



Appendix A

Environmental assessment requirements



Santos Ltd
Narrabri Gas Project – Environmental Impact Statement
Secretary’s environmental assessment requirements

January 2017

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The Narrabri Gas Project is state significant development under section 89C of the *Environmental Planning and Assessment Act 1979* and Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011*. Following a request by the proponent, the Secretary of the Department of Planning and Environment issued the Secretary's environmental assessment requirements on 25 July 2014.

Following the declaration of the project as a controlled action, the Commonwealth Department of the Environment provided environmental assessment requirements under the *Environment Protection and Biodiversity Conservation Act 1999*.

Table 1 cross-reference Secretary's environmental assessment requirements under the *Environmental Planning and Assessment Act 1979* while Table 2 to Table 7 inclusive cross-reference environmental assessment requirements under the *Environment Protection and Biodiversity Conservation Act 1999*.

The Commonwealth Government established the Independent Expert Scientific Committee to provide scientific advice to regulators on the impact of coal seam gas and large coal mining development on water resources. Table 8 details the specific information needs of the Independent Expert Scientific Committee set out in the *Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals*.

Table 1 Secretary’s environmental assessment requirements

Requirement	Chapter	Appendix
The Environmental Impact Statement (EIS) for the development must comply with the requirements of Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	–	–
In particular, the EIS must include:	–	–
<ul style="list-style-type: none"> • an executive summary 	Executive summary	–
<ul style="list-style-type: none"> • a full description of the development, including: <ul style="list-style-type: none"> – the resource to be extracted, demonstrating efficient resource recovery within environmental constraints; 	Chapter 2 Location and setting Section 2.3	–
<ul style="list-style-type: none"> – the conceptual layout of the gas field and likely scheduling of the gas field development; 	Chapter 6 Project description Section 6.3, Section 6.1.4	–
<ul style="list-style-type: none"> – surface infrastructure and facilities (including gas processing facilities and any other infrastructure that would be required for the development, but subject to a separate approvals process); 	Chapter 6 Project description Section 6.1.2, Section 6.2, Section 6.3, Section 6.4	–
<ul style="list-style-type: none"> – a waste management strategy, having regard to the NSW Environment Protection Authority’s (EPA) requirements; 	Chapter 28 Waste management	Appendix E Drilling waste letter from NSW Environment Protection Authority
<ul style="list-style-type: none"> – a water management strategy, having regard to the EPA’s and NSW Department of Primary Industries’ (DPI) requirements, and including a detailed description of the produced water resulting from the project, including management, treatment and disposal methods to be implemented, and the final disposal pathway; 	Chapter 7 Produced water management Chapter 12 Surface water quality Section 12.6.4 (stormwater management), Section 12.6.5 (dust suppression), Section 12.6.6 (irrigation), Section 12.6.7 Chapter 13 Hydrology and geomorphology Section 13.6 (stormwater management)	Appendix G1 Managed release study Section 7 Appendix G2 Concept irrigation study Section 9 Appendix G3 Water monitoring plan Section 5 Appendix H Hydrology and geomorphology Section 6.2 (stormwater management)

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> – a rehabilitation strategy, having regard to the NSW Department of Industry – Division of Resource and Energy’s (DRE) requirements; and 	Chapter 6 Project description Section 6.7	Appendix V Rehabilitation strategy
<ul style="list-style-type: none"> – the likely interactions between the development and any other existing, approved or proposed mining development and / or major infrastructure development in the vicinity of the site, including infrastructure currently used or approved for coal seam gas exploration; 	Chapter 29 Cumulative impacts	–
<ul style="list-style-type: none"> • justification why the proposed development is preferred over any other alternatives; 	Chapter 8 Assessment of alternatives	–
<ul style="list-style-type: none"> • a list of any approvals that must be obtained before the development may commence; 	Chapter 4 State legislation and approvals Section 4.5	–
<ul style="list-style-type: none"> • an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including: 	–	–
<ul style="list-style-type: none"> – a description of the existing environment likely to be affected by the development, using sufficient baseline data; 		–

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> - a description of the existing environment likely to be affected by the development, using sufficient baseline data; 	<p>Chapter 11 Groundwater and geology Section 11.3</p> <p>Chapter 12 Surface water quality Section 12.3</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2</p> <p>Chapter 14 Soils and land contamination Section 14.2</p> <p>Chapter 15 Terrestrial ecology Section 15.2</p> <p>Chapter 16 Aquatic ecology Section 16.2</p>	<p>Appendix F Groundwater impact assessment Section 4</p> <p>Appendix G1 Managed release study Section 4</p> <p>Appendix G2 Concept irrigation study Section 2</p> <p>Appendix G3 Water monitoring plan Section 2.2, Section 2.3</p> <p>Appendix G4 Water baseline report Section 3</p> <p>Appendix H Hydrology and geomorphology Section 4</p>

Requirement	Chapter	Appendix
	Chapter 17 Property and land use Section 17.2	Appendix I1 Interpretive soils report Section 3, Section 4
	Chapter 18 Air quality Section 18.3	Appendix I3 Contaminated land assessment Section 4
	Chapter 19 Noise and vibration Section 19.3	Appendix J1 Ecological impact assessment Section 3
	Chapter 20 Aboriginal heritage Section 20.2	Appendix K Agricultural impact statement Section 4
	Chapter 21 Historic heritage Section 21.2	Appendix L Air quality impact assessment Section 4
	Chapter 22 Traffic and transport Section 22.2	Appendix M Noise and vibration assessment Section 4
	Chapter 23 Landscape and visual Section 23.2	Appendix N1 Aboriginal cultural heritage assessment report Section 4
	Chapter 24 Greenhouse gas	Appendix O Historic heritage impact assessment Section 6
	Chapter 26 Social and health impacts Section 26.2	Appendix P Traffic impact assessment Section 4
	Chapter 27 Economics Section 27.2	Appendix Q Landscape and visual impact Section 4
	Chapter 28 Waste management Section 28.3	Appendix R Greenhouse gas assessment
	Chapter 29 Cumulative impacts Section 29.2	

Requirement	Chapter	Appendix
		Appendix T1 Social impact assessment Section 4 Appendix U2 Economic assessment (macroeconomic analysis)– Section 2
<ul style="list-style-type: none"> – an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice, including the Code of Practice for Coal Seam Gas Well Integrity (DRE, 2012); 	Chapter 11 Groundwater and geology Section 11.4, Section 11.6 Chapter 12 Surface water quality Section 12.4, Section 12.5 Volume 1 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Chapter 14 Soils and land contamination Section 14.3, Section 14.4, Section 14.5 Chapter 15 Terrestrial ecology Section 15.3, Section 15.4 Chapter 16 Aquatic ecology Section 16.3 Chapter 17 Property and land use Section 17.3, Section 17.4, Section 17.5 Chapter 18 Air quality Section 18.4, Section 18.5, Section 18.6	Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality) Appendix G1 Managed release study Section 8 Appendix G2 Concept irrigation study Section 8 Appendix H Hydrology and geomorphology Section 5 Appendix I1 Interpretive soils report Section 5 Appendix I2 Site verification of Biophysical Strategic Agricultural Land Appendix I3 Contaminated land assessment Section 7

	Chapter 19 Noise and vibration Section 19.3, Section 19.4	Appendix J1 Ecological impact assessment Section 6
	Chapter 20 Aboriginal heritage Section 20.3, Section 20.4, Section 20.5	Appendix K Agricultural impact statement Section 5
	Chapter 21 Historic heritage Section 21.3	Appendix L Air quality impact assessment Section 8
	Chapter 22 Traffic and transport Section 22.3, Section 22.4, Section 22.5	Appendix M Noise and vibration assessment Section 5
	Chapter 23 Landscape and visual Section 23.3	Appendix N1 Aboriginal cultural heritage assessment report Section 5.1, Section 5.4
	Chapter 24 Greenhouse gas Section 24.3.5	Appendix O Historic heritage impact assessment Section 7
	Chapter 25 Hazard and risk Section 25.2	Appendix P Traffic impact assessment Section 7
	Chapter 26 Social and health impacts Section 26.3	Appendix Q Landscape and visual impact Section 5
	Chapter 27 Economics Section 27.5	Appendix R Greenhouse gas assessment Section 5
	Chapter 28 Waste management Section 28.6	Appendix S Hazard and risk assessment Section 4
	Chapter 29 Cumulative impacts Section 29.3	Appendix T1 Social impact assessment Section 6
		Appendix T2 Health impact assessment

Requirement	Chapter	Appendix
		<p>Section 5 (air), Section 6 (water), Section 7 (land contamination), Section 8 (noise), Section 9 (hazards and risks), Section 10 (social and community)</p> <p>Appendix T3 Chemical risk assessment report Section 4 (persistence, bioaccumulation, toxicity assessment), Section 6 (groundwater modelling)</p> <p>Appendix U1 Economic assessment (cost benefit analysis) Section 4</p> <p>Appendix U2 Economic assessment (macroeconomic analysis) Section 4</p>

- a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of:
 - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;
 - the likely effectiveness of these measures, including performance measures where relevant; and
 - whether contingency plans would be necessary to manage any residual risks;

Chapter 11
Groundwater and geology
Section 11.8, Section 11.9,
Section 11.10

Chapter 12
Surface water quality
Section 12.6, Section 12.7

Volume 1 Chapter 13
Hydrology and
geomorphology
Section 13.6, Section 13.7

Chapter 14
Soils and land contamination
Section 14.6, Section 14.7

Chapter 15
Terrestrial ecology
Section 15.4, Section 15.5,
Section 15.6

Chapter 16
Aquatic ecology
Section 16.4

Chapter 17
Property and land use
Section 17.6

Chapter 18
Air quality
Section 18.7

Chapter 19
Noise and vibration
Section 19.5

Chapter 20
Aboriginal heritage
Section 20.6

Chapter 21
Historic heritage
Section 21.4

Appendix F
Groundwater impact assessment
Section 7.4

Appendix G1
Managed release study
Section 9.3, Section 9.4

Appendix G2
Concept irrigation study
Section 10

Appendix H
Hydrology and geomorphology
Section 6

Appendix I1
Interpretive soils report
Section 6.4

Appendix I3
Contaminated land assessment
Section 8.2

Appendix J1
Ecological impact assessment
Section 7

Appendix K
Agricultural impact statement
Section 6

Appendix L
Air quality impact assessment
Section 9

Appendix M
Noise and vibration assessment
Section 6

Appendix N1
Aboriginal cultural heritage
assessment report
Section 5.2, Section 5.3,
Section 5.5, Section 5.6,
Section 5.7, Section 5.8

Requirement	Chapter	Appendix
	Chapter 22 Traffic and transport Section 22.6 Chapter 23 Landscape and visual Section 23.4 Chapter 24 Greenhouse gas Section 24.4 Chapter 25 Hazard and risk Section 25.3 Chapter 26 Social and health impacts Section 26.4 Chapter 27 Economics Section 27.6 Chapter 28 Waste management Section 28.7	Appendix N2 Aboriginal cultural heritage management plan Section 4 Appendix O Historic heritage impact assessment Section 8 Appendix P Traffic impact assessment Section 8 Appendix Q Landscape and visual impact Section 6 Appendix R Greenhouse gas assessment Section 6 Appendix S Hazard and risk assessment Section 4.4 (bushfire management) Appendix T1 Social impact assessment Section 7 Appendix T2 Health impact assessment Section 5 (air), Section 6 (water), Section 7 (land contamination), Section 8 (noise), Section 9 (hazards and risks), Section 10 (social and community) Appendix U1 Economic assessment (cost benefit analysis) Section 4.3.3 (regional community benefit fund)

Requirement	Chapter	Appendix
-		Appendix U2 Economic assessment (macroeconomic analysis) Section 4.1.2 (regional community benefit fund) Appendix V Rehabilitation strategy Section 6, Section 7
- a description of the measures that would be implemented to monitor and report on the environmental performance of the development if it is approved;	Chapter 11 Groundwater and geology Section 11.9 Chapter 12 Surface water quality Section 12.6, Section 12.7 Volume 1 Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 14 Soils and land contamination Section 14.6 Chapter 15 Terrestrial ecology Section 15.5.4 Chapter 16 Aquatic ecology Section 16.4 Chapter 18 Air quality Section 18.7	Appendix F Groundwater impact assessment Section 7.6 Appendix G1 Managed release study Section 9.5 Appendix G2 Concept irrigation study Section 10 Appendix G3 Water monitoring plan Section 4, Section 5 Appendix H Hydrology and geomorphology Section 6.4, Section 6.5 Appendix I1 Interpretive soils report Section 6.4 Appendix J1 Ecological impact assessment Section 7.6

Requirement	Chapter	Appendix
	Chapter 19 Noise and vibration Section 19.5	Appendix K Agricultural impact statement Section 6
	Chapter 22 Traffic and transport Section 22.3.2	Appendix L Air quality impact assessment Section 9
	Chapter 24 Greenhouse gas Section 24.4.1, Section 24.4.2	Appendix M Noise and vibration assessment Section 6
	Chapter 26 Social and health impacts Section 26.4	Appendix P Traffic impact assessment Section 7.7
	Chapter 27 Economics Section 27.3.1	Appendix R Greenhouse gas assessment Section 6.2 (measurement in accordance with <i>National Greenhouse and Energy Reporting Act 2007</i>)
	Chapter 28 Waste management Section 28.5, Section 28.6	Appendix S Hazard and risk assessment Section 4.4 (bushfire management)
		Appendix T1 Social impact assessment Section 7.7 (housing)
		Appendix T2 Health impact assessment Section 5 (air), Section 6 (water), Section 7 (land contamination), Section 8 (noise), Section 9 (hazards and risks), Section 10 (social and community)
		Appendix U1 Economic assessment (cost benefit analysis) Section 4.3.3 (regional community benefit fund)

Requirement	Chapter	Appendix
		Appendix V Rehabilitation strategy Section 9 Appendix W Decommissioning report Section 4
<ul style="list-style-type: none"> a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; 	Chapter 31 Project commitments	–
<ul style="list-style-type: none"> consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007); and 	Chapter 4 State legislation and approvals Section 4.2	–
<ul style="list-style-type: none"> the reasons why the development should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development. 	Chapter 32 Conclusion Section 32.2 Chapter 4 State legislation and approvals Section 4.1.2 (ecologically sustainable development)	–
In addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the:	–	–
<ul style="list-style-type: none"> capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and 	Chapter 27 Economics	Appendix U1 Economic assessment (cost benefit analysis) Section 4.1.1 (capital investment)
<ul style="list-style-type: none"> jobs that would be created during each stage of the development. 	Chapter 27 Economics	Appendix U2 Economic assessment (macroeconomic analysis) Section 4.2

Requirement	Chapter	Appendix
The EIS must also address the requirements of the Commonwealth Department of the Environment and Energy issued in accordance with the Bilateral Agreement under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .	Table 2 through Table 7.	Table 2 through Table 7.
The EIS must address the following specific issues:	–	–
<ul style="list-style-type: none"> • Water – including: <ul style="list-style-type: none"> – an assessment of the likely impacts of the development on the quantity and quality of the region’s surface and groundwater resources, using detailed surface water and groundwater modelling undertaken in accordance with applicable National and NSW Guidelines, and having regard to the EPA’s and DPI’s requirements and the <i>Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals</i> (IESC, 2015); 	<p>Chapter 11 Groundwater and geology Section 11.4, Section 11.5</p> <p>Chapter 12 Surface water quality Section 12.4, Section 12.5</p> <p>Volume 1 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p>	<p>Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality)</p> <p>Appendix G1 Managed release study Section 8.1</p> <p>Appendix H Hydrology and geomorphology Section 5</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> - an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, groundwater dependant ecosystems and other water users, including an assessment of these impacts against the <i>NSW Aquifer Interference Policy</i> (NOW, 2012); and 	<p>Chapter 11 Groundwater and geology Section 11.4, Section 11.5</p> <p>Chapter 12 Surface water quality Section 12.5, Section 12.5</p> <p>Chapter 16 Aquatic ecology Section 16.3</p>	<p>Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality)</p> <p>Appendix G1 Managed release study Section 8</p> <p>Appendix H Hydrology and geomorphology Section 5</p> <p>Appendix J1 Ecological impact assessment Section 6.3.1 (riparian land), Section 6.4.2 (watercourses), Section 6.7 (groundwater dependant ecosystems)</p>
<ul style="list-style-type: none"> - an assessment of the potential flooding impacts of the development; 	<p>Volume 1 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p>	<p>Appendix H Hydrology and geomorphology Section 5.3, Section 5.5 (Leewood), Section 5.6 (Bibblewindi)</p>
<ul style="list-style-type: none"> • Land – including: <ul style="list-style-type: none"> - an Agricultural Impact Statement, prepared in accordance with <i>Agricultural Impact Statement: Technical Notes</i> (DPI, 2013), to assess the likely impacts of the development on the soils and land capability of the site and surrounds, including likely erosion and salinity impacts, having regard to DPI’s requirements; 	<p>Chapter 14 Soils and land contamination Section 14.3.1, Section 14.4.1</p> <p>Chapter 17 Property and land use Section 17.3.2, Section 17.4.2</p>	<p>Appendix I1 Interpretive soils report Section 5</p> <p>Appendix I3 Contaminated land assessment Section 7</p> <p>Appendix K Agricultural impact statement Section 5</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> – an assessment of the compatibility of the development with other land uses in the vicinity of the development, including the recreational use of the Pilliga Forest, in accordance with the requirements in Clause 12 of <i>State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007</i>; 	<p>Chapter 17 Property and land use Section 17.3.1, Section 17.4.1</p> <p>Chapter 26 Social and health impacts Section 26.3.5</p>	<p>Appendix K Agricultural impact statement Section 5</p> <p>Appendix T1 Social impact assessment Section 6.3.4 (recreation)</p>
<ul style="list-style-type: none"> • Biodiversity – including: <ul style="list-style-type: none"> – an assessment of the likely biodiversity impacts of the development, in accordance with the <i>Framework for Biodiversity Assessment</i> (OEH, 2014), unless otherwise agreed by OEH, and having regard to the OEH's and DPI's requirements; 	<p>Chapter 15 Terrestrial ecology Section 15.3, Section 15.4, Section 15.5</p>	<p>Appendix J1 Ecological impact assessment and Appendix J2 Biodiversity Assessment Report Section 6 (potential impacts), Section 8 (offset strategy)</p>
<ul style="list-style-type: none"> – a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the project over time if the project is approved; 	<p>Chapter 15 Terrestrial ecology Section 15.3.1, Section 15.4</p>	<p>Appendix J1 Ecological impact assessment Section 7 (mitigation measures)</p>
<ul style="list-style-type: none"> – a strategy to offset any residual impacts of the development in accordance with the <i>NSW Biodiversity Offsets Policy for Major Projects</i> (OEH, 2014), unless otherwise agreed by OEH 	<p>Chapter 15 Terrestrial ecology Section 15.5</p>	<p>Appendix J1 Ecological impact assessment Section 8 (offset strategy) and Appendix J2 Biodiversity Assessment Report</p>
<ul style="list-style-type: none"> • Heritage – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to OEH's requirements; and 	<p>Chapter 20 Aboriginal heritage Section 20.3, Section 20.4, Section 20.5</p> <p>Chapter 21 Historic heritage Section 21.3</p>	<p>Appendix N1 Aboriginal cultural heritage assessment report Section 5.1, Section 5.4</p> <p>Appendix O Historic heritage impact assessment Section 7</p>
<ul style="list-style-type: none"> – Adequate consultation with Aboriginal stakeholders having regard to the <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents</i> (OEH, 2010) 	<p>Chapter 20 Aboriginal heritage Section 20.1.1</p>	<p>Appendix N1 Aboriginal cultural heritage Section 3.2</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> Air Quality – including: <ul style="list-style-type: none"> an assessment of the likely air quality impacts of the development in accordance with the <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (EPA, 2005), and having regard to EPA’s requirements; and 	Chapter 18 Air quality Section 18.4, Section 18.5, Section 18.6	Appendix L Air quality impact assessment Section 8
<ul style="list-style-type: none"> an assessment of the likely greenhouse gas impacts of the development, including baseline and assessment of potential fugitive methane emissions; 	Chapter 24 Greenhouse gas Section 24.3.5	Appendix R Greenhouse gas assessment Section 5
<ul style="list-style-type: none"> Noise – including: <ul style="list-style-type: none"> an assessment of the likely operational noise impacts of the development (including construction noise) under the <i>NSW Industrial Noise Policy</i> (as may be updated or replaced), paying particular attention to the obligations in chapters 8 and 9 of the policy; 	Chapter 19 Noise and vibration Section 19.3, Section 19.4	Appendix M Noise and vibration assessment Section 5
<ul style="list-style-type: none"> if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the <i>Interim Construction Noise Guideline</i> (EPA, 2009); and 	Chapter 19 Noise and vibration Section 19.2	Appendix M Noise and vibration assessment Section 3.2.1
<ul style="list-style-type: none"> an assessment of the likely road noise impacts of the development under the <i>NSW Road Noise Policy</i> (EPA, 2011); 	Chapter 19 Noise and vibration Section 19.3.2, Section 19.4.4	Appendix M Noise and vibration assessment Section 5.9
<ul style="list-style-type: none"> Transport – including an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, having regard to Road and Maritime Services’ requirements; 	Chapter 22 Traffic and transport Section 22.3, Section 22.4, Section 22.5	Appendix P Traffic impact assessment Section 7
<ul style="list-style-type: none"> Visual – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, and an assessment of the likely lighting impacts of the development on the Dark Sky Region having regard to the <i>Dark Sky Planning Guideline</i> (DPE, 2016), including consultation with the Director of Siding Spring Observatory; 	Chapter 5 Commonwealth requirements Section 5.3.3 Chapter 18 Air quality Section 18.4, Section 18.5 Chapter 23 Landscape and visual Section 23.3	Appendix Q Landscape and visual impact Section 5

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> Public Safety - including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks, the potential for gas leaks, the transport, handling and use of any dangerous goods; 	<p>Chapter 25 Hazard and risk Section 25.2</p> <p>Chapter 26 Social and health impacts Section 26.3.6 (health)</p>	<p>Appendix S Hazard and risk assessment Section 4.3 (dangerous goods), Section 4.4 (bushfire)</p> <p>Appendix T2 Health impact assessment Section 5 (air), Section 6 (water), Section 7 (land contamination), Section 8 (noise), Section 9 (hazards and risks), Section 10 (social and community)</p> <p>Appendix T3 Chemical risk assessment report Section 4 (persistence, bioaccumulation, toxicity assessment), Section 6 (groundwater modelling)</p>
<ul style="list-style-type: none"> – a preliminary hazard analysis in accordance with <i>Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis</i> (DPE, 2011); and 	<p>Chapter 25 Hazard and risk Section 25.2.2</p>	<p>Appendix S Hazard and risk assessment Section 2.3</p>
<ul style="list-style-type: none"> – consideration of appropriate setbacks and/or asset protection zones for well heads, gas processing facilities and other infrastructure to manage risks; 	<p>Chapter 25 Section 25.2.2, Section 25.2.3</p>	<p>Appendix S Hazard and risk assessment Section 2.3, Section 4.4.2</p>
<ul style="list-style-type: none"> Social & Economic – including: <ul style="list-style-type: none"> – an assessment of the likely social impacts of the development, including consideration of how social impacts could be managed once the development ceases; 	<p>Chapter 26 Social and health impacts Section 26.3, Section 26.4</p>	<p>Appendix T1 Social impact assessment Section 6</p>
<ul style="list-style-type: none"> – an assessment of the likely economic impacts of the development in accordance with the <i>Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals</i> (DPE 2015); 	<p>Chapter 27 Economics Section 27.5</p>	<p>Appendix U1 Economic assessment (cost benefit analysis) Section 4, Section 5</p> <p>Appendix U2 Economic assessment (macroeconomic analysis) Section 4</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> an assessment of the demand for the provision of local infrastructure, services and housing generated by the project, having regard to Narrabri Shire Council's requirements, and including consideration of appropriate developer and community enhancement contributions. 	Chapter 26 Social and health Section 26.3.3, Section 26.3.4, Section 26.4	Appendix T1 Social impact assessment Section 6.3.5, Section 6.3.6, Section 7.8
<ul style="list-style-type: none"> the significance of the resource, including its potential to help meet the project demand for gas in NSW; 	Volume 1, Chapter 3 Strategic context and need Section 3.5	–
<ul style="list-style-type: none"> economic benefits of the project for the State and region; and 	Volume 1, Chapter 27 Economics Section 27.4.1, Section 27.4.2, Section 27.4.3	Volume 2, Appendix U1 Economic assessment (cost benefit analysis) Section 4.2, Section 4.3 Volume 2, Appendix U2 Economic assessment (macroeconomic analysis) Section 4.3 (government revenues), Section 4.4.2 (regional impacts)
During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners.	Chapter 9 Community and stakeholder consultation	Appendix D Stakeholder and community consultation report Section 4
The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Chapter 9 Community and stakeholder consultation, Section 9.2	Appendix D Stakeholder and community consultation report Section 5

Table 2 Environmental assessment requirements

Requirement	Chapter	Appendix
1 The action		
a) The Environmental Impact Statement (EIS) must describe in detail all construction, operational and decommissioning components of the action. This must include the location of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on matters of national environmental significance (MNES) or upon Commonwealth land.	Chapter 6 Project description	–
b) The description of the action must include details on how the works are to be undertaken (including the various stages of development and operation, and their timing) and design parameters for those aspects of the structures or elements of the action that may have relevant impacts.	Chapter 6 Project description	–
c) The EIS must include how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action.	Chapter 2 Location and setting Section 2.4 Chapter 29 Cumulative impacts Section 29.2	–
d) Any activities that are directly associated with the action and which have been excluded from the proposed works (as identified in the referral) must be supported by clear justification as to why these activities are unlikely to impact upon MNES or upon Commonwealth land, or if applicable, whether such activities are covered by a separate EPBC approval. According to the referral excluded activities may include: appraisal and exploration activities; hydraulic fracturing; a gas transmission pipeline; the sourcing of electricity supply; certain components of the water treatment and management process; and installation and use of groundwater monitoring bores.	Note: gas produced by the project would be transported to market via a high-pressure gas transmission pipeline. The pipeline would be subject to a separate assessment process and is not part of the project.	Appendix B Referral of proposed action
2 The environment including MNES		
a) The EIS must include a description of the environment and land uses within the proposal site and the surrounding areas, as well as other areas that may be affected by the action. This includes the following MNES and Commonwealth land protected by controlling provisions of Part 3 of the EPBC Act:	–	–

Requirement	Chapter	Appendix
<p>i. Listed threatened species and communities (including suitable habitat) that are or are likely to be present in all areas of potential impact. To satisfy this requirement details must be presented on the scope, timing/effort (survey season/s) and methodology for studies and surveys used to provide information on the relevant listed species/community/habitat (as identified in Appendix 1). This includes details of:</p> <ul style="list-style-type: none"> • how best practice survey guidelines have been applied • how surveys are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements. 	<p>Chapter 15 Terrestrial ecology Section 15.1.2 (likelihood of occurrence), Section 15.1.3 (field surveys), Section 15.1.5 (population estimates), Section 15.2.2 (flora), Section 15.2.3 (fauna)</p> <p>Chapter 16 Aquatic ecology Section 16.1.1 (desktop review), Section 6.1.2 (likelihood of occurrence), Section 16.1.3 (field surveys), Section 16.2.7 (threatened species and communities)</p>	<p>Appendix G1 Managed release study Appendix A Section 2 (aquatic ecology surveys), Section 4.2 (aquatic flora and fauna)</p> <p>Appendix J1 Ecological impact assessment Section 4 (flora and fauna surveys), Section 5.3 (terrestrial flora), Section 5.4 (terrestrial fauna)</p>
<p>ii. A description of the important water resources within all areas of potential impact, and a description of water related assets that are dependent on these resources, which is consistent with the requirements of the most recent version of the Independent Expert Scientific Committee (IESC) on Coal Seam Gas and Large Coal Mining Development's Information Guidelines for Independent Expert Scientific Committee Advice on Coal Seam Gas and Large Coal Mining Development Proposals, and which addresses the specific requirements of Appendix 2.</p>	<p>Chapter 11 Groundwater and geology Section 11.3</p> <p>Chapter 12 Surface water quality Section 12.3</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2.5, Section 13.2.6</p>	<p>Appendix F Groundwater impact assessment Section 4.4 (surface water and groundwater), Section 4.6 (environmental values), Section 4.8 (groundwater bores)</p> <p>Appendix G1 Managed release study Section 4</p> <p>Appendix G4 Water baseline report Section 6 (regional water quality and flow), Section 7 (site water quality and flow)</p> <p>Appendix H Hydrology and geomorphology Section 4.4</p>

Requirement	Chapter	Appendix
<p>iii. A description of the environment of Commonwealth land in which the Siding Spring Observatory is situated. This includes a description of</p> <ul style="list-style-type: none"> • the people/communities who utilise the facilities • the qualities, characteristics, and heritage values for which the observatory is recognised • the social, economic and cultural aspects of the Siding Spring Observatory above. 	<p>Chapter 5 Commonwealth requirements Section 5.5.3</p> <p>Chapter 21 Historic heritage, Section 21.2.3</p>	<p>Appendix O Historic heritage impact assessment</p> <p>Appendix C (statement of heritage impact)</p> <p>Appendix T1 Social impact assessment Section 4.2</p>
<p>A copy of the April 2014 version of the Information Guidelines for Independent Expert Scientific Committee Advice on Coal Seam Gas and Large Coal Mining Development Proposals is accessible from the following link:</p> <p>http://www.iesc.environment.gov.au/publications/information-guidelines-independent-expertscientific-committee-advice-coal-seam-gas</p>	<p>–</p>	<p>–</p>
<p>3 Impacts</p>		
<p>a) The EIS must include a description of all potential impacts of the action on MNES and Commonwealth land (identified in Section 2). Impacts during the construction, operational and the decommissioning phases of the project must be addressed, and the following information provided for each relevant controlling provision:</p> <ol style="list-style-type: none"> i. a description of the relevant impacts of the action ii. a detailed analysis of the nature and extent of the likely direct, indirect and consequential impacts relevant to MNES, including likely short-term and long term impacts iii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts 	<p>Chapter 5 Commonwealth requirements Section 5.5</p> <p>Chapter 11 Groundwater and geology Section 11.5</p> <p>Chapter 12 Surface water quality Section 12.4, Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 15 Terrestrial ecology Section 15.3, Section 15.4</p> <p>Chapter 16 Aquatic ecology Section 16.3.3 (Murray Cod)</p>	<p>Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality)</p> <p>Appendix G1 Managed release study Section 8</p> <p>Appendix G2 Concept irrigation study Section 8</p> <p>Appendix H Hydrology and geomorphology Section 5</p> <p>Appendix J1 Ecological impact assessment Section 6</p>

Requirement	Chapter	Appendix
	<p>Chapter 23 Landscape and visual Section 23.3.4 (Siding Spring Observatory)</p> <p>Chapter 26 Social and health impacts Section 26.3.5 (Siding Spring Observatory)</p> <p>Note: no historic heritage sites listed under the <i>Environment Protection and Biodiversity Act 1999</i> were identified in the project area.</p>	<p>Appendix O Historic heritage impact assessment</p> <p>Appendix C (heritage impacts at Siding Spring Observatory)</p> <p>Appendix Q Landscape and visual impact Section 5.4 (lighting impacts at Siding Spring Observatory)</p> <p>Appendix T1 Social impact assessment Section 6.3.4 (social impacts at Siding Spring Observatory)</p>
<p>b) If the conclusion is made that any relevant controlling provision or element of a relevant controlling provision will not be impacted by the proposed action, then justification must be provided for how this conclusion has been reached. This includes any threatened species or ecological communities that are likely to be present on site, and water resources and dependent assets that may be impacted by the proposed action.</p>	<p>Chapter 5 Commonwealth requirements Section 5.5</p> <p>Chapter 11 Groundwater and geology Section 11.5</p> <p>Chapter 12 Surface water quality Section 12.4, Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 15 Terrestrial ecology Section 15.3, Section 15.4</p> <p>Chapter 16 Aquatic ecology Section 16.3.3 (Murray Cod)</p> <p>Chapter 23 Landscape and visual Section 23.3.4 (Siding Spring Observatory)</p>	<p>Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality)</p> <p>Appendix G1 Managed release study Section 8</p> <p>Appendix G2 Concept irrigation study Section 8</p> <p>Appendix H Hydrology and geomorphology Section 5</p> <p>Appendix J1 Ecological impact assessment Section 6</p>

Requirement	Chapter	Appendix
	<p>Chapter 26 Social and health impacts Section 26.3.5 (Siding Spring Observatory)</p> <p>Note: no historic heritage sites listed under the <i>Environment Protection and Biodiversity Act 1999</i> were identified in the project area.</p>	<p>Appendix O Historic heritage impact assessment Appendix C (heritage impacts at Siding Spring Observatory)</p> <p>Appendix Q Landscape and visual impact Section 5.4 (lighting impacts at Siding Spring Observatory)</p> <p>Appendix T1 Social impact assessment Section 6.3.4 (social impacts at Siding Spring Observatory)</p>
<p>c) The documentation provided must include information addressing all relevant impacts upon water resources and their dependent assets, and whether these impacts may also extend to habitat for listed threatened species and communities. The information must be consistent with the requirements of the most recent version of the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's Information Guidelines for Independent Expert Scientific Committee Advice on coal seam gas and large coal mining development proposals (see hyperlink above), and address the requirements identified at Appendix 2.</p>	<p>Chapter 5 Commonwealth requirements Section 5.5</p> <p>Chapter 11 Groundwater and geology Section 11.5</p> <p>Chapter 12 Surface water quality Section 12.4, Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p>	<p>Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality)</p> <p>Appendix G1 Managed release study Section 8</p> <p>Appendix G2 Concept irrigation study Section 8</p> <p>Appendix H Hydrology and geomorphology Section 5</p>

Requirement	Chapter	Appendix
<p>d) The EIS must include information addressing all relevant impacts upon the environment of Commonwealth land in which the Siding Spring Observatory is situated. This includes potential impacts upon:</p> <ul style="list-style-type: none"> i. the people/communities who utilise the facilities ii. the qualities, characteristics, and heritage values for which the observatory is recognised iii. the social, economic and cultural aspects of the Siding Spring Observatory. <p>To support the assessment of potential heritage values associated with the observatory, the EIS must include a statement of heritage impacts.</p>	<p>Chapter 5 Commonwealth requirements Section 5.5.3</p> <p>Chapter 21 Historic heritage Section 21.2.3, Section 21.3.5</p> <p>Chapter 23 Landscape and visual Section 23.3.4 (lighting)</p> <p>Chapter 26 Social and health impacts Section 26.3.5</p>	<p>Appendix O Historic heritage impact assessment</p> <p>Appendix C (statement of heritage impact)</p> <p>Appendix Q Landscape and visual impact Section 5.4 (lighting impacts at Siding Spring Observatory)</p> <p>Appendix T1 Social impact assessment Section 6.3.4 (social impacts at Siding Spring Observatory)</p>
<p>e) The EIS should address the potential for facilitated impacts upon MNES at the local, regional, state, national and international scale.</p>	<p>Chapter 5 Commonwealth requirements Section 5.5.4</p>	–
<p>f) The EIS should identify and address cumulative impacts, where potential project impacts are in addition to: (1) existing impacts of other activities; and (2) possible impacts from known potential future expansions or developments by the proponent and other proponents in the region.</p>	<p>Chapter 29 Cumulative impacts Section 29.3</p>	–
<p>Further details of threatened flora and fauna, and ecological communities protected by the controlling provisions of Part 3 of the EPBC Act are provided at Appendix 1.</p>	–	–
<p>4 Avoidance and mitigation measures / alternatives</p>		
<p><u>Avoidance and Mitigation Measures</u></p> <p>a) The EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action on MNES and Commonwealth land.</p>	<p>Chapter 10 Approach to the impact assessment Section 10.3 (field development protocol)</p> <p>Chapter 11 Groundwater and geology Section 11.7</p> <p>Chapter 12 Surface water quality Section 12.6</p>	<p>Appendix C Field development protocol Section 6, Section 7, Section 9, Section 10</p> <p>Appendix J1 Ecological impact assessment Section 6.2, Section 7</p> <p>Appendix F Groundwater impact assessment Section 7.4, Section 7.5, Section 7.6 (monitoring)</p>

Requirement	Chapter	Appendix
	Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 15 Terrestrial ecology Section 15.4 Chapter 16 Aquatic ecology Section 16.4 Chapter 30 Environmental management and monitoring Section 30.4 (field development protocol), Section 30.5 (environmental management plans) Chapter 31 Project commitments	Appendix G1 Managed release study Section 9.3, Section 9.4 Appendix H Hydrology and geomorphology Section 6
b) The EIS must take into account relevant agreements and plans that cover impacts or known threats to MNES and Commonwealth land (including but not necessarily limited to): <ul style="list-style-type: none"> i. any recovery plan and/or conservation advice for the affected species or community ii. any threat abatement plan for a process that threatens an affected species or community iii. any wildlife conservation plan for the affected species iv. any Strategic Assessment. 	Chapter 15 Terrestrial ecology Section 15.1, Section 15.2	Appendix J1 Ecological impact assessment Section 4, Section 5, Section 6
c) The EIS must include and substantiate specific and detailed descriptions of the proposed avoidance and mitigation measures based on best available practices. This must include the following elements:	Chapter 30 Environmental management and monitoring Chapter 31 Project commitments	Appendix C Field development protocol Section 6, Section 7, Section 9, Section 10

Requirement	Chapter	Appendix
<p>i. A consolidated list of proposed avoidance and mitigation measures to prevent and/or minimise the relevant impacts of the action on MNES and Commonwealth land, including:</p> <ul style="list-style-type: none"> • a detailed description of such measures • an assessment of the expected or predicted effectiveness of these measures, giving consideration to the scale and intensity of likely impacts and the on-ground benefits to be gained through such measures • a description of the anticipated outcomes that measures will be achieved given consideration to known precedents • any statutory or policy basis for the mitigation measures • the likely cost of proposed mitigation measures. 	<p>Chapter 31 Project commitments (mitigation/management) Chapter 32 Conclusion, Section 32.2, Section 32.3 (residual risk summary)</p>	<p>Appendix C Field development protocol Section 6, Section 7, Section 9, Section 10 Appendix U1 Economic assessment (cost benefit analysis)</p>
<p>ii. A detailed outline of a plan for the continuing management, mitigation and monitoring of relevant MNES and Commonwealth land impacts of the action, including a description of the outcomes that will be achieved and any provisions for independent environmental auditing.</p>	<p>Chapter 30 Environmental management and monitoring Chapter 31 Project commitments</p>	<p>Appendix C Field development protocol Section 6, Section 7, Section 9, Section 10</p>
<p>iii. Where appropriate, each project phase (construction, operation, decommission) must be addressed separately. It must state the environmental outcomes, performance criteria, monitoring, reporting, corrective action, contingencies, responsibility and timing for each environmental issue being addressed.</p>	<p>Chapter 30 Environmental management and monitoring, Section 30.3</p>	<p>–</p>
<p>iv. The name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.</p>	<p>Chapter 4, State legislation and approvals</p>	<p>–</p>
<p>d) The EIS must address the requirements for ongoing management and monitoring of potential impacts to water resources identified at Appendix 8 and as prescribed in the latest version of the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's Information Guidelines for Independent Expert Scientific Committee Advice on coal seam gas and large coal mining development proposals (see hyperlink above).</p>	<p>Chapter 30 Environmental management and monitoring Section 30.6 Chapter 31 Project commitments</p>	<p>Appendix F Groundwater impact assessment Section 7.6 Appendix G1 Managed release study Section 9.5 Appendix G3 Water monitoring plan Section 4, Section 5, Section 6 Appendix H Hydrology and geomorphology Section 6</p>

Requirement	Chapter	Appendix
<p><u>Alternatives</u></p> <p>a) The EIS must include any feasible alternatives to the action to the extent reasonably practicable, including:</p> <ul style="list-style-type: none"> i. if relevant, the alternative of taking no action ii. a comparative description of the impacts of each alternative on the MNES and Commonwealth land protected by controlling provisions of Part 3 of the EPBC Act for the action iii. sufficient detail to make clear why any alternative is preferred to another. <p>b) The short, medium and long-term advantages and disadvantages of the options presented must also be discussed.</p>	<p>Chapter 8 Assessment of alternatives</p>	<p>–</p>
5 Residual impacts / offsets		
<p><u>Residual impacts</u></p> <p>a) The EIS must provide details of the likely residual impacts upon MNES and Commonwealth land after the proposed avoidance and mitigation measures have been taken into account. This includes:</p> <ul style="list-style-type: none"> i. the reasons why avoidance or mitigation of impacts may not be reasonably achieved ii. quantification of the extent and scope of significant residual impacts. 	<p>Chapter 5 Commonwealth requirements Section 5.5.5</p> <p>Chapter 11 Groundwater and geology Section 11.8, Section 11.10</p> <p>Chapter 12 Surface water quality Section 12.7, Section 12.8</p> <p>Chapter 13 Hydrology and geomorphology Section 13.6, Section 13.7</p> <p>Chapter 15 Terrestrial ecology Section 15.4, Section 15.6</p> <p>Chapter 16 Aquatic ecology Section 16.3.3 (Murray Cod)</p>	<p>Appendix J1 Ecological impact assessment Section 6.11</p> <p>Appendix F Groundwater impact assessment Section 6.13 (assessment of significance against water trigger)</p> <p>Appendix G1 Managed release study Section 9.4</p> <p>Appendix H Hydrology and geomorphology Section 6.5</p>

Requirement	Chapter	Appendix
<p><u>Offset Package</u></p> <p>a) The EIS must include details of an offset package to be implemented to compensate for residual significant impacts associated with the project, as well as an analysis of how the offset meets the requirements of the Department's Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy October 2012 (EPBC Act Offset Policy) or any alternative methodology that delivers long-term environmental benefits for the relevant Matter(s) of MNES in accordance with the objects of the EPBC Act, as advised by the Minister.</p> <p>b) Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain.</p> <p>c) Offsets should compensate for an impact for the full duration of the impact.</p> <p>d) Offsets must directly contribute to the ongoing viability of the MNES and Commonwealth land impacted by the project and deliver an overall conservation outcome that improves or maintains the viability of the protected matter, compared to what is likely to have occur under 'status quo' (i.e. if the action and associated offset had not taken place) .</p> <p>e) Note, offsets do not make an unacceptable impact acceptable and do not reduce the likely impacts of a proposed action. Instead, offsets compensate for any residual significant impact.</p> <p>f) The EIS must provide:</p> <ul style="list-style-type: none"> i. details of the offset package to compensate for significant residual impacts on MNES and/or Commonwealth land ii. an analysis of how the offset package meets the requirements of the relevant offset policy. <p>Further details of information requirements for EPBC Act offset proposals are provided at Appendix 3.</p>	<p>Chapter 15 Terrestrial ecology Section 15.5</p> <p>Note: the biodiversity offset package, including location and size of any offset sites, would be investigated following the environmental impact statement process.</p>	<p>Appendix J1 Ecological impact assessment Section 8, Appendix L (biodiversity offset strategy)</p>
<p>6 Environmental record of person(s) proposing to take the action</p>		
<p>a) The information provided must include details of any past or current proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:</p> <ul style="list-style-type: none"> i. the person proposing to take the action ii. the person making the application for any related permits. 	<p>Chapter 5 Commonwealth requirements Section 5.4</p>	<p>–</p>

Requirement	Chapter	Appendix
b) If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must also be included.	Chapter 30 Section 30.1.1, Section 30.1.2 Appendix C to Appendix T1	–
7 Economic and social matters		
a) The economic and social impacts of the action, both positive and negative, must be analysed. Matters of interest may include:	Chapter 9 Community and stakeholder consultation Section 9.1, Section 9.2	Appendix T1 Social impact assessment Section 2.6 (stakeholder engagement)
i. details of any public consultation activities undertaken, and their outcomes		
ii. details of any consultation with Indigenous stakeholders	Chapter 9 Community and stakeholder consultation Section 9.1, Section 9.2	Appendix D Stakeholder and community consultation report, Section 2.5.4
iii. projected economic costs and benefits of the project, including the basis for their estimation through cost/benefit analysis or similar studies	Chapter 27 Economic impacts Section 27.3 (cost benefit analysis), Section 27.4 (macroeconomic analysis) Chapter 26 Social and health impacts Section 26.3.7	Appendix U1 Economic assessment (cost benefit analysis) Appendix U2 Economic assessment (macroeconomic analysis) Section 4 (macroeconomic impacts)
iv. employment opportunities expected to be generated by the project (including construction and operational phases).	Chapter 27 Economic impacts Section 27.3 (cost benefit analysis), Section 27.4 (macroeconomic analysis) Chapter 26 Social and health impacts Section 26.3.7	Appendix T1 Social impact assessment Section 6.3.1
b) The economic and social impacts must include impacts at the local, regional and national level.	Chapter 27 Economic impacts Section 27.5 Chapter 26 Social and health impacts Section 26.3.7	Appendix U1 Economic assessment (cost benefit analysis)

Requirement	Chapter	Appendix
		Appendix U2 Economic assessment (macroeconomic analysis) Appendix T1 Social impact assessment
c) Details of the relevant cost and benefits of alternative options to the proposed action, as identified in Section 4, should also be included.	Chapter 8 Assessment of alternatives, Section 8.3, Section 8.4, Section 8.5	–
8 Information sources provided in the EIS		
For information given in the EIS, the EIS must state: a) the source of the information b) how recent the information is c) how the reliability of the information was tested d) what uncertainties (if any) are in the information e) what guidelines, plans and/or policies have been considered during preparation of the EIS.	Chapter 33 References	–
9 Conclusion		
An overall conclusion as to the environmental acceptability of the proposal on MNES and Commonwealth land must be provided, which includes: a) a discussion on how consideration has been given to the objects of the EPBC Act, the principles of ecologically sustainable development, and the precautionary principle (as detailed at Appendix 4) b) justification for undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures c) if relevant, a discussion of residual impacts and any offsets and compensatory measures proposed or required for significant residual impacts on MNES and Commonwealth land, and the relative degree of compensation and acceptability.	Chapter 32 Conclusion	–
10 Structure		
Unless the above requirements are addressed within a separate standalone chapter, then table 1 at Appendix 5 must also be included in the EIS	–	Appendix A Environmental assessment requirements

Table 3 Environmental assessment requirements (Appendix 1)

Requirement	Chapter	Appendix
Summary of relevant threatened flora, fauna and ecological communities:		
<p>The controlled action is considered likely to have a significant impact on the following listed threatened species and ecological communities:</p> <ul style="list-style-type: none"> • <i>Anthochaera phrygia</i> (regent honeyeater) – endangered • <i>Dasyurus maculates maculatus</i> (spotted-tailed quoll) – endangered • <i>Phasco/arctos cinereus</i> (combined koala populations of Qld, NSW and the ACT) – vulnerable • <i>Nyctophilus corbeni</i> (south-eastern long-eared bat) – vulnerable • <i>Pseudomys pilligaensis</i> (Pilliga mouse) – vulnerable • <i>Bertya opponens</i> (coolabah bertya) – vulnerable • <i>Lepidium aschersonii</i> (spiny peppergrass) – vulnerable • <i>Lepidium monoplocooides</i> (winged peppergrass) – vulnerable • <i>Rulingia procumbens</i> – vulnerable • <i>Tylophora linearis</i> – endangered • the Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) ecological community – endangered • the weeping Myall woodlands ecological community – endangered 	<p>Chapter 15 Terrestrial ecology Section 15.1.3 (field surveys), Section 15.2.2 (flora), Section 15.2.3 (fauna), Section 15.3.2 (direct impacts), Section 15.3.3 (indirect impacts), Section 15.3.5 (significance)</p>	<p>Appendix G1 Managed release study Appendix A Section 2 (aquatic ecology surveys), Section 4.2 (aquatic flora and fauna), Section 6 (impact assessment), Section 6.2 (assessment of significance) Appendix J1 Ecological impact assessment Section 4 (flora and fauna surveys), Section 5.3 (terrestrial flora), Section 5.4 (terrestrial fauna), Section 6 (potential impacts), Section 6.11 (assessment of significance)</p>

Requirement	Chapter	Appendix
<p>A significant impact could not be ruled out for the following protected matters:</p> <ul style="list-style-type: none"> • <i>Botaurus poiciloptilus</i> (Australasian bittern) – endangered • <i>Lathamus discolor</i> (swift parrot) – endangered • <i>Polytelis swainsonii</i> (superb parrot) – vulnerable • <i>Rostratula australis</i> (Australian painted snipe) – endangered • <i>Leipoa ocellata</i> (Mallee fowl) – vulnerable • <i>Bidyanus bidyanus</i> (silver perch) - critically endangered • <i>Maccullochella peelii</i> (Murray cod) – vulnerable • <i>Litoria booroo/ongensis</i> (booroolong frog) – endangered • <i>Chalinolobus dwyeri</i> (large-eared pied bat) – vulnerable • <i>Petrogale penicillata</i> (brush-tailed rock wallaby) – vulnerable • <i>Anomalopus mackayi</i> (five-clawed worm-skink) – vulnerable • <i>Aprasia parapulchella</i> (pink-tailed worm-lizard) – vulnerable • <i>Uvidicolus sphyrurus</i> (border thick-tailed gecko) – vulnerable • <i>Androcalva procumbens</i> – vulnerable • <i>Bertya opponens</i> – vulnerable • <i>Cadellia pentastylis</i> – vulnerable • <i>Philotheca ericifolia</i> – vulnerable • <i>Prasophyllum</i> sp. Wybong - critically endangered • <i>Thesium australe</i> - austral toadflax – endangered • the coolabah - black box woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions ecological community – endangered • the grey box (<i>Eucalyptus macrocarpa</i>) grassy woodlands and derived native grasslands of south-eastern Australia ecological community – endangered • the natural grasslands on basalt and fine-texture alluvial plains of northern NSW and southern Old ecological community - critically endangered • the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland ecological community - critically endangered 	<p>Chapter 15 Terrestrial ecology Section 15.1.3 (field surveys), Section 15.2.2 (flora), Section 15.2.3 (fauna), Section 15.3.2 (direct impacts), Section 15.3.3 (indirect impacts), Section 15.3.5 (significance)</p> <p>Chapter 16 Aquatic ecology Section 16.3.3 (Murray Cod)</p>	<p>Appendix G1 Managed release study Appendix A Section 2 (aquatic ecology surveys), Section 4.2 (aquatic flora and fauna), Section 6 (impact assessment), Section 6.2 (assessment of significance)</p> <p>Appendix J1 Ecological impact assessment Section 4 (flora and fauna surveys), Section 5.3 (terrestrial flora), Section 5.4 (terrestrial fauna), Section 6 (potential impacts), Section 6.11 (assessment of significance)</p>

Table 4 Environmental assessment requirements (Appendix 2)

Requirement	Chapter	Appendix
Supplementary guidance for addressing potential impacts to water resources		
1 Description of the environment		
<p>A description of the environment should include data relating to the climatic and hydro-meteorological setting of the region, as well as all relevant information generated by a bioregional assessment (where one has been completed) that can indicate the baseline conditions of the proposed development area.</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.3</p> <p>Chapter 18 Air quality Section 18.3.1 (climate)</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2.2 (hydro-meteorological setting)</p>	<p>Appendix F Groundwater impact assessment Section 4.3 (climate), Section 4.4 (catchment hydrology)</p> <p>Appendix G1 Managed release study Section 4</p> <p>Appendix G4 Water baseline report Section 3 (surface water and groundwater receptors), Section 6 (regional water quality and flow), Section 7 (site water quality and flow)</p> <p>Appendix H Hydrology and geomorphology Section 4.3</p>
<p>Where a bioregional assessment has not yet been completed, the best available information should be used to identify and describe the existing condition of water resources and water-related assets at a regional scale.</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.2.3 (methodology)</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2.3, Section 13.2.4, Section 13.2.5, Section 13.2.6</p>	<p>Appendix F Groundwater impact assessment Section 4.4 (surface water and groundwater), Section 4.6 (environmental values), Section 4.8 (groundwater bores)</p> <p>Appendix G1 Managed release study Section 4.1</p> <p>Appendix G4 Water baseline report Section 4 (baseline sampling)</p> <p>Appendix H Hydrology and geomorphology Section 4.4</p>

Requirement	Chapter	Appendix
<p>Trends and seasonal variation in the condition of water resources and water-related assets should also be identified. All water resources and water-related assets must be clearly identified on accompanying maps, as well as in the text.</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.2.3</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2.2</p>	<p>Appendix F Groundwater impact assessment Section 5.5 (groundwater fluxes), Section 5.6 (groundwater system), Section 5.7 (groundwater quality)</p> <p>Appendix G1 Managed release study Section 4.2.2 (rainfall and evaporation), Section 4.2.7 (water quality)</p> <p>Appendix G4 Water baseline report Section 4.0 (baseline sampling)</p>
<p>All results of modelling should take account of the sensitivity and uncertainty of the model, by presenting results in a probabilistic way (as data ranges with probabilities stated).</p>	<p>Chapter 11 Groundwater and geology Section 11.4.1</p>	<p>Appendix F Groundwater impact assessment Section 6 (model uncertainty and sensitivity)</p>
<p>1.1 Description of the environment - water resources</p>		
<p>A description of the water resources should include:</p> <p>a) the water resources of the site and region</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.3</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2.3, Section 13.2.3, Section 13.2.4, Section 13.2.5, Section 13.2.6</p>	<p>Appendix F Groundwater impact assessment Section 4 (regional context), Section 5 (conceptual model)</p> <p>Appendix G1 Managed release study Section 4.1 (Namoi catchment), Section 4.2</p> <p>Appendix G4 Water baseline report Section 7.0 (regional water quality and flow), Section 8.0 (site water quality and flow)</p> <p>Appendix H Hydrology and geomorphology Section 4.4</p>

Requirement	Chapter	Appendix
b) geology and hydrogeology at both site and regional scale	Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2	Appendix F Groundwater impact assessment Section 4.5 (geology), Section 4.6 (surface water and groundwater)
c) development or confirmation of the existing Narrabri gas field groundwater conceptual model by using actual data from recent drilling activities. This includes the updated geological maps and cross-sections, hydraulic parameters garnered from downhole wireline logging and pump tests	Chapter 11 Groundwater and geology Section 11.2.1, Section 11.3.1	Appendix F Groundwater impact assessment Section 3.1 (data collation and review), Section 3.2 (development of conceptual model)
d) a numerical groundwater model that includes at least two years of high quality groundwater collected from monitoring bores in the shallow and deep groundwater systems to allow meaningful calibration for steady state conditions	Chapter 11 Groundwater and geology Section 11.2.1	Appendix F Groundwater impact assessment Section 3.1 (data collation and review), Section 3.3 (development of numerical model)
c) hydraulic characteristics (including hydraulic conductivity and storage characteristics) for each formation <ul style="list-style-type: none"> provision of baseline data on the chemistry (including methane), isotopic and physical characteristics (including wireline logging) for potentially affected hydro-stratigraphic units 	Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2	Appendix F Groundwater impact assessment Section 5.3 (conductivity), Section 5.7 (water quality)
<ul style="list-style-type: none"> step drawdown, constant rate (or head) pump tests (three days minimum plus recovery) to determine good hydraulic parameters (including leakage factors in the lower transmissivity aquitards) 	–	Appendix F Groundwater impact assessment, Section 5.3, Section 6.7, Appendix B (hydrogeology properties)
<ul style="list-style-type: none"> a detailed water balance using actual real data collected to determine all sources of groundwater recharge, abstraction and discharge from the project area 	Chapter 7 Produced water management Section 7.4, Section 7.7 Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 6.6 Appendix G1 Managed release study Section 6.2 (beneficial use water balance model)

Requirement	Chapter	Appendix
<p>d) baseline water quality for all relevant surface and groundwater resources, including chemistry and ecology, at the local and regional scale</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.3</p>	<p>Appendix F Groundwater impact assessment Section 5.7</p> <p>Appendix G1 Managed release study Section 4.2.7</p> <p>Appendix G4 Water baseline report Section 6.0 (regional water quality), Section 7 (site water quality)</p>
<p>e) a detailed water balance using actual real data collected to determine all sources of groundwater recharge, abstraction and discharge from the project area</p>	<p>Chapter 7 Produced water management Section 7.4, Section 7.7</p> <p>Chapter 11 Groundwater and geology Section 11.3.2</p>	<p>Appendix F Groundwater impact assessment Section 6.6</p> <p>Appendix G1 Managed release study Section 6.2 (beneficial use water balance model)</p>
<p>f) based on the results of numerical modelling, water and salt balances for the proposed site and region, detailing the set of stores and the movement between those stores under current conditions, taking into account seasonal and long term climate variation</p>	<p>Chapter 7 Produced water management Section 7.4 (water balance), Section 7.7 (management), Section 7.8 (salt balance)</p> <p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.2.2 (salt balance)</p>	<p>Appendix F Groundwater impact assessment Section 6.6</p> <p>Appendix G1 Managed release study Section 6.2 (beneficial use water balance model)</p>
<p>g) direction of groundwater flow and potentiometric surfaces (contours of groundwater head) for each hydrogeological unit likely to be impacted by the proposed action. The measured potentiometric heads (standing water levels) on which the potentiometric surfaces are based should also be presented</p> <ul style="list-style-type: none"> • groundwater level trends versus climatic variations (especially for drought conditions) 	<p>Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2</p>	<p>Appendix F Groundwater impact assessment Section 5.6</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> an assessment of potential connectivity between the ephemeral Bohena Creek, the Bohena Alluvial unconsolidated aquifer, the Keelindi bed leaky aquitard, and the Pilliga sandstone consolidated aquifer 	Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2	Appendix F Groundwater impact assessment Section 4.4.4 (surface water and groundwater interaction), Appendix B (hydrogeology properties)
h) surface water flow regimes and flow directions	Chapter 13 Hydrology and geomorphology Section 13.2.4, Section 13.2.5, Section 13.2.6	Appendix H Hydrology and geomorphology Section 4.5, Appendix A (flood study)
i) all local drainages and estimates of baseflow to each local watercourse	Chapter 13 Hydrology and geomorphology Section 13.2.4, Section 13.2.5, Section 13.2.6	Appendix H Hydrology and geomorphology
j) identification of relevant water plans that may apply to the area	Chapter 4 State legislation and approvals Section 4.3.2 Chapter 7 Produced water management Section 7.3	Appendix F Groundwater impact assessment Section 2 (legislative context)
k) existing water quality guidelines, targets, environmental flow objectives and requirements for the ecosystems of the surface catchment and groundwater basin within which the project is based	Chapter 4 State legislation and approvals Section 4.3.2 Chapter 7 Produced water management Section 7.3 Chapter 11 Groundwater and geology Section 11.1	Appendix F Groundwater impact assessment Section 2 (legislative context) Appendix G3 Water monitoring plan Section 3 (threshold exceedance criteria)

Requirement	Chapter	Appendix
	Chapter 12 Surface water quality Section 12.2.2	
k) the ecological characteristics and processes of the water resources, including the biological diversity, species composition and ecosystem function.	Chapter 16 Aquatic ecology Section 16.2	Appendix G1 Managed release study Appendix A Section 4.2 (aquatic flora and fauna)
1.2 Description of the environment - water-related assets		
A description of water-related assets should include an estimation of water quantity and quality requirements (i.e. regional water use) for: a) aquatic and terrestrial ecosystems that are dependent on the water resource, including those dependent upon the particular geomorphology of a water resource	Chapter 11 Groundwater and geology Section 11.3.2 Chapter 16 Aquatic ecology Section 16.2	Appendix F Groundwater impact assessment Section 4.6.1 (groundwater dependent ecosystems), and Appendix B to Appendix F (groundwater dependent ecosystems risk assessment), Section 4.6.3 (aquatic ecosystems) Appendix G1 Managed release study Section 4.2.8 (aquatic habitat) Appendix G4 Water baseline report Section 3, Section 6 (regional water quality and flow, Section 7 (site water quality and flow) Appendix H Hydrology and geomorphology
b) ecosystems that are dependent on springs and groundwater, including identification of the relevant source hydrogeological unit	Chapter 11 Groundwater and geology Section 11.3.2	Appendix G1 Managed release study , Section 4.2.9
c) regional communities, industrial and/or agricultural activities, and indigenous cultural needs or assets that are dependent on the water resource	Chapter 11 Groundwater and geology Section 11.3.1, Section 11.3.2	Appendix F Groundwater impact assessment, Section 4, Regional context

Requirement	Chapter	Appendix
d) fauna, flora and species that are dependent on the water resource.	Chapter 11 Groundwater and geology Section 11.3.2 Chapter 16 Aquatic ecology Section 16.2	Appendix G1 Managed release study , Section 4.2.8, Section 4.2.9
2 Relevant impacts		
Relevant impacts should include impacts on water quality and quantity and water-related assets, including cumulative impacts.	Chapter 11 Groundwater and geology Section 11.4, Section 11.5.4 (cumulative) Chapter 12 Surface water quality Section 12.4.1, Section 12.5.1 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Chapter 16 Aquatic ecology Section 16.3.1 (water quantity), Section 16.3.2 (water quality) Chapter 20 Aboriginal heritage Section 20.3.2, Section 20.4.2 (cultural value of water) Chapter 29 Cumulative impacts Section 29.3.1, Section 29.3.2, Section 29.3.3	Appendix F Groundwater impact assessment Section 6.9 (water quantity), Section 6.12 (assessment against aquifer interference policy), Section 6.13 (assessment of significance against water trigger), Section 7.4 (water quality), Section 8.4 (cumulative impacts) Appendix G1 Managed release study Section 8 Appendix H Hydrology and geomorphology
2.1 Data		
When providing information on the relevant impacts it is important that the PER or EIS provides any technical data or other information that was used for modelling or assessing the relevant	–	Appendix F Groundwater impact assessment

Requirement	Chapter	Appendix
impacts in the preparation of the PER or EIS, or are needed to make a detailed assessment of the relevant impacts.		Section 3.1 (data collation and review) Appendix G1 Managed release study Section 2.4 (supporting studies), Section 2.5 (field work) Appendix G4 Water baseline report Section 6 (regional water quality and flow), Section 7 (site water quality and flow) Appendix H Hydrology and geomorphology
This should include hydrographs, raw data such as records of seasonal and/or historic annual variations in water quality and quantity, bore logs and water quality parameters (such as relevant inorganic chemicals). This should also include mapping and diagrams to illustrate modelled drawdown (both at local and regional scales), modelled head distribution, bore locations and geological structures to assist in the interpretation of model outcomes. Data should include dates and locations of measurements, flow conditions, and elevations of the reference points from which water levels were measured.	–	Appendix F Groundwater impact assessment Appendix G1 Managed release study Appendix G4 Water baseline report Appendix H Hydrology and geomorphology
Uncertainty of all data should be addressed, including seasonal and long term climate variations as well as the development of the activity over time. All results of modelling should take account of the sensitivity and uncertainty of the model by presenting results in a probabilistic way (as data ranges with probabilities stated).	Chapter 11 Groundwater and geology Section 11.4.1	
2.2 Relevant impacts - water resources and water-related assets		
An assessment of the likely significant impacts on important water resources and water related assets should include:	–	–
a) a numerical model, incorporating water quality and quantity (including salt) balances for both the project site and broader area of potential impact, including: <ul style="list-style-type: none"> i. an assessment of the changes that occur as a result of the proposed development on the quality and quantity of water within any store, or flow of water and salt between these stores 	Chapter 11 Groundwater and geology Section 11.4	Appendix F Groundwater impact assessment Section 3.1 (data collation and review), Section 3.3 (development of numerical model)

Requirement	Chapter	Appendix
		Appendix G1 Managed release study Appendix E (mixing zone analysis)
ii. identify any water necessary for the project that is not available from within the extraction and treatment loops that must be imported from elsewhere.	Chapter 6 Project description Section 6.5.4, Section 6.5.5	–
b) a quantitative prediction of subsidence and effects from dewatering and depressurisation (including lateral effects) on surface topography, groundwater, surface water and movement of water across the landscape, and possible fracturing of confining layers throughout the life of the operation	Chapter 11 Groundwater and geology Section 11.4.3	Appendix F Groundwater impact assessment Section 7.4.1 (subsidence), Section 7.4.4 (geological faulting)
c) discussion of seismic impacts from drilling and tracking on the structure of the receiving , surrounding and overlaying geology and the potential for impacts on aquifer connectivity with either the surface or other aquifers	Chapter 11 Groundwater and geology Section 11.4.3	Appendix F Groundwater impact assessment Section 7.4.1 (subsidence), Section 7.4.3 (aquifer connectivity via wells), Section 7.4.4 (geological faulting)
d) a quantitative prediction of the extent of the cone of depression and consequential impacts of the cone of depression and voids on surface topography, groundwater, surface water and movement of water across the landscape throughout the life of the project, post mining, and final site management.	Chapter 11 Groundwater and geology Section 11.4.2	Appendix F Groundwater impact assessment Section 6.11 (numerical modelling), Section 7.4.5 (consequential impacts)
e) predictions for stressors and toxicants, including chemical composition, mass and volumes, utilised and/or released to a water resource over the life of the project	Chapter 7 Produced water management Section 7.6 Chapter 12 Surface water quality Section 12.5.6	Appendix G1 Managed release study Section 8.1.2, Section 8.6, Appendix B (direct toxicity assessment), Appendix E (mixing zone analysis)
f) predicted volumes and quality of water proposed to be used during mining, including within the mine itself (for example, coal washing, dust suppression) and for other associated activities (for example, cooling or other industrial processes)	Chapter 7 Produced water management Section 7.4 (volume), Section 7.6 (quality)	–

Requirement	Chapter	Appendix
g) details of impacts to hydrogeological units, including units directly and indirectly impacted by the action	Chapter 11 Groundwater and geology Section 11.4.2	Appendix F Groundwater impact assessment Section 6.11 (numerical modelling), Section 7.4.5 (consequential impacts)
h) the impacts on the hydraulic properties, including both vertical and horizontal properties of hydrogeological unit geology, including the potential for physical transmission of water within and between formations, the effects of depressurisation due to gas and water extraction, and estimates of the likelihood of leakage of contaminants from coal beds through geological formations	Chapter 11 Groundwater and geology Section 11.4.2, Section 11.4.3	Appendix F Groundwater impact assessment Section 7.4.3 (hydraulic connectivity via wells), Section 7.4.4 (enhanced connectivity via geological faulting), Section 7.4.5 (depressurisation of coal seams)
i) the impacts associated with surface water extraction, releases and/or diversions, including alterations to flow regimes, flood heights, and/or erosion/sedimentation and impacts to habitat	Chapter 13 Hydrology and geomorphology Section 13.5.6	Appendix H Hydrology and geomorphology Section 5.3 (catchment hydrology and hydraulics), Section 5.5 (Leewood), Section 5.6 (Biblewindi), Appendix A (flood study)
j) the identification of any landscape modifications that will impact on surface water flow, i.e. a geomorphological assessment	Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5	Appendix H Hydrology and geomorphology Section 4.6, Section 4.7
k) an estimate of the quality and quantity of operational discharges of water, including potential emergency discharges due to unusual events, and the likely impacts on water-related assets	Chapter 7 Produced water management Section 7.7 Chapter 12 Surface water quality Section 12.5.3 (stormwater management), Section 12.5.4 (dust suppression), Section 12.5.5 (irrigation areas) Section 12.5.6	Appendix G1 Managed release study Section 6.5 (surface water release hydraulic model) Appendix G2 Concept irrigation study Section 8

Requirement	Chapter	Appendix
l) clarification of discharge sources (both of contaminated water and airborne contaminants)	Chapter 6 Section 6.4.3 , Section 6.4.4 (irrigation area) Chapter 7 Produced water management Section 7.7 Chapter 11 Groundwater and geology Section 11.4.3 Chapter 12 Surface water quality Section 12.5.3 (stormwater management), Section 12.5.4 (dust suppression), Section 12.5.5 (irrigation area) Section 12.5.6 Note: reinjection of produced water is not proposed.	Appendix G1 Managed release study Section 6 Appendix G2 Concept irrigation study Section 4 (site selection)
m) an assessment of the direct and indirect quality and quantity impacts on the water-related assets previously identified, with reference to the Australian Guidelines for Water Quality Monitoring and Reporting: http://www.environment.gov.au/resource/national-water-quality-managementstrategy-australian-guidelines-water-quality-monitoring-O	Chapter 7 Produced water management Section 7.8 Chapter 12 Surface water quality Section 12.4, Section 12.5	Appendix G1 Managed release study Section 8 Appendix G2 Concept irrigation study Section 8
2.3 Relevant impacts - modelling surface and groundwater impacts		
In addressing the relevant impacts to water resources it will be necessary to provide the results of a numerical surface and groundwater model that is calibrated to baseline conditions and enables a probabilistic evaluation of potential future scenarios, including a sensitivity and uncertainty analysis, consistently with the Modelling Guidelines. The model should be peer reviewed. The water modelling should:	Chapter 7 Produced water management Section 7.8 (salt balance) Chapter 11 Groundwater and geology Section 11.2.1 (methodology), Section 11.3.1 (baseline conditions), Section 11.4.1 (sensitivity)	Appendix F Groundwater impact assessment Section 6 (numerical model), Section 6.10 (uncertainty and sensitivity) Appendix G1 Managed release study Section 6 (managed release simulations), Appendix E (mixing zone analysis)

Requirement	Chapter	Appendix
	<p>Chapter 12 Surface water quality Section 12.5.5 (irrigation area), Section 12.5.6</p> <p>Chapter 13 Hydrology and geomorphology Section 13.3 (Water model), Section 13.1.3</p> <p>Chapter 16 Aquatic ecology Section 16.3.2</p>	<p>Appendix H Hydrology and geomorphology Appendix A (flood study)</p>
<p>a) outline the model's conceptualisation of the system or systems, including key assumptions and the model's limitations</p>	<p>Chapter 11 Groundwater and geology Section 11.2.1 (methodology), Section 11.3.1 (conceptual model)</p> <p>Chapter 12 Surface water quality Section 12.2.4 (irrigation area), Section 12.2.6</p> <p>Chapter 13 Hydrology and geomorphology Section 13.1 (methodology), Section 13.3</p>	<p>Appendix F Groundwater impact assessment Section 3.2, Section 5 (conceptual hydrogeological model)</p> <p>Appendix G1 Managed release study Section 6 (managed release simulations)</p>
<p>b) represent each water resource, the storage and flow characteristics of each; linkages, if any, between water resources and the existing flow regime, including recharge and discharge pathways of the hydrogeological units, and any changes that are predicted to occur upon commencement of the development activities</p>	<p>Chapter 11 Groundwater and geology Section 11.3.1 (conceptual model), Section 11.4.2 (induced groundwater flows)</p> <p>Chapter 13 Hydrology and geomorphology Section 13.1.4 (surface-groundwater interaction)</p>	<p>Appendix F Groundwater impact assessment, Section 4</p> <p>Appendix H, Hydrology and geomorphology, Section 4.5, Section 4.6</p>

Requirement	Chapter	Appendix
c) simulate the proposed sequence of development and provide predictions of water flow rates and water level/pressure changes in each hydrogeological unit for the life of the action and beyond	Chapter 11 Groundwater and geology Section 11.4.1 (numerical model simulations), Section 11.4.2 (induced groundwater flows)	Appendix F Groundwater impact assessment, Section 6
d) provide information on the progress of development, including timing for maximum impact of water resources, time to maximum drawdown and time for drawdown equilibrium to be reached , and timing for return to predevelopment conditions	Chapter 11 Groundwater and geology Section 11.4.1 (numerical model simulations), Section 11.4.2 (induced groundwater flows)	Appendix F Groundwater impact assessment, Section 6
e) identify the volumes of water predicted to be used on an annual basis with an indication of the proportion supplied from each water resource	Chapter 7 Produced water management Section 7.4 Chapter 11 Groundwater and geology Section 11.4.1 (numerical model simulations) Note: take of surface water for a consumptive, industrial or agricultural purpose is not proposed.	Appendix G1 Managed release study, Section 5 Project water management Appendix F Groundwater impact assessment, Section 6
f) include recommendations, a program for review, and an update of the model as more data and information become available.	Chapter 11 Groundwater and geology Section 11.9	Appendix F Groundwater impact assessment, Section 8.9
Note: The Australian groundwater modelling guidelines (Barnett 2012) should be used as a best practice guide to groundwater modelling at the following link: http://archive.nwc.gov.au/library/waterlines/82	Chapter 11 Groundwater and geology Section 11.2.1	Appendix F Groundwater impact assessment, Section 6
2.4 Relevant impacts - cumulative and indirect impacts		
The EIS should identify and address cumulative impacts that take into account all relevant actions (past, present and/or reasonably foreseeable) to determine the risks and impacts posed by the proposed action, in combination with other developments that currently or are likely to occur within the area (see the significant impact guidelines 1.3: coal seam gas and large coal	Chapter 29 Cumulative impacts Section 29.3	–

Requirement	Chapter	Appendix
mining developments - impacts on water resources for more information on cumulative impacts). The EIS should include:		
a) estimates of sediments as total suspended solids (TSS) and salts (including metals, metalloids and organic salts) being discharged from the development (including for other uses, such as irrigation or drinking water). This should also include estimates from overflow events from mine and sediment dams. These figures should be compared to background load levels, and with the estimated loads from current and likely future developments, both upstream and downstream	Chapter 7 Produced water management Section 7.8 (salt balance) Chapter 12 Surface water quality Section 12.5.5 (irrigation area), Section 12.5.6	Appendix G1 Managed release study Section 8.1, Appendix B (direct toxicity assessment), Appendix E (mixing zone analysis) Appendix G2 Concept irrigation study Section 8
b) mapping of existing and proposed mining and exploration activities within the catchment and region and modelling of potential cumulative impacts.	Chapter 11 Groundwater and geology Figure 11–5, Section 11.5.4 (cumulative) Chapter 29 Cumulative impacts Section 29.2	Appendix F Groundwater impact assessment Section 8.4 (cumulative)
c) details of the total existing and planned licensed and actual take of water for consumptive, industrial and agricultural purposes in the surface catchment and groundwater basin within which the proposed action is based	Chapter 7 Produced water management Section 7.4 Chapter 11 Groundwater and geology Section 11.1.3 Note: take of surface water for a consumptive, industrial or agricultural purpose is not proposed.	Appendix F Groundwater impact assessment Section 2.2.4 (water sharing plans), Section 4.8(licensed take), Section 6.8.2 (produced water extraction)
d) details of the total existing and planned discharges of waste water and injections of water into hydrogeological units from other mining and industrial purposes in the surface catchment and groundwater basin within which the proposed action is based	Chapter 11 Groundwater and geology Section 11.5.4 Note: reinjection of produced water is not proposed.	Appendix F Groundwater impact assessment Section 6.9.4 (reinjection from Narrabri Coal Mine) Appendix G1 Managed release study Section 6.5 (surface water release hydraulic model)

Requirement	Chapter	Appendix
		Appendix G2 Concept irrigation study Section 9
f) details of the proportional increase in water resource use and impacts as a consequence of the proposed action	Chapter 7 Produced water management Section 7.4 Chapter 11 Groundwater and geology Section 11.1.3 (water resource use), Section 11.4.2 (drawdown at existing groundwater bores)	Appendix F Groundwater impact assessment Section 2.2.4 (water sharing plans), Section 4.8(licensed take), Section 6.8.2 (produced water extraction) Appendix G1 Managed release study Section 8
g) the overall level of risk to water-related assets that combine probability of occurrence with severity of impact of current or potential multiple actions.	Chapter 11 Groundwater and geology Section 11.8 (risk), Section 11.5.4 (cumulative) Chapter 29 Cumulative impacts Section 29.4	Appendix F Groundwater impact assessment Section 8.4 (cumulative) Appendix G1 Managed release study Section 9
The EIS should reference any relevant regional water resource/catchment management or operational plans and/or regional water balance models in relation to the discussion on cumulative and indirect impacts.	Chapter 11 Groundwater and geology Section 11.1 Chapter 12 Surface water quality Section 12.2.2	Appendix F Groundwater impact assessment Section 2 (legislative context)
3 Proposed safeguards and mitigation measures		
The Environment Management Plan that is included in the EIS should:		
a) include any water quality or quantity trigger values for water resources and water-related assets, as relevant, which would trigger corrective actions	Chapter 7 Produced water management Section 7.3.1 Chapter 30 Environmental management and monitoring Section 30.6.2 (water monitoring)	Appendix G3 Water monitoring plan Section 3 (threshold exceedance criteria)

Requirement	Chapter	Appendix
	<p>Note: it is expected that water quality objectives would be formalised in licence and approval conditions, particularly under the <i>Protection of the Environment Operations Act 1997</i>.</p>	
<p>b) include details of the baseline monitoring program and a proposed monitoring program to monitor operational impacts to groundwater and surface water resources. The proposed water monitoring program should:</p> <ul style="list-style-type: none"> i. clearly define monitoring objectives, including what environmental values are being protected ii. describe what water quality guidelines will be used and how the parameters in the guidelines were derived iii. detail corrective actions that will be taken should the monitoring identify that water resources and/or water-related assets are being impacted by the proposed action. 	<p>Chapter 7 Produced water management Section 7.7.1 (irrigation area, Bohena Creek)</p> <p>Chapter 11 Groundwater and geology Section 11.9</p> <p>Chapter 30 Environmental management and monitoring Section 30.6</p>	<p>Appendix G3 Water monitoring plan Section 1.2 (purpose), Section 3 (threshold exceedance criteria), Section 5 (threshold action and response plan), Section 6 (continuous improvement)</p>
<ul style="list-style-type: none"> • The assessment documentation should include: <ul style="list-style-type: none"> – a firm commitment to active compliance monitoring, and to having an experienced field hydrologist on site during drilling – a commitment to report all well completion logs to the NSW Office for coal seam gas within one or two weeks. Six months is considered too long to ensure the correct emplacement of casing and the sealing off of alluvial aquifer and Pilliga sandstone aquifer from each other, and from Triassic and Permian hydrostratigraphic units (including coal measures). 	<p>Chapter 11 Groundwater and geology Section 11.7, Section 11.9</p>	<p>–</p>

Table 5 Supplementary environmental assessment requirements (Appendix 3)

Requirement	Chapter	Appendix
Information requirements for EPBC act offset proposals		
<p>a) Details in relation to the proposed offsets package, including:</p> <ul style="list-style-type: none"> i. the location and size, in hectares, of any offset site(s) ii. maps for each offset site that clearly show: <ul style="list-style-type: none"> • the relevant ecological features • the landscape context • the cadastre boundary. iii. the current tenure arrangements (including zoning and ownership) of any proposed offset sites iv. confirmed records of presence (or otherwise) of relevant protected matter(s) on the offset site(s) v. details of studies and surveys used to confirm the presence of individuals and or likely habitat within offset site(s), including the scope, timing/effort (survey season/s) and methodologies employed vi. detailed information regarding the extent (in hectares) and quality of habitat for relevant protected matter(s) on the offset site. The quality of habitat should be assessed in a manner consistent with the approach outlined in the document titled <i>How to use the offset assessment guide</i> available at: http://www.environment.gov.au/epbc/publications/environmental-offsetpolicy.html. 	<p>Chapter 15 Terrestrial ecology Section 15.5</p> <p>Note: the biodiversity offset package, including location and size of any offset sites, would be investigated following the environmental impact statement process.</p>	<p>Appendix J1 Ecological impact assessment Section 8, Appendix L (biodiversity offset strategy)</p>

Requirement	Chapter	Appendix
<p>b) Provide information and justification regarding how the offsets package will deliver a conservation outcome that will maintain or improve the viability of the protected matter(s) consistent with the EPBC Act environmental offsets policy (October 2012) including:</p> <ul style="list-style-type: none"> i. management actions that will be undertaken to improve or maintain the quality of the proposed offset site(s) for the relevant protected matter(s). Management actions must be clearly described, planned and resourced as to justify any proposed improvements in quality for the protected matter(s) over time ii. the time over which management actions will deliver any proposed improvement or maintenance of habitat quality for the relevant protected matter(s) iii. the risk of damage, degradation or destruction to any proposed offset site(s) in the absence of any formal protection and/or management over a foreseeable time period (20 years). Such risk assessments may be based on: <ul style="list-style-type: none"> • presence of pending development applications, mining leases or other activities on or near the proposed offset site(s) that indicate development intent • average risk of loss for similar site • presence and strength of formal protection mechanisms currently in place. iv. the legal mechanism(s) that are proposed to protect offset site(s) into the future and avert any risk of damage, degradation or destruction 		
<p>c) Provide information regarding how the proposed offsets package is additional to what is already required, as determined by law or planning regulations, agreed to under other schemes or programs or required under an existing duty-of-care.</p>		
<p>d) The overall cost of the proposed offsets package; including costs associated with, but not necessarily limited to:</p> <ul style="list-style-type: none"> i. acquisition and transfer of lands/property ii. implementation of all related management actions iii. monitoring, reporting and auditing of offset performance. 		

Table 6 Environmental assessment requirements (Appendix 4)

Requirement	Chapter	Appendix
The objects of the EPBC Act, principles of ecologically sustainable development and the precautionary principle		
3 Objects of the Act		
<p>The objects of the Act are:</p> <ul style="list-style-type: none"> a) to provide for the protection of the environment, especially those aspects of the environment that are MNES b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources c) to promote the conservation of biodiversity <ul style="list-style-type: none"> (ca) to provide for the protection and conservation of heritage; and d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples e) to assist in the co-operative implementation of Australia's international environmental responsibilities f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity g) to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge. 	<p>Chapter 32 Conclusion Section 32.2</p> <p>Chapter 4 State legislation and approvals Section 4.1.2 (ecologically sustainable development)</p>	<p>–</p>
3A Principles of Ecologically Sustainable Development		
<p>The following principles are <i>principles of ecologically sustainable development</i>:</p> <ul style="list-style-type: none"> a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation c) the principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making e) improved valuation, pricing and incentive mechanisms should be promoted. 	<p>Chapter 32 Conclusion Section 32.2</p> <p>Chapter 4 State legislation and approvals Section 4.1.2 (ecologically sustainable development)</p>	<p>–</p>

Requirement	Chapter	Appendix
Precautionary principle		
<p>The <i>precautionary principle</i> is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.</p>	<p>Chapter 32 Conclusion Section 32.2</p> <p>Chapter 4 State legislation and approvals Section 4.1.2 (ecologically sustainable development)</p>	<p>–</p>

Table 7 Supplementary environmental assessment requirements

Requirement	Chapter	Appendix
Water Quality Management		
The Environmental Impact Statement (EIS) must include:		
If hydraulic fracturing is proposed - a description of the scale of hydraulic fracturing proposed, including the likely number of wells, number of fracturing events per well and types of wells to be stimulated.	Note: hydraulic fracturing is not proposed.	–
A complete list of proposed chemicals to be used in coal seam gas extraction for the purpose of undertaking the proposed action, including in drilling fluids. This list must include the chemical name, CAS registry number, likely quantities, concentrations and the chemical's general purpose and function.	Chapter 6 Project description Section 6.5.2	Appendix T3 Chemical risk assessment report Section 4
A chemical risk assessment of the chemicals to be used in coal seam gas extraction (incorporating the best practice risk assessment methodology), including drilling fluids. The Chemical risk assessment needs to discuss any potential impacts on matters of national environmental significance, and have consideration to the chemical life-cycle under specific site conditions at both the surface and subsurface.	Chapter 6 Project description Section 6.5.2	Appendix T3 Chemical risk assessment report Section 4
The chemical risk assessment risk assessment must be peer reviewed by a suitably qualified chemical risk assessment expert/s. The peer review must include a statement from the suitably qualified chemical risk assessment expert/s stating that they carried out the peer review of the findings of the chemical risk assessment and evaluated the adequacy of the proposed monitoring, mitigation and management measures.	–	Appendix A of Appendix T3 Chemical risk assessment report
A description of the proposed mitigation and management measures for each chemical to be used in coal seam gas extraction (that will allow for the risks to matters of national environmental significance to be reduced to a low level).	Chapter 28 Waste management Section 28.5.3 Chapter 25 Hazard and risk Section 25.3	Appendix S Hazard and risk Section 4.3.6 Appendix T3 Chemical risk assessment report Section 9.0
A monitoring and reporting framework to assess the efficacy of the mitigation and management measures for the measurement and monitoring of fracture propagation, where hydraulic fracturing is proposed.	Note: hydraulic fracturing is not proposed.	–

Requirement	Chapter	Appendix
CSG waste management		
The Environmental Impact Statement (EIS) must detail:		
Measures that will be implemented to avoid, mitigate and manage impacts to matters of national environmental significance, as a result of the production, storage and disposal of CSG produced water and waste products, during the life of the project. The following elements should be discussed:	Chapter 28 Waste management Section 28.5	–
Proposed monitoring to measure the amount of CSG produced water and waste products produced.	Chapter 7 Produced water management Section 7.7 Chapter 28 Waste management Section 28.5	–
Proposed storage, management and disposal of CSG produced water and waste products, including, but not limited to: <ul style="list-style-type: none"> i. beneficial reuse ii. re-injection into groundwater aquifers iii. irrigation iv. transfer to a licensed waste management facility. 	Chapter 28 Waste management Section 28.5	–
Details of a monitoring network (including a baseline monitoring data acquisition program), and proposed early warning indicators, trigger thresholds and limits for detecting impacts on surface and groundwater quality.	Chapter 30 Environmental management and monitoring Section 30.6.2	Appendix G3 Water monitoring plan Section 3
Risk based exceedance responses that will be undertaken, and the timeframes in which these actions will be undertaken if early warning indicators or trigger threshold values are exceeded.	Chapter 30 Environmental management and monitoring Section 30.6.2	Appendix G3 Water monitoring plan Section 4
Australian Government bioregional assessments		
The bioregional assessment for the Namoi subregion will provide new scientific information about the potential impacts of coal and coal seam gas development in the Namoi subregion. This includes the potential impacts on water in the central and eastern parts of the subregion.	–	Appendix B of Appendix F Groundwater impact assessment

Requirement	Chapter	Appendix
<p>The assessment will also examine the cumulative impacts for surface water and groundwater across the Namoi river basin. As appropriate, regard should be given to the published bioregional assessment products for the Namoi subregion, that are expected to be made available during the assessment process, found at: http://www.bioregionalassessments.gov.au/assessments/namoi-subregion</p>		
Definitions		
<p>Best practice risk assessment methodology: A risk assessment in accordance with best practice national or international standards and guidelines may be based on the following:</p> <ul style="list-style-type: none"> • US EPA (2014). EPA-Expo-Box (A Toolbox for Exposure Assessors), available at http://www.epa.gov/expobox • OECD (2014). The OECD Environmental Risk Assessment Toolkit: Tools for Environmental Risk Assessment and Management, available at http://www.oecd.org/chemicalsafety/risk-assessment/theoecdenvironmentalriskassessmenttoolkittoolsforenvironmentalriskassessmentandmanagement.htm • The most recently published and approved guideline recommended by the Australian Government Minister administering the EPBC Act. 	–	–
<p>CAS registry number: means the unique, unmistakable identifier assigned for a chemical substance by the Chemical Abstracts Service division of the American Chemical Society.</p>	–	–
<p>Chemicals to be used in coal seam gas extraction/chemicals proposed to be used in coal seam gas extraction: means all chemicals in drilling fluids, hydraulic fracturing fluids and in the treatment of flowback or produced water.</p>	–	–
<p>CSG produced water: means underground water brought to the surface of the earth, or otherwise interfered with, in connection with exploring for or producing coal seam gas.</p>	–	–
<p>Hydraulic fracturing/fractured: means a well-stimulation technique in which rock is fractured by a hydraulically pressurised liquid.</p>	–	–
<p>Suitably qualified chemical risk assessment expert/s: means a natural person with at least a postgraduate degree (or equivalent) in a suitable area and a minimum of 10 (ten) years relevant experience in chemical risk assessment, including at least one year of experience in Australia.</p>	–	–
<p>Waste product: means anthropogenic and geogenic chemicals contained within CSG produced water and drilling muds including, but not limited to, brine and salt.</p>	–	–

Table 8 Specific information needs of the Independent Expert Scientific Committee

Requirement	Chapter	Appendix
Description of the proposal		
A regional overview of the proposed project area including a description of the geological basin, coal resource, surface water catchments, groundwater systems, water-dependent assets, and past, current and reasonably foreseeable coal mining and CSG developments.	Chapter 11 Groundwater and geology Section 11.4 Chapter 12 Hydrology and geomorphology Section 13.2	Appendix F Groundwater impact assessment Section 4, Section 5.5.5 Appendix H Hydrology and geomorphology Section 4
A description of the proposal's location, purpose, scale, duration, disturbance area, and the means by which it is likely to have a significant impact on water resources and water-dependent assets.	Chapter 6 Project description Chapter 7 Produced water management Chapter 11 Groundwater and geology Section 11.6	Appendix F Groundwater impact assessment Section 7 Appendix H Hydrology and geomorphology Section 5
A description of the statutory context, including information on the proposal's status within the regulatory assessment process and on any water management policies or regulations applicable to the proposal.	Chapter 4 State legislation and approvals Chapter 5 Commonwealth requirements Chapter 7 Produced water management Section 7.3	Appendix F Groundwater impact assessment Section 2 Appendix H Hydrology and geomorphology Section 3
A description of how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.	Chapter 4 State legislation and approvals Chapter 5 Commonwealth requirements Chapter 7 Produced water management Section 7.3	Appendix F Groundwater impact assessment Section 2 Appendix H Hydrology and geomorphology Section 3

Requirement	Chapter	Appendix
Groundwater	–	–
Context and conceptualisation	–	–
<p>Descriptions and mapping of geology at an appropriate level of horizontal and vertical resolution including:</p> <ul style="list-style-type: none"> • definition of the geological sequence/s in the area, with names and descriptions of the formations with accompanying surface geology and cross-sections. • definitions of any significant geological structures (e.g. faults) in the area and their influence on groundwater, in particular, groundwater flow, discharge or recharge. 	Chapter 11 Groundwater and geology Section 11.4.1, Section 11.4.2	Appendix F Groundwater impact assessment Section 4.4, Section 4.5, Section 5
Data to demonstrate the varying depths to the hydrogeological units and associated standing water levels or potentiometric heads, including direction of groundwater flow, contour maps, hydrographs and hydrochemical characteristics (e.g. acidity/alkalinity, electrical conductivity, metals, major ions). Time series data representative of seasonal and climatic cycles.	Chapter 11 Groundwater and geology Section 11.4.3	Appendix F Groundwater impact assessment Section 5, Section 6 Appendix G4 Water baseline report Section 3, Section 4
Description of the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.	Chapter 11 Groundwater and geology Section 11.4.3	Appendix F Groundwater impact assessment Section 5, Section 6
Values for hydraulic parameters (e.g. vertical and horizontal hydraulic conductivity and storage characteristics) for each hydrogeological unit.	Chapter 11 Groundwater and geology Section 11.4.2, Section 11.4.3	Appendix F Groundwater impact assessment Section 5.3, Section 6.7
Assessment of the frequency, location, volume and direction of interactions between water resources, including surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.	Chapter 11 Groundwater and geology Section 11.4.2, Section 11.4.3, Section 11.4.4 Chapter 13 Hydrology and geomorphology Section 13.2.6	Appendix F Groundwater impact assessment Section 4.4.4, Section 4.6, Section 5.3, Section 6.7
Analytical and numerical modelling	–	–

Requirement	Chapter	Appendix
A detailed description of all analytical and/or numerical models used, and any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Chapter 11 Groundwater and geology Section 11.3	Appendix F Groundwater impact assessment Section 3
Identification of the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.	Chapter 11 Groundwater and geology Section 11.4.3, Section 11.5.1	Appendix F Groundwater and geology Section 6.8.2
Undertaken in accordance with the Australian Groundwater Modelling Guidelines, including peer review.	Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 6
An explanation of the model conceptualisation of the hydrogeological system or systems, including key assumptions and model limitations, with any consequences described.	Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 5
Calibration with adequate monitoring data, ideally with calibration targets related to model prediction (e.g. use baseflow calibration targets where predicting changes to baseflow).	Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 6.5
Consideration of a variety of boundary conditions across the model domain, including constant head or general head boundaries, river cells and drains, to enable a comparison of groundwater model outputs to seasonal field observations.	–	Appendix F Groundwater impact assessment Section 6.10.8
Representations of each hydrogeological unit, the thickness, storage and hydraulic characteristics of each unit, and linkages between units, if any.	Chapter 11 Groundwater and geology Section 11.4.3	Appendix F Groundwater impact assessment Section 5, Section 6
Sensitivity analysis of boundary conditions and hydraulic and storage parameters, and justification for the conditions applied in the final groundwater model.	Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 6.10
Representation of the existing recharge/discharge pathways of the units and the changes that are predicted to occur upon commencement, throughout, and after completion of the development activities.	Chapter 11 Groundwater and geology Section 11.4.2, Section 11.4.3, Section 11.5.1, Section 11.5.3	Appendix F Groundwater impact assessment Section 5, Section 6, Section 7
An assessment of the quality of, and risks and uncertainty inherent in, the data used to establish baseline conditions and in modelling, particularly with respect to predicted potential impact scenarios.	Chapter 11 Groundwater and geology Section 11.3.2	Appendix F Groundwater impact assessment Section 6.2

Requirement	Chapter	Appendix
Incorporation of the various stages of the proposed development (construction, operation and rehabilitation) with predictions of water level and/or pressure declines and recovery in each hydrogeological unit for the life of the project and beyond, including surface contour maps.	Chapter 11 Groundwater and geology Section 11.5.1, Section 11.5.3	Appendix F Groundwater impact assessment Section 6.8.2, Section 6.9
A programme for review and update of the models as more data and information become available, including reporting requirements.	–	Appendix F Groundwater impact assessment Section 7.7.1
Information on the time for maximum drawdown and post-development drawdown equilibrium to be reached.	Chapter 11 Groundwater and geology Section 11.5.1	Appendix F Groundwater impact assessment Section 6.9.3
Impacts to water resources and water-dependent assets	–	–
An assessment of the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts:	–	–
<ul style="list-style-type: none"> Description of any hydrogeological units that will be directly or indirectly dewatered or depressurised, including the extent of impact on hydrological interactions between water resources, surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water. 	Chapter 11 Groundwater and geology Section 11.4.2, Section 11.4.3, Section 11.4.4 Chapter 13 Hydrology and geomorphology Section 13.2.6	Appendix F Groundwater impact assessment Section 4.4.4, Section 4.6, Section 5.3, Section 6.7
<ul style="list-style-type: none"> The effects of dewatering and depressurisation (including lateral effects) on water resources, water-dependent assets, groundwater, flow direction and surface topography, including resultant impacts on the groundwater balance. 	Chapter 11 Groundwater and geology Section 11.5	Appendix F Groundwater impact assessment Section 6.9, Section 7
<ul style="list-style-type: none"> Description of potential impacts on hydraulic and storage properties of hydrogeological units, including changes in storage, potential for physical transmission of water within and between units, and estimates of likelihood of leakage of contaminants through hydrogeological units. 	Chapter 11 Groundwater and geology Section 11.5	Appendix F Groundwater impact assessment Section 6.9, Section 7
<ul style="list-style-type: none"> Consideration of possible fracturing of and other damage to confining layers. 	Chapter 11 Groundwater and geology Section 11.6.2	Appendix F Groundwater impact assessment Section 7.4.1

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> For each relevant hydrogeological unit, the proportional increase in groundwater use and impacts as a consequence of the development proposal, including an assessment of any consequential increase in demand for groundwater from towns or other industries resulting from associated population or economic growth due to the proposal. 	Chapter 11 Groundwater and geology Section 11.5	Appendix F Groundwater impact assessment Section 6.9
Description of the water resources and water-dependent assets that will be directly impacted by mining or CSG operations, including hydrogeological units that will be exposed/partially removed by open cut mining and/or underground mining.	Chapter 11 Groundwater and geology Section 11.4.3, Section 11.5.1	Appendix F Groundwater impact assessment Section 4, Section 5, Section 6
For each potentially impacted water resource, a clear description of the impact to the resource, the resultant impact to any water-dependent assets dependent on the resource, and the consequence or significance of the impact.	Chapter 11 Groundwater and geology Section 11.5	Appendix F Groundwater impact assessment Section 6.9, Section 7
Description of existing water quality guidelines and targets, environmental flow objectives and other requirements (e.g. water planning rules) for the groundwater basin(s) within which the development proposal is based.	Chapter 11 Groundwater and geology Section 11.2.2, Section 11.2.3	Appendix F Groundwater impact assessment Section 2.1.3, Section 2.2.4, Section 6.8.7 Appendix G3 Water monitoring plan Section 1.3
An assessment of the cumulative impact of the proposal on groundwater when all developments (past, present and/or reasonably foreseeable) are considered in combination.	Chapter 11 Groundwater and geology Section 11.6.4	Appendix F Groundwater impact assessment Section 6.9.4, Section 8.4
Proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	Chapter 11 Groundwater and geology Section 11.8, Section 11.9	Appendix F Groundwater impact assessment Section 7.7
Description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	Chapter 11 Groundwater and geology Section 11.9	Appendix F Groundwater impact assessment Section 7.5, Section 7.7
Data and monitoring	–	–
Sufficient physical aquifer parameters and hydrogeochemical data to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes.	Chapter 11 Groundwater and geology Section 11.3.1	Appendix F Groundwater impact assessment Section 3.1 Appendix G4 Water baseline report Section 3, Section 4

Requirement	Chapter	Appendix
<p>Long-term groundwater monitoring, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.</p>	<p>Chapter 11 Groundwater and geology Section 11.8</p>	<p>Appendix F Groundwater impact assessment Section 7.7, Section 8.9 Appendix G2 Concept irrigation design Section 10.2 Appendix G3 Water Monitoring Plan Section 4.1</p>
<p>A robust groundwater monitoring programme, utilising dedicated groundwater monitoring wells and targeting specific aquifers, providing an understanding of the groundwater regime, recharge and discharge processes and identifying changes over time.</p>	<p>Chapter 11 Groundwater and geology Section 11.8</p>	<p>Appendix F Groundwater impact assessment Section 7.7, Section 8.9 Appendix G2 Concept irrigation design Section 10.2 Appendix G3 Water Monitoring Plan Section 4.1</p>
<p>Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines and relevant legislated state protocols .</p>	<p>Chapter 11 Groundwater and geology Section 11.2, Section 11.8</p>	<p>Appendix F Groundwater impact assessment Section 7.7, Section 8.9 Appendix G2 Concept irrigation design Section 10.2 Appendix G3 Water monitoring plan Section 1.3, Section 4.1</p>
<p>Surface water</p>	<p>–</p>	<p>–</p>
<p>A description of the hydrological regime of all watercourses, standing waters and springs across the site including:</p>	<p>–</p>	<p>–</p>

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> Geomorphology, including drainage patterns, sediment regime and floodplain features. 	Chapter 13 Hydrology and geomorphology Section 13.2.3, Section 13.3	Appendix H Hydrology and geomorphology Section 4.5, Section 4.6
<ul style="list-style-type: none"> Spatial, temporal and seasonal trends in streamflow and/or standing water levels. 	Chapter 13 Hydrology and geomorphology Section 13.2.1, Section 13.2.2	Appendix H Hydrology and geomorphology Section 4.3, Section 4.4, Section 4.5 Appendix G4 Water baseline report Section 5
<ul style="list-style-type: none"> Spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals and metalloids and radionuclides). 	Chapter 12 Surface water quality Section 12.2	Appendix G4 Water baseline report Section 5
<ul style="list-style-type: none"> Current stressors on watercourses, including impacts from any currently approved projects. 	Chapter 12 Surface water quality Section 12.2	Appendix G4 Water baseline report Section 5
A description of the existing flood regime, including flood volume, depth, duration, extent and velocity for a range of annual exceedance probabilities, and flood hydrographs and maps identifying peak flood extent, depth and velocity.	Chapter 13 Hydrology and geomorphology Section 13.3	Appendix H Hydrology and geomorphology Section 4.5, Section 4.6
Assessments of the frequency, volume and direction of interactions between water resources, including surface water/ groundwater connectivity and connectivity with sea water.	Chapter 13 Hydrology and geomorphology Section 13.1.4, Section 13.2.6	Appendix F Groundwater impact assessment Section 4.4.4, Section 5.6
Analytical and numerical modelling	–	–
Conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.	Chapter 7 Produced water management Section 7.4, Section 7.7 Chapter 13 Hydrology and geomorphology Section 13.1, Section 13.3	Appendix G1 Managed release study Section 6 Appendix G2 Concept irrigation design

Requirement	Chapter	Appendix
		Appendix H Hydrology and geomorphology Section 4.5
Description and justification of model assumptions and limitations, and calibration with appropriate surface water monitoring data.	Chapter 7 Produced water management Section 7.4, Section 7.7 Chapter 13 Hydrology and geomorphology Section 13.1, Section 13.3	Appendix G1 Managed release study Section 2.5, Section 2.6 Appendix G2 Concept irrigation design Section 1.2, Section 1.3 Appendix H Hydrology and geomorphology Section 2.5
Methods in accordance with the most recent publication of Australian Rainfall and Runoff	–	Appendix H Hydrology and geomorphology Section 2.2
An assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios.	–	Appendix G1 Managed release study Section 6.1 Note: a range of rainfall scenarios were assessed including the 1 in 100 year event, 1 in 200 year event and 1 in 500 year event.
A programme for review and update of the models as more data and information becomes available.	–	Note: the below references are monitoring activities that would be reviewed against model results. Appendix G1 Managed release study Section 9.5 Appendix G2 Concept irrigation design Section 10 Appendix G3 Water monitoring plan Section 4

Requirement	Chapter	Appendix
A detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Chapter 12 Surface water quality Section 12.1 Chapter 13 Hydrology and geomorphology Section 13.1	Appendix G1 Managed release study Section 2 Appendix G2 Concept irrigation design Section 1.2 Appendix H Hydrology and geomorphology Section 2
Impacts to water resources and water-dependent assets	–	–
Description of all potential impacts of the proposed project on surface waters, including a clear description of the impact to the resource, the resultant impact to any water-dependent assets dependent on the resource, and the consequence or significance of the impact, including:	–	–
<ul style="list-style-type: none"> Impacts on streamflow under different flow conditions. 	Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5	Appendix G1 Managed release study Section 8 Appendix H Hydrology and geomorphology Section 5
<ul style="list-style-type: none"> Impacts associated with surface water diversions. 	Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Note: no watercourse diversions are proposed	Appendix H Hydrology and geomorphology Section 5
<ul style="list-style-type: none"> Impacts to water quality, including consideration of mixing zones. 	Chapter 12 Surface water quality Section 12.4, Section 12.5	Appendix G1 Managed release study Section 8.1, Section 8.6, Appendix E

Requirement	Chapter	Appendix
<ul style="list-style-type: none"> Estimates of the quality, quantity and ecotoxicological effects of operational discharges of water (including saline water), including potential emergency discharges, and the likely impacts on water resources and water-dependent assets 	Chapter 7 Section 7.7 Chapter 12 Surface water quality Section 12.4.4, Section 12.4.5, Section 12.4.6 Chapter 16 Aquatic ecology Section 16.3.1, Section 16.3.2	Appendix G1 Managed release study Section 8.1, Section 8.6, Appendix A Appendix G2 Managed release study Section 8
<ul style="list-style-type: none"> Identification and consideration of landscape modifications, for example, subsidence, voids, onsite earthworks including disturbance of acid-forming or sodic soils, roadway and pipeline networks through effects on surface water flow, surface water quality, erosion and habitat fragmentation of water-dependent species and communities. 	Chapter 12 Surface water quality Section 12.3, Section 12.4 Chapter 16 Aquatic ecology Section 16.3.3, Section 16.3.4	Appendix F Groundwater impact assessment Section 7.4.1, Appendix G Appendix G1 Managed release study Appendix A Appendix H Hydrology and geomorphology Section 5
Existing water quality guidelines and targets, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.	Chapter 12 Surface water quality Section 12.1.1, Section 12.1.2	Appendix G1 Managed release study Section 3, Section 6.1, Section 4.2.11 Appendix G3 Water monitoring plan Section 1.3
Identified processes to determine surface water quality and quantity triggers which incorporate seasonal variation but provide early indication of potential impacts to assets.	Chapter 12 Surface water quality Section 12.1.1, Section 12.1.2	Appendix G1 Managed release study Section 3, Section 6.1, Section 4.2.11 Appendix G3 Water monitoring plan Section 3

Requirement	Chapter	Appendix
Proposed mitigation actions for each trigger and identified significant impact.	Chapter 12 Surface water quality Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6	Appendix G1 Managed release study Section 9.3, Section 9.5 Appendix H Hydrology and geomorphology Section 6
Description and adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	Chapter 12 Surface water quality Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6	Appendix G1 Managed release study Section 9.4 Appendix H Hydrology and geomorphology Section 6.5
Description of the cumulative impact of the proposal on surface water resources and water-dependent assets when all developments (past, present and/or reasonably foreseeable) are considered in combination.	Chapter 29 Cumulative impacts Section 29.3.2, Section 29.3.3	–
An assessment of the risks of flooding, including channel form and stability, water level, depth, extent, velocity, shear stress and stream power, and impacts to ecosystems, project infrastructure and the final project landform.	Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5, Section 13.6	Appendix G1 Managed release study Section 8, Appendix A Appendix H Hydrology and geomorphology Section 5
Data and monitoring	–	–
Monitoring sites representative of the diversity of potentially affected water-dependent assets and the nature and scale of potential impacts, and matched with suitable replicated control and reference sites (BACI design) to enable detection and monitoring of potential impacts.	–	Appendix G3 Water monitoring plan Section 4.2
A surface water monitoring programme collecting sufficient data to detect and identify the cause of any changes from established baseline conditions, and assessing the effectiveness of mitigation and management measures.	–	Appendix G3 Water monitoring plan

Requirement	Chapter	Appendix
Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines and relevant legislated state protocols.	Chapter 12 Surface water quality Section 12.1.1, Section 12.1.2, Section 12.5	Appendix G3 Water monitoring plan Section 1.3, Section 4.2
The rationale for selected monitoring variables, duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor large-scale impacts.	–	Appendix G3 Water monitoring plan Section 4.2
Specified data sources, including streamflow data, proximity to rainfall stations, data record duration and a description of data methods, including whether missing data has been patched.	Chapter 12 Surface water quality Section 12.1.3 Chapter 13 Hydrology and geomorphology Section 13.1	Appendix G1 Managed release study Section 2.4, Section 2.5 Appendix G2 Concept irrigation design Section 1.2 Appendix G4 Water baseline report Section 3 Appendix H Hydrology and geomorphology Section 2.2
Ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	–	Appendix G3 Water monitoring plan Section 4.2
Identification of dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of the development proposal and beyond.	–	Appendix G3 Water monitoring plan Section 4.2
Water-dependent assets	–	–
Context and conceptualisation	–	–
Identification of water-dependent assets, including:	–	–
<ul style="list-style-type: none"> Water-dependent fauna and flora supported by habitat, flora and fauna (including stygofauna) surveys. 	Chapter 11 Groundwater Section 11.4.6	Appendix F Groundwater impact assessment Section 4.6

Requirement	Chapter	Appendix
	Chapter 16 Aquatic ecology Section 16.2	Appendix G1 Managed release study Appendix C
<ul style="list-style-type: none"> Public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource. 	Chapter 17 Property and land use Section 17.2.5 Chapter 20 Aboriginal heritage Section 20.2.2, Section 20.2.4 Chapter 26 Social and health Section 26.2.9, Section 26.2.10	Appendix K Agricultural impact assessment Section 4 Appendix N1 Aboriginal cultural heritage Section 4.7, Section 4.8 Appendix T1 Social impact assessment Section 4.4.7 Appendix T2 Health impact assessment Section 4
An estimation of the ecological water requirements of identified GDEs and other water-dependent assets.	Chapter 11 Groundwater Section 11.4.6 Chapter 16 Aquatic ecology Section 16.2	Appendix F Groundwater impact assessment Section 4.6, Appendix B Appendix G1 Managed release study Appendix C
Identification of the hydrogeological units on which any identified GDEs are dependent.	Chapter 11 Groundwater Section 11.4.6	Appendix F Groundwater impact assessment Section 4.6, Appendix B Appendix G1 Managed release study Appendix C
Identification of GDEs in accordance with the method outlined by Eamus et al. (2006). Information from the GDE Toolbox and GDE Atlas may assist in identification of GDEs.	Chapter 11 Groundwater Section 11.4.6	Appendix F Groundwater impact assessment Section 4.6, Appendix B

Requirement	Chapter	Appendix
<p>An outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.</p>	<p>Chapter 11 Groundwater Section 11.3, Section 11.4</p> <p>Chapter 12 Surface water quality Section 12.1, Section 12.2</p> <p>Chapter 13 Hydrology and geomorphology Section 13.1, Section 13.2</p>	<p>Appendix F Groundwater impact assessment Section 3, Section 4, Section 5, Appendix B</p> <p>Appendix G1 Managed release study Section 2, Section 3, Section 4, Appendix C, Appendix E</p> <p>Appendix G2 Concept irrigation design Section 2, Section 3</p> <p>Appendix G3 Water monitoring plan Section 1.3</p> <p>Appendix G4 Water baseline report Section 2, Section 5</p> <p>Appendix H Hydrology and geomorphology Section 2.5, Section 3, Section 4</p>
<p>Conceptualisation and rationale for likely water-dependence, impact pathways, tolerance and resilience of water-dependent assets. Examples of ecological conceptual models can be found in Commonwealth of Australia (2015).</p>	<p>Chapter 11 Groundwater Section 11.3.2</p> <p>Chapter 12 Surface water quality Section 12.1.6</p> <p>Chapter 13 Hydrology and geomorphology Section 13.1</p> <p>Chapter 16 Aquatic ecology Section 16.3</p>	<p>Appendix F Groundwater impact assessment Section 5</p> <p>Appendix G1 Managed release study Section 6, Appendix E</p> <p>Appendix H Hydrology and geomorphology Section 2.6</p>

Requirement	Chapter	Appendix
<p>A description of the process employed to determine water quality and quantity triggers and impact thresholds for water-dependent assets (e.g. threshold at which a significant impact on an asset may occur).</p>	<p>Chapter 11 Groundwater Section 11.2</p> <p>Chapter 12 Surface water quality Section 12.1</p>	<p>Appendix F Groundwater impact assessment Section 2</p> <p>Appendix G1 Managed release study Section 3, Appendix B, Appendix E</p> <p>Appendix G3 Water monitoring plan Section 1.3, Section 3.3</p> <p>Appendix G4 Water baseline report Section 2, Section 5</p> <p>Appendix H Hydrology and geomorphology Section 3</p>
<p>Impacts, risk assessment and management of risks</p>	<p>–</p>	<p>–</p>
<p>An assessment of direct and indirect impacts on water-dependent assets, including ecological assets such as flora and fauna dependent on surface water and groundwater, springs and other GDEs.</p>	<p>Chapter 11 Groundwater Section 11.5</p> <p>Chapter 12 Surface water Section 12.3, Section 12.4</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 16 Aquatic ecology Section 16.3</p>	<p>Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B</p> <p>Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E</p> <p>Appendix H Hydrology and geomorphology Section 5, Appendix A</p>

Requirement	Chapter	Appendix
Estimates of the impact of operational discharges of water (particularly saline water), including potential emergency discharges due to unusual events, on water-dependent assets and ecological processes.	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water quality Section 12.4.6 Chapter 16 Aquatic ecology Section 16.3	Appendix F Groundwater impact assessment Appendix B Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E
A description of the potential range of drawdown at each affected bore, and a clear articulation of the scale of impacts to other water users.	Chapter 11 Groundwater Section 11.4, Section 11.5	Appendix F Groundwater impact assessment Section 7
An assessment of the overall level of risk to water-dependent assets that combines probability of occurrence with severity of impact.	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water Section 12.3, Section 12.4 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Chapter 15 Terrestrial ecology Section 15.3 Chapter 16 Aquatic ecology Section 16.3	Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E Appendix H Hydrology and geomorphology Section 5, Appendix A Appendix J1 Ecology Section 6 Appendix J2 Biodiversity Section 5

Requirement	Chapter	Appendix
<p>Indication of the vulnerability to contamination (for example, from salt production and salinity) and the likely impacts of contamination on the identified water-dependent assets and ecological processes.</p>	<p>Chapter 11 Groundwater Section 11.5</p> <p>Chapter 12 Surface water Section 12.3, Section 12.4</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 15 Terrestrial ecology Section 15.3</p> <p>Chapter 16 Aquatic ecology Section 16.3</p>	<p>Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B</p> <p>Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E</p> <p>Appendix H Hydrology and geomorphology Section 5, Appendix A</p> <p>Appendix J1 Ecology Section 6</p> <p>Appendix J2 Biodiversity Section 5</p>
<p>The proposed acceptable level of impact for each water-dependent asset based on the best available science and site-specific data, and ideally developed in conjunction with stakeholders.</p>	<p>Chapter 11 Groundwater Section 11.5</p> <p>Chapter 12 Surface water Section 12.3, Section 12.4</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 15 Terrestrial ecology Section 15.3</p> <p>Chapter 16 Aquatic ecology Section 16.3</p>	<p>Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B</p> <p>Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E</p> <p>Appendix H Hydrology and geomorphology Section 5, Appendix A</p> <p>Appendix J1 Ecology Section 6</p> <p>Appendix J2 Biodiversity Section 5</p>

Requirement	Chapter	Appendix
Proposed mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water quality Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 15 Terrestrial ecology Section 15.4 Chapter 16 Aquatic ecology Section 16.4	Appendix F Groundwater impact assessment Section 7 Appendix G1 Managed release study Section 9, Appendix A, Appendix C Appendix H Hydrology and geomorphology Section 6, Appendix A Appendix J1 Ecology Section 7 Appendix J2 Biodiversity Section 6
Data and monitoring	–	–
Sampling sites at an appropriate frequency and spatial coverage to establish pre-development (baseline) conditions, and test hypothesised responses to impacts of the proposal.	–	Appendix G4 Water baseline report Section 3
Monitoring that identifies impacts, evaluates the effectiveness of impact prevention or mitigation strategies, measures trends in ecological responses and detects whether ecological responses are within identified thresholds of acceptable change.	Chapter 30 Environmental management and monitoring Section 30.6	Appendix G3 Water Monitoring Plan Section 3
Concurrent baseline monitoring from unimpacted control and reference sites to distinguish impacts from background variation in the region (e.g. BACI design).	Chapter 30 Environmental management and monitoring Section 30.6	Appendix G4 Water baseline report Section 4, Section 5
Regular reporting, review and revisions to the monitoring programme.	Chapter 30 Environmental management and monitoring Section 30.6	Appendix G3 Water Monitoring Plan Section 3 Appendix J1 Ecology Section 7.6

Requirement	Chapter	Appendix
	Chapter 15 Terrestrial ecology Section 15.4 Chapter 16 Aquatic ecology Section 16.3	Appendix J2 Biodiversity Section 6.2.6
Ecological monitoring complying with relevant state or national monitoring guidelines.	Chapter 15 Terrestrial ecology Section 15.4 Chapter 16 Aquatic ecology Section 16.3	Appendix J1 Ecology Section 7.6 Appendix J2 Biodiversity Section 6.2.6
Water and salt balance and water management strategy		
Quantitative site water balance model describing the total water supply and demand under a range of rainfall conditions and allocation of water for mining activities (e.g. dust suppression, coal washing etc), including all sources and uses.	Chapter 13 Hydrology and geomorphology Section 13.3	Appendix G1 Managed release study Section 6
Estimates of the quality and quantity of operational discharges under dry, median and wet conditions, potential emergency discharges due to unusual events and the likely impacts on water-dependent assets.	Chapter 13 Hydrology and geomorphology Section 13.5	Appendix G1 Managed release study Section 5, Section 6
Description of water requirements and onsite water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	Chapter 13 Hydrology and geomorphology Section 13.5	Appendix G1 Managed release study Section 5
Salt balance modelling, including stores and the movement of salt between stores taking into account seasonal and long-term variation.	Chapter 11 Groundwater Section 11.3 Chapter 12 Surface water quality Section 12.1	Appendix F Groundwater impact assessment Appendix E
Cumulative impacts		

Requirement	Chapter	Appendix
Context and conceptualisation	Chapter 29 Cumulative impacts	–
Cumulative impact analysis with sufficient geographic and time boundaries to include all potentially significant water-related impacts.	Chapter 29 Cumulative impacts Section 29.3.1, Section 29.3.2, Section 29.3.3, Section 29.3.6	–
Cumulative impact analysis identifies all past, present, and reasonably foreseeable actions, including development proposals, programs and policies that are likely to impact on the water resources of concern.	Chapter 29 Cumulative impacts Section 29.3.1, Section 29.3.2, Section 29.3.3, Section 29.3.6	–
<p>An assessment of the condition of affected water resources which includes:</p> <ul style="list-style-type: none"> • Identification of all water resources likely to be cumulatively impacted by the proposed development. • A description of the current condition and quality of water resources and information on condition trends. • Identification of ecological characteristics, processes, conditions, trends and values of water resources. • Adequate water and salt balances. • Identification of potential thresholds for each water resource and its likely response to change and capacity to withstand adverse impacts (e.g. altered water quality, drawdown). 	<p>Chapter 11 Groundwater Section 11.4</p> <p>Chapter 12 Surface water Section 12.1, Section 12.2</p> <p>Chapter 13 Hydrology and geomorphology Section 13.2</p> <p>Chapter 16 Aquatic ecology Section 16.2</p>	<p>Appendix F Groundwater impact assessment Section 5, Section 6, Appendix B, Appendix C</p> <p>Appendix G1 Managed release study Section 4, Appendix A, Appendix C, Appendix E</p> <p>Appendix G4 Water baseline report Section 2, Section 4, Section 5</p> <p>Appendix H Hydrology and geomorphology Section 4, Appendix A</p>

Requirement	Chapter	Appendix
<p>An assessment of cumulative impacts to water resources which considers:</p> <ul style="list-style-type: none"> • The full extent of potential impacts from the proposed development, including alternatives, and encompassing all linkages, including both direct and indirect links, operating upstream, downstream, vertically and laterally. • An assessment of impacts considered at all stages of the development, including exploration, operations and post closure / decommissioning. • An assessment of impacts, utilising appropriately robust, repeatable and transparent methods. • Identification of the likely spatial magnitude and timeframe over which impacts will occur, and significance of cumulative impacts. • Identification of opportunities to work with others to avoid, minimise or mitigate potential cumulative impacts. 	<p>Chapter 11 Groundwater Section 11.5, Section 11.6</p> <p>Chapter 12 Surface water quality Section 12.3, Section 12.4</p> <p>Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5</p> <p>Chapter 29 Cumulative impacts Section 29.3.1, Section 29.3.2, Section 29.3.3, Section 29.3.6</p>	<p>Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B</p> <p>Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E</p> <p>Appendix H Hydrology and geomorphology Section 5, Appendix A</p>
<p>Mitigation, monitoring and management</p>	<p>–</p>	<p>–</p>
<p>Identification of modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts</p>	<p>Chapter 11 Groundwater Section 11.9</p> <p>Chapter 12 Surface water quality Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.6</p> <p>Chapter 16 Aquatic ecology Section 16.4</p>	<p>Appendix F Groundwater impact assessment Section 7.4, Appendix B</p> <p>Appendix G1 Managed release study Section 9.3, Appendix C</p> <p>Appendix H Hydrology and geomorphology Section 6</p>

Requirement	Chapter	Appendix
Identification of cumulative impact environmental objectives	<p>Chapter 11 Groundwater Section 11.9</p> <p>Chapter 12 Surface water quality Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.6</p> <p>Chapter 16 Aquatic ecology Section 16.4</p>	<p>Appendix F Groundwater impact assessment Section 7.4, Appendix B</p> <p>Appendix G1 Managed release study Section 9.3, Appendix A, Appendix C</p> <p>Appendix G3 Water monitoring plan Section 4, Section 5</p> <p>Appendix H Hydrology and geomorphology Section 6, Appendix A</p> <p>Appendix F Groundwater impact assessment Section 7</p> <p>Appendix J1 Ecological impact assessment Section 7</p> <p>Appendix J2 Biodiversity assessment report Section 6</p>
Identification of measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies	<p>Chapter 11 Groundwater Section 11.9</p> <p>Chapter 12 Surface water quality Section 12.5</p> <p>Chapter 13 Hydrology and geomorphology Section 13.6</p> <p>Chapter 16 Aquatic ecology Section 16.4</p>	<p>Appendix F Groundwater impact assessment Section 7.4, Appendix B</p> <p>Appendix G1 Managed release study Section 9.3, Appendix A, Appendix C</p> <p>Appendix G3 Water monitoring plan Section 4, Section 5</p> <p>Appendix H Hydrology and geomorphology Section 6, Appendix A</p>

Requirement	Chapter	Appendix
		Appendix F Groundwater impact assessment Section 7 Appendix J1 Ecological impact assessment Section 7 Appendix J2 Biodiversity assessment report Section 6
Appropriate reporting mechanisms	Chapter 11 Groundwater Section 11.9 Chapter 12 Surface water quality Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 16 Aquatic ecology Section 16.4	Appendix F Groundwater impact assessment Section 7.4, Appendix B Appendix G1 Managed release study Section 9.3, Appendix A, Appendix C Appendix G3 Water monitoring plan Section 4, Section 5 Appendix H Hydrology and geomorphology Section 6, Appendix A Appendix F Groundwater impact assessment Section 7 Appendix J1 Ecological impact assessment Section 7 Appendix J2 Biodiversity assessment report Section 6
Proposed adaptive management measures and management responses	Chapter 11 Groundwater Section 11.9	Appendix F Groundwater impact assessment Section 7.4, Appendix B

Requirement	Chapter	Appendix
	Chapter 12 Surface water quality Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 16 Aquatic ecology Section 16.4 Chapter 30 Environmental management and monitoring	Appendix G1 Managed release study Section 9.3, Appendix A, Appendix C Appendix G3 Water monitoring plan Section 4, Section 5 Appendix H Hydrology and geomorphology Section 6, Appendix A Appendix F Groundwater impact assessment Section 7 Appendix J1 Ecological impact assessment Section 7 Appendix J2 Biodiversity assessment report Section 6
Subsidence – underground coal mines and coal seam gas		
Predictions of subsidence impact on surface topography, water-dependent assets, groundwater (including enhanced connectivity between aquifers) and movement of water across the landscape	Chapter 11 Groundwater Section 11.5	Appendix F Groundwater impact assessment Section 7.4.1, Appendix G
Description of subsidence monitoring methods, including use of remote or on-ground techniques and explanation of predicted accuracy of such techniques.	Chapter 11 Groundwater Section 11.9	Appendix F Groundwater impact assessment Section 7.7.2, Appendix G
Consideration of geological layers and their properties (strength/hardness/fracture propagation) in subsidence modelling.	Chapter 11 Groundwater Section 11.4, Section 11.5	Appendix F Groundwater impact assessment Section 7.4.1, Appendix G
Final landform and voids – coal mines		
Identification and consideration of landscape modifications (for example, voids, onsite earthworks, roadway and pipeline networks) and their potential effects on surface water flow, erosion and habitat fragmentation of water-dependent species and communities.	Chapter 11 Groundwater Section 11.5	Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B

Requirement	Chapter	Appendix
	Chapter 12 Surface water Section 12.3, Section 12.4 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Chapter 16 Aquatic ecology Section 16.3	Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E Appendix H Hydrology and geomorphology Section 5, Appendix A Appendix V Rehabilitation Section 7
An assessment of the long-term impacts to water resources posed by various options for the final landform design, including complete or partial backfilling of mining voids, which considers: <ul style="list-style-type: none"> • Groundwater behaviour – sink or lateral flow from void. • Water level recovery – rate, depth, and stabilisation point (e.g. timeframe and level in relation to existing groundwater level, surface elevation). • Seepage – geochemistry and potential impacts. • Long-term water quality, including salinity, pH, metals and toxicity. • Measures to prevent migration of void water off-site. 	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water Section 12.3, Section 12.4 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5	Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E Appendix H Hydrology and geomorphology Section 5, Appendix A Appendix V Rehabilitation Section 7
An assessment of the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.	Chapter 11 Groundwater Section 11.3.2	Appendix F Groundwater impact assessment Section 6.2, Section 7.7.3
Acid-forming materials and other contaminants of concern		
Identification of the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).	Chapter 14 Soils and land contamination Section 14.2.1, Section 14.3.1	Appendix I1 Interpretive soils report Section 3.4
Handling and storage plans for acid-forming material (co-disposal, tailings dam, encapsulation).	Chapter 14 Soils and land contamination Section 14.2.1, Section 14.3.1	Appendix I1 Interpretive soils report Section 3.4

Requirement	Chapter	Appendix
Identification of the presence and volume of potentially acid-forming waste rock and coal reject/tailings material and exposure pathways.	Chapter 14 Soils and land contamination Section 14.2.1, Section 14.3.1 Chapter 28 Waste management Section 28.4.1, Section 28.5.3	Appendix I1 Interpretive soils report Section 3.4
Assessment of the potential impact to water-dependent assets, taking into account dilution factors, and including solute transport modelling where relevant, representative and statistically valid sampling, and appropriate analytical techniques.	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water Section 12.3, Section 12.4 Chapter 13 Hydrology and geomorphology Section 13.4, Section 13.5 Chapter 15 Terrestrial ecology Section 15.3 Chapter 16 Aquatic ecology Section 16.3	Appendix F Groundwater impact assessment Section 6, Section 7, Appendix B Appendix G1 Managed release study Section 8, Section 9, Appendix A, Appendix C, Appendix E Appendix H Hydrology and geomorphology Section 5, Appendix A Appendix J1 Ecological impact assessment Section 6 Appendix J2 Biodiversity Section 5
Identification of other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.	Chapter 14 Soils and land contamination Section 14.2	Appendix I3 Contaminated land assessment Section 7

Requirement	Chapter	Appendix
Description of proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.	Chapter 11 Groundwater Section 11.5 Chapter 12 Surface water Section 12.5 Chapter 13 Hydrology and geomorphology Section 13.6 Chapter 15 Terrestrial ecology Section 15.4 Chapter 16 Aquatic ecology Section 16.4	Appendix F Groundwater impact assessment Section 7 Appendix G1 Managed release study Section 9, Appendix A, Appendix C Appendix H Hydrology and geomorphology Section 6, Appendix A Appendix J1 Ecology Section 7 Appendix J2 Biodiversity Section 6
Hydraulic stimulation – coal seam gas		
A description of the scale of fracturing (number of wells, number of fracturing events per well), types of wells to be stimulated (vertical versus horizontal), and other forms of well stimulation (cavitation, acid flushing).	Note: hydraulic fracturing is not proposed.	–
A list of chemicals proposed for use in hydraulic fracturing including: <ul style="list-style-type: none"> • names of the companies producing fracturing fluids and associated products • proprietary names (trade names) of compounds (fracturing fluid additives) being produced • chemical names of each additive used in each of the fluids • Chemical Abstract Service (CAS) numbers of each of the chemical components used in each of the fluids • general purpose and function of each of the chemicals used • mass or volume proposed for use • maximum concentration (mg / L or g / kg) of the chemicals used • chemical half-life data, partitioning data, and volatilisation data • ecotoxicology • any material safety data sheets for the chemicals or chemical products used. 	–	–

Requirement	Chapter	Appendix
Measuring and monitoring of fracture propagation.	–	–
A description of the water source for hydraulic stimulation, volume of fluid and mass balance (quantities/volumes).	–	–
A description of the rules (e.g. water sharing plans) covering access to each water source for hydraulic stimulation and how the project proposes to comply with them.	–	–
Quantification of flowback water and a description of how it will be managed.	Chapter 7 Produced water management	–
Potential for inter-aquifer leakage or contamination.	Chapter 11 Geology and groundwater Section 11.5.3 and Section 11.6.2 Chapter 12 Surface water quality Section 12.3.2, Section 12.4.2 Chapter 25 Hazard and risk Section 25.2.2	Appendix F Groundwater impact assessment Section 5, Section 6, Section 7 Appendix G1 Managed release study Section 8.1 Appendix G2 Concept irrigation design Section 8.2 Appendix T3 Chemical risk assessment Section 6
The use of chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent with Australian Government testing guidelines.	–	Appendix S Hazard and risk Appendix T3 Chemical risk assessment report
Chemicals for use in hydraulic fracturing must be identified as being approved for import, manufacture or use in Australia (that is, confirmed by NICNAS as being listed in the Australian Inventory of Chemical Substances).	Note: hydraulic fracturing is not proposed.	–

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