

## **5.0 RISK-BASED ASSESSMENT APPROACH TO ENVIRONMENTAL IMPACT ASSESSMENT**

This PER and associated appendices make reference to both the Approved Gorgon Gas Development and the Revised Gorgon Gas Development, which is the subject of this PER. For clarification purposes, the following definitions are provided:

- ◆ “the Approved Gorgon Gas Development” or “the Approved Development” refers to the development proposed in the EIS/ERMP (Chevron Australia 2005a) and subsequently approved under Statement No. 748 and EPBC Reference: 2003/1294
- ◆ “the Gorgon Gas Development Revised and Expanded Proposal” or “the Revised Gorgon Gas Development” or “the Revised Proposal” refers to the development proposed in this PER, which is yet to gain approval
- ◆ “the Gorgon Gas Development” refers to the entire proposal. This descriptor may be used when the reference is being made to elements of “the Revised Proposal” described in the PER when they replace the elements of “the Approved Development” which have changed to create the final product as proposed in this PER.

### **5.1 Environmental Risk Assessment Methodology for the Revised Proposal**

#### **5.1.1 Overview**

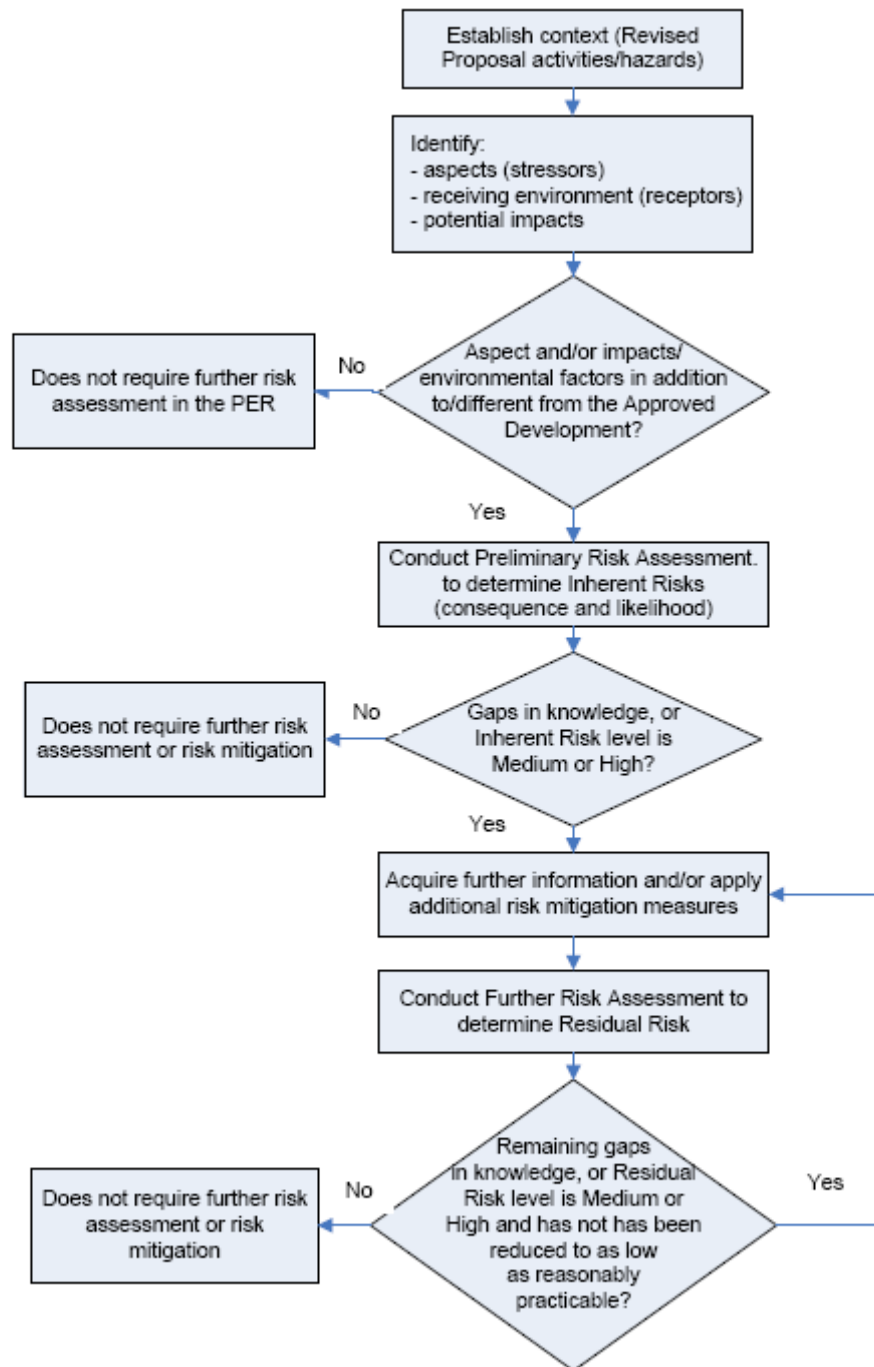
Environmental risk assessment is a process that evaluates the likelihood and consequence of environmental impacts occurring as a result of exposure to one or more stressors. One of the advantages of this process is that it allows potential environmental aspects or threats to be considered on the basis of the level of potential risk to the environment. This subsequently assists in prioritising the development of management measures to achieve an overall acceptable level of risk.

The GJVs undertook a risk assessment to support the environmental impact assessment for the Approved Development. For comparative purposes, the risk assessment process for the Revised Proposal followed the same methodology that was utilised for the Approved Development and presented in the EIS/ERMP (Chevron Australia 2005a).

For both the EIS/ERMP and the PER, the environmental risk assessment was undertaken in accordance with the principles and guidelines contained in the following:

- ◆ AS/NZS 4360:2004, Risk Management
- ◆ SAA Handbook 203:2004, Environmental Risk Management – Principles And Process
- ◆ AS/NZS 3931:1998, Risk Analysis of Technological Systems – Application Guide.

The environmental risk assessment process is depicted in Figure 5.1, and is described in the following sections.



**Figure 5.1: Steps in the Environmental Risk Assessment Process**

## 5.1.2 Establishment of Risk Assessment Framework for the Revised Proposal

### 5.1.2.1 Identification of Activities Associated with the Revised Proposal

Activities for the Revised Proposal were grouped into key project phases:

- ◆ construction
- ◆ commissioning
- ◆ operation
- ◆ unplanned events

- ◆ non-routine operations.

#### 5.1.2.2 Identification of Additional or Different Environmental Aspects and Impacts

A preliminary risk-based analysis was undertaken during the development of the Revised Proposal Environmental Scoping Document to identify:

- ◆ potential aspects and/or impacts that were in addition to, or different from, the Approved Development and/or may pose a significant environmental risk
- ◆ aspects and potential impacts (and the associated environmental factors) differing from those identified for the Approved Development and therefore requiring assessment in the PER (and where further data acquisition to support the assessment may be required)
- ◆ aspects and potential impacts (and the associated environmental factors) that remained unchanged from those identified for the Approved Development and therefore did not require further assessment in the PER.

During preparation of the Environmental Scoping Document for the Revised Proposal, a one day workshop was conducted on 11 April 2008, to consultatively identify the aspects, receptors and potential impacts of the Revised Proposal. This workshop was attended by officers of the Western Australian Environmental Protection Authority Service Unit (EPA SU) (as observers) and the Western Australian Department of Environment and Conservation (DEC) (as observers), specialist consultants and relevant Gorgon Project personnel.

In summary, it was determined that:

- ◆ most of the aspects and impacts associated with the Approved Development also apply to the Revised Proposal
- ◆ the Revised Proposal would result in primarily incremental environmental impacts and only a comparatively small number of different impacts when compared with the Approved Development.

A number of environmental factors were identified in the scoping phase (and presented in the Environmental Scoping Document) as not requiring further assessment in this PER because the Revised Proposal will not result in any additional or different impact to the environmental factor(s) when compared with the Approved Development. These environmental factors being:

- ◆ soils and landforms
- ◆ surface water
- ◆ groundwater.

The results from the preliminary risk-based analysis are presented in Appendix C of this PER.

#### 5.1.2.3 Definition of Likelihood, Consequences and Risk Matrix

The risk assessment for the Revised Proposal was undertaken using the same processes and format as were used for the Approved Development. That is, the risk matrix and its defining measures of likelihood and consequence were the same as those used for the Approved Development allowing the results from the two assessments to be directly compared. These measures of likelihood and consequences and the risk matrix are presented in Table 5.1, Table 5.2, Table 5.3 and Table 5.4.

**Table 5.1: Measures of Likelihood**

<b>Likelihood Category</b>	<b>Description</b>
1 – Almost certain	Very likely to occur on an annual basis, includes planned activities. Socio-economic description includes the period during construction.
2 – Likely	Likely to occur more than once during the life of the proposed development.
3 – Possible	May occur within the life of the proposed development.
4 – Unlikely	Not likely to occur within the life of the proposed development.
5 – Remote	Highly unlikely and unheard of in industry, but theoretically possible.

**Table 5.2: Measures of Consequence – Terrestrial**

	1	2	3	4	5
	<b>Critical</b>	<b>Major</b>	<b>Serious</b>	<b>Moderate</b>	<b>Minor</b>
Soils and Landform	Widespread contamination that cannot be readily remediated and/or; Major changes in regional recharge patterns and/or; Regional loss of a unique landform.	Widespread contamination requiring a significant probability of the event occurring, the receptor being present and the resultant long-term remediation effort and/or; Widespread, long-term change in soil characteristics and/or; Minor changes in regional recharge patterns and/or; Widespread loss of a unique landform habitat.	Local contamination that cannot be readily remediated and/or; Local, long-term, or widespread, short-term change in soil characteristics and/or; Major, widespread changes in sub-catchment recharge patterns and/or; Widespread loss of well-represented landform habitats and/or; Local loss of a unique landform habitat.	Local contamination requiring a long-term remediation effort and/or; Local, short-term change in soil characteristics and/or; Local and major change in recharge patterns within sub-catchments and/or; Widespread and minor changes in recharge patterns and/or; Local loss of well-represented landform habitats.	Local contamination that can be readily remediated and/or; Negligible impact to soil characteristics and/or; Local and minor change in recharge patterns within sub-catchments and/or; Disturbance of well-represented landform habitats.
Restricted Flora and Vegetation	Widespread and long-term decrease in abundance of flora or impact to community structure and/or; Extinction on Barrow Island, or reduced viability in the immediate region.	Widespread and long-term decrease in abundance of flora or impact to community structure and/or; Reduction in viability of taxon or community on Barrow Island.	Widespread, short-term or local, long-term decrease in abundance of flora or impact to community structure and/or; Reduced viability of community taxon in local area, no reduction in viability on Barrow Island.	Widespread, short-term or local, long-term decrease in abundance of flora or impact to community structure and/or; No reduction in community/taxon viability in local area.	Local and short-term decrease in abundance of flora or impact on community structure and/or; Sub-lethal physiological impacts.
General Flora and Vegetation	Widespread and long-term decrease in abundance of flora or impact to community structure and/or; Extinction in immediate area.	Widespread and long-term decrease in abundance of flora or impact to community structure and/or; Extinction on Barrow Island, or reduced viability in the immediate region.	Widespread and long-term decrease in abundance of flora or impact to community structure and/or; Reduced viability of community on Barrow Island.	Widespread, short-term or local, long-term decrease in abundance of flora or impact to community structure and/or; Reduced viability of community or taxon in local areas, no reduction in viability on Barrow Island.	Widespread, short-term or local, long-term decrease in abundance of flora or impact to community structure and/or; Sub-lethal physiological impacts and/or; No reduction in community or taxon viability in local area.

	Critical				
	1	2	3	4	5
Listed Terrestrial Fauna	Widespread, long-term impact to population and/or; Extinction of Barrow Island race.	Local, long-term or widespread, short-term impact leads to loss of local population/s and reduced viability of the race on Barrow Island.	Widespread, long-term behavioural impact and/or; Local, long-term or widespread short-term decrease in abundance and/or; Loss of individuals leads to reduction in viability of local population and/or; No reduction in viability of race on Barrow Island.	Local, long-term or widespread, short-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Loss of small number of individuals without reduction in local population viability.	Local, short-term behavioural impact and/or; Local, short-term decrease in abundance and/or; No lasting effects on local population.
General Terrestrial Fauna	Loss from immediate region.	Widespread, long-term impact on population and/or; Extinction on Barrow Island.	Local, long-term or widespread, short-term impact leads to loss of local population/s and reduced viability on Barrow Island.	Widespread, long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Loss of individuals leads to reduction in viability of local population and/or; No reduction in viability on Barrow Island.	Local, long-term or widespread, short-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Loss of small number of individuals without reduction in local population viability.
Subterranean Fauna	Loss from immediate region.	Widespread, long-term impact on population and/or; Extinction on Barrow Island.	Local, long-term or widespread, short-term impact leads to loss of local population/s and reduced viability on Barrow Island.	Widespread, long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Loss of individuals leads to reduction in viability of local population and/or; No reduction in viability on Barrow Island.	Local, long-term or widespread, short-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Loss of small number of individuals without reduction in local population viability.

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>Critical</b>	<b>Major</b>	<b>Serious</b>	<b>Moderate</b>	<b>Minor</b>
Surface Water	Regional, long-term reduction in water quality.	Regional, short-term reduction in water quality.	Widespread, long-term reduction in water quality.	Minor reduction in water quality which is widespread, short-term or local, long-term and/or; Major reduction in water quality which is local, short-term.	Local, short-term or minor reduction in water quality.
Groundwater	Regional, long-term reduction in water quality.	Regional, short-term reduction in water quality.	Widespread, long-term reduction in water quality.	Minor reduction in water quality which is widespread, short-term or local, long-term and/or; Major reduction in water quality which is local, short-term.	Local, short-term or minor reduction in water quality.
Air Quality	Regional, long-term change in air quality.	Regional, short-term change in air quality.	Widespread, long-term exceeding of standards.	Minor exceeding of standards that is widespread, short-term or local, long-term and/or; Major exceeding of standards which is local, short-term.	Local, short-term or minor exceeding of standards.

**Table 5.3: Measures of Consequence – Marine**




	1	2	3	4	5
	<b>Critical</b>	<b>Major</b>	<b>Serious</b>	<b>Moderate</b>	<b>Minor</b>
Restricted and Significant Marine Benthic Primary Producer Communities	Widespread and long-term decrease in abundance or impact to a community and/or; Extinction on Barrow Island, within mainland management unit, or in surrounding waters or reduced viability in the immediate region.	Widespread and long-term decrease in abundance or impact to a community and/or; Reduced viability of taxon or community in waters surrounding Barrow Island.	Widespread, short-term or local, long-term decrease in abundance or impact to a community and/or; Reduced viability in a local area and/or; No reduction in community or taxon viability in waters surrounding Barrow Island.	Widespread, short-term or local, long-term decrease in abundance or impact to a community and/or; No reduction in community or taxon viability in local area.	Local and short-term decrease in abundance or impact to a community.
General Benthic Primary Producer Taxa and Communities	Widespread and long-term decrease in abundance or impact to a community and/or; Extinction in immediate region.	Widespread and long-term decrease in abundance or impact on a community and/or; Extinction on Barrow Island, within mainland management unit, or in surrounding waters or reduced viability in the immediate region.	Widespread and long-term decrease in abundance or impact to a community and/or; Reduced viability of taxon or community in waters surrounding Barrow Island.	Widespread, short-term or local, long-term decrease in abundance or impact to a community and/or; Reduced viability in local area and/or; No reduction in community or taxon viability in waters surrounding Barrow Island.	Widespread, short-term or local, long-term decrease in abundance or impact to a community and/or; No reduction in local area.
Listed Marine Fauna and Benthic Communities or Evolutionary Significant Units	Widespread, long-term impact to population and/or; Extinction on Barrow Island or reduced viability in the immediate region.	Local, long-term or widespread, short-term impact to population and/or; Reduced population viability on Barrow Island or in surrounding waters.	Widespread and long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Reduced local population viability and/or; No reduction in population viability on Barrow Island or in surrounding waters.	Widespread, short-term or local, long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; No reduction in local population viability.	Local and short-term behavioural impact and/or; Local and short-term decrease in abundance.

	1	2	3	4	5
	Critical	Major	Serious	Moderate	Minor
General Marine Fauna and Benthic Communities	Extinction in the immediate region.	Widespread, long-term impact to population and/or; Extinction on Barrow Island or reduced viability in the immediate region.	Widespread, long-term or widespread, short-term impact to population and/or; Reduced population viability on Barrow Island or in surrounding waters.	Widespread and long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; Reduced local population viability and/or; No reduction in population viability on Barrow Island or in surrounding waters.	Widespread, short-term or local, long-term behavioural impact and/or; Local, long-term or widespread, short-term decrease in abundance and/or; No reduction in local population viability.
Marine Water Quality	Regional, long-term reduction in water quality.	Regional, short-term reduction in water quality.	Widespread, long-term reduction in water quality.	Small reduction in water quality which is widespread, short-term or local, long-term and/or; Large reduction in water quality which is local, short-term.	Local, short-term or small reduction in water quality.
Seabed (Subtidal and Intertidal) and Foreshore	Widespread contamination or disturbance that cannot be readily rectified and/or; Regional loss of a unique landform habitat.	Widespread contamination or disturbance requiring a significant long-term restoration effort and/or; Widespread, long-term change in benthic substrate characteristics and/or; Widespread loss of a unique landform habitat.	Localised contamination or disturbance that cannot be readily rectified and/or; Local, long-term, or widespread, short-term change in benthic substrate characteristics and/or; Widespread loss of well-represented landform habitats and/or; Local loss of a unique landform habitat.	Localised contamination or disturbance requiring a long-term restoration effort and/or; Local, short-term change in benthic substrate characteristics and/or; Local loss of well-represented landform habitats.	Localised contamination of low metabolic effect, or disturbance that can be readily rectified and/or; Negligible impact to benthic substrate characteristics and/or; Disturbance of well-represented landform habitats.

**Table 5.4: Risk Matrix**

		Consequence Category				
		5 Minor	4 Moderate	3 Serious	2 Major	1 Critical
Likelihood Category	1 Almost certain					
	2 Likely					
	3 Possible					
	4 Unlikely					
	5 Remote					

 Low risk	 Medium risk	 High risk
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**5.1.3 Preliminary Environmental Risk Assessment to Determine Inherent Risk**

Subsequent to the identification of environmental aspects, receptors and potential impacts of the Revised Proposal (undertaken during the scoping phase – Section 5.1.2.2), a Preliminary Environmental Risk Assessment was conducted to determine the inherent level of risk associated with the impacts identified for the Revised Proposal that were in addition to or different from the Approved Development. This process involved assessing the environmental risk posed by aspects of the proposal to the receptor (e.g. environmental factor) and assumed familiar management practices were applied. This preliminary environmental risk assessment was undertaken by relevant Gorgon Project subject matter experts and the results are presented in Appendix C.

Following this Preliminary Environmental Risk Assessment process, some potential impacts were found to be of a low level of risk, and therefore did not warrant further assessment in the PER. Potential impacts that were considered to be low risk are presented in Appendix C of this PER, but are not assessed in detail in this document.

**5.1.4 Further Assessment of Potentially Significant Impacts and Determination of Residual Risk**

Those aspects that were assessed as having potentially significant impacts (i.e. determined in the Preliminary Environmental Risk Assessment as being of Medium to High level of Inherent Risk) were further assessed by Gorgon Project subject matter experts during preparation of the PER in order to determine the extent of environmental impact(s). This assessment drew on existing data and/or specific investigations and/or modelling that was conducted to support the impact assessment. The assessment considered:

- ◆ the additional or different impacts associated with the Revised Proposal (compared to the Approved Development), as well as
- ◆ cumulative impact/s of the Gorgon Development as a whole (i.e. Approved Development and the Revised Proposal).

A Further Assessment of Residual Environmental Risk was then conducted based on:

- ◆ the impact assessment undertaken
- ◆ the application of environmental management measures and/or environmental offsets proposed.

The level of Residual Risk was assessed via workshops held on 19 and 20 June 2008 and attended by officers of the Commonwealth DEWHA, the Western Australian EPA Service Unit (as observers) and DEC (as observers), and Gorgon Project subject matter experts. The 'Predicted Environmental Risk' sections in each of the environmental factor sections of the PER (Sections 6.1.5, 6.2.5, 6.3.5, 7.1.5, 7.2.4, 7.3.4, 7.4.4) contains a discussion of the predicted Residual Risks.

The results of the workshops can be put into two categories:

1. Aspects requiring no further assessment - A number of additional environmental aspects were assessed as requiring no further assessment or discussion in the environmental factor sections of the PER. These were aspects that resulted in a Residual Risk ranking of Low and were assessed by the workshop attendees (including DEC, EPA SU and DEWHA observers) as requiring no further discussion in this PER. Aspects which fell into this category are listed in Table 5.5. Appendix C contains the Risk Assessment Tables that were used to record the findings of the workshops.
2. Aspects requiring further assessment - A number of environmental aspects were considered to require further analysis as the initial assessment suggested an increase in the Residual Risk ranking when compared to the Approved Development. However, as the assessment was conducted pending completion of studies or modelling that were still in progress at that time, the assessed Residual Risk levels were considered to be *tentative* until such time as the studies and modelling were completed. The Gorgon Project team (including subject matter experts) subsequently used the results of the studies and modelling to re-assess the accuracy of the Residual Risk rankings. Accordingly, the level of impact (consequence) for some Residual Risk levels discussed in the following sections of the PER, differ from the perceived impact (consequence) levels as they were recorded at the Residual Risk assessment workshops held on 19 and 20 June 2008 and presented in Appendix C. Explanation of these specific differences is provided in the relevant sections of this PER. These updated Residual Risk rankings (if required) are referred to in the PER Risk Assessment Tables as *Completed Residual Risk*.

**Table 5.5: Summary of Aspects and Associated Environmental Factors (Residual Risk Assessment)**

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
Aspects and associated environmental factors requiring further data acquisition and assessment in the PER (As listed in PER Environmental Scoping Document)			
Air emissions (other than dust)	Air quality and greenhouse gas emissions	The Revised Proposal may result in additional impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further data acquisition and shall be assessed/discussed in the PER.	Section 9 – Air Emissions – Risks and Management
	Flora and vegetation	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. These aspects and associated environmental factors will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
	Soils and landform		
	Terrestrial fauna		
CO <sub>2</sub> migration or release to the surface or near-surface environment	Terrestrial fauna	The Revised Proposal is not anticipated to result in any additional impacts to these environmental factors from the Approved Gorgon Gas Development (based on continuing research into CO <sub>2</sub> behaviour within the Dupuy Reservoir). There is likely to be community/public interest in this component of the development, and so this aspect and associated environmental factors shall be subject to further assessment/discussion in the PER utilising existing data/information	Section 12 – Greenhouse Gas Emissions – Risks and Management
	Subterranean fauna		
	Flora and vegetation		
	Soils and landform	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. These aspects and associated environmental factors will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
Physical disturbance of seabed	Marine primary producers	The Revised Proposal may result in additional impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further data acquisition and shall be assessed/discussed in the PER.	Section 7 – Marine and Coastal Environment – Risks and Management
	Physical environment – seabed (subtidal and intertidal) and foreshore)		
	Marine water quality		
Physical presence of infrastructure	Marine primary producers	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
		This aspect and associated environmental factor will not be further assessed in the PER.	
	Marine fauna	The Revised Proposal may result in incremental additional impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. These aspects and associated environmental factor shall be subject to further data acquisition and shall be assessed/discussed in the PER	Section 7 – Marine and Coastal Environment – Risks and Management
	Physical marine environment (including intertidal environment)		
	Beach environment		
Physical interaction	Marine fauna		
Aspects and associated environmental factors not requiring further data acquisition but will be addressed or analysed in the PER (As listed in PER Environmental Scoping Document)			
Vegetation clearing	Flora and vegetation	The Revised Proposal may result in incremental additional impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. There is likely to be community/public interest in vegetation clearing, and so this aspect and associated environmental factors shall be further assessed in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
	Terrestrial fauna		Section 6 – Terrestrial Environment – Risks and Management
Site disturbance/ excavation	Terrestrial fauna	The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factors shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
	Subterranean fauna		Section 6 – Terrestrial Environment – Risks and Management
Fire	Flora and vegetation	The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factors shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
	Terrestrial fauna		Section 6 – Terrestrial Environment – Risks and Management
Liquid and solid waste disposal	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
Spills and leaks	Soils and landform	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factors will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
	Surface water		
	Groundwater		
	Flora and vegetation		
	Terrestrial fauna		
	Water and sediment quality		
	Subterranean fauna	The Revised Proposal may result in some	Section 6 – Terrestrial

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
	Marine primary producers	incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factors shall be subject to further assessment in the PER utilising existing data/information.	Environment – Risks and Management Section 7 – Marine and Coastal Environment – Risks and Management
	Marine fauna		Section 7 – Marine and Coastal Environment – Risks and Management
Dust emissions	Flora and vegetation Air quality	The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factors shall be subject to further assessment in the PER utilising existing data/information.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
Physical presence of infrastructure	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
Physical interaction	Terrestrial fauna	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
Creation of shade	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
Hot and/or cold emissions	Terrestrial fauna	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
Noise and vibration emissions	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. .	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information. Section 11 contains an assessment of the predicted residual environmental risk associated with noise emissions.
	Marine fauna		Section 7 – Marine and Coastal Environment – Risks and Management
	Subterranean fauna	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
Light emissions	Terrestrial fauna	The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factors shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
	Marine fauna		Section 7 – Marine and Coastal Environment – Risks and Management
Introduction and/or spread of non-indigenous species (quarantine)	Terrestrial fauna	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. .	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.  Section 8 contains information on Quarantine Management and Risks.
	Marine fauna		
	Marine primary producers		
	Flora and vegetation	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in	Section 8 - Quarantine Management and

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
		comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Risks
Physical disturbance of seabed	Marine fauna	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Section 7 – Marine and Coastal Environment – Risks and Management
Air emissions	Water and sediment quality	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
CO <sub>2</sub> migration or release to the marine environment	Water and sediment quality	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factors will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
	Marine primary producers		
Aspects and associated environmental factors not requiring further assessment in the PER (As listed in PER Environmental Scoping Document)			
Vegetation clearing	Subterranean fauna	The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development. This aspect and associated environmental factor shall be subject to further assessment in the PER utilising existing data/information.	Section 6 – Terrestrial Environment – Risks and Management
	Soils and landform	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to this environmental factor in comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. This aspect and associated environmental factor will not be further assessed in the PER.	No additional discussion considered necessary in PER. Refer to Appendix C for Risk Assessment information.
Site disturbance/ excavation	Soils and landform	Assessed as Low Risk. The Revised Proposal may result in some incremental additional and/or different impacts to these environmental factors in	No additional discussion considered necessary in PER. Refer to
	Surface water		
Runoff	Surface water		

Aspect	Associated Environmental Factors	Conclusion Following Residual Risk Assessment Workshops	How Dealt with in PER
Liquid and solid waste disposal	Subterranean fauna	comparison to the Approved Gorgon Gas Development, but these impacts are not predicted to be significantly additional and/or different. These aspects and associated environmental factors will not be further assessed in the PER.	Appendix C for Risk Assessment information.
	Soils and landform		
	Surface water		
	Groundwater		
	Subterranean fauna		
Physical presence of infrastructure	Flora and vegetation		
	Surface water		
	Groundwater		
	Subterranean fauna		

## 5.2 Assessment of Relevant Environmental Factors

In summary, the following key environmental factors were determined in the PER scoping phase as requiring detailed assessment in the PER:

1. Terrestrial Environment:
  - fauna (including quarantine)
  - subterranean fauna
  - vegetation and flora (including quarantine)
  - light
  - noise.
2. Marine Environment:
  - fauna (including quarantine)
  - coastal processes
  - marine water and sediment quality
  - marine primary producers
  - light
  - noise.
3. Atmospheric Environment:
  - air quality – air emissions and greenhouse gas emissions (including reservoir CO<sub>2</sub> injection).

The above key environmental factors associated with the Revised Proposal are addressed in the following sections (Sections 6.0 through 13.0) of the PER in the following format:

- ◆ **Assessment Framework or Policy:** details the relevant EPA objective/s, key statutory requirements and environmental policy relevant to the environmental factor.
- ◆ **Detailed Assessment of Potentially Significant Impacts:** contains the detailed assessment of the aspects and potential impacts that were identified in the preliminary environmental risk assessment as having a medium to high inherent risk level.
- ◆ **Assessment of Potential Impacts to Matters of NES:** provides an impact assessment specifically relating to relevant matters of NES. As the Revised Proposal requires assessment under the Commonwealth EPBC Act, this PER needs to assess potential impacts to matters of NES, specifically listed threatened species and communities (sections 18 and 18A) and listed migratory species (sections 20 and 20A).
- ◆ **Proposed Management Actions:** lists those key management plans, programs and systems that will be implemented.

- ◆ **Predicted Environmental Risk:** provides a summary description of residual level of risk and includes consideration of the environmental acceptability of the Revised Proposal (and consistency with relevant EPA objectives/policies) and cumulative risk to the environmental factor.