Jemena Northern Gas Pipeline Pty Ltd

Northern Gas Pipeline

Draft Environmental Impact Statement

APPENDIX F1 – ENVIRONMENTAL RISK REGISTER

Public

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APPENDIX F1 ENVIRONMENTAL RISK REGISTER
PLANNING PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Threatened species surveys	Loss of biodiversity values due to an **inadequate assessment** of the **existing environment** leading ill-informed risk assessment and inadequate impact avoidance.	• There are significant biodiversity values awithin the Project footprint	1	E	S	• Desktop analysis of all possible biodiversity values • Engagement with Northern Territory Government scientists to ensure that the appropriate species targeted. • Field surveys undertaken by ecologists with relevant expertise in ecological surveying. • Well-respected experts were engaged to develop survey methods for key threatened species, and review results and interpretation.	High. Assessments and surveys undertaken by appropriately qualified and experienced ecologists	1	A	L
BIODIVERSITY & THREATENED SPECIES	Threatened species surveys	Loss of biodiversity values due to an **inadequate assessment** of the existing **threatened species**	• Important populations of **threatened species** likely to occur within the Project footprint based on desktop	1	E	S	• Desktop analysis of all possible biodiversity values • Engagement with Northern Territory Government scientists to ensure that the appropriate species targeted. • Field surveys undertaken by ecologists with relevant expertise in ecological surveying. • Well-respected experts were engaged to develop survey methods for key threatened species, and review results and interpretation.	High. Assessments and surveys undertaken by appropriately qualified and experienced ecologists	1	A	L
BIODIVERSITY & THREATENED SPECIES	Planning phase field surveys	Reduced habitat quality for flora and fauna could occur due to **weed introduction**	• Existing weed infestations present • Small numbers of vehicles and survey personnel • Mainly using existing access tracks • Some cross-country work involved • Existing weed infestations likely to be present	4	D	E	• Planning phase weed hygiene procedures • Pre-survey weed hygiene inspections before leaving Tenant Creek or Mt Isa	Moderate. Routine procedures. Consistent with the *Australian Pipeline Industry Code for Environmental Practice (APIA 2013)* . Compliance checks undertaken. Experience on other projects indicates that even with controls some weed spread may occur where existing infestations are present.	2	C	M
BIODIVERSITY & THREATENED SPECIES	Planning phase field surveys	Reduced habitat quality (long-term) for Plains Death Adder due to **weed introduction**	• Weeds are not considered a threatening process for **Plains Death Adder**	1	A	L	• Planning phase weed hygiene procedures • Pre-survey weed hygiene inspections before leaving Tenant Creek or Mt Isa	High. Routine procedures. Consistent with the *Australian Pipeline Industry Code for Environmental Practice (APIA 2013)* . Compliance checks undertaken.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Planning phase field surveys	Reduced habitat quality (long-term) for Carpentarian Antechinus due to **weed introduction**	• Weeds are a threatened process for **Carpentarian Antechinus** - in particular Buffel Grass • Buffel Grass is common in near Mount Isa but not in rocky country that constitutes critical Carpentarian Antechinus habitat. • Small numbers of vehicles and survey personnel	1	A	L	• Planning phase weed hygiene procedures • Pre-survey weed hygiene inspections before leaving Tenant Creek or Mt Isa	High. Routine procedures. Consistent with the *Australian Pipeline Industry Code for Environmental Practice (APIA 2013)* . Compliance checks undertaken.	1	A	L
WATER	Watercourse crossing assessments	Watercourse crossings not adequately assessed leading to insufficient detail for development of Progressive Erosion and Sediment Control Plans	• Watercourse crossing assessments will be undertaken prior to construction, during the dry season when flows are at a minimum.	2	C	M	• Watercourse crossing assessments are undertaken by a suitably qualified person • Information from watercourse crossing assessments is used to inform Progressive ESCP • Watercourse crossing assessments are undertaken for all watercourses (stream order 3+) crossed by the construction ROW, prior to construction	High. The IECA Guidelines are industry best practice and considered proven effective; a suitably qualified person will be engaged as per the IECA guidelines.	1	A	L
WATER	Soil surveys	Soils are not adequately mapped and problematic soils are not identified leading to inaccurate information for the development of specific management plans.	• A soil survey will be undertaken of the entire construction footprint prior to construction.	2	C	M	• Soil assessment and landscape mapping is undertaken by a suitably qualified soil scientist, and is undertaken for the entire construction footprint. • Information from soil landscape mapping is used to inform the specific management plans, where required.	High. A trained soil scientist will be engaged to conduct the surveys and gather information in accordance with the IECA guidelines, which are industry best practice.	1	A	L
WATER	Planning phase field surveys	Physical damage to watercourses when accessing survey activities	• No ground disturbance will occur in watercourses for early survey works. • Watercourses will be mainly dry at the time of any ground based survey.	3	B	M	• Existing tracks will be used for survey access • Water course crossing will only occur at locations with minimum impact to watercourse banks • No driving along watercourses or disturbance of watercourses	High. The risk is reduced through avoidance, which is considered effective.	1	A	L
HERITAGE	Planning phase field surveys	Insufficient heritage consultations, surveys and clearances	• Sacred sites and archaeological heritage surveys either not undertaken or are incomplete or insufficient.	3	B	M	• Sacred sites clearances undertaken by the CLC, NLC and AAC • Archaeological surveys undertaken by qualified and experienced archaeologists • Adequacy of surveys assessed by AAPA and NT Heritage Branch as part of approvals processes	High. Survey methods well established and undertaken by 3rd parties with appropriate qualifications and experience. Adequacy will be assessed by AAPA and NT Heritage Branch, which is considered a further clarification of effectiveness.	2	A	L
HERITAGE	Planning phase field surveys	Unauthorised entry onto sacred sites	• Sacred sites clearances yet to be obtained. Likely to be sites present that are not registered or recorded with the AAPA. Survey activities mainly visual assessments - some localised ground disturbance for geotechnical test pits only.	2	D	S	• Sacred Site surveys undertaken by Land Councils and reports received setting out Restricted Work Areas and Exclusion Zones. • Cultural heritage survey agreements in place with all other Aboriginal Parties, to identify Restricted Work Areas and Exclusion Zones. • No low impact ground disturbing works to be undertaken without Sacred Site clearance by Aboriginal Parties.	High. A number of NGP field surveys have already been facilitated using this process. Aboriginal groups, through the CLC, NLC and AAC, have provided approvals for these surveys to proceed and there has been no unauthorised entry to sacred sites.	1	B	L
HERITAGE	Planning phase field surveys	Damage to archaeological sites, places or objects	• Archaeological surveys yet to be undertaken. Survey activities mainly visual assessments - some localised ground disturbance for geotechnical test pits only.	3	C	S	• No ground disturbing field survey works to be undertaken without cultural heritage assessment by archaeologist.	High. A number of NGP field surveys have already been facilitated using this process. The approach therefore is considered to be working effectively in practice.	1	B	L
AIR QUALITY	Technical assessment of air quality risks	Air quality impacts not adequately assessed leading to lost opportunities for impact avoidance	• Key Project details are accurate • Project location and location of sensitive receptors does not alter significantly.	3	B	M	• Engage a suitably qualified person to undertake modelling based on most accurate Project details. • Model a number of scenarios to identify worst-case scenario and use this to assess risks associated with construction and operational activities. • If Project details change, revise the modelling and re-assess risks as required. • Modelling results are to inform the risk assessment and development of specific management and mitigation measures.	High. Engaging specialists consultants to undertake modelling informed by accurate Project details is considered effective. The modelling, and subsequent risk assessment and management measures, will be revised if Project details change.	1	A	L
NOISE AND VIBRATION	Technical assessment of noise and vibration risks	Noise and vibration impacts not adequately assessed leading to lost opportunities for impact avoidance	• Key Project details are accurate • Project location and location of sensitive receptors does not alter significantly.	3	B	M	· Engage a suitably qualified person to undertake modelling based on most accurate Project details. · Model a number of scenarios to identify worst-case scenario and use this to assess risks associated with construction and operational activities. · If Project details change, revise the modelling and re-assess risks as required. · Modelling results are to inform the risk assessment and development of specific management and mitigation measures.	High. Engaging specialists consultants to undertake modelling informed by accurate Project details is considered effective. The modelling, and subsequent risk assessment and management measures, will be revised if Project details change.	1	A	L

*L=likelihood, C=consequence, IR=inherent risk, RR=residual risk, L=low, M=moderate, S=significant, H=high

APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **ecosystems** due to **clearing**	• Vegetation communities within the Project footprint are regionally common and widespread. • Majority of the disturbed vegetation (~95%) will be effectively reinstated and rehabilitated after construction • Impact would only be temporary assuming effective rehabilitation	**1**	**B**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries • Progressive implementation of Reinstatement Procedures along ROW • Implementation of weed hygiene and control in construction phase • Develop and implement Rehabilitation Management Plan prior to works • Ongoing weed surveillance and control	High. Controls and reinstatement procedures prescribed by the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*. Proven effective and best-practice for pipeline projects in Australia.	**1**	**B**	**L**
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Loss of **sensitive vegetation types** due to **clearing**	• The only sensitive vegetation type occurring within the Project footprint is riparian vegetation (Project design has avoided wetlands).	**1**	**B**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries • Progressive implementation of Reinstatement Procedures along ROW • Implementation of weed hygiene and control in construction phase • Develop and implement Rehabilitation Management Plan prior to works • Ongoing weed surveillance and control	High. Controls and reinstatement procedures prescribed by the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*. Proven effective and best-practice for pipeline projects in Australia.	**1**	**B**	**L**
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Loss of **Plains Death Adder** habitat due to **clearing**	• The estimated temporary loss of habitat for the Plains Death Adder is 934ha. • The majority of that disturbed habitat will be effectively reinstated and rehabilitated after construction. • Impact would only be temporary assuming effective rehabilitation	**1**	**A**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries • Progressive implementation of Reinstatement Procedures along ROW • Implementation of weed hygiene and control in construction phase • Develop and implement Rehabilitation Management Plan prior to works • Ongoing weed surveillance and control	High. Controls and reinstatement procedures prescribed by the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*. Proven effective and best-practice for pipeline projects in Australia.	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Loss of **Carpentarian Antechinus** habitat due to **clearing.**	• The estimated temporary loss of habitat for the Carpentarian Antechinus is 1.04ha. • The majority of that disturbed habitat will be effectively reinstated and rehabilitated after construction. • Impact would only be temporary assuming effective rehabilitation • Reinstatement of rocky habitats will involve the return of any side-lined rocks and scree, therefore quickly re-creating functionally-similar habitat for the Carpentarian Antechinus to that disturbed	**1**	**A**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries • Progressive implementation of Reinstatement Procedures along ROW • Implementation of weed hygiene and control in construction phase • Develop and implement Rehabilitation Management Plan prior to works • Ongoing weed surveillance and control	High. Controls and reinstatement procedures prescribed by the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*. Proven effective and best-practice for pipeline projects in Australia. Reinstatement of important habitat features for Carpentarian Antechinus will limit disturbance.	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Transportation of personnel, machinery and materials	Loss of individuals due to interaction with construction traffic and earth-moving equipment (**fauna strike**)	• For human health and safety reasons, the Traffic Management Plan specifies that vehicle movement along the ROW will be ordinarily between the hours of 0600 and 1800 unless specific plans in place • All traffic will be required to adhere to speed limits on public roads.	**1**	**B**	**L**	• Traffic Management Plan specifies speed limits and controls relevant to any night time driving or works (if required)	High. Large projects such as the NGP have strictly enforced Workplace Health and Safety requirements in accordance with national WHS standards. Compliance monitoring and reporting will occur.	**1**	**B**	**L**
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** due to fauna injury or death during **trench excavation**	• Excavating a very narrow, linear trench may impact upon a few individual burrowing fauna, but at such a small scale that impact will be negligible impact at an ecosystem level. • Clearing will occur ahead of trenching - encouraging fauna to move out of area	**1**	**B**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries	High. Low inherent risk due to selected construction methods.	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Plains Death Adder** in **trench excavation**	• Plains Death Adders often retreat into deep soil cracks during the Dry season and so there is the possibility during that time that individuals may be injured or killed during trench excavation. • The area of Plains Death Adder habitat that will be excavated is a trench 0.6m wide extending for 206km – a total of 12.4ha. • Although the density of Plains Death Adder in suitable habitat is unknown, it seems unlikely that more than one or two individuals of this species will occur within the excavation corridor. • Clearing will occur ahead of trenching - encouraging fauna to move out of area	**1**	**B**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries	High. Low inherent risk due to selected construction methods.	**1**	**B**	**L**
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Carpentarian Antechinus** in **trench excavation**	• Carpentarian Antechinus roost in rock crevices during the day, there is the possibility during that time that individuals may be injured or killed during trench excavation. • The area of rocky refugia habitat that will be excavated is a negligible proportion of that habitat supporting this particular population (0.21ha out of the estimated 4,369ha). • Only if an individual is hiding in a rock crevice within the trench line could it be impacted by trenching. • Clearing will occur ahead of trenching - encouraging fauna to move out of area	**1**	**B**	**L**	• Ensure all vegetation clearing is undertaken within approved boundaries	High. Low inherent risk due to selected construction methods.	**1**	**B**	**L**
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** due to **entrapment** in the open trench and/or stored pipes	• Based on published work, if no controls are in place to rescue or manage fauna mortality will be ~ 11% as per Woinarski et al. (2000) • The sides of the trench are vertical, except in rocky country where blasting is required, in which case the sides of the trench will be sloped • Fauna would be unable to escape without assistance	**2**	**B**	**L**	• The trench will be progressively backfilled after the pipe is installed. • Earth plugs will be installed at a no greater than 5km intervals. The sides of the earth plug within the trench are at an angle of <45 degrees . • Trench fauna shelters will be installedno greater than15km intervals. • Qualified fauna spotter-catchers (FSC) will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight. • To ensure that fauna does not enter the pipe end caps will be welded on installed welded pipe strings at the end of each day's construction.	High. Inherent low risk, however, *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* specifies routine controls for pipeline projects. Construction Contractor has experience implementing controls and managing fauna clearance from the trench. A recent study (Swan and Wilson 2012) has shown a low trench mortality using the approach outlined here.	**2**	**A**	**L**

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CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Plains Death Adder** due to **entrapment** in the open trench and/or stored pipes	• Plains Death Adders occur within the construction footprint • It is unknown how proficient the species would be at escaping from a trench; however, Phillips (pers. comm. 2016) suggests that the species may have an adversity to falling given his experience in failing to capture Plains Death Adders in pitfall trapping exercises. • As snakes can generally survive for extended periods without food, trapped Plains Death Adders have a significant time-frame opportunity to escape from the trench. • Trapped Plains Death Adders would be able to defend themselves from predation.	1	B	L	• The trench will be progressively backfilled after the pipe is installed. • Earth plugs will be installed at a no greater than 5km intervals. The sides of the earth plug within the trench are at an angle of <45 degrees . • Trench fauna shelters will be installedno greater than15km intervals. • Qualified fauna spotter-catchers (FSC) will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight. • To ensure that fauna does not enter the pipe end caps will be welded on installed welded pipe strings at the end of each day's construction.	High. Inherent low risk, however, *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* specifies routine controls for pipeline projects. Construction Contractor has experience implementing controls and managing fauna clearance from the trench. A recent study (Swan and Wilson 2012) has shown a low trench mortality using the approach outlined here.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Carpentarian Antechinus** due to **entrapment** in the open trench and/or stored pipes	• Carpentarian Antechinus are adept climbers (given their preference for rocky habitats) and could generally escape from a sloped trench (but perhaps not a vertically-walled trench). • As small mammals typically have high metabolic rates, trapped Carpentarian Antechinus would likely perish from lack of food before managing to escape from a vertically-walled trench. • Trapped Carpentarian Antechinus would be highly vulnerable to predation.	1	B	L	• The trench will be progressively backfilled after the pipe is installed. • Earth plugs will be installed at a no greater than 5km intervals. The sides of the earth plug within the trench are at an angle of <45 degrees . • Trench fauna shelters will be installedno greater than15km intervals. • Qualified fauna spotter-catchers (FSC) will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight. • To ensure that fauna does not enter the pipe end caps will be welded on installed welded pipe strings at the end of each day's construction. • In the section of the construction ROW nearby to Carpentarian Antechinus habitat, for every 50m of rocky habitat and every 100m of intervening habitat, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench. This will allow trapped Carpentarian Antechinus to cross and/or escape the trench and provide shelter if necessary.	High. Inherent low risk, however, *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* specifies routine controls for pipeline projects. Construction Contractor has experience implementing controls and managing fauna clearance from the trench. A recent study (Swan and Wilson 2012) has shown a low trench mortality using the approach outlined here. Additonal measures in place to further reduce any potential impact to Carpentarian Antechinus .	1	B	L
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **ecosystems habitats** (long term or permanent) due to **edge effects**	• Apart from the increased likelihood of weed infestation, edge effects are more pronounced in forested areas, not open country that characterises the Project footprint • Sparsely vegetated habitats not likely to experience any significant or substantial edge effects – that will impact at an ecosystem level	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below. • Ensure all vegetation clearing is undertaken within approved boundaries • Progressive implementation of Reinstatement Procedures along ROW • Implementation of weed hygiene and control in construction phase • Develop and implement Rehabilitation Management Plan prior to works • Ongoing weed surveillance and control	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **threatened species** habitat (long term or permanent) due to **edge effects**	• Critical habitat for Plains Death Adder is sparsely-vegetated and so vegetation integrity is not an important ecological requirement for this species (as compared with, for instance, a forest-dwelling species)	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **ecosystems** (long term or permanent) due to **habitat fragmentation**	• Fragmentation unlikely as vegetation communities are widespread and contiguous and as this impact of construction ROW will be temporary • Long term fragmentation of riparian habitat as a consequence of the narrow, temporarily clearance of negligible areas of that habitat would only occur in exceptional circumstances i.e if reinstatement was not effective	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **Plains Death Adder** habitat (long term or permanent) due to **habitat fragmentation**	The Plains Death Adder is not described as a social species and so temporary fragmentation should not result in disrupted social dynamics. The Plains Death Adder has a vast and contiguous area of habitat available.	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Vegetation clearing	Reduction in the quality of **Carpentarian Antechinus** habitat (long term or permanent) due to **habitat fragmentation**	• Carpentarian Antechinus habitat is – by nature – already fragmented, and so minor, additional fragmentation will have a negligible effect on the species (apart from possible disruption to breeding, which is addressed elsewhere).	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** due to disruption of a breeding cycle caused by the construction ROW or **trench creating a barrier to dispersal.**	• The temporary presence of the construction ROW and a narrow trench may impact upon the local breeding success of a few individual fauna, but at such a small scale that impact will be negligible impact at an ecosystem level.	1	A	L	• Low inherent risk. No specific controls proposed.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Plains Death Adder** due to disruption of a breeding cycle caused by the construction ROW or **trench creating a barrier to dispersal**	• Assuming reinstatement and rehabilitation are effective, impact would only be temporary. • The Plains Death Adder generally breeds in black soil country from October to November, and produces live young from February to March (TSSC 2012). Because black soil country is usually very boggy during those months it is likely that construction works will not be undertaken during that period. • The Plains Death Adder has a vast and contiguous area of habitat available, such that a temporary division of that habitat will likely have a negligible impact to the population breeding cycle.	1	A	L	• Low inherent risk. No specific controls proposed. • Any animals captured in trench will be relocated to nearby suitable habitat.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Carpentarian Antechinus** due to disruption of a breeding cycle caused by the construction ROW or **trench creating a barrier to dispersal**	• Carpentarian Antechinus habitat is already fragmented, there is a single population within the Project footprint, and therefore gene flow and dispersal is restricted.	3	C	S	• For every 50m of rocky habitat and every 100m of intervening habitat in the section of the construction ROW between KP 609.5 and KP 622, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench, to aid escapte	Moderate. Controls considered adequate given short-term disturbance. It is not known if Antechinus will use the structures that will be put in place to extricate themselves from the trench, but it seems a reasonable assumption that Carpentarian Antechinus are adept climbers (given their preference for rocky habitats) and could escape from a sloped trench without the presence of controls, and from a vertically-walled trench using the controls.	1	A	L

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ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** (long term or permanent) due to **weed introduction** and/or proliferation, and/or bushfire caused by the proliferation of weeds creating higher fuel loads and therefore more intense fires.	• Weeds are likely to be common within the Project footprint • Weeds are easily transported. • Complete weed surveys will be undertaken prior to works	5	D	E	• Implement Weed Management Plan • Prior to entering the construction site, vehicles, machinery and equipment must undergo weed hygiene inspections • the introduction of soil or fill material must be accompanied by a Weed Hygiene Declaration form. • Prior to construction, the Project footprint will be surveyed to map existing weeds within the Project footprint or immediate surrounds to categorise weed management zones ('weed zones'). • Weed zones will inform weed control and weed hygiene requirements.	Moderate. The procedures outlined in the Weed Management Plan are best practice. Experience on other projects indicates that even with controls some weed spread may occur where existing infestations are present - so there will be a level of residual risk.	3	C	S
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (long term or permanent) due to weed introduction and/or proliferation, and/or bushfire caused by the proliferation of weeds creating higher fuel loads and therefore more intense fires.	Weeds are not considered a threatening process for Plains Death Adder (TSSC 2012)	1	A	L	• Low inherent risk. No specific controls proposed.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Carpentarian Antechinus** habitat (long term or permanent) due to **weed introduction and/or proliferation**, and/or bushfire caused by the proliferation of weeds creating higher fuel loads and therefore more intense fires.	• Weeds are a threatened process for Carpentarian Antechinus - in particular Buffel Grass • Buffel Grass is common in near Mount Isa but not in rocky country that constitutes critical Carpentarian Antechinus habitat. • Because only very small areas of critical Carpentarian Antechinus habitat will be disturbed during construction – the introduction or proliferation of weeds is not considered a significant threat to that species.	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below. • Implement Weed Management Plan • Prior to entering the construction site, vehicles, machinery and equipment must undergo weed hygiene inspections • the introduction of soil or fill material must be accompanied by a Weed Hygiene Declaration form. • Prior to construction, the Project footprint will be surveyed to map existing weeds within the Project footprint or immediate surrounds to categorise weed management zones ('weed zones'). • Weed zones will inform weed control and weed hygiene requirements.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** due to the introduction or proliferation of **feral fauna species.**	• The region is already populated by the array of vertebrate pests • The likelihood of Cane Toad being introduced into area of the Project footprint within which it does not yet occur is either zero (because the species cannot occur there) or else possible, but largely inconsequential, because self-introduction was inevitable and likely to occur soon.	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below. • Implement Waste Management Procedures • Bins covered • Waste removed for off site disposal at licenced facilities	High. Routine controls prescribed by Code of Environmental Practice for Onshore Pipelines (APIA 2013). Construction Contractor has experience implementing controls on pipeline projects in remoate areas.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Plains Death Adder** due to the introduction or proliferation of **feral fauna species**	• The relevant feral animal is poisoning by ingestion of Cane Toads. • The likelihood of Cane Toad being introduced into area of the Project footprint within which it does not yet occur is either zero (because the species cannot occur there) or else possible, but largely inconsequential, because self-introduction was inevitable and likely to occur soon.	1	A	L	• Low inherent risk. No specific controls proposed.	Not applicable	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Loss of **Carpentarian Antechinus** due to the introduction or proliferation of **feral fauna species**	• The region is already populated by the array of vertebrates • Feral cat, which probably predates this species would occur • Poisoning by ingestion of cane toads is a possible, but not demonstrated threat • The likelihood of Cane Toad being introduced into area of the Project footprint within which it does not yet occur is either zero (because the species cannot occur there) or else possible, but largely inconsequential, because self-introduction was inevitable and likely to occur soon.	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below • Implement Waste Management Procedures • Bins covered • Waste removed for off site disposal at licenced facilities	High. Routine controls prescribed by Code of Environmental Practice for Onshore Pipelines (APIA 2013). Construction Contractor has experience implementing controls on pipeline projects in remoate areas.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** (temporary) due to **noise and vibration**	• Noise assessment report indicates the 65 dB(A) threshold screening criteria for ecological receptors is exceeded within 200m of construction activities • For species which may be more sensitive to noise and which have permanent nesting, roosting or colony areas (e.g. bats), the conservative assessment criteria of 12 dB(A) above existing LAeq levels was applied - construction activities may cause disturbance up to 1km from the construction ROW • No noise sensitive fauna have been detected in the vicinity • Blasting will only be undertaken in small sections of rocky ground • Blasting will fracture rock to be later removed by an excavator i.e. the blast will not displace the rock. • Sensitive fauna have the potential to be affected by vibration and overpressure within 400m of the blasting. • Because construction will be progressive, any noise or blasting impacts will be short-lived.	1	B	L	• Low inherent risk. Controls in place that will further minimise risk are listed below • Blasting activities will ordinarily occur during the day (less impact on the mainly nocturnal fauna). • Implement the Noise Management Plan provided with Draft EIS • The blasting subcontractor will be required to provide a Blasting Management Plan demonstrating compliance with all approval conditions prior to the commencement of blasting activities. • Monitoring and recording of the air blast overpressure and ground borne vibration will be undertaken in accordance with regulatory requirements using the Queensland Transport – Technical Note 3 April 1993 – Measurement of Ground Vibration and Air Blast.	High. The noise controls are informed by technical assessments by qualified consultatnts. The controls are best-practice for pipeline projects in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* and regulatory requirements included in the Environment Authority (EA) for the Project issued pursuant to the EP Act in Queensland. The Construction Contractor has Standard Operating Procedures for management of noise, and experience implementing these procedures on other pipeline projects.	1	B	L

*L=likelihood, C=consequence, IR=inherent risk, RR=residual risk, L=low, M=moderate, S=significant

APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (temporary) due to **noise and vibration**	• Noise assessment report indicates the 65 dB(A) threshold screening criteria for ecological receptors is exceeded within 200m of construction activities • Species not noise sensitive • Species has a vast and contiguous extent of occurrence within which to temporarily retreat (if necessary) • Plains Death Adder does not occur in areas where blasting will be required.	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below • Blasting activities will ordinarily occur during the day (less impact on the mainly nocturnal fauna). • Implement the Noise Management Plan provided with Draft EIS • The blasting subcontractor will be required to provide a Blasting Management Plan demonstrating compliance with all approval conditions prior to the commencement of blasting activities. • Monitoring and recording of the air blast overpressure and ground borne vibration will be undertaken in accordance with regulatory requirements using the Queensland Transport – Technical Note 3 April 1993 – Measurement of Ground Vibration and Air Blast.	High. The noise controls are informed by technical assessments by qualified consultatnts. The controls are best-practice for pipeline projects in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* and regulatory requirements included in the Environment Authority (EA) for the Project issued pursuant to the EP Act in Queensland. The Construction Contractor has Standard Operating Procedures for management of noise, and experience implementing these procedures on other pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Carpentarian Antechinus** habitats (temporary) due to **noise and vibration**	• Noise assessment report indicates the 65 dB(A) threshold screening criteria for ecological receptors is exceeded within 200m of construction activities • Species may be noise sensitive and occurs wihtin zone of impact • Disturbance will be of short duration • Area of critical Carpentarian Antechinus habitat that will disturbed is small (a few hectares out of the estimated 4,369ha)	1	A	L	• Low inherent risk. Controls in place that will further minimise risk are listed below • Blasting activities will ordinarily occur during the day (less impact on the mainly nocturnal fauna). • Implement the Noise Management Plan provided with Draft EIS • The blasting subcontractor will be required to provide a Blasting Management Plan demonstrating compliance with all approval conditions prior to the commencement of blasting activities. • Monitoring and recording of the air blast overpressure and ground borne vibration will be undertaken in accordance with regulatory requirements using the Queensland Transport – Technical Note 3 April 1993 – Measurement of Ground Vibration and Air Blast.	High. The noise controls are informed by technical assessments by qualified consultatnts. The controls are best-practice for pipeline projects in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)* and regulatory requirements included in the Environment Authority (EA) for the Project issued pursuant to the EP Act in Queensland. The Construction Contractor has Standard Operating Procedures for management of noise, and experience implementing these procedures on other pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** (temporary) due to **dust**	• Matsuki et al. (2016) indicate that it seems likely that short-term dust generation in arid and semi-arid environments does not result in negative impacts on vegetation. • It is assumed that the semi-arid environment within which the NGP Project is proposed to be undertaken is similar to the semi-arid environment within which the abovementioned study was undertaken.	1	B	L	• Low inherent risk • Implement the Air Quality Management Plan, including the use of dust suppression trucks where required, to mitigate impacts to ALARP	High. The dust controls that will be implemented are best-practice in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)*. The Construction Contractor has Standard Operating Procedures for management of air quality, and experience implementing these procedures on other pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (temporary) due to **dust**	• Dust could have negative effect on the species • Disturbance will be of short duration • Species has a vast and contiguous extent of occurrence within which to temporarily retreat (if necessary).	1	A	L	• Low inherent risk • Implement the Air Quality Management Plan, including the use of dust suppression trucks where required, to mitigate impacts to ALARP	High. The dust controls that will be implemented are best-practice in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)*. The Construction Contractor has Standard Operating Procedures for management of air quality, and experience implementing these procedures on other pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Carpentarian Antechinus** habitats (temporary) due to **dust**	• Dust could have negative effect on the species • Disturbance will be of short duration • Area of species habitat that will be impacted is small.	1	A	L	• Implement the Air Quality Management Plan, including the use of dust suppression trucks where required, to mitigate impacts to ALARP	High. The dust controls that will be implemented are best-practice in accordance with the *Code of Environmental Practice for Onshore Pipelines (APIA 2013)*. The Construction Contractor has Standard Operating Procedures for management of air quality, and experience implementing these procedures on other pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Various construction-related activities	Reduction in the quality of ecosystems (long term or permanent) due to reduced ground or surface **water quality**	• Water risk assessment indicates inherent risk of water quality impacts is high without controls	4	C	H	• Implement Water Management Plan for management of hazardous materials and wastewater (including hydrostatic testing water) • A Spill Management Plan will be developed that outlines chemical spill response management. • Develop and implement Progressive Erosion and Sedimentation Control Plans at watercourse crossings	Moderate to High. Water risk assessment indicates controls will reduce most risks to low. There is a level of inherent risk to water quality associated with disposal of hydrstatic test water. This is expected to be further reduced once dispsal sites are identified and the Hydrotest Plan is in place.	2	C	M
BIODIVERSITY & THREATENED SPECIES	Various construction-related activities	Reduction in the quality of **threatened species** habitats (long term or permanent) due to reduced **water quality**	The threatened species being assessed do not live within, or depend upon, waterbodies, and so changes in water quality will not affect these species	1	A	L	• Low inherent risk. No specific controls proposed.	Not applicable.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Various construction-related activities	Reduction in the quality of **ecosystems** and loss of sensitive vegetation types (long term or permanent) due to reduced ground or surface **water quantity**	• Water risk assessment indicates inherent risk of impacts to surface water availability is low and groundwater is high • No Groundwater Dependent Ecosystems present • Riparian vegetation on some major rivers could be dependent on perched water tables	4	C	H	Develop and implement Hydrostatic Testing Management Plan that adheres to the requirements of the *APIA Code of Environmental Practice: Onshore Pipelines (2013)* . Source water from approved sources in accordance with agreements. Prior to construction, assess the sustainable yields for proposed groundwater extraction bores. Develop and implement Water Management Plan (Construction). Construct watercourse crossings in the following order of preference; firstly, in times when there is no water present, secondly in times of no flow, or thirdly, in times of flow, but in a way that does not impede low flow. Develop and implement specific Progressive ESCP for watercourse crossings in accordance with Appendix P of the IECA Guidelines. Design, install and reinstate watercourse crossings in accordance with the *APIA Code of Environmental Practice: Onshore Pipelines (2013)*	Moderate to High. Water risk assessment indicates controls will reduce most risks to low. In acknowledgement of the level of uncertainty around groundwater extraction, the residual risk remains moderate.	2	C	M
BIODIVERSITY & THREATENED SPECIES	Various construction-related activities	Reduction in the quality of **threatened species** habitats (long term or permanent) due to reduced **water quantity.**	• The threatened species being assessed do not live within, or depend upon, waterbodies, and so changes in water quantity will not affect these species.	1	A	L	• Low inherent risk. No specific controls proposed.	Not applicable.	1	A	L

APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **ecosystems** (temporary) due to **bushfire**	• Any bushfires generated by Project activities serve to increase the frequency of bushfires that occur in the region • Bushfires in areas of low fire frequency can cause long term habitat impacts	3	C	S	• All activities in cleared Project footprint to minimise the risk of ignition sources coming into contact with flammable material (such as cleared vegetation) • Any works involving potential ignition sources will have fire prevention and control requirements included in relevant procedures. • All vehicles and equipment will be equipped with fire extinguishers and water carts will be located in the proximity of high fire risk activities on high fire danger days. • There will be dedicated places for smoking and butt collection bins. • Fire ratings and warnings in the area will be monitored and Jemena and the Construction Contractor will liaise with Bushfires NT and Rural Fire Service Queensland as required • Bushfire response to be addressed in Emergency Response Plan	High. The controls all represent industry best-practice and are expected to be effective in reducing the probability and extent of bushfire. The Construction Contractor has experience implementing fire contols on other remote pipeline projects.	1	C	M
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (temporary) due to **bushfire**	• Any bushfires generated by Project activities serve to increase the frequency of bushfires that occur in the region • The black soil country which comprises critical Plains Death Adder habitat has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. • This assumption is based on field observations of that habitat being sparsely vegetated (tussocks of grass occurring in small, discrete patches) and exhibiting little evidence of historic burning (confirmed by the fire mapping).	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	High. The controls all represent industry best-practice and are expected to be effective in reducing the probability and extent of bushfire. The Construction Contractor has experience implementing fire contols on other remote pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Construction of the pipeline and facilities	Reduction in the quality of **Carpentarian Antechinus** habitats (temporary) due to **bushfire**	• Any bushfires generated by Project activities serve to increase the frequency of bushfires that occur in the region • The rocky country which comprises critical Carpentarian Antechinus habitat has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. • This assumption is based on field observations of that habitat being sparsely vegetated, free from Buffel Grass (which greatly increases fuel loads), exhibiting little evidence of historic burning.	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	High. The controls all represent industry best-practice and are expected to be effective in reducing the probability and extent of bushfire. The Construction Contractor has experience implementing fire contols on other remote pipeline projects.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Rehabilitation	Reduction in the quality of ecosystems (long term or permanent) due to **inadequate reinstatement** contributing to a failure of rehabilitation	• The majority of the land clearing is narrow and linear, and the vegetation communities within the Project footprint are regionally common and widespread • If reinstatement is inadequate it would only occur in discrete locations (i.e. it is not systemic)	4	C	H	• Reinstatement will follow the Construction Contractor's Reinstatement Management Procedure. It details how land will be cleared, vegetation stored, and land reinstated in the optimal way to give reinstatement the best chance of being successful. • Develop and implement a Rehabilitation Plan detailing acceptance criteria, monitoring and corrective actions • Reinstatement will be audited against strict acceptance criteria. Reinstatement works and weed control will be undertaken as required. In addition to re-instatement of species richness to at least 70% of pre-disturbance, the acceptance criteria include a requirement that declared plant pest species (weeds) must be equal to or less than the pre-disturbance land use.	Moderate. The process for reinstatement detailed in the Environmental Management Plan is derived from the APIA Code of Environmental Practice for Onshore Pipelines (2013). The reinstatement and rehabilitation acceptance criteria for the NGP are prescribed in the Environmental Authority for the Queensland component of the NGP Project issued by the Department of Environment and Heritage Protection (DEHP); these acceptance criteria will be used across the Project area. These acceptance criteria are applied routinely to similar Projects in Queensland and therefore are considered effective for long-term mitigation of biodiversity impacts. As the acceptance criteria apply to the life of the Project they are expected to be effective in ensuring that any failure of rehabilitation is detected and rectified. The effectiveness of rehabilitation will only be determined during the Project's' Operation Phase. The extent to which the Project has the potential to cause a significant impact to the environment because of unsuccessful reinstatement will largely depend on the effectiveness of the weed control measures implemented through the Weed Management Plan (Construction), and during operational phase weed surveillance and control.	2	C	M
BIODIVERSITY & THREATENED SPECIES	Rehabilitation	Reduction in the quality of **threatened species** habitat (long term or permanent) due to **inadequate reinstatement** contributing to a failure of rehabilitation.	• If reinstatement is inadequate it would only occur in discrete locations (i.e. it is not systemic) • The critical habitat of of the threatned species being assessed is sparsely-vegetated, and so vegetation integrity is not an important ecological requirement for this species (as compared with, for instance, a woodland species). • Localised rehabilitation failure due to inadequate reinstatement would have a negligible impact on the habitat quality of this threatened species.	1	A	L	• Low inherent risk. Refer above for controls in place that will further minimise risk.	No applicable	1	A	L

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APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
WATER	Transportation, storage and handling of fuels and other hazardous substances	Spills of chemicals or hazardous substances, and subsequent reduction in surface or groundwater quality	• Relatively small volumes of chemicals and hazardous substances will be required for construction. • All transport, storage and handling will be in accordance with relevant Australian and industry standards.	4	C	H	• Develop and implement a Traffic Management Plan which will include standard operating procedures for transport of chemicals and hazardous substances. • All chemicals, fuels and hazardous materials will be transported, stored and handled in accordance with applicable legislative requirements and relevant guidelines, including Australian Standard AS1940-2004 and relevant safety data sheets (SDS). • Storage and refuelling areas will be located away from sensitive receiving environments. • Hazardous substance storage areas will be either bunded or self-bunded. • Develop and implement a Dangerous Goods and Hazardous Substance Management Procedure prior to commencement of works, which will include spill response management.	High. Adherence to relevant Australian standards and the APIA Code of Environmental Practice: Onshore Pipelines (2013) is considered best practice, and industry standard.	2	B	L
WATER	Ground disturbance, earthworks and stockpiling of soils and vegetation within the construction footprint	Erosion resulting in sediment and/or vegetative material entering watercourses, and subsequent reduction in water quality	• Works are undertaken with no erosion or sediment controls in place. • No specific handling of soils and stockpiles.	4	C	H	• Develop and implement Water Management Plan (Construction). • Develop and implement Erosion and Sediment Control Plan (ESCP) in accordance with IECA Guidelines. • Minimise the area of exposed soils with progressive reinstatement and stabilisation.	High. Appendix P of the IECA Guidelines is the accepted Australian best practice guidelines for erosion and sediment control for linear infrastructure developments. The development and implementation of ESCP in accordance with these guidelines is considered to be a proven effective mitigation measure.	2	B	L
WATER	Ground disturbance, earthworks and stockpiling of soils and vegetation within the construction footprint	Exposure of problematic soils, and subsequent reduction in water quality due to inadequate handling and/or treatment of problematic soils	• No identification or special treatment of problematic soils is undertaken. • No specific handling of problematic soils. • Problematic soils potentially within the construction footprint are dispersive, acid sulfate or contaminated.	3	C	S	• Undertake a soil survey of the construction ROW prior to construction to identify, and map, areas of problematic soils. • Develop and implement a Progressive ESCP for dispersive soils if they are identified. • Where problematic soils are identified develop specific management plans and store and treat soils as required in accordance with relevant plans and guidelines, including: • The Queensland Acid Sulfate Soils Technical Manuals (Qld Government 2013) • National Guidance for the Management of Acid Sulfate Soils in Inland Aquatic Ecosystems (EPHC and NRMMC 2011) • IECA Best Practice Erosion and Sediment Control Guidelines (IECA 2008) • National Environment Protection (Assessment of Site Contamination) Measure (NEPC 2013) – referred to as the NEPM Guidelines	High. Adherence to established and accepted standards and guidelines.	2	B	L
WATER	Generation and on-site disposal of wastewater at construction workers camps	Construction camp wastewater entering watercourses or groundwater, and subsequent reduction in water quality	• Construction camp wastewater will be treated and disposed of by irrigation at each construction camp. • Washdown bays will be developed at each construction camp for vehicle washdowns and weed hygiene. • Uncontrolled release, or inadequate treatment, of these wastewater streams from construction camp areas will result in impacts to water quality and aquatic ecosystem health.	3	C	S	• Install and maintain suitably sized and designed wastewater treatment plant for each camp in accordance with Australian Standards and Department of Health (DoH) Guideline for Wastewater Works Design Approval. • Water to be treated to a suitable quality for release via irrigation (as per NT Guidelines for Wastewater Works Design Approval). • Treated wastewater will only be released to allocated and approved irrigation areas, in accordance with a Land Capability Assessment and Wastewater Works Design Approvals from DoH. • Application rates of irrigation water will ensure no surface runoff occurs. • No treated wastewater to be irrigated near a watercourse. • No treated wastewater to be irrigated on areas of limestone or dolomite outcrop or near sinkholes. • Vehicle washdown bays will be engineered to be closed loop, with no discharge.	High. Adherence to established and accepted standards and guidelines. Through design of closed loop washdown bays the risks to water quality have been avoided.	2	B	L
WATER	Disposal of hydrostatic test water	Hydrostatic test water entering surface watercourses or groundwater, and subsequent reduction in water quality	• Hydrostatic testing will be undertaken in accordance with AS2885.5. • 22ML of hydrostatic test water will be discharged once hydrostatic testing is completed. • 20kL of pre-fill water will be discharged at the end of each test section. • Hydrostatic test water quality will be similar to that for other pipeline projects (as described in the CSIRO 2005 study), and will not contain biocide additives. • Source water quality for hydrostatic testing will be generally good (i.e. near potable). • Hydrostatic test water will be stored in 12ML dams along the ROW.	3	C	S	• Hydrostatic testing will be conducted in accordance with AS2885.5 and the APIA Code of Environmental Practice: Onshore Pipelines (2013). • Develop and implement Hydrostatic Test Management Plan. • Obtain a Waste Discharge Licence from the NT EPA for discharge of the hydrostatic licence and adhere to all conditions of this licence. • Pre-fill water will be tested and filtered prior to being discharged to land at the end of each test section. • Hydrostatic test water will be stored in low consequence dams, reused for each test section, and discharged once at completion of testing. • Hydrostatic test water will be discharged to land at approved locations and in accordance with the requirements of discharge approvals. • Prior to discharge, hydrostatic test water will be tested and treated as required to meet discharge approvals. • Only low consequence dams will be constructed and used for storage of hydrostatic test water, in accordance with the Qld Manual for Assessing Hazard Categories and Hydraulic Performance of Dams. • When storing hydrostatic test water, dams will be monitored for signs of loss of structural or hydraulic integrity. • Test water prior to release and implement treatment as required to comply with discharge approvals.	Moderate. In acknowledgement of the level of uncertainty around hydrostatic test water quality and the discharge location, the effectiveness of mitigation cannot be completely assessed and the residual risk remains moderate. This can be further reduced during development of the Hydrostatic Test Management Plan, which will need to comply with the APIA Code of Environmental Practice: Onshore Pipelines (2013). Construction of low consequence dams in accordance with the Qld Manual for Assessing Hazard Categories and Hydraulic Performance of Dams is considered proven effective in reducing risks associated with water storage dams.	2	C	M
WATER	Sourcing and extraction of surface water for construction and hydrostatic testing	Reduced surface water flows, and subsequent impacts on downstream users and aquatic ecosystems	• Relatively small volumes of water would be extracted as one-off events.	2	B	L	• Source water from approved sources in accordance with agreements. • Do not extract water from watercourses. • Hydrostatic testing will be conducted in accordance with Australian Pipeline Industry Association (APIA) Code of Environmental Practice: Onshore Pipelines (2013). • Develop and implement Hydrostatic Testing Management Plan.	High. Adherence to established and accepted standa	1	B	L

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APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
WATER	Sourcing and extraction of groundwater for construction and hydrostatic testing	Drawdown of groundwater, and subsequent impacts on other groundwater users, groundwater dependent ecosystems and areas of ground-surface water interaction	• A total of 111ML of water will be required for construction purposes with up to 20ML of potable water from reticulated supply in Tennant Creek and Mount Isa. • Construction and hydrostatic test water volumes will be supplemented by water from groundwater bores along the ROW.	3	D	H	• Develop and implement Hydrostatic Testing Management Plan that adheres to the requirements of the APIA Code of Environmental Practice: Onshore Pipelines (2013). • Source water from approved sources in accordance with agreements. • Prior to construction, assess the sustainable yields for proposed groundwater extraction bores. • Measure the standing water level in bores prior to, during, and immediately following extraction to provide insight into drawdown. • Any new bores required will be drilled by a driller licenced under relevant legislation (e.g. NT Water Act).	Moderate. For new bores, use of a licenced driller and compliance with relevant sections of relevant legislation (e.g. NT Water Act) is considered to be proven effective in minimising impacts of new bores on the aquifer. For existing bores, further work is required to demonstrate the effectiveness of controls once additional detail is available on the location and volumes of groundwater extraction. In acknowledgement of the level of uncertainty around groundwater extraction, the residual risk remains moderate. This can be further reduced during development of the Hydrostatic Test Management Plan, which will need to comply with the APIA Code of Environmental Practice: Onshore Pipelines (2013).	2	C	M
WATER	Installation and operation of water storage dams	Sediment or contaminated water entering local watercourses due to an uncontrolled release from dams, and subsequent reduction in water quality	• 12 water storage dams will be constructed along the ROW for storage of construction water. • These dams will be temporary, unless the landholder requests that they remain following completion of construction.	4	C	H	• Engineer and design water storage dams to accommodate projected quantities, and to include sufficient free board to accommodate additional filling during rainfall events. • Only low consequence dams will be constructed. • After rainfall events, monitor and conduct controlled releases as required. • Develop and implement ESCP in accordance with IECA Guidelines.	High. Construction of low consequence dams in accordance with the Qld Manual for Assessing Hazard Categories and Hydraulic Performance of Dams is considered proven effective in reducing risks associated with water storage dams.	2	B	L
WATER	Trenching across watercourses for installation of pipeline	Sediment and/or vegetative material and/or contaminants entering groundwater aquifer due to the interception of shallow groundwater, and subsequent reduction in water quality	• Pipeline is installed via open cut trenches across watercourses. • Works are undertaken during times when there is no flow or low flow in the watercourses. • Watercourse crossings will be installed and reinstated progressively.	3	C	S	• Develop and implement Water Management Plan (Construction). • Construct watercourse crossings in the following order of preference; firstly, in times when there is no water present, secondly in times of no flow, or thirdly, in times of flow, but in a way that does not impede low flow. • Develop and implement specific Progressive ESCP for watercourse crossings in accordance with IECA Guidelines. • Design, install and reinstate watercourse crossings in accordance with the APIA Code of Environmental Practice: Onshore Pipelines (2013). • Reinstate watercourse crossings as soon as practicable after construction of crossing is complete to minimise duration of disturbance. • Only activities directly required for linear infrastructure construction are to be undertaken within watercourses.	High. Appendix P of the IECA Guidelines is the accepted Australian best practice guidelines for erosion and sediment control for linear infrastructure developments.	2	B	L
WATER	Trenching across watercourses for installation of pipeline	Alteration of surface water hydrology and sedimentation of watercourses, and subsequent impacts on water quality, downstream users and aquatic ecosystems	• Pipeline is installed via open cut trenches across watercourses. • Works are undertaken during times when there is no flow or low flow in the watercourses. • Watercourse crossings will be installed and reinstated progressively.	4	C	H	• Develop and implement Water Management Plan (Construction). • Construct watercourse crossings in the following order of preference; firstly, in times when there is no water present, secondly in times of no flow, or thirdly, in times of flow, but in a way that does not impede low flow. • Develop and implement specific Progressive ESCP for watercourse crossings in accordance with Appendix P of the IECA Guidelines. • Design, install and reinstate watercourse crossings in accordance with the APIA Code of Environmental Practice: Onshore Pipelines (2013) • Reinstate watercourse crossings as soon as practicable after construction of crossing is complete to minimise duration of disturbance. • Only activities directly required for linear infrastructure construction are to be undertaken within watercourses.	High. Adherence to the APIA Code of Environmental Practice: Onshore Pipelines (2013) and the IECA Guidelines is considered best practice, and industry standard. This is considered an effective mitigation measure when implemented appropriately.	2	B	L
WATER	Dewatering of water collected within trench	Sediment and/or vegetative material entering watercourses, and subsequent reduction in water quality	Dewatering will only be required if rainfall occurs or if shallow groundwater is intercepted by the trench (more likely in the wet season). Dewatering is undertaken with no erosion or sediment controls in place.	4	C	H	• Develop and implement Progressive ESCP for watercourse crossings, in accordance with IECA Guidelines. ESCP must include contingencies for rainfall. • Minimise duration of open trench across watercourse crossings through installing crossing and backfilling in the shortest practicable time. • If trench dewatering is required, dewater via erosion and sediment controls.	High. Adherence to the APIA Code of Environmental Practice: Onshore Pipelines (2013) and the IECA Guidelines is considered best practice, and industry standard. This is considered an effective mitigation measure when implemented appropriately.	2	B	L
HERITAGE	Ground disturbance and construction activities within approved construction areas	Unauthorised entry or damage to sacred sites	• Sacred Sites present in Project footprint • Authority Certificates obtained from AAPA prior to works	4	C	H	• Inclusion of access restrictions for workers in Project area in accordance with Sacred Site Authority Certificate. • All clearance activities undertaken in accordance with Sacred Sites Act Authority Certificates. • Authority Certificate conditions incorporated into Project Construction Management Plans and incorporated into all subcontracts. • Specific conditions set out in Project Cultural Heritage Management Plan (CHMP), including all clearance areas defined by line of site pegs prior to clearance activities. • Traditional Owner participation in clear and grade team ahead of construction in Restricted Work Areas.	High. Compliance with an Authority Certificate is anticipated to be effective in ensuring sacred sites are not accessed or damaged by Project activities, subject to the requirements of the certificate being effectively communicated to Project personnel and compliance with those requirements being achieved.	2	B	L
HERITAGE	Ground disturbance and construction activities within approved construction areas	Damage to archaeological, places or objects	• Archaeological surveys undertaken. • Sites of medium to high significance require protection either through avoidance or obtaining a Works Approval under the Heritage Act.	3	D	H	• Archaeological Heritage Reports will be provided to the Heritage Branch and discussed with Traditional Owners and Site Custodians either directly or through representative bodies. • Implement the Construction Phase CHMP including: • Incorporating site management conditions in Work Approvals under the Heritage Act. • Archaeological Heritage Field Hands working alongside Traditional Owners during clear and grade in Restricted Work Areas. • Archaeological Field Hands working during clear and grade in areas of high archaeological potential. • Marking out and fencing off of heritage site areas in close proximity to construction activities. • Inclusion of procedures in CHMP for management of further site discovery during clear and grade activities, and clearance for additional work areas.	High. Works Approval process established under the Heritage Act is considered the best-practice, and proven effective. Archaeological surveys and CHMP have been conducted by suitably qualified archaeologists, which is considered effective in identifying and managing risks to archaeological sites.	2	B	L

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APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
HERITAGE	Ground disturbance and construction activities within approved construction areas	Disturbance of skeletal remains and sub-surface heritage objects	• Sacred site and archaeological surveys did not indicate a high likelihood of sub-surface materials. • Tree burials may be present in some areas.	2	B	L	• Monitoring of initial clearance of treed areas through Traditional Owner participation in clear and grade team ahead of construction. • Inclusion of procedures in CHMP for skeletal remains discovery and management, and discovery of sub-surface heritage objects.	High. The controls will not prevent the remains from being damaged but will minimise the amount of damage. It is expected that the level of personnel compliance with these procedures would be high as the discovery of human skeletal remains is something that is generally taken seriously by law-abiding people.	1	A	L
COMMUNITY HEALTH AND SAFETY	Traffic and heavy vehicle movements	Public safety issues due to road traffic incidents	• Construction traffic will utilise public roads • Traffic Guidance Schemes yet to be finalised • Road users unaccustomed to/not expecting heavy traffic in remote area. • Bored pipeline crossings used for highways, major road and rail corridor. • Operational traffic - no significant increase above background	3	E	E	• Implement an approved Traffic Management Plan • Traffic Guidance Schemes (TGS) will detail signpost layout, traffic control devices and any temporary regulatory signs, or speed zones. • TGS's shall be developed in consultation with the relevant Road Authority. • Enforce traffic controls (speed limits, diversions, signage). • Determine and enforce traffic routes. • Manage fatigue in workers/drivers. • Assess driver competency prior to operating vehicles and machinery. • Establish exclusion zones around working areas to restrict access. • Equip vehicles with UHF/VHF radios and/or satellite phones allowing contact with emergency services or site first aid.	High. Controls are part of routine Construction Contractor SOP's. Effectiveness of TMP and TGS will be reviewed by relevant road authorities. Assume public compliance.	1	D	M
COMMUNITY HEALTH AND SAFETY	Construction and operation of the pipeline and facilities	Public safety issues due to incidents associated with unauthorised entry to works areas or facilities	• Low likelihood of unauthorised access due to remoteness from population centres • Operational facilities fenced and secured to prevent unauthorised access in accordance with the requirements of AS2885	2	D	S	• Implement Project Security Plans • Restrict access to work areas. • Ensure all entry points to the ROW are signed as no access zones. • Monitor for unauthorised entries. • Install temporary fencing where risk of accidental entry is high. • Undertake a community awareness program. • Security of operational facilities to be maintained in accordance with the requirements of AS2885.	High. Controls are part of routine Construction Contractor SOP's. Security of operational facilities in accordance with AS2885. Assume public compliance. Good community engagement in place.	1	D	M
COMMUNITY HEALTH AND SAFETY	Construction of the pipeline and facilities	Exposure to particulate (dust) and diesel exhaust emissions (respiratory issues)	• Large separation distances to sensitive receptors (closest residential receptor approx. 3.4km from ROW) • No sensitive receptors within modelled zone of impact	2	A	L	• Implement Air Quality Management Plan • Implement an approved Traffic Management Plan. • Enforce speed limits on unsealed roads near sensitive receptors. • Use dust suppression as required.	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	2	A	L

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CONSTRUCTION PHASE

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COMMUNITY HEALTH AND SAFETY	Construction of the pipeline and facilities (including blasting and drilling in some areas)	Exposure to noise and vibration emissions (nuisance and health impacts)	• Large separation distances to sensitive receptors (closest residential receptor approx. 3.4km from ROW) • No sensitive receptors within modelled zone of impact • Blasting will be required for some rocky sections of the construction ROW, mostly west of Mount Isa and around Phillip Creek near Tennant Creek.	3	B	M	• Implement Noise Management Plan • Implement a Blasting Management Plan • Community engagement and letter drops • Blasting and drilling undertaken at times of highest ambient noise or minimum intrusion • Transportation through isolated areas during preferred construction hours • Reversing and high rev operation will be minimised as far as practicable. • Where noise criteria may be exceeded negotiate 'alternative arrangements' • Alternative arrangements may include notifications prior to works, restriction of work hours, alternative accommodation or other arrangements as agreed	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	1	B	L
COMMUNITY HEALTH AND SAFETY	Waste and wastewater management at construction camps	Exposure to contaminated water (poisoning or disease)	• Risk of hazardous substances entering surface water or ground water is low due to routine compliance with Australian Standards and DG Code • Waste will be removed off-site for disposal in accordance with the Waste Management Plan • Hydrostatic testing wastewater disposed of in accordance with Hydrostatic Test Plan • Wastewater is treated in accordance with NT Department of Health requirements prior to irrigation to approved areas • Large separation distances to sensitive receptors and general remoteness of works, limits exposure potential	2	B	L	• Implement Emergency Response Plan in relation to spill response. • Ongoing monitoring of hazardous substances storage and handling areas. • Wastewater monitoring undertaken - water meets release criteria prior to irrigation	High. Australian Standards are best-practice. Addition controls as per CoEP Onshore Pipelines. DoH Guidelines best-practice wastewater management. Controls are part of Construction Contractor SOP's. Construction contractor as experience in implementation of controls.	1	B	L
COMMUNITY HEALTH AND SAFETY	Construction of the pipeline and facilities	Bushfire incident (serious injuries or fatality)	• Some construction activities could ignite a fire. • The majority of construction activities will occur within the cleared construction footprint, reducing the risk of a bushfire spreading. • Large separation distance to sensitive receptors reduces likelihood of community safety issues.	2	D	H	• Ensure a water cart is onsite during welding and grinding activities. • Vehicles and machinery fitted with fire extinguishers. • Deploy water trucks as required during high fire danger. • Earth pipe (e.g. grit blasting) where works may generate static electricity. • Dedicated smoking areas and butt bins in locations away from flammable material. • Construction to be carried out within cleared work areas. • Implement fire prevention and control procedures.	High. Controls as per CoEP Onshore Pipelines. Controls are part of Construction Contractor SOP's. Construction contractor as experience in implementation of controls.	1	D	M
HEALTH AND SAFETY	Use of local health and emergency services	Health and emergency services unable to adequately service local population	• Local services likely to be operating at or near capacity • Assume that any increased demand will impact service delivery • Project Emergency Response Plans not yet formalised	3	B	M	• Project First Aid and Paramedic support provided. • On-site paramedic engaged. • First aiders in all crews. • First aid facilities at camps and first aid and snake bite kits in all vehicles and machinery. • Stringent workplace health and safety controls to minimise injuries. • Emergency response plans established and emergency scenario drills conducted. • Regular consultation with health services and external response agencies.	Moderate. Construction contractor as experience in implementation of controls. Dependent on effective engagement with local health and emergency service providers in establishing Project plans.	2	B	L
COMMUNITY HEALTH AND SAFETY	Workforce accommodation	Reduced community health and well-being due to anti-social and risk taking behaviour of construction workforce	• Moderate numbers of the workforce are accommodated in Tennant Creek and Mount Isa. • Large numbers of the workforce are accommodated in construction workers camps, but the majority of them are remote. • Previous experience in remote construction projects indicates negative interactions between the workforce and the community can result in health impacts	3	B	M	• Pre-employment drug and alcohol testing of workers. • Implement Worker's Accommodation Plan • All workers to comply with Project Code of Conduct • Construction camps will be dry (no alcohol). • Daily site alcohol testing and random drug testing. • Personnel transported home for rostered breaks. • Sexual health education. • Recreational activities to be provided in camps.	Moderate. Dependent on effective communication and induction programs.	2	B	L
AIR QUALITY	Construction of the pipeline and facilities	Reduction in local air quality and nuisance and/or health impacts due to the emission of particulate (dust) and diesel exhaust	• The majority of areas where construction traffic will use unsealed roads are remote and away from sensitive receptors • Construction air quality impacts will be short term • Air quality assessment report indicates compliance with air quality criteria achieved at all sensitive receptors	3	B	M	• Implement an approved Traffic Management Plan. • Enforce speed limits on unsealed roads near sensitive receptors. • Use dust suppression as required • Covered loads where there is potential to emit dust during transport. • Maintain and operate equipment in accordance with manufacturer's requirements.	High. Requirements for controls assessed by appropriatly qualified and experienced air quality consultants. Routine controls are industry best-practice in accordance with APIA Code of Environmental Practice: Onshore Pipelines (2013). Construction contractor has identified water sources for dust surpression in planning phase and has experience in implementation of controls.	2	B	L
NOISE AND VIBRATION	Traffic and heavy vehicle movements for the transportation of personnel, machinery and materials	Nuisance and/or health impacts and reduced community well-being due to noise and vibration	• The majority of the transport routes are sparsely populated, with few sensitive receptors. • Construction traffic will not significantly increase existing noise levels (the existing highways and roads used for mobilisation and transportation to the construction footprint are already heavily trafficked by industrial and freight (i.e. road train) traffic).	1	B	L	• Implementation of Traffic Management Plan. • Vehicle movements scheduled to avoid night time driving in populated areas where possible. • Select traffic routes away from sensitive receptors where available. • Maintain and operate plant and equipment in accordance with manufacturer's requirements. • Observe project traffic movement restrictions and speed limits. • Provide avenues for complaints or feedback, to allow investigation and optimisation of specific	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	1	B	L
NOISE AND VIBRATION	Operation of mobile plant, equipment and vehicles	Nuisance and/or health impacts and reduced community well-being due to noise and vibration emissions	• The majority of the construction footprint is sparsely populated, with few sensitive receptors. • Construction noise impacts will be short term.	2	B	L	• Inform potentially affected residents of construction activities, working hours, level and duration to be expected. • Provide avenues for complaints or feedback, to allow investigation and optimisation of specific activities where possible. • Position and locate large and constantly operating items of plant so exhaust/intake (loudest side) are oriented away from sensitive areas. • Maintain and operate plant and equipment in accordance with manufacturer's requirements.	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	1	B	L

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APPENDIX F1 ENVIRONMENTAL RISK REGISTER
CONSTRUCTION PHASE

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
NOISE AND VIBRATION	Blasting	Intense and sudden noise or vibration due to the generation of noise and/or over-blast (i.e. Projected debris)	• Blasting will only be undertaken in certain rocky sections of the construction footprint, and for short durations of time. • Blasting will be undertaken in accordance with Australian and industry standards. • Blasting will be required near Mount Isa, where sensitive receptors may be affected for short durations of time.	2	C	M	• Develop and implement a Blasting Management Plan. • Communicate with potentially sensitive receptors prior to blasting. • Provide avenues for complaints or feedback, to allow investigation and optimisation of specific activities where possible.	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	1	B	L

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ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **ecosystems** (long term or permanent) due to **weed introduction** and/or proliferation caused by operational usage of vehicles.	• There will be low traffic volumes and minimal requirement for cross-country movements. • Construction phase weed management has been largely successful, but that there is still the occasional new outbreak of weeds.	**4**	**D**	**E**	• Implement Operations Weed Management Plan • Ongoing weed surveillance and control	Moderate. Weed surveillance and control is effective if implemented consistently by trained personnel. Dependent on frequency of surveillance and use of personnel trained in weed id, timing and the use of suitable control methods	**2**	**C**	**M**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **threatened species** habitat (long term or permanent) due to **weed introduction** and/or proliferation caused by operational usage of vehicles.	• Construction phase weed management has been largely successful, but that there is still the occasional new outbreak of weeds.	**1**	**A**	**L**	• Implement Operations Weed Management Plan • Ongoing weed surveillance and control	Moderate. Weed surveillance and control is effective if implemented consistently by trained personnel. Dependent on frequency of surveillance and use of personnel trained in weed id, timing and the use of suitable control methods	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **ecosystems** (long term or permanent) due to **failure of rehabilitation** (because of insufficient natural revegetation).	• The majority of the land clearing is narrow and linear, and the vegetation communities within the Project footprint are regionally common and widespread. • Unsuccessful rehabilitation would only occur in discrete locations (i.e. it is not systemic). • Reinstatement and rehabilitation acceptance criteria prescribed	**4**	**C**	**H**	• Construction Contractor to implement Reinstatement Management Procedure, which details how land will be cleared, vegetation stored, and land reinstated in the optimal way to give reinstatement the best chance of being successful • Develop and implement a Rehabilitation Plan detailing acceptance criteria, monitoring and corrective actions • Reinstatement will be audited against acceptance criteria put in place by regulators • Further reinstatement works and weed control will be undertaken as required as determined by ongoing monitoring	Moderate. The process for reinstatement detailed in the Environmental Management Plan is derived from the APIA Code of Environmental Practice for Onshore Pipelines (2013). The reinstatement and rehabilitation acceptance criteria for the NGP are prescribed in the Environmental Authority for the Queensland component of the NGP Project issued by the Department of Environment and Heritage Protection (DEHP); these acceptance criteria will be used across the Project area. These acceptance criteria are applied routinely to similar Projects in Queensland and therefore are considered effective for long-term mitigation of biodiversity impacts. As the acceptance criteria apply to the life of the Project they are expected to be effective in ensuring that any failure of rehabilitation is detected and rectified. The effectiveness of rehabilitation will only be determined during the Project's' Operation Phase. The extent to which the Project has the potential to cause a significant impact to the environment because of unsuccessful reinstatement will largely depend on the effectiveness of the weed control measures implemented through the Weed Management Plan (Construction), and during operational phase weed surveillance and control.	**2**	**C**	**M**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **threatened species** habitat (long term or permanent) due to **failure of rehabilitation** (because of insufficient natural revegetation)	• If reinstatement is inadequate it would only occur in discrete locations (i.e. it is not systemic) • The critical habitat of of the threatened species being assessed is sparsely-vegetated, and so vegetation integrity is not an important ecological requirement for this species (as compared with, for instance, a woodland species). • Localised rehabilitation failure due to inadequate reinstatement would have a negligible impact on the habitat quality of this threatened species.	**1**	**A**	**L**	• Low inherent risk. Refer above for controls in place that will further minimise risk.	As above	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **ecosystems** (long term or permanent) due to **noise** from the compressor stations.	• There are no threatened fauna or noise-sensitive ecological receptors (e.g. significant bat colonies) within the zone of influence (as indicated by the Threatened Species Survey Report – Appendix G).	**1**	**A**	**L**	• Low inherent risk. No specific controls proposed.	Not applicable.	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (long term or permanent) due **noise** from the compressor stations.	• Plains Death Adder does not occur within the zone of influence from noise from the compressor stations.	**1**	**A**	**L**	• Low inherent risk. No specific controls proposed.	Not applicable.	**1**	**A**	**L**
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **Carpentarian Antechinus** habitat (long term or permanent) due to **noise** from the compressor stations.	• Carpentarian Antechinus does not occur within the zone of influence from noise from the compressor stations.	**1**	**A**	**L**	• Low inherent risk. No specific controls proposed.	Not applicable.	**1**	**A**	**L**

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ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of ecosystems (long term or permanent) due to a **bushfire** caused by pipeline failure.	• The pipeline will be designed, constructed, tested, operated and maintained in accordance with Australian Standard 2885 Pipelines – Gas and Liquid Petroleum (AS 2885) and other applicable standards and regulations or industry Codes of Practice. This industry is mature and such incidents are rare. As part of the NGP Initial AS2885 Safety Management Study (SMS), the likelihood of an ignited gas release was assessed as low.	1	D	M	• Emergency Respponse Plan includes rapid response to prevent bushfire spreading	High. AS2885 prescribes requirements. Jemena has experience developing and implementing Emergency Response Plans for similar facilities.	1	B	L
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of **Plains Death Adder** habitat (long term or permanent) due to a **bushfire** caused by pipeline failure.	• The black soil country which comprises critical Plains Death Adder habitat has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. • This assumption is based on field observations of that habitat being sparsely vegetated (tussocks of grass occurring in small, discrete patches) and exhibiting little evidence of historic burning (confirmed by the fire mapping).	1	A	L	• Low inherent risk. No specific controls proposed.	• Low inherent risk. No specific controls proposed.	1	A	L
BIODIVERSITY & THREATENED SPECIES	Operation and maintenance of pipeline and facilities	Reduction in the quality of Carpentarian Antechinus habitat (long term or permanent) due to a **bushfire** caused by pipeline failure.	• The rocky country which comprises critical Carpentarian Antechinus habitat has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. • This assumption is based on field observations of that habitat being sparsely vegetated, free from Buffel Grass (which greatly increases fuel loads), exhibiting little evidence of historic burning.	1	A	L	• Low inherent risk. No specific controls proposed.	• Low inherent risk. No specific controls proposed.	1	A	L
WATER	Operation and maintenance of pipeline and facilities	Chemicals or hazardous substances entering groundwater or surface water due to a spill at compressor stations, and subsequent reduction in water quality	• All chemicals and hazardous substances are stored and handled in accordance with Australian and industry standards. • Infrastructure is maintained and operated in accordance with industry standards.	3	C	S	• All chemicals, fuels and hazardous materials will be stored and handled in accordance with applicable legislative requirements and relevant guidelines, including Australian Standard AS1940-2004 and relevant safety data sheets (SDS). • Develop and implement a Dangerous Goods and Hazardous Substance Management Procedure and Register. • Storages will be bunded or self-bunded. • Maintain and operate the pipeline and facilities in accordance with AS2885. • Conduct regular inspections of pipeline and infrastructure.	High. Adherence to relevant Australian standards is considered best practice, and industry standard.	2	B	L
WATER	Soil management within Project footprint	Failure of soil management and rehabilitation, resulting in erosion and sediment entering watercourses, and subsequent reduction in water quality	• Construction footprint was reinstated but there is no ongoing monitoring or maintenance of reinstated areas during the operational phase.	4	B	S	• Operate pipeline in accordance with AS2885. • Conduct rehabilitation monitoring, and required maintenance, of ROW and temporary access tracks in accordance with Rehabilitation Management Plan.	High. Appendix P of the IECA Guidelines is the accepted Australian best practice guidelines for erosion and sediment control for linear infrastructure developments. The development and implementation of ESCP in accordance with these guidelines is considered to be a proven effective mitigation measure.	2	B	L
WATER	Sourcing and extraction of surface water for operation of compressor stations	Reduced surface water flows, and subsequent impacts on downstream users and aquatic ecosystems	• MICS operational water requirements will be minimal. • PCCS operational water requirements cannot be supplied by surface water flows in the region and therefore must be sourced from alternative sources. No water will be extracted from surface watercourses.	1	A	L	• Source MICS operational water from approved sources in accordance with agreements. • Do not extract water from a watercourse.	Not required (inherent risk is low)	1	A	L

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WATER	Sourcing and extraction of groundwater for operation of compressor stations	Drawdown of groundwater, and subsequent impacts on other groundwater users, groundwater dependent ecosystems and areas of ground-surface water interaction	• PCCS operational water requirements will be 4,800L/day, which will be sourced from a groundwater bore drilled near the facility. • Groundwater extraction occurs without prior assessment of sustainable yields or aquifer capacity to supply PCCS needs. MICS will not require groundwater for water supply.	3	C	S	• Source groundwater for PCCS from a groundwater extraction bore to be drilled by a licenced driller, and in consultation with a hydrogeologist as required. • Assess sustainability of groundwater resources to inform location of groundwater extraction. • Pump test bore prior to use to assess groundwater drawdown. • Monitor standing water levels in bores prior to and during use to provide data on changes in groundwater levels.	Moderate. Use of a licenced driller, consultation with a hydrogeologist, and compliance with relevant sections of the Water Act *(NT)* is considered to be proven effective in minimising impacts of new bores on the aquifer. In acknowledgement of the level of uncertainty around groundwater extraction, the residual risk remains moderate. This can be further reduced during the detailed design phase for the PCCS through assessing the sustainable yields of surrounding aquifers and seeking the advice of suitably qualified people (i.e. hydrogeologists or licenced water bore drillers).	2	C	M
WATER	Operation and maintenance of evaporation pond at PCCS	Uncontrolled release of produced water, and subsequent reduction in surface and ground water quality	• No wastewater will be produced, stored or managed at MICS. • PCCS will produce 200L/hour of wastewater which will be filtered onsite and pumped to evaporation ponds for disposal via evaporation. • The design of the evaporation ponds will be engineered during the detailed design phase for the PCCS. *Note: there is currently limited information on the nature (i.e. water quality), treatment requirements or proposed evaporation pond design, however these details will be confirmed prior to construction of the PCCS.*	4	C	H	• Evaporation pond to be engineered and designed to accommodate expected water volumes, with sufficient freeboard for expected rainfall volumes. • Evaporation pond to be lined to prevent leakage. • Pond to be leak tested prior to use. • Leakage detection to be installed beneath pond and regularly checked by operational staff. • Water quality monitoring will be undertaken. • Residue to be removed as required and disposed of at a licenced facility in accordance with the Waste Management Plan.	Moderate. The evaporation ponds will be engineered and designed by suitably qualified engineers to contain expected water volumes without leakage or overflow. Engineering standards will ensure that expected wastewater volumes are contained, and evaporated onsite, with no unauthorised release into the environment, and with consideration of rainfall and weather conditions. Monitoring, inspections, and routine removal of residue will confirm the effectiveness of the evaporation ponds.	2	B	L
HERITAGE	Land access for operation and maintenance of pipeline	Unauthorised entry onto Sacred Sites	• AAPA Certificate and protection measures in place from construction phase. No increase in disturbance footprint.	2	B	L	• Inclusion of access restrictions for operations workers in project area in accordance with Sacred Site Authority Certificate implementation. • Restrictions addressed in OEMP	High. Jemena has experience developing and implementing OEMP that provide appropriate levels of staff induction.	1	B	L
HERITAGE	Land access for operation and maintenance of pipeline	Damage to archaeological sites, places or objects	• Heritage protected in accordance with a Works Approval prior to commencement of construction activities. No increase in disturbance footprint.	1	B	L	• Workers restricted to approved access tracks public roads and pipeline easement and respect of Authority Certificate conditions. No ground disturbing activities outside approved areas • Restrictions addressed in OEMP	High. Jemena has experience developing and implementing OEMP that provide appropriate levels of staff induction.	1	B	L
COMMUNITY HEALTH AND SAFETY	Gas venting at PCCS and MLV sites	Exposure to noise emissions (nuisance and health impacts)	• Large separation distances to sensitive receptors (closest residential receptor approx. 38 km from PCCS) • No sensitive receptors within modelled zone of impact	2	A	L	• Implement the Noise and Vibration Management Plan. • Where appropriate to do so, install silencers, mufflers and enclosures around vents and turbines.	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	1	A	L
COMMUNITY HEALTH AND SAFETY	Operation of PCCS	Exposure to combustion gas emissions	• Large separation distances to sensitive receptors (closest residential receptor approx. 38 km from PCCS) • Elevated emission stacks • No sensitive receptors within modelled zone of impact	2	B	L	• Implement Air Quality Management Plan • Regular maintenance (e.g. monitoring and recording of equipment operating parameters, regular stack emissions monitoring)	High. Management Plans prepared by specialist consultants. Good community engagement protocols in place. Routine controls are part of Construction Contractor SOP's. Construction contractor and Jemena have experience implementing similar controls.	2	B	L

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COMMUNITY HEALTH AND SAFETY	Operation of PCCS and MLV's	Exposure to methane gas emissions from venting - asphyxiation and explosion	• Large separation distances to sensitive receptors (closest residential receptor approx. 38 km from PCCS) • Elevated emission stacks • No sensitive receptors within modelled zone of impact • Impacts of methane exposure typically limited to confined spaces - venting will occur in open air - low likelihood	1	C	M	• Implement Air Quality Management Plan • Regular maintenance • Implement Safety Management Plans and Emergency Response Plans to manage occupational exposure	The proposed controls do not reduce the risks due to the high consequences. The controls are expected to ensure the likelihood of methane exposure remains low for the duration of the Project.	1	C	M
COMMUNITY HEALTH AND SAFETY	Operation and maintenance of the PCCS facility	Exposure to contaminated water (poisoning or disease)	• Risk of hazardous substances entering surface water or ground water is low • Contaminated wastewater at the PCCS will be directed to an evaporation pond • Operational procedures for the PCCS evaporation pond will include leakage detection and monitoring, and will restrict access • Large separation distances to sensitive receptors and general remoteness of works, limits exposure potential	2	B	L	• Regular maintenance and monitoring of evaporation pond • Implement Emergency Response Plan in relation to spill response • Ongoing monitoring of hazardous substances storage and handling	Moderate. The effectiveness of the controls proposed in relation to the PCCS evaporation pond will require further assessment following completion of detailed design.	2	B	L
COMMUNITY HEALTH AND SAFETY	Operation and maintenance of pipeline and facilities	Fire or explosion incident (serious injuries or fatality)	- Explosion or fire requires a gas leak and a source of ignition so would occur in remote circumstances - Remote location and sparse population of the Project area reduces consequence and number of people who would be impacted	3	D	H	• Facilities design and operation in accordance with AS 2885 with • Signage installed and maintained to mark location • Dial Before You Dig active • Community awareness and engagement program • 24/7 monitoring of the pipeline enables gross leak detection • Implement Pipeline Isolation Plan • Implement Emergency Response Plan • Securely fence compressor stations and pipeline facilities • Automated fire and leak detection and alarm systems.	High. Australian Standards are considered best-practice and are proven to be effective.	1	D	M
AIR QUALITY	Gas venting at compressor stations and MLV sites	Reduction in air quality due to methane emissions	• Gas venting at compressor stations and MLV sites will inherently involve gas emissions. • Assumes modelling in Air Quality Assessment is accurate.	3	B	M	• Emission stack is elevated. • Develop and implement Air Quality Management Plan. • Develop and implement an Inspection and Maintenance Program to ensure equipment operates as per design. • Monitor and record equipment operating parameters.	High. Controls will be in place and are considered to be industry standard approach. Emissions from the compressor stations and MLV's are inherent (hence moderate residual risk to air quality), however modelling indicates no exceedance of air quality criteria at sensitive receptors, and no human health impacts are expected.	3	A	M
AIR QUALITY	Operation and maintenance of PCCS and MICS facility	Reduction in air quality due to combustion emissions	• The operation of the compressor stations will inherently involve gas emissions. • Assumes modelling in Air Quality Assessment is accurate.	3	B	M	• Emission stack is elevated. • Develop and implement an Inspection and Maintenance Program to ensure equipment operates as per design. • Monitor and record equipment operating parameters. • Test emissions as stipulated by regulatory requirements.	High. Controls will be in place and are considered to be industry standard. Emissions from the compressor stations and MLV's are inherent (hence moderate residual risk to air quality), however modelling indicates no exceedance of air quality criteria at sensitive receptors, and no human health impacts are expected.	3	A	M
NOISE AND VIBRATION	Operation and maintenance of PCCS facility	Community disturbance or complaints due to continuous (24/7) elevated low frequency noise from facilities operations	• There are no sensitive receptors within 28km of the PCCS facility. • Operational activities will inherently involve noise emissions. • Continuous operational noise levels will be compliant with noise criteria >2km from the compressor station. • Assumes modelling in Noise Assessment is accurate.	2	B	L	• Develop and implement an Inspection and Maintenance Program to ensure equipment operates as per design. • Provide avenues for complaints or feedback, to allow investigation and optimisation of specific activities where possible.	Not required (inherent risk is low)	1	B	L
NOISE AND VIBRATION	Gas flaring and venting at the PCCS facility	Community disturbance or complaints due to high volume noise potentially occurring at any time	• There are no sensitive receptors within 28km of the PCCS facility. • Operational activities will inherently involve noise emissions. • Flaring and venting noise emissions will be periodic, short in duration, and restricted to daytime events unless it is an emergency situation. • Assumes modelling in Noise Assessment is accurate.	3	B	M	• Develop and implement an Inspection and Maintenance Program to ensure equipment operates as per design. • Ensure design has suitable flow and nozzle diameter or additional silencer to reduce the noise impact to an acceptable level. • Restrict maintenance/testing venting exercises to daytime periods where possible.	High. Implementation of industry standard controls are considered proven effective in reducing noise emissions. No impacts on sensitive receptors are predicted due to the large separation distance (>28km).	3	A	M

*L=likelihood, C=consequence, IR=inherent risk, RR=residual risk, L=low, M=moderate, S=significant, H=high

ASPECT	PROJECT ACTIVITY	POTENTIAL IMPACTS	ASSUMPTIONS IN ASSESSING INHERENT RISK	L*	C*	IR*	SUMMARY OF CONTROLS	EFFECTIVENESS OF MITIGATION	L*	C*	RR*
NOISE AND VIBRATION	Operation and maintenance of MICS facility	Community disturbance or complaints due to continuous (24/7) elevated low frequency noise from facilities operations	• Continuous operational noise levels will be compliant with noise criteria at all sensitive receptors. • Operational activities will inherently involve noise emissions. • Assumes modelling in Noise Assessment is accurate.	3	A	M	• Develop and implement Inspection and Maintenance Program to ensure equipment operates as per design. • Provide avenues for complaints or feedback, to allow investigation and optimisation of specific activities where possible.	High. Jemena have pre-existing maintenance practices which are proven effective in maintaining the operating efficiency of equipment. Other controls are considered industry standard.	3	A	M
NOISE AND VIBRATION	Gas flaring and venting at the MICS facility	Community disturbance or complaints due to high volume noise potentially occurring at any time	• There are sensitive receptors within 1.2km of the MICS. • Operational activities will inherently involve noise emissions. • Venting at the MICS will exceed noise criteria at some sensitive receptors, but will be periodic, short in duration, and restricted to daytime events unless it is an emergency situation. • Assumes modelling in Noise Assessment is accurate.	3	B	M	• Implement Inspection and Maintenance Program to ensure equipment operates as per design. • Ensure design has suitable flow and nozzle diameter, or additional silencer to reduce the noise impact to an acceptable level. • Restrict maintenance/testing venting exercises to daytime periods where possible.	High. Revision of the plant design and incorporation of an additional silencer, as recommended in the Noise Management Plan, is considered proven effective as the plant will be engineered to reduce noise emissions. Jemena have pre-existing maintenance practices which are proven effective in maintaining the operating efficiency of equipment.	3	A	M

*L=likelihood, C=consequence, IR=inherent risk, RR=residual risk, L=low, M=moderate, S=significant, H=high