determined to be key factors for consideration in Loops 0 – 8. There will not be a requirement for blasting to be carried out in Loops 9 and 10.

Loops 9 and 10 traverse areas of low, moderate and high density living. Within Loop 9, residential properties come within 5 m of the corridor in some places. Loop 10 traverses predominantly agricultural areas, with residences generally not within 100 m.

12.2 potential impacts

Vibration and ambient noise levels near the construction right-of-way will increase as a result of the operation of vehicles and equipment. Potential impacts that may result from these activities include:

- affect the amenity of nearby residences (noise and vibration)
- cause damage to property (vibration)
- interrupt fauna behaviour and movement (Chapter 1 Section 5).

Noise

Noise emissions from the construction right-of-way will vary depending on the aspect of the project being undertaken (e.g. blasting, clearing and grading), the resultant tonality of the noise emission, and the duration of the emission. Some noise emissions from the construction operations with varying tones could be considered intrusive (e.g. vehicle reversing beacon or blasting activities), whilst other noise emissions with a continuous tone could be considered less intrusive (e.g. running vehicle engine).


The noise levels generated by the various construction activities will vary in intensity and tonal characteristics depending upon the combination of equipment in operation at any one time, and the location and duration of the individual activities. Construction traffic will cause minor increases in traffic noise on roads near the pipeline corridor.

Noise emissions from pipeline construction will cause localised temporary disruption to fauna in areas adjacent to the corridor; however, it is unlikely that the behaviour of fauna will be disrupted by noise emissions in the long term.

The progressive movement of the active construction area will limit the duration of noise emissions in any particular location.

The predominant land use along the pipeline corridor in the pastoral region is grazing consequently there are few potential noise sensitive premises close to the pipeline corridor. These premises comprise mainly homesteads on pastoral properties. The predominant land use along the pipeline corridor in Loops 7 and 8 is agricultural and there are only a small number of potential noise sensitive premises near the pipeline corridor. These premises comprise mainly rural residences.

Loop 9 traverses the Perth Metropolitan Area and consequently high density residential areas are near the pipeline corridor. Within Loop 10, the pipeline corridor is routed through predominantly agricultural areas with few residences. Where construction is close to residences, it will mainly occur during normal working hours from Monday to Saturday. Where construction is required out of hours or on Sundays and/or public holidays, noise

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emissions will comply with the assigned levels provided in Regulation 7 of the Noise Regulations or construction will be undertaken in accordance with an approved Noise Management Plan.

DBP will minimise noise emissions through mitigation measures that include ensuring noise and vibration from construction of the pipeline complies with the requirements of the Noise Regulations and Department of Mines and Petroleum (DMP) requirements for mine safety and health.

Vibration

Vibration may result from blasting and the movement of heavy vehicles along the pipeline corridor. Vibration has the potential to affect adjacent residences, farm structures or historical sites and also the adjacent existing pipeline within the corridor. Blasting and rock breaking may be required in the northern loops, but will not be required in Loops 9 and 10. Ground compaction will be required in all loops following backfilling the trench.

The location of the existing gas pipeline, within 6 metres of the proposed trench, is a major consideration with regard to vibration impacts. Due to safety aspects associated with the use of explosives in proximity of this pipeline, blasting will be limited, with the smallest practicable blast undertaken. Where required, several small blasts will be undertaken, as opposed to single blasts, to minimising vibration emissions from blasting.

Compaction of the backfilled trench will be undertaken by driving rubber wheeled vehicles (excavators and other earth moving equipment) along the trench. This option will be undertaken to minimise potential impacts on the pipeline and surrounding residences.

Based on the above information, the potential for vibration impacts from blasting and ground compaction on dwellings and structures is anticipated to be low.



13 AIR QUALITY (DUST)


13.1 Air quality (dust) overview

Dust will be the main component of air emissions during the construction phase of the proposed development. No dust emissions are likely once the pipeline is in operation. Dust from construction activities is not likely to be a key public concern in areas remote from populated centres (e.g. most of the northern section of Loop 9 outside of the Perth Metropolitan Area and most of Loop 10).

13.2 Potential impacts

Dust emissions generated from construction of the pipeline may result from vehicle movements, ground disturbance activities, wind action on stockpiles and bare areas, and blasting activities. Dust emissions have the potential to create a short-term nuisance to nearby sensitive residents and may reduce visual amenity, be of general nuisance and cause health problems in susceptible individuals. There are few potential dust sensitive premises along Loops 0 to 8, reducing the potential for activities to affect sensitive premises. The effects of dust on vegetation and flora, and fauna are described in Chapter 1 Sections 4 and 5 respectively.

The potential impacts of dust are likely to be more prevalent in Loops 9 and 10, compared with the pastoral and agricultural areas, due to the increased population density, particularly in the Perth metropolitan region (Loop 9). Should dust emissions pose a significant risk to nearby residences in Loop 9, or substantiated public complaints are received, DBP will implement additional dust suppression measures.

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14 PUBLIC SAFETY AND RISK

14.1 Public safety and risk overview

Pipelines are recognised as a safe and efficient means of transporting natural gas. However, all developments present some level of risk during construction and operation. There are several aspects of the Stage 5 Expansion that could potentially pose an off-site risk to the safety of the general public, not including pipeline construction personnel. These include:

- proximity of construction activities to private residences and public roads
- the requirement for transportation of equipment, hydrocarbons and chemicals on public roads
- the increase in traffic volumes on public roads
- interference with the pipeline (during operation).

Public Safety and Risk were not determined to be a Key Factor for Loops 0 – 8. There are several aspects of the Stage 5 Expansion that could potentially pose an off-site risk to the safety of the general public, not including pipeline construction personnel. These include risks during construction and operational phases.

Loops 9 and 10 traverse numerous local government authorities and their associated suburbs, crossing a number of major and minor roads and railway networks. There are also a number of public utilities occurring close to the pipeline corridor (e.g. water, gas and electricity) that may be affected by the installation of the pipeline.

14.2 Potential impacts

14.2.1 Pastoral and agricultural regions (Loops 0 to 8)

The pastoral region is remote and thus the proportion of the public likely to be affected by the construction risks identified above is reduced in comparison to highly populated areas. Public safety and access during construction and management of land use activities within the pipeline corridor post-construction will be addressed through a Land Management Strategy to be developed for the Stage 5 Expansion.

Potential risks to public safety arising from pipeline construction in the agricultural region are expected to be similar to those applying to the pastoral region section of the pipeline.

The transport of potentially hazardous material (e.g. hydrocarbons and chemicals) will be managed in accordance with relevant State legislation and Australian standards to ensure risks to the public are minimised as far as practicable. Requirements of this legislation and standards include, amongst others, vehicle and driver licensing and vehicle placarding. The storage and handling of fuels and chemicals and response to spills will also be managed in accordance with specific management measures to be detailed in the *Fuel and Chemical Storage, Spill and Emergency Response Protocol* (Chapter 4 Section 14).

Construction of the Stage 5 Expansion will result in a small increase above current levels in general traffic and freight movement along the major transport routes in the project area. Anticipated traffic increases will be within the current capacity of the public roads and are not expected to pose a significant risk to other road users.

The pipeline will be constructed in accordance with AS 2885, implementing a number of procedural and physical mitigation measures that will reduce the potential risks associated with public safety.

14.2.2 Swan Coastal Plain Region (Loops 9 and 10)

Proximity to the public during construction

A Stage 5 Expansion Land Management Strategy has been developed and will address public safety and access to the corridor during construction, and management of land use activities within the pipeline corridor post-construction.



There will also be a requirement for a variety of machinery/equipment and hazardous materials to be transported to the different locations of pipeline construction via public roads. The transport of potentially hazardous material (e.g. hydrocarbons and chemicals) will be managed in accordance with relevant State legislation and Australian standards to ensure risks to the public are minimised as far as practicable. The storage and handling of fuels and chemicals and response to spills will also be managed in accordance with specific management measures to be detailed in the *Fuel and Chemical Storage, Spill and Emergency Response Protocol* (Chapter 4 Section 14).

Pipeline interference post construction

The main threat to pipeline integrity once installed is external or mechanical interference. External interference usually involves the removal of the protective ground cover and contact with the pipe, which may or may not penetrate the pipe wall (APIA 1998).


The Stage 5 pipeline will be constructed in accordance with Australian Standard 2885 to meet appropriate safety standards. This includes physical and procedural measures, such as burying the pipeline and installing signs. These measures will reduce the likelihood of post-construction interference.



Chapter 2 Environmental Management

1 INTRODUCTION

This chapter describes the DBNGP Stage 5 Expansion environmental impact mitigation measures that will be implemented by DBP. It will also describe the mechanisms/tools that will be employed to implement those measures. All impact mitigation measures that will apply to the Stage 5 Expansion will be consistent with the Australian Pipeline Industry Association (APIA) impact mitigation measures as outlined in the *APIA Code of Environmental Practice*.

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2 MANAGEMENT FRAMEWORK

2.1 Environmental management system

DBP operates in accordance with its Environmental Management System that includes the Health, Safety and Environment Policy, the Construction Environmental Management Plan, Operational Environmental Management Plan, and other subsidiary environmental documentation. . The purpose of the Environmental Management Plan is to ensure proactive planning, sustainable development and continuous environmental improvement.

The key elements of the DBP Environmental Management System include:

- a corporate environmental policy (Appendix 1)
- assessing environmental risk and identification of legal requirements
- developing objectives and targets for improvement
- training, operational control, communication, emergency response, corrective and preventative actions
- audits and review.

2.2 Environmental policy

DBP is committed to responsible environmental management of the Stage 5 Expansion project and believes that all potential adverse environmental effects can be effectively managed. All planning, construction and operation activities shall be conducted in accordance with the DBP Environmental Policy (Appendix 1), which outlines the company's commitment to sound management of environmental aspects of the project.

2.3 Stage 5 Expansion management plans

2.3.1 Construction Environmental Management Plan (CEMP)

Under the *Petroleum Pipeline Act 1969*, DBP is required to submit a Construction Environmental Management Plan (CEMP) to DMP for approval prior to the commencement of construction. This document forms this CEMP and aims to address potential environmental impacts that may be encountered during construction of the pipeline.

Environmental Line List

All site specific environmental information will be captured in an Environmental Line List (ELL). This list will be sorted by chainage (KPs) and will include the location, issue and management practices (e.g. protocols to be implemented) required for site specific environmental issues. Results of the specialist surveys and consultation will be captured here. The Environmental Line Lists will be consolidated with other critical construction information in a Construction Line List, which will be issued to all crews.

2.3.2 Land Management Strategy

A Stage 5 Expansion Land Management Strategy will be developed that will outline land management processes: such as the notification of landowners and facilitation of land owner agreements, and land management activities: such as determining construction access to the pipeline corridor and rehabilitation requirements. A Stage 5 Land Management Team will be responsible for communicating with landowners along the pipeline route to advise them of all aspects of the construction activities that are likely to affect them. The aim is to deliver the project with minimum disruption to the landowners affected by both pre-construction and construction activities.

2.3.3 Operational Environmental Management Plan (OEMP)

Under the *Petroleum Pipeline Act 1969*, DBP is also required to submit an Operational Environmental Management Plan (OEMP) to DMP for approval, prior to commencement of operation of the pipeline.

2.4 Environmental management actions/protocols

The environmental management actions and protocols prescribed which are included in this CEMP, aim to meet the Management Commitments and achieve the objectives outlined in Chapter 2 Section 5. The procedures are intended to provide clear and practical guidance to the planning, construction and operation workforce. As such, the procedures are structured according to the activity (or task) for each phase of the project, which reference specific protocols to address key issues (or protect significant environmental locations).

2.5 Job environmental analysis

A Job Environmental Safety Hazard Analysis (JESHA) is to be completed by the construction supervisor and submitted to the Project Manager prior to commencement of each construction activity (eg. clear and grade, trenching etc.). This form shall identify the specific environmental objectives and hazards associated with the particular type of construction activity, and shall receive approval from DBP prior to commencement of the outlined activities.

2.6 Responsibilities

As the proponent for the Stage 5 DBNGP expansion, DBP is responsible for overall environmental compliance with the Ministerial Statement on implementation of the proposal, and for implementation of the CEMP. However, all personnel and contractors are accountable through conditions of employment or contracts (Table 2-1), with each individual responsible for ensuring that their work complies with the stated procedures. This CEMP designates the specific responsibilities of DBP, and the Construction Contractor in implementing this CEMP, within each of the management protocols set out in Chapter 4. The Proponent and the Construction Contractor shall each prepare a detailed schedule nominating the specific personnel responsible for each of the management actions set out in this CEMP, and it will form part of the CEMP. This will be completed prior to commencement of any construction activities.

The proposed organisational responsibilities for personnel overseeing environmental management during construction are detailed in Figure 2-1 and Table 2-1. While it is not the present intention, it should be noted that one or more positions may be amalgamated or the responsibilities shared under a modified arrangement.

Environmental management and compliance with the management actions and protocols outlined below will be the responsibility of all personnel and a contractual obligation for all contractors involved with the Project.

Figure 2-1 Reporting structure (DBP/DBP)

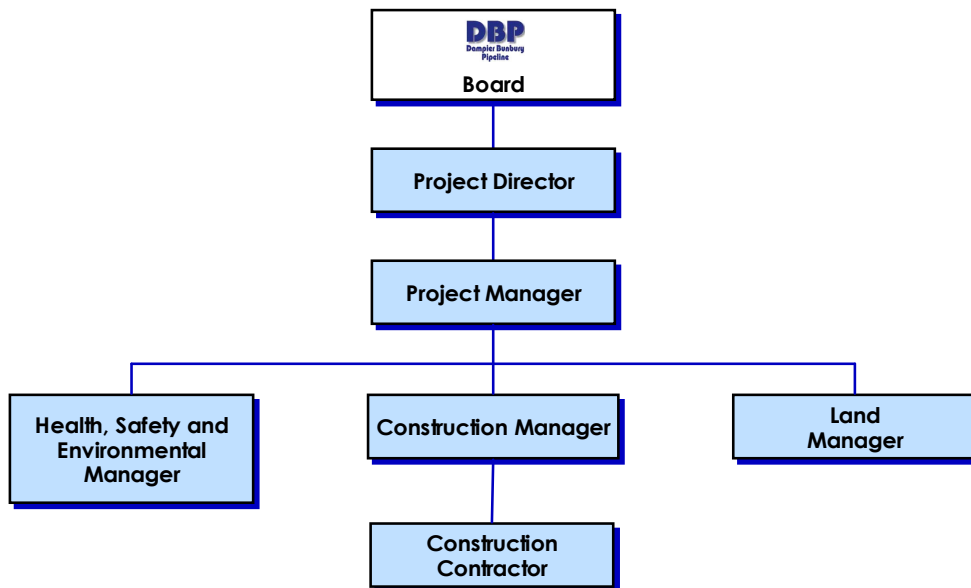




Table 2-1 Responsibilities

Position	Responsibilities
DBP	
Project Manager	Directly responsible for the management of the Project, including all environmental aspects. Reports directly to the DBP Executive Management.
Construction Manager/Supervisor	Directly responsible for overseeing and fulfilling commitments contained in this CEMP. Reports to the Project Manager regarding the project environmental performance and due diligence.
Environmental and Land Managers	Responsible for overseeing, supporting and advising the Construction Manager on environmental, cultural heritage and land matters. Environmental Manager (external specialist contractor) to liaise with Construction Contractor Environmental Manager on implementation of CEMP. Coordinates DBP audit programs.
Construction Contractor	
Environmental Manager	Responsible for ensuring that works comply with the CEMP, meet regulatory requirements, and that all environmental objectives contained in the contracts are attained. Provides advice to the construction workforce regarding implementation of the CEMP. Co-ordinates external heritage monitors, through specialist external heritage contractor, to be onsite in nominated areas during construction.
Superintendent and Inspectors	Field based personnel responsible for ensuring construction complies with the project's objectives and the CEMP.
External	
Environmental Auditors	External to DBP and contracted to conduct periodic audits according to the principles of this CEMP and relevant environment legislative compliance. The Auditors are coordinated by the Environment Manager but report to the Project Manager.
Heritage Advisers	Specialist external contractors used in the field to provide advice on specific heritage matters on an as-needs basis. Co-ordinated by the DBP Approvals Manager.
Heritage Monitors	Aboriginal community representative engaged to assist with cultural heritage site management in nominated areas during construction. Co-ordinated by the Construction Manager/Construction Environmental Manager through specialist external heritage contractor.

2.7 Inductions and training

Construction personnel shall be required to attend a project induction program prior to commencing work on site. The induction program will include a major environmental component designed to ensure that all personnel are aware of their environmental responsibilities.

The construction environmental induction component shall cover general environmental management issues, including:

- relevant legislation and legislative requirements
- roles and responsibilities
- environmental issues for the project, including:
 - management of sensitive areas
 - erosion and sediment control
 - protection of water quality
 - spill management and response



- vegetation and habitat management
- interaction with fauna
- weed and pathogen control
- heritage management
- protecting existing utilities, infrastructure and the amenity of landholders
- traffic and access
- waste management
- fire management
- emergency response
- project documentation (including the CEMP, Construction Alignment Sheets, Environmental Line List, technical drawings and other associated documents)
- incident reporting.


In addition, job specific training shall be conducted prior to the commencement of the following activities:

- clearing and grading
- trenching
- lowering in and backfill
- clean up and rehabilitation
- testing and commissioning
- drilling/boring.

It is the responsibility of the construction contractor to prepare and implement an environmental induction and job specific training program that has been previously approved by DBP.

2.8 Public complaint response

All complaints from the public regarding construction activities and that relate to environmental factors shall be treated as Environmental Incidents and shall be managed consistent with the Environmental Incident Response Protocol outlined in Chapter 4 Section 1. Complaints shall be referred to the Environmental Manager or Construction Contractors for investigation. Incident forms will be used for recording and detailing investigations and management responses as for all environmental incidents. Completed forms will be forwarded to the Project Manager for information and recording.


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3 ASSESSMENT OF ENVIRONMENTAL EFFECTS AND RISK

3.1 Methodology

DBP is committed to continual improvement in performance, efficient use of natural resources and aspires to zero harm to the environment. A risk-based approach is applied in the management of construction and operations; the overall philosophy is to give priority to designing the pipeline and work activities in such a manner as to avoid the creation of hazards that may lead to the potential for environmental impact. Where this is not possible, the priority will be to minimise and mitigate potential environmental impact through design and/or the implementation of specific constructional processes and procedures. Where environmental hazards are inevitable, they are to be managed to ensure that the potential for environmental harm is reduced to “As Low As Reasonably Practicable” (ALARP).

Potential environmental impacts have been assessed to determine their consequence. Refer to Appendix 14 for a copy of the DBP Risk Model. The Risk Model combines the consequence and likelihood to determine the risk ranking which in turn assigned the correct level of management required to successfully reduce the environmental risk to ALARP. This model was revised in 2008, and would be applied to any new risk assessments associated with the project.

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4 ENVIRONMENTAL RISK REGISTER FOR DBNGP STAGE 5

An environmental risk register has been developed for the DBNGP Stage 5 Project. The following environmental factors were examined in developing the environmental risk register:

- vegetation and flora
- wetlands
- fauna
- conservation reserves and bush forever
- soils and terrain
- groundwater
- rivers and streams
- noise and vibration
- air quality (dust)
- waste management
- heritage
- land usage and services
- public safety and risk.

The majority of potential impacts identified are considered to be of low risk and can be managed through standard operating procedures. Six aspects were considered be of moderate or high risk and these will require senior management attention. These aspects related to:

- dieback management
- trenching and excavation
- drilling/boring
- stringing and welding
- crossing watercourses
- clean up and rehabilitation.

The project will conduct construction risk assessments prior to implementation to ensure that all risks are appropriately identified, mitigation plans developed, and recording and auditing systems initiated.



Table 2-2 Environmental risk register

Activity	Potential environmental impact	Mitigation Measures ¹⁹	Consequence	Likelihood	Risk Level
Pre planning	Disturbance to infrastructure, nearby residents and land use activities Increase public risk from siting of pipeline	Dust Management Protocol (Section 12) Noise Management Protocol (Section 13) Rehabilitation Management Protocol (Section 18)	Minor	Remote	Negligible
Refuelling and servicing	Contamination of local environment	Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14)	Minor	Remote	Negligible
Chemical storage and handling	Contamination of local environment	Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14)	Minor	Remote	Negligible
Waste management	Contamination of local environment	Waste Management Protocol (Section 15)	Minor	Remote	Negligible
Environmental Sensitive areas	Clearing of vegetation and flora in environmentally sensitive areas	Conservation Area, and Flora and Vegetation Management Protocols (Sections 2 and 3)	Minor	Remote	Negligible
Clear and Grade	Impacts on vegetation and flora	Flora and Vegetation Management Protocol (Section 3)	Minor	Remote	Negligible
	Disturbance to Declared Rare Flora	Flora and Vegetation Management Protocol (Section 3)	Severe	Remote	Low
	Impacts on fauna	Fauna Interaction Protocol (Section 8)	Minor	Remote	Negligible
	Spreading of weeds to detriment of native vegetation	Weed, Pest and Dieback Management Protocol (Section 4)	Minor	Remote	Negligible
	Impacts on watercourses, wetlands, groundwater and surface waters	Wetland Management Protocol (Section 5) Dewatering and Water Disposal Management Protocol (Section 6) Watercourse Crossing Protocol (Section 9) Acid sulphate management Protocol (Section 7)	Minor	Remote	Negligible
	Spread of dieback to detriment of native vegetation	Weed, Pest and Dieback Management Protocol (Section 4)	Catastrophic	Remote	High
	Cultural heritage disturbance	Aboriginal Heritage Site Management Protocol (Section 17)	Minor	Remote	Negligible
	Noise	Noise Management Protocol (Section 13)	Minor	Remote	Negligible

¹⁹ All management protocols referred to in Table 2-2 are located in Chapter 4.



Activity	Potential environmental impact	Mitigation Measures ¹⁹	Consequence	Likelihood	Risk Level
	Generation of dust that will impact on flora/fauna and local amenity	Dust Management Protocol (Section 12)	Minor	Remote	Negligible
Trenching and Excavation	Alteration to hydrological regimes (surface drainage) and sedimentation	Wetlands Management Protocol (Section 5) Watercourse Crossing Management Protocol (Section 9)	Trivial	Unlikely	Low
	Soil erosion	Soil Management Protocol (Section 16) Dune Crossing Management Protocol (Section 10)			
	Fauna impacts (injury/death by falling in trenches)	Fauna Interaction Protocol (Section 8)			
	Damage to other land-uses	Management Measures not addressed in this plan			
	Disturbance of Acid Sulphate soils	Acid Sulphate Soil Management Protocol (Section 7)			
Drilling/boring	Soil erosion	Soil Management Protocol (Section 16)	Trivial	Unlikely	Low
	Sedimentation	Soil Management Protocol (Section 16)			
	Disturbance of acid sulphate soils	Acid Sulphate Soil Management Protocol (Section 7)			
	Contamination of surface and groundwater	Acid Sulphate Soil Management Protocol (Section 7) Use of water based drilling fluids			
	Noise	Noise Management Protocol (Section 13)			
Dewatering	Impacts on watercourses, wetlands, groundwater and surface waters	Dewatering and Water Disposal Management Protocol (Section 6)	Minor	Remote	Negligible
	Disturbance of acid sulphate soils	Acid Sulphate Soil Management Protocol (Section 7)	Trivial	Remote	Low
Stringing and Welding	Potential to cause fire that will impact on flora, fauna and other land uses	Fire Management Protocol (Section 11)	Severe	Remote	Low
Lowering-in and backfilling	Trapping of fauna in trench	Fauna Interaction Protocol (Section 8)	Minor	Remote	Negligible
	Dust	Dust Management Protocol (Section 12)	Minor	Remote	Negligible
Clean-up and rehabilitation	Lack of vegetation can lead to erosion, sedimentation, visual amenity and alterations in hydrological regimes Disturbance to existing vegetation and faunal habitats	Rehabilitation Management Protocol (Section 17)	Severe	Remote	Low
	Dust	Dust Management Protocol (Section 12)	Minor	Remote	Negligible



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5 ENVIRONMENTAL OBJECTIVES AND PERFORMANCE CRITERIA

Table 2-3 sets out the full range of environmental objectives and associated performance indicators for all aspects of the proposal.

Table 2-3 Environmental objectives and performance criteria

Issue	Objective	Performance Indicator
INCIDENT RESPONSE		
Environmental impact	To minimise and limit environmental impacts to the extent of the environmental approval.	Breaches of Ministerial Conditions.
Complaint	Investigate complaint and implement action to minimise future complaints.	Investigation completed. Remediation action undertaken. Complainant advised of outcomes.
Protocol	Protocols implemented to manage potential environmental impacts.	Protocol updated to minimise potential for future complaints.
CONSERVATION AREAS		
Disturbance to areas of conservation value	Minimise and manage disturbance to areas of conservation value.	No vegetation outside approved areas in areas of conservation value is cleared or destroyed. No vehicle or machinery movement outside of approved areas. Threatened Flora and Ecological Communities managed consistent with the Flora and Vegetation Management Protocol (Chapter 4 Section Chapter 43). Weeds and diseases managed consistent with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4). Wetlands managed consistent with the Wetland Management Protocol (Chapter 4 Section 5). Fauna, including Threatened and/or Migratory species, managed consistent with the Fauna Interaction Protocol (Chapter 4 Section 8).
FLORA AND VEGETATION		
Weeds and diseases	Prevent the introduction and dispersal of weeds and pathogens and pest species.	The presence of weeds, pathogens and pest species on the construction right-of-way is consistent with or better than adjacent land.
Disturbance to vegetation	Minimise and manage disturbance to remnant vegetation.	All construction activities undertaken within the construction right-of-way. All areas of remnant vegetation (habitat) avoided outside the construction right-of-way.
Disturbance to Threatened Flora and Threatened Ecological Communities	To minimise the disturbance or clearing of Threatened Ecological Communities and Threatened Flora, including Declared Rare Flora and Priority Flora species listed under the Wildlife Conservation Act 1950 and Threatened Flora and Ecological Communities listed under the Environment Protection and Biodiversity Conservation Act 1999.	No disturbance or clearing to Threatened Flora species other than that approved under licence to take. The width of the construction right-of-way reduced to prevent or minimise disturbance to the Threatened Ecological Communities and Threatened Flora populations.
WEED AND DIEBACK		
Introduction of new weeds and pests	To minimise the potential for new weeds and pests to be introduced into the DBNGP corridor from external sources.	No new species of weeds or pests recorded in the pipeline corridor within one year of completion of construction activities.



Issue	Objective	Performance Indicator
Threat of spreading weeds, pests and diseases	To minimise the risk of spreading existing weeds, pests and dieback along the corridor and to adjacent areas.	Hygiene management stations located at edges of areas of conservation value and high risk areas. No significant change to the extent and distribution of weeds, pests and dieback within one year of completion of construction activities compared to the extent and distribution of weeds, pests and dieback prior to construction.
WETLANDS		
Disturbance to wetlands	To minimise and manage disturbance to wetlands and wetland buffer areas from construction activities.	No wetland dependent vegetation outside approved areas is cleared or destroyed.
Wetland water quality and water regimes	To prevent adverse changes to wetland water quality or hydrological regimes resulting from construction activities.	No permanent impact on wetland values during construction or following rehabilitation. No adverse change in the water quality of wetlands following rehabilitation. No change in wetland water level regimes following rehabilitation.
DEWATERING AND WATER DISPOSAL		
Water Quantity	To ensure that dewatering activities or water disposal do not extract excessive amounts of water that may be detrimental to the water resource.	No drawdown of the aquifer beyond the immediate proximity of the construction works from dewatering activities.
Water Quality	To ensure that dewatering activities do not degrade the beneficial use of the aquifer or compromise the ecological value of nearby surface receptors.	No long-term detrimental impact to the aquifer compared to pre-construction background water quality from dewatering activities. Groundwater returned to the aquifer will meet or exceed pre-construction groundwater quality components. No greater than a 10% variation of water quality in nearby ecological receptors from dewatering activities.
ACID SULPHATE SOIL		
Acidification and release of metals	To ensure that there are no adverse impacts to sensitive receptors as a result of the excavation and stockpiling of acid sulphate soils.	Groundwater and surface water quality near the pipeline is not degraded as a result of soil disturbance activities. No visual acid sulphate soil oxidation impacts result from the stockpiling of acid sulphate soils.
FAUNA INTERACTION		
Fauna habitat	To minimise the temporary and permanent reduction or fragmentation of existing fauna habitat.	No habitat trees, or parts of habitat trees, other than those in the direct line of the proposed pipeline or that materially interfere with construction of the pipeline to be removed. No vegetation clearing to be undertaken outside approved areas.
Direct fauna impacts	To minimise the direct impacts on fauna through impacts with vehicles, entrapment in construction works, or extraordinary exposure to predators.	Vehicle speeds limited on unformed access tracks and construction worksite. Pipeline trenches to be open for a limited period of time. Achievement of fauna inspection and clearing requirements. Adherence to injured animal protocol.



Issue	Objective	Performance Indicator
WATERCOURSE CROSSING		
Disturbance to watercourses	Minimise and manage disturbance of watercourses.	<p>No adverse impacts (for example to downstream ecology or land use) resulting from water body flow reductions, or diversions as a result of pipeline construction activities.</p> <p>No change in water body flows.</p> <p>No erosion of the water body intersecting or adjacent to the pipeline construction right-of-way.</p>
Contamination of watercourses	Prevent contamination of watercourses from construction activities.	<p>No direct discharge of dewatering water to watercourses.</p> <p>No decrease in water quality attributable to construction activities.</p> <p>No significant (in excess of 80 litres near wetlands and rivers) spills or leaks of hydrocarbons during construction and rehabilitation operations outside of areas designated for maintenance, refuelling or storage.</p>
DUNE CROSSINGS		
Disturbance to dunes	Minimise and manage disturbance of dunes.	<p>No increased risk of erosion of the dune surface.</p> <p>No long-term loss of dune vegetation.</p>
FIRE		
Prevent fires	To prevent fires occurring as a result of construction activities.	No pipeline construction related fires.
DUST		
Landholders	To minimise the temporary impact of dust emissions from construction activities, machinery and vehicles.	<p>No reasonable substantiated complaints.</p> <p>Accordance with relevant policies.</p> <p>Acceptable ambient dust levels down-wind of the construction site.</p>
Vegetation	To minimise the impact of dust on surrounding vegetation so long-term existence is ensured.	Health of vegetation adjacent to the construction right-of-way remains the same post-construction as it was pre-construction.
NOISE		
Public/residents	To minimise the impact of noise and vibration emissions from construction activities, machinery and vehicles.	<p>No reasonable landholder complaints.</p> <p>Land holder complaints resolved in a timely manner.</p> <p>Compliance with Environmental Protection (Noise) Regulations 1997.</p>
FUEL AND CHEMICAL STORAGE, SPILL AND EMERGENCY RESPONSE		
Contamination	Prevent contamination of groundwater, surface water and soil.	<p>Chemicals and fuels stored and handled within designated areas.</p> <p>No significant spills or leaks of hydrocarbons (in excess of 80 litres near wetlands and rivers) during construction and rehabilitation operations outside areas designated for maintenance, refuelling or storage.</p> <p>No significant spills or leaks of hydrocarbons (in excess of 500 litres) during construction and rehabilitation operations outside of areas designated for maintenance, refuelling or storage.</p> <p>No spills or measurable leaks of hydrocarbons within any Water Reserve.</p>




Issue	Objective	Performance Indicator
WASTE		
Waste management	<p>Minimise generation of waste during construction.</p> <p>Minimise pollution or environmental harm due to inappropriate disposal of waste.</p>	<p>Minimise waste generation.</p> <p>No uncontained waste, rubbish or litter is found within the construction right-of-way or at facilities during construction.</p> <p>No waste found within construction right-of-way or at facilities immediately following construction.</p> <p>A waste register is maintained during construction indicating waste categories, approximate volumes of waste, and location of disposal.</p> <p>Waste material is contained and disposed of in accordance with Environment Protection Act 1986.</p>
SOIL		
Topsoil	Minimise change to soil profile from excavation activities.	<p>No evidence of subsoil on surface (as detected by colour and texture) within construction right-of-way following backfill.</p> <p>No visual evidence of soil compaction following backfill and rehabilitation (e.g. hard soil, local water pooling).</p>
Erosion	Prevent occurrence of soil erosion during and following construction.	<p>The extent of soil erosion within the construction right-of-way during and within two years following construction is consistent with surrounding land.</p> <p>No visible soil erosion from construction right-of-way during or within three years following construction.</p>
ABORIGINAL SITES		
Known (recorded) Aboriginal heritage sites	To avoid disturbance to Aboriginal heritage sites identified for protection near the pipeline corridor.	No disturbance to Aboriginal heritage sites identified for protection.
New (unrecorded) Aboriginal heritage sites	To manage new Aboriginal heritage sites/artefacts uncovered or identified during construction in accordance with the requirements of the <i>Aboriginal Heritage Act 1972</i> .	All new Aboriginal heritage sites managed in accordance with the <i>Aboriginal Heritage Act 1972</i> .
REHABILITATION		
Vegetation	To re-establish vegetation and associated habitat areas to the condition that it was in prior to disturbance or better.	Achievement of the completion criteria set out in Chapter 4 Section 18.7.
Soil	To control sediment and erosion.	Achievement of the completion criteria set out in Chapter 4 Section 18.7.



Chapter 3 Activity specific environmental management

The following management actions are to be undertaken at all times during the described activity for the DBNGP Stage 5 Expansion Project

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1 GENERAL ENVIRONMENTAL MANAGEMENT

Several of the environmental factors associated with the construction of the pipeline are likely to be encountered regardless of the activity to be undertaken. On this basis, the management actions outlined in Section 1.2 should be undertaken regardless of the activity. Additional management actions specific to the activity to be undertaken, are presented in Sections 2 to 10.

1.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

1.2 Required methods and actions

Issue	Action
Induction	Induction programs should include a session sufficient to ensure all personnel are aware of the environmental obligations prescribed within this CEMP. Personnel engaged in the various construction activities should be made aware of the specific management protocols that apply to their work activity, as set out in the following sections of this Chapter of the CEMP.
Location	Activities associated with pipeline construction shall be undertaken within the designated construction right-of-way unless otherwise approved. Disturbance shall be limited to the areas approved in the DBNGP Stage 5 Expansion environmental impact statement (Strategen 2006).
Vehicle movements	Vehicles travelling on unformed access roads shall not exceed 80 km/hr. Vehicles travelling on the construction right-of-way shall not exceed 60 km/hr. Vehicles travelling within active construction areas shall not exceed 5 km/hr.
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).
Conservation areas	Activities within conservation areas designated on the Environmental Line List (ELL) shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).
Vegetation	Activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).
Weeds and dieback	All construction activities shall be managed in accordance with the Weed and Dieback Area Management Protocol (Chapter 4 Section 4).
Threatened flora	Activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).
Wetlands	Activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).
Dewatering and disposal of water	All dewatering activities and disposal of hydro-test water shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6).
Acid sulphate soils	Activities within areas designated on the ELL as being subject to potential acid sulphate soils shall be managed in accordance with the Acid Sulphate Soil Management Protocol (Chapter 4 Section 7).
Fauna	Interactions within fauna during construction shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).
Watercourse crossings	Activities associated with construction of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).
Dunes	Excavation and rehabilitation of dunes shall be managed in accordance with the Dune Crossing Management Protocol (Chapter 4 Section 10).
Fire	Fire resulting from or threatening construction activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).
Dust	Dust emissions resulting from construction activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).



Issue	Action
Noise	Noise emissions shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).
Soil	Activities involving movement of soil shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).
Heritage	Activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).
Rehabilitation	Cleanup and rehabilitation of all construction areas and campsites shall be managed in accordance with the Rehabilitation Protocol (Chapter 4 Section 18).



2 SURVEY, FENCING AND SERVICE LOCATION

Survey crews will locate and accurately survey the pipeline alignment, and marking the centreline, bends and offsets along the alignment. A construction survey will be undertaken immediately prior to construction commencing, with pegs used to clearly delineate the construction right-of-way and areas of disturbance outside the construction right-of-way.

Temporary access gates will be installed in existing fences to provide access to the corridor for machinery and vehicles. Fences will be reinstated at the completion of construction, with gates left for operational purposes or if required by the landowner. New fencing materials are used to reinstate fences, with gates recycled where possible.

Service location personnel will work ahead of clearing and grading to locate services (i.e. phone lines, mains water and sewerage lines, and poly water lines) and will be responsible for placing warnings and flagging for overhead powerlines.

2.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

2.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements, in particular reduced working widths, prior to start up.	Prior to the commencement of activities
	The construction right-of-way shall be clearly marked paying particular attention to reduced working widths as outlined in the ELL.	Prior to ground disturbing activities
	Features such as vegetation to be trimmed/retained, heritage sites, etc, shall be identified and flagged in accordance with the ELL.	Prior to ground disturbing activities
	Environmentally sensitive areas and "no-go" area boundaries (e.g., DRF, Hygiene points and weed boundaries) shall be delineated and marked as outlined in the ELL.	Prior to ground disturbing activities
	All personnel shall be advised of additional environmental management requirements during inductions and toolbox meetings.	Prior to commencement of daily activities
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Vegetation	Activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Weeds and dieback	All surveying and fencing activities shall be managed in accordance with the Weed and Dieback Area Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Surveying and fencing activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Fire	Fire resulting from or threatening surveying and fencing activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times



Issue	Action	Timing
Dust	Dust emissions resulting from surveying and fencing activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Heritage	Surveying and fencing activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times



3 CLEAR AND GRADE

Clearing involves the removal and stockpiling of vegetation from the pipeline construction right-of-way, typically using bulldozers, graders or 'slashers', while grading involves the removal and separate stockpiling of topsoil for use during rehabilitation. Temporary sediment and erosion controls may be installed during clearing and grading operations.

3.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

3.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements, in particular reduced working widths, prior to start up.	Prior to ground disturbing activities
	Delineation of environmentally sensitive areas and the construction right-of-way shall be checked to ensure the extent of authorised clearing has been defined.	Daily
	All personnel shall be advised of additional environmental management requirements during inductions and toolbox meetings.	Daily: prior to daily activities
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Clear and grade activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Vegetation	Clear and grade activities shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Weeds and dieback	All clear and grade activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Clear and grade activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Clear and grade activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Fauna	Interactions with fauna during clear and grade activities shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).	At all times
Watercourse crossings	Clear and grade activities associated with construction of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).	At all times
Dune crossings	Excavation of dunes shall be managed in accordance with the Dune Crossing Management Protocol (Chapter 4 Section 10).	At all times
Fire	Fire resulting from or threatening clear and grade activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from clear and grade activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times



Issue	Action	Timing
Soil	Clear and grade activities shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).	At all times
Heritage	Clear and grade activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times



4 TRENCHING AND EXCAVATION

Trenching is undertaken using a purpose-built trenching machine, with excavators required to dig the trench at tie-ins, bends, in very wet or boggy areas, in rocky areas, and in other areas where the use of the trenching machine is impractical. Excavators are also required to dig “bell holes”²⁰ and used to construct temporary erosion controls. Bell holes are usually benched and have ramped access points that enable personnel to enter the trench but also provide points for entrapped wildlife to leave the trench. Drilling and blasting may be undertaken where rock is encountered.

Dewatering will generally be avoided through wet trenching techniques, although it may be required where structural difficulties are encountered.

4.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

4.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements.	Daily, prior to ground disturbing activities
	Delineation of environmentally sensitive areas and the construction right-of-way shall be checked.	Daily
	All personnel shall be advised of additional environmental management requirements during inductions and toolbox meetings.	Prior to daily activities
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Trenching and excavation activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Vegetation	Trenching and excavation activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Weeds and dieback	Trenching and excavation activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Trenching and excavation activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Trenching and excavation activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Dewatering and disposal of water	All dewatering activities shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6).	At all times
Acid sulphate soils	Trenching and excavation activities within areas designated on the ELL as being subject to potential acid sulphate soils shall be managed in accordance with the Acid Sulphate Soil Management Protocol (Chapter 4 Section 7).	At all times

²⁰ Bell holes are required to be constructed where pipe strings are joined, at mainline valves, at major bends, at facilities crossings, and where loop ends are tied into the existing pipeline or compressor station.



Issue	Action	Timing
Fauna	Interactions with fauna during trenching and excavation activities shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).	At all times
Watercourse crossings	Trenching and excavation activities associated with construction of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).	At all times
Dune crossings	Excavation of dunes shall be managed in accordance with the Dune Crossing Management Protocol (Chapter 4 Section 10).	At all times
Fire	Fire resulting from or threatening trenching and excavation activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from trenching and excavation activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions resulting from trenching and excavation activities shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Soil	Trenching and excavation activities involving movement of soil shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).	At all times
Heritage	Trenching and excavation activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times



5 DRILLING AND BORING

Horizontal directional drilling (HDD) can be used for installing the pipe under watercourses and other features, and involves drilling at a shallow angle beneath the surface and pulling the pipe through the drill hole. Bentonite (drill mud) is a fine non-dispersive clay, which is used as the lubricant during drilling. It can be recycled but will need to be disposed of appropriately once HDD is complete. Bentonite is non-hazardous and hence disposal may involve reuse in dam lining to prevent leaks.

Boring is commonly used to install pipe beneath infrastructure such as roads, railways, etc, and involves the excavation of a large bell hole on either side of the crossing. A hole is hammered and/or drilled between the two bell holes, with spoil from the trench stockpiled on the construction right-of-way.

Unlike HDD, which provides a parabolic tunnel, boring provides a straight tunnel in which the pipeline is placed.

5.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

5.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements.	Daily
	Delineation of environmentally sensitive areas and the construction right-of-way shall be checked.	Daily
	Liaise on additional management issues for the day.	Daily
	Additional management practices shall be included in toolbox meetings.	Prior to daily activities
General	HDD equipment shall be inspected prior to commencement of works to ensure it is in good working order.	As required
	The drilling site shall be completely contained within an appropriate earthen bund.	At all times
	Topsoil shall not be used in the construction of the earthen bund.	At all times
	Drilling mud shall be contained in mud tanks or pits and de-sanded and recirculated during drilling.	At all times
Incidents and complaints	Only water based drilling fluids shall be used.	At all times
	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Drilling and boring activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Vegetation	Drilling and boring activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Weeds and dieback	All drilling and boring activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Drilling and boring activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Drilling and boring activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Dewatering and disposal of water	All dewatering activities associated with drilling and boring shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6).	At all times



Issue	Action	Timing
Watercourse crossings	Drilling and boring activities associated with construction of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).	At all times
Fire	Fire resulting from or threatening drilling and boring activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from drilling and boring activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions resulting from drilling and boring activities shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Soil	Drilling and boring activities involving movement of soil shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).	At all times
Heritage	Drilling and boring activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times

5.3 Contingency action

Event	Action	Responsibility
Uncontrolled release of drilling mud	Cease operations. Stop mud entering surrounding environment (i.e. watercourse, vegetation). Investigate cause. Undertake required remedial action. Investigate and update protocol as required.	Construction Contractor



6 PIPE STRINGING AND WELDING

This phase of pipeline construction involves the delivery of the pipe to the construction area and its welding into continuous lengths known as pipe strings. The management actions relating to pipe stringing and welding are to minimise:


- adverse effects to fauna
- disruption to landowner, third parties and existing road networks.

6.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

6.2 Required methods and actions

Issue	Action	Timing
General	All pipe stringing activities (including stockpiling of pipeline sections) shall be confined to the construction right-of-way or other approved areas.	At all times
	All pipe welding activities shall be confined to the construction right-of-way.	At all times
	Defective machinery shall be shut down until the defect is rectified and the machine made safe for operations.	At all times
	Pipe shall be strung and mainline welded, allowing gaps for vehicles, stock and wildlife access across the construction right-of-way.	At all times
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Pipe stringing and welding activities within conservation areas designated on the Environmental Line List (ELL) shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Weeds and dieback	Pipe stringing and welding activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Pipe stringing and welding activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Pipe stringing and welding activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Fauna	Interactions with fauna during construction shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).	At all times
Fire	Fire resulting from or threatening pipe stringing and welding activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from pipe stringing and welding activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions resulting from pipe stringing and welding activities shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Heritage	Activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Section 17).	At all times

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7 LOWERING-IN AND BACKFILL

Side booms or excavators are used in sequence to lift the welded pipe off the skids, move it over to the trench and position the pipe in the trench. The skids are removed and reused or, if damaged returned to the depot/yard for disposal. “Jeeping” is often undertaken again at this point to ensure the coating has not been damaged, with damaged sections repaired prior to lowering in. The lowering-in crew may also be undertaking tie-ins, i.e. welding the long sections of pipe together in the trench.

Prior to lowering-in, a bedding layer may be placed in the base of the trench, with a padding layer placed around and on top of the pipe where trench conditions could damage the coating on the pipe. Bedding and padding material is screened material that does not have many large or sharp rocks that can damage the pipe coating or the pipe. Bedding material may be sourced by importing approved material or by screening trench spoil. Excavators or specialised padders will be used to place the bedding and padding carefully around the pipe.

Trench breakers are placed around the laid pipe to prevent tunnel erosion where the potential for this exists, e.g. steep slopes and on the banks of watercourse crossings. Trench breakers are constructed of cement, cement-stabilised sand bags or non-hazardous polyurethane foam, which expands and hardens once exposed to the air.

Backfill of the trench is undertaken after lowering-in and padding, with the spoil returned to the trench and compacted by rubber-tyred vehicles of a limited wheel load.

7.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

7.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements.	Daily
	Delineation of environmentally sensitive areas and the construction right-of-way shall be checked to ensure definition of the extent of authorised clearing.	Daily
	All personnel shall be advised of additional environmental management requirements during inductions and toolbox meetings.	Prior to daily start up
Timing	Where practicable, backfilling shall be within 0.5 km of lowering-in.	At all times
	Trenches shall be backfilled as soon as possible following pipe installation.	At all times
Backfill	The backfilled trench shall be compacted to reduce subsidence.	As required
	Surface contours shall be reinstated as soon as practicable.	Following backfill
	Following reinstatement of surface contours, the corridor shall be ripped to a depth of up to 40 cm if the ground has been over-compacted by traffic.	Following backfill
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Lowering-in and backfill activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Weeds and dieback	All lowering-in and backfill activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Wetlands	Lowering-in and backfill activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Fauna	Interactions with fauna during lowering-in and backfill shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).	At all times



Issue	Action	Timing
Watercourse crossings	Lowering-in and backfill activities associated with construction of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).	At all times
Fire	Fire resulting from or threatening lowering-in and backfill activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from lowering-in and backfill activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions resulting from lowering-in and backfill activities shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Soil	Backfill activities shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).	At all times
Heritage	Activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times



8 CLEAN-UP AND REHABILITATION

The final phase of the project is Clean-up and Rehabilitation (Reinstatement), which involves:

- removing construction materials from the construction right-of-way (e.g. skids, palletes, etc).
- shaping the land surface to match the existing contours, including compacting material back into side cuts.
- ploughing or ripping of heavily compacted areas by graders.
- construction of final sediment and erosion controls from subsoil.
- respread topsoil across the construction right-of-way.

In all cases the vegetation removed from the construction right-of-way will be respread to aid in sediment and erosion control, retain moisture, and to aid establishment of seeds/seedlings and revegetation of the construction right-of-way, particularly within Nature Reserves and Conservation Parks. Active rehabilitation (seeding) in remnant vegetation will only be conducted on areas that do not respond to the initial rehabilitation treatment, while seeding may be undertaken to re-introduce pasture in agricultural areas.

Aerial photography and land owner consultations have shown that many areas of remnant vegetation through which the DBNGP corridor traverses are currently used by landowners as fire breaks, stock routes and vehicle access tracks. Hence, the quality of regrowth on the DBNGP construction right-of-way in many of these areas of remnant vegetation is poor. Vegetation will be re-established to its condition prior to construction.

DBP will finalise rehabilitation objectives on private land with the concerned landowner, prior to ground disturbing activities. These objectives and specific environmental management requirements will be added to the environmental line list as required.

8.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

8.2 Required methods and actions

Issue	Action	Timing
Clean-up and rehabilitation	Cleanup and rehabilitation of all construction areas and campsites shall be managed in accordance with the Rehabilitation Protocol (Chapter 4 Section 18).	During and following cleanup and rehabilitation
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Cleanup and rehabilitation activities within conservation areas designated on the Environmental Line List (ELL) shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Vegetation	Cleanup and rehabilitation activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Weeds and dieback	All cleanup and rehabilitation activities shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Threatened flora	Cleanup and rehabilitation activities within areas designated on the ELL as containing Threatened Flora shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Wetlands	Cleanup and rehabilitation activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Fauna	Interactions with fauna during clean-up and rehabilitation shall be managed in accordance with the Fauna Interaction Protocol (Chapter 4 Section 8).	At all times



Issue	Action	Timing
Watercourse crossings	Cleanup and rehabilitation activities of watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Chapter 4 Section 9).	At all times
Dune crossings	Rehabilitation of dunes shall be managed in accordance with the Dune Crossing Management Protocol (Chapter 4 Section 10).	At all times
Fire	Fire resulting from or threatening cleanup and rehabilitation activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from cleanup and rehabilitation activities shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions resulting from cleanup and rehabilitation activities shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Soil	Cleanup and rehabilitation activities involving movement of soil shall be managed in accordance with the Soil Management Protocol (Chapter 4 Section 16).	At all times
Heritage	Cleanup and rehabilitation activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times



9 TESTING AND COMMISSIONING

Hydrostatic testing (hydro-testing) involves filling the pipe with water and increasing the pressure to ensure the pipe can withstand the required pressure. Prior to hydro-testing commencing, agreement is usually sought from the controlling regulatory authority to source water from creeks, mains or bores, and to discharge the final water onto land surrounding the pipeline construction right-of-way. Once the test is complete, the water is pushed from the pipe by well-fitting plugs (known as pigs), with the controlled flow of water sprayed on to suitable areas surrounding the construction right-of-way.


Once the testing of the pipeline is complete, it can be commissioned.

9.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

9.2 Required methods and actions

Issue	Action	Timing
Environmental Line List (ELL)	The ELL shall be reviewed for specific environmental management requirements, in particular reduced working widths, prior to start up.	Prior to the commencement of activities
	All personnel shall be advised of additional environmental management requirements during inductions and toolbox meetings.	Prior to the commencement of daily activities
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Conservation areas	Testing and commissioning activities within conservation areas designated on the ELL shall be managed in accordance with the Conservation Area Management Protocol (Chapter 4 Section 2).	At all times
Weeds and dieback	All testing and commissioning activities shall be managed in accordance with Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4).	At all times
Wetlands	Testing and commissioning activities within areas designated on the ELL as being wetlands shall be managed in accordance with the Wetland Management Protocol (Chapter 4 Section 5).	At all times
Disposal of water	All disposal of hydro-test water shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6).	At all times
Fire	Fire resulting from or threatening testing and commissioning activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Noise	Noise emissions resulting from testing and commissioning shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Heritage	Activities within or near areas designated on the ELL as being of Aboriginal heritage value shall be managed in accordance with the Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17).	At all times

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10 CONSTRUCTION CAMP MANAGEMENT

Construction camps will be erected along or near the pipeline at various intervals on previously disturbed areas wherever practicable, avoiding impacts to important vegetation or wildlife habitats. These camps will accommodate up to approximately 300 people and be constructed of demountable buildings with individual sleeping quarters, toilet/showers, laundry, food mess, wet mess (bar) and recreation rooms. Caterers will be contracted to cook and clean for the construction personnel. Where possible, camps will be located in existing cleared areas, removed from residences.

Waste produced from the camp will include:

- food scraps and general domestic waste (putrescibles waste)
- recyclables, such as aluminium cans, bottles, steel and cooking oil
- wastewater – black and grey streams are generally combined.


Water for construction, campsites and hydro-testing of the pipeline will be drawn from surface water, groundwater or public water supply on a location specific basis.

10.1 Environmental objectives and key performance criteria

Environmental objectives and performance indicators are as described for all factors in Chapter 2 Section 5.

10.2 Required methods and actions

Issue	Action	Timing
Planning	Camps shall be located in areas that have previously been disturbed/cleared.	Where possible
	The site for the accommodation camp shall be selected to minimise clearing.	As required
Incidents and complaints	All environmental incidents and complaints shall be managed in accordance with the Environmental Incident Response Protocol (Chapter 4 Section 1).	At all times
Vegetation	Activities involving interaction with vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Chapter 4 Section 3).	At all times
Fire	Fire resulting from or threatening construction camp activities shall be managed in accordance with the Fire Management Protocol (Chapter 4 Section 11).	At all times
Dust	Dust emissions resulting from construction or rehabilitation of the campsite areas shall be managed in accordance with the Dust Management Protocol (Chapter 4 Section 12).	At all times
Noise	Noise emissions from campsite areas shall be managed in accordance with the Noise Management Protocol (Chapter 4 Section 13).	At all times
Fuels and chemicals	Handling and storage of all fuels and chemicals shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14).	At all times
Waste	All campsite rubbish and waste materials shall be managed in accordance with the Waste Management Protocol (Chapter 4 Section 15).	At all times
Rehabilitation	Cleanup and rehabilitation of all campsites shall be managed in accordance with the Rehabilitation Protocol (Chapter 4 Section 18).	At all times


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Chapter 4 Management protocols

The following management protocols are to be followed as directed in Chapter 3 and the Environmental Line List (ELL)

	Title: DBPL00-501-0722-01 Construction Environmental Management Plan	Rev: D Chapter 4
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1 ENVIRONMENTAL INCIDENT RESPONSE PROTOCOL

1.1 Background and environmental risks

Construction activities proposed to be undertaken as part of the Stage 5 Expansion of the DBNGP may inadvertently result in environmental impacts beyond the scope of the environmental approvals.

DBP proposes to manage environmental issues associated with the project such that there are no significant environmental impacts. However, it is important that should an environmental incident occur, or a complaint about an environmental issue be received, the issue is appropriately and efficiently managed to identify the cause and minimise potential re-occurrence.

1.2 Purpose and scope of protocol

This protocol provides for the management of environmental incidents and concerns raised by the public, to minimise potential re-occurrence.

1.3 Objectives and key performance criteria

Issue	Objective	Performance Indicator
Environmental impact	To minimise and limit environmental impacts to the extent of the environmental approval.	Breaches of Ministerial Conditions.
Complaint	Investigate complaint and implement action to minimise future complaints.	Investigation completed. Remediation action undertaken. Complainant advised of outcomes.
Protocol	Protocols implemented to manage potential environmental impacts.	Protocol updated to minimise potential for future complaints.

1.4 Incident level

The assessment of Hazard/Incidents that pose potential and actual significant threats to the environment shall be undertaken in order to learn from these Hazard/Incidents and prevent reoccurrence.

When classifying incidents, the Consequence Definitions from the DBNGP Risk Model (August 2008) shall be used (see Section 1.5). The level of analysis required will depend on the severity of the event (e.g. Trivial (1) < Minor (2), Negligible (1), Severe (3), Major (4) or Catastrophic (5). Where more than one level is identified, the level of investigation will be determined by the highest risk rating. This level determines the management action and priority required to be undertaken following the incident.

1.5 Environmental incident classification (as per DBNGP risk model August 2008)

Level	Severity	Impact on environment	Impact on DBP
1	Trivial	No effect; or Minor on-site effects rectified rapidly with negligible residual effect; or Minor leak not contaminating.	No significant impact on DBP, issues are routinely dealt with by operational areas.
2	Minor	Effect very localised (<0.1 ha) and very short-term (weeks), easily rectified; or Minor impact upon cultural and heritage sites; or rare and endangered flora/fauna; or Onsite chemical release which is contained without outside assistance with the impacts described above.	No significant impact on DBP, issues are dealt with internally.



Level	Severity	Impact on environment	Impact on DBP
3	Severe	Localised (<1 ha) and short-term (<2 yr) effects; easily rectified; or Significant impact upon cultural and heritage sites; or rare and endangered flora/fauna; or Chemical release contained with outside assistance resulting in the impacts described above.	No threat to the effective operation of DBP, but exposes DBP to unacceptable cost consequences.
4	Major	Major off-site impact; long term (2 years or more) severe effects; rectification difficult; or Major impact in an area of high conservation value or special significance (eg National Heritage list, Class A Reserves, National Parks, where the area of impact could be localized or very localized).	Would threaten the effective operation of DBP for a substantial period, including its ability to raise capital, or have a significant effect on how DBP will operate in the future.
5	Catastrophic	Effects widespread; viability of ecosystems or species affected; or Permanent major changes.	Would threaten the survival of DBP without an additional unplanned equity contribution.

1.6 Management actions

Issue	Action	Timing	Responsibility
Recording of Public complaint	Complainant details recorded, including: <ul style="list-style-type: none"> name address contact details recorded details of the incident, including: <ul style="list-style-type: none"> type of concern (dust/noise etc) time and date of concern duration of concern possible source of concern. 	At all times	Construction Contractor
Remediation	Rectifying or remedial action will be initiated.	Level 1	Construction Contractor
Cease operations	All work activities directly causing an environmental incident shall be stopped immediately and corrective work procedures adopted. Rectifying or remedial action will immediately be implemented.	Level 2 or higher	Construction Contractor
Reporting	The Project Manager shall be advised of all Level 2, 3, 4 or 5 incidents as follows: <ul style="list-style-type: none"> Level 2: within 24 hours Level 3, 4 or 5: As soon as practicable within four hours. 	As prescribed	Construction Contractor
	An Environmental Incident Report shall be completed and forwarded to the Project Manager.	Level 1 or higher	Construction Contractor
	Level 3, 4 and 5 incidents shall be notified to the Department of Environment and Conservation (DEC) and to the Department of Environment, Water, Heritage and the Arts (Environmental Protection Branch) where the incident involves matters pertaining to the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .	As soon as becoming aware	DBP
Reporting of incidents under the requirements of the <i>Petroleum Pipelines Act 1969</i> and Schedule of Onshore Petroleum Exploration and Production Requirements 1991 shall be carried out as detailed in Section 1.8 below.	As detailed in Section 1.8	DBP	
Incident level	The impact level of an environmental incident shall be determined from the table provided above.	As soon as practical	Construction Contractor



Issue	Action	Timing	Responsibility
Mitigation	Measures to limit the impact of Level 4 and 5 incidents on the environment shall be implemented.	As soon as practical	Construction Contractor
Procedural changes	The causes and effects of the incident, and actions to prevent the incident from reoccurring shall be discussed and documented in the Environmental Incident Report.	As soon as practical	Construction Contractor
	Recommended changes to management protocols shall be implemented.	As soon as practical	Construction Contractor
	The Environmental Incident Report shall be 'signed-off' following agreement on new procedures to prevent reoccurrence of the incident, and on any further remedial action required to mitigate impacts to the satisfaction of DBP and any regulatory authorities that were involved.	As soon as practical	Construction Contractor
	Any new procedures arising from the Environmental Incident process shall be added to the CEMP following Document Control procedures.	As soon as practical	DBP

1.7 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Recording of environmental incidents	As required	Environmental Incident Register	Ensure environmental incidents and resolutions are recorded	Construction Contractor

A record of all environmental incidents, including complaints, will be maintained in an Incident Register, and will include details of the action implemented to minimise potential reoccurrence.

1.8 Reporting

Under the *Petroleum Pipelines Act 1969* and Schedule of Onshore Petroleum Exploration and Production Requirements 1991 significant incidents must be reported to DMP. This is for incidents within the Pipeline Licence area(s). Incidents outside the Pipeline Licence area(s) are covered under the *Environmental Protection Act 1986* and must be reported to the Department of Environment & Conservation. Initial notice to DMP shall be verbal and must be provided at the earliest practicable opportunity, within 24 hours, and initial report within 3 days after the first occurrence of the accident or incident; or the detection of the accident or incident by the operator (unless a written extension is obtained). DBP is responsible for reporting incidents to DMP.

Reportable incidents include:

- leakage or escape of dangerous goods to the environment
- spills of >500 L hydrocarbons to land
- spills of hydrocarbons or other materials (such as drilling fluids, chemicals, produced formation water or substances that have the potential to adversely affect the surface vegetation, soil or subsurface ground water) that affects a ground surface area greater than 100 m²
- uncontrolled escape of >500 m³ of gas
- an unplanned potentially hazardous event
- discharge of ozone depleting substances (during servicing or refrigeration or air conditioning equipment) inappropriate waste disposal causing environmental pollution.

Contact Details:

DMP 24-Hour Reporting Number: 0419 960 621

DMP Reporting Email: petroleum.environment@dmp.wa.gov.au.



A report in writing of any occurrence referred above shall be submitted to the Director as soon as practicable after the occurrence specifying:

- a) the date, time and place of the occurrence
- b) the estimated quantity of liquid that escaped or burned
- c) particulars of damage caused by the escape of ignition
- d) the events so far as they are known or suspected that caused or contributed to the escape or ignition
- e) particulars of methods used to control the escape or ignition
- f) particulars of methods used or proposed to be used to repair property damaged by the escape or ignition
- g) measures taken, or to be taken, to prevent a possible recurrence of the escape or ignition.

1.9 External complaint resolution

Following sign-off of an incident reported from external sources, the Construction Contractor will advise the complainant of the outcomes of the investigation and any action taken to resolve their concerns and minimise potential re-occurrence. The Incident Register shall include a Section providing for sign-off on stakeholder consultation.

1.10 Non-environmentally related complaints

This protocol relates specifically to environmentally related complaints.

1.11 Abbreviations

CEMP	Construction Environmental Management Plan
DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum



2 CONSERVATION AREA MANAGEMENT PROTOCOL

2.1 Background and environmental risks

The DBNGP traverses a number of key areas of conservation value (e.g. nature reserves, Bush Forever Sites) and/or Environmentally Sensitive Areas²¹ (ESAs). These areas may also support matters of national environmental significance (e.g. Threatened Flora or Fauna, Ramsar wetlands) as defined and listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Construction activities, particularly clearing and grading will directly affect the vegetation within the approved corridor in these areas of high conservation value. Construction activities in the construction right-of-way may also increase the risk of indirect impacts on adjacent bushland in areas of conservation value through:

- introduction of weeds and disease
- alteration of groundwater and surface drainage regimes affecting dependent vegetation
- increased bushfire risk (associated with metal cutting, welding and grinding activities, as well as by the operation of equipment or vehicles in high fire risk areas/conditions) affecting both vegetation and fauna
- increased predation on native fauna from feral animals due to increased cleared areas and lack of cover allowing improved access for feral predators.

Detrimental environmental impacts may lead to a reduction in the conservation significance of these areas and as such, management is required to minimise the risk of construction activities affecting areas outside the approved corridor.

In Western Australia flora species considered to be rare, in danger of extinction or in need of special protection are listed for protection under the *Wildlife Conservation Act 1950* (Wildlife Act). These species are commonly referred to as Declared Rare Flora (DRF), although the Wildlife Act also provides protection for flora under consideration for declaration as 'rare flora' but are in urgent need of further survey (Priority One – Three) or require monitoring every five – ten years (Priority Four). Special management attention for these species is required and specific approval to 'take' or damage DRF requires Ministerial approval under the Wildlife Act. Some DRF are also listed as Threatened Flora under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Approval from the Commonwealth Minister for the Environment is required if proposals are likely to have a significant impact to listed Threatened Flora. Only one EPBC Act listed Threatened Flora species has been recorded along the Stage 5 section of the DBNGP corridor, *Conospermum undulatum*. This species was recorded from Bush Forever Site 320 in Loop 9 (Hartfield Park, Forrestfield; KP 1361 to KP 1364).

For the purpose of this protocol, the term 'Threatened Flora' is used to collectively describe DRF, Priority Flora and Threatened Flora listed under the EPBC Act.

Ecological communities are biological assemblages that occur in a particular habitat. Unlike Threatened Flora, there is currently no State legislation covering the protection of Threatened Ecological Communities (TECs). However, an informal, non-statutory process is in place and is coordinated by the Department of Environment and Conservation (DEC). Some TECs are listed as matters of national environmental significance under the EPBC Act. Approval from the Commonwealth Minister for the Environment is required if proposals are likely to have a significant impact to a listed TEC.

²¹ For the purposes of this protocol, an ESA is defined as any of those areas listed under the Environmental Protection (Environmentally Sensitive Areas) Notice 2005. Government Gazette No. 55, 8 April 2005 Perth.



Three occurrences of the TEC '*Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain' were recorded along the DBNGP corridor Loop 9. All occurrences were within Bush Forever Site No. 320 (Hartfield Park, Forrestfield; KP 1361 to KP 1364). This TEC is listed as Endangered under the EPBC Act. Two occurrences of this TEC within the DBNGP corridor were also recorded in Loop 10 (KP 1438.06 and KP 1438.25). These two occurrences were fragmented, small and largely disturbed. No other TECs were recorded.

Construction activities associated with the Stage 5 looping of the DBNGP may result in the direct or indirect disturbance of a number of Threatened Flora and several occurrences of a TEC. As such, specific management is required to ensure compliance with relevant legislation and minimise the risk of inappropriate clearing or disturbance of protected species and communities.

2.2 Purpose and scope

The purpose of this protocol is to provide for the management of construction activities so that potential impacts to areas of conservation value are minimised. This protocol has been developed to achieve the environmental objectives outlined below.

This protocol is applicable to the areas of conservation value identified on the Environmental Line List (ELL), including:

- nature and conservation reserves
- ESAs
- those areas supporting Declared Rare Flora (DRF), Priority Flora or Threatened Ecological Communities (TECs) (Loops 0 – 10)²²
- those areas supporting Threatened and/or Migratory Fauna species²³
- places listed on the Australian Heritage Database
- conservation category wetlands, resource enhancement wetlands and wetlands gazetted under the Environmental Protection (Swan Coastal Plain Lakes) Policy (Lakes EPP)²⁴
- Bush Forever Sites (Loop 9).

For wetland areas as defined above, this protocol should be read in conjunction with the Wetland Management Protocol (Section 5). This protocol should also be read in conjunction with the Weed, Pest and Dieback Management Protocol (Section 4) and Fauna Interaction Protocol (Section 8).

For the purposes of this protocol, "habitat trees" refers to trees with a trunk of diameter greater than 30 cm at breast height, irrespective of evidence of use or potential for use by fauna.

²² Includes those areas supporting Listed Threatened Flora species or Listed Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999*.

²³ Listed Threatened and Migratory fauna species under the *Environment Protection and Biodiversity Conservation Act 1999*.

²⁴ Includes Listed Ramsar wetlands.



2.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Disturbance to areas of conservation value	Minimise and manage disturbance to areas of conservation value	<p>No vegetation outside approved areas in areas of conservation value is cleared or destroyed.</p> <p>No vehicle or machinery movement outside approved areas.</p> <p>Threatened Flora and Ecological Communities managed consistent with the Flora and Vegetation Management Protocol (Section 3).</p> <p>Weeds and diseases managed consistent with the Weed, Pest and Dieback Management Protocol (Section 4).</p> <p>Wetlands managed consistent with the Wetland Management Protocol (Section 5).</p> <p>Fauna, including Threatened and/or Migratory species, managed consistent with the Fauna Interaction Protocol (Section 8).</p>

2.4 Management actions for areas of conservation value

Activity	Action	Timing	Responsibility
Induction	The induction program shall include information to ensure all personnel are aware of the specified requirements within areas of conservation value.	Induction	Construction Contractor
Planning	Areas of conservation value that intersect with potential construction areas shall be entered onto the ELL.	Prior to ground disturbing activities on the relevant loop	DBP
Survey	Areas of conservation value that intersect with potential construction areas shall be clearly marked on-the-ground in accordance with the ELL. Records of the marking to be made as set out in Section 2.5 (Monitoring and recording in areas of conservation value) below.	Prior to ground disturbing activities on the relevant loop	Construction Contractor
	On-ground making of protection zones shall be through the use of fencing or flagging, and signage on site.	Prior to construction	Construction Contractor
	On-ground marking of the areas of conservation value shall remain in place until completion of clean up and rehabilitation.	Until rehabilitation complete	Construction Contractor
Clear and grade of construction right-of-way	No ground disturbing activities shall commence within areas of conservation value until the pre-construction field survey for that area is complete and a report submitted to DEC, in accordance with the Weed and Dieback Area Management Protocol (Section 4) and the Flora and Vegetation Management Protocol (Section 3).	Prior to ground disturbing activities on the relevant loop	Construction Contractor
	The construction right-of-way width shall be reduced to 20 m within all areas of conservation value, with the exception of those areas containing DRF, Priority Flora or TECs.	Prior to ground disturbing activities on the relevant loop	Construction Contractor
	A 20 m buffer zone shall be marked around any DRF, Priority Flora or TECs within 20 m of the construction right-of-way and the construction right-of-way width reduced to no less than 20 m, provided such reduction can be implemented on the western (working) side (see Figure 4-1 Example 1). Where a reduction in construction right-of-way width on the western side will not intersect with the buffer zone, no reduction in width is required as the eastern edge of the construction right-of-way is fixed by the pipeline alignment (see Figure 4-1 Example 2).	Prior to ground disturbing activities on the relevant loop	Construction Contractor
	Clearing and stockpiling of vegetation shall be managed in accordance with the Flora and Vegetation Management Protocol (Section 3).	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
	The Flora and Vegetation Management Protocol (Section 3) shall be followed for any removal of Threatened Flora (DRF or Priority species).	As required	Construction Contractor
	Habitat trees shall not be cleared from construction areas unless they unavoidably obstruct traffic movement or the construction process.	As required	Construction Contractor
	Habitat trees that overhang construction areas shall be pruned rather than removed using the 'three cut method' to prevent bark stripping (see Figure 4-2).	As required	Construction Contractor
	In the event that Threatened Flora cannot be avoided and destruction of some plants is necessary to implement the project, the following management steps shall be taken: <ol style="list-style-type: none"> The impact of removal of the plants on the conservation status of the species shall be assessed at a local and regional scale by a qualified botanical consultant. Options for transplanting of individual plants or salvage of biological material for later propagation shall be assessed by a qualified botanical consultant. An application to take DRF shall be prepared and submitted to DEC for approval by the Minister for the Environment in accordance with the Wildlife Act. All conditions of permits shall be followed. 	Prior to construction	Construction Contractor
Bush Forever policy areas	Identification of areas required for construction facilities outside the construction right-of-way and within Bush Forever policy areas will be undertaken in consultation with the Bush Forever Office and agreement reached on management of the areas.	Prior to any work within Bush Forever policy areas	Construction Contractor
Access and vehicular movement	Personnel shall remain on designated roads and access tracks and will not go outside approved access areas in areas of conservation value.	At all times	Construction Contractor
Facilities and infrastructure	All turkey nests, turnarounds for vehicles and other infrastructure shall be located outside areas of conservation value where possible.	At all times	Construction Contractor
	All turkey nests, turnarounds for vehicles and other infrastructure within areas of conservation value shall be located within existing cleared areas unless agreed by DEC.	At all times	Construction Contractor
	There shall be no clearing of vegetation associated with DRF, Priority Flora, TECs or places listed on the Australian Heritage Database outside the construction right-of-way within areas of conservation value unless agreed by DEC and all required (State and Commonwealth) permits and approvals have been obtained.	At all times	Construction Contractor
Weeds and dieback	Prior to entering areas of conservation value, all vehicles and construction equipment/machinery shall be cleaned down in accordance with the Weed, Pest and Dieback Management Protocol (see Section 4).	At all times	Construction Contractor
Consultation	Regional DEC offices shall be notified prior to construction activities occurring in areas of conservation value.	Prior to construction on relevant loop	DBP
Trenching	Trenching shall be managed in accordance with the Fauna Interaction Protocol (Section 8).	During trenching	Construction Contractor
Pressure testing	No hydro-test water shall be sourced from local groundwater or streamflows that may cause a detrimental effect on water-dependent vegetation in areas of conservation value.	Prior to pressure testing	Construction Contractor
	No hydro-test water shall be discharged within areas of conservation value unless approved by DEC.	During pressure testing	Construction Contractor
	Disposal of hydrotest water shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).	During pressure testing	Construction Contractor

Activity	Action	Timing	Responsibility
Clean up and rehabilitation	Areas of conservation value shall be rehabilitated in accordance with the Rehabilitation Management Protocol (Section 17).	Immediately following construction	Construction Contractor
Reporting	All incidences of clearing or disturbance to vegetation outside approved construction areas in areas of conservation value shall be reported in accordance with the requirements of the Environmental Incident Response Protocol (Section 1).	As required	Construction Contractor
Chemical spill and refuelling	Fuel and chemicals shall not be stored within areas of conservation value in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14).	At all times	Construction Contractor

Figure 4-1 Buffer zone intersections with construction right-of-way (diagrammatic)

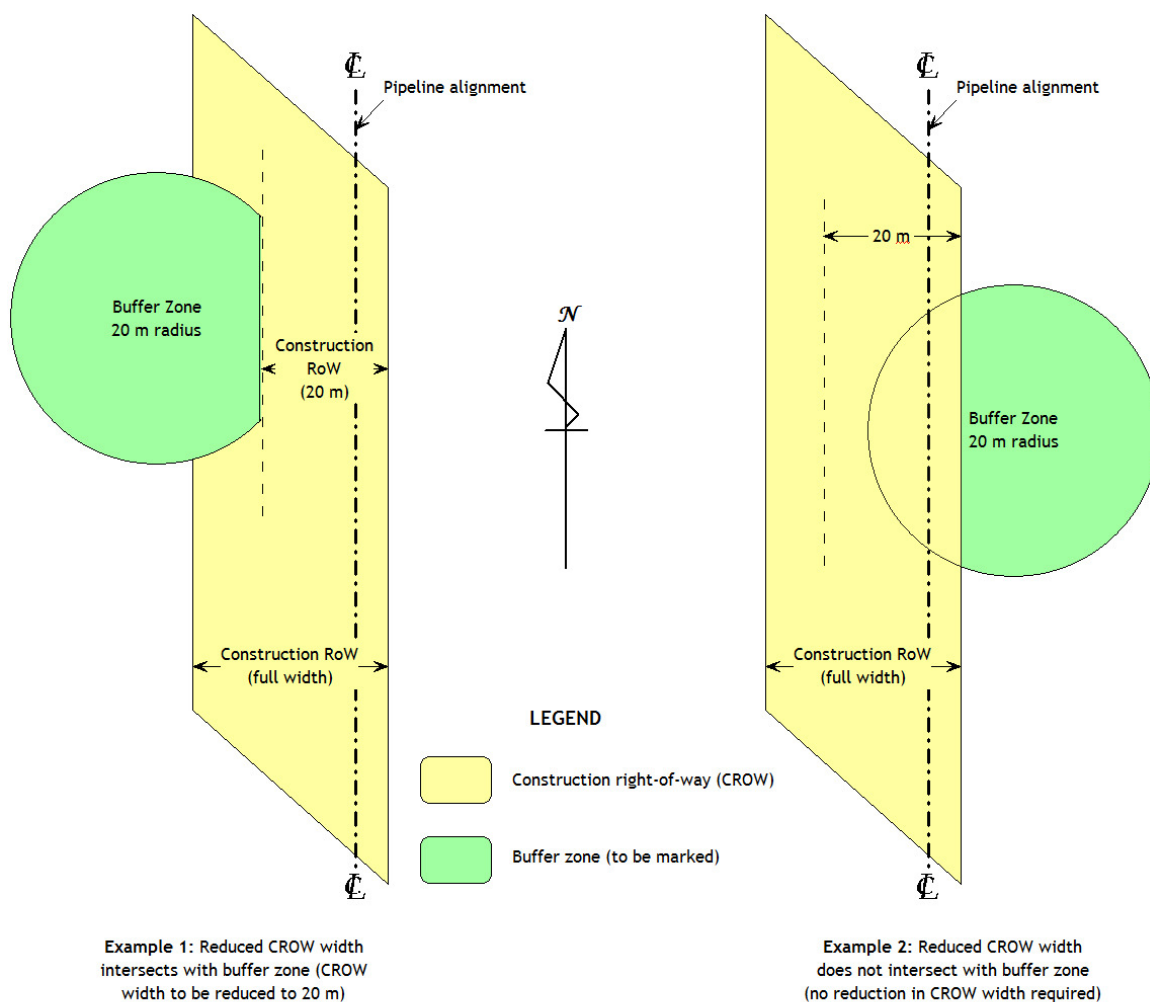
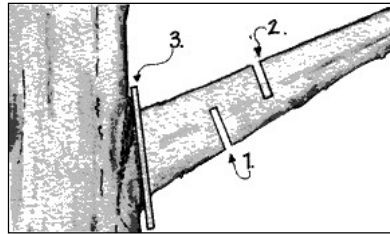


Figure 4-2 Three cut method of branch pruning



2.5 Monitoring and recording in areas of conservation value

Parameter	Frequency	Location	Purpose	Responsibility
Photographic evidence and GPS coordinates of on-ground delineation of areas of conservation value	Prior to ground disturbance on relevant loop	Areas of conservation value that intersect with potential construction areas	To record incidences of clearing of vegetation and/or flora outside approved construction areas	Construction Contractor
GPS coordinates of all marked habitat trees	Prior to ground disturbance on relevant loop	All areas of conservation value	To record habitat tree locations	Construction Contractor
Disturbance to vegetation and flora in areas of conservation value outside of the approved construction area	Weekly	All areas of conservation value	To record incidences of clearing of vegetation and/or flora outside approved construction areas	Construction Contractor
Approved removal or disturbance of Threatened Flora species.	As occurs	All approved access roads and construction right-of-ways	To record details of all DRF and Priority Flora removed under permits, including GPS locations.	Construction Contractor
Adequacy of fencing and/or signage of Threatened Flora within construction right-of-way (visual inspection).	Weekly	All approved access roads and construction right-of-ways	To determine if Threatened Flora is being appropriately identified and protected during construction activities.	Construction Contractor
Retention of Threatened Flora identified for protection within the construction right-of-way (visual inspection).	Weekly	All approved access roads and construction right-of-ways	To determine if Threatened Flora, identified to be avoided during construction is retained and protected.	Construction Contractor
Post-construction impacts on specially protected or conservation-significant flora species	Once-off spring survey in southern loops (Loops 8–10) and post-cyclonic season in northern loops (Loops 1–7). To be undertaken in the first season immediately following completion of construction of any sub-stage.	All approved access roads and construction right-of-ways	To determine extent to which Threatened Flora were protected during construction activities.	DBP



2.6 Contingency actions

Trigger	Action	Responsibility
Clearing occurs outside approved areas or extent of any approvals	Determine extent of clearing. Determine activity that caused the clearing. Review the Conservation Area Management Protocol. Contact DEC and advise of unapproved clearing and seek advice regarding rehabilitation measures. Implement rehabilitation measures as soon as practicable. Record incident in Incident Register.	Construction Contractor
Introduction of new weed species	Review Weed, Pest and Dieback Management Protocol (Section 4).	Construction Contractor
	Treat infestations as outlined in the Weed, Pest and Dieback Management Protocol.	Construction Contractor
Fire	Implement procedures outlined in the Fire Management Protocol (Section 11).	Construction Contractor
	Review Fire Management Protocol.	Construction Contractor
Clearing of Threatened Flora without the required permit.	Review the process to identify, flag and fence or signpost Threatened Flora species.	Construction Contractor
	Contact DEC for advice regarding the conservation status of the affected species.	DBP
	Determine mitigation and management options with advice from DEC. This may include a management plan to be developed and shall include all obligations in relation to any legislative requirements.	DBP
New location of a Threatened Flora species is identified within the approved construction right-of-way.	Threatened Flora species shall be fenced and/or signposted to protect from disturbance. DEC shall be notified of location of species.	Construction Contractor (fencing/ signposting) DBP (DEC)
	In the event that Threatened Flora (DRF or Priority Flora species) cannot be avoided and destruction of some plants is necessary, the management actions outlined above shall be followed.	Construction Contractor

2.7 Width of construction right-of-way in areas of conservation value

The construction width of the corridor shall be reduced to 20 m in areas of conservation value to minimise the potential impacts in these areas, as set out in Section 2.4. Additionally, infrastructure requirements (such as turnarounds and turkey nests) shall be located outside areas of conservation value where possible, otherwise they will be located within already cleared or disturbed areas to avoid disturbing additional areas.

The Construction Contractor will identify the proposed locations of off-construction-right-of-way facilities such as turkey nests and turnarounds, subject to approval by DBP, to ensure avoidance of unnecessary clearing in conservation areas. The Construction Contractor will identify off-construction-right-of-way work areas in accordance with the DBP approved Construction Execution Procedures. This procedure is approved by DBP prior to implementation and includes the requirement for all necessary approvals and agreements to be in place prior to use of off-construction-right-of-way areas.

2.8 Weed, pest and dieback hygiene measures

Weed and dieback hygiene management stations shall be located at the entry points for all areas of conservation value, consistent with the Weed, Pest and Dieback Management Protocol (Section 4). This measure will ensure that potential impacts on areas of conservation value through the introduction of weeds and dieback will be minimised as far as practicable.



2.9 Management of threatened flora

The actions described in this protocol are considered adequate to cover the management of Threatened Flora listed under the EPBC Act; no additional species-specific management is considered necessary.

Any Threatened Flora (DRF, Priority Flora or EPBC Act listed Threatened Flora species) identified within the construction right-of-way shall be managed in accordance with relevant legislative requirements. If individuals of the species are unable to be avoided during construction, Ministerial approval of a 'Permit to Disturb Habitat Containing DRF' (including appropriate mitigation measures) shall be obtained prior to any construction activities being undertaken.

Consultation regarding the management of Threatened Flora shall be undertaken with DEC.

2.10 Abbreviations

DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
DRF	Declared Rare Flora
ELL	Environmental Line List
EPP	Environmental Protection Policy
ESA	Environmental Sensitive Area
GPS	Global Positioning System
TEC	Threatened Ecological Community



3 FLORA AND VEGETATION MANAGEMENT PROTOCOL

3.1 Background and environmental risks

The Stage 5 looping of the DBNGP requires the removal of native vegetation from areas which have been largely previously disturbed, to enable access to the pipeline corridor. This vegetation is a resource as it provides habitat for fauna, contains seed that assists in revegetation and stabilises the soil profile. However, the cleared vegetation may contain weeds and diseases, which if not adequately managed, may be spread into unaffected areas. Further, stockpiling or burning of the cleared vegetation may increase the fire hazard associated with construction activities. Consequently, effective management of vegetation within the corridor is required during removal, storage and re-use, to ensure that the environmental risks are minimised and the resource is efficiently utilised.

3.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management of flora and vegetation to ensure that clearing of the resource is minimised, the resource (vegetation) is reused, the risk of weeds and diseases spreading is reduced, and to set out the necessary actions to address and minimise the potential impacts to Threatened Flora and TECs. The protocol will apply to the full length of the pipeline corridor and areas required for construction facilities. This protocol should be read in conjunction with the Conservation Area Management Protocol (Section 2) and Weed, Pest and Dieback Management Protocol (Section 4).

For the purposes of this protocol, “habitat trees” refers to trees with a trunk of diameter greater than 30 cm at breast height, irrespective of evidence of use or potential for use by fauna.

3.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Weeds and diseases	Prevent the introduction and dispersal of weeds, pathogens and pest species.	The presence of weeds, pathogens and pest species on the construction right-of-way is consistent with or better than adjacent land.
Disturbance to vegetation	Minimise and manage disturbance to remnant vegetation.	All construction activities undertaken within the construction right-of-way. All areas of remnant vegetation (habitat) avoided outside the construction right-of-way.
Disturbance to Threatened Flora and Threatened Ecological Communities	To minimise the disturbance or clearing of Threatened Ecological Communities and Threatened Flora, including Declared Rare Flora and Priority Flora species listed under the <i>Wildlife Conservation Act 1950</i> and Threatened Flora and Ecological Communities listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .	No disturbance or clearing to Threatened Flora species other than that approved under licence to take. The width of the construction right-of-way reduced to prevent or minimise disturbance to Threatened Ecological Communities and Threatened Flora populations.

3.4 Management actions

Activity	Action	Timing	Responsibility
General requirements	The induction program shall include information regarding flora and vegetation management practices.	Prior to and during construction	Construction Contractor
	Personnel shall be provided with information regarding Threatened Flora and the management practises at toolbox meetings on loops where the plants have been identified.	As required	Construction Contractor



Activity	Action	Timing	Responsibility
	Burning of vegetation shall not occur.	At all times	Construction Contractor
	A construction survey will be undertaken immediately prior to construction commencing, with pegs to clearly delineate the construction right-of-way and all areas of disturbance outside the construction right-of-way. Records of the delineation are to be made as set out in Section 3.5 (Monitoring and recording) below.	Prior to ground disturbing activities	Construction Contractor
	Campsites in any vegetated areas shall provide space for firebreaks on all sides of the site that are contiguous with such vegetation. The firebreaks need not be cleared unless there is clear and immediate risk of fire, but should be delineated as part of the campsite, prior to any clearing for the facility.	Prior to ground disturbing activities	Construction Contractor
	No construction activities shall be undertaken outside the delineated construction right-of-way and areas of disturbance unless specifically approved.	At all times	Construction Contractor
	All turkey nests, turnarounds for vehicles and other infrastructure shall be located within existing cleared areas where possible.	At all times	Construction Contractor
	No vegetation flagged for protection shall be removed.	At all times	Construction Contractor
Weeds and dieback	Refer to the Weed, Pest and Dieback Management Protocol (Section 4).	At all times	Construction Contractor
Areas of conservation value	Refer to the Conservation Area Management Protocol (Section 2).	As required	Construction Contractor
Clear and grade	Trimming of branches on flagged vegetation overhanging the corridor shall be undertaken in preference to whole tree removal. All habitat trees flagged for either removal or branch trimming within DEC managed estate will require signoff by the local DEC district representative.	Where appropriate	Construction Contractor
	Trimming overhanging branches shall be undertaken using the 'three-cut method' to prevent bark stripping (see Figure 4-2).	As required	Construction Contractor
	No flora or vegetation outside approved areas shall be removed or disturbed.	At all times	Construction Contractor
Stockpiles	Cleared vegetation and log debris shall be stockpiled along the construction right-of-way separately from topsoil.	At all times	Construction Contractor
	Stockpiles shall be located adjacent to where vegetation has been cleared.	At all times	Construction Contractor
	Stockpiles shall be located so as not to impede vehicles, wildlife, and surface drainage, and avoid damage to adjacent live vegetation.	At all times	Construction Contractor
Welding	Welding activities shall be in accordance with the Fire Management Protocol (Section 11).	At all times	Construction Contractor
Pressure testing	No hydro-test water shall be sourced from local groundwater that may cause a detrimental effect to any known Threatened Flora.	At all times	Construction Contractor
	No hydro-test water shall be discharged into areas supporting Threatened Flora.	At all times	Construction Contractor
	Hydro-test water shall be disposed of in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).	At all times	Construction Contractor
Revegetation	Stockpiled cleared or trimmed vegetation shall be respread evenly across the construction right-of-way and other work areas from which it was removed as soon as practicable after the completion of construction works.	Following topsoil spreading	Construction Contractor



Activity	Action	Timing	Responsibility
	Vegetative material including logs and leaf litter shall be respread to provide habitat.	As required	Construction Contractor
Reporting	All incidences of clearing or disturbance of Threatened flora (including DRF or Priority species) without the necessary approvals shall be reported via the Incident Report Form and DEC notified.	As occurring	Construction Contractor (Incident Report) and DBP (DEC)

3.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Photographic evidence and GPS coordinates of on-ground delineation of proposed disturbance areas	Prior to ground disturbance on relevant loop	All areas of proposed disturbance of native vegetation	To record incidences of clearing of vegetation and/or flora outside approved construction areas	Construction Contractor
GPS coordinates of all marked habitat trees	Prior to ground disturbance on relevant loop	All areas of conservation value	To record habitat tree locations	Construction Contractor
Clearing of native vegetation	As clearing occurs	All areas of clearing of native vegetation	To provide record of areas of clearing of native vegetation	Construction Contractor
Weed cover and species monitoring	Following rehabilitation	Entire corridor length	The results will be used to develop weed management programs in consultation with DEC.	Construction Contractor

3.6 Contingency actions

Trigger	Action	Responsibility
Sites identified as weed infested.	Active weed control shall be required for at least one year after construction. Additional appropriate control measures shall be utilised after this time, based on monitoring results.	DBP
Clearing occurs outside approved areas or extent of any approvals	Determine extent of clearing. Determine activity that caused the clearing. Review the Flora and Vegetation Management Protocol. Implement rehabilitation measures as soon as practicable. Record incident in Incident Register.	Construction Contractor



3.7 Abbreviations

DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
DRF	Declared Rare Flora
ELL	Environmental Line List
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	Global Positioning System
TEC	Threatened Ecological Community
Wildlife Act	<i>Wildlife Conservation Act 1950</i>



4 WEED, PEST AND DIEBACK MANAGEMENT PROTOCOL

4.1 Background and environmental risks

Construction activities have the potential to introduce or disperse weeds and diseases such as dieback (caused by *Phytophthora cinnamoni*) during operations on the Stage 5B Looping of the DBNGP. The highest risk of weed and dieback spread will be during clear and grade operations and rehabilitation. The introduction of the European House Borer has resulted in regulations being promulgated, that restrict the movement of the pest within specific areas.

The occurrence of dieback in Western Australia is rainfall dependent and requires management on Loops 8, 9 and 10, where rainfall is sufficient for the disease to occur. As construction on these Loops will occur in predominantly dry seasons, the risk of spreading dieback will be minimal.

The highest risk of weed spread will be during the clear and grade and rehabilitation operations as weeds will be contained within the topsoil. As such, machinery associated with these operations will be cleaned down to remove all soil/organic matter when moving from disturbed/cleared areas into undisturbed areas. Removal of topsoil will sufficiently reduce the risk of weed spread during other construction activities. Dieback can be present within all layers of the soil profile, and as such clean down will be undertaken during all construction activities.

European House Borer (EHB), *Hylotrupes bajulus Linnaeus*, is a destructive pest of seasoned coniferous timber including pine, fir and spruce. If allowed to become established it can cause major structural damage to buildings. The adult beetle lays its eggs into cracks, holes and joints in dead pine trees, dead branches, or other dead parts of living trees and untreated pine timber.

The Agriculture and Related Resources Protection (European House Borer) Regulations 2006 have set Restricted Movement Zones (RMZ) in specific areas within Loop 9. Maps are regularly updated and are available via <http://www.ehb.wa.gov.au/html/rmzmaps.htm>. Movement of untreated pine into and out of these areas is restricted. If a piece of seasoned pinewood has been in a RMZ for 72 hours or more, a person must not remove it from the RMZ unless any of the following applies:

- the volume of the pinewood is less than 100 cm³, or one third the size of a soft drink can
- at all times while it was in the RMZ (other than while it was being transported) the pinewood was stored in accordance with the regulations (i.e., in a suitable, secure building or fully enclosed in plastic wrapping)
- the pinewood has been treated with a preservative meeting Australian Standard AS 1604.1
- the pinewood has been fumigated or heat treated and is removed from the RMZ within 72 hours after being treated
- in the case of pinewood being transported through the RMZ, the pinewood has not remained stationary for a period of, or periods totalling, more than 72 hours
- removal of the pinewood other than in accordance with the regulations has been authorised and the pinewood is removed in accordance with the authorisations.

Areas of surveyed occurrence of dieback, high-risk dieback areas, and weed and pest areas will be marked on the Environmental Line List (ELL). Corridor access hygiene points shall be marked on the construction alignment sheets.

4.2 Purpose and scope

The purpose of this protocol is to provide for the management of construction activities to prevent the introduction and spread of weeds, pests and dieback along the DBNGP corridor and associated construction areas, to achieve the environmental objectives outlined below.



4.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Introduction of new weeds and pests	To minimise the potential for new weeds and pests to be introduced into the DBNGP corridor from external sources.	No new species of weeds or pests recorded in the pipeline corridor within one year of completion of construction activities.
Threat of spreading weeds, pests and diseases	To minimise the risk of spreading existing weeds, pests and dieback along the corridor and to adjacent areas.	Hygiene management stations located at edges of areas of conservation value and high risk areas. No significant change to the extent and distribution of weeds, pests and dieback within one year of completion of construction activities compared to the extent and distribution of weeds, pests and dieback prior to construction.
Transport of European House Borer out of Restricted Movement Zone	To minimise risk of transport of European House Borer into potentially unaffected risk areas.	No movement of untreated pine material to any area outside of limits of Restricted Movement Zones.

4.4 Management actions

Activity	Action	Timing	Responsibility
Induction	The induction program shall involve hygiene training to ensure all personnel are aware of the requirements to prevent the spread of weeds and diseases.	Induction	Construction Contractor
General requirements	Field surveys of dieback risk areas shall be completed to identify medium to low, medium and high risk areas in Loops 8-10 and the Environmental Line List (ELL) updated with results. ²⁵	Prior to ground disturbing activities	DBP
	Field surveys shall be completed to identify areas of significant populations of Declared Plants, as defined by the Department of Agriculture and Food (DAF), and aggressive environmental weeds, which are aggressive and invasive and which may threaten the integrity of native plant communities (identified in consultation with DEC). These areas shall be marked as 'high risk' weed areas on the ELL.	Prior to ground disturbing activities	DBP
	Construction areas containing native vegetation and displaying weed covers in excess of 50% shall be selectively sprayed with Glyphosate to reduce weed seed loads in the topsoil in order to improve establishment of native species in the rehabilitation." Where such weeds are of a variety not conducive to eradication with Glyphosate, they shall be cleared and the weeds disposed of to an appropriate landfill. Construction areas that are heavily infested with weeds but not containing native vegetation shall also be cleared and the weeds disposed of to an appropriate landfill.	Prior to ground disturbing activities	Construction Contractor
	Bureau of Meteorology weather forecasts shall be used to schedule movements in dieback risk areas, with movement through dieback risk areas restricted during periods of wet weather.	Daily	Construction Contractor
	Access and vehicular /machinery movement	All vehicles and machinery that will access the construction right-of-way shall be checked to ensure they are free from soil/organic matter prior to arrival on site (recorded as part of the mobilisation procedure) and marked accordingly.	Prior to entering the corridor
Personnel shall remain on designated roads and access tracks and shall not go outside approved access areas.		At all times	Construction Contractor

²⁵ The potential to conduct field surveys in many areas will be limited if no vegetation is present, such as occurs in cleared agricultural land.



Activity	Action	Timing	Responsibility
	In dieback risk areas, the number of vehicles entering these areas shall be minimised.	At all times	Construction Contractor
	Vehicles that move off the construction right-of-way but remain on bitumen or hard surfaces do not require clean down prior to entering areas of the corridor with the same risk rating.	At all times	Construction Contractor
Surveying	Distinctive flagging and signage shall be used to identify those areas of high risk for dieback and weeds and those areas known to be weed or dieback free.	Prior to ground disturbing activities	Construction Contractor
	Corridor access hygiene points shall be identified on construction alignment sheets.	Prior to ground disturbing activities	Construction Contractor
	Corridor access hygiene points shall be flagged in the field.	Prior to ground disturbing activities	Construction Contractor
	Flagging indicating the dieback infested areas shall remain in place until after rehabilitation works are complete.	At all times	Construction Contractor
Hygiene	Entry to areas identified as 'high risk', 'disease/weed free' and areas of conservation value in the ELL will only be through hygiene stations.	Prior to construction	Construction Contractor
	Weed, pest and dieback (Loops 8 – 10 only) hygiene stations shall be located at: <ol style="list-style-type: none"> 1. Entry points for areas of conservation value. 2. Entry and exit points for areas identified as 'high risk' for dieback (Loops 8 – 10 only). 3. Entry and exit points for areas identified as 'high risk' for weeds. 	At all times	Construction Contractor
	Hygiene stations shall be at least 200 m from any watercourses/streams, environmentally sensitive areas and vulnerable areas provided no risk of contamination exists from within the area between the hygiene station and the area to be protected (hygiene buffer area). Where such risk of contamination may exist, the station shall be located as far from the area to be protected as will practically ensure no risk of contamination is present from the resulting hygiene buffer area.	At all times	Construction Contractor
	Signage shall be erected outlining the hygiene management procedure at each station.	At all times	Construction Contractor
	All construction machinery, including handheld tools, and vehicles shall be cleaned down at the hygiene management stations.	At all times	Construction Contractor
	Personnel shall clean footwear each time they enter or exit a high risk area.	At all times	Construction Contractor
	If weed seeds and/or soil are found attached to vehicles, footwear, clothing and/or equipment, they shall be collected in a sealed container and disposed in accordance with the Waste Management Protocol (Section 15).	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
Conservation reserves and Bush Forever sites	<p>The following actions are to be taken with respect to management of weeds in all gazetted conservation reserves and nominated Bush Forever sites:</p> <ol style="list-style-type: none"> 1. Thoroughly clean down all vehicles and plant mobilised into any Loop, and record in register. 2. For potholing, clear and grade, and rehabilitation activities: <ol style="list-style-type: none"> (a) Clean down all vehicles and plant on entry into any conservation reserves (at reserve boundary). (b) Clean down all vehicles and plant moving from any mapped weed risk area into any other (non-weed or uninterpretable risk) area within any conservation reserve or nominated Bush Forever site. 3. For all other activities: <ol style="list-style-type: none"> (a) Clean down all vehicles and plant on entry into a conservation reserve or nominated Bush Forever site (at boundary) if the vehicle or plant has travelled in areas other than on sealed roads, designated access tracks, or the yard/camp, subsequent to mobilisation to the loop. 	At all times for activities as prescribed	Construction Contractor
Construction materials	Construction materials (i.e. fencing, timber skids), brought onsite shall be demonstrated to be disease, pest and weed free.	Prior to entering site	Construction Contractor
European House Borer	<p>If a piece of seasoned pinewood (eg skids) has been in a RMZ for 72 hours or more, it must not be removed from the construction site unless any of the following applies:</p> <ul style="list-style-type: none"> • the volume of the pinewood is less than 100 cm³ • at all times while in the RMZ (other than while being transported) the pinewood was stored in a suitable, secure building or fully enclosed in plastic wrapping • the pinewood has been treated with a preservative meeting Australian Standard AS 1604.1 • the pinewood has been fumigated or heat treated and removed from the RMZ within 72 hours after being treated • in the case of pinewood being transported through the RMZ, the pinewood has not remained stationary for a period of, or periods totalling, more than 72 hours • removal of the pinewood other than in accordance with the regulations has been authorised and the pinewood is removed in accordance with the authorisations. 	At all times	Construction Contractor
	<p>Untreated pine in a RMZ may be disposed of by either:</p> <ul style="list-style-type: none"> • chipping so that it is smaller than 100 cm³ • burning (during burning permitted times) 	At all times	Construction Contractor
	If a piece of seasoned pinewood (eg skids) has been in a PMZ for 72 hours or more, it must not be removed out of the PMZ without prior approval from the EHB group at the Department of Agriculture and Food.	At all times	Construction Contractor
Clear and grade	All topsoil within identified 'high risk' areas shall be stockpiled within the high risk area and not with topsoil from lower risk areas.	At all times	Construction Contractor
Trenching	Stockpiles of weed and weed-free material, and dieback and dieback free material, shall be kept separate.	At all times	Construction Contractor
	Infected soil shall be stockpiled in a manner that minimises the risk of being washed into the trench or out of the construction right-of-way.	At all times	Construction Contractor
	Drainage for dieback or weed infected areas shall be designed so that it prevents water draining into dieback or weed free areas.	At all times	Construction Contractor
Bedding material	Bedding material imported to the site shall be certified as free of disease, weeds.	As required	Construction Contractor



Activity	Action	Timing	Responsibility
Rehabilitation	Stockpiles of weed and weed-free material, as well as dieback and dieback free material, shall only be re-spread back to their point of origin.	At all times	Construction Contractor

4.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Stockpiles of topsoil and trench material	Daily	All access and construction activities.	To ensure that high risk weed and/or dieback infested material is stockpiled separately from other material.	Construction Contractor
Digital photographs ²⁶ of respreading of stockpiles in weed infested or dieback infested areas	During stockpile respreading for rehabilitation	At each location that infested/infected stockpiles are respread for rehabilitation	To provide evidence of respreading of infested/infected material being confined to source location	Construction Contractor
Hygiene stations	Daily	Identified hygiene stations. Entry of 'high risk' and conservation areas. Exit of 'high risk' areas.	To ensure that all vehicles, construction machinery including handheld tools, and footwear is subject to hygiene management procedures on entering/exiting high risk areas.	Construction Contractor
Pine material movement and/or disposal	All pine material movement within Loop 9	Within Loop 9.	To ensure all pine material movement and/or disposal is in accordance with hygiene requirements for European House Borer.	Construction Contractor
Vehicle hygiene	Each passing of a hygiene station	All hygiene stations	To record vehicle clean-downs as required to be undertaken	Construction Contractor
	All vehicle transfer between loops	Pre-entry to loop	To ensure all vehicles entering a loop are clean	Construction Contractor

²⁶ Original digital photographs should be retained to ensure files contain details of photograph (date and time taken, etc.).



4.6 Contingency actions

Trigger	Action	Responsibility
New infestation of weed(s) identified in areas of conservation value during construction	Identify source of weed infestation.	Construction Contractor
	Undertake weed control immediately (or as appropriate) in consultation with the Department of Agriculture and Food (DAF) and DEC and follow up weed control during Clean-up and Rehabilitation.	Construction Contractor
	Review hygiene management procedures.	Construction Contractor
New infestation of 'high risk' weed(s)	Identify source of weed infestation.	Construction Contractor
	Undertake weed control immediately (or as appropriate) in consultation with the DAF and DEC and follow up weed control during Clean-up and Rehabilitation.	Construction Contractor
	Review hygiene management procedures.	Construction Contractor
Weed and/or dieback infected and non-infected material are not stockpiled separately	Investigate cause of 'contamination'.	Construction Contractor
	Ensure appropriate identification of high risk areas for dieback and/or environmental weeds.	Construction Contractor
	Dispose infected stockpiled material off-site to a suitable disposal location, to be determined in consultation with DEC and DAF, to avoid contaminating non-infected areas.	Construction Contractor
	Source dieback and weed free material suitable for use in backfilling in consultation with DEC and DAF.	Construction Contractor
	Review hygiene management procedures.	Construction Contractor
Pine material transported beyond boundaries of any RMZ without appropriate approval or treatment	Located untreated material and arrange immediate return to within RMZ, or treatment, or disposal in approved manner.	Construction Contractor
	Review pine transport management procedures.	
Reporting	Any breaches of the hygiene management procedures shall be reported to DBP and DMP and investigated.	Construction Contractor

4.7 Hygiene management procedures

Hygiene protocols have been developed to contain and minimise the spread of weeds and dieback caused by *P. cinnamoni* during the construction period. Disturbed areas along the pipeline route may contain a number of environmental weeds. Hygiene operations will be required to reduce the risk of spreading weeds into undisturbed areas of the construction right-of-way. Any locations and boundaries of *P. cinnamoni* or weed infestations will be identified on a map if recorded, and included in the ELL for the respective Loops.

The primary method for vehicle clean-down in the field will be by blow-down rather than wash-down. Wash-down is acceptable for the main site office if the vehicles are able to air dry whilst driving on the bitumen road before entering the construction right-of-way. Vehicle wash-down on the construction right-of-way is considered inappropriate, as it would provide wet surfaces for adhesion of soils and organic materials. However, wash-down will be required on the construction right-of-way during significant rain events when air drying is impractical.

Clean down for footwear and handheld tools where required is to follow standard clean down protocols (possible methods to be employed include water wash downs and brush downs).



If water is used during clean down, it is to be from a disease free source and once used, the spoiled water is to be diverted back into dieback infected and weed infested areas.

4.8 Clean down procedures

Clean down operations will involve:

- laying timber skids across boundary (e.g. between dieback infected areas and non-infected areas, boundary to areas of conservation value etc.)
- cleaning vehicles/construction machinery using an air blower or high pressure water (e.g. to clean rake bucket and rake blade and undercarriage of machines and tyres etc.) inside the boundary of the disturbed/undisturbed area
- driving machinery from disturbed area onto timber skids
- cleaning tracks/wheels of machinery as the machine drives along the timber skids into the undisturbed area
- logging machinery hygiene inspections in machine daily log books
- audit of vehicle hygiene operations in the field
- conducting a clean down of all vehicles that accessed the construction right-of-way prior to them leaving the site
- ensuring the flow of water when washing down at a designated dieback boundary flows towards, or is contained within, the dieback area; if washdown runoff naturally flows into dieback free areas, then a suitable sump will be constructed to contain all water from washdown activities, from flowing into dieback free areas.

4.9 Environmental weeds

Topsoil in the identified disturbed and cleared areas is potentially infested with environmental weed seeds. The machinery involved in the clear and grade, and rehabilitation operations will need to be cleaned down to remove all soil and/or organic matter when moving from disturbed/cleared areas into undisturbed areas. This will minimise the risk of spreading weed seeds and disease into undisturbed areas.


Environmental weeds will be dealt with on a case by case basis. Where infestations are extreme and contained only within the construction right-of-way, measures for their removal will be implemented. Declared plants and other invasive species will be controlled with herbicide, as advised by DAF, or where possible removed by hand to ensure underground corms are eradicated during rehabilitation monitoring after construction (refer to the Clean-up and Rehabilitation Management Protocol - Section 17).

4.10 Clean-up and rehabilitation

Weed monitoring and management requirements have been included into the Clean-up and Rehabilitation Management Protocol (Section 17). As part of this protocol, the project footprint will be inspected for weed outbreaks approximately 4 -6 weeks after the first significant rainfall event (greater than 5 mm). Active control of weed outbreaks in previously uninfected areas along the construction right-of-way will be carried out in consultation with the relevant authorities.

4.11 Abbreviations

ASS	Acid sulphate soils
CEMP	Construction Environmental Management Plan
DAF	Department of Agriculture and Food
DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
ELL	Environmental Line List

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5 WETLAND MANAGEMENT PROTOCOL

5.1 Background and environmental risks

Construction of the Stage 5 Looping of the DBNGP has the potential to affect wetlands located within and adjacent to the corridor alignment in a number of ways including:

- damage or destruction of wetland vegetation
- spread of weeds, disease (e.g. dieback) and feral fauna
- fragmentation of habitat (temporary) and loss of habitat (generally temporary, however, some permanent loss of habitat will occur where removal of habitat trees is necessary for construction to occur)
- connecting adjacent wetlands and affecting water quality through consequential transfer of water from one wetland to another
- affecting wetland hydrological regimes through increased water runoff flows into wetlands.

Trench dewatering, and sourcing and disposing of hydro-test water may affect wetlands through potentially altering hydrological regimes. Changes to the hydrological regimes of wetlands may result from any activities that cause the interception of surface and groundwater flows or through increased water/runoff flows into wetlands. Trench dewatering may also have an effect on groundwater-dependent vegetation. Inappropriate disposal of trench dewater and hydro-test water, and surface runoff may lead to the deterioration of surface water quality in wetlands.

Consequently, appropriate management is required to ensure that the environmental risk associated with construction of the pipeline through wetland areas is undertaken to minimise potential detrimental impacts.

5.2 Purpose and scope

The purpose of this protocol is to provide for the management of construction activities in or adjacent to conservation category wetland areas. The actions outlined in this protocol are aimed at minimising potential impacts on wetlands, particularly vegetated wetlands, to achieve the environmental objectives for wetlands outlined below.

This protocol applies to all wetlands of conservation significance as identified in the Environmental Line List (ELL). This includes Forrestdale Lake, which is part of a Ramsar listed wetland (Forrestdale and Thomsons Lakes) and consequently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For wetland areas within areas of conservation value, this protocol should be read in conjunction with the Conservation Area Management Protocol (Section 2). The protocol should also be read in conjunction with the Dewatering and Water Disposal, and Acid Sulphate Soils Management Protocols (Sections 6 and 7 respectively).

For the purposes of this protocol:

- wetlands do not include watercourses – management of watercourse crossings is specifically addressed within the Watercourse Crossing Protocol (Section 9)
- “habitat trees” refers to trees with a trunk of diameter greater than 30 cm at breast height, irrespective of evidence of use or potential for use by fauna.



5.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Disturbance to wetlands	To minimise and manage disturbance to wetlands and wetland buffer areas from construction activities.	No wetland dependent vegetation outside approved areas is cleared or destroyed.
Wetland water quality and water regimes	To prevent adverse changes to wetland water quality or hydrological regimes resulting from construction activities.	No permanent impact on wetland values during construction or following rehabilitation. No adverse change in the water quality of wetlands following rehabilitation. No change in wetland water level regimes following rehabilitation.

5.4 Management actions for wetland areas

Activity	Action	Timing	Responsibility
Planning	All conservation category wetlands and wetlands protected under an Environmental Protection Policy (EPP) within and immediately adjacent to the construction right-of-way shall be identified and recorded in the ELL, including identification of EPP status.	Prior to construction activities	DBP
	All activities with potential to affect wetlands shall be scheduled to be undertaken during statistically dry periods.	Prior to construction activities	Construction Contractor
	All service locations, including construction camps, fuel storage sites and infrastructure such as turn around and turkey nests shall be at least 200 m from the nearest wetland.	Prior to construction	Construction Contractor
	Ground disturbing activities with potential to affect wetlands shall not be undertaken during periods of rainfall or when Bureau of Meteorology forecasts indicate rainfall may occur.	At all times	Construction Contractor
	Stockpiles shall not be located in wetlands and associated buffer areas.	During clear and grade activities	Construction Contractor
Survey, fencing and service locations	All wetlands identified in the ELL shall be flagged in the field.	Prior to construction activities	Construction Contractor
	A buffer zone extending 200 m from each edge of all wetlands identified in the ELL along the construction right-of-way shall be flagged and signposted.	Prior to construction activities	Construction Contractor
	Wetland vegetation identified for retention in areas of conservation value shall be protected through the use of fencing or flagging, and/or signage.	Prior and during construction activities	Construction Contractor
	Where vegetation within a wetland or its associated buffer area is required to be disturbed to enable construction, the width of the construction right-of-way shall be reduced to 20 m where that reduction would result in minimising the disturbance. Flagging and signage will be used to delineate the reduced width and will remain in place until reinstatement is complete.	Prior and during construction activities	Construction Contractor
Fuel storage	Fuel storage and handling shall be consistent with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14). No storage of fuel or hydrocarbons shall occur within 200 m of a wetland.	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
Refuelling	Refuelling of any plant within 200 m of a wetland is to be undertaken in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14).	At all times	Construction Contractor
Clear and grade	Within a wetland or its associated buffer area, all construction activities shall remain within the designated construction right-of-way.	During clear and grade activities	Construction Contractor
Trenching and excavation	Trench lengths in wetlands shall be limited to ensure that the trench does not provide a direct connection between any two wetlands.	During trenching activities	Construction Contractor
	Dewatering of the trench shall be avoided in wetlands and associated buffer areas unless conditions are such that it is required as a result of engineering limitations.	During trenching activities	Construction Contractor
	If Acid Sulphate Soils are identified, trenching and excavation shall be managed in accordance with the Acid Sulphate Soil Management Protocol (Section 7).	During trenching activities	Construction Contractor
	Disposal of dewater shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).	During trenching activities	Construction Contractor
Drilling/boring	Surface water run-off and erosion control bunds around drill sites shall be constructed prior to any drilling or boring activities commencing.	Prior to drilling	Construction Contractor
Lowering-in and backfill	Backfill shall be graded and shaped to be consistent with the pre-existing contours of wetland area.	During backfilling operations	Construction Contractor
Testing and commissioning	Hydro-test water shall not be taken from wetlands.	At all times	Construction Contractor
	Hydro-test water shall not be discharged into any wetlands.	At all times	Construction Contractor
	Disposal of hydro-test water shall be managed in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).	At all times	Construction Contractor
Clean-up and rehabilitation	All wetlands crossed using open cut techniques shall be reinstated as close as possible to their original profile and condition, with pre-construction equivalent stability and bed composition achieved wherever possible, in accordance with the Soil Management Protocol (Section 16).	As required	Construction Contractor
	Rehabilitation shall ensure that erosion and sediment control measures are implemented in wetlands and waterway areas where required, in accordance with the Soil Management Protocol (Section 16).	After construction activities	Construction Contractor
	Disturbed wetlands shall be graded to reinstate pre-existing surface contours and natural drainage patterns.	During construction activities	Construction Contractor
Weeds, Pests and dieback	Weeds, pests and dieback shall be managed according to the Weed, Pest and Dieback Management Protocol (Section 4).	Rehabilitation and cleanup	Construction Contractor

5.5 Monitoring and recording, reporting and recording

All information and data recorded through monitoring shall be recorded by the Construction Contractor. In the event that a specific parameter indicates an unexpected adverse environmental impact, this shall be recorded and monitored through the Environmental Incident Response Protocol (Section 1).



Parameter	Frequency	Location	Purpose	Responsibility
Wetland water quality (visual inspection, pH, EC, N, P, chlorophyll a, turbidity and TSS in wetlands with surface water)	Immediately prior to construction commencing in a wetland, weekly during dewatering activities, immediately following backfilling and 12 months following rehabilitation.	All open wetland water bodies within 50 m radius of the trench.	To determine whether dewatering is affecting the water quality of nearby wetlands.	Construction Contractor
Wetland water levels	Immediately prior to construction commencing in a wetland, weekly during dewatering activities, and immediately following backfilling.	All open wetland water bodies within 50 m of the trench.	To determine whether dewatering is affecting the water levels in nearby wetlands.	Construction Contractor
Groundwater	Groundwater monitoring will be undertaken in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).			
Soil erosion	Weekly during construction.	All wetland areas within and adjacent to the construction right-of-way.	Visual inspection of wetland areas and banks to determine if soil erosion has occurred and affected wetland areas.	Construction Contractor

5.6 Contingency actions

Trigger	Action	Responsibility
Wetland areas cleared outside of approved construction areas	Investigate the activity that caused the clearing and determine responsibility. Review Wetland Management Protocol. Undertake rehabilitation measures after contacting DEC and obtaining advice regarding rehabilitation measures for wetlands.	Construction Contractor
Dewatering activities affecting hydrological regimes of wetlands	The length of the open trench will be reduced such that lower dewatering rates can be applied. Infiltration of abstracted trench dewatering water near the open water body subject to acceptability of quality of discharged water. Controlled dewatering inflow directly into the open water body depending on water quality compatibility and endorsement by DEC. Stop work if severe impact on water body is likely to occur and develop other mitigation measures in consultation with DEC.	Construction Contractor
Soil erosion in wetland areas	Investigate cause - if the result of trench de-watering, minimise the time the trench is open and the length of the trench. Install bunds and drainage measures to reduce impact. Review surface drainage contours.	Construction Contractor

5.7 Ramsar wetland


The actions described in this protocol are considered adequate to cover the management of construction activities in the vicinity of Forrestdale Lake; no additional site-specific management is considered necessary.

5.8 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline



DEC Department of Environment and Conservation
DMP Department of Mines and Petroleum
ELL Environmental Line List
EPP Environmental Protection Policy
EPBC Act *Environment Protection and Biodiversity Conservation Act 1999*

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6 DEWATERING AND WATER DISPOSAL MANAGEMENT PROTOCOL

6.1 Background and environmental risks

Construction of the Stage 5 Looping of the DBNGP requires clearing and grading, excavation, pipe-laying, backfilling, hydro-testing, rehabilitation and commissioning activities to be undertaken adjacent to the existing DBNGP pipeline in eleven looped sections distributed between Karratha and Wagerup. There will be a requirement for construction camps, stockpile sites, small worksites, access roads and water storage facilities (turkey nests) associated with these works. The following activities may require dewatering to facilitate construction works if shallow groundwater/surface water is encountered:

- trenching
- bell holes²⁷
- watercourse crossings.

A desktop assessment was undertaken to identify the potential areas where groundwater and surface water would be likely to be encountered during construction activities. The results of the assessment are presented in Table 4-1.

Table 4-1 Locations of shallow groundwater

Loop	Rivers, streams and water bodies	Locations of shallow groundwater (<5 mBGL)
0	Maitland River, Yanyare River, Fortescue River and 4 unnamed rivers	KP22 – KP36, KP53 – KP60
1	Robe River, Cane River	None
2	Yannarie River, Lyndon River	None identified based on sparse information. Available information suggests shallow groundwater is unlikely.
3	Minilya River, Newman Creek, Lyons River	None identified based on sparse information. Available information suggests shallow groundwater is unlikely.
4	Jacobs Gully, Wooramel River, unnamed lake	None identified based on sparse information. Available information suggests shallow groundwater is unlikely.
5	2 unnamed lakes	None identified based on sparse information. Available information suggests shallow groundwater is unlikely.
6	Murchison River, Greenough River	None identified based on sparse information. Available information suggests shallow groundwater is unlikely.
7	Irwin River, unnamed lake	None
8	Moore River	None
9	Gingin Brook, Swan River, Helena River, Canning River, Wright Lake Melaleuca Park Wetland, Armadale Sumpland, Mandogalup Swamp North, Spectacles Wetlands	Most areas between KP1281 and KP1395 excluding a few isolated 1 to 5 km areas where pipeline crosses topographical highs.
10	North Dandalup River, South Dandalup River, Murray River, Harvey River	Most areas on the Swan Coastal Plain excluding a few isolated 1 to 5 km areas where pipeline crosses topographical highs.

²⁷ Bell holes are constructed where pipe strings are joined, at mainline valves, at major bends, at facilities crossings, and where loop ends are tied into the existing pipeline or compressor station. Bell holes are usually benched and have ramped access points that enable personnel to enter the trench but also provide points for entrapped wildlife to leave the trench.



6.2 Purpose and scope of protocol

The purpose of this protocol is to provide for:

1. The management of dewatering and the preservation of environmental water quality during excavation and dewatering to achieve the environmental objectives for the water management factor (Section 6.3).
2. The management of abstraction and disposal of groundwater associated with dewatering and post-construction hydro-testing of the pipeline.

6.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Water Quantity	To ensure that dewatering activities do not extract excessive amounts of water that may be detrimental to the water resource.	No drawdown of the aquifer beyond the immediate proximity of the construction works from dewatering activities.
Water Quality	To ensure that dewatering activities or water disposal do not degrade the beneficial use of the aquifer or compromise the ecological value of nearby surface receptors.	No long-term detrimental impact to the aquifer compared to pre-construction background water quality from dewatering activities. Groundwater returned to the aquifer will meet or exceed pre-construction groundwater quality components. No greater than a 10% variation of water quality in nearby ecological receptors from dewatering activities.

6.4 Management actions

Issue	Action	Timing	Responsibility
DEWATERING MANAGEMENT			
Timing of Dewatering	Where practicable, earthworks in areas requiring dewatering shall be undertaken during summer and autumn months when water table levels are annually low.	During construction	Construction Contractor
	Where trench dewatering is undertaken at any location, it shall be undertaken as one continuous action to prevent the trench from periodically refilling with water overnight and endangering fauna (that is, dewatering should not be undertaken intermittently).	During construction	Construction Contractor
Area of Impact	Dewatering shall be undertaken using a method that minimises the area of impact.	During construction	Construction Contractor
	Dewatering of trenches and bell holes shall be undertaken at a rate such that the drawdown cone will not impact on surrounding sensitive wetlands and water bodies, and groundwater dependent ecosystems (i.e. no drawdown at surface water bodies).	During construction	Construction Contractor
Effluent Treatment	Effluent treatment shall occur where background water quality indicates that the pH is less than 6 and acidity is greater than 50 mg/L, or in areas where Al, Fe or As exceed the applicable guideline for beneficial use by a factor greater than 10.	During construction	Construction Contractor
	Where pH and acidity exceed the aforementioned triggers, groundwater shall be treated with a neutralising agent to raise the pH to greater than 6 prior to disposal.	During construction	Construction Contractor
	In acid sulphate soil risk areas, dewatering product shall be treated in accordance with specific requirements set out in the Acid Sulphate Soil Management Protocol (Section 7)	During construction	Construction Contractor
	Where metals exceed the aforementioned triggers, dewatering effluent shall be passed through a suitable metals stripping system to reduce concentrations.	During construction	Construction Contractor



Issue	Action	Timing	Responsibility
Disposal	Disposal of dewater product shall be undertaken through use for dust suppression in the first instance.	During construction	Construction Contractor
	Disposal of dewater product shall be undertaken by transport to a Turkey Nest for re-infiltration in the second instance.	During construction	Construction Contractor
	Where disposal to a Turkey Nest is not practicable, dewater product shall be disposed of to ground in a manner that ensures that standing water does not remain present beyond the construction right-of-way for a period of more than 3 days.	During construction	Construction Contractor
	Disposal of trench water shall be undertaken in a manner that shall avoid soil erosion, through the use of flow diffusers and energy dissipaters. Disposal shall avoid damage to remnant vegetation.	During construction	Construction Contractor
	Disposal of dewater product or hydro-test water shall comply with Department of Water (DoW) requirements as set out in Water Quality Protection Note 13 (DoW 2006). In Water Reserves, the water quality should be compatible with the Australian Drinking Water Quality Guidelines 2004 criteria.	During construction	Construction Contractor
Record Keeping	Daily estimates shall be made of volumes abstracted. Field measurements of water levels and physical parameters shall also be recorded along with any visual observations made regarding water quality.	During construction	Construction Contractor
HYDRO-TESTING			
Disposal	Water used for hydro-testing shall be disposed of direct to Turkey Nests for re-infiltration or, if quality of water allows, disposed of to ground in a manner that ensures that erosion is prevented and standing water does not remain present beyond the construction right-of-way for a period of more than 3 days. Disposal will comply with DoW requirements as set out in Water Quality Protection Note 13 (DoW 2006).	During construction	Construction Contractor
	No hydro-test water shall be discharged within areas of conservation value, unless approved by DEC.	During pressure testing	Construction Contractor
	No hydro-test water shall be discharged within areas supporting Threatened Flora or wetlands.	During pressure testing	Construction Contractor

6.5 Dewatering management plans for acid sulphate soil areas

Site specific acid sulphate soil and dewatering management plans are required to be implemented for Loops 9 and 10, and the investigation reports and detailed plans for these loops within each individual stage are included in Appendix 8.



6.6 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
DEWATERING				
Abstraction Volumes	Daily.	Pumps.	To estimate dewatering volumes.	Construction Contractor
Water level	Daily during dewatering in a given area and for a period of 1 week post-dewatering then monthly for a period of 6 months.	Relevant temporary piezometers.	To monitor the impacts of dewatering on water resource.	Construction Contractor
Field pH, EC, total acidity and DO	Daily during dewatering in a given area and for a period of 1 week post-dewatering then monthly for a period of 3 months.	In areas where acid sulphate soils are found, and at relevant temporary piezometers, pump outlets, and holding basin outlets.	To provide an early indication of adverse impacts from dewatering on acid sulphate soils.	Construction Contractor
Laboratory total acidity, total alkalinity, pH, EC, TDS, SO ₄ , Cl, total and dissolved Al, total and dissolved Fe, dissolved As, Cr, Cd, Mn, Ni, Zn, Se, H ₂ S	Prior to commencement of dewatering, at the conclusion of dewatering in each area, 1 week after dewatering activities in a given area cease, then monthly for a period of 3 months.	In areas where acid sulphate soils are found, relevant temporary piezometers, nearby water bodies, pump outlet, holding basin outlet.	To confirm potential long-term impacts from dewatering activities near acid sulphate soils on groundwater and surface water.	Construction Contractor
GROUNDWATER ABSTRACTION – HYDRO-TESTING				
Abstraction Volumes	Daily.	Pumps.	To estimate abstraction volumes.	Construction Contractor

6.7 Contingency actions

Trigger	Action	Responsibility
Long-term deterioration of groundwater/surface water quality	Investigate and identify cause.	Construction Contractor
	Develop and implement a suitable groundwater and soil management strategy to mitigate impacts.	Construction Contractor
Lack of re-infiltration	If re-infiltration of dewatering effluent cannot be achieved through any of the options provided, dewatering effluent shall be disposed of off-site, to an approved location.	Construction Contractor

6.8 Recording


Records shall be kept of all areas where dewatering occurs. These shall include (where practicable): date, location (KP), looping number, UTM, datum (WGS84 or similar), volumes of water abstracted and methods of groundwater treatment. Results of any field testing and stockpile inspections undertaken shall be recorded.



Records shall be kept of the dates of abstraction for hydro-testing water, volumes abstracted and location of disposal.

6.9 Abbreviations

DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
DoW	Department of Water
HDD	Horizontal directional drilling
mBGL	Metres below ground level

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7 ACID SULPHATE SOIL MANAGEMENT PROTOCOL

7.1 Background and environmental risks

Acid sulphate soil is the common name for soil that contains iron sulphide or sulphide oxidation products. When acid sulphate soils are exposed to air and water, the iron sulphides can oxidise to produce sulphuric acid, iron precipitates and groundwater with elevated concentrations of dissolved metals such as aluminium, iron and arsenic. Although these materials are typically benign when undisturbed in their natural environment, the dewatering, excavation and/or stockpiling of acid sulphate soils that lies below the naturally occurring watertable may promote the occurrence of these adverse environmental impacts.

Construction of the Stage 5 Looping of the DBNGP will result in the excavation and dewatering of soils adjacent to the existing DBNGP pipeline in eleven looped sections distributed between Karratha and Wagerup. These activities could potentially result in the oxidation of acid sulphate soils along the portions of the length of the pipeline.

A desktop assessment was undertaken to identify the potential areas where acid sulphate soils were likely to be encountered during construction activities. The potential for occurrence of acid sulphate soils occurring within the proposed excavation footprint was assessed through the use of key indicators such as geology, wetlands, depth to groundwater and vegetation, and classified as HIGH (almost certain), MEDIUM (likely), MED-LOW (possible in isolated circumstances), and LOW (unlikely). The results of the assessment are summarised below:

Table 4-2 Potential occurrence of acid sulphate soils within Stage 5 of DBNGP

Loop	Potential occurrence of acid sulphate soils (km)				Description
	HIGH	MED-LOW	MEDIUM	LOW	
0	15	0	30	71	Acid sulphate soils are likely to be present in association with cracking clays located in the low-lying areas of Loop 0.
1	0	14	0	110	Acid sulphate soils are unlikely to be present in the Loop 1 environment.
2	0	1	0	106	Acid sulphate soils are unlikely to be present in the Loop 2 environment.
3	0	3	0	111	Acid sulphate soils are unlikely to be present in the Loop 3 environment.
4	0	5	0	109	Acid sulphate soils are unlikely to be present in the Loop 4 environment.
5	0	1	0	119	Acid sulphate soils are unlikely to be present in the Loop 5 environment.
6	0	1	0	131	Acid sulphate soils are unlikely to be present in the Loop 6 environment.
7	0	3	0.5	140	Regional mapping indicates that acid sulphate soils may be locally present around the Irwin River where the Irwin Coal Measures outcrop.
8	0	0	0.5	97.5	Acid sulphate soils may be locally present around the low-lying unassessed wetland area surrounding the Moore River.
9	11.5	26.5	69	20	Acid sulphate soils are likely to be present along the Swan Coastal Plain in association with wetlands and Bassendean sands associated with shallow groundwater.
10	3.5	18.5	40	0	Acid sulphate soils are likely to be present along the Swan Coastal Plain in association with wetlands and Bassendean sands associated with shallow groundwater.

Field investigations of medium or higher risk areas in each Loop were subsequently undertaken and found no acid generating soils within Loops 0, 7 or 8. Detailed acid sulphate soil and dewatering management plans were



prepared for the areas of potential acid generation in Loops 9 and 10, and the plans for these individual loops and stages are presented in Appendix 8.

7.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management of acid sulphate soils during excavation and dewatering to achieve the environmental objectives for the acid sulphate soil factor (Section 7.3).

7.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Acidification and release of metals	To ensure that there are no adverse impacts to sensitive receptors as a result of the excavation and stockpiling of acid sulphate soils.	Groundwater and surface water quality near the pipeline is not degraded as a result of soil disturbance activities. No visual acid sulphate soil oxidation impacts result from the stockpiling of acid sulphate soils.

7.4 Management actions

Issue	Action	Timing	Responsibility
Acid Sulphate Soil Surveys	Pre-construction acid sulphate soil surveys shall be undertaken in areas where there is a HIGH or MEDIUM risk of the presence of acid sulphate soils. Results shall be included in the Environmental Line List (ELL) and specific management plans developed for handling soils in these areas.	Prior to clear and grade	DBP
	No excavation or dewatering operations shall commence on any loop until the pre-construction field survey for that loop is complete, site specific acid sulphate soil management plans are approved by DEC and the ELL has been updated with the results of the survey.	Prior to construction	DBP
	Soils in the MED-LOW risk areas with potential for excavation below the watertable shall be in-field tested prior to excavation for field pH (pHF) and field pH after oxidation with hydrogen peroxide (pHFOX) at a rate of 1 sample per 200 m3 of soil expected to be excavated.	Prior to excavation	Construction Contractor
	Acid sulphate soils shall be managed in accordance with both this protocol and the DEC approved site specific acid sulphate soil and dewatering management plans (see Appendix 8).	During construction	Construction Contractor
Trench Management	Segments of the trench that occur within the HIGH, MEDIUM, and MED-LOW acid sulphate soil risk areas shall be excavated in lengths that permit opening and closing of the trench within a period not to exceed 48 hours to minimise the opportunity for the oxidation of soils. A sufficient number of machines capable of backfilling trenches is to be kept immediately available on the relevant loops while trenches are open, with sufficient aggregated backfilling capability to ensure the 48 hour requirement can be met. Note: All machines with backfilling capability are to be pre-rated as to their backfilling capability in terms of kilometres of trench/hour.	During construction	Construction Contractor
Soil Treatment	Soils excavated from the LOW risk areas do not require active treatment or management.	During construction	Construction Contractor
	Soils excavated from the MED-LOW area do not require active treatment or management unless in-field testing indicates that pHF<4 and pHFOX<3. If pHF<4 and pHFOX<3 then the soils shall be: <ul style="list-style-type: none"> underlain by a 0.1 m guard layer of aglime or equivalent before being re-replaced in the trench, or uniformly treated with sufficient neutralising agent using an alternative method approved by the DEC. 	During construction	Construction Contractor



Issue	Action	Timing	Responsibility
	Soils within the MEDIUM and HIGH risk areas that are confirmed to be potentially acid generating as evidenced by a sulphide content: for coarse sandy soils (clay content <5%) of 0.03%S, for sandy loam to light clay (clay content <40%) of 0.06%S and for clayey soils with clay content >40% of 0.1%S shall, in the case of dry soils be uniformly treated with sufficient neutralising agent using a method approved by the DEC. The amount of neutralising agent at any location shall be based on the laboratory defined %S concentration with a 1.5 safety factor. Approved treatment methods include either of the following: 1. Prior to excavation of the trench, a layer of neutralising agent (aglime or lime sands) shall be laid along the trench line, within the width of the expected excavation. The thickness of the neutralising layer shall be based on the laboratory defined %S concentration with a 1.5 safety factor. Excavation of the trench will result in a blended stockpile. The blended stockpile should then all be placed into the trench during backfilling. 2. The excavated soil stockpile shall be uniformly covered with the neutralising agent (aglime or lime sands) immediately upon excavation from the trench. The thickness of the neutralising layer shall be based on the laboratory defined %S concentration with a 1.5 safety factor. The stockpile and covering layer should then all be placed into the trench during backfilling to result in a blended backfill.	During construction	Construction Contractor
	Clays excavated from within the MEDIUM and HIGH risk areas that exhibit a sulphide content >0.03%S and <0.1%S shall not require active treatment or management unless visual signs of sulphide oxidation arise during the stockpiling period.	During construction	Construction Contractor
Dewatering and water disposal	Dewatering and water disposal in areas of identified Acid Sulphate Soil shall be carried out in accordance with the Dewatering and Water Disposal Management Protocol (Section 6).	During construction	Construction Contractor
Record Keeping	Records shall be kept of the source, type and volume of neutralising agent supplied for the project. The Effective Neutralising Value (ENV) of the neutralising agent will be provided by the supplier and kept on record.	During construction	Construction Contractor
	Records shall be kept of daily excavation lengths, neutralising rates and areas, and stockpile inspections. Photographs shall be taken to demonstrate protocols have been followed.	During construction	Construction Contractor

NOTE: The above management actions only apply to acid sulphate soils that occur below the natural watertable.

7.5 Site specific acid sulphate soil management plans

Site specific acid sulphate soil and dewatering management plans are required to be implemented for Loops 9 and 10, and the investigation reports and detailed plans for these loops within each individual stage are included in Appendix 8.

7.6 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Sulphide oxidation	Daily.	Stockpiles.	To confirm that sulphide oxidation does not occur as a result of stockpiling activities.	Construction Contractor
pHF and pHFOX	1 sample per 200 m3 of soil excavated.	MED-LOW risk areas.	To confirm that acid sulphate soils are not present.	Construction Contractor
Trench backfilling capability	Daily while any trench is open in HIGH, MEDIUM, and MED-LOW acid sulphate soil risk area	On Loops with identified acid sulphate risk	To demonstrate capability to backfill trench within 48 hours of opening, if required	Construction Contractor



Parameter	Frequency	Location	Purpose	Responsibility
Source, type, ENV and volume of neutralising agent used	On application to trench	On Loops with identified acid sulphate risk	To demonstrate compliance with required treatment rates	Construction Contractor
Daily excavation lengths, neutralising rates and areas, and stockpile inspections. Photographs shall be taken to demonstrate protocols have been followed.	Daily when trenches open in acid sulphate soil risk areas	On Loops with identified acid sulphate risk	To demonstrate compliance with required treatment rates and protocol	Construction Contractor

7.7 Contingency actions


Trigger	Action	Responsibility
Trench remains open for longer than 48 hours	Investigate cause of trenching delay.	Construction Contractor
	Stockpiles shall be tested daily for pH _F at a rate of 1 sample per 200 m ³ of stockpiled soil. If pH _F <4 then the stockpile shall be covered with a guard layer of neutralising material.	Construction Contractor
Unexpected soils	If any soil types are encountered in the MEDIUM or HIGH risk areas during the excavation works that are not representative of the material sampled during the acid sulphate soil investigation, these soils shall be treated as acid generating and neutralised by layering with a neutralising material (aglime or lime sands) at 0.5 m intervals upon re-emplacement in the trench. The thickness of the neutralising layers shall be 0.05 m/layer.	Construction Contractor
Unquantified Neutralising Agent	If the ENV of the neutralising agent is not provided by the supplier, 1 sample for every 500 m ³ of neutralising agent shall be collected and analysed for Calcium Carbonate Equivalence by a NATA accredited laboratory to determine the ENV of the material.	Construction Contractor

7.8 Recording

Records shall be kept of all areas where active acid sulphate soil management occurs. Records to be kept shall include (where practicable): date, location (KP), looping number, UTM, datum (WGS84 or similar), volumes of neutralising agent used, volume of soil treated, soil type and photographic evidence of the soil management process to confirm adherence to the protocol. Results of any field testing and stockpile inspections undertaken shall be recorded.

7.9 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline
 DEC Department of Environment and Conservation
 DMP Department of Mines and Petroleum
 ELL Environmental Line List
 ENV Effective Neutralising Value
 pH_F Field pH
 pH_{FOX} Field pH after oxidation with hydrogen peroxide

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8 FAUNA INTERACTION PROTOCOL

8.1 Background and environmental risks

Construction of the Stage 5 Looping of the DBNGP requires clearing and grading, excavation, pipe-laying, backfilling, hydrotesting, rehabilitation and commissioning activities to be undertaken adjacent to the existing DBNGP pipeline in eleven looped sections distributed between Karratha and Wagerup. There will be a requirement for construction camps, stockpile sites, small worksites, access roads and water storage facilities (turkey nests) associated with these works. Looping construction could potentially affect indigenous and feral fauna in a number of ways, including:

- death/injury of fauna from impact with vehicles
- spread of weeds and feral fauna along cleared line
- fragmentation of habitat (temporary)
- loss of habitat (generally temporary, however, the necessary removal of large habitat trees may result in some permanent habitat loss)
- increase in indigenous and feral fauna due to provision of water in “turkey nests” (temporary)
- entrapment in trenches excavated to receive the pipeline with potential for stress, and mortality through exposure or increased predation (temporary)
- disturbance of fauna in nearby areas from light, noise and even by personnel feeding selected species (temporary).

Rare or endangered fauna species are protected by the *Wildlife Conservation Act 1950* (Wildlife Act), some of which are also listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). EPBC Act listed species potentially occurring along the DBNGP corridor are listed in Table 4-3.

Table 4-3 EPBC Act listed Threatened and/or Migratory Fauna species potentially occurring along the DBNGP corridor

Species	Loop species likely to occur along	Species	Loop species likely to occur along
Western Spiny-tailed Skink	2, 3, 4, 5, 6, 7, 8	Oriental Plover	0, 1, 2, 3, 4, 5
Malleefowl	2, 3, 4, 5, 6, 7, 8, 9, 10	Oriental Pratincole	0, 1, 2
White-bellied Sea-eagle	All	Slender-billed Thornbill	2, 3, 4, 5, 6, 7
Little Curlew	0, 1, 2	Barn Swallow	0, 1
Common Greenshank	All	Mulgara	0, 1, 2, 3, 4, 5
Northern Quoll	0, 1	Carnaby’s Black Cockatoo	5, 6, 7, 8, 9, 10
Chuditch	7, 8, 9, 10	Baudin’s Black Cockatoo	8, 9, 10

A cleared access track near the pipeline will be retained for maintenance purposes. The existing track may be relocated within the pipeline easement to cater for access to two pipelines.

8.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management of interactions between people/machinery and fauna so that the above effects on fauna are minimised, to achieve the environmental objectives for the fauna factor (Section 0).



The fauna inspection and clearing protocols associated with the trenches, including time limits on trench openings, do not apply to “bell holes”²⁸ left open where pipe strings are joined, at valve pit installation points, etc., which would be managed in the same fashion as any point excavations associated with maintenance of the existing pipeline facility. For safety purposes, bell holes are required to be constructed with ramps to enable construction personnel to safely egress. These ramps also prevent entrapment of fauna.

For the purposes of this protocol:

- “trench” refers to any open excavation deeper than 50 cm below the working surface of the construction right-of-way, intended to contain the gas pipeline or containing the gas pipeline
- “fauna” refers to native vertebrate fauna and feral fauna refers to predatory species, such as foxes, cats, etc.
- “habitat trees” refers to trees with a trunk of diameter greater than 30 cm at breast height, irrespective of evidence of use or potential for use by fauna.

8.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Fauna habitat	To minimise the temporary and permanent reduction or fragmentation of existing fauna habitat.	No habitat trees, or parts of habitat trees, other than those in the direct line of the proposed pipeline or that materially interfere with construction of the pipeline to be removed. No vegetation clearing to be undertaken outside approved areas.
Direct fauna impacts	To minimise the direct impacts on fauna through impacts with vehicles, entrapment in construction works, or extraordinary exposure to predators.	Vehicle speeds limited on unformed access tracks and construction worksite. Pipeline trenches to be open for a limited period of time. Achievement of fauna inspection and clearing requirements. Adherence to injured animal protocol.

8.4 Management actions

Issue	Action	Timing	Responsibility
Fauna surveys	Pre-construction fauna surveys shall be undertaken in areas where significant species are considered likely to occur, and specific management plans developed for handling each species. No clear and grade operations shall commence on each loop until the pre-construction field survey is complete for that loop, preservation markings on vegetation to be retained (e.g. habitat trees, Threatened Flora, TECs) are affixed and the Environmental Line List (ELL) updated with the results of the survey.	Prior to construction	Construction Contractor
	WA Museum shall be advised of the project and specimens collected as requested by the Museum.	Prior to construction	Construction Contractor
Inductions	All field staff are to be made familiar with the fauna interaction protocol.	During induction	DBP and Construction Contractor

²⁸ Bell holes are constructed where pipe strings are joined, at mainline valves, at major bends, at inlets for hydrotesting, at facilities crossings, and where loop ends are tied into the existing pipeline or compressor station. Bell holes are usually benched and have ramped access points that enable personnel to enter the trench but also provide points for entrapped wildlife to leave the trench. Bell holes will be required, on average, every 500 m along the pipeline.



Issue	Action	Timing	Responsibility
Vehicle impact	Clearing shall not occur outside authorised clearing areas.	At all times	Construction Contractor
	Vehicle speeds shall not exceed 60 km/h in the construction right-of-way ²⁹ or walking pace in active construction areas.	At all times	All drivers
	Vehicle drivers and construction staff shall arrange translocation (by licensed handlers) of fauna observed in construction area.	As required	Vehicle drivers and construction staff
Loss of habitat	Habitat trees within or immediately adjacent to any construction areas shall be marked by the fauna handling team and the relevant Regional Office of DEC advised with opportunity to comment. Marked trees shall not be felled except where they materially interfere with construction of the pipeline, or are a safety concern. All habitat trees identified for felling within DEC managed estate will require signoff by the local DEC district representative.	Prior to clearing and grading	Construction Contractor
	Fauna handlers to inspect habitat trees for fauna immediately prior to felling and shall be present during felling to translocate fauna as required.	During clearing and grading	Construction Contractor
	Any habitat trees with nesting hollows that are felled are to have the hollow removed and attached to a suitable nearby tree, if available.	Prior to clearing and grading	Construction Contractor
	Prune habitat trees that overhang construction areas, rather than remove them, where practical. Pruning is to be undertaken with the 'three cut method' to prevent bark stripping (see Figure 4-2).	As required	Construction Contractor
	Areas of conservation value shall be rehabilitated in accordance with the Rehabilitation Protocol (Section 18).	Immediately following construction	Construction Contractor
Entrapment in pipeline	Pipes shall be inspected by fauna handlers prior to welding and observed fauna removed.	Prior to welding	Construction Contractor
	Welded pipeline sections shall be capped at end of shifts to prevent fauna entry.	Immediately following welding and weld testing	Construction Contractor
Entrapment in trenches	Where practicable to do so, open trenching in Loops 0 to 2 shall be avoided between the months of November to March to minimise fauna stress or deaths during the summer months.	November to March	Construction Contractor
	Fauna shelters/refuges (eg: cardboard boxes, hessian bags, commercial egg cartons) shall be placed in open trenches at intervals not exceeding 100 m unless alternative arrangements are agreed with DMP in consultation with DEC on a loop by loop basis.	Immediately following trenching	Construction Contractor
	Trench plugs and fauna exit ramps shall be installed at both ends of trenches at intervals not exceeding 1200 m and ramp slopes are not to exceed 45° unless alternative arrangements are agreed to with DMP in consultation with DEC, on a loop by loop basis.	During trench excavation	Construction Contractor
	Open trenches shall be inspected and cleared by fauna handling teams by: <ul style="list-style-type: none"> Loops 0 – 7: 4.5 hours after sunrise Loops 8 – 10: 5.0 hrs after sunrise. Trench clearing shall be managed in accordance with Section 8.10.	Daily when trenches are open	Construction Contractor

²⁹ The construction right-of-way is the area that has been or is being cleared for active works for the construction of the pipeline. It is typically a 30 m wide corridor with a reduced width in specified areas to minimise environmental impacts.



Issue	Action	Timing	Responsibility
	If open trenching is undertaken in Loops 0 to 2 during November to March, trenches shall be inspected and cleared by 3 hours after sunrise, except if the maximum daily temperature is forecast to exceed 35°C, then trenches shall be inspected and cleared by 2.5 hours after sunrise.	November to March	Construction Contractor
	Trench inspections procedures shall ensure inspection of the entire base of the trench, with attention to evidence of burrowing reptiles, and inspection of all shelters/refuges.	All inspections	Construction Contractor
	Open trench lengths shall not exceed lengths capable of being practically inspected and cleared in accordance with this protocol by the available fauna teams at any time.	During construction	Construction Contractor
	In all conservation areas and in vegetated bushland areas in Loops 8 – 10, trenches shall not be left open during construction breaks that exceed three days duration.	Construction breaks	Construction Contractor
	No part of the trench, other than “bell holes”, shall remain open for more than 14 days unless such an exceedance can be demonstrated as being unavoidable under the prevailing circumstances and approval is obtained from the CEO of the DEC ^{30,31} .	During construction	Construction Contractor
	In environmentally sensitive areas, no part of the trench shall remain open for more than 7 days unless such an exceedance can be demonstrated as being unavoidable under the prevailing circumstances and approval is obtained from the CEO of the DEC ³² .	During construction	Construction Contractor
	The occurrence of water in trenches shall be managed by taking action to avoid the development of any individual water bodies longer than 100 m in length ³³ .	While trench open	Construction Contractor
	Where a trench contains water and is not dewatered, the trench shall not remain open for longer than 7 days, except within wetlands and environmentally sensitive areas where it shall not remain open for longer than 48 hours.	While trench open	Construction Contractor
	Open trench shall be inspected by construction contractor immediately prior to lowering in and any entrapped fauna cleared by a fauna handler before lowering in can be completed.	Prior to lowering in	Construction Contractor
	Open trench shall be inspected by construction contractor half an hour prior to backfilling and any entrapped fauna cleared by a fauna handler before backfilling can be completed.	Prior to backfilling	Construction Contractor
Spread of weeds	The Weed, Pest and Dieback Management Protocol shall be implemented (Section 4).	As required	Construction Contractor
Fauna access to turkey nests	All turkey nests and dams shall be fenced.	As required	Construction Contractor
Weekly reports	Weekly reports on fauna interactions shall be provided to the Environmental Management Branch and the relevant Regional office of DEC no later than one week after the period covered by the report.	Weekly	DBP

³⁰ Routine construction breaks in areas other than conservation areas are considered as being demonstrably unavoidable.

³¹ CEO Approval has been obtained for trenches to remain open for up to 21 days in areas where rock is encountered, such that trenching is slowed down. See Section 8.5 for details of approval and associated requirements.

³² CEO Approval has been obtained for trenches to remain open for up to 10 days in environmentally sensitive areas where rock is encountered, such that trenching is slowed down, and for up to 14 days in the Melaleuca Park and Ellenbrook Landscape Conservation Areas. See Section 8.5 for details of approval and associated requirements.

³³ Use of soil “islands” or floating refuges would be an acceptable method of managing water body lengths in situations where dewatering of the trench is not to be undertaken.



Issue	Action	Timing	Responsibility
Adverse weather	Daily checks of Bureau of Meteorology flood forecasts shall be undertaken. In the event of flooding being forecast for areas with open trench, the contingency action (Section 8.7) shall be implemented.	Daily	Construction Contractor
Other	Rubbish shall be managed in accordance with the Waste Management Protocol (Section 15).	At all times	Construction Contractor
	The feeding of animals, hunting, or keeping of firearms or pets on the construction site and camps is prohibited.	At all times	Construction Contractor

8.5 Approvals for extended trench open times

Approval of the Chief Executive Officer (CEO) of the Department of Environment and Conservation has been obtained to extend the time that trenches may be left open where trenching in rock (any loop). In areas where blasting or other rock breaking measures are required to excavate the trench, trenches may remain open for a maximum of 21 days, with the exception of trenches located in environmentally sensitive areas, in which case trenches may remain open for a maximum of ten days. In addition, approval has been obtained for trenches within the Melaleuca Park and Ellenbrook Landscape Conservation Area to remain open for a maximum of 14 days.

Where the extended times are to be implemented, the following management actions are required:

1. The Environmental Management Branch of the DEC and the relevant DEC regional office is to be informed via DBP on each occasion the extended time is to be implemented, including an explanation of the reasons for that occurrence.
2. Fauna refuges are to be placed in trenches at spacing no greater than 50 m.
3. Fauna inspections are to be conducted twice daily, with the first inspections to be undertaken in accordance with the requirements set out in Section 8.4. The second inspection and clearing is to be undertaken daily between the hours of 3:00 pm and 6:00 pm.
4. The requirements for the second inspection and clearing are to be reviewed after ten days of implementation in consultation with DBP and the DEC and may be consequently modified with the approval of the DEC Regional Manager and the Owner's Representative.



8.6 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Trench open lengths and locations (trench start and end locations by KP points)	Daily	All open trenches	To demonstrate compliance with time limits on open trenches	Construction Contractor
Trench plug locations (by KP point)	Daily	All open trenches	To demonstrate compliance with trench plug requirements	Construction Contractor
Bell hole locations	Daily	All open trenches	To demonstrate compliance with time limits on open trenches where extended by crew breaks	Construction Contractor
Areas of rock excavation (by KP point)	Daily	All open trenches	To demonstrate compliance with time limits on open trenches in rock areas	Construction Contractor
Break periods for pipe laying and backfilling crews	Daily	All open trenches	To demonstrate compliance with time limits on open trenches where extended by crew breaks	Construction Contractor
Vehicle interactions	As occurs	All access and construction roads	To record incidences of vehicular contact with fauna	All drivers
Habitat tree removal	During clear and grade	All access and construction roads	To record removal of fauna habitat	Construction Contractor
Fauna entrapment incidents and actions taken	Daily	Pipes prior to welding Open trenches Constructed water sources	To record fauna entrapment and clearing incidents	Construction Contractor
Reports on fauna inspections, interactions, mortalities, opportunistic sightings and all actions taken	Weekly	All	To advise DEC	Construction Contractor
Performance monitoring reports on fauna management	Monthly reporting, to be made publicly available on completion of each Loop	Each Loop in which construction is being undertaken	To inform public	Construction Contractor
Fauna handler licence register	Maintained up to date	On each loop	To record staff authorised to perform duties as an experienced fauna handler (see Section 8.8)	Construction Contractor
Fauna handler training register	Maintained up to date	On each loop	To record staff authorised to perform duties as an assistant fauna handler (see Section 8.8)	Construction Contractor



Parameter	Frequency	Location	Purpose	Responsibility
Pre-pipe laying and backfilling fauna inspection register	Maintained up to date during pipe laying and backfilling operations	On each loop during pipe laying and backfilling operations	To record inspections of trench for entrapped fauna immediately prior to pipe-laying and/or backfilling	Construction Contractor
Digital photographs ³⁴ of fauna teams with required fauna handling equipment (hoop and bag)	Weekly during fauna inspection and clearing activities	On each loop during periods that trenches are open	To provide evidence of use of required equipment for audit purposes	Construction Contractor

8.7 Contingency actions

Trigger	Action	Responsibility
Weekly fauna mortality rate exceeds 5% for two consecutive weeks on any loop where the weekly fauna interaction rate exceeds 25/week [#] .	Advise DEC as soon as practically possible in order to determine a possible cause and implement appropriate and timely contingency measures.	DBP
Request to any query from DEC regarding fauna interaction or mortality rates.	Respond to DEC query.	DBP
Death of any <i>Wildlife Conservation Act 1950</i> or EPBC Act listed species	Advise DEC regional staff as soon as practically possible.	DBP
Injured animals	Injured animals shall be reported to the fauna team in the first instance and assessed by an experienced zoologist to determine whether translocation, transfer to wildlife carer or euthanasia is the required action, and that action shall be implemented (see Sections 8.10 and 8.11). If the injured fauna is of conservation significance, the regional DEC office shall be advised.	All drivers

8.8 Fauna teams

Daily trench inspections and fauna handling shall only be undertaken by teams of a minimum of two people. At least one person in each team must be able to demonstrate experience in:

- fauna identification, capture and handling (including venomous snakes)
- identification of tracks, scats, burrows and nests of conservation significant species (i.e. mulgara or malleefowl)
- fauna vouchering
- assessing injured fauna for suitability for release, rehabilitation or euthanasia
- familiarity with the ecology of the species that may be encountered in order to be able to appropriately translocate fauna encountered
- performing euthanasia
- interacting with venomous snakes.

³⁴ Original digital photographs should be retained to ensure files contain details of photograph (date and time taken, etc.).



The means of demonstrating the required experience shall be through the holding of a Section 15 *Licence to take fauna for public purposes*, under the Wildlife Conservation Regulations 1950, issued specifically for the purposes of fauna capture and release on the DBNGP Stage 5 Looping Expansion, and based on having the required experience as above.

Basic fauna handling training is to be provided to all members of fauna handling teams who do not possess the above experience. This training is to be provided before team members are employed in fauna inspection or clearing activities, in accordance with a DEC approved training package. Experienced fauna handlers are to conduct training, unless otherwise authorised by DBP.

An experienced zoologist or veterinarian shall be available for consultation on fauna handling matters as required. The zoologist need not be located on site.

8.9 Fauna handling and inspections

Fauna handlers shall be equipped with a hoop-bag for capturing animals, a snake jigger, and means of inspecting fauna shelters without the need to enter the trench.

Trench inspections and clearing could, on average, be expected to progress at walking pace (≈ 3 km/hr). Based on the 4.5-hour clearing period in the northern sections, trench lengths of about 13.5 km can be managed per fauna team. In the southern sections, trench lengths of about 15 km/team can be managed during the 5-hour clearing period. Based on this, limitations on the lengths of trench permitted to be open at any one time can be related directly to the number of fauna teams available.

Inspections, other than those associated with the required daily trench inspections, may be carried out by any personnel employed on the site. Fauna handling shall only be undertaken by an experienced member of any fauna team, or under the direct supervision of an experienced fauna handler.

Pre-pipe laying and backfilling inspections may be carried out by any person, however, any fauna found in the trench are to be immediately reported to the fauna handling team and removal arranged before pipe laying or backfilling is undertaken at that location.

8.10 Translocation and release

Where animals are to be captured for immediate translocation, this shall be done in a manner that will minimise stress and risk of injury to both the animal and the handler. Translocation shall be immediate to suitable habitat at a suitable distance from the disturbance, on advice from an experienced zoologist.

There may be a trade-off between distance from disturbance (and, therefore, chance of re-encounter) and habitat or species requirements (and, therefore, species' survival). For small species, species with small home ranges, or species that have reasonably specific habitat requirements, this may mean that the optimum release point is near the point of disturbance. For example, species from rocky habitats need to be released in rocky habitats even if these lie only 20 – 30 m from the pipeline route.

For large species, species with broad home ranges, or species that have broad/general habitat requirements, the release point could be over 100 m from the pipeline route. In uniform habitat, practicality may determine the appropriate release distance. A suitably experienced zoologist with a sound working knowledge of fauna ecology and requirements shall be responsible for the management of this process. They shall also be responsible for deciding if an injured animal should be released or dealt with in another way (see below).

8.11 Injured animals

In some instances, injured animals may be found. If the injuries to an animal are so serious that it is decided that the animal will not survive if released, transfer to a wildlife carer may be appropriate in some cases. The same situation would apply with nesting birds and orphaned joeys. The alternative to caring for such fauna would be euthanasia (see below).



Transfer to a wildlife carer

Transfer of injured or orphaned fauna to a wildlife carer will be dependent upon a number of factors, including:

1. **Location.** In remote areas (Loops 0 to 6), there is unlikely to be access to a wildlife carer. Where there is no ready access to a wildlife carer, euthanasia may be the only option (see below). There may be ready access to a wildlife carer in other areas.
2. **Species.** Decisions to rehabilitate or not rehabilitate wildlife shall be made by a suitably experienced/trained zoologist, in consultation with DEC in the case of rare species.
3. **Introduced species.** As a policy, injured introduced species should be euthanased (see below).

A directory of recognised DEC wildlife carers shall be distributed to relevant project construction personnel.

Euthanasia

If an experienced zoologist/veterinarian advises that rehabilitation is not an option for an injured or orphaned animal because it is an introduced species or because access to a carer is not possible or justified, then euthanasia is the only option. Injured animals shall not be left to suffer.

Transferring injured animals to a veterinarian is unlikely to be a viable option in most cases, unless the animal is located near a veterinary clinic, as an animal is likely to suffer during such transportation.

Euthanasia shall be carried out by a suitably qualified person and shall be consistent with animal welfare legislation and DEC guidelines (e.g. Chapman *et al.* 2005). All fauna handlers shall have access to this document.

In most cases, dead animals, either found during operations or euthanased, shall be removed from the immediate vicinity of activity to prevent carrion feeding species being attracted to areas where they may, in turn, be injured. Carcasses shall be incinerated or buried.

8.12 Recording

Records shall be kept of all animals encountered during fauna management operations. Opportunistic listings of fauna (native and introduced) shall also be kept, including bird lists. Detailed records shall be made of animals handled. Records to be kept shall include (where practicable): date, location (KP), looping number, UTM, datum (WGS84 or similar), species, vegetation and landform, and any notes such as the form of encounter and details regarding release. Photographs shall be taken of any unidentifiable species.

The WA Museum shall be contacted prior to operations commencing at each Loop to determine if there are any species of which specimens may be required. The Museum will also be able to advise on how specimens should be preserved, however frozen material is usually acceptable. A GPS shall be used to note the collection location of museum-bound specimens.

Weekly reports on fauna interactions, together with any information on opportunistic sightings shall be forwarded weekly to the Environmental Management Branch of DEC. Monthly performance monitoring reports on fauna management shall be produced for each Loop in which construction is being undertaken, and made publicly available. A final summary report shall also be forwarded to the relevant regulatory agencies on completion of the project.

8.13 EPBC Act listed threatened and/or migratory species

The actions described in this protocol are considered adequate to cover the management of Threatened and/or Migratory Fauna species listed under the EPBC Act; no additional species-specific management is considered necessary.

8.14 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline
DEC Department of Environment and Conservation



DMP Department of Mines and Petroleum
ELL Environmental Line List
EPBC Act *Environment Protection and Biodiversity Conservation Act 1999*
TEC Threatened Ecological Community



9 WATERCOURSE CROSSING MANAGEMENT PROTOCOL

9.1 Background and environmental risks

The DBNGP runs north-south from Dampier to Bunbury and crosses a number of ephemeral and permanent watercourses. Crossing the watercourses may result in disturbance of the beds and banks, increasing the risk of erosion and disturbance of riparian vegetation, which may result in a reduction of water quality.

Two methods are proposed to be undertaken to cross watercourses, with the methods adopted based on the geotechnical characteristics of the site, the environmental significance of the watercourse, the potential for environmental impacts as a result of the activity and expected water flow during construction. The methods proposed involve:

- open trenching
- horizontal directional drilling (HDD).

The environmental impacts associated with both open trenching and HDD are likely to be temporary, although trenching is likely to be more disruptive to the bed and banks of the watercourse. HDD cannot be undertaken where the geotechnical characteristics of the site may result in the possibility of drilling fluid escaping through the bed of the watercourse. Generally, trenching will be undertaken on the smaller and ephemeral watercourses, with HDD likely to be undertaken on the Swan, Canning and Murray Rivers. The method to be adopted for the individual sites will be determined by the Construction Contractor on a site specific basis.

Due to the environmental risk associated with both open trenching and HDD, specific management is required to minimise the potential for environmental impacts to result from the construction activities.

The construction right-of-way through watercourses will be substantially wider than in other areas, to facilitate space for the excavation necessary to establish a working surface close to the pipeline trench invert, and to provide areas to store excavated material.

9.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management and protection of watercourses, water quality and dependent ecosystems, including minimisation of disturbance of riparian vegetation. The protocol will apply where outlined in the Environmental Line List (ELL).

9.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Disturbance to watercourses	Minimise and manage disturbance of watercourses.	No adverse impacts (for example to downstream ecology or land use) resulting from water body flow reductions or diversions as a result of pipeline construction activities. No change in water body flows. No erosion of the water body intersecting or adjacent to the pipeline construction right-of-way. Minimal disturbance of riparian vegetation.
Contamination of watercourses	Prevent contamination of watercourses from construction activities.	No direct discharge of dewatering water to watercourses. No decrease in water quality attributable to construction activities. No significant (in excess of 80 litres near wetlands and rivers) spills or leaks of hydrocarbons during construction and rehabilitation operations outside of areas designated for maintenance, refuelling or storage.



9.4 Management actions

Issue	Action	Timing	Responsibility
General requirements	The induction program shall involve a watercourse management component to ensure all personnel are aware of the requirements for the protection of watercourses.	Induction	Construction Contractor
	Watercourse crossings shall be scheduled during dry conditions or low flow periods wherever practicable.	As required	Construction Contractor
	Erosion control measures shall be installed as required to protect sites near the pipeline corridor.	Prior to construction	Construction Contractor
	A watercourse crossing rehabilitation and wet crossing plan shall be prepared and submitted to DoW for approval. The plan should set out the rehabilitation procedure for all major watercourse crossings and should include geotechnical survey data, stabilisation techniques and revegetation plans. The plan should also set out the detailed procedures to be applied where crossing watercourses that contain water is to be prepared for the approval of the DoW (wet crossing procedure). The procedures are to ensure that there is no adverse effect on the flow available to downstream users in terms of either quantity or quality. The procedures will set out the methods to be employed, including flow bypass methods, i.e.: trenches, pumps etc. Detailed requirements for the procedures are set out in Section 9.4.1 below. A previously approved plan is provided in Appendix 14 and may be adopted by the Construction Contractor to satisfy the requirements of this management action.	Prior to construction commencing	Construction Contractor
	Major watercourse crossings in northern loops shall be avoided during the cyclone season (October to March) unless agreed with DoW.	October to March	Construction Contractor
Survey, fencing and service location	Riparian vegetation along watercourses which will be traversed will be delineated on the ground and the relevant Regional Office of DEC advised with opportunity to comment.	Prior to construction	Construction Contractor
	Vehicular intrusion into the riparian zone and along stream banks shall be limited through fencing or flagging, and/or signage.	At all times	Construction Contractor
	Vehicles accessing watercourse areas shall keep to existing tracks, and use existing crossings when traversing waterways.	At all times	Construction Contractor
	Watercourses and riparian zones shall only be accessed along the construction right-of-way.	At all times	Construction Contractor
	A buffer zone extending 200 m from each bank of all watercourses identified in the ELL along the construction right-of-way shall be flagged and signposted.	Prior to construction activities	Construction Contractor
	The total area of proposed disturbance shall be marked out with survey pegs and flagging so as to delineate the areas of construction activity.	Prior to ground disturbing activities	Construction Contractor
	Habitat trees shall be marked in accordance with the Flora and Vegetation Management Protocol (Section 3).	Prior to ground disturbing activities	Construction Contractor
Fuel storage, handling and refuelling	Fuel storage and handling shall be consistent with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14). No storage of fuel or hydrocarbons shall occur within 200 m of a watercourse.	At all times	Construction Contractor
	Refuelling of any plant within 200 m of a watercourse is to be undertaken in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14).	At all times	Construction Contractor



Issue	Action	Timing	Responsibility
Soil management	Soil management shall be in accordance with the Soil Management Protocol (Section 16).	As required	Construction Contractor
	Topsoil shall be cleared from any area within the watercourse buffer zone to be subject to disturbance and stockpiled separately from subsoil to avoid soil profile inversion on backfilling.	As required	Construction Contractor
Vegetation	Vegetation management shall be in accordance with the Flora and Vegetation Management Protocol (Section 3).	As required	Construction Contractor
	Watercourses may be used for access; however, clear and grade activity beyond the width required for access through major watercourses shall be left until the special crossings crew arrives on site to carry out the works unless specifically approved by DBP.	As required	Construction Contractor
	Cleared and pruned vegetation shall be stockpiled on-site for later use in bank stabilisation and rehabilitation.	As required	Construction Contractor
	Cleared and pruned vegetation shall be placed and secured over the disturbed areas of the mid-stream banks to stabilise and minimise erosion when the river is in flood and to encourage the re-establishment of mid-stream vegetation.	As required	Construction Contractor
	HDD drill entry and exit points shall be located to avoid impact on riparian vegetation and heritage areas.	At all times	Construction Contractor
Trenching and excavation	When surface water is present, diversion berms or drains shall be installed to divert water away from the construction area.	As required	Construction Contractor
Drilling	HDD drill site, entry and exit points shall be located away from watercourse banks and riparian areas, as far as practicable.	As required	Construction Contractor
	Prior to commencement of works HDD equipment shall be inspected to ensure it is in good working order.	Daily	Construction Contractor
	The drilling site shall be completely contained within an appropriate earthen bund. Topsoil must not be used in the construction of the bund.	At all times	Construction Contractor
	Drill entry and exit points shall be monitored during drilling for potential fracturing out of drilling mud.	At all times	Construction Contractor
	Only water based drilling fluids shall be used and shall be contained in mud tanks or pits and de-sanded and recirculated during drilling.	At all times	Construction Contractor
	Drilling mud and cuttings shall be disposed of consistent with the Waste Management Protocol (Section 15).	At all times	Construction Contractor
Erosion	Removal of riparian, bank and in-stream vegetation should be minimised where ever possible to reduce the risk of erosion and to assist in maintaining the stability of river beds and banks.	At all times	Construction Contractor
Clean-up and rehabilitation	Rehabilitation of watercourses shall be undertaken as set out in the DoW approved plan referred to under the <i>General requirements</i> section of these Management Actions.	As required	Construction Contractor
	Cleared and pruned vegetation shall be placed over the disturbed areas of banks to stabilise and minimise erosion when the river is in flood and to encourage the re-establishment of vegetation, unless this action is inconsistent with the DoW approved plan referred to under the <i>General requirements</i> section of these Management Actions.	Following backfilling	Construction Contractor
	As far as practicable the river beds and banks shall be landscaped to their former pre disturbance condition and best practice will be followed to ensure that watercourse crossings retain their form and function, unless this action is inconsistent with the DoW approved plan referred to under the <i>General requirements</i> section of these Management Actions.	At all times	Construction Contractor



Issue	Action	Timing	Responsibility
	Pre-construction equivalent stability, channel profile and bed composition shall be achieved wherever practicable.	At all times	Construction Contractor
	The banks shall be reinstated in the same manner as the original pipeline construction using hessian bags filled with a combination of sand and cement, unless otherwise approved by DBP and the action is consistent with the DoW approved plan referred to under the <i>General requirements</i> section of these Management Actions.	As required	Construction Contractor
	Backfill crown shall be graded and shaped as closely as practicable to pre-existing contours and flow patterns of riverbed and riparian zone.	At all times	Construction Contractor
	Particular care shall be taken with erosion and sediment control in waterway zones when implementing rehabilitation measures.	At all times	Construction Contractor

9.4.1 Wet crossing procedure requirements

The Department of Water requires that the Wet Crossing Procedure must contain the following:

1. Survey and soil information: Channel profile, soil characteristics
2. Crossing techniques: Diagrams and examples of the types of crossing techniques used.
3. Wet crossing procedures (only required where the watercourse is flowing, or has shallow groundwater): Specific protocols to ensure downstream flow, erosion control for any pipe structures, turbidity control measures and protocols to maintain water quality.
4. Erosion control measures: Examples of erosion control measures for bed and bank stabilisation, erosion control for trench spoil, erosion control for pipes and culverts. Where possible, soft engineering techniques should be used, such as brush matting, organic geotextiles, sand filled hessian bags and revegetation.
5. Rehabilitation: Restoration of channel form and revegetation with native species.
6. Monitoring: Watercourse crossings should be monitored to ensure that stabilisation is adequate and rehabilitation is complete. Monitoring should be conducted quarterly and after significant flow events.

9.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Photographic evidence and GPS coordinates of on-ground delineation of proposed disturbance areas within and adjacent to watercourses	Prior to ground disturbance on relevant loop	All areas of proposed disturbance of native vegetation associated with watercourses	To record incidences of clearing of vegetation and/or flora outside approved construction areas	Construction Contractor
Inspection	Opportune	Drilling sites	Ensure mud and drilling fluids contained	Construction Contractor
Rehabilitation effectiveness	After first significant flow event following rehabilitation	All major river crossings	To confirm effectiveness of rehabilitation	DBP




9.6 Contingency actions

Trigger	Action	Responsibility
Erosion/sedimentation	Initiate control measures to prevent further erosion/sedimentation.	Construction Contractor
	Undertake remedial action.	Construction Contractor
	Investigate and update protocol as required.	Construction Contractor
Uncontrolled release of drilling mud or fluid	Cease operations.	Construction Contractor
	Stop mud entering watercourse.	Construction Contractor
	Investigate cause.	Construction Contractor
	Undertake required remedial action.	Construction Contractor
	Investigate and update protocol as required.	Construction Contractor
Complaints	Should DBP or DoW receive a complaint of low flow or silt problems etc., the company will audit /review their on the ground practices to ensure they are not contributing or causing the problem and then report their findings to the DoW within 7 days of receiving the complaint. If the audit identified they were causing the problem they would also advise the DoW on what action they have taken to rectify the problem and prevent it happening again.	DBP

9.7 Abbreviations

- DBNGP Dampier-Bunbury Natural Gas Pipeline
- DEC Department of Environment and Conservation
- DMP Department of Mines and Petroleum
- DoW Department of Water
- ELL Environmental Line List
- HDD Horizontal directional drilling

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10 DUNE CROSSING MANAGEMENT PROTOCOL

10.1 Background and environmental risks

The DBNGP runs north-south from Dampier to Bunbury and crosses areas with potentially mobile sand dunes in Loops 4 and 6. In these areas, the cover over the pipeline may need to be more than the nominal 850 mm to ensure future mobilisation of the dunes does not expose the pipeline. In these circumstances, excavation of the dune will be required to enable the trench to be constructed to an appropriate depth, in a similar fashion to watercourse crossings. Such excavations can expose the surface of the dune to loss of dune vegetation and increased erosion risk.

The environmental risks of excavation through dunes can be managed through appropriate handling of topsoils and overburden, and rehabilitation as set out in this protocol.

10.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management and protection of mobile dunes in which excavation will be required to provide a working space to construct the pipeline trench and lay the pipe. The protocol will apply where outlined in the Environmental Line List (ELL) based on vegetation mapping of the pipeline corridor.

10.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Disturbance to dunes	Minimise and manage disturbance of dunes.	No increased risk of erosion of the dune surface. No long term loss of dune vegetation.

10.4 Management actions

Issue	Action	Timing	Responsibility
General requirements	The induction program shall involve a dune management component to ensure all personnel are aware of the requirements for the protection of dunes.	Induction	Construction Contractor
Survey	The areas in which this protocol shall be applied will be marked on the Environmental Line List (ELL).	Prior to clear and grade	DBP
	The area required for storing the additional excavated soil (overburden) shall be clearly flagged and kept separate from the topsoil storage area.	Prior to clear and grade	Construction Contractor
Soil management	The area shall be rolled or lightly stripped to maintain root stock before excavation proceeds.	Prior to excavation	Construction Contractor
	The topsoil (seed stock) from the dunes shall be stripped and stored separately.	During clear and grade	Construction Contractor
	The excavated soil shall be removed and stored in the delineated storage areas.	During excavation	Construction Contractor
Clean-up and rehabilitation	After the pipeline has been laid, the area shall be reinstated as quickly as practicable to prevent erosion and enhance reinstatement.	Immediately following backfilling	Construction Contractor
	The excavated soil (overburden) shall be replaced followed by the return of the topsoil (seed stock).	Immediately following backfilling	Construction Contractor
	Cleared vegetation shall be evenly respread over the reinstated works.	Immediately following backfilling	Construction Contractor
	The access track shall be sheeted by gravel or clay to avoid erosion after reinstatement.	Immediately following backfilling	Construction Contractor



Issue	Action	Timing	Responsibility
	The sheeted track shall be built with a "dome" to allow any storm water to run off the sides of the track rather than down the track creating an erosion issue.	Immediately following backfilling	Construction Contractor
	The entire disturbed area of the dunes (other than the sheeted access track) shall be stabilised with either a chemical spray-on stabilising agent (such as Gluon 240), or the use of a mechanical agent (such as matting or jute mesh). The method and material to be used by the construction contractor shall be approved by WestNet prior to any use of application.	Immediately following backfilling	Construction Contractor
	As part of the reinstatement, any disturbed areas at the "foot" of the dunes shall be lightly ripped to create a "catch" for seed and to mitigate wind erosion potential.	Immediately following backfilling	Construction Contractor

10.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Inspection	Weekly during dune crossing.	All dune crossings.	Ensure compliance with protocol.	Construction Contractor

10.6 Contingency actions

Trigger	Action	Responsibility
Erosion	Initiate control measures to prevent further erosion	Construction Contractor
	Undertake remedial action	Construction Contractor
	Investigate and update protocol as required	Construction Contractor

10.7 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline
 DEC Department of Environment and Conservation
 DMP Department of Mines and Petroleum
 ELL Environmental Line List



11 FIRE MANAGEMENT PROTOCOL

11.1 Background and environmental risks

Construction activities associated with the Stage 5 Looping Expansion of the DBNGP (i.e. welding) and the operation of equipment (generators) may increase the risk of fire, particularly within high fire danger areas. Fires have the potential to result in damage to property and equipment, and cause injury or loss of life. Further, fire within bushland and areas of conservation value can detrimentally affect the conservation significance of these areas.

As such, the fire risk associated with construction activities is required to be managed, to minimise the potential for fires and contingency actions implemented should a fire occur.

11.2 Purpose and scope of protocol

The purpose of this protocol is to provide for fire management during the construction activities of the Stage 5 Looping Expansion, to achieve the environmental objectives outlined below.

11.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Prevent fires	To prevent fires occurring as a result of construction activities.	No pipeline construction related fires.

11.4 Management actions

Issue	Action	Timing	Responsibility
Induction	All construction staff shall be trained in the use of fire fighting equipment, and shall be familiar with the equipment located within their specific work areas and campsites.	Prior to commencing work on site	Construction Contractor
General	Campsites in any vegetated areas shall provide space for firebreaks on all sides of the site that are contiguous with such vegetation. The firebreaks need not be cleared unless there is clear and immediate risk of fire, but should be delineated as part of the campsite, prior to any clearing for the facility.	Prior to and during construction	Construction Contractor
	Open fires (including BBQs, billy fires, brush burning and rubbish burning) are banned.	During construction	Construction Contractor
	Fire prevention and response equipment shall be organised and checked prior to construction in any area.	Prior to construction	Construction Contractor
	All machinery shall be maintained and operated to comply with relevant fire safety standards.	At all times	Construction Contractor
	Defective machinery shall be shut down until the defect is rectified and the machine made safe for operations.	At all times	Construction Contractor
	All personnel shall be inducted on the smoking policy and the dangers of inappropriate cigarette disposal with reiteration of duty of care to be stated at toolbox meetings.	Prior to construction and daily	Construction Contractor
	No burning of vegetation shall occur.	At all times	Construction Contractor



Issue	Action	Timing	Responsibility
Consultation	Regular liaison shall be initiated and maintained with local emergency service organisations and stakeholders, including advising them of the nature and schedule of construction activities.	As required	Construction Contractor
	Regional DEC offices shall be notified of construction activities in gazetted conservation reserves and of potential fire dangers in these areas.	As required	Construction Contractor
Fire weather monitoring	Fire weather warnings will be monitored daily through local government sources and other relevant authorities (DEC, Department of Agriculture and Food [DAF]).	Daily	Construction Contractor
	Information regarding fire warnings shall be provided to construction crews during toolbox meetings.	As required	Construction Contractor
Permits	Work necessary to be undertaken that is in contravention of fire bans shall only be managed in accordance with permits from DEC.	As required	Construction Contractor
Fuel storage and re-fuelling	Fuel storage and re-fuelling shall be managed in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14).	At all times	Construction Contractor
Fire fighting equipment	All vehicles shall be fitted with dry chemical extinguishers (light vehicles with 1 kg units, trucks etc 9 kg units). All extinguishers shall be tagged by an approved inspector prior to mobilisation.	Prior to and during construction	Construction Contractor
	Fast attack vehicles shall be provided and used in accordance with FESA requirements.	Prior to and during construction	Construction Contractor
	Access to pump, hose and associated fire fighting equipment shall be available at all times.	At all times	Construction Contractor
	A water cart (approx 4000-5000 litre capacity) with fire fighting capacity shall be available for use within each pipeline spread.	During construction	Construction Contractor
	The service truck shall be fitted with both a 9 kg foam extinguisher and a 9 kg chemical extinguisher.	During construction	Construction Contractor
Clear and grade	Cleared vegetation shall be stockpiled clear of any hot work activities.	During clear and grade	Construction Contractor
Welding and weld testing	All welding and grinding shall be undertaken with facilities in place to prevent any sparks contacting any flammable material.	During welding operations	Construction Contractor
	The welding rig shall be fitted with a 900 litre capacity tank and spray packs for welding crews for fire fighting purposes.	Prior to construction	Construction Contractor
	A water cart shall be available at all times for use by the welding crew.	During welding operations	Construction Contractor
	Welding assistants shall be alert for any evidence of spot fires.	During welding operations	Construction Contractor
Waste disposal	Disposal of refuse, including cigarettes, shall be undertaken to minimise potential fire risk in accordance with the Waste Management Protocol (Section 15).	During construction	Construction Contractor
Fire reporting	Any fires within the construction right-of-way or in adjoining lands shall be reported to the Site Supervisor and appropriate actions taken (site evacuation, mobilisation of fire fighting teams etc.). All incidents will be recorded.	During construction	Construction Contractor



11.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Fire fighting training	All welding crews, plant operators and supervisors	Active construction areas	To ensure adequate training of personnel likely to be exposed to fires	Construction Contractor
Occurrence of fires as a result of construction activities	As occurs	Active construction areas	To determine if management measures are appropriate to prevent fires occurring as a result of construction activities	All employees
Inspection	Opportunistic	Active construction areas	To determine if management measures are appropriate to prevent fires occurring as a result of construction activities	Construction Contractor

11.6 Contingency actions

Trigger	Action	Responsibility
Localised (small) fire incident	Extinguish fire. Determine the activity that caused the fire incident. Review fire management protocol and implement additional management measures as necessary to prevent another fire occurring.	Construction Contractor
Significant fire incident	Extinguish fire. Determine the activity that caused the fire incident. Review the fire management protocol and implement additional management measures as necessary to prevent another fire occurring. Advise DMP and other stakeholders such as landholders, DEC and DAF. Undertake rehabilitation measures in accordance with the Clean-up and Rehabilitation Protocol (Section 18) for areas of conservation value and in consultation with landholders and other stakeholders.	Construction Contractor

11.7 Fire equipment training

As part of the induction package, all project personnel shall be instructed on prevention, safety and response practices for fire management as a component of the environmental induction process. Specific training on the use of relevant fire fighting equipment is to be provided to all welding crews, plant operators and supervisors.

11.8 Communications

DEC district (regional) offices shall be advised of activities prior to construction occurring in areas of conservation value. This will include an assessment of potential fire risks and management measures implemented to minimise the dangers.

In the event of a fire ban, construction activities shall cease unless a permit to work is obtained. In areas of conservation value, the process to obtain a permit to work will also require seeking advice from DEC district offices.



11.9 Abbreviations

DAF	Department of Agriculture and Food
DBNGP	Dampier-Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
FESA	Fire and Emergency Services Authority



12 DUST MANAGEMENT PROTOCOL

12.1 Background and environmental risks

Construction activities; such as clearing and grading, trenching, backfill and rehabilitation, and general vehicle movement along the corridor are likely to increase the risk of atmospheric dust emissions. These emissions may result in off-site environmental impacts and public concern, particularly when activities are undertaken close to residences.

The risk of activities resulting in off-site dust emissions is generally dependant on:

- the frequency at which a dust generating activity takes place
- meteorological conditions, such as wind speed
- composition of dust, including particle size distribution, particle density and moisture content
- the condition of the source.

The majority of the airborne particles associated with dust emissions from construction activities are likely to be larger than PM₁₀ and are associated with nuisance rather than public health problems. Further, the larger particles tend to settle back to the ground within a short range (<300 m) from the source, reducing the potential impact of the operations.

The impact of dust on fauna is expected to be insignificant as individuals are unlikely to be near the construction site when dust generating activities are being conducted. Further, due to the short term nature of the construction activities, the risk of dust smothering vegetation is not expected to be significant.

To ensure environmental impacts are minimised, and to provide for appropriate working conditions, dust generation should be minimised to the greatest extent practical, with specific management required when activities are close to residences and within the Perth Metropolitan region.

12.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management of dust emissions to achieve the environmental objectives outlined in Section 12.3. Contingency actions are provided and should be implemented where existing management measures are determined to be inadequate in being able to meet the environmental objectives.

12.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Landholders	To minimise the temporary impact of dust emissions from construction activities, machinery and vehicles.	No reasonable substantiated complaints. Accordance with relevant policies. Acceptable ambient dust levels down-wind of the construction site.
Vegetation	To minimise the impact of dust on surrounding vegetation so long-term existence is ensured.	Health of vegetation adjacent to the construction right-of-way remains the same post-construction as it was pre-construction.

12.4 Management actions

Activity	Action	Timing	Responsibility
Planning	Dust generating activities shall not be undertaken during unfavourable weather conditions (e.g. high wind speed), unfavourable wind directions relative to sensitive premises.	Daily	Construction Contractor
	Construction shall be planned to minimise the elapsed time between clearing, grading and restoration.	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
	Contingency measures outlined in Section 12.6 shall be implemented during construction of Loop 9, in accordance with the specified triggers.	At all times	Construction Contractor
Consultation	Local residents and stakeholders (within 200 m of pipeline construction right-of-way) shall be advised of the likely duration, impacts, potential health risks and mitigation measures to be undertaken whilst construction is occurring in their vicinity (consult DEC Guidelines for the Prevention of Dust and Smoke Pollution from Land Development Sites).	At least 48 hrs prior to construction	Construction Contractor
Vehicle movement	Unnecessary movement of vehicles shall be avoided.	At all times	Construction Contractor
	Vehicles shall not operate on areas other than designated roads, access tracks, construction right-of-way and associated construction areas, including construction camps.	At all times	Construction Contractor
Clearing and grading	Vehicle speed shall be restricted to no more than 60 km/hr in the construction right-of-way.	At all times	Construction Contractor
	Operations shall be monitored to ensure compliance with design requirements.	At all times	Construction Contractor
	The area being cleared, and thus exposed soil surfaces, shall be minimised.	At all times	Construction Contractor
	Stockpiles shall be lower than the average height of surrounding structures, with a maximum height of 3 m.	At all times	Construction Contractor
Trenching	Stockpiles shall be below fence heights when within 5 m of residential boundary.	When within 5 m of residential boundary	Construction Contractor
	Stockpiles shall be lower than the average height of surrounding structures, with a maximum height of 3 m.	At all times	Construction Contractor
	When within 5 m of residential boundary, stockpiles shall be below fence heights.	When within 5 m of residential boundary	Construction Contractor
Pipe Joining	Grit blasting shall be undertaken to comply with the Environmental Protection (Abrasive Blasting) Regulations 1998.	At all times	Construction Contractor
Padding	Where screening is to be undertaken within 200 m of residences, material shall be damp to prevent visible dust crossing the corridor boundary.	As required	Construction Contractor
Rehabilitation	Exposed areas shall be rehabilitated and/or stabilised as soon as possible after disturbance, in accordance with the Rehabilitation Management Protocol (Section 18).	As required	Construction Contractor
Hygiene	Where applied, dust suppression using water spraying shall use water from <i>Phytophthora cinnamoni</i> (dieback) free water sources.	During water use	Construction Contractor
Record keeping	Records shall be kept of all dust monitoring undertaken under Section 12.5.	As required	Construction Contractor
Complaints handling	All complaints shall be managed consistent with the Environmental Incident Response Management Protocol (Section 1).	As required	Construction Contractor

12.5 Monitoring and recording and recording

Parameter	Frequency	Location	Purpose	Responsibility
Dust monitoring	Daily Opportunistic	Construction Area Access tracks	To monitor dust generation and determine if dust suppression is required.	Construction Contractor



Parameter	Frequency	Location	Purpose	Responsibility
Dust from stockpiles	Daily Opportunistic	Construction Area Access tracks	To monitor dust generation and determine if dust suppression is required.	Construction Contractor
Dust on vegetation	Weekly Opportunistic	Construction Area Access tracks	Impacts of dust on vegetation will be visually monitored.	Construction Contractor

12.6 Contingency actions

Trigger	Action	Responsibility
Excessive dust generation noted during monitoring or receipt of a reasonable landholder complaint	Investigate cause.	Construction Contractor
	Implement appropriate dust control measures within 48 hrs, including as appropriate: <ul style="list-style-type: none"> Application of water or stabilisers via water trucks and sprayers to dampen down soil. No run-off should be generated from application. Applications should be frequent enough to provide persistent dust suppression. Cover vehicles with dust emitting loads (except when loading/unloading). Use of dust stabilisers, tarps or geo-textile materials to suppress dust generated from stockpiles. These measures shall remain in effect until construction is completed and rehabilitation has taken place.	Construction Contractor and relevant personnel
	Should dust suppression techniques be inadequate, construction activities that generate dust shall be temporarily ceased until a remedy is sought (consultation with relevant agencies may be required).	Construction Contractor

12.7 Recording

A record of all dust monitoring shall be maintained with any exceedances reported to DMP within 14 days. The report shall include details of the action implemented to minimise potential reoccurrence of the emissions.


12.8 Complaints register

A register of all external complaints received shall be maintained by the Construction Contractor. This register will contain information provided by the complainant regarding their concerns, including:

- name and contact details
- details of the complaint; date, time and description of dust
- outcomes of the investigation
- documentation of the consultation with the complainant describing the mitigation measures that were implemented.

12.9 Abbreviations

DEC Department of Environment and Conservation
DMP Department of Mines and Petroleum

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13 NOISE AND VIBRATION MANAGEMENT PROTOCOL

13.1 Background and environmental risks

Noise emissions from the construction right-of-way will vary depending on the activity being undertaken (e.g. blasting, clearing and grading), with the duration that noise and vibration impact on any one location limited by the progressive movement of the active construction areas (3 to 6 km per day in the northern loops and 500 m per day in the southern loops).

Construction activities may result in minor increases in traffic noise on roads near the pipeline corridor, and may cause localised temporary disruption to fauna in areas adjacent to the corridor. However, increased noise emissions will be temporary and as such it is unlikely that the behaviour of fauna will be disrupted in the long term.

Construction activities may also result in noise impacts on neighbouring residences, although the risk of these impacts is generally limited to Loops 9 and 10 (Perth Metropolitan area) and occasions when the active construction area is close to isolated residences within the remaining loops.

Noise from campsites (eg, music, workshops, etc.) is not expected to be a factor as no campsites will be located in Loops 9 and 10, and residences adjacent to the other loops are sparsely distributed. Campsites will not be close to such residences. No blasting is anticipated in Loops 9 and 10.

The assigned noise levels in the Environmental Protection (Noise) Regulations 1997 (Noise Regulations) do not apply to construction activities carried out between 0700 and 1900 hours on any day except Sunday and public holidays provided:

- construction work is carried out in accordance with Section 6 of the Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"
- the equipment used is the quietest reasonably available
- Where work is to be undertaken outside these times, the following provisions will be additionally required:
- demonstration to the satisfaction of DMP that it is necessary for the activity to be undertaken during these times
- preparation of a noise management plan to the requirement of the Local Government Authority (LGA), which will include a requirement to notify residents likely to be affected, at least 24 hours prior to commencement of the relevant activity.

Activities outside normal working hours (7 am to 6 pm Monday to Saturday) will be undertaken to ensure emissions comply with the assigned levels provided in the Noise Regulations, unless undertaken in compliance with an approved Noise Management Plan.

Compliance with the assigned levels is based on an approximate distance to residence, calculated from the sound pressure levels provided in AS2436-1981 and using the inverse square rule. Given the temporary nature of the activity, notional criteria consistent with the L_{A1} and L_{Amax} for the specified times have been determined as reasonable targets, and will be used to restrict activities that are unable to comply. Table 4-4 provides an estimate of the distance required to ensure compliance with proposed noise criteria.



Table 4-4 Noise emission characteristics of equipment proposed to be used (taken from AS 2436—1981)

	Expected noise emissions (dBA)	Approx distance to meet noise criteria (m)		
		55 dB (LAmax)	45 dB (LA1) (prior to 9 am Sundays)	50 dB (LA1) (between 9 am and 7 pm Sundays)
Excavators 100 kW to- 200 kW	112	290	948	527
Tractors track 100-200 kW	118	579	1896	1053
Compressors 7 m ³ /m partly silenced	100	73	240	133
Graders > 100 kW	120	730	2388	1327
Hand tools: grinder breaker	106	145	474	263
Hand tools: chipping hammer	119	655	2142	1190
Trucks 20 T	108	183	600	333
Rock breaker: breaker hydraulic	119	655	2142	1190
Ditching machine: approx	112	290	948	527
Padding machine: approx	115	413	1350	750
Dewatering pump	108	183	600	333
Generator	112	290	948	527

It is also proposed to undertake monitoring to substantiate the expected area of impact and clarify the distance to residences in which activities will be restricted if undertaken outside the prescribed hours. This will clarify the assumptions on the noise emission levels of the actual equipment to be used by the contractor.

Vibration may result from blasting, compaction, excavation and the movement of equipment within the corridor, with blasting and compaction likely to result in the greatest potential for impact. Significant levels of vibration have the potential to damage buildings adjacent to the pipeline corridor. As with noise, vibration may result in localised temporary disruption to fauna in areas adjacent to the corridor disturb fauna, although the increased emissions will be temporary and as such it is unlikely to result in long term disruption to the behaviour of fauna.


The inappropriate use of explosives and vibration may detrimentally impact on the existing gas pipeline, located within 6 metres of the proposed trench. Consequently, due to the safety aspect associated with the existing gas pipeline, the use of explosives, and mass of the charges, will be minimised.

Vibration due to compaction of the backfilled trench is unlikely to be a significant issue as the required compaction will be achieved through the driving of rubber wheeled vehicles along the trench in favour of plate and other vibratory based compactors. Vibration impacts from the movement of heavy vehicles along the corridor will be managed through the operating hour limitations proposed to manage noise emissions, as vibration is unlikely to 'travel' as far as noise emissions.

Consequently, specific management is required to ensure compliance with relevant legislation, and to minimise the potential for noise and vibration associated with construction activities affecting residences adjacent to the corridor.

13.2 Purpose and scope of protocol

The Noise and Vibration Management Protocol provides for the management of noise and vibration so that the above effects are minimised to achieve the environmental objectives for this factor (Section 13.3). The protocol outlines management actions to be undertaken to minimise potential impacts during construction, and ensures compliance with relevant legislation.

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13.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Public/residents	To minimise the impact of noise and vibration emissions from construction activities, machinery and vehicles	No reasonable landholder complaints. Landholder complaints resolved in a timely manner Compliance with Noise Regulations and approved noise management plans.

13.4 Management actions

Activity	Action	Timing	Responsibility
Planning	Schedule activities to avoid construction activities near residences being carried out: <ul style="list-style-type: none"> • on Sundays and public holidays • after 1900 and before 0700 hours on any other day unless the construction activities can comply with the assigned levels in the Environmental Protection (Noise) Regulations 1997 (Noise Regulations) or are managed in accordance with an approved Noise Management Plan.	When residences are within the distance specified in Table 4-4 and at all times within the metropolitan area	Construction Contractor
	The noise emissions from construction activities may be monitored to substantiate the expected area of potential impact, with this information used to establish the required distance to residential areas.		Construction Contractor
	Semi-fixed noise generating equipment (e.g. generators, compressors and campsite equipment) shall be located as far as practicable from surrounding premises.		Construction Contractor
	The accommodation camps shall be located greater than 2 km from neighbouring residences.	As required	Construction Contractor
	Residents in proximity to the pipeline shall be advised of the proposed working schedule.	Prior to construction	Construction Contractor
General requirements	Appropriate mufflers shall be maintained on earth-moving equipment and other vehicles on the site.	At all times	Construction Contractor
	Equipment used within the corridor shall be the quietest reasonable practicable.	At all times	Construction Contractor
	All equipment and plant shall conform to appropriate noise control standards.	At all times	Construction Contractor
	All equipment shall be regularly and efficiently maintained to ensure that noise attenuating measures are operating efficiently.	At all times	Construction Contractor
	Between work periods, machines such as cranes, loaders and generators shall be shut down or use minimum throttle.	At all times	Construction Contractor
	All mobile machinery and stationary equipment shall be fitted with appropriate noise control equipment (eg. mufflers or sound attenuation enclosures).	At all times	Construction Contractor
	Construction work shall be carried out in accordance with Section 6 of the Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites".	At all times	Construction Contractor
All noise management plans shall be submitted to the LGA for approval, consistent with the Noise Regulations.	At all times	Construction Contractor	
Vehicles	All vehicles shall comply with Australian Design Rules.	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
	Site speed limits shall be complied with at all times.	At all times	Construction Contractor
Blasting	Blasting shall only be carried out during daylight hours.	At all times	Construction Contractor
Record keeping	Records shall be kept of all noise emission monitoring.	At all times	Construction Contractor
Survey, fencing and service location	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Clear and grade	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Trenching and excavation	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Dewatering	Dewatering pumps shall be the quietest practicably available.	At all times	Construction Contractor
	Dewatering pumps shall be located as far from residences as practicable.	At all times	Construction Contractor
Drilling/boring	Drilling equipment shall be the quietest practicably available.	At all times	Construction Contractor
Pipe stringing and welding	Grinding shall not be undertaken after 7:00 pm and prior to 7:00 am, or on Sundays or public holidays.	Within 1000 m of any residence	Construction Contractor
	Grinding and welding shall be undertaken within the mobile enclosure.	At all times	Construction Contractor
Lowering-in and backfill	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Clean-up and rehabilitation	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Testing and commissioning	Equipment used shall be the quietest practicably available.	At all times	Construction Contractor
Complaints register	All complaints received from landholders shall be recorded and stored in a Complaint register. The ensuing investigation outlining the cause of excessive noise emissions and consultation with the landholder shall also be recorded.	As required	Construction Contractor

13.5 Monitoring and recording and recording

Parameter	Frequency	Location	Purpose	Responsibility
Integrity of noise control equipment	As part of construction site inspections.	Entire construction site.	To ensure noise control measures are in good working order.	Construction Contractor




13.6 Contingency actions

Trigger	Action	Responsibility
Complaint received from external source	Any complaints shall be considered incidents and shall be managed in accordance with the Environmental Incident Response Protocol (Section 1). Noise and vibration monitoring and data recording may be initiated to provide information to support development of a management response.	Construction Contractor
	If deemed necessary, mitigation measures shall be implemented to the satisfaction of DMP in consultation with DEC/LGA.	Construction Contractor

13.7 Abbreviations

DEC Department of Environment and Conservation
DMP Department of Mines and Petroleum
LGA Local Government Authority

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14 FUEL AND CHEMICAL STORAGE, SPILL AND EMERGENCY RESPONSE PROTOCOL

14.1 Background and environmental risks

The uncontrolled release of fuels and chemicals has the potential to result in the contamination of soil, groundwater and surface water, which may lead to significant environmental impact and harm. On this basis, the storage and use of fuels and chemicals must be managed to minimise the risk of a release, and measures adopted to promptly address these impacts should a release occur.

14.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management of fuel and chemicals to achieve the following environmental objectives.

14.3 Environmental objectives and key performance criteria

Issue	Objective	Performance Indicator
Contamination	Prevent contamination of groundwater, surface water and soil.	<p>Chemicals and fuels stored and handled within designated areas.</p> <p>No significant spills or leaks of hydrocarbons (in excess of 80 litres near wetlands and rivers) during construction and rehabilitation operations outside of areas designated for maintenance, refuelling or storage.</p> <p>No significant spills or leaks of hydrocarbons (in excess of 500 litres) during construction and rehabilitation operations outside of areas designated for maintenance, refuelling or storage.</p> <p>No spills or measurable leaks of hydrocarbons within any Water Reserve.</p>

14.4 Management actions

Activity	Action	Timing	Responsibility
Planning	Strategies shall be developed to deal with a spill of all types of fuel, oil or chemicals to be used on-site.	Prior to construction	Construction Contractor
	Major servicing of plant and equipment shall be undertaken off-site in appropriately equipped areas.	At all times	Construction Contractor
	All construction staff will receive information and training on: <ul style="list-style-type: none"> spill management spill response refuelling. 	Induction	Construction Contractor
	The boundaries of the Allanooka–Dongara, Gngangara and Jandakot Water Reserves established by the Department of Water shall be entered onto the Environmental Line List (ELL).	Prior to construction	DBP
	Wellhead Protection Zones in the Allanooka–Dongara, Gngangara and Jandakot Water Reserves established by the Department of Water (DoW) shall be entered onto the ELL as designated non-refuelling areas.	Prior to construction	DBP
	Areas on the construction right-of-way within which refuelling is prohibited should be marked on the ELL as designated non-refuelling areas.	Prior to ground disturbing activities	Contractor Construction
Areas on the construction right-of-way that are subject to special conditions regarding refuelling (wetlands and watercourses) shall be marked on the ELL with those special conditions.	Prior to ground disturbing activities	Contractor Construction	



Activity	Action	Timing	Responsibility
Survey	The boundaries of the Allanooka–Dongara, Gnangara and Jandakot Water Reserves shall be marked in the field.	Prior to ground disturbing activities	Contractor Construction
	Wellhead Protection Zones in the Allanooka–Dongara, Gnangara and Jandakot Water Reserves established by the Department of Water (DoW) shall be marked in the field as designated non-refuelling areas.	Prior to ground disturbing activities	Contractor Construction
	Areas on the construction right-of-way within which refuelling is prohibited shall be marked in the field as designated non-refuelling areas.	Prior to ground disturbing activities	Contractor Construction
	Areas on the construction right-of-way that are subject to special conditions regarding refuelling (wetlands and watercourses) should be marked shall be marked in the field as special condition refuelling areas.	Prior to ground disturbing activities	Contractor Construction
	Areas for refuelling within campsites, laydown areas or other areas outside the construction right-of-way shall be designated and marked with appropriate signage.	Prior to ground disturbing activities	Contractor Construction
Storage	Fuel, chemicals and/or lubricants shall only be stored in the campsite or within the laydown area and not within 200 m of any Conservation Category Wetland or watercourse, or within areas designated to be of conservation value.	At all times	Construction Contractor
	Fuels, lubricants and chemicals shall be stored within containment facilities including: <ul style="list-style-type: none"> leak proof trays impermeable bunds The volume of the containment facility should be sufficient to hold at least 110% of the volume of the largest container of product stored within or on the facility.	At all times	Construction Contractor
	All fuel and chemical storage and handling equipment (including transfer hoses, etc.) shall be kept in a well-maintained condition.	At all times	Construction Contractor
	The location of on-site fuel/chemical storage areas shall be clearly signed and designated.	At all times	Construction Contractor
	Storage and handling of fuels and chemicals shall be in compliance with relevant legislation, regulations and Australian Standards.	At all times	Contractor Construction
	No campsites or laydown areas shall be located within the boundaries of the Allanooka–Dongara, Gnangara and Jandakot Water Reserves unless approved by the DoW.	At all times	Contractor Construction
Bulk fuel storage and refuelling areas	Containment and recovery equipment (including but not limited to absorbent materials, shovels and sandbag sacks, plastic bags and protective clothing eg. gloves and overalls) shall be provided and maintained at all bulk fuel storage and refuelling areas.	At all times	Construction Contractor
	Vehicles being refuelled from any bulk fuel storage shall be parked over a steel grating and spill capture tank fitted with a drain and fuel/water recovery system.	At all times	Construction Contractor
Refuelling vehicles	Refuelling vehicles shall be equipped with the following to enable quick response to spillages: <ul style="list-style-type: none"> 250 L spill kits spill tray(s) shovel containers for temporary storage and transport of contaminated soil. 	At all times	Contractor Construction



Activity	Action	Timing	Responsibility
Refuelling: General	Refuelling shall not be undertaken within designated non-refuelling areas.	At all times	Contractor Construction
	Refuelling procedures shall be adopted to minimise the risk of spills, including measures such as shut-off nozzles and spill buckets.	At all times	Contractor Construction
	High pressure hose shall be used for low pressure pumping of fuel to reduce the risk of hose rupture.	At all times	Contractor Construction
	Absorbent material shall be placed beneath machinery being refuelled in the field to collect any drips and potential spills.	At all times	Contractor Construction
Refuelling: Self-propelled plant	<p>Refuelling of any self-propelled plant within 200 m of a Conservation Category Wetland, EPP wetland or any watercourse is prohibited unless this results in a requirement to move the plant more than 400 m to enable refuelling. In this situation, the plant may be refuelled at a location no closer than 50 m from the edge of the wetland or watercourse, with the following additional safeguards being applied:</p> <ol style="list-style-type: none"> 1. Refuelling of self-propelled plant is to be carried out from a mobile tank no larger than 1000 L in capacity, towed to a refuelling location no closer than 50 m from the edge of the wetland or watercourse. 2. The refuelling crew will be one experienced fuel truck operator and one experienced off-sider as well as the operator of the individual machine if required. 3. The mobile tank unit may only be refilled in the field from bulk tanker within designated refuelling areas (and not within the 200 m wetland or watercourse buffer). 4. Refuelling procedures and safeguards otherwise apply as for designated refuelling areas. <p>Application of these requirements may be varied for specific locations with the written approval of the Department of Environment and Conservation.</p>	At all times	Construction Contractor
Refuelling: Non self-propelled plant	<p>Refuelling of non self-propelled plant proximate to wetlands or watercourses shall be carried out as follows:</p> <ol style="list-style-type: none"> 1. Refuelling of non self-propelled plant proximate to or within wetlands or watercourses is to be carried out from a mobile tank no larger than 1000 L in capacity, towed to the location of the non self-propelled plant. 2. The refuelling crew will be one experienced fuel truck operator and one experienced off-sider as well as the operator of the individual machine if required. 3. The mobile tank unit may only be refilled in the field from bulk tanker within designated refuelling areas (and not within the 200 m wetland or watercourse buffer). 4. The 1000 L mobile tank will travel between the designated refuelling locations and the non self-propelled plant. 5. Refuelling procedures and safeguards otherwise apply as for designated refuelling areas. 	At all times	Construction Contractor
Spillages	<p>Spill kits are to be provided as follows:</p> <ul style="list-style-type: none"> • all refuelling vehicles carry 250 L spill kits • all vehicles fitted with hydraulic hoses have immediate access to 20 L spill kits • all crews handling hazardous chemicals have immediate access to 20 L spill kits • all supervisors will carry 20 L spill kits. 	At all times	Construction Contractor
	All vehicles and equipment shall be adequately maintained to minimise drips/leaks of oil and fuel.	At all times	Construction Contractor
	Spills shall be stopped at source as soon as practicable.	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
	Spilt material shall be contained to the smallest possible area.	At all times	Construction Contractor
	Spilt material shall be recovered as soon as possible, using appropriate equipment.	At all times	Construction Contractor
	Pipe coating shall be carried out over a spill tray or absorbent material to prevent drips of coating chemicals contaminating the soil.	At all times	Construction Contractor
Material handling and disposal	Hazardous materials or wastes, such as solvents, rust proofing agents and primer, shall be managed, transported, stored and handled in accordance with the requirements of relevant legislation and industry standards (i.e. Australian Dangerous Goods Code and relevant OH&S regulations).	At all times	Construction Contractor
	Contaminated materials such as absorbent pads and soil shall be disposed of to appropriately licensed facilities, consistent with the Waste Management Protocol (Section 15).	As required	Construction Contractor
	Handling and disposal of wastes shall comply with the Waste Management Protocol (Section 15).	At all times	Construction Contractor
Safety	Material Safety Data Sheets shall be kept for each chemical used on-site and at a location that is easily accessible to all construction personnel.	At all times	Construction Contractor
Designated areas of conservation value	No fuel or chemical storage facilities shall be located within areas of conservation value identified in the ELL.	At all times	Construction Contractor
Water Reserves	No fuel or chemicals shall be stored within Water Reserves as marked on the ELL unless managed in accordance with DoW requirements as set out in Water Quality Protection Note 58 (DoW 2006a).	At all times	Construction Contractor
Reporting	All spills over 2 L shall be considered an environmental incident and reported via the Incident Report Form.	As required	Construction Contractor
	Any spillage of hydrocarbons in excess of 2 L within the boundaries of the Allanooka–Dongara, Gnangara and Jandakot Water Reserves or within a Wellhead Protection Zone is to be reported to DoW.	As required	Construction Contractor
Drilling	Only water based drilling fluids shall be used.	At all times	Construction Contractor
	All drilling fluids shall be managed in accordance with the material handling and disposal activity actions of this protocol.	At all times	Construction Contractor
Trenching and excavation	Fuel powered dewatering pumps shall be banded to contain spills, using an impermeable liner. The bund shall be large enough to contain 110% of the volume of the pump fuel tank.	At all times	Construction Contractor
Pipe stringing and welding	All hazardous materials, including radiographic processing liquid shall be managed in accordance with the material handling and disposal activity actions of this protocol.	At all times	Construction Contractor

14.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Inspections	Weekly. Opportune.	Construction and refuelling areas.	Ensure compliance management protocols.	Construction Contractor
Hydrocarbon and chemical storage	Prior to receipt of hydrocarbon and chemicals.	Storage area.	Ensure that separation distances and bunding as required.	Construction Contractor




14.6 Contingency actions

Trigger	Action	Responsibility
Uncontrolled release (i.e. spill, leak)	Further loss of material shall be prevented either by addressing the process control problem or by undertaking repair of faulty pipe, valve or other components.	Construction Contractor
	Spillages shall be immediately contained by constructing earthen bunds or using other containment methods.	Construction Contractor
	Ponded material shall be removed as soon as practicable by pumping into an appropriate storage facility, or withdrawn using an absorbent material.	Construction Contractor
	Contaminated soil or material shall be removed offsite and disposed of in an approved landfill facility.	Construction Contractor
	Person(s) involved in the incident (or witness to) shall notify the Construction Contractor if not already aware of the incident (see below).	Construction Contractor
	An Environmental Incident Report shall be completed for spills greater than 2 L.	Construction Contractor
	Spill response action shall be investigated to ascertain if it was appropriately initiated and achieved objectives.	Construction Contractor
Inappropriate storage of material	Investigate why material is being inappropriately stored.	Construction Contractor
	Initiate action to ensure compliance.	Construction Contractor
	Amend protocol if required.	DBP

14.7 Abbreviations

- DEC Department of Environment and Conservation
- DMP Department of Mines and Petroleum
- DoW Department of Water
- ELL Environmental Line List

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15 WASTE MANAGEMENT PROTOCOL

15.1 Background and environmental risks

Waste from the project will include waste generated from construction activities such as welding, and waste from the accommodation camps. Both waste streams have the potential to result in detrimental impacts on the environment and as such will require specific management.

Waste disposal must also be undertaken so as to ensure compliance with relevant environmental legislation, including the Environmental Protection (Controlled Waste) Regulations 2004 and the *Environmental Protection Act 1986*.

Consequently, specific management is required to ensure that waste is appropriately managed to ensure compliance with relevant legislation and minimise potential contamination of the corridor.

15.2 Purpose and scope

The purpose of this protocol is to provide for the management of generation and disposal of waste materials within the DBNGP corridor and associated construction areas, to achieve the environmental objectives outlined below.

15.3 Environmental objectives and key performance criteria

Issue	Objective	Performance Indicator
Waste management	Minimise generation of waste during construction.	Minimise waste generation.
	Minimise pollution or environmental harm due to inappropriate disposal of waste.	No uncontained waste, rubbish or litter is found within construction right-of-way or at facilities during construction. No waste found within construction right-of-way or at facilities immediately following construction. A waste register is maintained during construction indicating waste categories, approximate volumes of waste, and location of disposal. Waste material is contained and disposed of in accordance with <i>Environment Protection Act 1986</i> .

15.4 Management actions

Activity	Action	Timing	Responsibility
Planning	Waste management strategies shall be developed for each waste stream based on the principles of reduce, reuse, recycle and appropriate disposal.	Prior to commencing any waste producing activities	Construction Contractor
	The boundaries of the Allanooka–Dongara, Gngara and Jandakot Water Reserves established by the Department of Water (DoW) shall be entered onto the Environmental Line List (ELL).	Prior to construction	DBP
	Wellhead Protection Zones in the Allanooka–Dongara, Gngara and Jandakot Water Reserves established by the Department of Water shall be entered onto the ELL.	Prior to construction	DBP
General	All waste shall be removed from the site for reuse/recycling/disposal.	At all times	Construction Contractor
	All waste shall be collected and transported to appropriately licensed disposal sites.	As required	Construction Contractor



Activity	Action	Timing	Responsibility
	High emphasis shall be placed on housekeeping and cleanliness at the site.	At all times	Construction Contractor
	Records shall be kept of all waste removed from site.	At all times	Construction Contractor
	No waste materials shall be stored within Water Reserves as marked on the ELL unless managed in accordance with DoW requirements as set out in Water Quality Protection Note 58 (DoW 2006a).	At all times	Construction Contractor
	No waste materials shall be stored within a Wellhead Protection Zone.	At all times	Construction Contractor
Ablution facilities	Temporary portable sanitary or ablation facilities shall be provided on-site (in the laydown areas and campsites) where existing facilities are not present.	Prior to construction activities	Construction Contractor
	Ablution facilities shall be regularly cleaned and maintained.	At all times	Construction Contractor
	Septage collected within portable sanitary or ablation facilities shall be either removed by a licensed contractor and disposed of to a licensed facility, or treated and disposed of through an appropriately approved on-site facility operated by the Construction Contractor.	As required	Construction Contractor
Oil, solvents and Chemicals	Chemical wastes (e.g. spent x-ray film developer chemicals) shall be collected in appropriately labelled drums.	At all times	Construction Contractor
	Waste oil, solvents and other toxic material, shall be collected for off-site reuse, recycling, treatment or disposal.	At all times	Construction Contractor
	Chemical wastes, waste oils, solvents and other toxic material shall be stored in appropriately banded areas prior to off-site disposal.	At all times	Construction Contractor
	Licensed carriers shall be used for off-site transport and disposal.	As required	Construction Contractor
Hygiene stations	Seed, soil and organic matter removed during clean-down activities shall be collected in a sealed container for disposal.	As required	Construction Contractor
	Seed, soil and organic matter removed during clean-down activities shall be disposed of at approved landfill facilities or within areas that have been determined to be weed and dieback infected.	As required	Construction Contractor
Pipe stringing and welding	Timber skids, pallets, rope spacers, drums and scrap metal shall be stockpiled separately for salvaging or recycling.	At all times	Construction Contractor
	Welding refuse, including electrode stub-ends shall be retrieved for disposal at an approved waste disposal site and shall not be discarded in the pipe trench.	At all times	Construction Contractor
	All bonding and dunnage from transport vehicles and unloading areas shall be collected and transported offsite to approved disposal facilities.	As required	Construction Contractor
	All hazardous materials, including radiographic liquid processing waste, shall be managed consistent with the actions outlined in the Oil, Solvents and Chemicals in this protocol.	At all times	Construction Contractor
	Empty paint tins and used brushes shall be disposed of at licensed facilities.	As required	Construction Contractor
Drilling and boring	Drilling mud and cuttings shall be disposed of to a licensed waste disposal centre unless alternative reuse options or disposal sites have been approved.	As required	Construction Contractor
Trench dewatering	Disposal of water shall be consistent with the Dewatering and Water Disposal Management Protocol (Section 6).	At all times	Construction Contractor
Hydro-test water	Disposal of water shall be consistent with the Dewatering and Water Disposal Management Protocol (Section 6).	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
Rehabilitation	All waste material shall be removed from the construction right-of-way on completion of each section of the pipeline.	As required	Construction Contractor
Construction camps	Litter bins shall be provided within campsites and construction storage yards/laydown areas.	At all times	Construction Contractor
	Litter bins and waste containers shall be covered as necessary to prevent: <ul style="list-style-type: none"> access by fauna waste falling out of the container as a result of overfilling waste material being blown out of the container by wind. 	At all times	Construction Contractor
	All waste storage containers shall be regularly emptied and waste removed from site.	At all times	Construction Contractor
	Domestic campsite wastes (e.g. sewage, kitchen/putrescible, grey water, packaging etc) shall be disposed of to a licensed facility.	At all times	Construction Contractor
	Hydrocarbon wastes, including lube oils, shall be collected for safe transport off-site for reuse, recycling, treatment or disposal at approved locations.	At all times	Construction Contractor
	Licensed carriers shall be used for the transport of all controlled wastes (such as liquid waste).	At all times	Construction Contractor
	Waste fuels, waste hydrocarbons and other waste chemicals shall be stored and handled in accordance with the Fuel and Chemical Storage, Spill and Emergency Response Protocol (Section 14).	At all times	Construction Contractor

15.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
Inspection	Weekly Opportunistic	Construction areas and campsite.	Ensure appropriate disposal of waste material.	Construction Contractor
Record keeping	All inspections and waste disposal activities as they occur.	Construction areas and campsite.	Ensure appropriate disposal of waste material.	Construction Contractor

15.6 Contingency actions

Trigger	Action	Responsibility
Inappropriate disposal of waste	Investigate cause of inappropriate disposal.	Construction Contractor
	Initiate action to rectify disposal methods.	Construction Contractor
	Amend protocol to avoid recurrences.	DBP
Ablution facilities inappropriately cleaned	Investigate cause of concerns.	Construction Contractor
	Contact contractor to rectify.	Construction Contractor



Abbreviations

DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
DoW	Department of Water
ELL	Environmental Line List



16 SOIL MANAGEMENT PROTOCOL

16.1 Background and environmental risks

Topsoil is an important resource in construction right-of-way rehabilitation as it provides nutrients, biomass and productivity for vegetation and contains a significant seed bank. Inappropriate soil management increases the risk of erosion, sedimentation, and mixing of the soil profiles, potentially resulting in environmental impacts on surrounding vegetation, waterbodies and residents.

Topsoil performs a vital role in rehabilitation processes, and the loss or contamination of topsoil (with subsoil) may reduce the success of rehabilitation efforts.

16.2 Purpose and scope

The purpose of this protocol is to provide for the effective management of soil and disturbed areas to achieve the environmental objectives outlined below.

16.3 Environmental objectives and key performance criteria

Issue	Objective	Performance Indicator
Topsoil	Minimise change to soil profile from excavation activities.	No evidence of subsoil on surface (as detected by colour and texture) within construction right-of-way following backfill. No visual evidence of soil compaction following backfill and rehabilitation (e.g. hard soil, local water pooling).
Erosion	Prevent occurrence of soil erosion during and following construction.	The extent of soil erosion within the construction right-of-way during and within two years following construction is consistent with surrounding land. No visible soil erosion from construction right-of-way during or within three years following construction.

16.4 Management actions

Activity	Action	Timing	Responsibility
Topsoil	The top 100-150 mm of topsoil shall be removed from any areas where soil disturbance is likely to occur as a consequence of the construction process, and includes: <ul style="list-style-type: none"> all areas to be subjected to excavation all areas where spoil from excavations is to be stored all areas where construction machinery is operating all areas on the construction right-of-way which will be used in any way during construction all areas where soil inversion or loss of topsoil is likely as a result of any activities associated with construction, including at facilities such as camp sites. The exception to the above is areas that do not contain native vegetation and where there is a formal agreement with the landowner to leave topsoil in place.	As required	Construction Contractor
	Any topsoil removed, including leaf litter shall be stockpiled to one or either side of the corridor with breaks provided in the stockpiles to allow water and stock movement.	At all times	Construction Contractor
	The topsoil shall be stockpiled in a manner so that it can be easily returned to the construction right-of-way during reinstatement.	At all times	Construction Contractor



Activity	Action	Timing	Responsibility
	Graded topsoil shall be stockpiled separately from cleared stockpiled ground cover vegetation and other excavated material (e.g. trench spoil, padding material, etc).	At all times	Construction Contractor
Stockpiles	Trench spoil (backfill soil) shall be stockpiled separately from topsoil.	As required	Construction Contractor
	Trench spoil stockpiles shall be located immediately adjacent to the area from which soil was removed, except in major watercourses where trench spoil stockpiles may be located out of the watercourse, but as close as practically possible to the watercourse without impacting riparian vegetation	As required	Construction Contractor
	Topsoil stockpiles shall not be located where they have the potential to contribute to sedimentation of land or surface water.	At all times	Construction Contractor
	Stockpiles shall be stored away from watercourse banks to reduce the impact on bank vegetation.	As required	Construction Contractor
	Bank spoil shall be stored to the side of the corridor and away from the riparian vegetation on the top of the river banks so as to minimise the disturbance to the river banks.	As required	Construction Contractor
	River overburden (sand) stockpiles shall be located in open areas within the river bed so as to not disturb existing river bed vegetation.	As required	Construction Contractor
	Overburden (other than river overburden) shall be stockpiled away from stream banks, beds and riparian zones and windrows broken either side of waterways.	At all times	Construction Contractor
	Stockpiles shall not be graded across property boundaries. A break in the windrow shall be maintained at property boundaries.	Property access points	Construction Contractor
Erosion	Temporary and/or permanent soil erosion berms, drains and sediment barriers shall be installed, where required, for erosion protection.	As required	Construction Contractor
	Design of erosion and sediment control measures shall consider site conditions such as wind, rainfall frequency and intensity, soil type, infiltration rates, gradient, catchment area, vegetation cover and condition.	As required	Construction Contractor
Padding	Where practicable, padding material shall be reclaimed from trench spoil.	As required	Construction Contractor
	Imported padding material shall be demonstrated to be disease, pest and weed free and be non-acid sulphate soils (ASS).	As required	Construction Contractor
	Topsoil shall not be used as backfill or padding.	At all times	Construction Contractor
	As much rock material as possible shall be returned to the trench, without threatening the integrity of the pipe coating.	As required	Construction Contractor
Rehabilitation	In the event that excavation (bell holes) or a drilling platform is required, topsoil shall be cleared from the site and stockpiled separately from subsoil to allow the subsequent backfilling of soil in the correct horizons.	At all times	Construction Contractor



16.5 Monitoring and recording


Parameter	Frequency	Location	Purpose	Responsibility
Erosion	Opportune	Active construction areas	Ensure that erosion control measures are effective.	Construction Contractor
Stockpiles	Opportune	Stockpiles	Ensure that separation of soil profiles is being observed. Ensure that stockpiles are not impeding access to property or fauna.	Construction Contractor
Photographs of topsoil stockpiles	Immediately following backfilling	Construction right-of-way	To demonstrate that topsoil has not been used for backfilling	Construction Contractor

16.6 Contingency actions

Trigger	Action	Responsibility
Erosion	Investigate cause.	Construction Contractor
	Implement remedial action.	Construction Contractor

16.7 Abbreviations

- ASS Acid sulphate soils
- DEC Department of Environment and Conservation
- DMP Department of Mines and Petroleum

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17 ABORIGINAL HERITAGE SITE MANAGEMENT PROTOCOL

17.1 Background and environmental risks

The Stage 5 looping of the DBNGP traverses land covered by numerous Aboriginal tribal territories and Native Title claims, and due to the length of the pipeline corridor many archaeological and ethnographic sites have been recorded near the pipeline corridor. Further, due to the remote locations of much of the corridor, construction activities have the potential to uncover unrecorded sites.

Although not 'sites' *per se*, many waterways are of heritage significance to Aboriginal persons as they sometimes represent foci for camping, ceremonies and other activities and may have mythological associations. The Swan, Canning, Moore and Murray Rivers are listed as sites on the DIA database.

Construction activities that physically disturb the land surface or subsurface profile (e.g. clear and grade, trenching), may unearth and/or destroy Aboriginal artefacts or skeletal remains and may also have the potential to disturb known Aboriginal sites adjacent to construction areas identified for protection. Consequently, specific management is required to minimise the risk of construction activities detrimentally affecting or destroying heritage sites and to ensure compliance with relevant legislation.

17.2 Purpose and scope of protocol

The purpose of this protocol is to provide for the management and protection of known (e.g. recorded) Aboriginal heritage sites identified for protection and any new sites/artefacts uncovered or identified during construction, to achieve the environmental objectives for the heritage factor. The protocol will apply to the full length of the pipeline corridor.

17.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Known (recorded) Aboriginal heritage sites	To avoid disturbance to Aboriginal heritage sites identified for protection near the pipeline corridor.	No disturbance to Aboriginal heritage sites identified for protection.
New (unrecorded) Aboriginal heritage sites	To manage new Aboriginal heritage sites/artefacts uncovered or identified during construction in accordance with the requirements of the <i>Aboriginal Heritage Act 1972</i> .	All new Aboriginal heritage sites managed in accordance with the <i>Aboriginal Heritage Act 1972</i> .

17.4 Management actions

Activity	Action	Timing	Responsibility
General requirements	The induction program shall involve an Aboriginal Heritage component to ensure all personnel are aware of obligations under the <i>Aboriginal Heritage Act 1972</i> , and the requirements for the protection of known Aboriginal heritage sites and are directed to avoid any disturbance to the sites.	Induction	Construction Contractor
	The induction program shall ensure personnel are informed of the possibility of encountering new sites and what may constitute a site/artefact.	Induction	Construction Contractor
	Aboriginal heritage sites to be protected shall be recorded on the Environmental Line List (ELL).	Prior to construction	DBP
	Erosion control measures shall be installed as required to protect sites near the pipeline corridor.	Prior to construction	Construction Contractor
Survey and Fencing	Heritage sites near construction activities identified for protection shall be clearly flagged and/or fenced.	Prior to construction	Construction Contractor



Activity	Action	Timing	Responsibility
Clear and grade	Qualified site heritage monitors and archaeologists (issued with a Section 16 permit) shall be onsite to monitor clear and grade activities for areas designated in the ELL (e.g. areas considered to have a high potential to contain additional surface or sub-surface archaeological material).	As outlined in the ELL	Construction Contractor
Trenching and excavation	Qualified site heritage monitors and archaeologists (issued with a Section 16 permit) shall be onsite to monitor trenching activities for areas designated in the ELL (e.g. areas considered to have a high potential to contain additional surface or sub-surface archaeological material).	As outlined in the ELL	Construction Contractor
Clean-up and rehabilitation	All flagging and fencing used to identify and protect heritage sites (if any) shall be removed. Erosion control measures not required post-construction (if installed) shall be removed.	At completion of construction activities	Construction Contractor

17.5 Monitoring and recording

Parameter	Frequency	Location	Purpose	Responsibility
New (unrecorded) Aboriginal heritage sites, artefacts or skeletal remains	During clear and grade, and trenching	All active construction areas.	To ensure no new heritage sites or artefacts (e.g. currently unrecorded sites) are disturbed or destroyed by construction activities in contravention of the <i>Aboriginal Heritage Act 1972</i> .	Construction Contractor

17.6 Contingency actions

Trigger	Action	Responsibility
Previously unrecorded Aboriginal heritage site/artefact is uncovered or identified	Immediately cease construction operations within 30 m of the potential heritage site.	Construction Contractor
	Establish a 30 m buffer around the potential heritage site, outside which work may continue.	Construction Contractor
	Notify DBP appointed archaeologist and the Department of Indigenous Affairs (DIA) (if not already present). The Police and State Coroner shall be contacted in the instance of the discovery of skeletal remains. If it is determined the remains are Aboriginal, the Commonwealth Minister for Aboriginal Affairs shall be notified (legal requirement under the <i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984 – Section 20(1)</i>).	Construction Contractor
	The authenticity of the site or material shall be determined using appropriate methods, in consultation with all relevant stakeholders, and suitable mitigative/management measures, once agreed upon by all stakeholders, shall be implemented as soon as practicable. Where disturbance to the site cannot be avoided, consent to disturb the site shall be obtained under Section 18 of the <i>Aboriginal Heritage Act 1972</i> . Where disturbance to the site can be avoided (i.e. through reduced working widths), actions may include compiling a detailed site record, collection of the cultural material or protection of the site (e.g. fencing).	Construction Contractor
	Complete and forward an Incident Report to the appropriate person(s).	Construction Contractor




Trigger	Action	Responsibility
Disturbance of an existing Aboriginal heritage site identified for protection	Immediately cease all work in the area of the heritage site	Construction Contractor
	Investigate the cause of disturbance	Construction Contractor
	Implement actions to prevent disturbance from reoccurring (e.g. fencing site or re-informing workforce).	Construction Contractor
	If necessary, consult with relevant stakeholders (e.g. DIA) to determine actions required to restore the site to its original condition.	Construction Contractor
	Complete and forward an Incident Report to the appropriate person(s).	Construction Contractor

17.7 Recording

All new Aboriginal heritage sites or disturbances to sites identified for protection, shall be recorded in accordance with the Incident Reporting procedures and a report prepared and submitted to the DIA within seven days of the discovery/disturbance incident. The report shall outline the nature of the discovery, the extent and significance of any disturbance, and any mitigation/management measures implemented.

17.8 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline
 DIA Department of Indigenous Affairs
 ELL Environmental Line List

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18 REHABILITATION PROTOCOL

18.1 Background and environmental risks

The final phase of the project is Clean-up and Rehabilitation (Reinstatement), which involves:

- removing construction materials from the construction right-of-way (e.g. skids, palettes, survey pegs, flagging, etc)
- shaping the land surface to match the existing contours, including compacting material back into side cuts
- ploughing or ripping of compacted areas by graders
- construction of final sediment and erosion controls from subsoil
- respread topsoil and cleared vegetation/brush across the construction right-of-way.

Effective rehabilitation will minimise the risk of introducing weed species, minimise disturbance of fauna through re-establishing habitat and stabilising disturbed areas; reducing the potential for erosion and sedimentation of surrounding water bodies.

Native vegetation removed from the construction right-of-way will be respread to aid in sediment and erosion control, retain moisture and to aid establishment of seeds/seedlings and revegetation of the construction right-of-way. Active rehabilitation (seeding) in remnant vegetation will only be conducted on areas that do not respond to the initial rehabilitation treatment.

Aerial photography and land owner consultations have shown that the DBNGP corridor traverses many areas of remnant vegetation that are currently used by land owners as fire breaks, stock routes and vehicle access tracks. Consequently, the quality of regrowth on the DBNGP corridor in many of these areas is poor. This protocol aims to re-establish the land condition to that prior to construction, to the most practical extent.

DBP will finalise rehabilitation objectives on private land, with the concerned landowner prior to ground disturbing activities. These objectives and specific environmental management requirements will be added to the Environmental Line List (ELL) as required.

18.2 Purpose and scope of protocol

The purpose of this protocol is to guide reinstatement of the construction right-of-way and associated construction areas to achieve the following environmental objectives (Section 18.3).

For the purpose of this protocol, the term 'Threatened Flora' is used to collectively describe DRF, Priority Flora and Threatened Flora listed under the EPBC Act.

18.3 Environmental objectives and key performance criteria

Issue	Environmental objective	Performance Indicator
Vegetation	To re-establish vegetation and associated habitat areas to the condition that it was in prior to disturbance or better.	Achievement of the completion criteria set out in Section 18.7 ³⁵ .
Soil	To control sediment and erosion.	Achievement of the completion criteria set out in Section 18.7.

³⁵ There are obligations under the Department of Industry and Resources legislation to maintain the vehicle access track and certain completion criteria may not be achievable within the access track.



18.4 Management actions

Issue	Action	Responsibility
ELL	Areas requiring rehabilitation other than spreading of vegetation and re-seeding shall be entered onto the Environmental Line List (ELL).	DBP
Clean-up	All waste materials (e.g. bags, pegs, skids, pillows) and equipment shall be removed from the construction areas once backfilling and tie-ins are completed.	Construction Contractor
	All flagging and bunting installed for other than environmental or safety reasons shall be removed from the construction areas once backfilling and tie-ins are completed.	Construction Contractor
	Small amounts of rocks and stones generated by the construction process shall be distributed evenly over the construction right-of-way. Where larger volumes of such material have been produced, consideration shall be given to its removal from site.	Construction Contractor
Infrastructure	All temporary gates shall be removed (unless required for operational reasons) and the fence reinstated to at least as good as the pre-construction condition. Gates removed from the fence line shall be returned.	Construction Contractor
	Any third party infrastructure disturbed during construction shall be restored to the owner's satisfaction.	Construction Contractor
	Public roads and tracks used during construction shall be returned to their pre-construction state, or to a condition agreed to with the landholder.	Construction Contractor
	All fences that were cut and replaced by gates during construction shall be repaired to at least the equivalent pre-construction condition, unless permanent gates or other arrangements are agreed to with the landholder.	Construction Contractor
Ripping	Areas subject to high traffic movements during construction to be rehabilitated shall be ripped to a depth of 30 cm, where necessary, prior to resspreading topsoil.	Construction Contractor
Topsoil	Topsoil spreading will be managed in accordance with the Soil Management Protocol (Section 16) and with the completion criteria set out in Section 18.7.	Construction Contractor
Vegetation	Vegetation spreading will be managed in accordance with the Flora and Vegetation Management Protocol (Section 3) and with the completion criteria set out in Section 18.7.	Construction Contractor, DBP
Erosion	Erosion shall be managed in accordance with the Soil Management Protocol (Section 16) and with the completion criteria set out in Section 18.7.	Construction Contractor
	If the construction works result in subsequent erosion of watercourses, reasonable remedial action will be taken if requested by the DoW. This would require that the erosion is demonstrably attributable to the construction work or an associated activity by DBP.	DBP
Watercourses	Watercourse crossings shall be managed in accordance with the Watercourse Crossing Management Protocol (Section 9).	Construction Contractor
Dunes	Rehabilitation of dune crossings shall be managed in accordance with the Dune Crossing Protocol (Section 10.4).	Construction Contractor
Wetlands	Wetlands shall be managed in accordance with the Wetland Management Protocol (Section 5).	Construction Contractor
Weeds, pathogens, pests	Weed and disease management shall be managed in accordance with the Weed, Pest and Dieback Management Protocol (Section 4) and with the completion criteria set out in Section 18.7.	Construction Contractor

18.5 Monitoring and recording

Issue	Action	Timing	Responsibility
Native species	Species abundance and, distribution within the construction right-of-way after rehabilitation.	12 months after reinstatement	DBP
	Records of visual and photo monitoring.	Prior to clear and grade and immediately following reinstatement	Construction Contractor



Issue	Action	Timing	Responsibility
	Records of visual and photo monitoring.	12 months after instatement	DBP
Weed assessment	Quadrant and photo-point monitoring of rehabilitation in areas of remnant vegetation.	Immediately following reinstatement	Construction Contractor
	Weed species richness and cover to facilitate management of weed issues.	Following completion of reinstatement	Construction Contractor
Erosion	Inspections of the soil shall be undertaken in the 12-month period following the completion of construction to determine subsequent erosion and changes in the drainage patterns, and any further rehabilitation measures required determined in consultation with regulators.	12 months following reinstatement	DBP
	If the construction works result in subsequent erosion of watercourses, reasonable remedial action will be taken if requested by the DoW. This would require that the erosion is demonstrably attributable to the construction work or an associated activity by DBP.	At any time following completion of construction	DBP
	Records of visual and photo monitoring.	Prior to clear and grade and following reinstatement	Construction Contractor
Landowner satisfaction	Following reinstatement, DBP and the Construction Contractor shall meet with affected landowners to discuss rehabilitation and further ongoing management.	Following reinstatement	DBP and Construction Contractor

18.6 Photo monitoring

Photo monitoring shall be conducted to monitor reinstatement, with two photographs taken at each point – one in each direction along the corridor, immediately prior to clear and grade and immediately following reinstatement. At a minimum, two photos shall be taken at spacing no greater than the maximum as set out in Table 4-5. The two photos at each point are to be looking in both directions along the construction right-of-way alignment. These photo monitoring locations shall be used for subsequent monitoring of rehabilitation progress.

Table 4-5 Photo-point spacing

Loop	Area	Maximum photo-point spacing
Loops 0 to 6	1. Areas of conservation value other than locations of Threatened Flora	200 m
	2. Locations of Threatened Flora	50 m
	3. All other areas	5 km
Loops 7 – 10	1. Areas of conservation value other than locations of Threatened Flora	200 m
	2. Locations of Threatened Flora	50 m
	3. Other areas containing native vegetation	200 m
	4. All other areas	Not required

All photo points will be recorded on the Environmental Line List, with monitoring sites located in nearby control areas (with similar vegetation) and in the rehabilitated areas of the pipeline construction right-of-way.

Aerial photographs and land owner consultations have shown that the previously established corridors through the remnant vegetation areas are currently used by land owners as fire breaks, stock routes and vehicle access tracks. The access for vehicles in the future near the pipeline is critical for ongoing maintenance and or operational activities along the pipeline. Therefore, parts of the construction right-of-way will remain disturbed as



a result of the need for an access track. The existing track may be relocated within the pipeline easement to cater for access to two pipelines.

Because of the obligation to strip all topsoil, any monitoring quadrats shall be located immediately adjacent to the construction right-of-way in vegetation type and density that is consistent with the area to be cleared.

Monitoring shall be conducted annually in spring for Loops 8 to 10 and post wet season for Loops 0 to 7 until the rehabilitated areas have regenerated to a stable condition, to the satisfaction of DEC.


After completion, the entire construction right-of-way shall be reviewed for bare areas and weed infestations. Once the rehabilitation programme is complete, this monitoring shall be captured in the ongoing operational management of the DBNGP.

Propagule augmentation may be necessary to achieve completion criteria.



18.7 Rehabilitation Completion Criteria

Aspect	Objective	Criteria	Assessment Method
Construction	To ensure that the key commitments implemented during the construction phase will assist in maximising the recovery of the native flora and vegetation on the pipeline construction right-of-way.	100% compliance with the weed hygiene protocol.	Audit during the operation.
		100% compliance with the dieback hygiene protocol (Loops 8 and 9 only).	Audit during the operation.
		Vegetation and topsoil is cleared and stored in compliance with CEMP.	Audit during the operation.
		Significant plant species are protected in accordance with the CEMP.	Audit during the operation.
Decommissioning	To ensure that all visual disturbances are removed by prompt remedial action to the greatest extent practicable.	All equipment, materials and litter are removed from the area of disturbance.	Visual inspection of the area of disturbance.
Erosion	To reinstate the land to provide suitable conditions for natural re-colonisation of native vegetation and support natural surface water movement.	Re-instatement of natural contours to pre-disturbance conditions.	Visual inspection of area of disturbance.
		No active erosion rills in excess of the surrounding land.	GPS record and physical measurement of any points of erosion.
		In erosion prone areas, within the 30 m wide construction right-of-way, individual bare patches must not exceed 10 m in length, and the cumulative sum of bare patches must not exceed 10% of the total area of each consecutive 100 m length of construction right-of-way after 12 and 24 months.	Visual assessment. Note this criterion does not apply in areas that were previously bare.
Weeds	To facilitate the establishment of native plant species, where native vegetation has been removed during the construction process.	Minimise the spread and intensification of weed infestations through vehicle hygiene protocols.	Visual inspection of the area of disturbance, with backing from photographs, baseline surveys and rehabilitation monitoring datasets.
		The foliage cover of declared and environmental weeds within disturbed areas should be similar to vegetation immediately adjacent to the area of disturbance after 12 and 24 months.	Visual inspection of the area of disturbance, with backing from photographs, baseline surveys and rehabilitation monitoring datasets.
Flora and Vegetation (where native vegetation has been removed during the construction process)	To facilitate the establishment of native plant species, where native vegetation has been removed during the construction process.	A minimum of 1 native plant per square metre when averaged over the entire area rehabilitated at 12 months. A minimum of 2 native plants per square metre when averaged over the entire area rehabilitated at 24 months.	Visual inspection of the area of disturbance, with backing from photographs, baseline surveys and rehabilitation monitoring datasets.
		Percentage foliage cover of native species indigenous to each plant community is greater than or equal to 40% of foliage cover in vegetation immediately adjacent to the area of disturbance after 24 months (excluding pipeline access track).	Visual inspection of the area of disturbance, with backing from photographs, baseline surveys and rehabilitation monitoring datasets.

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Aspect	Objective	Criteria	Assessment Method
		Species Richness of greater than or equal to 50% (unless negotiated otherwise with DEC) in vegetation immediately adjacent to the area of disturbance after 24 months.	Visual inspection of the area of disturbance, with backing from photographs, baseline surveys and rehabilitation monitoring datasets.

Rehabilitation of areas of conservation value immediately following completion of construction will be the responsibility of the Construction Contractor. Subsequent monitoring and completion of this rehabilitation will be the responsibility of DBP.

18.8 Contingency actions

If monitoring indicates that the criteria are not being met after 12 months (Loops 8 to 10) and 24 months (Loops 0 to 7), remedial action shall be discussed with DEC and DMP. Remedial action within failed areas may include active reinstatement such as ripping, seeding or active weed control. In the event that reseeding is required, DEC will be invited to participate in the reseeding process (e.g. identify suitable seed lists, witness reseeding activities).

Areas of high weed cover will be treated, with a program developed in consultation with the Department of Agriculture and Food (DAF) and Department of Environment and Conservation DEC, and designed to ensure weed infestations are at least comparable to pre-construction levels and, where possible, less than those baseline levels.

While best endeavours will be made to achieve these Completion Criteria there may be some exclusions in the event that uncharacteristic seasonal weather conditions prevail. This shall be taken into consideration in relation to the Completion Criteria. In the event of areas not meeting Completion Criteria, joint site reviews will be undertaken to determine appropriate remedial action, if required, to DEC requirements.

18.9 Abbreviations

CEMP	Construction Environmental Management Plan
DAF	Department of Agriculture and Food
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
ELL	Environmental Line List



19 ACCESS AND SAFETY MANAGEMENT PROTOCOL

19.1 Background

Access management is primarily managed under the DBNGP Stage 5 Land Management Strategy and in accordance with the objectives of that strategy. The following management actions are essential for ensuring public amenity is not significantly affected by temporary or permanent change in access and land use due to the project.

19.2 Management actions

Prior to entry onto the construction right-of-way, DBP and the Contractor will ensure that the relevant authorities, landowners and/or occupiers are notified as to when their land will be accessed and for how long construction works will be undertaken. Adjacent landowner whose property access could be affected by the construction work shall also be consulted as well as the relevant authority for roads or other infrastructure intercepted by the project.

Additional work areas, such as turning areas, laydown areas and turkey nests, outside the construction right-of-way shall be agreed to between DBP and the relevant authority, landowner and/or occupier prior to arrival on site should they be required.

Issue	Action	Timing	Responsibility
Disruption to land use and infrastructure	All work areas and access tracks required on subject land outside the construction right-of-way shall be identified.	Prior to contact with landowner / occupiers	DBP
	Infrastructure (roads, railways) along the construction right-of-way that will require access to be maintained or managed during construction shall be identified.	Prior to contact with relevant authorities	DBP
	Homes and commercial properties shall be identified along the construction right-of-way.	Prior to contact with landowner / occupiers	DBP
	Activities shall be scheduled to minimise delay between initial clearing and restoration.	Prior to entry	Construction Manager
	Agreement regarding minimisation of impact to land and to access shall be made with authorities, landowner and occupiers in advance of construction.	Two months prior to entry	Construction Manager
	Impact on local roads or other infrastructure and maintenance or management of access shall be agreed with relevant authorities.	Two months prior to entry	Construction Manager
	Affected stakeholders shall be consulted to ensure that necessary action is taken to address concerns throughout and after construction.	Two months prior to entry	Construction Manager
	Times of highest potential to significantly impact on access shall be ascertained in consultation with adjacent landowner or relevant authority and activities scheduled to avoid these times where practicable.	Two months prior to entry	Construction Manager
	All landowner, occupier or relevant authorities shall be provided with notification of timing of pre-construction activities before arrival on their land.	Five days prior to entry	Construction Manager
	All landowner, occupier or relevant authorities shall be provided with notification of timing of construction activities before arrival on their land.	14 days prior to arrival on site	Construction Manager
All construction activities (including stockpiling of pipeline sections) shall be restricted to the construction right-of-way unless otherwise agreed to with landowner and described in the environmental approval documentation.	During construction	All personnel	



Issue	Action	Timing	Responsibility
	Agreed management of interaction with other infrastructure shall be adhered to.	During construction	Construction Manager
	Personnel shall enter and exit the corridor on designated roads and access tracks.	During construction	Construction Manager
Safety	All personnel shall adhere to Project vehicle speed limits (i.e. 60 km/hr on the construction right-of-way and walking speed next to project equipment).	During construction	Construction Manager
Public risk and safety	Appropriate signage, in accordance with project traffic management plans, shall be installed during construction and operation to clearly identify the presence of construction vehicles and the pipeline.	During construction	Construction Manager
Stock access	Crossing points for stock and vehicle access shall be maintained as agreed with landowner.	During construction	Construction Manager
	Temporary gates shall be kept closed at all times to prevent escape of stock.	During construction	All personnel

19.3 Abbreviations

DBNGP Dampier-Bunbury Natural Gas Pipeline
 DEC Department of Environment and Conservation
 DMP Department of Mines and Petroleum



Chapter 5 Administration

1 STAKEHOLDER CONSULTATION

DBP has undertaken a program identify and consult stakeholders, including local residents and all landholders whose properties will be affected by the project, to inform them of the Stage 5 Expansion, the proposed schedule of construction works and the actions that will be undertaken to minimise potential impacts.


DBP and its contractors will continue this consultation program to ensure stakeholders are kept informed on the project and to minimise disruption to landowners affected by both pre-construction and construction activities. Many of the management actions, particularly those with the potential to impact on neighbouring residences including dust, noise and rehabilitation, require continued ongoing consultation with landowners.

As part of this consultation program, DBP has also consulted and will continue to consult with a number of regulatory authorities, including:

- Department of Sustainability, Environment, Water, Population and Communities (proposal has been assessed as a “controlled action” under the *Environment Protection and Biodiversity Conservation Act 1999*)
- Department of Water (licences required for surface water and groundwater supplies under the *Rights in Water and Irrigation Act 1914*)
- Department of Environment and Conservation (development of protocols for activities regulated under the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950*)
- Environmental Protection Authority Service Unit (proposal has been formally referred under the *Environment Protection Act 1986*)
- Department of Mines and Petroleum (approval of this CEMP under the pipeline licence issued under the *Petroleum Pipelines Act 1969*)
- Department of Planning and Infrastructure (*Land Administration Act 1997* and *Dampier to Bunbury Pipeline Act 1979*).

The major issues raised by the agencies related to management of acid sulphate soils, dewatering and disposal of water, and fauna impacts and handling. Many of the other issues had been resolved in the CEMP for Stage 4 and a similar approach has been adopted for those issues in Stage 5. Discussions have been held with the agencies on the major issues of concern, the results of which have formed the basis for the management protocols presented in this CEMP.

The Land Management Strategy sets out the performance standards and key management requirements for the management of access to land, and the establishment and maintenance of good relations with landowners and occupiers affected by the project.

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2 AUDITING


Assessment of the level of compliance will be undertaken through a number of methods and at different timeframes throughout the life of the project. Construction areas shall be subject to weekly (or as required by DBP in consultation with its environmental consultants) inspections during construction, to be undertaken by construction contractors. Relevant documentation to be reviewed during these inspections may include Environmental Incident Reports, waste disposal forms and previous records of inspection, to check whether problems or non-adherences to the Management Protocols have been rectified. Monitoring will be undertaken on an as required basis, dependent upon the management protocols being implemented.

Auditing will be undertaken separately from the contractor inspections, and will assess and record whether activities are being undertaken in compliance with regulatory requirements and the objectives outlined in this CEMP. The audit program will involve:

- Bi-monthly audits – assess implementation of key management actions and protocols and may involve specialist auditors
- 12 monthly environmental compliance audits – assess compliance with the conditions and objectives of the CEMP.

Bi-monthly audits will be internal, undertaken by suitably qualified environmental personnel employed by DBP to ensure contractors are fulfilling environmental obligations. The 12-monthly audit will be undertaken by an external auditor, conducted in accordance with an agreed Audit Protocol, with the outcomes to form the basis of the statement of compliance submitted to DEC.

The findings of environmental audits will be submitted to the Project Manager, and used to develop and implement rectification plans as required. The auditable parameters for the project shall be based on the objectives and performance criteria provided in Chapter 2 Section 5.

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3 REVIEW AND REVISION

Revision of the CEMP and associated Management Protocols may be required to ensure that the proposed management actions are current and effective in achieving the management objectives. As such, a “change management” process is required to ensure that regulatory bodies and the proponent may request and be involved in the development of new or additional management protocols. The “change management” process must be capable of ensuring that all versions of the document, held by the various parties, are updated with recent amendments.

3.1 Approval

This document is subject to approval by a number of regulators, each with responsibilities for various aspects covered by the management protocols set out in Chapter 4.

Table 5-1 Construction Environmental Management Plan and management protocol approval matrix

Component	Approving agency(s)	Consultation agency(s)	Authority
Overall CEMP	DMP and Minister [#]		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence Decision to Approve the Taking of an Action (EPBC 2006/2813)
Environmental Incident Response Protocol (Chapter 4 Section 1)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Conservation Area Management Protocol (Chapter 4 Section 2)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Flora and Vegetation Management Protocol (Chapter 4 Section 3)	DMP, Requirements of Minister [#]	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence, <i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Weed, Pest and Dieback Management Protocol (Chapter 4 Section 4)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Wetland Crossing Management Protocol (Chapter 4 Section 5)	Requirements of Minister [#] , DoW	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735, <i>Rights in Water and Irrigation Act 1914</i> permit
Dewatering and Water Disposal Management Protocol (Chapter 4 Section 6)	DMP	DoW	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Acid Sulphate Soil Management Protocol (Chapter 4 Section 7)	DMP	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Fauna Interaction Protocol (Chapter 4 Section 8)	Requirements of Minister [#]		<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735
Watercourse Crossing Protocol (Chapter 4 Section 9)	Requirements of Minister [#] , DoW	DEC	<i>Environmental; Protection Act 1986</i> Ministerial Statement No 735, <i>Rights in Water and Irrigation Act 1914</i> permit
Dune Crossing Management Protocol (Chapter 4 Section 10)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Fire Management Protocol (Chapter 4 Section 11)	DMP	FESA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Dust Management Protocol (Chapter 4 Section 12)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Noise Management Protocol (Chapter 4 Section 13)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence



Component	Approving agency(s)	Consultation agency(s)	Authority
Fuel and Chemical Storage, Spill and Emergency Response Protocol (Chapter 4 Section 14)	DMP	DEC, FESA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Waste Management Protocol (Chapter 4 Section 15)	DMP	DEC	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Soil Management Protocol (Chapter 4 Section 16)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Aboriginal Heritage Site Management Protocol (Chapter 4 Section 17)	DMP	DIA	<i>Petroleum Pipelines Act 1969</i> Pipeline Licence
Rehabilitation Management Protocol (Chapter 4 Section 18)	Requirements of Minister [#]	DEC	Environmental; Protection Act 1986 Ministerial Statement No 735
Access and Safety Management Protocol Chapter 4 Section 19)	DMP		<i>Petroleum Pipelines Act 1969</i> Pipeline Licence

Minister [#]	State Minister for the Environment	DIA	Department of Indigenous Affairs (WA)
Minister ^{##}	Federal Minister for the Environment	DMP	Department of Mines and Petroleum (WA)
Minister ^{###}	Federal Minister for Transport	DoW	Department of Water (WA)
DEC	Department of Environment and Conservation (WA)	DPI	Department of Planning and Infrastructure (WA)
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cwlth)	EPA	Environmental Protection Authority (WA)
		SRT	Swan River Trust

3.2 Change control

A review or amendment to the CEMP, including any management protocol may be initiated at any time by either:

- DBP
- State Minister for the Environment
- Federal Minister for the Environment
- DMP.

Where any relevant agency with a statutory interest in the management of environmental aspects of construction requires review of any part of the CEMP, that review should be requested in writing to DBP.

DBP (after agreement with the Contractor) shall make any request for a review or revision in writing to the Federal Minister for the Environment, the EPA and to DMP.

Following agreement between DBP and the Contractor on the outcome of the proposed review or revision, the outcome will be documented by exchange of letters and the amended CEMP or appropriate part thereof, reissued to all holders of the document.

NOTE: This CEMP does not remove any obligations on DBP or the Contractor to comply with the statutory requirements of any regulating agency.




4 REPORTING

DBP shall maintain an appropriate and auditable record system in accordance with its EMS. Environmental reporting shall be conducted in accordance with licence conditions.

Environmental reporting information shall include:

1. Non-conformance reports.
2. Remedial actions taken following incident reports.
3. Quantitative records of discharges to the environment that are accurate and can be monitored and audited.
4. Detail on fauna interactions.
5. Waste register.
6. Fires.
7. Spills.
8. Inspection reports.
9. Training and induction attendance.
10. Consultation records and meeting notes.
11. Audit reports.
12. Monitoring results.

Environmental incidents and identified instances of non-compliance with the CEMP shall be recorded and reported on an Incident Report proforma in accordance with the Environmental Incident Response Protocol (Section 1).

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Chapter 6 References and abbreviations

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2 ABBREVIATIONS AND ACRONYMS

Table 6-1 Abbreviations

Abbreviation	Full Title
AIC	Australian Interaction Consultants
ALARP	As low as reasonably practicable
ANZECC	Australian and New Zealand Environment Conservation Council
APIA	Australian Pipeline Industry Association Inc
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASS	Acid sulphate soils
CAMBA	China-Australia Migratory Bird Agreement
CCW	Conservation category wetland
CEMP	Construction Environmental Management Plan
CITES	Convention on International Trade in Endangered Species
Cwth	Commonwealth
d	day
DAF	Department of Agriculture and Food
dB	Decibel
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DBP	Dampier Bunbury Pipeline (the trading name of the DBNGP group of companies)
DEC	Department of Environment and Conservation (WA)
DEP	Department of Environmental Protection (former)
DIA	Department of Indigenous Affairs
DO	Dissolved oxygen
DoE	Department of Environment (former)
DMP	Department of Mines and Petroleum
DoW	Department of Water
DRF	Declared Rare Flora
DUET	Diversified Utilities and Energy Trust
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELL	Environmental Line List
EMS	Environmental Management System
ENV	Effective neutralising value
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPP	Environmental Protection Policy
ESA	Environmentally Sensitive Area
GDE	Groundwater dependent ecosystems
GPS	Global Positioning System



Abbreviation	Full Title
ha	Hectare
HDD	Horizontal directional drilling
Heritage Act	<i>Heritage of Western Australia Act 1990 (WA)</i>
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for the Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JESHA	Job environmental safety hazard analysis
km	Kilometre
KP	Kilometre point
kW	Kilowatt
m	Metre
mAHD	metres above Australian Height Datum
mbgl	Metres below ground level
ML	Megalitres
mm	Millimetre
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
OEMP	Operational Environmental Management Plan
pH _F	Field pH
pH _{FOX}	Field pH after oxidation with hydrogen peroxide
RWI Act	<i>Rights in Water and Irrigation Act 1914</i>
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cwth)
SWALSC	South West Aboriginal Land and Sea Council
TDS	Total dissolved solids
TEC	Threatened ecological community
TJ	Tetra-joules
WA	Western Australia
WAPC	Western Australian Planning Commission
Wildlife Act	<i>Wildlife Conservation Act 1950 (WA)</i>
WRC	Water and Rivers Commission (now DoW and DEC)
YMBBMAC	Yamatji Marlpa Barna Baba Maaja Aboriginal Corporation



Chapter 7 Construction right-of-way maps

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