GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

Valhalla Gas Exploration and Appraisal Program

Bennett Resources Pty Ltd

Report 1800

January 2026

This assessment report has been prepared by the Environmental Protection Authority (EPA) under s. 44 of the *Environmental Protection Act 1986* (WA). It describes the outcomes of the EPA's assessment of the Valhalla Gas Exploration and Appraisal Program proposal by Bennett Resources Pty Ltd.

This assessment report is for the Western Australian Minister for Environment and sets out:

- what the EPA considers to be the key environmental factors identified in the course of the assessment
- the EPA's recommendations as to whether or not the proposal may be implemented and, if it recommends that implementation be allowed, the conditions and procedures, if any, to which implementation should be subject
- other information, advice and recommendations as the EPA thinks fit.

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Environmental Protection Authority

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Proposal

The Valhalla Gas Exploration and Appraisal Program is a proposal to undertake an unconventional exploration drilling and hydraulic fracture simulation in the Canning Basin, within the Shire of Derby-West Kimberley. The proposal is located approximately 123 kilometres (km) southeast of the town of Derby, in the Kimberley region of Western Australia.

The proponent for the proposal is Bennett Resources Pty Ltd.

The disturbance footprint is 112 hectares (ha) within a development envelope of 93,006 ha, noting that the proponent has 'locked' the location of the disturbance footprint. The proposal will involve the drilling and construction of up to 20 gas exploration wells across up to 10 well pads and will be implemented in two phases over a 7-year timeframe.

The proposal is limited to exploration and appraisal only and is not for the purpose of producing or processing of petroleum products such as natural gas. Should the proposal identify a commercially viable resource, the proponent has identified that further and separate approvals would be sought, including referral to the EPA.

Context

The proposal is located within the Canning Basin situated within the West Kimberley Dampierland Interim Biogeographic Regionalisation for Australia (IBRA) bioregion of Australia. The proposal is situated within a sparsely populated region, with the nearest population centre being the Yungngora (Noonkanbah) community approximately 18 km to the south of the development envelope and 28 km from the nearest proposed well site.

The proposal area is the subject of two native title determinations under Commonwealth *Native Title Act 1993*. The majority of the development envelope is within the Yungngora (Noonkanbah) People determination area, while the remaining northern portion is within the Warlangurru People determination area.

The proposal is located within the middle catchment of the extensive and prominent Fitzroy River catchment, with the river itself located approximately 16 km south of the development envelope. The proposal is located within proximity to the National Heritage listed West Kimberley Heritage Place (WKHP), which includes the Fitzroy River and the Camballin Floodplain. The development envelope is approximately 7.5 km from the boundary of the WKHP.

The use of hydraulic fracture stimulation (HFS; 'fracking') is a key element of the proposal and is central to the high level of public concern and interest in the proposal. In September 2017 the State Government implemented a ban on HFS in the South-West, Peel and Perth metropolitan areas of WA, and a moratorium was imposed for the remainder of the state, including the Canning Basin.

An Independent Scientific Inquiry into HFS in WA (the HFS Inquiry) was carried out in 2018 by a panel of experts appointed under Section 25 of the EP Act. The inquiry delivered its report to government in September 2018. The State Government considered the inquiry's findings and made policy decisions that resulted in lifting the HFS moratorium for all existing (as at November 2018) petroleum titles in the Canning Basin. An Implementation Plan was approved by government in 2019 to address the findings and recommendations of the inquiry (Government of Western Australia 2019). The EPA has had regard to the HFS Inquiry findings and recommendations, as well as the Implementation Plan, in the assessment of this proposal.

In 2015 Buru Energy completed a HFS exploration program within EP371, including the drilling and stimulation of two wells within the development envelope. The EPA understands that the evidence provided in relation to the 2015 HFS program contributed to the HFS Inquiry's finding that the existing regulatory framework was generally adequate to mitigate significant impacts to the environment. The EPA's assessment of this proposal has considered the environmental outcomes of the 2015 HFS program.

Environmental values

The key environmental values that may be impacted by the proposal are:

- the Fitzroy River catchment area, including the river itself and its tributaries, including Mount Hardman Creek
- groundwater quantity and quality and its associated cultural, ecological and socioeconomic values
- terrestrial fauna, particularly greater bilby individuals and suitable habitat
- the West Kimbereley National Heritage Place and its inherent ecological and social values
- Aboriginal cultural heritage sites and areas of cultural significance, including the Fitzroy River.

Consultation

The EPA published the proponent's referral information for the proposal on its website for seven days public comment. The EPA also published the proponent's environmental review document on its website for public review for 8 weeks (from 12 August 2024 to 7 October 2024). The EPA considered the comments received during these public consultation periods in its assessment.

Mitigation hierarchy

The mitigation hierarchy is a sequence of proposed actions to reduce adverse environmental impacts and emissions. The sequence commences with avoidance, then moves to minimisation, rehabilitation, and offsets are considered as the last step in the sequence.

The proponent considered the mitigation hierarchy in the development and assessment of its proposal, including the following measures:

Avoidance measures

- siting the proposal to avoid public drinking water source areas, including a separation distance of greater than 2 km for well sites
- altering the disturbance footprint to avoid direct disturbance to surface water features, such as Mount Hardman Creek
- siting wells such that the expected groundwater drawdown does not intersect potential groundwater-dependent ecosystems
- designing the disturbance footprint to avoid listed Aboriginal heritage sites and other sites of cultural significance in consultation with relevant Traditional Owners
- committing to no clearing of occupied greater bilby burrows.

Minimisation measures

- maintain a separation distance between the HFS zone and lowest extent of the Grant Formation
- undertaking monitoring of groundwater prior, during, and after HFS operations
- reduce greenhouse gas emissions by utilising horizontal drilling technique, flaring of gas during well testing, and using efficient diesel generators and solar powered lighting
- ongoing consultation with the Traditional Owners, including the presence of ‘heritage monitors’ during ground disturbance
- implement the well management plan to ensure each petroleum well is designed, constructed, and managed to mitigate well integrity risks.

Rehabilitation measures

- progressively rehabilitating areas no longer required for operations
- appropriately storing topsoil for use in rehabilitation.

Assessment of key environmental factors

The EPA has identified the key environmental factors (listed below) in the course of the assessment. For each factor, the EPA has assessed the residual impacts of the proposal on the environmental values and considered whether the environmental outcomes are likely to be consistent with the EPA environmental factor objectives.

Inland waters

Residual impact or risk to environmental value		Assessment finding
1.	Groundwater drawdown associated with water supply for hydraulic fracture stimulation (HFS) activities has the potential to impact surface waters and groundwater dependant ecosystems (GDE) from reduced groundwater inflow and other groundwater users, such as pastoral bores.	Groundwater abstraction from the Liveringa Aquifer for operations is expected up to 100 ML per exploration well. Groundwater modelling indicates that groundwater drawdown will be limited in extent and duration, with negligible drawdown occurring beyond 700 m from each well site. There are no identified GDEs or bore users located within 700 m of the well site locations. The closest credible GDE is Mount Hardmann Creek located approximately 1.5 km a well site. Based on modelled drawdown extents, no drawdown related impacts are expected to occur. The EPA's recommended conditions and Decision Making Authority (DMA) regulation (*Rights in Water and Irrigation Act 1914* (RiWI Act)) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.
2.	Potential impacts to groundwater quality from unexpected fracture heights	The EPA recognises that there are a suite of management measures that will be implemented to ensure that fracture heights are controlled and do result in conduits for the movement of contaminants to overlying freshwater aquifers. These include, microseismic monitoring and an accompanying early warning detection system. The risk is also low in the context of the significant separation distance between the target Laurel Formation and the closest viable aquifer. The EPA notes the proponent's commitment to maintain a separation distance from the top of the HFS zone to the base of the Grant Formation. The EPA has recommended conditions requiring proposal induced fractures to remain within the Laurel Formation, and for mitigation measures recommended under the HFS Inquiry to be incorporated into the proponent's required plans under the *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act). The EPA's recommended conditions and DMA regulation (PGER Act) will

		appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.
3.	Potential impacts to groundwater quality from hydrogeological faults	Existing hydrogeological faults may provide a conduit to allow the movement of contaminants into overlying aquifers. HFS activities may also reactivate existing faults. Based on available geomechanical information for the proposal area and geomechanical risk assessment by the proponent, the risk of significant faults providing a conduit for the migration of contaminants is low. The EPA has recommended a condition requiring further site specific geomechanical risk assessment to be incorporated into the proponent's required plans under the PGER Act. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.
4.	Potential impacts to groundwater quality from well integrity failure	The EPA advises that standard well design and testing requirements provide suitable mitigation of potential impacts to groundwater associated with well integrity failure. Aspects relating to well design, construction and testing are regulated through the statutory Well Management Plan under the PGER Act. Consistent with the HFS Inquiry recommendations, the EPA has recommended a condition requiring well design, construction and testing to be assessed by an independent certified well examiner. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.
5.	Potential impacts to groundwater and surface water quality from surface spills and leaks	The EPA considers that small volume incidental spillages and leaks of chemicals, fuel and wastewater may occur. However, the EPA advises that with standard operational controls and mitigation measures, there is a low likelihood of

		significant adverse impacts to groundwater or surface water quality. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.
6.	Potential impacts to groundwater quality associated with surface management of wastewater, including flowback water.	The EPA advises that the toxicity of the proposed HFS fluid system has been previously tested and found to be of low toxicity. Formation water produced during flowback and well testing is likely to be highly saline and contain other geogenic contaminants that warrant precautionary management and containment. The management of waste flowback water in suitably designed and constructed lined containment ponds will mitigate potential impacts to groundwater and surface water. The EPA has recommended a condition (B1-1(5)) requiring the proponent to ensure that all wastewater remains contained within the specifically designed ponds. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.

Greenhouse gas emissions

Residual impact or risk to environmental value		Assessment finding
1.	Scope 1 emissions are estimated to peak at 368,260 t CO_2-e in years 6 and 7, representing 0.45 % of WA annual emissions (based on 2022 data). No scope 2 emissions are expected. Scope 3 GHG emissions may occur at scale in the event that hydrocarbons, such as condensate, are captured during well testing and consumed down-stream.	The proposal's scope 1 emissions arise primarily from the flaring of hydrocarbons during well testing. The quantity of annual emissions are dependent on the number of wells drilled and tested in that year, and the duration of well testing and the expected rate of hydrocarbon flow during testing. The emissions intensity of the proposal is high relative to comparable activities, but is a result of the predicted high flow rates, noting the mature appraisal nature of the proposal and the expected reservoir performance. The flaring of hydrocarbons during prolonged well testing is increasingly not representative of best practice. A condition

	GHG emissions contribute to climate change, which impacts on WA's environment.	requiring the implementation of reasonable measures to minimise the flaring of gas and condensate is recommended. Technologies for the collection and beneficial use of gas are becoming more available, and should be considered for implementation. The EPA recommends a condition requiring performance reporting in relation to the collection of gas for use or sale. There are practical measures identified by the proponent that should be adopted to avoid methane release during operations, such as 'reduced emissions completions'. The EPA recommends a condition requiring the implementation of these measures where applicable. The Safeguard Mechanism is expected to apply to the proposal and require emissions reductions consistent with the applicable baseline. In consideration of this, the EPA is of the view that the likely environmental effects of the proposal can be mitigated through the recommendation conditions, in conjunction with the obligations required under the *National Greenhouse and Energy Reporting Act 2007,* to ensure the environmental outcome is likely to be consistent with the EPA objective for greenhouse gas emissions.

Social surroundings

Residual impact or risk to environmental value		Assessment finding
1.	Direct impacts to Aboriginal heritage features/sites.	Based on the survey information provided, and the proponent's consultation with Traditional Owners, the EPA advises that the risk of impacts to Aboriginal cultural heritage associated with direct disturbance to heritage sites or features is likely to be low. However, consistent with recent EPA recommendations, and to ensure that risks of direct impacts are appropriately managed, the EPA has recommended condition B4 to ensure impacts to Aboriginal heritage sites are avoided unless consent is granted through another decision-making

		process in consultation with the relevant Traditional Owners.
2.	Loss or restriction of access to land for cultural purposes.	The EPA advises there is a risk, albeit low, of residual impact to Aboriginal cultural heritage through the loss of access to, or restriction of access to the land for cultural activities. The EPA recommends condition B5-1(2) to ensure Traditional Owner access to the land for traditional or cultural purposes, subject to reasonable health and safety requirements.
3.	Impacts to aesthetics and amenity due to noise, dust, light and vibrations.	The EPA has considered the potential impacts of the proposal on nearby Aboriginal communities, pastoralists, and the broader values of the West Kimberley National Heritage Area. The EPA has concluded that given the short duration and small scale of the proposal, in the context of the remote location away from sensitive receptors, impacts to aesthetics and amenity values from potential noise, dust, light and vibration emissions during operations are likely to be negligible. The EPA has also considered the management measures committed to by the proponent, and the expected incorporation of these measures into statutory plans (such as the Environment Plan under the PGER Act) required under other decision-making processes. The EPA advises that recommended conditions on the limits and extents of the proposal will ensure the environmental outcome is consistent with the EPA objective for social surroundings.

Terrestrial fauna

Residual impact or risk to environmental value		Assessment finding
1.	Direct impacts to Fauna habitat type 2 from clearing of up to 34.8 ha.	The EPA advises that the residual impact to habitat utilised by conservation significant fauna species can be adequately regulated through the recommended conditions (A1 and B2-1). Further, rehabilitation of fauna habitat can be adequately regulated through

		recommended condition B4 and under the PGER Act. The EPA considers that the environmental outcome is likely to be consistent with the EPA objective for terrestrial fauna.
2.	Disturbance of occupied greater bilby burrows.	The proposal has the potential to result in disturbance of greater bilby burrows. The EPA considers that clearing of burrows, if found within the development envelope, should be avoided. The EPA advises that, subject to the recommended conditions (A1-1, B2-1, and B2-3), the residual risk is likely to be consistent with the EPA objective for this factor.
3.	Impact to threatened or priority fauna from vehicle strikes.	The proposal has the potential to result in impacts to terrestrial fauna species from vehicle strikes. The proponent's proposed mitigation measure to limit vehicle speed of 40 km/hr at night is considered reasonable, however, the EPA also recommends a 60 km/hr limit during the day to ensure the environmental outcome is consistent with the EPA objective for this factor (recommended condition B2-2).
4.	Indirect impacts from noise and light pollution.	There is potential for terrestrial fauna species to be indirectly impacted from noise and light emissions, including from gas flaring. Given the scale and duration of activities that will result in noise and light emissions, the EPA advises that indirect impacts to terrestrial fauna are unlikely to be significant. The EPA also considers that noise and light emissions, such as those associated with flaring activities, can be further regulated through the Environment Plan required under the PGER Act. The EPA considers that there is unlikely to be a significant residual impact, and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Holistic Assessment

The EPA considered the connections and interactions between relevant environmental factors and values to inform a holistic view of impacts to the whole

environment. The EPA formed the view that the holistic impacts would not alter the EPA's conclusions about consistency with the EPA factor objectives.

Conclusion and recommendations

The EPA has taken the following into account in its assessment of the proposal:

- environmental values which may be significantly affected by the proposal
- assessment of key environmental factors, separately and holistically (this has included considering cumulative impacts of the proposal where relevant)
- likely environmental outcomes which can be achieved with the imposition of conditions
- consistency of environmental outcomes with the EPA's objectives for the key environmental factors
- the proponent's proposed mitigation measures
- whether other statutory decision-making processes can mitigate the potential impacts of the proposal on the environment
- principles of the *Environmental Protection Act 1986*
- the findings and recommendations of the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia 2018.
- The Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (the IESC) advice on the Valhalla Gas Exploration and Appraisal Project.

The EPA has recommended that the proposal may be implemented subject to conditions recommended in Appendix A.

Other advice

The EPA has provided other advice to the Minister in relation to:

- the EPA's expectations for the regulation of the proposal under the *Petroleum and Geothermal Energy Resources Act 1967*, including having regard to the HFS Inquiry outcomes
- delivering the outstanding actions of the Government's Implementation Plan developed to address the recommendations of the 2018 HFS Inquiry
- consideration of a regional environmental assessment framework to ensure cumulative impacts are appropriately considered and addressed in the event that future growth of the petroleum industry in the Canning Basin occurs
- the application of financial assurances.

1 Proposal

The Valhalla gas exploration and appraisal program is an unconventional natural gas exploration drilling and hydraulic fracture stimulation (HFS) program. The proposal is located within Exploration Permit EP 371 (EP371) located approximately 123 kilometres (km) south-east of Derby and 50 km west of Fitzroy Crossing, in the Kimberley region of Western Australia (see Figure 1).

The proposal involves the drilling and construction of up to 20 gas exploration wells across up to 10 well pads, with a disturbance footprint of up to 112 hectares (ha) within a broad development envelope of 93,006 ha (see Figure 2). The proposal is intended to be implemented in two phases over a 7-year timeframe. With 6 wells being drilled and testing in the first 3 years, followed by drilling and testing a further 14 wells in phase II (years 4 to 7). The proposal includes drilling vertically up to 4000 m below ground level to target the prospective Laurel Formation followed by horizontal drilling up to 5000 m within the target depth interval (refer to Figure 3).

Following completion, each well will be subject to HFS to facilitate the flow of natural gas. Well testing (appraisal) involves allowing reservoir fluids to flow to the surface whereby produced gas is flared (burned). Well testing is proposed to occur 24 hours per day for up to 90 days for each well, after which the well will be suspended or 'shut-in'.

The proposal is limited to exploration and appraisal only and is not for the purpose of producing or processing of petroleum products. Should the proposal identify a commercially viable resource that is proposed to be targeted for extraction, processing and distribution, the proponent would require further and separate approvals, including referral to the EPA. However, the EPA notes that wells drilled, and hydraulic fracture stimulated as part of this proposal may be utilised as part of a future production program.

The proponent for the proposal is Bennett Resources Pty Ltd, a subsidiary of Black Mountain Energy Limited. The proponent referred the proposal to the Environmental Protection Authority (EPA) on 24 December 2020. The referral information was published on the EPA website for seven days public comment. On 3 February 2021, the EPA decided to assess the proposal at the level of Public Environmental Review. The EPA published the environmental review document (Bennett Resources, 2024) on its website for public review for 8 weeks from 12 August 2024 to 7 October 2024.

The elements of the proposal which have been subject to the EPA's assessment are included in Table 1.

Table 1: Proposal content (Bennett Resources 2022a)

Proposal element	Location	Maximum extent or range
Physical elements		
Clearing of native vegetation	Figure 1	No more than 110 ha

Proposal element	Location	Maximum extent or range
Gas exploration wells	Figure 1	No more than 20 wells across 10 well sites (2 at each well site)
Operational elements		
Water abstraction for process water and camp supply	Within the well sites shown in Figure 2	Up to 100 ML for each exploration well via groundwater abstraction bores
Gas exploration method	n/a	Unconventional (hydraulic fracture stimulation)
Well design	Figure 3	Vertical wells with horizontal HFS wellbore sections
Hydraulic fracture stimulation intervals	n/a	Up to 70 intervals per horizontal well
Water retention pond	At each well site	One pond per well site with a capacity of approximately 160,000 m^3, to hold raw bore water, then produced formation water evaporation
Well test flaring	At each well site	One well test flare pit per well site, or, subject to equipment availability, use of a flare stack to combust gas off the separator
Proposal elements with greenhouse gas emissions		
Construction elements		
Scope 1	Vegetation clearing of up to 110 ha: 287 tCO_2-e Site preparation – diesel emissions: 54 tCO_2-e / well	
Scope 2	None expected	
Scope 3	None expected	
Operation elements		
Scope 1	<u>Diesel emissions:</u> Drilling operations: 857 tCO_2-e / well HFS operations: 1,382 tCO_2-e / well Site reinstatement: 54 tCO_2-e / well Transport (vehicles / rigs): 931 tCO_2-e / well Site power: 22 tCO_2-e / well (based on 90 days flaring) <u>Flaring emissions:</u> Gas: 44,620 tCO_2-e / well (based on 90 days flaring for 6 exploration wells), and 80,921 tCO_2-e / well (based on 90 days flaring for 14 appraisal wells) Condensate: 4,140 tCO_2-e / well (based on 90 days flaring for 6 exploration wells), and 7,507 tCO_2-e / well (based on 90 days flaring for 14 appraisal wells)	

Proposal element	Location	Maximum extent or range
	Fugitive emissions: Drill cuttings: 30 tCO_2-e / well Waste water: 20 tCO_2-e / well	
Scope 2	None expected	
Scope 3	Scope 3 emissions may occur in the event that condensate produced during well testing is collected for sale to third parties. The estimate of scope 3 emissions is based on all condensate produced from a 60 day and 90 day flaring period being captured and transported via Wyndham to Singapore where it would be processed and consumed. 60 days flaring – 105,523 tCO_2-e (222,240 bbl condensate) 90 days flaring – 158,284 tCO_2-e (333,360 bbl condensate)	
Rehabilitation		
Once drilling and hydraulic fracture stimulation activities are complete, cleared areas that are not required to support the maintenance of infrastructure will be progressively reinstated and rehabilitated to minimise environmental liability at the end of asset life. Topsoil is to be respread, and rehabilitation sites actively monitored to ensure they meet the required completion criteria. Completion criteria will ensure that rehabilitation is conducted to enable long-term land use to continue.		
Commissioning		
The exploration and appraisal program is expected to commence in 2023[1].		
Decommissioning		
After completing the proposal activities, and as required under the *Petroleum and Geothermal Energy Resources Act 1967*, the proponent will submit to the Department of Mines, Petroleum and Exploration and implement a decommissioning Environment Plan.		
Other elements which affect the extent of effects on the environment		
Proposal time	Maximum project life	Up to 7 years
	Construction phase	Construction of the well sites, access tracks and camps are expected to be completed in the first year of the project. Phase 1 operations will also begin in the first year.
	Operations phase	Operations across the proposed well sites will be achieved one well site at a time, starting with Phase I exploration wells. Phase I operations are expected to take between 1 – 3 years. Should Phase I be successful, Phase II wells will then undergo operations one well at a time. Phase 2 operations are

[1] At the time of the amendment to the proposal under section 43A of the EP Act in 2022 the proposal was intended to commence implementation in 2023.

Proposal element	Location	Maximum extent or range
		expected to take an additional 2 – 4 years.
	Decommissioning phase	Infrastructure to be maintained or reinstated should it no longer be required during the operations phase of the Proposal. All assets will be decommissioned where a field management plan approved under the Petroleum and Geothermal Energy (Resource Management and Administration) Regulations 2015 does not consider the assets in the plan for future field development. This will ensure that direct environmental impacts from future activities are minimised to the smallest practicable extent.

Units and abbreviations
ha – hectare
ML – megalitres
m^3 – cubic metres
tCO_2-e – tonnes of carbon dioxide equivalent
bbl – barrel (159 litres)

Proposal amendments

The original proposal is set out in section 2.3 (key proposal characteristics) of the proponent's referral supporting report (Bennet Resources 2020), which is available on the EPA website.

The proponent requested changes to the original proposal during the assessment. The changes were assessed to be unlikely to significantly increase any impacts of the proposal. The EPA Chair's notice, of 6 May 2022, consenting to the change is available on the EPA website.

The consolidated and updated elements of the proposal which has been subject to the EPA's assessment are included in Table 1.

Proposal alternatives

The proposal is located within the Canning Basin which has been subject to extensive petroleum exploration activity since the early 1920s. The broader proposal area reflects the location of the prospective unconventional gas resources identified through the course of previous exploration activities. This includes data collected during a 2015 HFS program within the development envelope by a previous operator at sites 'Asgard 1' and 'Valhalla North 1'.

The proponent (Bennett Resources 2024) identified the following key alternatives in defining the proposal:

- use of horizontal well design instead of vertical well design, to reduce the surface footprint required

- staging the proposal such that phase II will only be implemented if the results of the phase I testing and appraisal program confirms the presence of a commercially viable resource.

Proposal context

The proposal is located within the Canning Basin situated within the West Kimberley Dampierland Interim Biogeographic Regionalisation for Australia (IBRA) bioregion of Australia which is dominated by sand sheets and sandy rises, occasionally dissected by alluvial and lacustrine features associated with surface waters.

The proposal is situated within a sparsely populated region, with the nearest population centre being the Yungngora (Noonkanbah) community approximately 18 km to the south of the development envelope and 28 km from the nearest proposed well site. The nearest townships are Fitzroy Crossing (52 km east), Camballin (58 km west) and Derby (123 km northwest).

The development envelope is situated on Crown land characterised by semi-arid rangelands with a long history of pastoral uses. The majority of the area (and proposed well sites) is within the Noonkanbah Pastoral Station lease area, operated by the Yungngora People through the Yungngora Association Incorporated. The northern portion of the development envelope is situated within the Blina Pastoral Station lease area.

The proposal area is the subject of two native title determinations under Commonwealth *Native Title Act 1993*. The majority of the development envelope is within the Yungngora (Noonkanbah) People determination area, while the remaining northern portion is within the Warlangurru People determination area.

The proposal is located within the middle catchment of the extensive and prominent Fitzroy River catchment, with the river itself located approximately 16 km south of the development envelope. The proposal is located within proximity to the National Heritage listed West Kimberley Heritage Place (WKHP), which includes the Fitzroy River and the Camballin Floodplain. The development envelope is approximately 7.5 km from the boundary of the WKHP.

Hydraulic Fracture Stimulation

The use of hydraulic fracture stimulation (HFS; ‘fracking’) is a key element of the proposal and is central to the high level of public concern and interest in the proposal. In September 2017 the State Government implemented a ban on HFS in the South-West, Peel and Perth metropolitan areas of WA, and a moratorium was imposed for the remainder of the state, including the Canning Basin.

An Independent Scientific Inquiry into HFS in WA (the HFS Inquiry) was carried out in 2018 by a panel of experts appointed under Section 25 of the EP Act. The inquiry delivered its report to government in September 2018, which included 91 findings and 44 recommendations (Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia 2018; HFS Inquiry Report). The HFS Inquiry found that the existing regulatory framework was generally adequate, but

enhancements were recommended to ensure environmental protection and public confidence. The State Government considered the inquiry's findings and made policy decisions that resulted in lifting the HFS moratorium for all existing (as of November 2018) petroleum titles, whilst maintaining the ban for the South-West, Peel, Perth Metropolitan regions and the Dampier Peninsula. An Implementation Plan was approved by government in 2019 to address the findings and recommendations of the inquiry (Government of Western Australia 2019).

Key aspects of the Implementation Plan included the development of an enforceable Code of Practice that prescribes the minimum standards for HFS proposals in WA (Action 11), and a requirement for Traditional Owner and private landowner consent prior to hydraulic fracture production (Actions 5a and 5b respectively). At the time of the EPA's assessment of this proposal, neither a Code of Practice nor requirement for consent had been established. It is noted that proponents may not be permitted to commence HFS activities until the WA Code of Practice has been developed, and hydraulic fracturing production may not be approved until Traditional Owner and private landowner consent requirements have been implemented.

The EPA-prepared environmental scoping document was substantially informed by the recommendations of the HFS Inquiry, including the specific recommendations that were to be addressed through the Code of Practice. The EPA's assessment has also addressed the specific matters identified in Action 7.3 of the Implementation Plan for consideration in the assessment of onshore HFS proposals. A detailed analysis of the EPA's consideration of the matters specified in Action 7.3 of the Implementation Plan is provided in Appendix I.

In its assessment of the proposal the EPA has not sought to duplicate the scope or intent of the HFS Inquiry and has not attempted to undertake a broad-ranging reassessment of the risks, both real and perceived, of HFS in Western Australia. The EPA's assessment has given due regard and consideration to the findings and recommendations of the HFS Inquiry. However, the EPA has assessed the likely impacts of the proposal based on its location and proximity to sensitive receptors and environmental values, and in terms of the mitigation measures committed to by the proponent and the ability of other statutory decision-making processes which can mitigate the potential impacts of the proposal.

Buru Energy 2015 HFS Program

Prior to the moratorium on HFS being imposed in 2017, Buru Energy completed a HFS exploration program within EP371 during 2015. The program included the drilling and stimulation of two wells 'Valhalla North 1' and 'Asgard', both of which are located within the development envelope. The EPA notes that extensive monitoring and testing was undertaken as part of this program in accordance with statutory plans, such as an Environment Plan, required under the *Petroleum and Geothermal Energy Resources Act 1967* and subsidiary regulations. The environmental outcomes and learnings of the 2015 HFS program are documented in Buru Energy's submission to the HFS Inquiry (Buru Energy 2018).

Environment Protection and Biodiversity Conservation Act 1999

Phase I of the proposal was initially referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in July 2024 for consideration of impacts to matters of national environmental significance (MNES) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Phase I project was subsequently withdrawn at the proponent's request and the entire proposal (Phase I and II) was referred to DCCEEW in December 2024.

In February 2025 the proposal was determined to be a controlled action (EPBC 2024/10006) to be assessed by DCCEEW on preliminary documentation and is not the subject of an accredited assessment. At the time of the EPA's assessment the EPBC Act assessment was ongoing.

As part of DCCEEW's assessment, advice was sought from the Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (the IESC). The IESC's advice on the action became available late in the EPA's assessment process (IESC 2025). The EPA acknowledges that the IESC advice identified information and data gaps in the proponent's documentation. The EPA advises that the matters raised in the IESC advice and identified deficiencies in the proponent's information were broadly consistent with limitations identified by the EPA during its assessment as well as key themes raised in public submissions. The EPA concluded that, despite the identified uncertainties, that sufficient information was available to characterise the environmental values of the area and the potential impacts and risks posed by the proposal. The EPA's recommended conditions respond to these uncertainties and require further collection of information prior to and during implementation of the proposal to adaptively manage potential impacts and ensure that significant environmental harm does not occur. Further discussion on information gaps and residual uncertainty in assessment information, and how this was addressed through the EPA's assessment and recommendations, is provided in section 4.

Consultation and EPA Consideration of submissions

Following referral of the proposal on 24 December 2020 the EPA published the referral information for the proposal on its website for a seven-day public comment period. The EPA also published the EPA prepared draft Environmental Scoping Document (ESD) for a 4 week comment period from 4 August 2021 to 1 September 2021, and the proponent's Environmental Review Document (ERD) for an 8 week public comment period from 12 August 2024 to 7 October 2024.

The ERD received 8,124 public comments and two agency comments during the public comment period (see Appendix F for details). The EPA considered the comments received during the public consultation periods and the proponent's Response to Submissions (RtS) in its assessment. The proponent's RtS is published on the EPA website.

In considering the comments received, the EPA noted that some of the issues raised in public submissions were contextually relevant, but not directly relevant to the EPA's formal assessment of the proposal against the key environmental factors.

Such matters primarily included concerns about consequential development, including GHG emissions associated with the potential future production and consumption of natural gas, and the broader industrialisation of the Kimberley associated with economic development of the Canning Basin. The EPA has included information about these matters in section 5 of this report ('other advice').

Figure 1: Project location

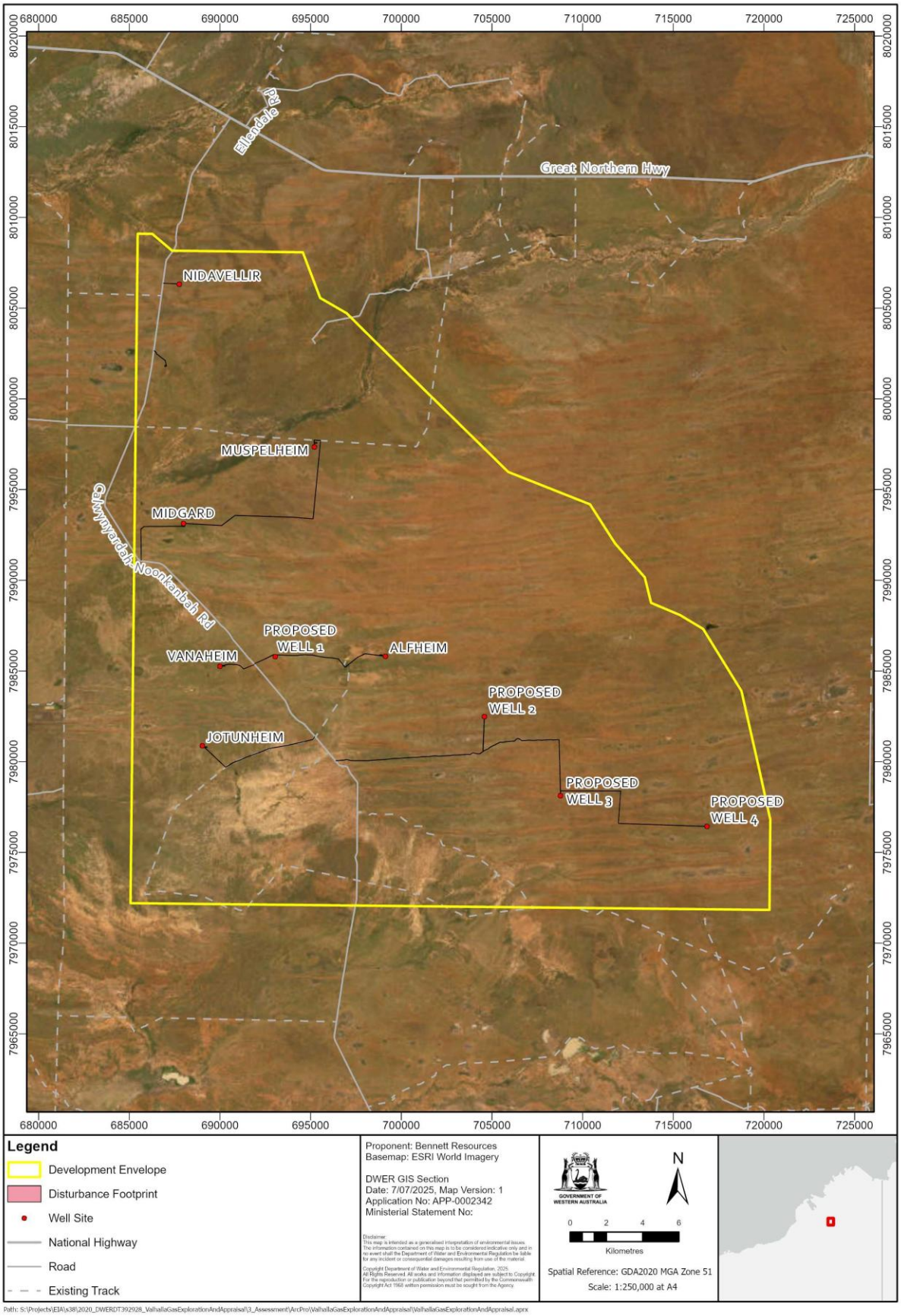

Figure 2: Development envelope and disturbance footprint

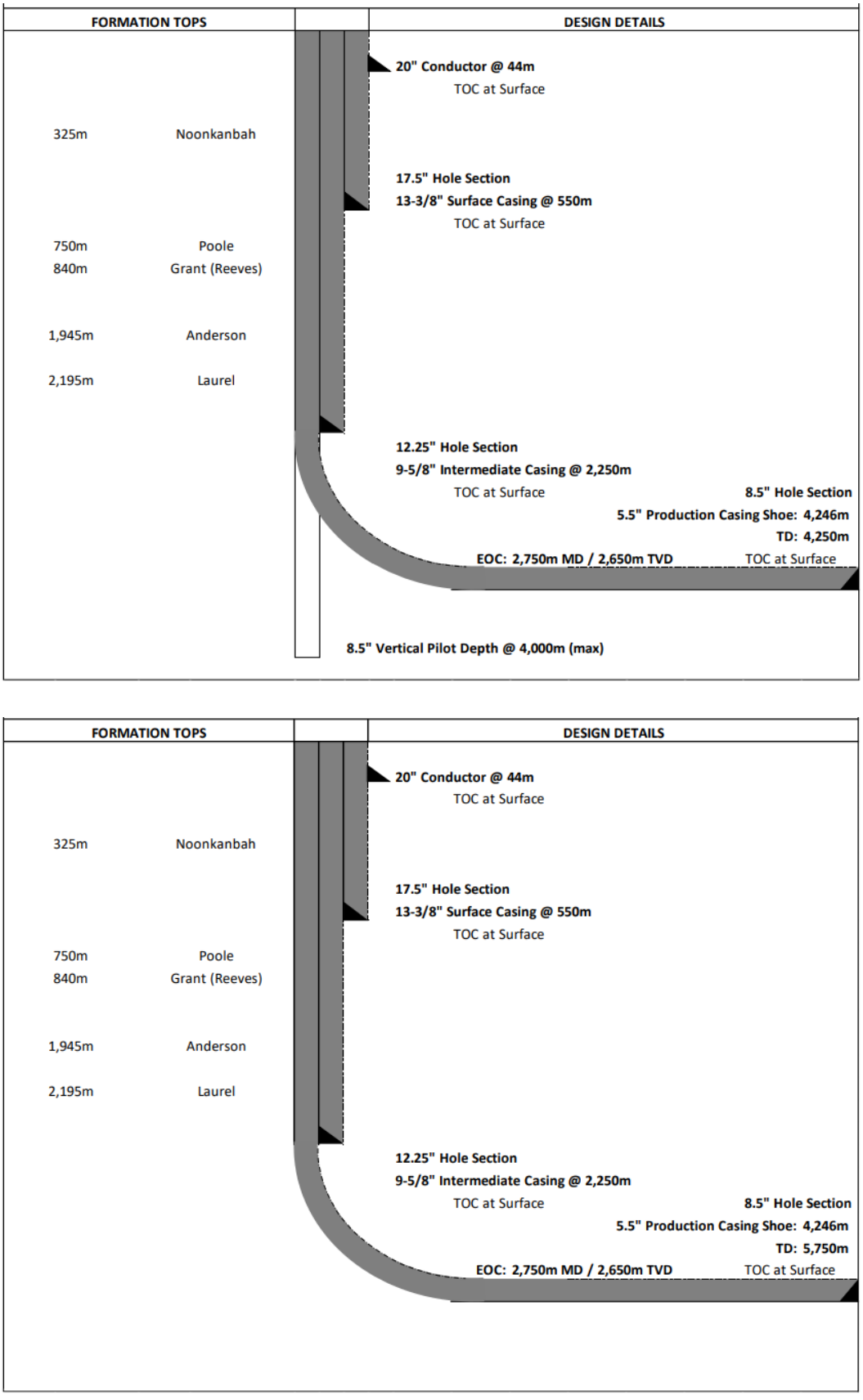

Figure 3: Indicative well design for Phase I (top) and Phase II (bottom) wells (Bennett Resources 2024)

2 Assessment of key environmental factors

This section includes the EPA's assessment of the key environmental factors. The EPA also evaluated the impacts of the proposal on other environmental factors and concluded these were not key factors for the assessment. The evaluation of other environmental factors is included in Appendix D.

2.1 Inland Waters

2.1.1 Environmental objective

The EPA environmental objective for inland waters is *to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected* (EPA 2018).

2.1.2 Investigations and surveys

The EPA advises the following investigations and reports were used to inform the assessment of the potential impacts to inland waters:

- Valhalla Gas Exploration and Appraisal Program, Geotechnical Risk Analysis (Appendix B of the environmental review document) (Bennett Resources, 2022)
- Hydrogeological Assessment of Paradise – Valhalla – Asgard Project Areas, Report for Buru Energy (Appendix I of the environmental review document) (Rockwater, 2016)
- Local Groundwater Characterisation Results (Appendix J of the environmental review document) (no author - raw groundwater monitoring data 2015 to 2022)
- Yungngora Community Data (Appendix K of the environmental review document) (no author - raw groundwater monitoring data 2021 to 2023)
- Revised modelling of drawdown impacts from proposed rig supply bores in the Bennett Resources Valhalla Gas Development Project (Appendix L of the environmental review document) (Intera 2024)
- Bennett Resources 2022, *Valhalla Gas Exploration and Appraisal Program Geotechnical Risk Analysis*, 10 January 2022 [appendix B of Bennett Resources 2024]

The EPA sought advice from the Department of Water and Environmental Regulation (DWER) in relation to the groundwater modelling and hydrogeological characterisation that was considered as part of this assessment.

The EPA determined it could proceed with its assessment despite limitations in the proponent's information, such as the completion of baseline groundwater monitoring. The EPA had regard to the proponent's commitments to undertake further monitoring and risk analysis prior to fully implementing the proposal, including as part of compliance with other statutory decision-making processes. The EPA notes that the proponent's assessment of potential impacts on inland waters was supported by the fact that a detailed geological understanding of the proposal area was integral to determining the project's viability. Furthermore, groundwater modelling undertaken

by the proponent was reviewed by the Department of Water and Environmental Regulation (DWER) and deemed appropriate and proportionate to both the potential risk of impact and the scale of groundwater abstraction proposed. In forming its view, the EPA also considered the extensive hydrological and hydrogeological studies conducted by DWER across the broader Fitzroy River catchment over an extended period.

The EPA considered that sufficient hydrogeological information was available to inform its assessment of the proposal, and the likely impacts and key risks to the environment.

2.1.3 Assessment context – existing environment

The proposal is located within the Fitzroy River Catchment of the Canning Basin region. The region is dominated by monsoonal wet seasons typically from December to March, and a distinct dry season from April to November. The region experiences an annual total rainfall of between 600 mm and 900 mm and annual evaporation of approximately 2,400 mm.

Surface hydrology

The proposal is situated within the North Fitzroy Plains of the expansive Fitzroy River catchment. The Fitzroy River is located approximately 16 km south of the development envelope and typically flows between November and May in response to rainfall events. The Fitzroy River flows west from headwaters in the Fitzroy Ranges in the Central Kimberley through the Fitzroy Trough before discharging to the ocean at King Sound near Derby. In some areas, streamflow is maintained into the dry season as a result of inflow from groundwater (DWER 2023). Salinity levels in the Fitzroy River are typically fresh, however brackish conditions during dry season flow in the vicinity of the Noonkanbah community may reflect baseflow contribution both from the alluvial aquifer, and potentially the deeper Noonkanbah Formation (Lindsey and Commander 2005).

The geomorphology of the proposal area is comprised of dune and swale systems and includes rain-fed claypans within swales that reflect drainage lines between dunes. The area consists of eolian sand and gravel, underlain by laterised sandstone and mudstone, with ephemeral creeks occurring within internal drainage depressions (Lindsey and Commander 2005). The two main tributaries in the area are Mount Hardmann Creek, which intersects the northern portion of the development envelope, and Mount Wynne Creek, located approximately 5 km north of the development envelope (Figure 4). Mount Hardman Creek is non-perennial and only flows in response to significant rainfall events (Bennett Resources 2024).

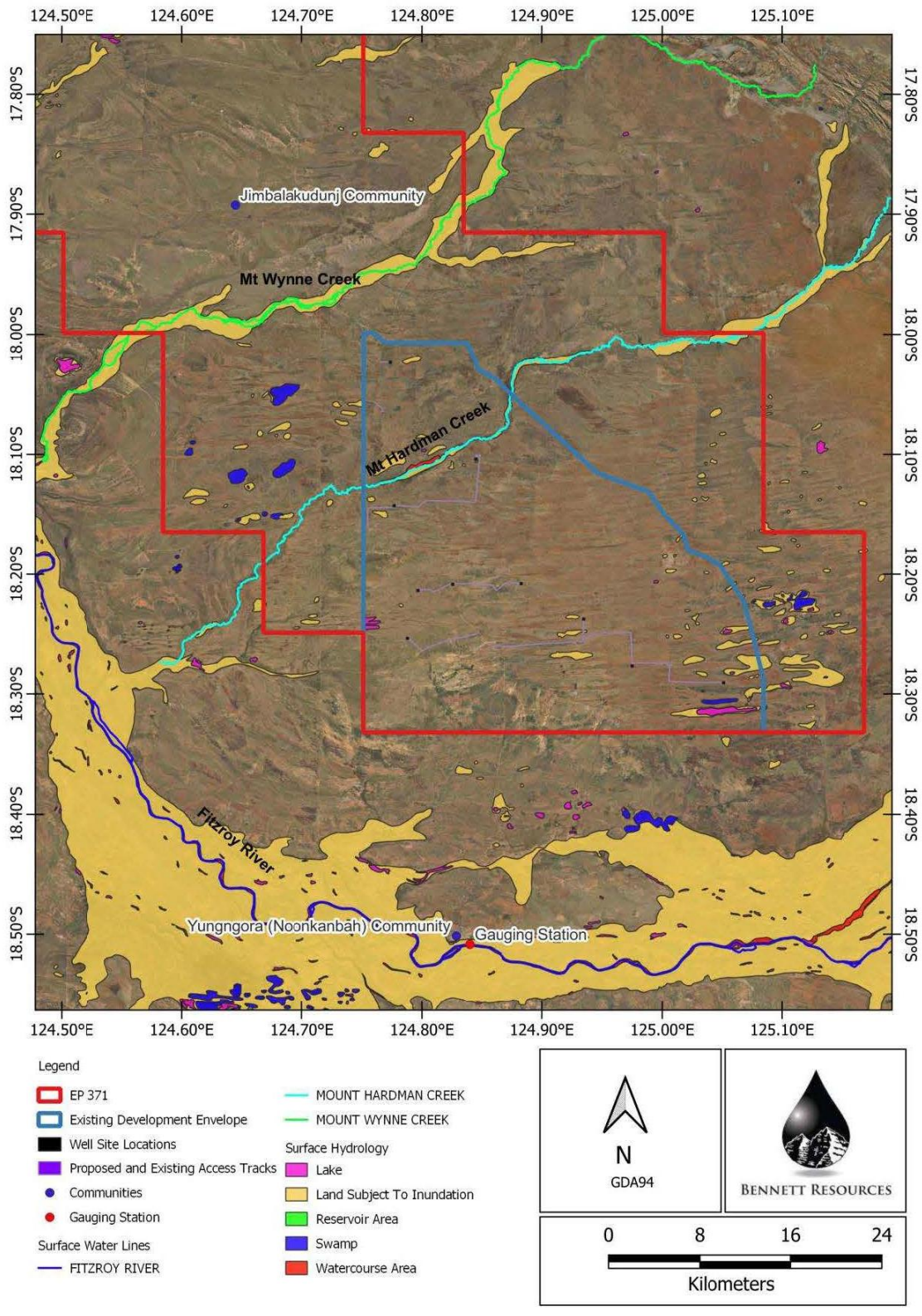

Figure 4: Surface water features within the proposal area (Bennett Resources 2024)

Groundwater hydrology

The Canning Basin is a large sedimentary basin covering an onshore area of more than 450,000 km^2 and is considered the second largest groundwater resource in Australia (Department of Water 2012). An extensive overview of the hydrogeology of the Canning Basin is presented in DWER's Fitzroy Valley groundwater investigation report (DWER 2023). A detailed description of the hydrogeology of the proposal area is provided in the proponent's environmental review document (Bennett Resources 2024).

The major regional aquifer systems in the Canning Basin are (geologically oldest to youngest) the Grant Formation, Liveringa Formation, Wallal Sandstone and Broome Sandstone. There are two main aquifers within the proposal area, the Grant Poole Aquifer and the surficial Liveringa Aquifer. A conceptual schematic of the regional hydrogeology is presented in Figure 5.

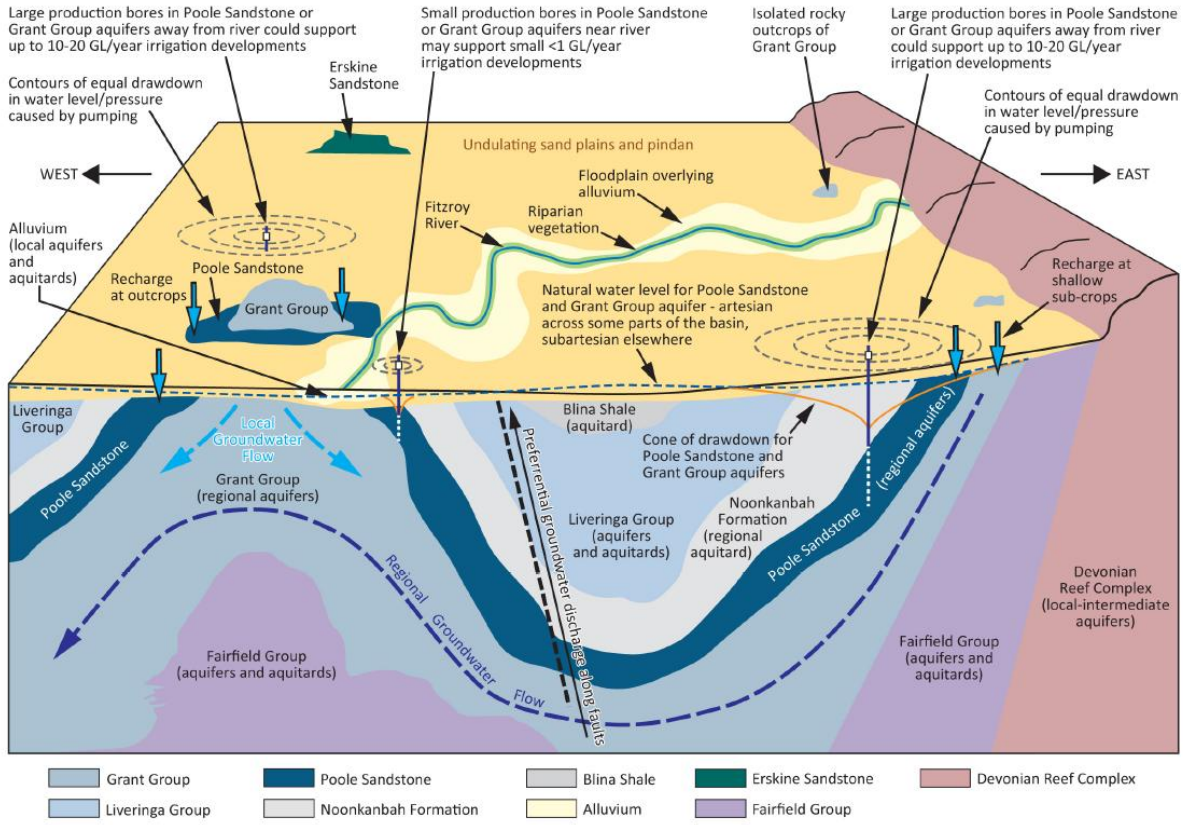

Figure 5: Conceptual hydrogeology of the Fitzroy Trough (Taylor et al. 2018)

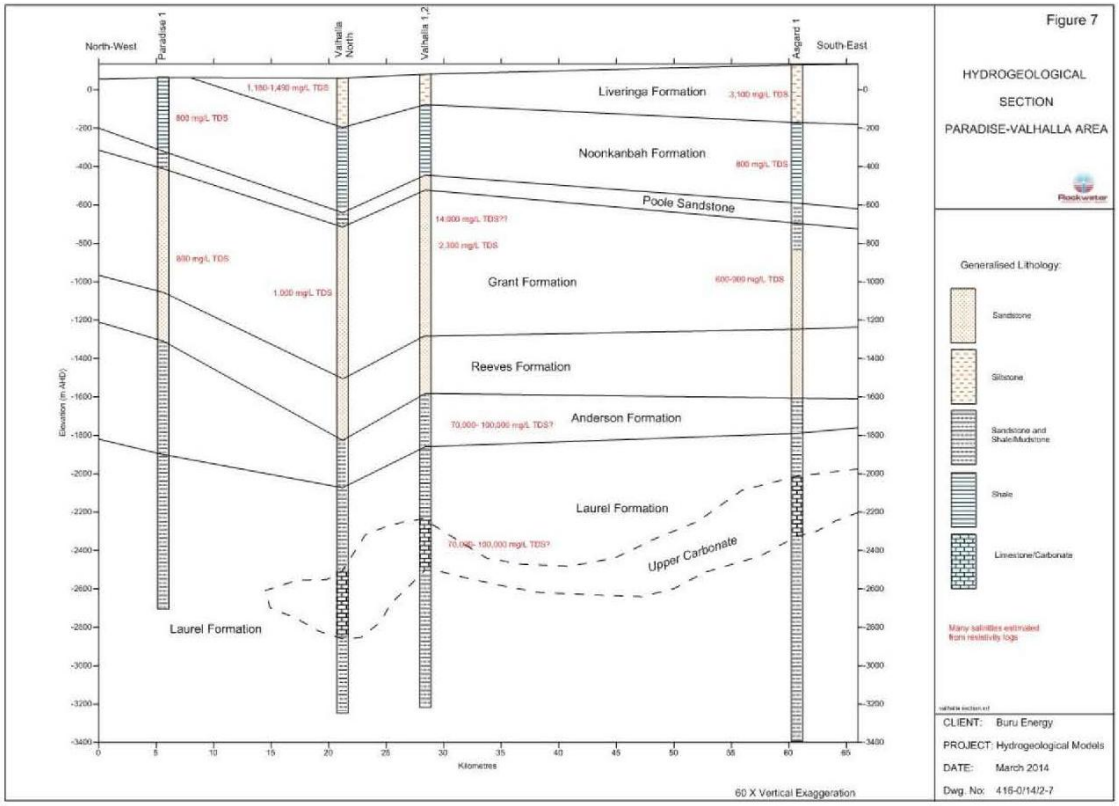

Figure 6: Inferred hydrogeological cross-section (Bennett Resources 2024)

Liveringa Aquifer

The Liveringa Aquifer is the surficial aquifer within the proposal area and consists of interbedded sandstones, siltstones and shales, varying in thickness across the region from 320 m to 900 m. Within the proposal area the aquifer has a thickness of up to approximately 300 m and varying salinity between 500 and 12,400 milligrams per litre (mg/L) total dissolved solids (TDS).

The Liveringa Aquifer is recharged through rainfall on outcrop areas. Hydrological assessments in the region found that water levels in the aquifer respond to high river flow events, suggesting the aquifer is recharged by floodwaters (DWER 2023). Groundwater within the Liveringa Aquifer flows in a westerly direction and is reported to discharge into the Fitzroy River, located approximately 20 km down-hydraulic gradient (i.e. to the west) of the development envelope. The flow velocity of groundwater in the Liveringa Aquifer within the proposal area is reportedly low, with groundwater estimated to take several thousand years to move from the development envelope to the Fitzroy River (Rockwater 2016).

As shown in Figure 6 the Liveringa Aquifer is underlain by the Noonkanbah Formation that is generally regarded as a regional aquitard (DWER 2023). The Noonkanbah Formation is predominantly comprised of mudstone and siltstone with some thin sandstone beds and exhibits very low hydraulic conductivity. The low hydraulic conductivity of the Noonkanbah Formation effectively separates the Liveringa aquifer from underlying formations, unless preferential pathways (such as large open faults) are present (DWER 2023).

Grant Poole Aquifer

The Poole Sandstone and the two sandstone dominated members of the Grant Group are lithologically similar and are regarded as forming a hydraulically connected regional aquifer referred to as the Grant Poole Aquifer (DWER 2023). The aquifer underlies the Noonkanbah aquitard and is the deepest and one of the major groundwater resources within the Canning Basin. The connected system is managed as a single aquifer for the purposes of groundwater licensing under the *Rights in Water and Irrigation Act 1914* (RiWI Act) (DWER 2023).

Within the proposal area the Grant Poole Aquifer is encountered at depths of approximately 500 to 600 mbgl, with an overall thickness of 600 to 800 m. The Grant Poole Aquifer is recharged where the formation outcrops at the surface or at shallow sub crops at locations to the east and west of the proposal area. No outcrops or shallow sub crops are known to occur within the development envelope (Bennett Resources 2024). The hydraulic head of the confined aquifer is high, with artesian groundwater pressures identified in the proposal area (DWER 2023).

Due to the overlying aquitard of the Noonkanbah Formation, groundwater flow between the Grant Poole Aquifer and the shallower Liveringa Aquifer is generally considered not to occur (DWER 2023). However, fault-induced preferential pathways have been inferred in the area to the south-east of Noonkanbah, associated with a set of north-south trending faults transecting the Fitzroy River (Harrington et al. 2011).

Groundwater flow in the Grant Poole Aquifer is from the east to west, potentially with some flow towards the Fitzroy River in the vicinity of the proposal area. Groundwater quality within the Grant Poole Aquifer is typically fresh and is considered a highly prospective resource.

Beneficial use of water

Environmental

The Fitzroy River, its floodplain and tributaries provide important habitat for a diverse array of ecological communities, flora and fauna. During long dry seasons, groundwater-fed river pools and wetlands in the region provide important ecological refuges.

Based on information available through the Bureau of Meteorology's Groundwater Dependent Ecosystems Atlas (2012), Mount Hardman Creek and the Fitzroy River to the south, are the only groundwater-dependent ecosystems (GDE) in the proposal area. As noted above, deep groundwater from the Grant Poole Aquifer is thought to discharge into the alluvial aquifer feeding the Fitzroy River near Noonkanbah. During the dry season, permanent pools along the Fitzroy River are potentially sustained by groundwater inflow from regional aquifers, including the Grant Pool Aquifer.

Cultural

Water and water places are integral to Traditional Owners' systems of knowledge and society. Water in the Fitzroy River catchment is of significant cultural value and has been documented in detail as part of water planning for the catchment (DWER 2023b). The EPA acknowledges that the Fitzroy River and its catchment hold profound cultural significance for Aboriginal communities throughout the region, who regard the river as a living ancestral being and a vital source of spiritual, cultural, and physical sustenance. Water in the catchment underpins traditional practices, kinship systems, and community well-being, with continued custodianship of land and water seen as essential to maintaining cultural identity and resilience (DWER 2023b).

Socioeconomic uses

The are no public drinking water source areas within or proximal to the development envelope. The nearest proclaimed areas are the Camballin Water Reserve and the Fitzroy Crossing Water Reserve, located approximately 60 km west and 51 km east of the development envelope respectively (Bennett Resources 2024). Both of these water reserves are associated with the regional Grant Poole Aquifer.

There are three known groundwater users in the proposal area abstracting from the Grant Poole Aquifer. These include the Yungngora Community at Noonkanbah, and the localities of Camballin and Fitzroy Crossing, where groundwater is used for potable purposes. There are also several groundwater abstraction licences (under the RiWI Act) for the Grant Poole Aquifer across the broader region (Bennett Resources 2024). The EPA notes that abstraction from the Grant Poole Aquifer typically occurs from the upper portion of the aquifer, with bores screened in the shallower upper Pool Sandstone Formation (e.g. the Yungngora Community bore).

In addition to licensed groundwater users, there are known to be unlicensed bores in the area primarily targeting the shallow Liveringa Aquifer for domestic and pastoral purposes (e.g. stock watering). The proponent identified 14 pastoral bores within or proximal to the development envelope. These bores are known to be used for stock water purposes only, with no reported potable or crop irrigation usage (Bennet Resources 2024).

Surface water flow in the proposal area, such as within the Fitzroy River or Mount Hardman Creek, is not known to be harvested for potable, agricultural or other socioeconomic uses. The State Government's policy position paper for water allocation planning in the Fitzroy states that the Fitzroy River or its tributaries will not be allowed to be dammed (Government of Western Australia 2023).

The Fitzroy River and its tributaries support a range of recreational uses, such as fishing and swimming, that are highly valued by local communities, Traditional Owners and visitors. These recreational uses also contribute to local tourism values and are dependent on the river's ecological health and natural flow regime being maintained.

2.1.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in the proponent's response to submissions document (Bennett Resources 2025). The risk of impacts to surface water and groundwater values, such as contamination of aquifers, underpins much of the public interest and concern relating to HFS. Public consultation on the proposal raised several concerns directly and indirectly related to inland waters, key issues included:

- the identification of, and assessment of potential impacts to GDEs and ephemeral wetlands
- the lack of site-specific surveys and baseline data to support the assessment of potential impacts to surface water
- the adequacy of baseline groundwater monitoring and the lack of contemporary hydrological investigations and the reliance on pre-existing reports (such as DWER (2023a))
- the adequacy of groundwater modelling, including aspects relating to aquifer connectivity and vertical groundwater flow
- the impacts of the proposal on water values in the context of climate change induced weather changes in the region
- the volume of groundwater required for the proposal, and potential impacts to other groundwater users
- the absence of a site-specific geomechanical risk assessment and potential impacts to groundwater aquifers from fracturing and faulting associated with HFS activities
- potential contamination of surface water and groundwater resulting from management of drilling fluids, flowback water and produced fluids
- cumulative impacts of the proposal on water values, including concerns associated with the potential future development of petroleum industry in the Canning Basin
- potential impacts to the Fitzroy River and the West Kimberley National Heritage Area.

The key issues raised during the public consultation on the proposal and how they have been considered in the assessment are described in the following sections.

2.1.5 Potential impacts from the proposal

The proposal has the potential to have significant direct and indirect impacts on inland waters from:

- groundwater drawdown resulting from groundwater abstraction for process water needs, including potential impacts to GDEs and other water users
- contamination of surficial aquifers due to leaks and spills of chemicals, fuel and/or wastewater at the well pad surface

- contamination of aquifers due to release of HFS fluids, drillings fluids, formation water resulting from well integrity failure
- contamination of deep aquifers from unplanned fracture heights and migration of saline formation water, hydrocarbons and/or HFS fluids between aquifers
- contamination of surface water due to overland migration of contaminants from the well pad surface, and/or from discharge of contaminated groundwater
- alteration of natural surface water flow regimes from construction of access tracks and wells pads.

The potential impacts listed above relating to groundwater drawdown and groundwater contamination also have the potential to indirectly impact stygofauna individuals and habitat.

2.1.6 Avoidance measures

The proponent has designed the proposal to avoid impacts to inland waters by:

- siting the proposal to avoid PDWSAs, including ensuring proposed wells are more than 2 km from proclaimed PDWSAs consistent with the separation distance recommended through the HFS Inquiry
- designing the disturbance footprint to avoid direct disturbance of identified surface water features, such as Mount Hardman Creek
- situating proposed wells such that the expected drawdown extent does not intersect with potential GDEs

2.1.7 Minimisation measures (including regulation by other DMAs)

The proponent has proposed the following measures to minimise impacts to inland waters:

- ensuring that a minimum 450 m separation distance is maintained between the upper extent of the HFS zone and the lowest extent of the Grant Poole Aquifer
- completing a site-specific geomechanical risk assessment following the drilling of, and prior to HFS, each petroleum well
- implementing an early warning system to detect geomechanical events
- implementing a well management plan to ensure each petroleum well is designed, constructed and managed to mitigate well integrity risks and is consistent with industry standards
- well integrity assessment
- undertake groundwater monitoring prior to, during and after HFS operations and, where required, implement management actions
- manage produced formation water, i.e. ‘flowback water’, in dual-lined engineered storage ponds constructed with leak detection systems and sufficient freeboard to reduce the risk of discharge to the environment

- hydrostratigraphically log each petroleum well during drilling and undertake geophysical interpretation of groundwater aquifers to validate site specific hydrogeological information prior to HFS
- use of 'low-toxicity' drilling mud systems for drilling the uppermost section of the petroleum wells that intersect aquifers
- monitoring and reporting of any loss of fluids during circulation[2]
- undertaking ecotoxicology testing of produced formation waters at each well site.

Rights in Water and Irrigation Act 1914

The proposal is located in a proclaimed groundwater area under the RiWI Act, the Canning-Kimberley Groundwater Area. The proponent would be required to obtain a licence to take water (section 5C) that would include conditions intended to mitigate impacts of taking water and describe how the water resource must be monitoring and managed. One of the primary objectives of this legislation is the management of water resources, including regulation of activities which are detrimental to the protection of the water resource ecosystems and the environment in which the water resource is situated.

An Operating Strategy would be needed to supplement the conditions of the RiWI Act licence. The Operating Strategy would contain monitoring and reporting requirements, and the proponent would need to verify the results against a hydrogeological model to ensure the results align with predictions. If the monitoring shows that the proposal is having unintended impacts on the aquifer, the environment, or other users, or that the impacts of taking the water are significantly different to those originally predicted, DWER may require the Operating Strategy to be amended (DWER 2020).

Part V, Division 3 of the EP Act

Some oil and gas activities require a works approval and/or licence under Part V of the EP Act. Premises on which more than 5,000 tonnes per year of crude oil, natural gas or condensate is extracted and treated or separated to produce stabilised crude oil, purified natural gas or liquefied hydrocarbon gases are 'prescribed premises' under the Environmental Protection Regulations 1987.

The EP Act requires a person or occupier to hold a works approval in order to carry out any works that cause a premise to become a prescribed premise. A licence is needed to authorise any emissions from a prescribed premise. Emissions include noise, odour, electromagnetic radiation and discharge of waste. Waste includes liquid, solid, gaseous and radioactive matter that is discharged to the environment.

Petroleum and Geothermal Energy Resources Act 1967

The *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) governs the onshore petroleum and geothermal exploration and production industry, including

[2] 'well circulation loss' or 'lost circulation' occurs when there is a loss of drilling fluid into the surrounding formation through fractures, faults or porous zones

matters relating to the regulation of environmental and safety aspects. The PGER Act is supported by a suite of regulations that govern the technical, environmental and administrative aspects of the onshore petroleum industry, including exploration and appraisal.

PGER (Environment) Regulations 2012

The PGER (Environment) Regulations regulate environmental impacts of onshore petroleum activities through an objective-based framework by way of an Environment Plan (EP) that must be approved by DMPE prior to the activity commencing. The EP must demonstrate that all environmental risks and impacts have been reduced and will be mitigated through the 'As Low As Reasonably Practicable' (ALARP) management principle. The EP must also include appropriate monitoring and management measures to mitigate the identified risks and impacts. Petroleum activities, including HFS, cannot proceed unless the EP specifically addresses the potential risks and impacts of HFS, such as groundwater contamination, induced seismicity, chemical handling and water interactions. The regulator, DMPE, reviews the technical and environmental adequacy of the EP in consultation with other agencies as required (DEMIRS 2024).

PGER (Resource Management and Administration) Regulations 2015

The PGER (Resource Management and Administration) Regulations regulate the technical integrity, well construction and operations aspects of petroleum exploration. A key provision of the regulations is the requirement for an approved Well Management Plan (WMP) prior to conducting the activity, such as drilling of an exploration well. The WMP must detail how the operator will manage well integrity through the life-cycle of the well, including:

- design and construction of the well, including casing and cementing design, and pressure containment systems
- operation control of the well, including monitoring
- well integrity management, including design and monitoring of barriers, details of maintenance and inspection
- suspension or abandonment, including criteria and procedures for well suspension or permanent abandonment
- monitoring programs and reporting of incidents (DEMIRS 2016).

The proponent must adhere to an approved WMP, failure to comply with a requirement in the plan can result in directions, withdrawal of approval for the WMP, prosecution or cancellation of the petroleum title. PGER (Resource Management and Administration) Regulations also provide for a general offence for a titleholder who fails to control an identified well integrity hazard or an existing risk to the well that has significantly increased.

Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022

The regulations, under the *Work Health and Safety Act 2020,* require a Safety Case to demonstrate how an operator will manage health and safety risks associated with petroleum operations such as well drilling and HFS. A Safety Case is primarily for the management of risks to the safety and health of workers involved in the activity, however the Safety Case requirements indirectly contribute to the mitigation of potential impacts to the environment, such as through:

- well integrity and barrier management - demonstration that well design and construction will prevent unplanned releases, such as gas or HFS fluids into aquifers or the environment
- blowout prevention and pressure control - mitigation of large scale releases such as spills of fluids or cold venting[3] of gas
- emergency response systems – spill containment and management.

2.1.8 Rehabilitation measures

The proponent has committed to progressively rehabilitate cleared areas that are not required to support he maintenance of infrastructure at the completion of drilling and well testing. The proponent has advised that rehabilitation criteria will be developed through the Environment Plan required under the PGER (Environment) Regulations. No specific rehabilitation measures have been specified by the proponent for inland waters.

2.1.9 Assessment of impacts to environmental values

The EPA considered that the key environmental values for inland waters that have the potential to be impacted by the proposal are the Fitzroy River and its tributaries and groundwater resources. The EPA recognises the significant ecological, social and cultural values of the Fitzroy River, including the relevance of the specific values of the river system to the listing of the WKNHA. Many of the potential impacts to inland waters are interconnected, whereby a potential impact to groundwater may have a resultant impact to surface water and vice versa.

Impacts to these key environmental values of the Fitzroy River and its tributaries and groundwater resources are considered below in the context of potential impact pathways associated with the proposal.

Direct impacts to surface waters

The EPA notes that no prominent or ecologically significant surface water features have been identified within the proposed disturbance footprint. The disturbance footprint has been designed to avoid direct impacts to surface waters, such as from river/creek crossings or clearing of riparian vegetation. However, the proposal area is located within the broader Fitzroy River catchment, and Mount Hardman Creek, a

[3] Cold venting is the discharge of gas, typically methane, from processing or pressure control equipment into the atmosphere without being ignited.

tributary of the Fitzroy River, is located within the development envelope, and is approximately 1.5 km from the nearest proposed well pad (Muspelheim).

The EPA notes that whilst the surface disturbance footprint avoids surface water features, the horizontally drilled sections of the exploration wells are proposed to extend between 3000 and 5000 m laterally from the proposed well sites. It is therefore possible, subject to the orientation of the horizontally drilled component, that a portion of the horizontal wells may pass beneath the location of surface water values, such as Mount Hardman Creek, albeit at substantial depth (>2500 m below the surface). The EPA has considered the risk of contamination of overlying aquifers from the deep migration of contaminants, e.g. such as from induced fractures and hydrogeological faults, in the sections below.

Spills and leaks

The potential for surface water contamination as a result of the spills of chemicals, HFS fluids, flow-back water and wastewater was a prominent issue raised in public submissions. As noted above, the nearest well site 'Muspelheim' is located approximately 1.5 km from Mount Hardman Creek. As such, the likelihood of a spill or leak event resulting in a significant impact to surface water quality is unlikely. The EPA has also considered the application of mitigation measures through the Environment Plan and Well Management Plan that are required to be submitted for approval to DMPE under the PGER Act prior to implementation. Further discussion regarding the mitigation of potential impacts associated with spills and leaks is provided below in relation to potential impacts to groundwater from spill and leaks.

Alteration of flow regimes and catchment dynamics

The EPA considered that impacts to surface waters from the alteration of natural surface water regimes are unlikely to be material given the scale and nature of the proposed access tracks and well pad sites. The EPA notes that the proponent has designed the disturbance footprint to avoid Mount Hardman Creek and other low-lying areas prone to inundation during flood events such that significant diversion of surface water flows will not be required. The EPA notes that the 112 ha disturbance footprint represents a very small percentage (0.001%) of modification of the expansive Fitzroy River catchment area of approximately 94,000 square kilometres. The proponent has committed to implementing standard surface water management controls, such as culverts and turnouts, through the design and construction of the access roads and well pads such that erosion and alteration to nature flows is expected to be minimal. The EPA expects that these surface management controls will be detailed in the EP required under the PGER (Environment) Regulations.

Groundwater drawdown

Several public submissions identified concerns relating to the abstraction of groundwater for the proposal and potential indirect impacts to surface waters and associated GDEs and riparian vegetation, particularly associated with Mount Hardman Creek. The proposal will involve the abstraction of up to 100 ML of groundwater from the Liveringa Aquifer for each of the 20 exploration wells proposed to be drilled and stimulated across 10 well pad locations. This represents a total

abstraction volume of 2 gigalitres (GL) over the 7-year proposal life, or less than 0.3 GL per annum on average. The EPA notes this is a small volume in the context of the total groundwater allocation (up to 108.5 GL per annum) for the region foreshadowed in the State Government's Policy Position Paper on water allocation in the Fitzroy catchment area (Government of Western Australia 2023). The EPA notes that the duration of groundwater abstraction is comparatively short, approximately 6 months for each exploration well, in comparison to other types of proposals (e.g. mine dewatering, irrigated agriculture) where groundwater extraction occurs over a long duration, resulting in more pronounced and longer-term groundwater drawdown.

Groundwater modelling, to predict the magnitude and extent of groundwater drawdown, was completed by the proponent in multiple iterations informed by DWER review and utilising empirical groundwater abstraction data collected during the 2015 HFS program within the development envelope. Revised modelling (Intera 2024) examined an unrealistic worst-case scenario where all 10 abstraction wells operated continuously for a period of 6 months. This modelling predicted a potential drawdown of 0.2 m within 400 m of each production bore. Given the distance between the production bores, cumulative effects of drawdown were predicted to be negligible, even if abstraction was occurring from every bore simultaneously (Figure 7).

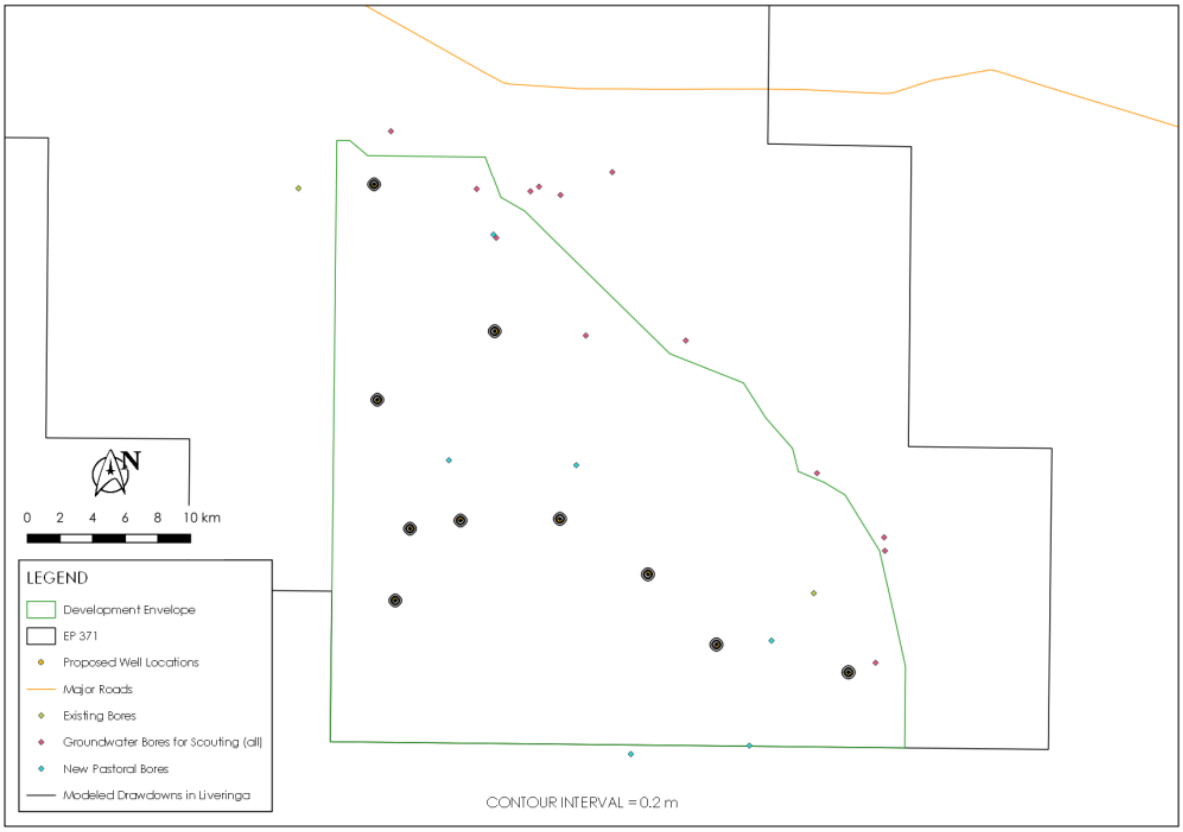

Figure 7: Modelled groundwater (Liveringa) drawdown extent after 6 months of abstraction and pastoral bore locations (Bennett Resources 2024)

A further scenario was modelled to predict drawdown resulting from the operation of a single production bore at the Muspelheim wellsite, situated closest to Mount Hardman Creek. This predicted a 0.1 m drawdown at 400 m from the production bore, reducing to 0.001 m (1 millimetre) at a distance of 700 m (Intera 2024). The

EPA considers this to be a more realistic scenario given that appreciable volumes of water are only required to support the HFS element of the proposal and will occur sequentially at a single well pad.

Based on the drawdown modelling presented, the magnitude of drawdown is expected to be negligible at distances greater than 700 m from each well pad. As shown in Figure 8 below, there are no prominent or ecologically significant surface water features within 700 m of each well pad. The EPA therefore considers that significant impacts surface waters, including Mount Hardman Creek, are unlikely to occur.

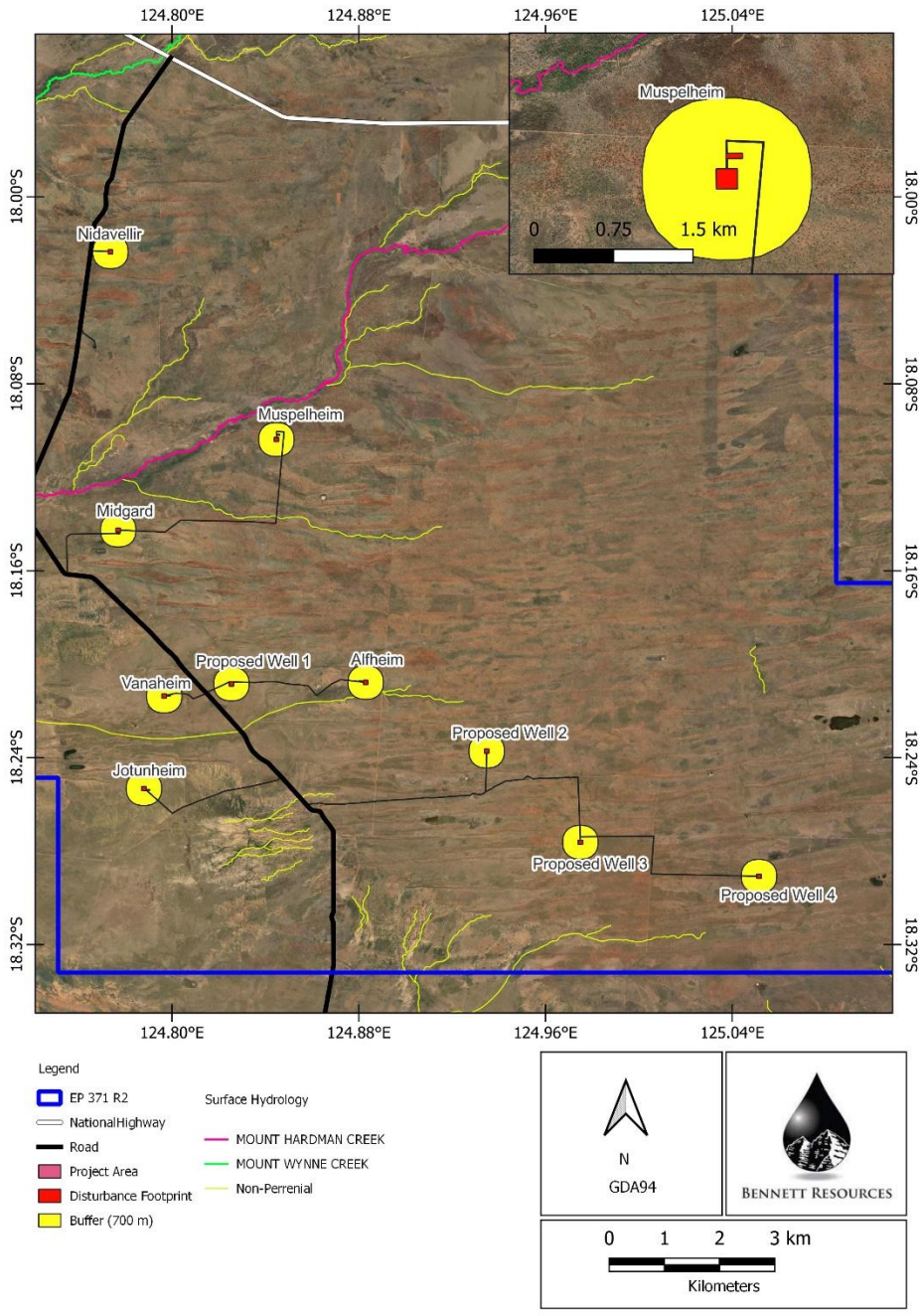

Figure 8: Modelled 700 m groundwater (Liveringa) drawdown extent (buffer) relative to non-perennial surface water features (Bennett Resources 2024)

The EPA notes that GDE mapping in the Fitzroy River area by DWER (2023c) indicates that a potential aquatic GDE is located in close proximity to the Muspelheim well pad and within the extent of modelled groundwater drawdown. The mapped GDE is categorised as an area of seasonal inundation with a low potential to be groundwater dependent. The EPA considers that groundwater drawdown from the Muspelheim well pad may interact with this area, but given the low magnitude and duration of drawdown the impacts to potential GDEs is unlikely to be significant.

Furthermore, the predicted lateral extent of groundwater drawdown, is not expected to extend to adversely impact other groundwater users in the area, with no known pastoral, or other bores, within 700 m of the proposed well sites. It is noted that the proponent has committed to lock the location of the well sites within the development envelope as shown in Figure 1.

The EPA also considers that potential impacts to GDEs and existing bore users from drawdown will be further considered and mitigated through the licensing process under the RiWI Act. As noted in section 2.1.7, the proponent will be required to obtain[4] a 5C licence under the RiWI Act for the abstraction of groundwater required for implementation. The RiWI Act licence is expected to require the proponent to develop and implement an Operating Strategy to document how the abstraction of groundwater can be monitoring and managed such that there is no adverse impact to GDEs or other water users (e.g. pastoral bores) from drawdown.

The EPA has recommended conditions (A1 limits and extents; B1-1 outcomes for inland waters, including for potential groundwater-dependent vegetation near the Muspelheim well pad) to ensure that groundwater drawdown is monitored and managed during implementation such that the outcome for GDEs is consistent the EPA's factor objective for inland waters.

The EPA notes that groundwater drawdown may also result in potential impacts to stygofauna through loss of habitat and individuals. Noting the considerations above, and notwithstanding the limited knowledge of site-specific stygofauna biological diversity, the EPA considers that potential impacts to stygofauna are not likely to be significant. Subterranean fauna is not considered to be a key environmental factor for the EPA's assessment and is discussed in Appendix E – 'Other environmental factors'.

Impacts to groundwater quality

The EPA notes that much of the public interest and concerns relating to HFS activities are associated with perceived risk of groundwater contamination and subsequent impacts to water resources and environmental values such as rivers that receive groundwater discharge. This was reflected in the public submissions received on the proposal during the 8-week public review period.

[4] The proponent holds an existing licence to take water from within the proposal area under the RiWI Act associated with maintenance of existing infrastructure.

Understanding the risks of HFS on inland waters was a major component of the HFS Inquiry. The HFS Inquiry found that the risk to water resources through below-ground pathways for contaminants is generally low, with a greater risk arising from surface spills of chemicals or wastewater.

The assessment of potential impacts to groundwater quality associated with the proposal is detailed below through consideration of the key pathways of concern for contaminants to enter groundwater.

The EPA notes that groundwater and surface water interactions occur in the area and hence contamination of groundwater has the potential to also give rise to impacts to surface water, such as through the discharge of groundwater into the Fitzroy River and Mount Hardman Creek during dry season conditions. The EPA's assessment of potential impacts to groundwater quality and potential subsequent impacts to surface water quality has considered the cultural, ecological and socioeconomic values of the surface water features in the area, including the Fitzroy River, as described in section 2.1.3. This has included consideration for the significance of the Fitzroy River and its tributaries in supporting regionally important habitat for threatened and endemic fauna, such as the largetooth sawfish (*Pristis pristis*).

Unplanned fracture heights

HFS involves the pumping of fluids under high pressure into the subsurface to create fractures within petroleum-bearing rock formations. Several submissions raised concerns about the potential for fractures propagated during HFS to create a pathway for HFS fluid, methane gas and or saline groundwater to migrate and adversely impact the groundwater quality of overlying fresh aquifers, in this case the Liveringa and Grant Poole Aquifers.

The EPA notes that the propagation of factures was a key impact pathway considered in the HFS Inquiry, which found: *The risk of contamination of shallow fresh water aquifers by saline groundwater through hydraulically stimulated fractures is low, because the likelihood of fractures propagating and creating pathways which would contaminate overlying aquifers is very low* (Finding 21).

The proposal will involve HFS within the target Laurel Formation which is present at a depth of approximately 2000 mbgl within the proposal area. Proposed wells will be drilled to a vertical depth of approximately 2500 m before extending horizontally within the Laurel Formation a further 3000 to 5000 m. The target formation is overlain by the Anderson Formation, comprised of thick deposits of sandstone, siltstone and shale. This formation is present within the proposal area at a thickness of between 180 to 280 m and is considered to act as a confining layer limiting vertical groundwater movement between the saline water of the Laurel Formation and the comparatively fresh water of the Grant Pool Aquifer (Rockwater 2016). The proximity of the proposed HFS relative to recognised geological formations and aquifers is illustrated in Figure 9.

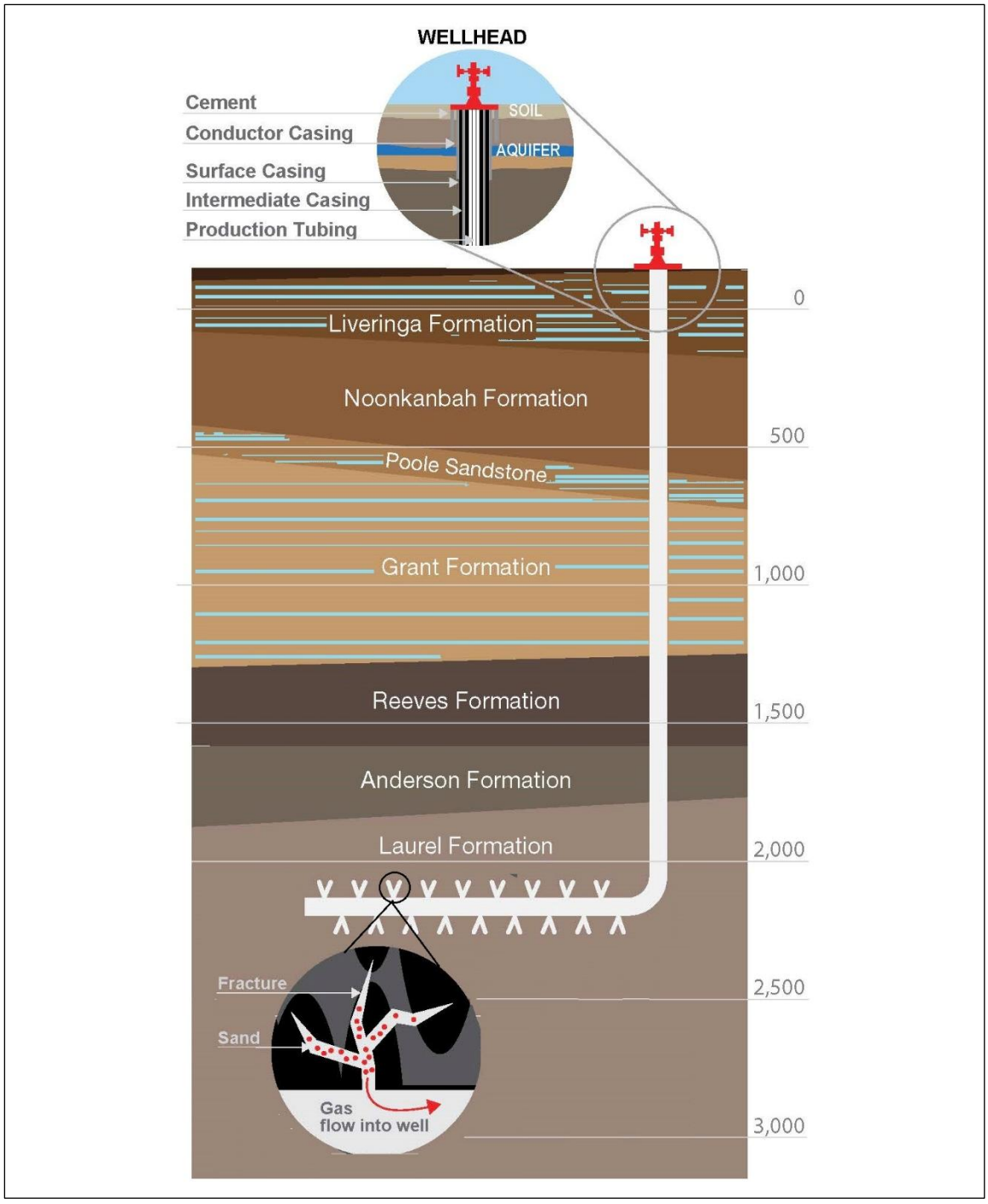

Figure 9: Stylised depiction of proposed horizontal drilling and HFS zone relative to geological formations and aquifers (Stylised and inferred from Bennett Resources 2024)

The proponent has advised that the planned vertical (upwards and downwards) extent of the HFS zone is approximately 150 m and has committed to maintaining a vertical separation between the maximum height of the HFS zone and the base of the deepest viable freshwater aquifer (Bennett Resources 2025a). The Poole Sandstone formation, i.e. the upper portion of the Grant Pool Aquifer, is the deepest aquifer unit currently utilised in the area and is regarded by the proponent as the

deepest viable freshwater aquifer. The EPA recognises that in the proposal area the Grant Poole Aquifer is the deepest recognised groundwater resource, and is comprised of the Pool Sandstone formation and the two hydraulically connected sandstone members of the underlying Grant Group. Additionally, it is noted that the underlying Reeves Formation hosts a sandstone aquifer that is thought to be hydraulically connected to the Grant Poole Aquifer. The Reeves Formation aquifer is not regarded as a prospective water resource. However, given the likely hydraulic connection with the Grant Poole Aquifer, the EPA has considered the potential risk of impact to groundwater quality of the Grant Poole Aquifer, including the shallow Poole Sandstone unit, if impact to the hydraulically connected Reeves Formation occurred, such as due to a unforseen fracturing event.

The EPA notes that the proponent, in its Response to Submissions, has committed to maintaining a vertical separation distance of at least 450 m between the upper extent of the HFS zone and the base of the Grant Formation (Bennett Resources 2025a). The EPA recognises that the effective separation distance between the base of the Poole Sandstone Formation, from which water is currently abstracted for drinking purposes, will be at least 600 m. This is consistent with the broadly adopted vertical separation distance to drinking water aquifers based on an analysis of several thousand shale gas HFS operations completed in the United States of America that found that the maximum reported height of an upward propagating hydraulic fracture was 588 m (Davies et al 2012).

The EPA notes that data will be collected during and immediately after vertical drilling of the petroleum wells that will provide a detailed and site-specific geological and hydrogeological understanding of the subsurface to inform the design of the HFS program such that separation distances will be achieved.

To ensure that the risk of impact to overlying aquifers from unplanned fracture heights is mitigated, the EPA has recommended condition B1-1(3) requiring the proponent to ensure that HFS-induced fractures remain within the Laurel Formation. The EPA considers this to be readily achievable through appropriate HFS design informed by site-specific data, as discussed below. It is also noted that the 2015 HFS program in the proposal area maintained all fractures within the Laurel Formation, and produced average fracture heights (total upward and downward fractures) of 63 m at Asgard 1 and 151.5 m at Valhalla North 1 (Buru Energy 2018).

The EPA also notes that the proponent has committed to undertaking micro-seismic monitoring prior to, during and post HFS activities to monitor geomechanical events. This monitoring will provide real-time data on the size and orientation of induced fractures and will be capable of detecting the occurrence of any fractures beyond the intended HFS zone (Bennett Resources 2022). The proponent has also committed to developing an early warning system, based on the micro-seismic monitoring, to ensure geomechanical integrity of subsurface formations can be maintained. The EPA recognises that this is consistent with the HFS Inquiry recommendations (Recommendation 4). The EPA notes that micro-seismic monitoring during the early stages of the proposal will also provide important data to better design and implement subsequent stages and refining fracture modelling. The EPA has recommended a condition (condition B1-2) requiring the proponent to develop a micro-seismic monitoring program and early warning system, and for these to be

incorporated into the Environment Plan or Well Management Plan submitted to DMPE for approval under the PGER Act.

Hydrogeological faults

In addition to the creation of new fractures during HFS, the EPA notes that existing faults and fractures in the subsurface may act as preferential pathways for the movement of contaminants into shallow freshwater aquifers. Concerns were raised in public submissions about the potential for the HFS process to reactivate or exacerbate existing hydrogeological conduits and allow migration of contaminants from deep formations (e.g. saline groundwater, HFS chemicals and hydrocarbons) into shallow aquifers.

The HFS Inquiry found that the risk of contamination of shallow fresh water aquifers by saline groundwater through hydrogeological faults is moderate, however where activities are undertaken such that faults are avoided, the risk is considered to be low. This is based on the likelihood that the presence of these permeable faults to propagate and create pathways which could contaminate overlying aquifers is rare (Finding 22). Notwithstanding, it was recommended that all HFS operations should be preceded by a comprehensive geomechanical risk analysis (Recommendation 7).

The proponent completed a preliminary geotechnical (or geomechanical) risk analysis based on existing regional data and specific data collected during previous petroleum exploration activities (Bennett Resources 2022). Public submissions raised concerns over the preliminary nature of the geomechanical risk analysis and the lack of local data to inform the risk analysis. The EPA recognises that geomechanical risk analysis in petroleum activities is an iterative process that provides for the refinement of the risk assessment as further data become available. The proponent has committed to updating the geomechanical risk analysis based on local site-specific geological data collected during drilling of the exploration wells.

Based on currently available information and data, the EPA notes that the geological setting and stress conditions make it unlikely that hydraulic fractures or fluids will migrate upward through faults into aquifers (Bennett Resources 2024a). The EPA considers that there is sufficient information available regarding the geological setting to inform its assessment of the proposal and the risk of impacts associated with existing faults.

The EPA has recommended a condition (condition B1-2) requiring the proponent to develop a procedure for the completion of geomechanical risk assessment for each well, and for this procedure to be incorporated and for these to be incorporated into the Environment Plan or Well Management Plan submitted to DMPE for approval under the PGER Act.

The EPA notes the specific concerns raised during the public review relating to the migration of geogenic methane from deep formations into shallow formations and aquifers. One submission included an interpretation of gas isotopic data reported by Geoscience Australia (Edwards et al 2021). The data were interpreted as providing evidence of existing gas seepage from deep formations of the Canning Basin to the surface at the location of the ‘Mount Wynne Creek gas seep’, therefore

demonstrating a likelihood of connection between the shale gas resource and surface formations.

The EPA understands that the natural gas seep associated with Mount Wynne Creek is located approximately 30 km to the west of the development envelope, and approximately 32 km from the nearest well site. The proponent advised that subsurface geology is variable across the Canning Basin and conditions that may result in gas seepage at Mount Wynne Creek do not necessarily reflect the conditions within the proposal area. The EPA notes that, as shown in Figure 5, the regional hydrogeology suggests that to the west of the development envelope, the confining layer of the Noonkanbah Formation is absent, and the geology of the Grant Poole Aquifer outcrops on the surface. It is therefore plausible that in these areas, near the confluence of Mount Wynne Creek and the Fitzroy River, the subsurface geology provides less impediments to the migration of fluids between the deep hydrocarbon-bearing formations and the surface.

Substantial geological survey has been completed within the development envelope that enables an understanding of the subsurface geology and the potential presence of significant faults that may act as conduits between the deep Laurel Formation and overlying shallow formations and recognised aquifers. The EPA has considered this information, along with the additional regulatory controls that will be administered through the PGER Act in relation to collecting additional site-specific geomechanical and hydrogeological information as part of implementation of the proposal. Having regard to this information and statutory processes, the EPA advises that risks associated with the migration of fluids from the Laurel information into overlying formations through faults can be managed such that the environmental outcome for inland waters is consistent with the EPA's factor objective.

Well integrity failure

Well integrity is defined as "*maintaining the full control of fluids within a well at all times by employing and maintaining one or more well barriers to prevent unintended fluid movement between formations with different pressure regimes or loss of containment to the environment*" (International Organization for Standardization 2017). The risk of groundwater contamination arising from well integrity failure is central to much of the public concerns associated with petroleum exploration drilling and HFS activities and was raised in several public submissions on the proposal.

The EPA notes that many of the well integrity risks associated with the proposal are the same as those encountered in conventional oil and gas exploration and production wells (i.e. that do not involve HFS). The HFS Inquiry considered matters around well integrity in detail and found that the risk of contamination of shallow fresh water aquifers by saline groundwater and chemicals used in hydraulic fracture stimulation from well integrity failure is low, based on the likelihood of well failure occurring such that aquifers are interconnected in the study area being determined to be rare (Finding 25). Further, the HFS Inquiry found that the global best practice standards for the design, construction and operation of oil and gas wells, including those relating to hydraulic fracture stimulation, are generally sufficient if competently executed and complied with (Finding 76). Notwithstanding, the HFS Inquiry recommended that to further ensure well integrity and thus environmental protection

and public safety, well design, construction and testing should be assessed by an independent, certified expert well examiner, reporting to the regulator as a required part of commissioning, licensing and decommissioning (Recommendation 33).

The proponent has committed to undertaking a risk assessment for each proposed well throughout the well lifecycle to ensure that well integrity is maintained. The risk assessment will be detailed in the WMP required under the PGER (Resource Management and Administration) Regulations and will involve, amongst other things, identification of integrity risks, including casing failure, and identification of suitable preventative controls, as well as recovery controls to be implemented in the event of a failure. The EPA notes that the proponent has committed to ensuring that well integrity is assessed by an independent and certified well examiner approved by DMPE (Bennett Resources 2024).

The EPA notes that well design and construction incorporates a system of barriers to prevent the uncontrolled flow of fluids within or out of the well and that for well integrity failure to occur all of these barriers would need to fail. The proponent has committed to comply with relevant Australian and International standards relevant to well construction and well integrity (Bennett Resources 2024).

The EPA considers that potential impacts to inland waters associated with well integrity failure can be appropriately managed through existing statutory decision - making processes under the PGER (Resource Management and Administration) Regulations. Further, noting the recommendations of the HFS Inquiry, the EPA has recommended a condition (condition B1-2) requiring the proponent to develop a program for well design, construction and testing to be assessed by an independent certified well examiner, and for this program to be incorporated in the WMP submitted to DMPE for approval under the PGER (Resource Management and Administration) Regulations.

Surface spills and leaks

The potential for groundwater and surface water contamination as a result of the spills of chemicals, HFS fluids, flow-back water and wastewater was another prominent issue raised in public submissions. The proposal involves the handling and management of several fluids at the surface which, if released to the environment through spills or containment failures, has the potential to cause contamination of the unconfined Liveringa Aquifer depending on the scale and nature of the spill. The key fluids of concern and related potential release pathways include:

- diesel fuel from storage tanks or during refueling activities
- hydrocarbons (hydraulic oils etc) and chemicals from storage and handling at the well site
- HFS fluid during HFS activities due to a leak from pressurised lines
- formation hydrocarbons and formation water from a loss of well control during drilling
- flow back water during well clean up and well testing.

The HFS Inquiry found that the risk of groundwater contamination from surface spills is moderate, noting that a review of available spill data indicated that spills do occasionally happen (Finding 28), albeit typically of small volumes. The HFS Inquiry noted that the consequence was minor on the basis of generally low groundwater flows, depth to water table, and attenuation of contaminants in the subsurface.

The EPA notes that spill management measures, including bunding, waste management, and spill response and cleanup protocols are routine and included in Environment Plans required under the PGER (Environment) Regulations.

The HFS Inquiry recommended, under the precautionary principle, that a 2000 m separation distance be maintained between HFS activities and bores used for public drinking water supply (Recommendation 9). The EPA notes that the proposal complies with this separation distance, given the nearest proclaimed water reserves are more than 50 km from the development envelope, and the nearest known groundwater bore used for potable community supply (Noonkanbah) is more than 17 km from the development envelope.

The EPA notes that in the proposal area the superficial Liveringa Aquifer is present at depths of approximately 20 to 30 m below ground level. Baseline soil sampling undertaken by the proponent, although across a limited spatial area, found that the surface soil profile is comprised of silty clayey sands to depths of approximately 2 m below ground level with increased clay content at depth (Gemec 2023). The EPA notes that clay-based soil profiles typically inhibit the rapid migration of contaminants. In addition, based on currently available regional hydrogeological information, the groundwater velocity in the proposal area is predicted to be in the order of less than 5 m per year (Rockwater 2016).

The EPA notes that the PGER (Environment) Regulations require an Oil Spill Contingency Plan (OSCP) which is required to outline spill scenarios and risk assessment, reporting obligations, and response strategies, amongst other things, to ensure that an operator is fully prepared to respond quickly, effectively, and safely to any unplanned release of petroleum products such that potential impacts to the environment, people and property are minimised (Department of Mines and Petroleum 2016).

The EPA considers that minor spills and discharges of potential contaminants at the surface, particularly at the well site, may occur during operations, but based on the soil characteristics, the depth to the water table, expected groundwater velocity and the mitigation measures applied through the PGER (Environment) Regulations, such incidents are unlikely to result in groundwater contamination of any significance.

Management of wastewater, including flowback water

The risk of impacts arising from the management of wastewater at the well site surface, particularly the volume and quality of wastewater returned to the surface during and after HFS activities, was a key concern raised in public submissions. At the completion of HFS activities HFS fluids, along with produced formation water, will flow back to the surface and require management and disposal. Flowback fluids

initially consist primarily of the HFS fluids, but over time the fluid composition transitions to consisting entirely of formation water[5].

The EPA acknowledges that the chemical composition of HFS fluids has and continues to a major source of community concern. The HFS fluids for the proposal will consist of approximately 98% water, with the balance being chemical additives. The proponent has provided a chemical inventory, including the material safety data sheets (MSDS) for the chemicals to be used (appendix A of the environmental review document). The proponent has advised that the HFS fluid system proposed to be used (Halliburton CleanStim) was subject to ecotoxicity testing as part of Buru Energy's 2015 HFS program[6] in the area and found to be of low toxicity to aquatic organisms (Buru Energy 2018).

Formation water from gas-bearing shales is typically very saline, and contains geogenic chemicals such as metals, hydrocarbons, organic compounds and Naturally Occurring Radioactive Material (NORM). Formation water from the Laurel Formation is highly saline, with salinity values, represented as total dissolved solids' ranging between 40,000 and 60,000 milligrams per litre (mg/L), as characterised through sampling and analyses of water produced during Buru Energy's prior exploration activities within the development envelope. Based on the information provided (refer to Table 5-30 of the environmental review document) the concentrations of metals and metalloids in the formation water are low and unlikely to pose a significant risk of groundwater or surface water contamination if released into the environment. However, the EPA recognises that the concentrations of potential contaminants, such as metals, may increase over time due to the effects of evapoconcentration.

Testing also found that radionuclides, such as Radium-228 and Radium-226, are likely to be present in formation water at elevated concentrations. Some individual raw flowback samples exceeded annual dosage criteria relevant to human health under a drinking water scenario. However, the EPA recognises that this exposure scenario is based on a person consuming 2 L of raw flowback water per day over the course of a year (National Health and Medical Research Council & Natural Resource Management Ministerial Council 2011). It is further noted that 'composite' samples from the flowback containment ponds did not return radionuclide concentrations above the relevant drinking water criteria (Buru Energy 2018).

Whilst not tested as part of the 2015 HFS program, the EPA notes that flowback water is also expected to contain appreciable levels of hydrocarbons such as monocyclic aromatic hydrocarbons[7], phthalates and polycyclic aromatic hydrocarbons originating from the hydrocarbon-bearing target formation.

Having regard to the above, the EPA considers that flowback water is not an extremely hazardous or toxic material that would be expected to result in significant

[5] Formation water refers to the naturally occurring water found within the pore spaces of subsurface rock formations,

[6] Noted that Halliburton CleanStim was one of two fluid systems subject to ecotoxicity testing but was not selected for use in the 2015 HFS program

[7] A class of organic compounds that consist of a single aromatic ring (typically a six-carbon benzene ring) and includes benzene, toluene, ethylbenzene and xylenes (referred to as BTEX).

adverse impacts to the environment if it were released. The EPA considers that at a minimum flowback water presents a known risk associated with the high levels of salinity, which if released into the environment would be expected to adversely impact exposed vegetation. However, the EPA recognises that there remains uncertainty on the actual composition and toxicity of flowback water that will be produced during operations. In recognition of this uncertainty, and noting the elevated salinity, along with elevated levels of radionuclides and geogenic hydrocarbons, it is appropriate that cautionary mitigation measures are adopted to ensure that flowback water is mitigated from entering the environment.

The EPA notes that the HFS Inquiry found that the risk of contamination of near surface aquifers from management of wastes, including flowback water and formation water is low, based on existing regulatory requirements and the containment of potentially hazardous fluids in lined storage ponds (Finding 30).

The proponent's water balance (see section 2.4.5 of the environmental review document) assumes up to 57 ML of flowback water will be produced per exploration well, based on a 70% recovery, which is noted to be higher than that typically recovered during HFS (Zhang and Hascakir 2021), but lower than that recorded during the 2015 HFS program at Valhalla North 1 (78%) (Buru Energy 2018). Flowback water is proposed to be managed and disposed via evaporation containment ponds to be constructed on the well site. The proponent has committed to construct lined ponds designed to maintain a minimum 500 millimeter (mm) freeboard to prevent unintended overflow during high rainfall events.

Public submissions raised concerns over the potential overtopping of the ponds during high rainfall events and indicated that such events had occurred previously in the region. Detailed design of the ponds has not been completed; however the proponent has provided indicative design calculations (see Table 5-32 of the environmental review document) demonstrating the allowances for rainfall contingencies and freeboard in the pond volume requirements. This includes incorporating additional volume in the pond design to account for a 90th percentile wet season as well as a 1 in 100-year storm event, whilst still maintaining a minimum 500 mmm freeboard. The EPA advises that the risk of impacts to inland waters, including groundwater and surface water, from ponds overtopping or spilling during high rainfall events is low providing that the ponds are appropriately designed and constructed. The EPA advises that risks associated with wastewater management could be further reduced through the adoption of a fully closed or a 'closed-open' system where the containment pond is covered or closed during the wet season when high intensity rainfall events are expected to occur, and then opened during the dry season to facilitate evaporative loss. The EPA notes that such systems align with the ALARP management principle under the PGER (Environment) Regulations. In the event that a permanently open containment system is adopted, the EPA advises that pond design should include consideration of:

- rainfall events with annual exceedance probabilities rarer than 1%
- rainfall intensities associated with current and predicted climate change (Wasko et al. 2024)

- maintaining a suitable freeboard that accounts for a range of climatic conditions and extreme rainfall intensities over a range of durations.

The EPA is of the view that regulation of containment system design can be appropriately accounted for through the Environment Plan required under the PGER (Environment) Regulations such that the EPA's factor objective for Inland Waters can be met.

The EPA considers that there is a low probability of unforeseen failure of the proposed containment ponds as a result of flooding, noting that the well sites are located in areas that are elevated above 1 in 100-year flood events for the Fitzroy River (Bennett Resources 2024). It is noted that based on available survey information, proposed well sites 'midgard' and 'muspelheim' may be affected by flooding of Mount Hardman Creek during major rainfall events. The proponent has committed to completing quantitative flood modelling during the design phase of the proposal to ensure that infrastructure, such as containment ponds, are suitably designed to withstand flood events.

Having regard to the above, the EPA considers that appropriate risk proportionate measures can be implemented through the Environment Plan to mitigate potential impacts to inland waters associated with spills, leaks or discharges of HFS fluids or flowback water from the containment ponds. To ensure that this appropriately considered by the proponent in the Environment Plan, the EPA has recommended a condition (condition B1-5) requiring the proponent to ensure that implementation of the proposal does not result in any discharge or loss of HFS fluid or flowback water from the containment ponds into the environment. The EPA advises that the Environment Plan will provide an appropriate mechanism for the proponent to demonstrate how the environmental outcome in B1-5 can be met. In addition, and to reflect the recommendations of the HFS Inquiry (Recommendation 8), the EPA has recommended a condition (condition B1-2) requiring the proponent to develop a site water audit program that accounts for water produced, evaporated and disposed, such that significant leakage of fluids can be detected and remedial action implemented promptly, and for this program to be incorporated in the Environment Plan submitted to DMPE for approval under the PGER (Resource Management and Administration) Regulations.

The EPA notes that public submissions also expressed concerns regarding the management and disposal of potentially hazardous and contaminating solid residue remaining at the base of ponds as a result of evaporation. Specific concerns included the potential presence of elevated concentrations of radionuclides originating from the formation water. The proponent has advised that only a thin solid residue is expected to remain on the pond liner surface after evaporation. The proponent has committed to recovering any solid residue and disposing of it off-site at an appropriate waste disposal facility. The EPA is of the view that management of solid residue in the flowback containment pond, as well as the drilling fluid and cutting sump, can be appropriately addressed through the decommissioning provisions captured in the Environment Plan required to be submitted to DMPE for approval under the PGER (Resource Management and Administration) Regulations.

Groundwater monitoring

The EPA acknowledges that the groundwater monitoring provisions of the existing regulatory framework was a key consideration of the HFS Inquiry, which found that baseline and surveillance groundwater quality monitoring has become a standard component of onshore petroleum activities (Finding 12). Consistent with Recommendation 5 of the HFS Inquiry, the approved ESD for the proposal included a requirement to conduct a minimum of 24 months baseline groundwater monitoring to inform the assessment.

Several public submissions raised concerns that the proponent had not undertaken an appropriate baseline groundwater monitoring program. The EPA has considered that it had sufficient information on the expected hydrogeological conditions within the proposal area to inform its assessment of potential impacts to inland waters. The proponent's information included a substantial groundwater monitoring data set generated as part of Buru Energy's 2015 HFS program. This included groundwater monitoring data for the Liveringa Aquifer collected over a period of approximately 5 years, which captured groundwater data prior to, during and after the HFS program. The EPA acknowledges that a substantial portion of the monitoring was undertaken after the HFS activities had occurred, and monitoring wells were located in proximity to potential sources of contamination.

The EPA notes that the purpose of baseline groundwater monitoring is to establish a comprehensive understanding of the natural (pre-disturbance) groundwater quality and groundwater elevation condition prior to any potentially contaminating activity. This is distinct from the type and extent of hydrogeological information typically required to inform the EPA's assessment of potential impacts.

Therefore, the EPA considers that the available dataset presented in the proponent's environmental review document does not represent baseline groundwater monitoring data that could be utilised as part of the management of proposal implementation. However, the data does provide valuable hydrogeological information in terms of the expected quality and level of groundwater within the Liveringa Aquifer. The data also demonstrates that hydrogeochemical conditions within the Liveringa Aquifer are relatively stable, and therefore suggests that an extended baseline monitoring program may not be warranted in this instance.

The proponent has prepared a revised Groundwater Management Plan (Bennett Resources 2025b, GWMP) incorporating review comments provided by DWER. The EPA considers that the GWMP provides a framework to ensure that appropriate local baseline groundwater monitoring is undertaken to support surveillance monitoring during and post drilling, and HFS activities. The EPA advises that further revision of the GWMP is required and should:

- be revised and approved for implementation prior to the commencement of drilling activities
- include consultation with DWER and DMPE
- have regard for the findings and recommendations of the HFS Inquiry

- have regard for and be consistent with any regulatory requirements, guidance or policy outcomes associated with the delivery of the Implementation Plan.

Recognising the critical role of groundwater management, the EPA recommends that the Groundwater Management Plan (GWMP) be approved by the EPA, following advice from DMPE and DWER, prior to any exploration drilling (condition C1-1). This ensures groundwater-related risks are managed within a robust and transparent framework. The GWMP must include local-scale groundwater monitoring for at least 12 months before drilling to establish baseline data, and a revision of groundwater modelling for each well site prior to the drilling of the exploration well (condition C4-3). Importantly, findings from recommended environmental performance reporting and independent review (condition B6) trigger revisions and updates to the GWMP which includes a review of the project-scale hydrological and hydrogeological conceptualisation (condition C2-2(4)) ensuring that learnings are integrated, and safeguards are progressively strengthened. This adaptive approach provides assurance that the EPA's environmental objectives will be met and maintains public confidence in the proposal's implementation.

2.1.10 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the proposal on inland waters environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 2.

The EPA has also considered the principles of the *Environmental Protection Act 1986* (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (see Appendix A).

Table 2: Summary of assessment for inland waters

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
1.	Groundwater drawdown associated with water supply for HFS activities has the potential to impact surface waters and GDEs from reduced groundwater inflow and other groundwater users, such as pastoral bores.	Groundwater abstraction from the Liveringa Aquifer for operations is expected up to 100 ML per exploration well. Groundwater modelling indicates that groundwater drawdown will be limited in extent and duration, with negligible drawdown occurring beyond 700 m from each well site. There are no identified GDEs or bore users located within 700 m of the well site locations. The	**Condition A1 (Limitations and extent of proposal)** Limit on volume of groundwater abstraction per well. Limiting well site locations via the defined (locked) disturbance footprint. **Condition B1 (Inland waters)**

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
		closest credible GDE is Mount Hardmann Creek located approximately 1.5 km a well site. Based on modelled drawdown extents, no drawdown related impacts are expected to occur. The EPA's recommended conditions and DMA regulation (RiWI Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	Ensure groundwater drawdown does not exceed modelled extent, including revised sites specific modelling (condition C4-3(2)). **Condition B6 (Environmental Performance Reporting)** Staged revision and independent review to ensure achievement of environmental outcomes. Linked to adaptive management and update of the groundwater management plan (condition C2-2(4) **DMA legislation** DWER can regulate groundwater abstraction and potential drawdown impacts under the RiWI Act.
2.	Potential impacts to groundwater quality from unexpected fracture heights	The EPA recognises that there are a suite of management measures that will be implemented to ensure that fracture heights are controlled and do result in conduits for the movement of contaminants to overlying freshwater aquifers. These include, microseismic monitoring and an accompanying early warning detection system. The risk is also low in the context of the significant separation distance between the target Laurel Formation and the closest viable aquifer. The EPA notes the proponent's commitment to maintain a separation distance from the top	**Condition B1 (Inland waters)** Ensure no decrease in groundwater quality of the Liveringa and the Grant Poole Aquifer (condition B1-1(2)). Ensure induced fractures remain within the target Laurel Formation (condition B1-1(3)). Ensure no movement of potential contaminants into overlying aquifers as a result of fracture propagation (condition B1-1(4)).

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
		of the HFS zone to the base of the Grant Formation. The EPA has recommended conditions requiring proposal-induced fractures to remain within the target Laurel Formation, and for mitigation measures recommended under the HFS Inquiry to be incorporated into the proponent's required plans under the PGER Act. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	Proponent must incorporate mitigation measures as recommended by the HFS Inquiry into statutory plans required under the PGER Act. **Condition B6 (Environmental Performance Reporting)** Staged revisions and independent reviews to ensure environmental outcomes, with adaptive management and updates to the groundwater management plan (condition C2-2(4)) **DMA legislation** DMPE can HFS activities to mitigate the risks to groundwater from fracture propagation under the PGER Act.
3.	Potential impacts to groundwater quality from hydrogeological faults	Existing hydrogeological faults may provide a conduit to allow the movement of contaminants into overlying aquifers. HFS activities may also reactivate existing faults. Based on available geomechanical information for the proposal area and geomechanical risk assessment by the proponent, the risk of significant faults providing a conduit for the migration of contaminants is low. The EPA has recommended a condition requiring further site specific geomechanical risk assessment to be incorporated into the proponent's required plans under the PGER Act.	**Condition B1 (Inland waters)** Ensure no decrease in groundwater quality of the Liveringa and the Grant Poole Aquifer (condition B1-1(2)). Proponent must incorporate mitigation measures as recommended by the HFS Inquiry into statutory plans required under the PGER Act. Proponent must ensure no movement of contaminants into overlying aquifers as a result of hydrogeological

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
		The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	faults (condition B1-1(4)). Revised groundwater management plan (condition C2-2(4)) incorporating staged learnings via Environmental Performance Reporting (condition B6). **DMA legislation** DMPE can regulate HFS activities to mitigate the risks to groundwater from hydrogeological faults under the PGER Act.
4.	Potential impacts to groundwater quality from well integrity failure	The EPA advises that standard well design and testing requirements provide suitable mitigation of potential impacts to groundwater associated with well integrity failure. Aspects relating to well design, construction and testing are regulated through the statutory Well Management Plan under the PGER Act. Consistent with the HFS Inquiry recommendations, the EPA has recommended a condition requiring well design, construction and testing to be assessed by an independent certified well examiner. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	**Condition B1 (Inland waters)** Ensure no decrease in groundwater quality of the Liveringa and the Grant Poole Aquifer (condition B1-1(2)). Proponent must incorporate well design, construction and testing to be assessed by an independent certified well examiner into statutory plans required under the PGER Act. Proponent must ensure no movement of contaminants into overlying aquifers as a result of well integrity failure (condition B1-1(4)).**DMA legislation** DMPE can regulate well integrity to mitigate the risks to groundwater from hydrogeological faults under the PGER Act.

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
5.	Potential impacts to groundwater and surface water quality from surface spills and leaks	The EPA considers that small volume incidental spillages and leaks of chemicals, fuel and wastewater may occur. However, the EPA advises that with standard operational controls and mitigation measures, there is a low likelihood of significant adverse impacts to groundwater or surface water quality. The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	**Condition B1 (Inland waters)** Ensure no decrease in groundwater quality of the Liveringa and the Grant Poole Aquifer (condition B1-1(2)). Revised groundwater modelling for each well site (condition C4-3(2), and adaptive management from learings via Environmental performance reporting (condition B6 and C2-2(4)). **DMA legislation** DMPE can regulate storage and handling of potential contaminants, and the response and clean-up of spill events through the Environment Plan under the PGER Act.
6.	Potential impacts to groundwater quality associated with surface management of wastewater, including flowback water.	The EPA advises that the toxicity of the proposed HFS fluid system has been previously tested and found to be of low toxicity. Formation water produced during flowback and well testing is likely to be highly saline and contain other geogenic contaminants that warrant precautionary management and containment. The management of waste flowback water in suitably designed and constructed lined containment ponds will mitigate potential impacts to groundwater and surface water. The EPA has recommended a condition (B1-1(5)) requiring the proponent to ensure that all wastewater remains contained within the specifically designed ponds.	**Condition B1 (Inland waters)** Ensure no decrease in groundwater quality of the Liveringa and the Grant Poole Aquifer (condition B1-1(2)). Ensure that all wastewater, including flowback water, remains contained within the water retention pond(s) (condition B1-1(5)). Adaptive management through staged revisions of the ground water management plan via learninsg through environmental performance reporting

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
		The EPA's recommended conditions and DMA regulation (PGER Act) will appropriately manage impacts to ensure they are likely to be consistent with the EPA objective for inland waters.	(condition B6, C2-2(4) and C4-3(2)). **DMA legislation** DMPE can regulate the storage and handling of wastewater, including the specific design and construction details of the containment ponds through the Environment Plan under the PGER Act.

2.2 Greenhouse Gas Emissions

2.2.1 Environmental objective

The EPA environmental objective for greenhouse gas (GHG) emissions is *to minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.*

2.2.2 Policy context

The EPA recognises that the proponent prepared its information relating to this factor in accordance with the 2023 Environmental Factor Guideline – Greenhouse Gas Emissions (EPA 2023a). Additional information was provided as part of the proponent's response to submissions document to address the 2024 WA Governments GHG policy changes, and a subsequent update of the EPA's Environmental Factor Guideline – Greenhouse Gas Emissions (EPA 2024).

The EPA acknowledges the 2021 publication of the Government of Western Australia's Position Paper addressing the HFS Inquiry's recommendations relating to GHG emissions from HFS proposals (Government of Western Australia 2021). The EPA considers that the relevant provisions of the Position Paper were reflected in the environmental scoping document and through the proponent's environmental review document. The EPA as had regard to the Position Paper, but notes that the primary policy document for the EPA's assessment of GHG emissions is the EPA's Environmental Factor Guideline – Greenhouse Gas Emissions (EPA 2024) (GHG Guideline).

The GHG Guideline, provides that, generally, GHG emissions from a proposal will be considered significant where they exceed 100,000 tonnes of scope 1 emissions each year measured in tonnes of carbon dioxide equivalent (t CO_2-e). This is currently the same as the threshold criteria for designation of a large facility under the Australian Government's Safeguard Mechanism.

2.2.3 Assessment context

GHG emissions from a cumulative range of sources have an impact on Western Australia's environment, even if the specific impact of a particular proposal's emissions may not be known with certainty. This is because there is an established link between GHG emissions and the risk of climate change. The EPA recognises that climate change will impact on Western Australia's environment and its environmental values. For example, climate change has already caused a significant drying of the State's south-west, which in turn places significant additional pressures on water resources, flora and fauna, marine environmental quality, and social surroundings.

There is also an established correlation between global temperature rise and GHG emissions. The EPA advises that for every 1,000 giga tonnes (Gt) of CO_2-e emitted by human activity, global surface temperature rises by 0.45°C (best estimate, with a likely range from 0.27°C to 0.63°C) (IPCC 2023). The EPA therefore usually assesses proposals where GHG emissions are reasonably likely to exceed 100,000 t of scope 1 or scope 2 emissions each year measured in t CO_2-e. The GHG

Guideline does not mandate net zero emissions over the life of a proposal. Rather, its objective is reduction of emissions having regard to the United Nations Framework Convention on Climate Change (UNFCC) Paris Agreement and the Intergovernmental Panel on Climate Change's (IPCC) 1.5 report which recommend achievement of net zero emissions by 2050. When assessing proposals where GHG emissions are a key environmental factor, the EPA usually considers a proposal's annual and total contributions to GHG emissions but also assesses the proponent's contribution and trajectory towards this net zero by 2050 goal.

2.2.4 Potential emissions from the proposal

The proposal will produce GHG emissions from:

- flaring of produced petroleum fluids during flow testing (approximately 93% of scope 1 emissions)
- stationary, mobile and transport diesel combustion
- land clearing
- indirect emissions related to purchased goods, transport of materials, fuels and personnel to and from site
- potential emissions associated with the transport, downstream processing and consumption of gas condensate.

The proposal has the potential to emit GHG emissions which exceed 100,000 tonnes of CO_2-e scope 1 emissions per annum. The proponent has provided the following estimates of GHG emissions which reflect a worst-case scenario that reflects flaring of all liquid condensate and flaring of each well for 90 days:

- scope 1 emissions on average of 229,503 t of CO_2-e per annum (up to a maximum of 368,260 t of CO_2-e per annum, and total emissions of 1,606,526 t of CO_2-e over the 7-year life of the proposal
- no scope 2 emissions are expected
- no scope 3 emissions are expected under the worst-case scope 1 scenario where all produced condensate and gas is flared during well testing.

WA's yearly scope 1 emissions based on 2022 levels were 82.5 million tonnes (Mount) CO_2-e (DCCEEW 2024) and national emissions for 2022 were 432.9 Mount CO_2-e (DCCEEW 2023a). The peak annual estimated scope 1 GHG emissions from the proposal during years 6 and 7 (368,260 t CO_2-e) would constitute approximately 0.45% of WA's total emissions and 0.09% of Australia's total reported GHG emissions.

2.2.5 Consultation

Several public submissions raised concerns about the potential GHG emissions associated with the proposal, key matters raised include:

- the effect of the proposal of climate change and related national and international commitments, such as the Paris Agreement

- cumulative GHG emissions associated with a possible future broader development of the Canning Basin
- the veracity of GHG emissions estimates, including the duration of flaring, and local data on the carbon dioxide content of the target gas within the Laurel Formation
- the emissions intensity of the proposal compared to similar exploration projects and whether best practice has been adopted
- reliance on carbon offsets
- how the proposal will interact with the Commonwealth Safeguard Mechanism.

2.2.6 Minimisation measures (including regulation by other DMAs)

The proponent has identified the following measures to minimise GHG emissions:

- reducing emissions associated with land clearing by utilising horizontal drilling techniques
- flaring of gas during well testing rather than cold venting
- selection of efficient diesel generators and solar powered lighting
- Implementing the Valhalla Gas Exploration and Appraisal Program Greenhouse Gas Environmental Management Plan (GHGMP; Bennett Resources 2025b).

The GHGMP includes:

- details of the above-mentioned minimisation measures, and estimates of emissions reductions that may be achieved
- discussion of minimisation measures considered for the proposal but not selected
- consideration of collecting gas condensate for beneficial use off-site rather than on-site flaring.
- emission reduction targets reflecting a 43% reduction in scope 1 emissions after 5 years of operations
- a strategy to purchase Australian Carbon Credit Units (ACCUs) to achieve emissions reductions targets where necessary.

With these mitigation measures, the lifetime (7 years) scope 1 emissions would be reduced from 1,606,526 tonnes CO_2-e to approximately 1,569,000 tonnes of CO_2-e (Bennett Resources 2025b). With the application of the proponent's reductions targets in conjunction with the purchasing of ACCUs, net scope 1 emissions would be further reduced. Based on the proponent's implementation schedule and associated emissions estimates, net GHG emissions would be further reduced by approximately 318,000 t CO_2-e, assuming that 4 wells are drilled in years 6 and 7 of the proposal.

The EPA notes that, until emissions are under 100,000 t CO_2-e per annum, the proponent will be subject to reporting requirements of the Clean Energy Regulator to

comply with the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), and also subject to the NGER Emissions Reduction Fund Safeguard which requires facilities whose net emissions exceed the safeguard threshold to keep emissions at or below baseline. The application of the Commonwealth Safeguard Mechanism is further discussed in section 2.2.8 below.

2.2.7 Best practice review

To gain a better understanding of whether the proposal's GHGMP is consistent with best practice measures and as required by the 2023 version of the GHG Guideline, the proponent provided an independent review of its GHGMP. The aim of the review was to determine if the best practice measures have been adopted to avoid or reduce emissions associated with the proposal, if offsets that satisfy integrity principles are likely to be reasonably practicable and available at the time of proposed future surrender, and if the proposal is consistent with, or outperforming, relevant sector pathways and milestones.

The proponent engaged Evolveable Consulting to undertake the peer review for the GHGMP (version 3). The peer review of the proposal's GHGMP (Evolveable Consulting 2024) was prepared to address the scope and intent of an expert review as set out in the EPA's 2023 GHG Guideline and submitted to the EPA prior to the publication of the 2024 GHG Guideline revision in line with the WA *Government's Greenhouse Gas Emissions Policy for Major Projects 2024*. The peer review also considered other relevant guidance documentation associated with emissions mitigation strategies for onshore petroleum operations, including the HFS Inquiry final report.

The outcomes of the review concluded that the proposal's GHGMP:

- sets out a methodology and assumptions to estimate emissions that align with good emissions accounting practices
- outlines emissions reduction opportunities that align with national and international industry best practices, when considering the project-specific context
- provides benchmarking that indicates that the proposal's emissions intensity on a per well, per day basis, is high relative to other comparable exploration. proposals.

Following recommendations provided in the peer review, the GHGMP was revised to include:

- increased emissions reductions (to 43%) to align with revised Commonwealth targets for 2030
- ambient methane monitoring post implementation of the proposal
- further detail on the volume and preferred types of offsets, and consideration of offset availability.

2.2.8 Assessment of GHG emissions

The GHG Guideline (EPA 2024) provides that, generally, GHG emissions from a proposal will be considered significant where they exceed 100,000 t CO_2-e of scope 1 emissions each year. The EPA notes that this proposal is likely to exceed that threshold in most years of operation, and therefore GHG emissions is a key environmental factor in the assessment of the proposal.

Emissions estimates

The proponent's GHGEMP, including the Nimbleng Energy Consultants report (2021) at appendix B, outlines the methodologies used to calculate the quantities of proposal GHG emissions. Scope 1 GHG emissions from construction and operations were calculated using the National Greenhouse and Energy Reporting (Measurement) Determination 2008 and were based on predicted vehicle and mechanical operating times and typical diesel fuel efficiencies.

Scope 1 GHG emissions from vegetation clearing were calculated using the Full Carbon Accounting Model and were estimated to be approximately 6000 t CO_2-e in total based on a factor of 56.3 t CO_2-e per hectare of vegetation removal.

The EPA notes that most scope 1 emissions, approximately 93%, are associated with the combustion of gas (methane) and gas condensate[8] during well testing or flow testing. The proponent's GHGMP provides different emissions estimates based on a 60 day and 90 day well testing (flaring) duration. The quantity of emissions per exploration well are also predicted to be different for the two phases of the proposal, noting higher hydrocarbon production (flow) rates are anticipated for Phase II because of the optimisation of drilling and HFS design.

The balance of material scope 1 emissions arise from the combustion of diesel by mobile plant equipment and vehicles during clearing and construction of the access tracks and well pads, well drilling and during HFS. Scope 1 emissions associated with diesel consumption were estimated to be approximately 3,300 t CO_2-e per well.

No scope 2 GHG emissions are expected, given the proposal will not utilise any grid-connected or third-party electricity sources, as there are none available in the area.

The proponent advised that scope 3 emissions for the proposal are not expected. The EPA notes that the proponent is considering the capture of condensate for sale and offshore consumption. The EPA advises that although this approach would reduce the proposal's scope 1 emissions, compared to onsite flaring of condensate, it only changes where and how the emissions are accounted for (i.e. as scope 3 emissions). The proponent did provide an estimate of potential scope 3 emissions associated with the capture and use of gas condensate. The proponent estimated that scope 3 emissions may be up to 158,284 t CO_2-e per well assuming up to 90 days of flaring, and condensate production, per well. Scope 3 emissions were estimated from the transport of condensate to Singapore via the Port of Wyndham for downstream processing and consumption.

[8] A mixture of reservoir derived hydrocarbons that form a liquid phase at atmospheric pressure and temperature.

The EPA considers that the proponent's estimated GHG emissions quantities are a reasonable basis for the assessment. The EPA's assessment of the proposal has considered the potential GHG emissions associated with a worst-case scenario, which in this case would be flaring of all condensate and gas produced during a maximum 90 day well testing regime for each of the 20 proposed wells. The EPA notes that the emissions estimates provided by the proponent do not include quantification of any fugitive methane emissions associated with venting during well completion, or at the completion of well testing. The proponent has advised that 'Reduced Emissions Completions' will be used, and no cold venting is expected to occur during well completions. The EPA has recommended a condition (condition B5-1) to reflect these commitments.

Baseline emissions avoidance and minimisation, including best practise review and benchmarking

The EPA recognises that the majority of scope 1 emissions associated with the proposal (93% in phase I and 96% in phase II) arise from the combustion of hydrocarbons during well testing. The quantity of scope 1 emissions per exploration well are therefore largely influenced by the duration of well testing, the rate of hydrocarbon production during testing, and the methods for management of produced hydrocarbons, e.g. capture, flaring or venting.

The potential for material scope 1 emissions reductions unrelated to well testing, such as diesel consumption, are relatively limited. The EPA notes that the proponent has achieved some modest emissions reductions through the minimisation measures identified in section 2.2.6 above. Whilst these minimisation measures, such as use of high efficiency diesel engines and use of solar powered lighting, do align with best practice, the EPA notes that the emissions reductions achieved are not material in the context of the emissions associated with flaring.

The proponent has identified flaring of hydrocarbons during well testing as a minimisation measure. The EPA acknowledges that flaring represents a significant reduction in GHG emissions when compared to cold venting, i.e. the direct release of uncombusted reservoir petroleum gases into the atmosphere, due to the higher 'global warming potential' of methane compared to carbon dioxide. However, the EPA notes that the cold venting release of methane, such as during flow testing, is not regarded as standard industry practice and is increasingly not permitted in many jurisdictions. As such, the EPA recommends condition B5-1(3) to avoid cold venting unless required under a safety scenario.

The proponent advised that alternatives to the flaring of gas during well testing were investigated but not considered viable in the context of the proposal's remote location and availability of the necessary technology. The EPA notes that there is currently no gas collection or distribution infrastructure within the Canning Basin area that would facilitate the collection and sale of gas for use by third parties. In the

absence of such infrastructure, smaller proposal-specific alternatives include compressed natural gas (CNG) and 'Micro liquefied natural gas (LNG)'[9].
The EPA is encouraged that the proponent advised through its Response to Submissions that it will consider the use of CNG during implementation, such as in dual fuel engines, subject to the availability of suitable equipment (Bennett Resources 2025a).

The EPA acknowledges that the consideration of best practice for this proposal is influenced by the regional and remote context of the proposal area and the lack of infrastructure that would facilitate the capture and use of well test gas. However, the EPA notes that the HFS Inquiry found that there was a global move toward reducing venting and flaring of gas across the petroleum sector (Finding 42). The EPA also notes that technological options exist, such as the Cryobox™ Micro LNG plant, that would allow the capture and use of well test gas such that flaring and direct proposal emissions could be substantially reduced. The EPA understands that such technologies have been applied successfully in remote areas such as North Dakota's shale gas region (Nimbleng Energy Consultants 2021), and the EPA considers that viable options are available in the Australian context to minimise or otherwise avoid gas flaring during exploration and appraisal activities. In addition, the EPA notes that well test gas associated with exploration and appraisal activities in the Beetaloo basin is proposed to be captured for use through the construction of the Sturt Plateau Compression Facility (Tamboran Resources 2024).

The EPA considers that flaring of condensate during well testing is unlikely to be consistent with best practice. However, the EPA notes that while the proponent has provided worst case GHG emissions estimates based on high levels of condensate production, until the commencement of well testing it is uncertain if sufficient quantities of condensate will be produced to enable condensate recovery and distribution to be viable in this instance. The EPA understands that during Buru Energy's 'TGS14 project' in 2015, significant volumes of condensate were not produced during well testing, and as a result all condensate was flared rather than captured.

The EPA has recommended a condition (condition B5-1) requiring the proponent to take reasonable measures to minimise the flaring of condensate produced during well testing. The EPA has also recommended a performance reporting condition (condition B6-2) requiring the periodic review and reporting on available measures to capture and utilise well test gas and condensate produced during flow testing. The EPA notes that the capture and sale of condensate and gas produced during well testing will contribute towards the reduction of covered scope 1 emissions expected to be subject to regulation under the Safeguard Mechanism, as described below.

The proponent undertook GHG benchmarking against a limited set of comparable gas exploration and appraisal projects completed in the McArthur and Beetaloo sub-basins in the Northern Territory. Previous activities in the Canning Basin were excluded as they were not considered comparable as they involved vertical not

[9] CNG involves the capture and storage of well test gas at high pressure in specialised bullet tanks to facilitate its use, such as for power generation offsite or onsite as an alternative to diesel generated power. Micro LNG involves the use of a mobile micro LNG plant to capture treat and store well test gas as LNG in a manner that would allow its transportation to domestic or international markets.

horizontally drilled wells. Noting that exploration and appraisal programs do not result in a product upon which to calculate an emissions intensity value, the benchmarking exercise compared emissions intensities on a 'per well per test day' basis. This found that the proposal emissions intensity for wells during phase I and phase II were substantially higher relative to other activities (Figure 10).

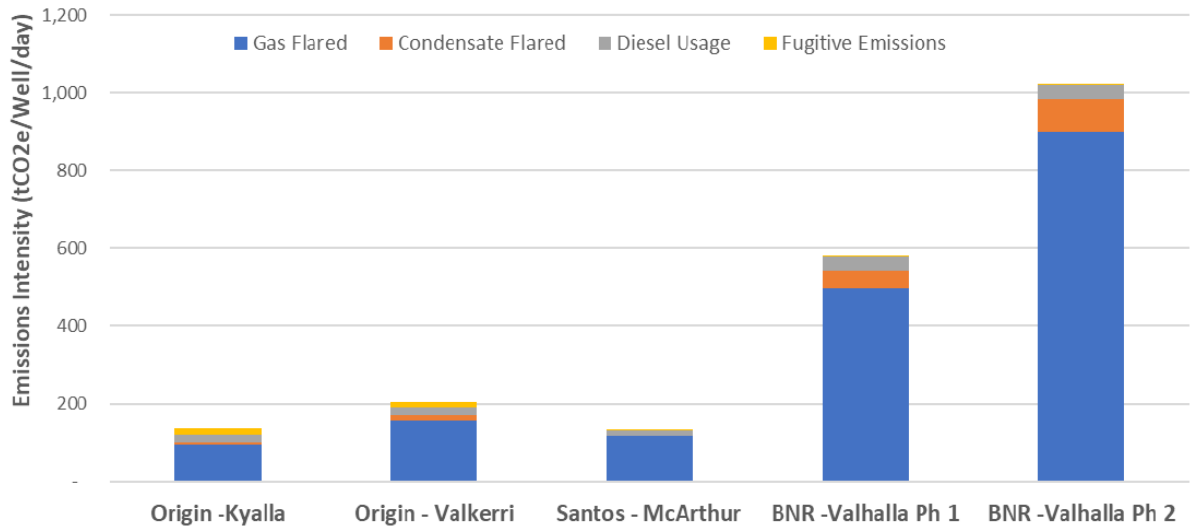

Figure 10: GHG benchmarking for emissions intensity per well per test day (Nimbleng Energy Consultants 2021)

Further analysis was undertaken to compare the planned minimum and maximum total emissions per well, to address the difference in planned duration of well testing between the proposal (2 to 3 months) and the comparison test programs (3-12 months) (Figure 11). This found that the emissions intensity per test well for Phase I is comparable to other exploration activities. However, the emissions intensity per test well for Phase II was found to be approximately double that predicted for other exploration activities.

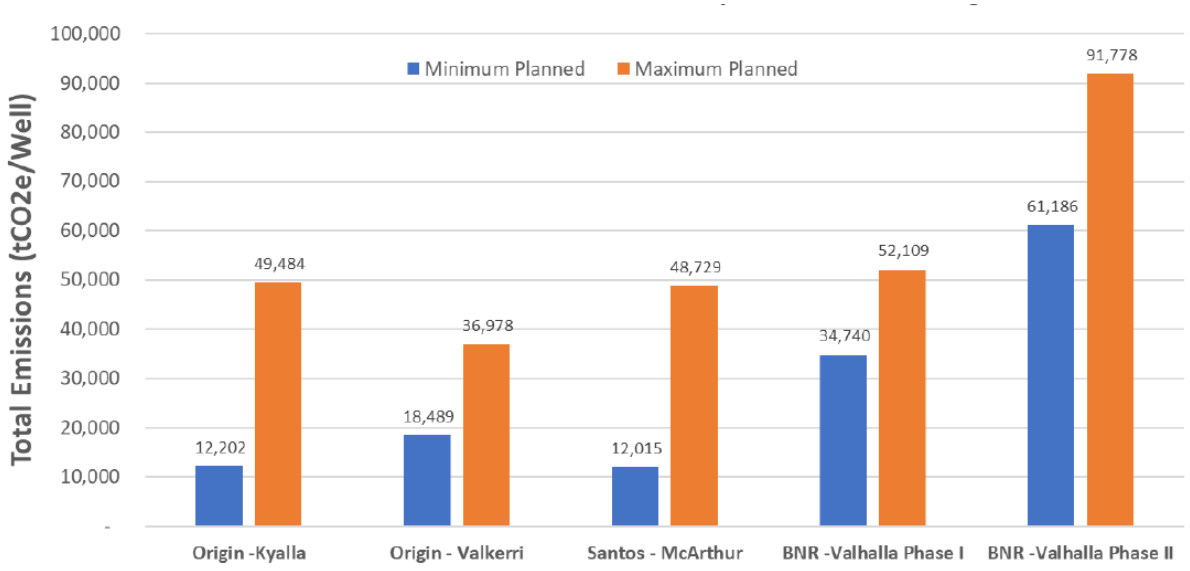

Figure 11: GHG benchmarking for planned minimum and maximum emissions per well (Nimbleng Energy Consultants 2021)

The EPA acknowledges that the comparatively high emissions intensity of the proposal, relative to other exploration and appraisal activities, is primarily a result of the predicted higher flow test rates (higher rates of hydrocarbon flow), particularly during the more optimised phase II. Based on the benchmarking, the EPA concludes that the proponent's baseline emissions estimates are plausible and are reasonable to form the basis for the EPA's assessment.

In summary, the EPA acknowledges the proponent's assessment that the proposal is best practice in the context of the remote location and availability of supporting infrastructure. However, the EPA considers that technological options exist that may be reasonably implemented in the future to minimise flaring and associated emissions, as evidenced by recent proposals in the Northern Territory. The EPA has therefor recommended a performance reporting condition (Condition B6) that would require the proponent to periodically review the availability of options to materially reduce gas flaring and associated GHG emissions, and demonstrate that reasonably available options have, or will be implemented. The EPA advises that this is consistent with the EPA's expectations for continuous improvement and periodic review to ensure reasonably practicable measures to mitigate GHG emissions are being considered over the life of the proposal. The EPA's recommended conditions (B6-3) also require the Environmental Performance Report to be independently reviewed to assess whether the conclusions are supported by evidence, and to provide recommendations for measures, where applicable, to reduce flaring.

Commonwealth Safeguard Mechanism

The proponent has identified that as an oil and gas exploration activity, the proposal will be reportable under the Commonwealth National Greenhouse and Energy Reporting Scheme. The Safeguard Mechanism applies to facilities that emit more than 100,000 tCO_2-e covered scope 1 emissions per year. Proposals regulated under the Safeguard Mechanism are required to take actions to reduce emissions to achieve Australian emission reduction targets of 43% below 2005 levels by 2030 and net zero by 2050.

The proposal's annual Safeguard Mechanism covered emissions is dependant on the number of wells drilled per year, and the duration of well testing and associated rate of flaring. Based on the proponent's estimates, the proposal will exceed the 100,000 tCO_2-e threshold for all years of operations in the event that all wells are flared for the maximum 90-day period. The threshold is expected to be substantially exceeded during phase II of the proposal, years 4 to 7, due to the larger number of wells proposed to be drilled and tested each year, and the anticipated higher petroleum flow rates during testing. The EPA therefore considers that the proposal likely to be subject to regulation under the Safeguard Mechanism for most, if not all, years of operations.

As raised in public submissions, the EPA notes that under section 10(2) of the Safeguard Rule new shale gas facilities, as defined in section 54 of the Safeguard Rule, are subject to a baseline of zero GHG emissions per year. The proponent has advised that based on consultation with the Commonwealth Clean Energy Regulator, the zero baseline that applies to shale gas facilities is not applicable to the proposal

as it is exploration and appraisal only and does not comprise production of shale gas.

The proponent has advised that the proposal is expected to be subject to the default Safeguard Mechanism baseline value of 100,000 tCO_2-e per year. The EPA understands that where the default baseline applies to a facility, the annual baseline reduces according to the Safeguard decline rate, currently 4.9% per year, to align all facilities with the net zero by 2050 target. Based on the maximum emissions estimates provided by the proponent, i.e. 90 day flaring of gas and condensate at all wells, the EPA estimates that the Safeguard Baseline would require covered scope 1 emissions to be substantially reduced, particularly in later years of the proposal where approximately 80% of proposal emissions will require mitigation to meet the baseline (Figure 12; see Offsets section below).

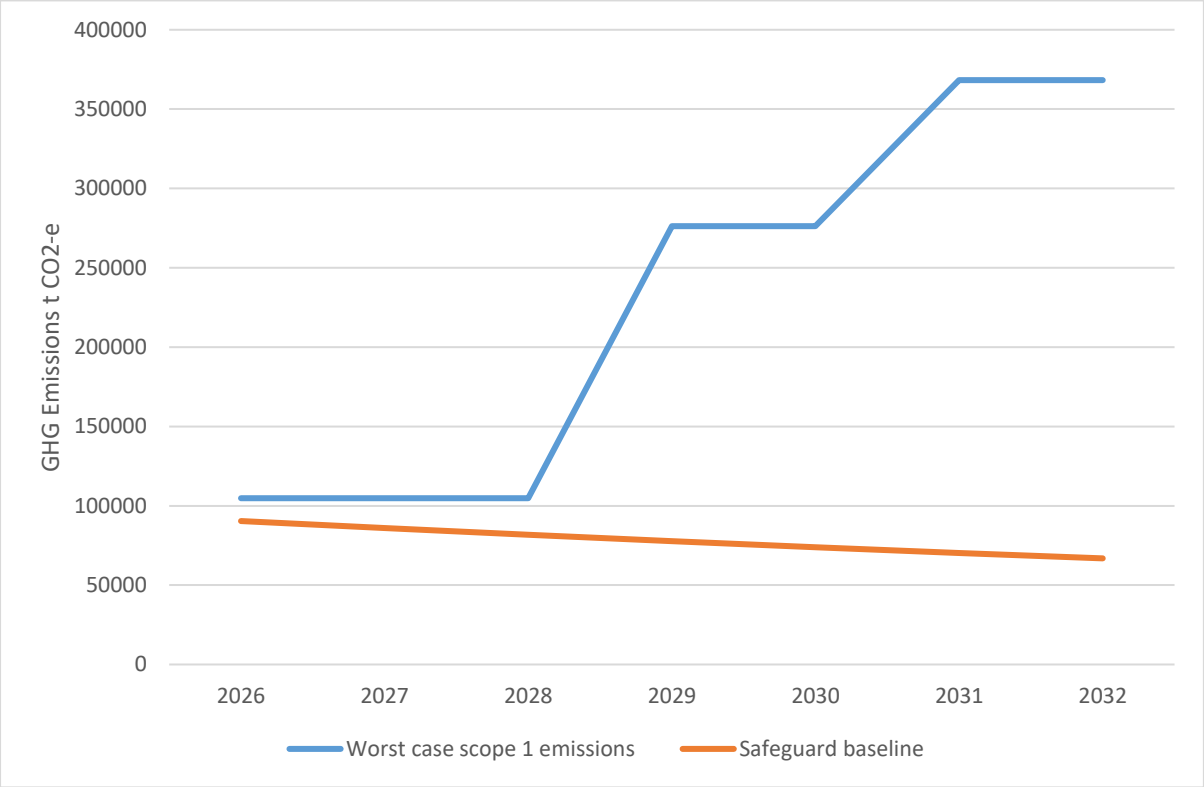

Figure 12: Proposal GHG emissions trajectory comparison to Safeguard Mechanism Baseline trajectory

The EPA notes that annual residual scope 1 emissions not covered under the Safeguard Mechanism, such as from land clearing and fugitive emissions from wastewater, are expected to be well below 100,000 t CO_2-e.

Offsets

Based on the expected application of the Safeguard Mechanism to the proposal, the EPA acknowledges that a substantial quantity of offsets is expected to be required for the proposal to meet the emissions reductions required under the Safeguard Mechanism. The EPA advises that carbon offsets required should demonstrate they

meet offset integrity principles, and be based on clear, enforceable and accountable methods.

The EPA notes that the proponent intends to acquire and surrender Australia carbon credit units (ACCUs) to meet the proposal's emissions reductions targets. The EPA considers that offsets through ACCUs are expected to be of sufficient integrity.

2.2.9 Summary of key factor assessment and recommended regulation

The EPA considers that the emissions avoidance, minimisation and offsets proposed by the proponent are generally consistent with the EPA's factor objective *to minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable*.

The EPA recognises that the significantly strengthened Commonwealth Safeguard Mechanism is expected to require the proponent to take actions to reduce GHG emissions, including imposing annual baseline decline rates to ensure Australian emission reduction targets of 43% below 2005 levels by 2030 and net zero by 2050 are achieved. The EPA is of the view that emissions reductions required under the Safeguard Mechanism represent an as far as practicable reduction of the proposal's scope 1 GHG emissions, and therefore the likely environmental effects of this exploration and appraisal proposal can be mitigated to achieve consistency with the environmental factor objective for GHG emissions. The EPA has recommended a condition that requires the proponent to notify the State of a substantial change to its obligations under the Safeguard Mechanism (recommended condition B5-2).

In conjunction with the application of the Safeguard Mechanism, the EPA considers that it is appropriate to recommend further conditions to ensure that GHG emissions are reduced as far as practicable consistent with the EPA's factor objective. Consistent with the proponent's commitments, the EPA has recommended a condition (condition B5-1) that would reduce the potential for methane release to the atmosphere by requiring the proponent to:

- avoid 'cold venting' of gases
- take reasonable measures to minimise flaring of condensate and natural gas during well testing
- take reasonable measures to implement 'reduced emissions completions' methods during well completion
- ensure that flaring of gases achieves a minimum 98% flaring efficiency.

The EPA considers that flaring of gas and condensate during prolonged well testing is not consistent with current best practice in the context of reducing GHG as far as practicable. The EPA has therefore recommended a condition (condition B5-1(1)) to require the proponent to take reasonable measures to minimise the flaring of condensate and gas during well testing. The EPA acknowledges that the avoiding or substantially minimising flaring of hydrocarbons is constrained by the remote location of the proposal and the availability of necessary equipment and technologies. The EPA has recommended a performance reporting condition (condition B6) that would require the proponent to periodically review the availability of options to materially

reduce flaring and associated GHG emissions, and demonstrate that reasonably available options have, or will be implemented. The EPA's recommended condition also requires the Environmental Performance Report to be peer reviewed by an independent person who will, amongst other things, provide recommendations for any measures that should be implemented to reduce flaring (condition B6-3).

The EPA acknowledges the issues raised in public submissions regarding the potential for this proposal to facilitate future petroleum exploration and/or production proposals in the area and associated GHG emissions that may occur. The EPA has considered the potential for this proposal to be an enabler of future proposals that may give rise to substantial GHG emissions, such as from the extraction and consumption of large quantities of gas. The likelihood of Canning Basin gas development, specifically for shale gas, is a complex issue with both potential and significant challenges. While there's substantial gas-in-place within the basin, particularly in shale formations, the isolation of the Canning Basin and the high costs associated with developing remote unconventional gas resources present major hurdles. Further, the EPA has sought to provide advice to the Minister, see section 5, in relation to the WA Government taking a strategic approach to future development of the Canning Basin and the long-term sustainability of the Kimberley region.

The EPA has considered whether the residual emissions from the proposal are consistent with the principles of the EP Act (see Appendix C) and with the EPA factor objective for GHG emissions. In doing so, the EPA has also considered whether reasonable conditions could be imposed to reduce potential inconsistency with the EP Act principles and EPA's factor objective. The EPA summary findings are in Table 3.

Table 3: Summary of assessment for greenhouse gas emissions

Residual emissions	Assessment finding	Recommended conditions and DMA regulation
Scope 1 emissions are estimated to peak at 368,260 t CO_2-e in years 6 and 7, representing 0.45 % of WA annual emissions (based on 2022 data). No scope 2 emissions are expected. Scope 3 GHG emissions may occur at scale in the event that hydrocarbons, such as condensate, are captured during well testing and consumed down-stream.	The proposal's scope 1 emissions arise primarily from the flaring of hydrocarbons during well testing. The quantity of annual emissions is dependent on the number of wells drilled and tested in that year, and the duration of well testing and the expected rate of hydrocarbon flow during testing. The emissions intensity of the proposal is high relative to comparable activities but is a result of the predicted high flow rates, noting the mature appraisal nature of the proposal and the expected reservoir performance.	**Condition A1 (Limits and Extents)** Well testing limited to 90 days. **Condition B5 (Greenhouse Gas Emissions)** Reporting if obligations change under the *National Greenhouse and Energy Reporting Act 2007* and Safeguard Mechanism. Implement measures to avoid methane release to atmosphere during operations. Take reasonable measures to minimise flaring of gas and condensate produced during well testing.

Residual emissions	Assessment finding	Recommended conditions and DMA regulation
GHG emissions contribute to climate change, which impacts on WA's environment.	The flaring of hydrocarbons during prolonged well testing is increasingly not representative of best practice. A condition requiring the implementation of reasonable measure to minimise the flaring of gas and condensate is recommended. Technologies for the collection and beneficial use of gas are becoming more available, and should be considered for implementation. The EPA recommends a condition requiring performance reporting in relation to the collection of gas and condensate for use or sale. There are practical measures identified by the proponent that should be adopted to avoid methane release during operations, such as 'reduced emissions completions'. The EPA recommends a condition requiring the implementation of these measures. The Safeguard Mechanism is expected to apply to the proposal and require emissions reductions consistent with the applicable baseline. In consideration of this, the EPA is of the view that the likely environmental effects of the proposal can be mitigated through the recommendation conditions, in conjunction with the obligations required under the *National Greenhouse and Energy Reporting Act 2007,* to ensure the environmental outcome is likely to be consistent with the EPA objective for greenhouse gas emissions.	**Condition B6 (Performance reporting)** Periodically report on and review the availability of options to materially reduce gas and condensate flaring and demonstrate that reasonably available options have, or will be implemented.

Social Surroundings

2.3.1 Environmental objective

The EPA environmental objective for social surroundings is *to protect social surroundings from significant harm*.

2.3.2 Investigations and surveys

The EPA's assessment of the potential impacts to social surroundings was informed by the proponent's environmental review document (Bennet Resources 2024) and through direct engagement with Traditional Owners, including a visit to the proposal area and the Noonkanbah community in May 2025. The EPA acknowledges the broad support for the proposal by the Yungngora and Warlangurru People, as represented by the Yungngora Aboriginal Corporation and Warlangurru Aboriginal Corporation, including letters of support provided to the EPA in 2024.

The EPA's assessment of social surroundings was also informed by the following surveys and reports:

- Report on the Ethnographic Aboriginal Heritage Survey of the Odin 2D & 3D Seismic Survey Areas and the Valhalla Gas Exploration and Appraisal Program Access Tracks, Well & Camp Sites, Blina & Noonkanbah Stations, Kimberley, Western Australia (Deep Woods Surveys (WA) 2021). (confidential document not released through the public review).
- Valhalla Gas Exploration and Appraisal Program – Environmental Acoustic Impact Assessment (Herring Storer Acoustics 2021).

2.3.3 Assessment context: existing environment

Aboriginal cultural heritage

The proposal area is within two native title determination areas under the Commonwealth *Native Title Act 1993*. The majority of the development envelope is within the Yungngora (Noonkanbah) People determination area, while the remaining northern portion is within the Warlangurru People determination area.

The proponent has an Indigenous Land Use Agreement (ILUA) in place with the Yungngora people and a 'Land Access and Use Agreement' in place with the Warlangurru People. The proponent has advised that both agreements have provisions relating to the management of potential cultural and environmental impacts associated with the proponent's activities on the land (Bennett Resources 2024).

A desktop search of the Department of Planning Lands and Heritage (DPLH) 'Aboriginal Heritage Inquiry System' (AHIS) identified two registered Aboriginal heritage sites within the development envelope, both of which are designated as 'mythological' sites. There are also two further sites within the development envelope identified as 'other heritage places', also both mythological sites (see Figure 12).

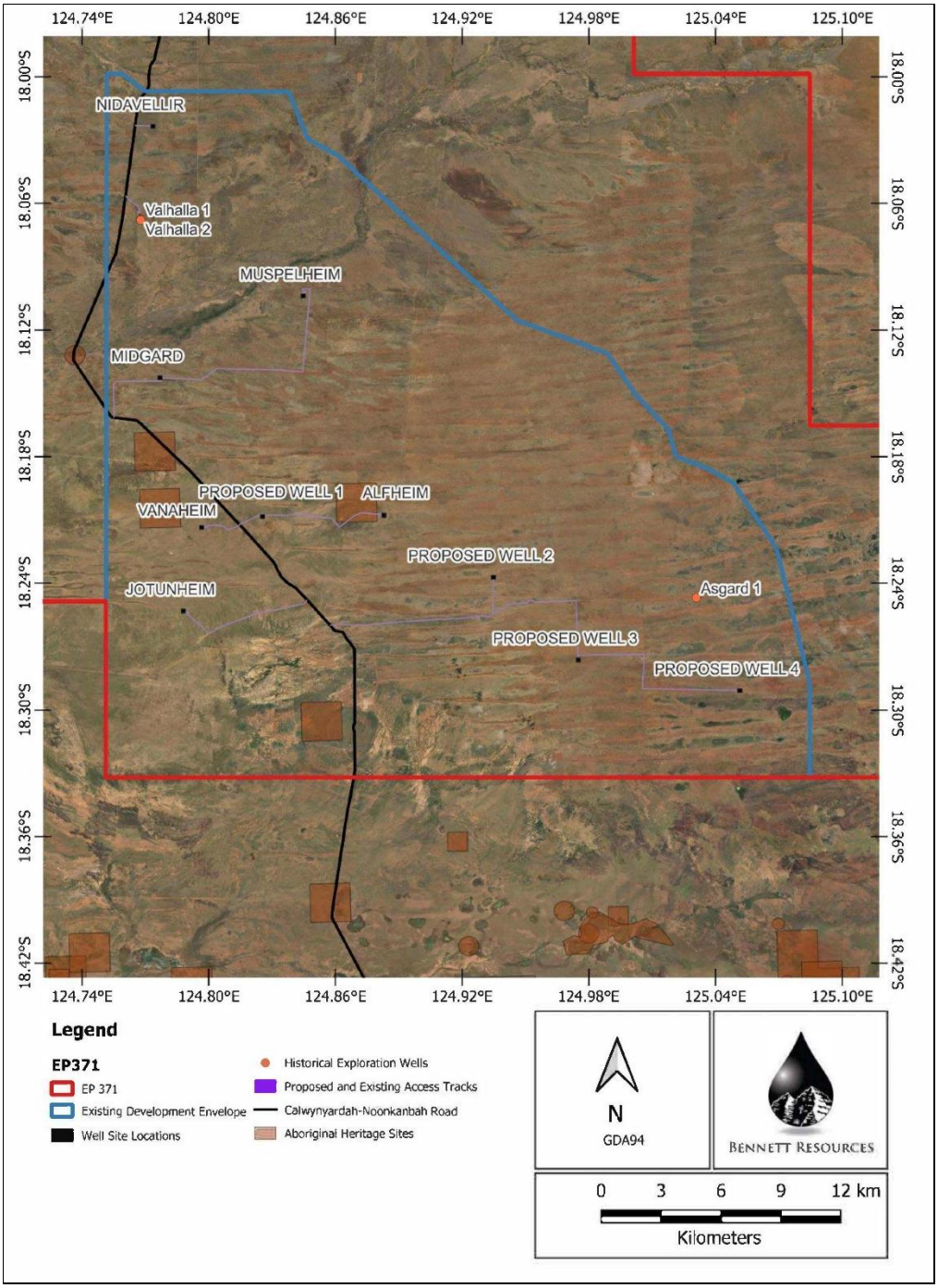

Figure 12: Registered Aboriginal heritage within and near the development envelope (Bennett Resources 2024a)

A number of activity-specific Aboriginal heritage surveys have been undertaken in the proposal area in consultation with Traditional Owners dating back to 2007. These surveys were coordinated by previous exploration permit holders and were done to facilitate specific petroleum exploration activities, such as seismic surveys and exploration drilling. A summary of these surveys is provided in the proponent's environmental review document (Table 5-36, Bennett Resources 2024). In 2021 an

ethnographic and archaeological heritage survey was undertaken by a consultant in consultation with Traditional Owner representatives from both the Yungngora and Warlangurru People (Deep Woods (WA) Surveys 2021). This survey covered the proposed disturbance footprint of the proposal as well as disturbance associated with a previously completed and related seismic survey (Odin 2D and 3D) primarily within the development envelope. The archaeological and ethnographic survey did not identify any notable archaeological values within the disturbance footprint. As a result of consultation with Traditional Owners during the course of the survey, the disturbance footprint, including the proposed Muspelheim well site was moved further east away from values associated with Mount Hardman Creek.

The proposal is located within proximity to the National Heritage listed West Kimberley National Heritage Place (WKNHP), which includes the formally recognised culturally significant Fitzroy River (formally recognised under the *Aboriginal Heritage Act 1972*) and the Camballin Floodplain. The development envelope is approximately 7.5 km from the boundary of the WKNHP.

Land use and tenure

The proposal is located within a sparsely populated pastoral area. The nearest population centre is the Yungngora (Noonkanbah) community approximately 18 km to the south of the development envelope and 29 km from the nearest proposed well site. The nearest townships are Fitzroy Crossing (52 km east), Camballin (58 km west) and Derby (123 km northwest).

The development envelope is situated on Crown land characterised by semi-arid rangelands with a long history of pastoral uses. The majority of the area (and proposed well sites) is within the Noonkanbah Pastoral Station lease area, operated by the Yungngora People through the Yungngora Association Incorporated. The northern portion of the development envelope is situated within the Blina Pastoral Station lease area. In addition, the Traditional Owners of the land, including members of the Yungngora and Jimbalakudunj Communitis, are known to use the land for cultural and recreational purposes, including education, hunting, fishing and swimming.

The proposal is within the Canning Basin, which is a large, predominantly undeveloped, sedimentary basin covering around 530,000 square kilometres. The Canning Basin has a long history of oil and gas exploration dating back to the 1920s, including more recently the drilling and hydraulic fracture stimulation of wells within the development envelope between 2012 and 2015.

2.3.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in the proponent's response to submissions document (Bennett Resources 2025). Public consultation on the proposal raised several concerns directly and indirectly related to social surroundings and Aboriginal cultural heritage issues, key issues included:

- potential impacts to the Fitzroy River and related values of the WKNHA, including values associated with the Rainbow Serpent

- amenity, aesthetic and heritage impacts from noise, light and odour emissions associated with flaring
- cumulative impacts resulting from the future development of a petroleum production industry in the Canning Basin
- potential impacts to Aboriginal communities due to water and air pollution, restricted access for cultural purposes, and loss of culturally relevant flora and fauna.

The EPA acknowledges the submissions made by the Yungngora and Warlangurru Peoples, including engagement with, and submissions made directly to, the EPA. It is the EPA's understanding that the Yungngora and Warlangurru People have been satisfactorily engaged such that potentially significant impacts from the proposal on Aboriginal cultural heritage values have been adequately identified and considered by the proponent in the design of the proposal. The EPA considered that the level of consultation undertaken with the Yungngora and Warlangurru was sufficient to inform its assessment, and that the broader cultural significance of the Fitzroy River and related values of the WKNHA was available and documented, without specific consultation with other Traditional Owner groups.

The proponent has undertaken ongoing consultation with the Blina and Noonkanbah Station leaseholders, with key issues arising during consultation being:

- disturbance footprint of the proposal and potential loss of grazing land
- potential impacts to water resources, such as through contamination
- interruptions to station activities, such as mustering
- utilisation of proposal infrastructure (such as water production bores) for pastoral uses at the end of the proposal.

2.3.5 Potential impacts from the proposal

The proponent has identified that the proposal has the potential to impact on social surroundings through:

- direct, physical disturbance to Aboriginal heritage sites as a result of clearing and ground disturbance
- inhibiting access or use of land for traditional activities, including cultural and pastoral activities
- adverse impacts to amenity and aesthetics due to dust, noise and vibration emissions
- increased traffic
- impacts to mental health and wellbeing due to impacts from changes to the physical or biological environment.

2.3.6 Avoidance measures

The proponent has proposed the following avoidance measures:

- designing the disturbance footprint to avoid listed Aboriginal heritage sites and other locations of Aboriginal cultural heritage value in consultation with relevant Traditional Owners
- siting the proposal activities away from residential areas and receptors.

2.3.7 Minimisation measures (including regulation by other DMAs)

The proponent outlined the following minimisation measures to reduce both direct and indirect impacts to social surroundings:

- implementing a complaints management system to record and respond to matters relating to amenity and aesthetics
- undertaking site specific amenity and aesthetics assessment to ensure that visual impacts and noise emissions to not adversely impact the amenity of users of the Calwynyardah– Noonkanbah Road
- implementing dust management controls, such as water carts for dust suppression
- ongoing consultation with Traditional Owners
- utilising Traditional Owner representatives as 'heritage monitors' during ground disturbance and ceasing works if evidence of heritage values are identified
- cultural awareness training and inductions for site personnel developed and delivered in consultation with Traditional Owners.

The EPA also recognises the that the proponent has an ILUA in place with the Yungngora people and a 'Land Access and Use Agreement' in place with the Warlangurru People. The provisions of these agreements are expected to contribute to the minimisation of potential impacts to matters relating to social surroundings, including Aboriginal cultural heritage.

Aboriginal Heritage Act 1972

Potential impacts of the proposal to Aboriginal heritage values may be further mitigated through the provisions of the *Aboriginal Heritage Act 1972* (AH Act). The AH Act provides for the mitigation and/or management of impacts to Aboriginal heritage sites. Such AH Act provisions are of most relevance in instances where direct physical disturbance to a registered site is unable to be avoided. The disturbance footprint intersects the 'dithered'[10] boundary of one registered Aboriginal heritage site (Place ID 13851 known as 'No. 19 Bore'). The proponent advised that the disturbance footprint in this location (an access track) was realigned to avoid direct impact to the values associated with this site. Consent under section 18 of the AH Act to impact an Aboriginal site is not expected to be required. However, the proponent has advised that authorisation under section 16 of the AH Act will be sought to enter the boundary of the registered Aboriginal site.

[10] A dithered boundary provides the general locality of a cultural heritage site, rather than its specification location, in order to protect culturally sensitive site

The EPA notes that the provisions relating to the protection of Aboriginal sites apply even if sites or relevant heritage features are not registered or lodged with DPLH under the AH Act. The proponent has committed to use of heritage monitors during ground disturbance, and consulting with Traditional Owners in the event that any previously unidentified heritage values are encountered. The EPA notes that the AH Act makes it an obligation to report Aboriginal cultural sites or objects to DPLH.

2.3.8 Assessment of impacts to environmental values

The EPA considered that the key social surroundings values likely to be impacted by the proposal are Aboriginal cultural heritage, and amenity and aesthetics resulting from noise, light, dust and vibration emissions.

Aboriginal cultural heritage

The proponent has modified the disturbance footprint to avoid direct impacts to identified Aboriginal cultural heritage features. As noted above, the disturbance footprint intersects the boundary of one registered Aboriginal site ('No. 19 Bore'), however through consultation with relevant Traditional Owners, the disturbance footprint was realigned to ensure that no direct impacts to the registered site were expected to occur. The proponent also confirmed through consultation that the proximity of the access track was unlikely to result in any significant indirect impacts to the cultural value of the No. 19 Bore site through dust, noise or vibration. The EPA notes that consistent with recommendations from the 2021 survey, the disturbance footprint was aligned to avoid disturbance of larger physical landscape features such as hills, breakaways or rock outcrops that may be associated with cultural heritage values.

Indirect impacts to Cultural Heritage values such as from noise, dust, light and vibration are not expected to be significant noting that through consultation with Traditional Owners no significant specific cultural heritage values or features have been identified in proximity to the proposed operations. The EPA notes that following completion of the 2021 archaeological and ethnographic survey (Deep Woods (WA) Surveys 2021) the development of a heritage management plan was not deemed necessary (Bennett Resources 2024).

The EPA notes that the proponent has committed to the disturbance footprint as shown in Figure 2 and is not seeking flexibility in siting proposal within the development envelope. The EPA considers that the disturbance footprint has been suitably surveyed in consultation with the relevant Traditional Owners such that any significant Aboriginal heritage sites or Aboriginal cultural heritage values would have been identified.

The EPA acknowledges concerns raised in public submissions that the primary survey information for Aboriginal cultural heritage is from 2021, and that unprecedented flooding in the region in 2023 may have exposed previously undiscovered evidence of heritage sites. The EPA notes that the concealment and/or exposure of archaeological sites through wind and water erosion was a recognised limitation of the 2021 survey report. The EPA considers that there is a low risk of direct impact or disturbance of Aboriginal heritage sites given the:

- evidence of ongoing consultation between the proponent and the relevant Traditional Owners, including through the land use agreements in placed with both the Yungngora and Warlangurru people
- the proponent's commitment to involve Traditional Owners as 'heritage monitors' during ground disturbance
- the provisions of the AH Act in the protection of Aboriginal heritage sites, regardless of where they have been registered or lodged under the Act.

The EPA recognises the inherent and significant Aboriginal cultural heritage values associated with the Fitzroy River and its tributaries, including Mount Hardman Creek. The EPA notes that potential impacts to the cultural values of the Fitzroy River was a concern raised in many of the public submissions received. The potential impacts and risks to the Fitzroy River relate to indirect impacts associated with adverse changes to groundwater or surface water quality or levels/flow. Given the proximity and scale of the proposal activities to the Fitzroy River, the EPA notes that adverse changes to groundwater or surface water would need to occur at a unforeseen scale to give rise to any discernible impact to the cultural values of the Fitzroy River. The EPA's consideration of these impacts is addressed through the assessment of Inland Waters in section 2.1 above.

The EPA considers that, subject to recommended condition B4, there is sufficient information available to establish environmental outcomes to ensure that the EPA's objective for social surroundings is likely to be met for Aboriginal cultural heritage values.

Loss or restriction of access to land for cultural purposes

The EPA has considered the potential impact of the proposal on restricting access to the land by the Yungngora and Warlangurru People for cultural and recreational reasons, such as education, hunting, gathering, fishing and swimming. Given the relatively small scale of the proposal (112 ha disturbance footprint) in the context of the broad landscape of the proposal area, the impacts from land access interruption are unlikely to be significant. Additionally, the support of the proposal by the Yungngora and Warlangurru People, as represented by the Yungngora Aboriginal Corporation and Warlangurru Aboriginal Corporation, indicates that the proposal is unlikely to result in a significant adverse impact to the ongoing use of the land by the Yungngora and Warlangurru People.

The EPA also notes that while access to the well sites will necessarily be restricted for safety reasons, the remainder of the disturbance footprint is access tracks that will not restrict Traditional Owner access to the land for cultural or recreational purposes. Matters relating to land access are also expected to be addressed through the provisions of the land use agreements in place between the Traditional Owners and the proponent.

Consistent with contemporary EPA assessment recommendations, the EPA has recommend a condition (B4-1(2)) to ensure that Traditional Owner access to the land is maintained, subject to reasonable health and safety requirements.

Amenity

The EPA notes that the proposal has the potential to adversely impact amenity values through nuisance dust, noise, light and vibration emissions during construction and operations. The EPA notes that drilling, HFS activities, and well testing will occur continuously 24-hours a day for a period of approximately 3-4 months for each exploration well. The nature of these activities has the potential to emit light, noise and vibration such that amenity values may be impacted if sensitive receptors are located close to the proposed activities.

The EPA notes that the proposal is located within a sparsely populated area primarily utilised for pastoral grazing. The nearest population centre is the Yungngora (Noonkanbah) community approximately 18 km to the south of the development envelope and 29 km from the nearest proposed well site. The separation distance between the disturbance footprint (from the nearest proposed well site) and the nearest fixed sensitive receptor (Quanbun Downs homestead) is approximately 21 km. The EPA notes that noise monitoring undertaken during previous HFS activities in the area recorded noise levels <65 dB(A) at 800 m from the source. The proponent also undertook baseline noise monitoring and developed a quantitative noise model that found that noise levels were likely to remain below maximum allowable external noise levels (35 dB L_{A10}) at a distance of approximately 2,500 km from the source. Given the above, and noting the remote location and the separations distances to sensitive receptors, the EPA considers that amenity and aesthetic impacts are unlikely to be significant. Similarly, light emissions are also not expected to result in any significant loss of amenity for relevant sensitive receptors.

Dust emissions are also expected to occur during construction activities, and from vehicle and machinery movements on unsealed roads and access tracks. The proponent's air quality monitoring program found that airborne dust levels in the proposal area are naturally elevated during the dry season (Bennett Resources 2024). The EPA notes that existing roads in the area are unsealed and contribute to ambient dust emissions. Given the remote location of the proposal area, the EPA considers that dust emissions are unlikely to significantly impact amenity values. The EPA has also considered the proponent's commitment to implement management measures during construction where necessary, including dust suppression. Such management measures are expected to be applied and enforced through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.

Potential impacts to terrestrial fauna from noise and light emissions are considered through the EPA's assessment of terrestrial fauna in section 2.4.

The EPA considers that visual amenity related impacts are likely to be negligible given the relatively low height of the temporary equipment (e.g. drilling rig) and the absence of prominent landforms in the area that would provide a vantage point from which the proposal activities could be readily observed.

The EPA notes that the proposal will result in increased traffic movements on otherwise relatively infrequently used roads, such Calwynyardah–Noonkanbah Road and the relevant portion of Great Northern Highway. The EPA understands that no

upgrades to the unsealed Calwynyardah–Noonkanbah Road are expected to be required, and the proponent has committed to continued engagement with the Shire of Derby West Kimberley and the Yungngora Association Inc. in relation to road maintenance requirements. The proponent predicted that, based on the highest average number of traffic moves per day, the proposal may result in a 60% increase in traffic along the Calwynyardah–Noonkanbah Road. However, this is expected to be limited primarily to 2-week periods during mobilisation to new well sites (Bennett Resources 2024). The EPA considers that the increase in traffic movements may adversely impact other road users for brief periods during mobilisation, however this is likely to be limited to residents and visitors to the Noonkanbah community. The EPA considers that the traffic impacts are unlikely to be significant and can be mitigated through ongoing consultation with the Yungngora people through the ILUA.

West Kimberley National Heritage Area

The EPA recognises that the development envelope is located within in the vicinity of the West Kimberley National Heritage Area (WKNHA) which, at its closest point, is located approximately 7.5 km to south of the development envelope. The WKNHA, listed under the EPBC Act, is recognised for its natural, indigenous and historic heritage values. The EPA recognises that the Fitzroy River, and its associated ecological and cultural values is central to the WKNHA listing. The boundary of the WKNHA in the vicinity of the proposal reflects the alignment of the Fitzroy River.

The EPA notes that several submissions raised concerns over potential impacts to the WKNHA from the proposal, and the lack of consideration of these impacts in the proponent's environmental review document. The proponent has responded to these matters in its response to submissions (Bennett Resources 2025a). Consistent with the EPA's findings above in relation to potential loss of amenity, the EPA considers that indirect impacts to the WKNHA due to loss of amenity arising from noise, dust or light emissions, or through loss of visual amenity, are unlikely to be material given the nature, scale and duration of the proposal, and the distance of the WKNHA from the proposal activities. The EPA acknowledges concerns regarding potential impacts to the WKNHA associated with indirect impacts due to adverse changes to groundwater or surface water quality or levels/flow affecting the Fitzroy River. However, as noted above, given the scale of the proposal activities and their proximity to the Fitzroy River, the EPA considers that adverse changes to groundwater or surface water would need to occur at an unforeseen scale to give rise to any discernible impact to the WKNHA. The EPA's consideration of these potential impacts is addressed through the assessment of Inland Waters in section 2.1 above.

Cumulative impacts

The EPA acknowledges that several public submissions identified the comparatively pristine and undeveloped nature of the broader West Kimberley region and raised concerns about the proposal in the context of potentially representing the commencement of 'industrialisation' of the region. As discussed above, the EPA considers that its objective for social surroundings is likely to be met for this proposal, subject to implementation of conditions and other decision-making processes. It is noted that this finding reflects the limited scale and duration of the

proposal in the context of past, present and reasonably foreseeable future activities and pressures in the region.

The EPA recognises that the wider development of a shale gas industry in the Canning Basin, including extraction, processing and distribution infrastructure, would likely result in different and increased impacts and pressures on social surroundings values, as well as other environmental values. However, in order to maintain the integrity and objectivity of the environmental assessment process, EPA's assessment is confined to consideration of the specific, and defined elements of the referred proposal. With the exception of assessing the cumulative impact of a proposal in the context of reasonably foreseeable activities, the EPA is unable to speculate or attempt to assess the potential impacts of hypothetical future proposals or activities. In regard to the assessment of potential pressures and impacts on environmental values that may result from future petroleum-related activities of scale in the Canning Basin, the EPA has provided advice to the Minister (section 5 'Other advice').

2.3.9 Summary of key factor assessment and recommended regulation

The EPA has considered the likely environmental outcomes of the proposal to social surroundings environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA's factor objective. The EPA's assessment findings are presented in Table 4.

Table 4: Summary of assessment for social surroundings

Residual impact		Assessment finding	Recommended conditions and DMA regulation
1.	Direct impacts to Aboriginal heritage features/sites.	Based on the survey information provided, and the proponent's consultation with Traditional Owners, the EPA advises that the risk of impacts to Aboriginal cultural heritage associated with direct disturbance to heritage sites or features is likely to be low. However, consistent with recent EPA recommendations, and to ensure that risks of direct impacts are appropriately managed, the EPA has recommended condition B4 to ensure impacts to Aboriginal heritage sites are avoided unless consent is granted through another decision-making process in consultation with the relevant Traditional Owners.	**Condition A1 (Limitations and extent of proposal)** Limiting extent of disturbance to the defined (locked) disturbance footprint. **Condition B4 (Aboriginal cultural heritage)** Requirement to avoid disturbance of Aboriginal cultural heritage features/sites unless consent granted through approvals under the AH Act and in consultation with the relevant Traditional Owners. ***Aboriginal Heritage Act 1972*** Regulation of direct disturbance of Aboriginal heritage sites.

Residual impact		Assessment finding	Recommended conditions and DMA regulation
2.	Loss or restriction of access to land for cultural purposes.	The EPA advises there is a risk, albeit low, of residual impact to Aboriginal cultural heritage through the loss of access to, or restriction of access to the land for cultural activities. The EPA recommends condition B5-1(2) to ensure Traditional Owner access to the land for traditional or cultural purposes, subject to reasonable health and safety requirements.	**Condition B4 (Aboriginal cultural heritage)** No interruption of ongoing access to land utilised for traditional use or custom by the relevant Traditional Owners.
3.	Impacts to aesthetics and amenity due to noise, dust, light and vibrations.	The EPA has considered the potential impacts of the proposal on nearby Aboriginal communities, pastoralists, and the broader values of the West Kimberley National Heritage Area. The EPA has concluded that given the short duration and small scale of the proposal, in the context of the remote location away from sensitive receptors, impacts to aesthetics and amenity values from potential noise, dust, light and vibration emissions during operations are likely to be negligible. The EPA has also considered the management measures committed to by the proponent, and the expected incorporation of these measures into statutory plans (such as the Environment Plan) required under other decision-making processes. The EPA advises that recommended conditions on the limits and extents of the proposal will ensure the environmental outcome is consistent with the EPA objective for social surroundings.	**Condition A1 (Limitations and extent of proposal)** Limiting extent, duration and location of proposal activities, including within the defined (locked) disturbance footprint. ***Petroleum and Geothermal Energy Resources Act 1967*** Management measures required through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.

2.3 Terrestrial Fauna

2.4.1 Environmental objective

The EPA environmental objective for terrestrial fauna is *to protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*

2.4.2 Investigations and surveys

The EPA advises the following surveys were used to inform the assessment of the potential impacts to terrestrial fauna:

- Acoustic assessment Valhalla Gas Exploration and Appraisal Program (appendix P of the environmental review document) (Herring Storer Acoustics 2021)
- Valhalla flora and fauna survey (appendix C of the environmental review document) (Eco Logical 2021)
- Valhalla Project targeted greater bilby survey (appendix 3 of the response to submissions document) (Ecologia Environmental 2024).

The EPA notes that the vertebrate terrestrial fauna surveys and short-range endemic (SRE) invertebrate fauna survey were not consistent with EPA guidance (EPA 2020 and EPA 2016a, respectively). The surveys present several limitations, including a lack of spatial coverage across the development envelope.

Despite the limitations, the EPA considers that the proponent's decision to 'lock' the disturbance footprint, along with the clarifications provided in the Response to submissions document (Bennett Resources 2025), provides sufficient information for the EPA to proceed with its assessment.

2.4.3 Assessment context: existing environment

Fauna Habitat

The proponent mapped three broad terrestrial fauna habitat types across the disturbance footprint (Eco Logical 2021):

- Fauna habitat 1: mixed open woodland over grassland on sandy clay flats and slopes
- Fauna habitat 2: mixed open woodland over tussock grasses on dune slopes and crests
- Fauna habitat 3: eucalypt open woodland and mixed shrubland on closed depression and creekline.

The riparian zone associated with the Mount Hardman Creek supports groundwater-dependent vegetation, which is likely to act as a refuge for fauna. The potential impacts to the Mount Hardman Creek are discussed in section 2.1 above, and therefore are not discussed further in this chapter.

The quality of vegetation across the disturbance footprint was predominately in 'Very good' to Excellent' condition, with only 10.1% in a 'Good' or 'Poor' condition.

Significant fauna

A total of 75 fauna species were recorded during terrestrial fauna surveys. No threatened fauna were sighted in the surveys; however, secondary evidence of the greater bilby (*Macrotis lagotis*) was recorded in the south-east of the development envelope (see Figure 5-15 of the ERD; Map 2 of Ecologia 2024), and greater bilby activity has been recorded in the area historically. The greater bilby is listed as vulnerable under the *Biodiversity Conservation Act 2016* (BC Act) and under the EPBC Act.

Fauna species of significance that were considered to potentially occur within the development envelope:

- Gouldian finch (*Erythrura gouldiae*; listed as endangered under the EPBC Act and priority 4 by DBCA)
- purple crowned fairy-wren (*Malurus coronatus*; listed as endangered under the EPBC Act and BC Act)
- grey falcon (*Falco hypoleucos*; listed as vulnerable under the EPBC Act and BC Act)
- common sandpiper *Actitis hypoleucos*; listed migratory under the EPBC Act and BC Act)
- fork-tailed swift (*Apus pacificus*; listed migratory under the EPBC Act and BC Act)
- sharp-tailed sandpiper (*Calidris acuminata*; listed migratory under the EPBC Act and BC Act)
- glossy ibis (*Plegadis falcinellus*; listed migratory under the EPBC Act and BC Act)
- peregrine falcon (*Falco peregrinus*; listed as other specially protected under the BC Act
- spotted ctenotus (northeast) (*Ctenotus uber johnstonii*; listed as priority 2 by DBCA)
- northern short-tailed mouse (*Leggadina lakedownensis*; listed as priority 4 by DBCA).

Based on advice from DBCA, the northern blue-tongued skink (*Tiliqua scincoides intermedia*) and northern brushtail possum (*Trichosurus vulpecula arnhemensis*; listed as vulnerable under EPBC Act and BC Act) also have the potential to occur within the development envelope. The northern blue-tongued skink is currently under consideration to be listed as critically endangered under the BC Act.

It is also noted that the proponent conducted a targeted fauna survey to determine the presence of northern quoll (*Dasyurus hallucatus*) and ghost bat (*Macrodermas gigas*) following concerns raised during public consultation.

Surveys for short-range endemic fauna have not been conducted within the area of proposed disturbance. However, a desktop assessment (Bennelongia 2011) was conducted for the assessment of the adjacent Duchess Paradise Project (see Figure 5-13 of the ERD). This desktop assessment considered that SRE species are unlikely to occur in the area due to a lack of restricted landforms that could give rise

to SRE species. Therefore, SRE species were not considered further in this assessment.

2.4.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in the proponent's Response to Submissions document (Bennett Resources 2025). During the public review, concerns were raised regarding the potential adverse impacts on terrestrial fauna from habitat loss and fragmentation, noise and light pollution, gas flaring, and the consumption of contaminated water. Submitters also raised concern about the adequacy of fauna surveys, and the mitigation and management measures proposed for fauna species, in particular, the greater bilby.

The key issues raised during the public consultation on the proposal and how they have been considered in the assessment are described in sections 2.4.5 to 2.4.9.

2.4.5 Potential impacts from the proposal

The proposal has the potential to significantly impact on terrestrial fauna from:

- clearing of terrestrial fauna habitat, including suitable habitat for the greater bilby
- fauna mortality or injury associated with vehicle strikes, spills and leaks of contaminants, and ingestion of contaminated water
- habitat fragmentation and edge effects as barriers to fauna movement and resulting in a loss of ecological connectivity
- habitat degradation or alteration from increased dust emissions, weeds, altered fire regimes, and altered hydrological regimes
- disturbance from noise, light, vibration, and gas flaring
- increase in predation of fauna species due to increased feral animal presence.

The EPA considers that changes in groundwater and hydrological regimes may impact terrestrial fauna habitat, such as groundwater drawdown resulting in a decline in the health of groundwater dependent vegetation and habitat degradation. Impacts to inland waters are considered in section 2.1.

2.4.6 Avoidance measures

The proponent has designed the proposal to avoid impacts to terrestrial fauna by:

- 'locking' the disturbance footprint, including avoiding any known greater bilby burrows
- applying buffer zones of no clearing within 50 m of any greater bilby burrows, and no clearing within 75 m of any active burrows.

2.4.7 Minimisation measures (including regulation by other DMAs)

The proponent has proposed measures to minimise impacts to fauna:

- implement egress management measures and exclusionary barriers to minimise the occurrence of fauna entrapment
- routinely inspect areas that have the potential to trap fauna
- maintain firebreaks to reduce the risk and severity of fire
- implement vehicle and equipment hygiene control measures to reduce the introduction or spread of weeds
- maintain a feral fauna register and implement fauna control methods, if necessary, after consultation with DBCA
- a speed limit of 40 km/h for vehicles between dusk and dawn, reducing to 20 km/h in areas where the greater bilby has been recorded
- utilise areas of existing clearing, such as existing roads to access wells
- pre-clearance surveys will be conducted for the greater bilby, including scouting for any burrows within 75 m of the disturbance footprint

The issues raised during the public consultation about potential impacts to terrestrial fauna from the introduction or spread of weeds, fauna entrapment, and feral fauna have been considered through the minimisation measures described above.

2.4.8 Rehabilitation measures

The proponent has proposed the following rehabilitation measures:

- topsoil will be stockpiled and used to restore vegetation
- progressive rehabilitation of cleared areas once drilling and FHS activities are complete
- post-decommissioning land use to be developed in consultation with relevant stakeholders.

2.4.9 Assessment of impacts to environmental values

The EPA considered that the key environmental value for terrestrial fauna proposed to be impacted by the proposal is threatened fauna.

Fauna Habitat

The proponent did not provide an estimate of the fauna habitat types across the entire development envelope and restricted mapping to the disturbance footprint. Despite survey limitations, all three fauna habitat types observed were well represented across the broader landscape, were not considered locally restricted (Eco Logical 2021), and the habitat was similar to those recorded in other surveys conducted nearby (Buru Energy and Outback Ecology 2014; ELA 2016). In addition, by ‘locking’ the disturbance footprint, the proponent was able to clearly map and describe the full extent of habitat proposed to be cleared. The mapped extents are presented in Table 5 below.

Fauna habitat type 2 was identified as suitable burrowing and foraging habitat for the greater bilby, and sighting of diggings provided secondary evidence of the greater

bilby being likely present in the area. Fauna habitat types 1 and 3 were not considered to be highly valuable with negligible evidence of use or observations of conservation significant fauna occurred in these habitat types. Due to the likely presence of the greater bilby within fauna habitat type 2, clearing of this habitat is likely to represent a residual impact, with an overall recommended clearing limit for native vegetation (condition A1-1) and a specific clearing limit for fauna habitat type 2 (recommended condition B2-1).

The EPA notes that the proponent has committed to rehabilitation measures to be included in the Environment Plan required under the *Petroleum and Geothermal Energy Resources Act 1967* regulated by DMPE. The EPA considers that measures to rehabilitate terrestrial fauna habitat are required, and the EPA is of the view that recommended condition B3-1 is required to ensure vegetation and fauna habitat are progressively rehabilitated to an adequate condition. The EPA considers that the residual impacts from habitat loss can be mitigated through recommended condition B2 (habitat clearing limit) and recommended condition B3 (rehabilitation) and subject to the recommended conditions is likely to consistent with the EPA objective for terrestrial fauna.

Table 5: Limits of disturbance for fauna habitat types

Fauna habitat type	Extent mapped within disturbance footprint (ha)	Extent mapped outside disturbance footprint (ha)	Total extent mapped (ha)
Fauna habitat 1: Mixed open woodland over grassland on sandy clay flats and slopes.	74.80	7.06	81.86
Fauna habitat 2: Mixed open woodland over tussock grasses on dune slopes and crests.	34.73	3.39	38.12
Fauna habitat 3: Eucalypt open woodland and mixed shrubland on closed depression and creekline.	2.92	5.25	8.17
Total	**112**	**15.69**	**128.15**

Significant fauna

A basic vertebrate fauna survey was conducted in 2021, and a targeted survey for the greater bilby was conducted in July 2024. Neither survey recorded sightings of significant fauna species, however, it is noted that surveys were restricted to the disturbance footprint only. Both the basic and targeted surveys recorded secondary evidence (diggings) for the greater bilby within Fauna habitat type 2.

Greater bilby

The basic vertebrate fauna survey (Eco Logical 2021) identified four greater bilby diggings within the disturbance footprint, estimated at less than one year old. The targeted survey (Ecologia 2024) appears to have recorded seven “old” greater bilby

diggings, but it is not clear whether some of these diggings are the same holes that were recorded during the basic survey. The EPA notes that the Traditional Owners who attended the targeted survey indicated that bilbies were not regularly encountered in the project area and were more common to the south of the Fitzroy River (Bennett Resources 2025).

The proponent has committed to pre-clearance surveys for the greater bilby and will survey areas up to 75 m from the disturbance footprint to locate bilby burrows. The proponent has also committed to not clearing any active greater bilby burrows. Noting that greater bilbies are highly mobile and are known to dig new burrows on average every 2.5 weeks (TSSC 2016), the EPA considers that the proponent should avoid clearing of any occupied burrows. If burrows located within the disturbance footprint are unable to be avoided, the proponent will relocate any bilbies consistent with DBCA advice.

To reduce the potential for fauna strikes of greater bilbies, the proponent has proposed a 40 km/hr speed limit between dusk and dawn. The EPA notes that speed limits are also likely to minimise the risk of impacts to other fauna species, conservation significant or otherwise.

The EPA considers that given the local and regional presence of suitable habitat outside the disturbance footprint, and considering the mitigation measures as discussed above, the proposal is unlikely to result in a significant residual impact to the greater bilby. The EPA has recommended conditions B2-1 (limit extent of fauna habitat disturbance and no disturbance of occupied burrows), B2-2 (speed limit), and B2-3 (pre-clearance survey) to minimise the risk of mortality, injury, and disturbance, and ensure the environmental outcome that is consistent with the EPA's objective for terrestrial fauna.

Northern quoll, ghost bat, grey falcon and purple-crowned fairy-wren

It is considered unlikely that the northern quoll, ghost bat, and grey falcon utilise the area. No critical habitat was recorded within the disturbance footprint for the northern quoll or ghost bat, and no ghost bat calls were recorded. The proponent also noted that Traditional Owners who attended the fauna survey have never observed northern quoll on Yungngora country or in the vicinity of the project.

The grey falcon typically nests in tall trees along watercourse, particularly river red gum (*Eucalyptus camaldulensis*) and coolibah (*E. coolabah*) (TSSC 2019). While these species are present within the development envelope, particularly along the Mount Hardman Creek, the proponent is not clearing any vegetation along this creekline. Further, the habitat assessment of trees across the disturbance footprint noted that hollow observed in tress were small, and therefore unlikely to be suitable for nesting.

Although the purple-crowned fairy-wren was directly observed during ecological surveys (Eco Logical 2021), no suitable habitat for this species occurs within the Project Area. This conclusion is based on the absence of key habitat features, including dense riparian vegetation dominated by species such as Pandanus and canegrass (*Chionachne cyathopoda*), which are essential for breeding and foraging

(TSSC, 2015). Eco Logical (2021) reported historical records prior to 2000 approximately 25 kilometres east of the Project Area. Based on this information, it is likely any occurrence within the Project Area is incidental and transient, and the presence of large numbers of individuals is unlikely.

The EPA considers that there is unlikely to be any residual impacts to the northern quoll, ghost bat, grey falcon and purple-crowned fairy-wren, and the EPA considers that the proposal environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Northern blue-tongue skink and northern brush-tail possum

Northern blue-tongue skink may shelter under shrubs and thick grasses, in leaf litter and within burrows and rock crevices and most of their movements throughout the day are limited to 20 metres (DCCEEW, 2023).

The proponent has commitment to pre-clearance surveys, with regard the northern blue-tongue skink and northern brush-tail possum. The EPA considers that pre-clearance surveys are appropriate to minimise the risk to these species should they occur in the area and has included the surveys in recommended conditions B2-3.

The northern brush-tail possum typically inhabits large hollow-bearing trees. As discussed above, large hollow-bearing trees were not recorded within the disturbance footprint.

The EPA considers that there are unlikely to result in residual impacts to the northern blue-tongue skink and northern brush-tail possum and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Priority fauna and migratory species

The proposal is expected to have a minimal impact on the priority fauna and migratory species. The clearing extent of habitat types is limited, and suitable habitat for these species is likely to be widespread across the landscape.

Migratory species, if present, are more likely to utilise waterways and wetlands, which are outside the disturbance footprint, after periods of high rainfall. It is also noted that migratory species have extensive foraging ranges. As such, the EPA considers that migratory species are unlikely to be dependent on the habitat proposed to be cleared. It is noted that the assessment of migratory species under the EPBC Act determined that migratory bird species were unlikely to be present or would not be significantly impacted (EPBC reference 2024/10006). The EPA considers that the proposal is unlikely to have a significant impact on migratory species, and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

The priority fauna species determined to have a potential presence, the Gouldian finch, spotted ctenotus (northeast), and northern short-tailed mouse, were not recorded within the development envelope during surveys. The proponent has also committed to pre-clearance surveys to ensure priority fauna species will not be

adversely impacted, and the EPA has included this in recommended condition B2-3. The EPA considers that priority fauna species are unlikely to have a dependence on the habitat present within the disturbance footprint and, subject to the recommended conditions, the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Indirect impacts to terrestrial fauna

Fragmentation, weeds, and fire regimes

While the overall clearing extent is relatively small, the linear footprint introduces potential impacts from fragmentation and edge effects, introduction and spread of weeds, and changes to fire regimes. The EPA considers that given the extent of clearing proposed for access tracks and wells, which will be relatively narrow and traversed infrequently by light vehicles, and the existing pastoral station land use, it is unlikely that there will be a significant increased risk of fragmentation and edge effects, introduction and spread of weeds. The environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

The EPA notes that the proposal has the impact to change fire regimes, including increase fire events as a result of proposal activities, such as flaring during well testing. The EPA advises that fire safety is a critical consideration in petroleum activities and mitigation measures, including emergency response protocols, are expected to be addressed through the Environment Plan required under the PGER Act.

Noise and light pollution

The proponent is proposing to operate 24 hours per day, which will produce noise and will result in light pollution during night-time hours. It is noted that the proponent will only drill, stimulate and flow test one well at a time, therefore reducing overall noise and light pollution, such as could result from simultaneous operations across all 10 well sites. The implementation of speed limits will also limit impacts from noise.

The proponent has conducted an assessment of noise emissions in relation to sensitive human receptors (Herring Storer Acoustics 2021). While the exact make and model of machinery and equipment has not been finalised, the expected maximum noise emissions at the source is expected to be no more than 110 dB(A). Given that operations will be conducted in series, noise emissions are only expected to be localised and over a short period and likely to only result in short term displacement of fauna.

Similarly, light pollution is expected to be highly localised as operations will be limited to one well at a time. The proponent notes that gas flaring would result in increased light pollution, however, this is also expected to be highly localised with a relatively short duration. The EPA considers that the residual indirect impacts from noise and light pollution are unlikely to be significant, and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Exposure to wastewater

The EPA has considered the potential exposure of terrestrial fauna to stored flow back water and HFS fluids. As discussed in Section 2.1, HFS fluids are not expected to be highly toxic, and flowback water is highly saline and unlikely to attract fauna. Additionally, stock water bores of the pastoral station, permanent pools and other water sources in the broader area are likely to be preferential waters sources for terrestrial fauna. The EPA notes that the proponent has committed to utilise 'bird diverters' if evidence of avian fauna usage of ponds is observed (Bennett Resources 2025a). The EPA considers that the residual indirect impacts from exposure to wastewater is unlikely to be significant, and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.

Cumulative impacts

The proponent has not provided a cumulative impact assessment on terrestrial fauna. Despite this, the EPA has considered the proposed level of impact in relation to the likely presence of significant fauna and clearing of fauna habitat types. Considering the EPA's recommended limit on clearing of greater bilby habitat, the overall lack of critical habitat types, and relatively low likelihood of conservation significant fauna presence within the disturbance footprint, the EPA considers that the cumulative impact posed by the proposal are unlikely to be at a level that would alter the likely environmental outcomes.

2.4.10 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the proposal on terrestrial fauna environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective.

The EPA has also considered the principles of the *Environmental Protection Act 1986* (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objectives and whether reasonable conditions can be imposed (see Appendix A).

The EPA considers that implementation of this proposal should be subject to recommended conditions B2 and B3.

Table 6: Summary of assessment for terrestrial fauna

Residual impact		Assessment finding	Recommended conditions and DMA regulation
1.	Direct impacts to Fauna habitat type 2 from clearing of up to 34.8 ha.	The EPA advises that the residual impact to habitat utilised by conservation significant fauna species can be adequately regulated through the	**Condition A1 (Limitations and extent of proposal)** Limiting extent of disturbance to the defined

Residual impact		Assessment finding	Recommended conditions and DMA regulation
		recommended conditions (A1 and B2-1). Further, rehabilitation of fauna habitat can be adequately regulated through recommended condition B4 and under the *Petroleum and Geothermal Energy Resources Act 1967*. The EPA considers that the environmental outcome is likely to be consistent with the EPA objective for terrestrial fauna.	(locked) disturbance footprint. **Condition B3 (Terrestrial fauna)** Disturbance limit of no more than 34.8 ha of Fauna habitat type 2. **Condition B4 (Rehabilitation)** Rehabilitation of fauna habitat. ***Petroleum and Geothermal Energy Resources Act 1967*** Regulation through Environment Plan capturing mitigation measures and rehabilitation following completion.
2.	Disturbance of occupied greater bilby burrows.	The proposal has the potential to result in disturbance of greater bilby burrows. The EPA considers that clearing of burrows, if found within the development envelope, should be avoided The EPA advises that, subject to the recommended conditions (A1-1, B2-1, B2-2, and B2-3), the residual risk is likely to be consistent with the EPA objective for this factor.	**Condition A1 (Limitations and extent of proposal)** Limiting extent of disturbance to the defined (locked) disturbance footprint. **Condition B3 (Terrestrial fauna)** Disturbance limit of no more than 34.8 ha of Fauna habitat type 2. No disturbance of occupied greater bilby burrows. Pre-clearance surveys of conservation significant fauna, including the greater bilby. ***Biodiversity Conservation Act 2016*** Regulation of the take or disturb of threatened fauna.

Residual impact		Assessment finding	Recommended conditions and DMA regulation
3.	Impact to threatened or priority fauna from vehicle strikes.	The proposal has the potential to result in impacts to terrestrial fauna species from vehicle strikes. The proponent's proposed mitigation measure to limit vehicle speed of 40 km/hr at night is considered reasonable, however, the EPA also recommends a 60 km/hr limit during the day to ensure the environmental outcome is consistent with the EPA objective for this factor (recommended condition B2-2).	**Condition A1 (Limitations and extent of proposal)** Limiting extent of disturbance to the defined (locked) disturbance footprint. **Condition B3 (Terrestrial fauna)** Speed limits of vehicles and machinery during construction and operations.
4.	Indirect impacts from noise and light pollution.	There is potential for terrestrial fauna species to be indirectly impacted from noise and light emissions, including from gas flaring. Given the scale and duration of activities that will result in noise and light emissions, the EPA advises that indirect impacts to terrestrial fauna are unlikely to be significant. The EPA also considers that noise and light emissions, such as those associated with flaring activities, can be further regulated through the Environment Plan required under the PGER Act. The EPA considers that there is unlikely to be a significant residual impact, and the environmental outcome is likely to be consistent with the EPA's objective for terrestrial fauna.	**Condition A1 (Limitations and extent of proposal)** Limiting the location and duration of activities that result in noise and light emissions. ***Petroleum and Geothermal Energy Resources Act 1967*** Regulation through Environment Plan capturing mitigation measures for indirect impacts to terrestrial fauna.

3 Holistic assessment

While the EPA assessed the impacts of the proposal against the key environmental factors and environmental values individually in the key factor assessments above, given the link between key environmental factors, the EPA also considered connections and interactions between them to inform a holistic view of impacts to the whole environment.

Inland waters – terrestrial fauna

Terrestrial fauna has an integral reliance on inland waters to sustain and maintain growth. Surface water catchment and groundwater aquifers support riparian vegetation and groundwater-dependent ecosystems, which provide habitat for fauna species. Surface water pools and river systems also provide a source of water for terrestrial fauna species. Minimising impacts to inland waters will minimise impacts to terrestrial fauna species and fauna habitat.

The EPA considers that the proposed mitigation and management measures and recommended conditions for impacts to inland waters will also mean the inter-related impacts to the health of other factors of the environment including the values associated with terrestrial fauna are likely to be consistent with the EPA environmental factor objectives.

Greenhouse gas emissions

There is an established link between GHG emissions and the risk of climate change. The EPA recognises that climate change will impact on Western Australia's environment and environmental values. The EPA considers that the proposed mitigation of GHG emissions, as regulated under the Safeguard Mechanism and through the recommended conditions, will also mean that the impacts to other factors and values of the environment including the values associated with terrestrial fauna, flora and vegetation and inland waters are likely to be consistent with the EPA environmental factor objectives.

Social surroundings

There is a direct link between Aboriginal culture and the physical or biological aspects of the environment. Access to land, ability to carry out traditional Aboriginal customs and areas of cultural importance may be impacted through impacts to values of flora and vegetation, terrestrial fauna and inland waters. Water resources are important to the Yungngora and Warlangurru People. The EPA recognises the strong cultural links between the Yungngora and Warlangurru People and Country, and the potential impacts posed by a loss of access to country, changes to surface and groundwater, and disturbance of flora and vegetation and terrestrial fauna may have on this connection.

The EPA considers that the proposed mitigation and management measures, recommended conditions, and management via other regulatory processes for impacts to flora and vegetation, terrestrial fauna and inland waters will also mean the

interrelated impacts to the values of social surroundings will likely be consistent with the EPA environmental factor objectives.

Summary of holistic assessment

When the separate environmental factors and values affected by the proposal were considered together in a holistic assessment, the EPA formed the view that the impacts from the proposal would not alter the EPA's views about consistency with the EPA's factor objectives as assessed in section 2.

4 Information Gaps and Assessment Actions

The EPA acknowledges that some uncertainties and knowledge gaps remain in the available information and has also considered the advice from the Independent Expert Scientific Committee (IESC). This includes limited site-specific hydrogeological and hydrological data, uncertainty in groundwater-surface water connectivity, potential overtopping of wastewater ponds during extreme rainfall events, lack of stygofauna surveys, and incomplete understanding of fracture propagation and fault reactivation risks. These limitations were a recurring theme in public submissions. These gaps highlight the importance of a regulatory framework that can respond dynamically as new information becomes available. The EPA has adopted a considered, objective, and risk-based approach to its assessment, ensuring that the proposal can be implemented in a manner consistent with the EPA's environmental objectives.

To address residual uncertainty, the EPA recommends layered implementation conditions that ensure outcomes and mitigation measures are proportionate to potential impacts, enabling adaptive management throughout the proposal's life. Conditions B1-2 require programs to manage specific HFS risks, including micro-seismic monitoring and geomechanical risk assessment, while B1-4 addresses well integrity and mandates independent expert peer review to confirm alignment with best practice and environmental objectives. Through the Groundwater Management Plan (GWMP), condition C4-3 requires local-scale groundwater monitoring for at least 12 months prior to drilling, providing baseline data to inform management. Performance reporting and independent review under condition B6 work in tandem with these measures to progressively strengthen safeguards, with findings integrated into future GWMPs to support adaptive management (e.g. recommended condition C2-2(4)).

A layered approach ensures that early monitoring results and operational experience inform refinements to subsequent stages, allowing the proposal to adaptively improve and deliver better environmental outcomes aligned with the EPA's objectives. By requiring iterative data collection, validation of predictive models, and periodic review of performance, the recommended conditions provide a structured pathway for continuous improvement. The approach reflects the EPA's intent to manage residual uncertainty through proportionate and responsive measures, ensuring that environmental values are protected while enabling informed decision-making as knowledge evolves.

The EPA's approach and recommended conditions are also complemented by other statutory decision-making processes and regulatory frameworks, such as the *Petroleum and Geothermal Energy Resources Act 1967* and the *Rights in Water and Irrigation Act 1914*, which provide additional safeguards to ensure the EPA's objectives are met.

For example, groundwater drawdown modelling was based on regional hydraulic parameters rather than site-specific data. While modelling predicts negligible drawdown beyond 700 metres from each well site, the EPA recognises the

uncertainty associated with these predictions. Accordingly, recommended conditions include:

- limits on groundwater abstraction and drawdown extent
- no adverse impact to groundwater-dependent vegetation
- implementation of a Groundwater Management Plan (GWMP) with monitoring capable of detecting preferential drawdown.

Similarly, uncertainties remain regarding fracture propagation and the potential for hydrogeological faults to act as conduits for contaminants. To mitigate these risks, the EPA has recommended conditions requiring:

- proposal-induced fractures to remain within the target Laurel Formation
- microseismic monitoring and early warning systems to detect unexpected fracture growth
- site-specific geomechanical risk assessments prior to HFS activities.

The EPA has considered the findings and recommendations of the Independent Scientific Inquiry into Hydraulic Fracture Stimulation (HFS Inquiry), which was a robust and comprehensive review of environmental and technical risks conducted by an expert panel underpinned by peer-reviewed science and transparent processes. While some actions under the WA Governments Implementation Plan remain outstanding, such as the establishment of an enforceable Code of Practice. The EPA notes the Government's commitment that HFS exploration activities will not proceed until this Code is in place. The EPA is therefore assured that implementation of the proposal will occur under a strengthened regulatory framework that reflects the HFS Inquiry's recommendations.

5 Recommendations

The EPA has taken the following into account in its assessment of the proposal:

- environmental values which may be significantly affected by the proposal
- assessment of key environmental factors, separately and holistically (this has included considering cumulative impacts of the proposal where relevant)
- likely environmental outcomes which can be achieved with the imposition of conditions
- consistency of environmental outcomes with the EPA's objectives for the key environmental factors
- EPA's confidence in the proponent's proposed mitigation measures
- whether other statutory decision-making processes can mitigate the potential impacts of the proposal on the environment
- principles of the EP Act.

The EPA recommends that the proposal may be implemented subject to the conditions recommended in Appendix A.

6 Other advice

The EPA may, if it sees fit, include other information, advice or recommendations relevant to the environment in its assessment reports, even if that information has not been taken into account by the EPA in its assessment of a proposal.

It is noted that environmental survey data, including site-specific hydrogeological data, provided by the proponent was limited in extent and varied from the relevant EPA technical guidance. The EPA determined it could proceed with its assessment with the available qualitative contextual information to support its assessment. It is noted that for future impact assessment in this region, the EPA expects proponents to provide information that is consistent with the relevant technical guidelines and to provide quantitative local and regional information to support a thorough impact assessment.

The EPA provides the following information for consideration by the Minister.

Regulation by the Department of Mines, Petroleum and Exploration

The EPA notes that onshore petroleum development activity associated with the proposal will be subject to the *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) and associated regulations, administered by the Department of Mines, Petroleum and Exploration (DMPE). The EPA expects that the PGER Act will apply further and complementary statutory requirements to limit potential impacts from the construction, operation and decommissioning of the proposal on the environment. In discharging its statutory responsibilities in respect of this proposal, the EPA advises that DMPE should have regard to the specific findings and recommendations of the HFS Inquiry, including the technical and risk mitigation measures that were anticipated to be included in the Code of Practice.

Government delivery of the Implementation Plan

The EPA notes that some recommendations of the HFS Inquiry that are important to the mitigation of environmental impacts of HFS activities are yet to be addressed through the Government's delivery of the Implementation Plan. The EPA notes the Government's commitment to not approve HFS exploration activities until an enforceable Code of Practice has been established. The EPA advises that the agencies tasked with delivering the Implementation Plan should prioritise efforts to fulfilling the outstanding tasks and delivering the legislative reforms consistent with the Government's decisions in response to the HFS Inquiry.

Petroleum exploration and production in the Canning Basin

The EPA acknowledges the significant public concern expressed through public submissions regarding the potential future cumulative impacts should petroleum activities in the Canning Basin intensify. The EPA has assessed the cumulative impacts of this proposal having regard to past, current and reasonably foreseeable activities and pressures in the region. The EPA notes that whilst there has been a long history of petroleum exploration in the Canning Basin, the small scale and low

intensity of these activities means there has been a limited effect on the environmental values of the area. The potential petroleum resources of the Canning Basin are well discussed, however the EPA notes that there are no reasonably foreseeable large scale petroleum production proposals that could be practicably considered as part of a cumulative impact assessment.

However, noting the level of public interest, combined with the unique environmental and cultural values of the area, the EPA recommends that if there is likely to be growth in shale gas exploration or progression to production, that a regional cumulative risk assessment framework should be developed. The EPA recommends that such a framework should be supported by a program of regional baseline monitoring and characterisation, including but not limited to geomechanical, hydrogeological, cultural and biological information to support impact assessment and decision making.

Financial assurance

The HFS Inquiry identified deficiencies in the existing regulatory framework under the PGER Act in respect of financial assurance provisions available for environmental liabilities that may arise of over the life of petroleum exploration and production activities. This finding was noted to be relevant to both conventional and unconventional (HFS) petroleum operations. The HFS Inquiry noted that there are no financial assurances required from operators, nor the ability to require discretionary assurances, such as the 'Unconditional Performance Bonds' available under the *Mining Act 1978* (Mining Act). There is also no equivalent to the Mining Rehabilitation Fund for onshore petroleum activities. The HFS Inquiry subsequently recommended that appropriate financial assurances or insurances should be required to cover potential environmental liabilities, as well as contributions to a fund to cover liabilities defaulted by other unconventional oil and gas operations associated with hydraulic fracture stimulation in Western Australia (Recommendation 39).

The EPA notes that the Implementation Plan includes an action to implement financial assurances to protect the State from liabilities associated with HFS (Action 19). Delivery of a financial assurances framework for the onshore petroleum industry has not yet occurred. However, the EPA notes that Government released a Position Paper in July 2020 (Government of WA 2020) which, amongst other things, identified potential amendments to the PGER Act to broaden existing financial assurance mechanisms consistent with the recommendations of the HFS Inquiry. It is understood that drafting is underway for the Bill amending the PGER Act. The EPA also notes that, as an alternative, the Minister may consider imposing financial assurance requirements in respect of this proposal under Part VA of the EP Act.

Appendix A: Recommended conditions

Section 44(2)(b) of *Environmental Protection Act 1986* specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This appendix contains the EPA's recommended conditions and procedures.

Recommended Environmental Conditions

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
***(Environmental Protection Act 1986*)**

VALHALLA GAS EXPLORATION AND APPRAISAL PROGRAM

Proposal:	Bennett Resources is proposing to undertake an unconventional exploration drilling and hydraulic fracture stimulation program within Petroleum Exploration Permit EP 371 (EP 371) within the Shire of Derby, West Kimberley. The proposal area is located approximately 123 kilometres south-east of the town of Derby. The proposal comprises the construction of up to twenty wells in a region of the Canning Basin that has been previously surveyed and explored for petroleum purposes. The proposal is targeting hydrocarbons in the Laurel Formation, with hydrocarbon shows present at depths in the order of 2,000 metres (m) to 4,000 m below ground level. The proposal will require an overall disturbance footprint of 112 hectares.
Proponent:	Bennett Resources Pty Ltd Australian Company Number 145 113 186
Proponent address:	Level 4, 225 St Georges Terrace PERTH WA 6000
Assessment number:	2281

Report of the Environmental Protection Authority: 1800

Introduction: Pursuant to section 45 of the *Environmental Protection Act 1986,* it has been agreed that the proposal entitled Valhalla Gas Exploration and Appraisal Program, described in the referral of 24 December 2020, as amended by the change to proposal approved under s. 43A on 6 May 2022, may be implemented and that the implementation of the proposal is subject to the following implementation conditions and procedures:

Conditions and procedures

Part A: Proposal extent

Part B: Environmental outcomes, prescriptions and objectives

Part C: Environmental management plans and monitoring

Part D: Compliance and other conditions

PART A: PROPOSAL EXTENT

A1 Limitations and Extent of Proposal

A1-1 The proponent must ensure that the proposal is implemented in such a manner that the following limitations or maximum extents / capacities / ranges are not exceeded:

Proposal element	Location	Maximum extent
Physical elements		
Development envelope	Figure 1	No more than 93,006 **ha**
Disturbance footprint	Figure 1	No more than 112 **ha**
		No **disturbance** outside of the spatial area defined in Figure 1 except for the purpose of **environmental monitoring**
Direct **disturbance** of native vegetation	Within the **disturbance footprint** shown in Figure 1	No more than 110 **ha**
Exploration wells	Within the well sites shown in Figure 1	No more than 20 wells
		Horizontally drilled section no more than 5000 **m** in length within the **Laurel Formation**
Operational elements		
Groundwater abstraction	Within the well sites shown in Figure 1	**Groundwater abstraction** from the **Liveringa Aquifer** up to 100 **ML** per **exploration well**
Well testing	n/a	No more than 90 days of **flaring** per **exploration well**
Timing elements		
Proposal life	n/a	Up to 7 years

PART B – ENVIRONMENTAL OUTCOMES, PRESCRIPTIONS AND OBJECTIVES

B1 Inland waters

B1-1 The proponent must ensure the implementation of the proposal achieves the following environmental **outcomes**:

(1) groundwater drawdown does not exceed the **predicted drawdown extent;**

(2) no **detectable** decrease in groundwater quality of the **Liveringa Aquifer** and the **Grant Poole Aquifer**, compared to **baseline**;

(3) proposal-induced fractures must remain within the **Laurel Formation**;

(4) no movement of **HFS fluids**, hydrocarbons or saline groundwater into the **Liveringa Aquifer** or the **Grant Poole Aquifer** as a result of well integrity failure, fracture propagation or activation of hydrogeological faults;

(5) all **wastewater** must remain contained within **water retention pond(s)**; and

(6) no **detectable** decrease in the health of groundwater dependent vegetation as a result of **groundwater abstraction** at the Midgard or Muspelheim well pads as shown in Figure 1.

B1-2 Prior to the commencement of drilling, the proponent must prepare:

(1) a micro seismic monitoring program that includes monitoring prior to, during and after **HFS** activities;

(2) an early warning system based on a 'traffic light scheme' suitable to prevent adverse geo-mechanical events reaching a size of any consequence to land or hydrogeology for geomechanical events;

(3) a procedure for the completion of geomechanical risk assessment for each proposed well, that includes incorporation of geological data collected during drilling;

(4) a program for well design, construction and testing to be assessed by an independent certified well examiner;

(5) a site water audit program to account for water produced, evaporated and disposed, such that significant leakage of fluids can be detected and remedied.

B1-3 The elements in condition B1-2 must be prepared to contribute to the achievement of the environmental **outcomes** in condition B1-1 and be informed

by and, where relevant, be consistent with the findings and recommendations of the **HFS Inquiry**.

B1-4 A peer review of the elements in condition B1-2 must be carried out by an independent person or independent persons with relevant expertise determined by the **CEO**, that provides an analysis of whether the elements:

(1) meet the requirements of condition B1-3; and

(2) are consistent with relevant **industry best practices** at the time.

B1-5 The elements in condition B1-2 and the peer review in condition B1-3 must be included in the proponent's **petroleum management documents** and submitted to the **CEO**.

B1-6 The proponent must review and update the *Valhalla Gas Exploration and Appraisal Program - Groundwater Management Plan* (Revision 5, 29 May 2025) that satisfies the requirements of condition C4 and demonstrates how achievement of the environmental **outcomes** in condition B1-1 will be monitored and substantiated and submit it to the **EPA**.

B2 Terrestrial Fauna

B2-1 The proponent must ensure the implementation of the proposal achieves the following environmental **outcomes**:

(1) **disturb** no more than 34.8 **ha** of **Fauna habitat type 2** for the greater bilby (*Macrotis lagotis*); and

(2) no direct **disturbance** of **occupied greater bilby burrows** is to occur outside of the **disturbance footprint**.

B2-2 During **construction activities** and **operations**, vehicle and machinery speed limits within the **development envelope**, excluding the Calwynyardah-Noonkanbah Road and **emergency response vehicles**, must not exceed:

(1) 40 **km/hr** during **night-time hours**.

B2-3 Prior to **ground disturbing activities**, the proponent must undertake the following actions:

(1) within seven (7) days prior to **clearing**, using a **fauna spotter**, undertake **pre-clearance surveys** of the areas to be cleared to detect presence of **significant fauna**, including greater bilby (*Macrotis lagotis*); and

(2) where **significant fauna**, including greater bilby (*Macrotis lagotis*), are identified, **ground disturbing activities** shall not commence in that location until:

(a) the finding has been notified to the **CEO** and **DBCA**; and

(b) either:

(i) the individual(s) have been relocated by a licensed **fauna handler** to **similar habitat**; or

(ii) the individual(s) have been observed by the **fauna spotter** to have moved on from the area to adjoining **similar habitat**; or

(iii) the **fauna spotter** considers that the individual(s) no longer occur in the area to be cleared.

B3 Rehabilitation

B3-1 The proponent must ensure the implementation of the proposal achieves the following environmental **outcomes**:

(1) rehabilitated vegetation and fauna habitat are **self-sustaining**;

(2) soil and water within rehabilitated areas is of a quality that is suitable to support post closure landuses;

(3) supporting infrastructure including **water retention pond(s)** is dismantled and removed and either disposed of at a licensed landfill or otherwise reused/recycled;

(4) rehabilitated areas are consistent with the species diversity, abundance and function of native vegetation within comparative **reference sites**; and

(5) rehabilitated landforms are stable and do not cause **pollution** or **environmental harm**.

B3-2 The proponent must revegetate all areas of native vegetation cleared but not reasonably expected to be required for **operations** in a **progressive manner** until the **outcomes** required by condition B3-1 are achieved or as otherwise agreed by the **CEO**.

B4 Aboriginal cultural heritage

B4-1 The proponent must implement the proposal to meet the following environmental **outcomes**:

(1) no disturbance of **Aboriginal sites** or to **Aboriginal cultural heritage** in the proposal disturbance footprint other than where consent is granted for the use of the land under the *Aboriginal Heritage Act 1972*; and

(2) subject to reasonable health and safety requirements, no interruption of ongoing access to land utilised for traditional use or custom by the **native title party/ies**.

B4-2 The proponent must implement the proposal to meet the following environmental **objective**:

(1) avoid, and where unavoidable, minimise adverse impacts to **Aboriginal cultural heritage** within and surrounding the **development envelope**.

B4-3 The proponent must undertake ongoing consultation and engagement with the **native title party/ies** about the achievement of the **outcomes** in condition B1-1, condition B2-1, condition B3-1 and condition B4-1 and the **objective** in condition B4-2 the life of the proposal.

B5 Greenhouse gas emissions

B5-1 The proponent must:

(1) take reasonable measures to minimise the **flaring** of **condensate** and natural gas produced during **well testing;**

(2) take reasonable measures to implement **reduced emissions well completions**;

(3) avoid **cold venting**, unless necessary to maintain safe operating conditions or in emergency situations;

(4) ensure **flaring** of hydrocarbons during **well testing** achieves a minimum combustion efficiency of 98%.

B5-2 The proponent must notify the **CEO** in writing within one month of it becoming aware that implementation of the proposal will not be or is not expected to be regulated under the **Safeguard Legislation** as a designated large facility (*the notifiable event*) and such notice must briefly describe the reasons for and expected duration of the notifiable event.

B5-3 The proponent must, if requested in writing by the **CEO**, provide the **CEO** with a report on the implications for the proposal of any amendment or proposed amendment to the **Safeguard Legislation**, or a decision or proposed decision made under the **Safeguard Legislation** that is specified in the **CEO**'s request.

B5-4 The report required by condition B5-2 must:

(1) be submitted to the **CEO** within three months of the date of the **CEO's** request or such longer period as the **CEO** agrees to in writing; and

(2) explain the implications that the specified amendment or decision has had or is expected to have on:

(a) the obligation to reduce net **Scope 1 greenhouse gas emissions** from implementation of the proposal under the **Safeguard Legislation**; and

(b) the quantity of actual and net **Scope 1 greenhouse gas emissions** likely to result from the future implementation of the proposal.

B6 Environmental Performance Reporting

B6-1 The proponent must submit an Environmental Performance Report to the **CEO** within six (6) months of the completion of **well testing** of:

(1) the first one (1) **exploration well**;

(2) the first four (4) **exploration wells**; and

(3) the first ten (10) **exploration wells**,

or such other times as may be approved by the **CEO**.

B6-2 Each Environmental Performance Report must:

(1) report on the measures implemented to reduce the **flaring** of natural gas and **condensate** during **well testing** for all wells tested during the preceding period, including:

(a) the status and commercial availability of equipment and relevant technology for the reduction of **flaring** in the Australian context;

(b) the quantity and proportion of natural gas and **condensate** diverted from **flaring** and an estimate of the resulting reduction in **Scope 1 greenhouse gas emissions**; and

(c) identifying and describing measures available to the proponent to reduce **flaring** of natural gas and **condensate** during **well testing**, including the adoption of proposed technologies and methods, and specifically the timeframe within which each technology or method will be implemented.

(2) report on the effectiveness of mitigation measures implemented to achieve the environmental **outcomes** in condition B1-1, including:

(a) the implementation of and effectiveness of the measures listed in condition B1-2 to mitigate the potential impacts of the proposal;

(b) consistency of the proposal implementation with the recommendations of the **HFS Inquiry**; and

(c) identification of available **adaptive** management and continuous improvement strategies that may be implemented, including improvement in monitoring undertaken to demonstrate achievement of the **environmental outcomes** in condition B1-1.

B6-3 The Environmental Performance Report required by condition B6-1 is to be accompanied by a peer review carried out by an independent person or independent persons with relevant expertise determined by the **CEO**, that provides:

(1) an assessment of whether the conclusions provided in the Environmental Performance Report are supported by evidence;

(2) recommendations, where applicable, for any revision of the environmental management plan required by condition B1-6; and

(3) recommendations, where applicable, for any measures that should be implemented to reduce flaring.

PART C – ENVIRONMENTAL MANAGEMENT PLANS AND MONITORING

C1 Environmental Management Plans: Conditions Related to Commencement of Implementation of the Proposal

C1-1 The proponent must not undertake:

(1) drilling of **exploration wells** until the **EPA**, on advice of **DMPE and DWER**, has **confirmed** in writing that the environmental management plan required by condition B1-6 meets the requirements of that condition and condition C4;

C2 Environmental Management Plans: Conditions Relating to Approval, Implementation, Review and Publication

C2-1 Upon being required to implement an environmental management plan under Part B, or after receiving notice in writing from the **EPA** under condition C1-1 that the environmental management plan(s) required in Part B satisfies the relevant requirements, the proponent must:

(1) implement the most recent version of the **confirmed** environmental management plan; and

(2) continue to implement the **confirmed** environmental management plan referred to in condition C2-1(1), other than for any period which the **CEO** confirms by notice in writing that it has been demonstrated that the relevant requirements for the environmental management plan have been met, or are able to be met under another statutory decision-making process, in which case the implementation of the environmental management plan is no longer required for that period.

C2-2 The proponent:

(1) may review and revise a **confirmed** environmental management plan provided it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan;

(2) must review and revise a **confirmed** environmental management plan and ensure it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan, as and when directed by the **CEO;**

(3) must review and revise the **confirmed** environmental management plan required by Condition B1-6 and submit to the **CEO** for approval within three (3) months of each Environmental Performance Report required to be submitted under Condition B6-1;

(4) the review and revision of the environmental management plan required under condition C2-2(3) must include:

(a) learnings and findings of the environmental performance reports required under condition B6-2(2), including any identified adaptive management and continuous improvement strategies;

(b) revised conceptualisation of the hydrological and hydrogeological processes within the **development envelope**; and

(c) recommendations made under condition B6-3(2).

(5) must revise and submit to the **CEO** the **confirmed** Environmental Management Plan if there is a material risk that the **outcomes** or **objectives** it is required to achieve will not be complied with, including but not limited to as a result of a change to the proposal.

C2-3 Despite condition C2-1, but subject to conditions C2-4 and C2-5, the proponent may implement minor revisions to an environmental management plan if the revisions will not result in new or increased **adverse impacts** to the environment or result in a risk to the achievement of the limits, **outcomes** or **objectives** which the environmental management plan is required to achieve.

C2-4 If the proponent is to implement minor revisions to an environmental management plan under condition C2-3, the proponent must provide the **CEO** with the following at least twenty (20) business days before it implements the revisions:

(1) the revised environmental management plan clearly showing the minor revisions;

(2) an explanation of and justification for the minor revisions; and

(3) an explanation of why the minor revisions will not result in new or increased **adverse impacts** to the environment or result in a risk to the achievement of the limits, **outcomes** or **objectives** which the environmental management plan is required to achieve.

C2-5 The proponent must cease to implement any revisions which the **CEO** notifies the proponent (at any time) in writing may not be implemented.

C2-6 **Confirmed** environmental management plans, and any revised environmental management plans under condition C2-4(1), must be published on the proponent's website and provided to the **CEO** in electronic form suitable for on-line publication within twenty (20) business days of being implemented, or being required to be implemented (whichever is earlier).

C3 Conditions Related to Monitoring

C3-1 The proponent must undertake monitoring capable of:

(1) substantiating whether the proposal limitations and extents in Part A are exceeded; and

(2) **detecting** and substantiating whether the environmental **outcomes** identified in Part B are achieved (excluding any environmental **outcomes** in Part B where an environmental management plan is expressly required to monitor achievement of that **outcome**).

C3-2 The proponent must submit as part of the Compliance Assessment Report required by condition D2, a compliance monitoring report that:

(1) outlines the monitoring that was undertaken during the implementation of the proposal;

(2) identifies why the monitoring was capable of substantiating whether the proposal limitation and extents in Part A are exceeded;

(3) for any environmental **outcomes** to which condition C3-1(2) applies, identifies why the monitoring was scientifically robust and capable of **detecting** whether the environmental **outcomes** in Part B are met;

(4) outlines the results of the monitoring;

(5) reports whether the proposal limitations and extents in Part A were exceeded and (for any environmental **outcomes** to which condition C3-1 (2) applies) whether the environmental **outcomes** in Part B were achieved, based on analysis of the results of the monitoring; and

(6) reports any actions taken by the proponent to remediate any potential non-compliance.

C4 Environmental Management Plans: Conditions Relating to Monitoring and Adaptive Management for Outcomes Based Conditions

C4-1 The environmental management plan required under condition B1-6 must contain provisions which enable the substantiation of whether the relevant **outcomes** of those conditions are met, and must include:

(1) **threshold criteria** that provide a limit beyond which the environmental **outcomes** are not achieved;

(2) **trigger criteria** that will provide an early warning that the environmental **outcomes** are not likely to be met;

(3) monitoring parameters, sites, control/reference sites, methodology, timing and frequencies which will be used to measure **threshold criteria** and **trigger criteria**. Include methodology for determining alternate monitoring sites as a contingency if proposed sites are not suitable in the future;

(4) **baseline** data;

(5) data collection and analysis methodologies;

(6) adaptive management methodology;

(7) **contingency measures** which will be implemented if **threshold criteria** or **trigger criteria** are not met; and

(8) reporting requirements.

C4-2 Without limiting condition C3-1, failure to achieve an environmental **outcome**, or the exceedance of a **threshold criteria**, regardless of whether threshold **contingency measures** have been or are being implemented, represents a non-compliance with these conditions.

C4-3 The environmental management plan required under condition B1-6 must:

(1) provide for the collection of a minimum of twelve (12) months of baseline groundwater monitoring data from the **Liveringa Aquifer** for each **exploration well** prior to drilling of the **exploration well**;

(2) provide for the revision of groundwater modelling for each well site prior to the drilling of the **exploration well**, based on **hydraulic parameters** measures at or proximal to each well site;

(3) include a program of groundwater monitoring that is capable of detecting potential **preferential groundwater drawdown** towards Mount Hardman Creek associated with **groundwater abstraction** at the Muspelheim well pad shown in Figure 1;

(4) be informed by and, where relevant, be consistent with the findings and recommendations of the **HFS Inquiry**; and

(5) be informed by and, where relevant, be consistent with any regulatory requirements, guidance or policy outcomes associated with the delivery of the **implementation plan**.

PART D – COMPLIANCE, TIME LIMITS, AUDITS AND OTHER CONDITIONS

D1 Non-compliance Reporting

D1-1 If the proponent becomes aware of a potential non-compliance, the proponent must:

(1) report this to the **CEO** within seven (7) days;

(2) implement **contingency measures**;

(3) investigate the cause;

(4) investigate environmental impacts;

(5) advise rectification measures to be implemented;

(6) advise any other measures to be implemented to ensure no further impact;

(7) advise timeframe in which **contingency measures**, rectification and other measures have and/or will be implemented; and

(8) provide a report to the **CEO** within twenty-one (21) days of being aware of the potential non-compliance, detailing the measures required in conditions D1-1(1) to D1-1(7) above.

D1-2 Failure to comply with the requirements of a condition, or with the content of an environmental management plan required under a condition, constitutes a non-compliance with these conditions, regardless of whether the **contingency measures**, rectification or other measures in condition D1-1 above have been or are being implemented.

D2 Compliance Reporting

D2-1 The proponent must provide an annual Compliance Assessment Report to the **CEO** for the purpose of determining whether the implementation conditions are being complied with.

D2-2 Unless a different date or frequency is approved by the **CEO**, the first annual Compliance Assessment Report must be submitted within fifteen (15) months of the date of this Statement, and subsequent reports must be submitted annually from that date.

D2-3 Each annual Compliance Assessment Report must be endorsed by the proponent's Chief Executive Officer, or a person approved by proponent's Chief Executive Officer to be delegated to sign on the Chief Executive Officer's behalf.

D2-4 Each annual Compliance Assessment Report must:

(1) state whether each condition of this Statement has been complied with, including:

(a) exceedance of any proposal limits and extents;

(b) achievement of and/or progress towards the achievement of environmental **outcomes**;

(c) achievement of and/or progress towards the achievement of environmental **objectives**;

(d) requirements to implement the content of environmental management plans;

(e) monitoring requirements;

(f) implement **contingency measures**;

(g) requirements to implement adaptive management; and

(h) reporting requirements;

(2) include the results of any monitoring (inclusive of any raw data) that has been required under Part C in order to demonstrate that the limits in Part A, and any **outcomes** or any **objectives** are being met;

(3) provide evidence to substantiate statements of compliance, or details of where there has been a non-compliance;

(4) include the corrective, remedial and preventative actions taken in response to any potential non-compliance;

(5) be provided in a form suitable for publication on the proponent's website and online by the Department of Water and Environmental Regulation; and

(6) be prepared and published consistent with the latest version of the Compliance Assessment Plan required by condition D2-5 which the **CEO** has **confirmed** by notice in writing satisfies the relevant requirements of Part C and Part D.

D2-5 The proponent must prepare a Compliance Assessment Plan which is submitted to the **CEO** at least six (6) months prior to the first Compliance Assessment Report required by condition D2-2, or prior to implementation of the proposal, whichever is sooner.

D2-6 The Compliance Assessment Plan must include:

(1) what, when and how information will be collected and recorded to assess compliance;

(2) the methods which will be used to assess compliance;

(3) the methods which will be used to validate the adequacy of the compliance assessment to determine whether the implementation conditions are being complied with;

(4) the retention of compliance assessments;

(5) the table of contents of Compliance Assessment Reports, including audit tables; and

(6) how and when Compliance Assessment Reports will be made publicly available, including usually being published on the proponent's website within sixty (60) days of being provided to the **CEO**.

D3 Contact Details

D3-1 The proponent must notify the **CEO** of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

D4 Time Limit for Proposal Implementation

D4-1 The proposal must be substantially commenced within five (5) years from the date of this Statement.

D4-2 The proponent must provide to the **CEO** documentary evidence demonstrating that they have complied with condition D4-1 no later than thirty (30) days after the substantial commencement.

D4-3 If the proposal has not been substantially commenced within the period specified in condition D4-1, implementation of the proposal must not be commenced or continued after the expiration of that period.

D5 Public Availability of Data

D5-1 Subject to condition D5-2, within a reasonable time period approved by the **CEO** upon the issue of this Statement and for the remainder of the life of the proposal, the proponent must make publicly available, in a manner approved by the **CEO**, all validated environmental data collected before and after the date of this Statement relevant to the proposal (including sampling design, sampling methodologies, monitoring and other empirical data and derived information products (e.g. maps)), environmental management plans and reports relevant to the assessment of this proposal and implementation of this Statement.

D5-2 If:

(1) any data referred to in condition D5-1 contains trade secrets; or

(2) any data referred to in condition D5-1 contains particulars of confidential information (other than trade secrets) that has commercial value to a person that would be, or could reasonably be expected to be, destroyed or diminished if the confidential information were published,

the proponent may submit a request for approval from the **CEO** to not make this data publicly available and the **CEO** may agree to such a request if the **CEO** is satisfied that the data meets the above criteria.

D5-3 In making such a request the proponent must provide the **CEO** with an explanation and reasons why the data should not be made publicly available.

D6 Independent Audit

D6-1 The proponent must arrange for an independent audit of compliance with the conditions of this statement, including achievement of the environmental **outcomes** and/or the environmental **objectives** and/ or environmental performance with the conditions of this statement, as and when directed by the **CEO**.

D6-2 The independent audit must be carried out by a person with appropriate qualifications who is nominated or approved by the **CEO** to undertake the audit under condition D6-1.

D6-3 The proponent must submit the independent audit report with the Compliance Assessment Report required by condition D2, or at any time as and when directed in writing by the **CEO**. The audit report is to be supported by credible evidence to substantiate its findings.

D6-4 The independent audit report required by condition D6-1 is to be made publicly available in the same timeframe, manner and form as a Compliance Assessment Report, or as otherwise directed by the **CEO**.

Table 1: Abbreviations and definitions

Acronym or abbreviation	Definition or term
Aboriginal cultural heritage	Means the tangible and intangible elements that are important to the Aboriginal people of the state, and are recognised through social, spiritual, historical, scientific or aesthetic values, as part of Aboriginal tradition to the extent they directly affect or are affected by physical or biological surroundings.
Aboriginal site(s)	As defined in section 4 and 5 under the *Aboriginal Heritage Act 1972*.
Adaptive	Means having the ability or tendency to adapt in response to evidence in a manner which is most effective at achieving the specified outcomes.
Adverse impact(s)	Negative change that is neither trivial nor negligible that could result in a reduction in health, diversity or abundance of the receptor/s being impacted, or a reduction in **environmental value**. Adverse impacts can arise from direct or indirect impacts, or other impacts from the proposal. In relation to **Aboriginal cultural heritage**, includes but is not limited to, hydrological change, structural damage, introduction or spread of non-indigenous flora and/or fauna, alteration of fauna behaviour, dust, light, and noise emissions.
Baseline	Initial conditions measured before **disturbance** associated with the proposal, which is used for comparison with data collected during and after **disturbance** to identify and measure changes in conditions.
CEO	The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or the **CEO's** delegate.
Clearing	Has the same meaning as in section 51A of the *Environmental Protection Act 1986*.
CO_2-e	Carbon dioxide equivalent
Cold venting	The intentional release of uncombusted gases, primarily methane, directly into the atmosphere from oil and gas operations without **flaring** or combustion.
Condensate	Also referred to as 'natural gas condensate, is a light liquid hydrocarbon mixture that is produced from natural gas reservoirs when the pressure and temperature drop as the gas flows to the surface.
Confirmed	In relation to a plan required to be made and submitted to the **CEO**, means, at the relevant time, the plan that the **CEO**

	confirmed, by notice in writing, meets the requirements of the relevant condition. In relation to a plan required to be implemented without the need to be first submitted to the **CEO**, means that plan until it is revised, and then means, at the relevant time, the plan that the **CEO** confirmed, by notice in writing, meets the requirements of the relevant condition.
Construction activities	Activities that are associated with the substantial implementation of a proposal including but not limited to, earthmoving, civil works, vegetation **clearing**, grading or construction of right of way. Construction activities do not include geotechnical investigations (including potholing for services and the installation of piezometers) and other pre-construction activities where no **clearing** of vegetation is required.
Contingency measures	Planned actions for implementation if it is identified that an environmental **outcome**, environmental **objective**, **threshold criteria**, or **management target** are likely to be, or are being, exceeded. Contingency measures include changes to **operations** or reductions in **disturbance** or **adverse impacts** to reduce impacts and must be decisive actions that will quickly bring the impact to below any relevant **threshold criteria**, **management target** and to ensure that the environmental **outcome** and/or **objective** can be met.
DBCA	The Department responsible for administration of the *Biodiversity Conservation Act 2016*, which at the time of writing is the Department of Biodiversity, Conservation and Attractions.
DWER	The Department responsible for administration of the *Rights in Water and Irrigation Act 1914*, which at the time of writing is the Department of Water and Environmental Regulation.
Detecting/ detectable	The smallest statistically discernible effect size that can be achieved with a monitoring strategy designed to achieve a statistical power value of at least 0.8 or an alternative value as determined by the **CEO**.
Development envelope	The maximum area within which the proposal will be located, and consistent with the Proposal Content Document for the proposal as referred to in the Introduction to this Statement.
Disturb/ disturbance	Means directly has or materially contributes to the disturbance effect on health, diversity or abundance of the receptor/s being impacted or on an **environmental value**. In relation to flora, vegetation or fauna habitat, includes to result in the death, destruction, removal, severing or doing substantial damage. In relation to fauna, includes to have the effect of altering the natural behaviour of fauna to its detriment.

Disturbance footprint	The location within which the physical proposal elements will occur.
DMPE	The Department responsible for administration of the *Petroleum and Geothermal Energy Resources Act 1967,* which at the time of writing is the Department of Mines, Petroleum and Exploration.
Emergency response vehicles	Vehicles responding to an emergency, as defined by section 5 of the *Emergency Management Act 2005*.
Environmental harm	Has the meaning provided by section 3A(2) of the *Environmental Protection Act 1986*.
Environmental monitoring	Installation of equipment or monitoring infrastructure, and associated monitoring activity required for confirming compliance with ministerial conditions.
Environmental value	A beneficial use, or ecosystem health condition.
EPA	The Environmental Protection Authority, as established under section 7 of the *Environmental Protection Act 1986*.
Exploration well(s)	A well drilled and constructed to target the **Laurel Formation** for the purposes of determining the presence of or appraising the size, composition, and commercial potential of a petroleum resource/reservoir.
Fauna habitat type 2	The habitat type as described in the Valhalla Gas Exploration and Appraisal Program Environmental Review Document, Version 4, Dated 21 June 2024).
Fauna handler	A person who is qualified and has attained the appropriate licence/s and authorisation/s under section 40 of the *Biodiversity Conservation Act 2016* and the Biodiversity Conservation Regulations 2018.
Fauna spotter	A person who is suitably trained in species identification, who does not perform any handling of animals where a licence to do so is required.
Flaring	The controlled burning or combustion of petroleum hydrocarbon fluids (such as natural gas and **condensate**) extracted from the ground as part of **well testing** operations.
Grant Poole Aquifer	The combined hydrogeological unit housed within the Poole Sandstone geologic unit with Stratigraphic Number 27680 and the Grant Group geologic unit with Stratigraphic Number 7696 as described in the Geoscience Australia Stratigraphic Units Database - Australian Stratigraphic Units Database | Geoscience Australia (accessed 12 September 2025).
Greenhouse gas	Has the meaning given by Section 7A of the *National Greenhouse and Energy Reporting Act 2007* (Cth) or, if that definition is amended or repealed, the meaning set out in an Act, regulation or

	instrument concerning greenhouse gases as specified by the Minister.
Greenhouse gas emissions	Greenhouse gas emissions expressed in tonnes of **CO_2-e** as calculated in accordance with the definition of 'carbon dioxide equivalence' in Section 7 of the *National Greenhouse and Energy Reporting Act 2007* (Cth), or, if that definition is amended or repealed, the meaning set out in an Act, regulation or instrument concerning greenhouse gases as specified by the Minister.
Ground disturbing activities	Any activity or activities undertaken in the implementation of the proposal, including any **clearing**, civil works or construction.
Groundwater abstraction	The process of taking water from a ground source.
ha	Hectare(s).
HFS	Hydraulic fracturing simulation means the underground petroleum extraction process that involves the injection of fluids under high pressure into low permeability rock to induce fractures for the purpose of increasing the rock's permeability.
HFS fluids	Fluid made up of water, proppant and chemical additives used in the **HFS** process.
HFS Inquiry	Means the independent Scientific Inquiry carried out in 2018 to understand the risks associated with extracting petroleum products using **HFS** and to protect the State's environment from those risks. Final report of the inquiry - https://frackinginquiry.wa.gov.au/sites/default/files/final_report.pdf (accessed 11 July 2025)
Hydraulic parameters	Includes but is not limited to: - Hydraulic conductivity - Transmissivity - Storativity - Specific Yield - Aquifer thickness
Implementation plan	The Western Australian Government's response to the HFS Inquiry, including the actions to implement the governments' policy and HFS Inquiry recommendations - https://www.hydraulicfracturing.wa.gov.au/wp-content/uploads/2019/07/Implementation-Plan.pdf (accessed 11 July 2025)
Industry best practices	The use of the most effective and widely accepted methods, technologies, and management systems in the petroleum industry that deliver high standards of environmental performance, are supported by current scientific and technical knowledge, and are continually improved as better approaches become available.
km/hr	Kilometre(s) per hour.

Laurel Formation	The geological formation with Stratigraphic Number 25727 as described in the Geoscience Australia Stratigraphic Units Database - Australian Stratigraphic Units Database | Geoscience Australia (accessed 12 September 2025).
Liveringa Aquifer	A hydrogeological formation housed within the Liveringa Group geologic unit with Stratigraphic Number 25997 as described in the Geoscience Australia Stratigraphic Units Database - Australian Stratigraphic Units Database | Geoscience Australia (accessed 12 September 2025).
m	Metre(s).
Management actions	The identified actions implemented with the intent of to achieving the environmental **objective**.
Management target	A type of indicator to evaluate whether an environmental **objective** is being achieved.
ML	Megalitres or million litres.
Native title party/ies	As defined in section 18(1AA) under the *Aboriginal Heritage Act 1972.*
Night-time hours	The period between sunset and sunrise on any given day.
Objective(s)	A proposal-specific desired state for an environmental factor/s to be achieved from the implementation of **management actions**
Occupied greater bilby burrow	As outlined in *The conservation and management of the bilby (Macrotis lagotis) in the Pilbara* (Department of Biodiversity, Conservation and Attractions, 2018).
Operations	Activities associated with the implementation of the proposal, including drilling and construction of **exploration wells** and **well testing**, but not including **construction activities**.
Outcome(s)	A proposal-specific result to be achieved when implementing the proposal.
Petroleum management documents	The Environment Plan, Safety Management System, or Well Management Plan, where applicable, required under the *Petroleum and Geothermal Energy Resources Act 1967* or subsidiary legislation, and required to be submitted for approval to **DMPE**.
Pollution	Has the meaning provided by section 3A(1) of the *Environmental Protection Act 1986*.
Pre-clearance surveys	Surveys designed to identify the presence or evidence of threatened fauna listed under the *Biodiversity Conservation Act 2016* prior to **ground disturbing activities**.
Predicted drawdown extent	The modelled groundwater drawdown extent as depicted in Figure 2 and defined by the geographic coordinates in Schedule 1.

Preferential groundwater drawdown	The non-uniform reduction in groundwater levels due to **groundwater abstraction** causing water level declines to propagate more rapidly or more deeply along zones of relatively higher hydraulic conductivity, anisotropy, or structural connectivity, compared with surrounding aquifer materials.
Reasonable steps to consult	As outlined in the EPA's *Technical Guidance Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage*, as amended from time to time.
Reduced emissions well completion	Also known as a 'green completions', is a practice used in the oil and gas industry to minimise the release of natural gas and hydrocarbons into the atmosphere during well completions and workovers. This involves capturing the gas that would otherwise be flared or vented during the cleanup process after **HFS** and directing it for processing and storage or distribution, or on-site use.
Reference site	A natural area in good ecological condition that serves as a benchmark against which rehabilitation outcomes are compared. It provides a clear example of the desired vegetation structure, species composition, and ecosystem function.
Safeguard legislation	The Commonwealth *National Greenhouse and Energy Reporting Act 2007* and associated National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.
Scope 1	Scope 1 emissions of **greenhouse gas**, in relation to a facility, means the release of **greenhouse gas** into the atmosphere as a direct result of one or more activities, which are part of the proposal, that generate **greenhouse gas emissions**.
Self-sustaining	Refers to vegetation that can survive (continue indefinitely) without on-going **management actions** such as watering, weed control or in-fill planting.
Significant fauna	Threatened fauna species listed under the *Biodiversity Conservation Act 2016* and Priority fauna listed by the **DBCA**.
Similar habitat	Habitat not subject to any proposal related **disturbance** that shares characteristics like climate, vegetation, water availability, and soil type making it suitable as habitat for **significant fauna**.
Threshold criteria	The indicators that have been selected to represent limits of impact beyond which the environmental **outcome** is not being met.
Trigger criteria	Indicators that have been selected for monitoring to provide a warning that, if exceeded, the environmental **outcome** may not be achieved. They are intended to forewarn of the approach of the **threshold criteria** and trigger response actions.
Wastewater	the fluid that returns to the surface after **HFS**, including flowback water (**HFS fluids** returning shortly after injection) and produced formation water (naturally occurring formation water brought up

	during well testing or production), typically containing salts, chemicals, hydrocarbons, and other contaminants.
Water retention pond(s)	Engineered basin designed to temporarily store water used in drilling and **HFS** operations, including management of flowback and produced formation water. For the purposes of condition B1-1(5) this is also includes any alternative **wastewater** containment equipment or infrastructure that may be implemented, such as enclosed tanks.
Well testing	Occurs after **HFS**. The process of temporarily producing fluids (gas, **condensate**, water) from an exploration or appraisal well to evaluate the reservoir's properties, such as pressure, flow rate, permeability, and fluid composition.

Figures (attached)

Figure 1 Valhalla Gas Exploration and Appraisal Program location and development envelope (This figure is a representation of the co-ordinates referenced in Schedule 1)

Figure 2 Valhalla Gas Exploration and Appraisal Program development envelope and predicted groundwater drawdown extent (This figure is a representation of the co-ordinates referenced in Schedule 1)

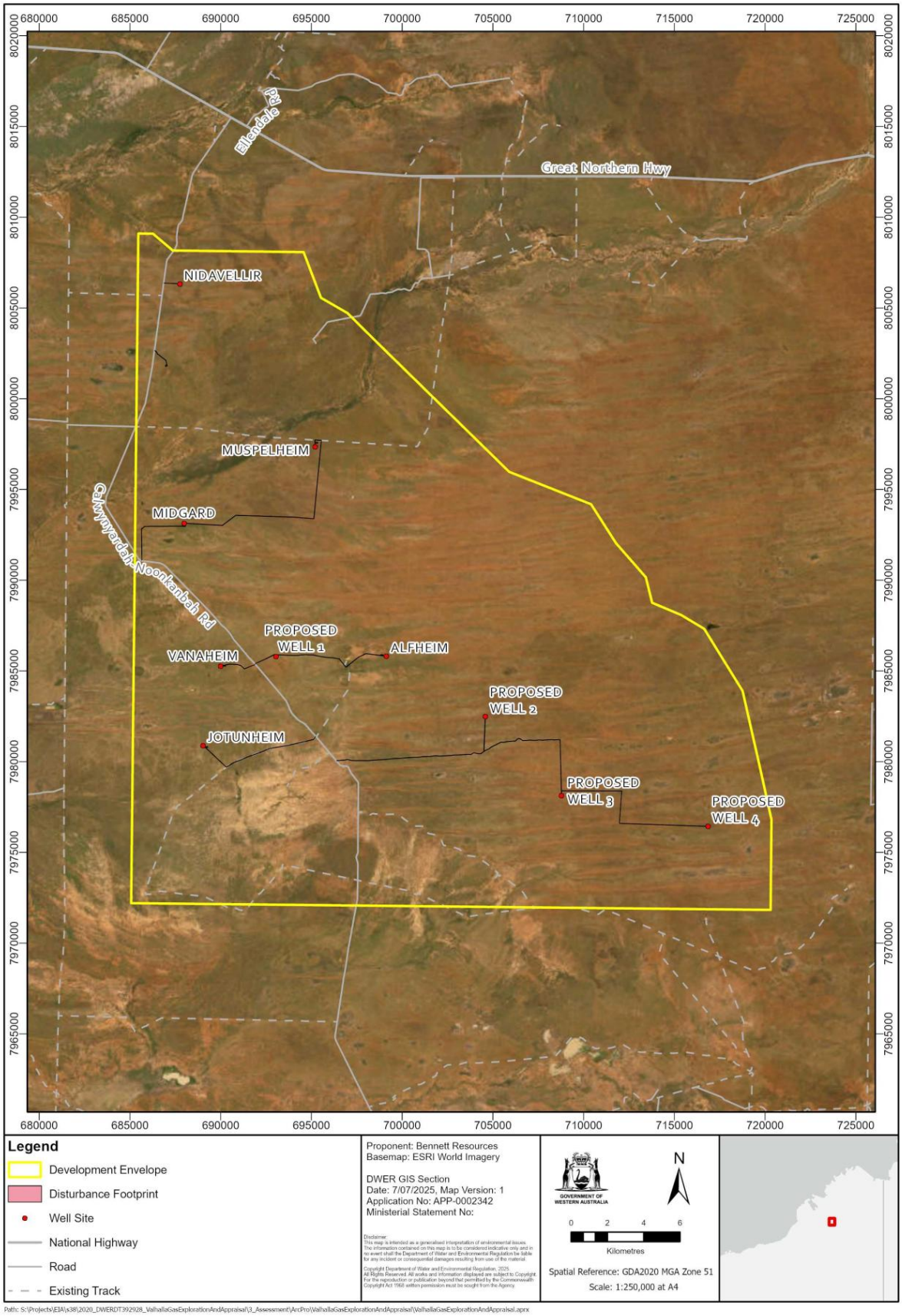

Figure 1 Valhalla Gas Exploration and Appraisal Program location and development envelope

Figure 2 Valhalla Gas Exploration and Appraisal Program predicted groundwater drawdown extent

Schedule 1

All co-ordinates are in metres, listed in Map Grid of Australia Zone 50 (MGA Zone 50), datum of Geocentric Datum of Australia 2020 (GDA2020).

Spatial data depicting the figures are held by the Department of Water and Environmental regulation. Record no. APP-0002342.

Appendix B: Decision-making authorities

Table B1: Identified relevant decision-making authorities for the proposal

Decision-Making Authority	Legislation (and approval)
1. Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972* - section 18 consent to impact a registered Aboriginal heritage site)
2. Minister for Environment	*Biodiversity Conservation Act 2016* - section 40 authority to take or disturb threatened species and
3. Minister for Water	*Rights in Water and Irrigation Act 1914* - groundwater abstraction licence - licence to construct bores
4. Chief Executive Officer, Department of Mines, Petroleum and Exploration	*Petroleum and Geothermal Energy Resources Act 1967* Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 - Environment plan - Oil spill contingency plan Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2012 - Well management plan Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010 - Safety Management System
5. Chief Executive Officer, Department of Biodiversity, Conservation and Attractions	*Biodiversity Conservation Act 2016* - authority to take flora and fauna (other than threatened species)
6. Chief Dangerous Goods Officer, Department of Local Government, Industry Regulation and Safety	*Dangerous Goods Safety Act 2004* - storage and handling of dangerous goods
7. Chief Executive Officer, Department of Water and Environmental Regulation	*Environmental Protection Act 1986* - Part V works approval and licence - Part IV compliance (Ministerial statements)
8. Chief Executive Officer, Shire of Derby-West Kimberley	*Planning and Development Act 2005* - Development /planning approval *Building Act 2011* - Building permit *Public Health Act 2016* - treatment of sewage
9. Secretary, Radiological Council	*Radiation Safety Act 1975* - permit to transport radioactive materials

Appendix C: Regulation under other statutory processes

Table C1: Identified relevant decision-making authorities for the proposal

Statutory decision-making process	Environmental outcome
Aboriginal Heritage Act 1972	No disturbance to Aboriginal heritage sites unless consent is granted to disturb that place under the and has involved reasonable steps to consult with relevant Traditional Owners.
Biodiversity Conservation Act 2016	The taking of threatened flora, fauna and ecological communities does not result in any species or community being listed under a higher conservation status.
Contaminated Sites Act 2003	Contamination of soil or water is reported, investigated, and where necessary, remediated and managed to ensure that there is no unacceptable risk to human health or the environment.
Dangerous Goods Safety Act 2004	Regulating the storage, handling, and transport of hazardous substances to prevent spills, leaks, and accidents that could contaminate land, air, or water.
Environmental Protection Act 1986 Part V Division 2 (Prescribed premises, works approvals and licences)	Part V, Division 2 provides for the regulation of emissions and discharges such that potential risks are assessed and managed through enforceable conditions to prevent or minimise environmental harm. The proposal's activities may trigger the thresholds specified in Schedule 1 of the Environmental Protection Regulations 1987 (e.g. Category 10, oil or gas production from wells). Where triggered, the proposal becomes a prescribed premises and will require a works approval and licence. Relevant emissions and discharges associated with the proposal that may be regulated under Part V include management of wastewater/flowback water, air emissions from flaring, and noise and dust emissions during construction and operations.
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)	The EPA has recommended conditions in relation to impacts on listed threatened species protected by the EPBC Act. The Department of Climate Change, Energy, the Environment and Water may impose additional conditions under the EPBC Act.
Public Health Act 2016	Regulation of sewage treatments systems such that risks to public health are mitigated.
National Greenhouse and Energy Reporting Act 2007 (Commonwealth)	The reduction of scope 1 GHG emissions to meet Australian emission targets of 43% below 2005 levels by 2030 and net zero by 2050.

	The potential environmental effects of the proposal associated with the emissions of scope 1 GHG emissions are likely to be mitigated to achieve consistency with the environmental factor objective for GHG emissions through the obligations required under the *National Greenhouse and Energy Reporting Act 2007* and the Commonwealth Safeguard Mechanism.
Petroleum and Geothermal Energy Resources Act 1967	Regulation of well design and construction, drilling, hydraulic fracturing activities, well testing, decommissioning and related activities such that risks to health, safety, and the environment be reduced to a level that is as low as reasonably practicable (ALARP). Potential impacts are required to be systematically identified, assessed, and minimised through statutory plans including an Environment Plan and Well Management Plan.
Radiation Safety Act 1975	Regulating the safe disposal and management of wastes classified as radioactive substances. This may include management of pond sediment in the event that radionuclides are present at concentrations exceeding exemption levels.
Rights in Water and Irrigation Act 1914	The abstraction of groundwater is regulated such that the drawdown and taking of groundwater is ecologically sustainable, and potential impacts to nearby groundwater users are monitored to ensure there are no adverse impacts. Construction of monitoring and abstraction bores is conducted in a manner that ensures the integrity of the resource is not unduly compromised. Activities that modify the bed and banks of watercourses are regulated to maintain the natural flow of water and avoid or minimise impacts to other water users and protect environmental values.

Appendix D: Environmental Protection Act principles

Table D1: Consideration of principles of the *Environmental Protection Act 1986*

EP Act principle	Consideration
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by –* *(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *(b) an assessment of the risk-weighted consequences of various options.*	The EPA has considered the precautionary principle in its assessment and has had particular regard to this principle in its assessment of inland waters, terrestrial fauna, social surroundings, and greenhouse gas emissions. The proponent has undertaken studies and investigations to provide scientific information on the environmental values likely to be present. The EPA acknowledges that in some instances the availability of local data was limited. The EPA considered that it had sufficient information to progress the assessment with confidence in the likelihood of significant impacts occurring. In doing so, the EPA also had regard to the function and controls provided by recommended conditions and other statutory decision-making processes to ensure that additional site-specific data is collected during implementation for monitoring and further mitigate the potential impacts of the proposal. The EPA notes that the proponent has considered alternatives in designing the proposal to avoid, where practicable, impacts on the environment. This includes: • ‘locking’ the disturbance footprint • conducting baseline and targeted fauna surveys across the entire disturbance footprint • conducting pre-clearance surveys prior to clearing of native vegetation • monitoring of groundwater level and quality. <u>Greenhouse gas emissions</u> The EPA notes that climate change as a result of cumulative GHG emissions has the potential to cause serious damage to WA’s environment. The specific impacts of any single proposal’s GHG emissions are not able to be known with certainty at this time. However, the EPA has not used this as a reason for postponing assessment of the proposal’s contribution to the State’s GHG emissions or recommending practicable conditions to reduce emissions in order to minimise the risk of environmental harm associated with climate change. The EPA notes that the proposal will result in residual scope 1 emissions that will be emitted prior to the proponent reaching net zero. The EPA considers that the

EP Act principle	Consideration
	Commonwealth's Safeguard Mechanism represents an as far as practicable reduction of the proposal's GHG emissions. The EPA has recommended condition B5 that requires the proponent to notify the State of a substantial change to its obligations under the Safeguard Mechanism. Further, the EPA has recommended condition B5-1 to minimise the generation of emissions, which includes limits on flaring and cold venting.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	The EPA has considered the principle of intergenerational equity in its assessment and has had particular regard to this principle in its assessment of inland waters, terrestrial fauna, social surroundings, and greenhouse gas emissions. The EPA notes that the proponent has considered this principle by: - monitoring groundwater quality for the life the proposal - consulting with the Traditional Owners, the Yungngora and Warlangurru People, on the potential impacts to social and cultural values - committing to progressively rehabilitating and ensuring all disturbance is rehabilitated to an appropriate standard upon closure. The EPA considers consistency with this principle could be achieved with the implementation of its recommended conditions, which require the proponent to: - ensure there is no detectable decrease in the level and/or quality of groundwater aquifers - ensure wastewater is appropriately contained - ensuring ongoing access to land used for traditional use or custom by the Traditional Owners - maintain levels of ecological protection through limits on the extent of disturbance to terrestrial fauna habitat - rehabilitate landforms, vegetation, and fauna habitat to an appropriate state. The EPA has concluded that the environmental values will be protected, and the health, diversity, and productivity of the environment will be maintained for the benefit of future generations. <u>Greenhouse gas emissions</u> The EPA has noted that GHG emissions pose a risk to future generations, however, also notes the proponent's obligations under the Commonwealth's

EP Act principle	Consideration
	Safeguard Mechanism to net zero emissions by 2050 consistent with the Paris Agreement and IPCC 1.5 report, and to use offsets should these targets not be met by continuous improvement. The EPA has recommended condition B5-2 which requires the proponent to report to the CEO of DWER if obligations change under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and Safeguard Mechanism. Further, the potential impacts from greenhouse gas emissions will be minimised through the measures included in recommended condition B5-1, such as the avoidance of cold venting.
3. The principles of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*	The EPA has considered the principle of conservation of biological diversity and ecological integrity in its assessment and has had particular regard to this principle in its assessment of terrestrial fauna. The EPA notes that proponent will not clear any critical habitat types and will avoid disturbance of any occupied greater bilby burrows. The proponent's decision to 'lock' the disturbance footprint will also minimise potential impacts. To ensure biodiversity and ecological integrity of terrestrial fauna values are maintained, the EPA has recommended conditions including a disturbance limit on Fauna habitat type 2 and speed limits of vehicles and machinery. The EPA has concluded that the recommended conditions would likely ensure that environmental outcomes are achieved. The application of limits on disturbance and any associated conditions are to ensure there is no significant residual impact on the biodiversity diversity and ecological integrity of these values.
4. Principles relating to improved valuation, pricing and incentive mechanisms • *Environmental factors should be included in the valuation of assets and services.* • *The polluter pays principle — those who generate pollution and waste should bear the cost of containment, avoidance or abatement.* • *The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.* • *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to*	In considering this principle, the EPA notes that the proponent will bear the costs relating to implementing the proposal to achieve environmental outcomes, and management and monitoring of environmental impacts during construction, operation and decommissioning of the proposal. The EPA has had particular regard to this principle in considering inland waters, terrestrial fauna, social surroundings, and greenhouse gas emissions. The EPA notes that the proponent has pursued these principles by: • undertaking surveys to identify and confirm environmental values within the disturbance footprint • committing to pre-clearance surveys prior to clearing of native vegetation • ensuring costs associated with emissions and waste is incorporated into project planning • minimising clearing to the extent required

EP Act principle	Consideration
maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	• progressively rehabilitating throughout the life of the proposal. <u>Greenhouse gas emissions</u> The proponent will be responsible for bearing the costs of implementing measures to reduce and offset GHG emissions, including the costs of adopting advances in process management and other measures in the future to further reduce and offset GHG emissions to achieve net zero along a linear trajectory to net zero by 2050.
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	The EPA has considered the principle of waste minimisation in its assessment and has had particular regard to this principle in its assessment of inland waters, terrestrial fauna, social surroundings, and greenhouse gas emissions. The proponent has considered the principle of waste minimisation in designing the proposal, such as: • utilising existing access tracks where possible • evaluating waste streams and adopting management measures to minimise impacts from flooding and waste disposal • prior to disposal at a licensed facility, waste will be stored in such a way to prevent contamination through flood events. The EPA notes the recommended conditions (B1-1) would ensure wastewater is appropriately managed and is not discharged into the environment. The EPA notes that the proposal involves the flaring of a substantial volume of petroleum gas and condensate during well testing. The EPA has considered that best practice waste minimisation would involve the capture of produced gas and condensate for beneficial use, such as in energy production. The EPA has recommended conditions limiting the flaring of condensate (condition B5-1), which is readily captured, and requiring periodic performance reporting in respect of reasonably practicable options for the capture and use of gas (condition B6-2).

Appendix E: Other environmental factors

Table E1: Evaluation of other environmental factors

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
Land			
Flora and vegetation	Clearing of up to 110 ha of native vegetation, including 101 ha in 'very good' condition or better (North Fitzroy Plains vegetation unit).	Public comments • General concerns over the extent of clearing of vegetation in 'very good' condition within a 'pristine' landscape. • Deficiencies in the flora and vegetation survey effort and extent, particularly in areas outside of the disturbance footprint, and the lack of targeted surveys • Potential disturbance of vegetation associated with future development/production activities and related, but separate, activities such as sand mining to source 'proppant' material. Agency comments • DMPE advised that potential impacts to flora and vegetation can be regulated through the Environment Plan required under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012. However, also advised that rehabilitation of vegetation may not be able to be regulated under the Petroleum and Geothermal Energy Resources (Environment) Regulations	Flora and vegetation was identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, the EPA considers it to not be a key factor at the conclusion of its assessment. Having regard for: • no identified threatened flora species being recorded in the disturbance footprint (Bennet Resources 2024) • no identified priority or threatened ecological communities being recorded in the disturbance (Bennet Resources 2024) • the general adequacy of survey effort within the disturbance footprint, being proportional to the anticipated scale and nature of impacts to flora and vegetation • the limitation on the extent of clearing consistent with recommended condition A1 • the effects of historic and current grazing pressure on flora and vegetation values • siting of the disturbance footprint to avoid identified priority flora species within the development envelope, in conjunction with the proponent's commitment to 'lock' the disturbance footprint, reflected through recommended condition A1

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
		2012 if the clearing of that vegetation is authorised under Part IV of the EP Act.	• the relatively small extent of the vegetation units proposed to be cleared, in the context of the high local and regional extent of the units remaining (more than 99% of pre-European extent) • considerations regarding significance of impacts, as set out in the Statement of environmental principles, factors, objectives and aims of the EPA (EPA 2023b) The EPA considers it unlikely that the proposal would have a significant impact on flora and vegetation. The EPA also had regard for the mitigation provisions that are expected to be applied and enforced through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012. Potential indirect impacts to vegetation, such as through spills and leaks, and groundwater drawdown effects on groundwater-dependent vegetation, are addressed through the EPA's consideration of the Inland Waters factor. As discussed in Section 2.4, the EPA has considered the value of flora and vegetation in the context of it providing important habitat for terrestrial fauna, including critical habitat for the greater bilby (vulnerable). Noting the limitations under the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 in relation regulation to rehabilitation, the EPA has recommended condition B3 to ensure that flora and vegetation is rehabilitated to mitigate impacts to fauna habitat.

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			The EPA notes that impacts associated with third-party suppliers of raw materials (e.g. proppant) are outside the scope of this proposal. Any such activities would require separate approval from the relevant decision-making authority (e.g. local government or under Part V of the EP Act) or prior assessment by the EPA. Given the above, the EPA did not consider flora and vegetation to be a key environmental factor at the conclusion of its assessment.
Subterranean fauna	The disturbance of subterranean fauna habitat, such as through groundwater drawdown, and/or subterranean fauna individuals is likely to be minor.	<u>Public comments</u> • Lack of detailed on-ground subterranean survey information to inform the assessment. • The adequacy of management strategies in the absence of adequate local survey data. • The current lack of knowledge of subterranean fauna biodiversity in the Kimberley region. • Potential impacts to stygofauna habitat given the volume of groundwater abstraction required, and potential contamination of groundwater. <u>Agency comments</u> • DWER advised that potential impacts to subterranean fauna are expected to be low given the nature, scale, and duration of the proposal.	Subterranean fauna was identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, the EPA considers it to not be a key factor at the conclusion of its assessment. The EPA acknowledges the limited survey or local data available to understand the potential richness of subterranean fauna communities within the proposal area. However, having regard for: • the proponent's subterranean fauna desktop assessment (Bennelongia 2023) that concluded there was a little likelihood of impact to subterranean fauna irrespective of the biodiversity that may be present in the area • advice received from DWER that further surveys are not warranted given the likelihood and scale of expected impacts to subterranean fauna • impacts to stygofauna habitat and individuals are not expected to be significant given the small magnitude and short duration of groundwater drawdown, reinforced through recommended condition B1-1(1) • impacts to troglofauna habitat and individuals are not expected to be significant given the relatively

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			small scale of direct habitat disturbance through drilling and well construction • the likely extent, magnitude and significance of impacts for potential subterranean fauna populations that may occur within the locality of the proposal site, as set out in the Statement of environmental principles, factors, objectives and aims of the EPA (EPA 2023b) The EPA concluded that it had sufficient information available to it, proportional to the risk and expected impact of the proposal, and did not consider subterranean fauna to be a key environmental factor at the conclusion of its assessment.
Landforms	Potential impacts to landforms typically include reduced landform diversity and aesthetic impacts through visual amenity. Impacts to landforms from the proposal are not expected.	<u>Public comments</u> One public submission noted that landforms should be considered in the context of their role in surface water flows and the potential movement of contaminants associated with the proposal. No comments were received by technical agencies in relation to landforms.	Landforms were not identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, landforms were raised in some public submissions. The EPA considers landforms not to be a key factor at the conclusion of its assessment. Having regard for: • the general absence of prominent or unique landforms within or proximal to the disturbance footprint • the small scale of physical disturbance • the landscape encountered in the proposal area being ubiquitous in the wider region. The EPA considers it is unlikely that the proposal would have a significant impact on landforms as the significant criteria of variety, integrity, ecological importance, scientific importance, rarity and social importance were not met and that the impact to this factor is negligible.

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			The matters raised in public submissions relating to surface water flows and the potential movement of contaminants are addressed through the EPA's consideration of the Inland Waters factor.
Terrestrial environmental quality	The primary risk of impact to terrestrial environmental quality is through contamination of soils from surface spills and leaks of potential contaminants, including fuels, chemicals, petroleum hydrocarbon liquids, and wastes, including flowback water. Minor impacts may also occur from erosion and scouring associated with civil construction works, and compaction of soils inhibiting effective rehabilitation.	<u>Public comments</u> • General concerns regarding risk of impacts from chemicals used in HFS activities and lack of ecological risk assessment for chemicals. • Concerns regarding the adequacy of regulatory controls for protecting against environmental impacts from HFS chemicals. • The potential for contaminant migration to the Fitzroy River via the alluvial aquifer due to the sand soils in the area. <u>Agency comments</u> • DMPE advised that potential impacts to flora and vegetation can be regulated through the Environment Plan required under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.	Terrestrial environmental quality was identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, the EPA considers it to not be a key factor at the conclusion of its assessment. Having regard for: • the proponent's mitigation measures in relation to the management and containment of wastewater, including flowback water, and the expected chemical composition of produced water (refer to section 2.1.9), including containment in engineered and lined ponds • standard industry controls that will be applied in relation to the storage and handling of fuels and chemicals, including secondary containment and drip trays, • the requirement under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 to disclose all chemicals intended for use • the use of a HFS fluid system that has been previously utilised for HFS activities in the area, and which has been subject to ecotoxicity testing and found to have very low toxicity (Buru Energy 2018) • the requirement to develop and implement an Oil Spill Contingency Plan including spill kits and immediate response actions to contain and clean up spills

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			• site reinstatement activities including ripping to address soil compaction prior to rehabilitation • the proponent's monitoring program, including soil quality monitoring (Bennett Resources 2024b) the EPA considers it unlikely that the proposal would have a significant impact on terrestrial environmental quality. The EPA also had regard for the direct and indirect mitigation provisions relevant to terrestrial environmental quality that are expected to be applied and enforced through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, as well as the indirect provisions through the Well Management Plan required under the PGER (Resource Management and Administration) Regulations, and the Safety Case required under the Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022. Potential impacts to terrestrial environmental quality area also addressed in more detail through the EPA's consideration of the Inland Waters factor. Accordingly, the EPA did not consider terrestrial environmental quality to be a key environmental factor at the conclusion of its assessment.
Air			
Air quality	The proposal will result in generation of dust emissions during construction activities which can impact the amenity of nearby receptors. Dust emissions can also have an indirect impact on flora and	<u>Public comments</u> • General concerns over the potential impacts to air quality from HFS activities, including from flaring. • Air quality impacts to the West Kimberley National Heritage Place.	Air quality was identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, the EPA considers it to not be a key factor at the conclusion of its assessment. Having regard for: • the separation distance between the disturbance footprint (from the nearest proposed well site) and

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
	vegetation and terrestrial fauna values. Flaring during well testing can result in emissions (including volatile organic compounds) that can impact local air quality.	• Human health risks from silica dust emissions from proppant, and volatile organic compounds from flaring and fugitive emissions. • Release of radon gas and associated radiation impacts. <u>Agency comments</u> • DWER provided review and comment on the proponent's baseline air quality monitoring. • The Department of Health reviewed the human health risk assessment (Bennett Resources 2022c) and advised that public health impacts are highly unlikely to occur due to the distance from fixed locations, and the infrequent exposure of non-fixed populations (such as pastoral station workers and traditional owners).	the nearest community (Noonkanbah) is approximately 28 km • the separation distance between the disturbance footprint (from the nearest proposed well site) and the nearest fixed sensitive receptor (Quanbun Downs homestead) is approximately 21 km • management measures proposed during construction including dust suppression • temporary nature of dust generating activities during construction and the natural prevalence of airborne dust in the region during dry season conditions • proposed use of pilot flame during well testing to ensure the flare flame is maintained to minimise likelihood of 'cold venting' the EPA considers it unlikely that the proposal would have a significant impact on air quality. The EPA also had regard for the direct and indirect mitigation provisions relevant to air quality that are expected to be applied and enforced through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, as well as the Well Management Plan required under the PGER (Resource Management and Administration) Regulations, and the Safety Case required under the Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022. It is not likely that the proposal will have a significant impact on air quality, and the proposal is likely to be consistent with the EPA factor objective. Accordingly, the EPA did not consider air quality to be a key environmental factor at the conclusion of its assessment.

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
People			
Human health	Consistent with the EPA's factor guideline for human health (EPA 2016b), impacts to human health are explicitly information through the EPA's assessment of other factors (such as Inland Waters and Air Quality). Accordingly, the EPA's consideration here is limited to possible impacts to human health arising from the emission of radiation. The proposal has the potential to impact human health due to radiation associated with elevated levels of radionuclides (naturally occurring radioactive material [NORM]) in formation water that is returned to the surface during exploration activities, and in the release of radon gas associated with formation gases.	<u>Public comments</u> • Concerns that HFS activities will increase the release of radioactive substances into the atmosphere (including radon gas and uranium progeny) • The presence of NORM in produced formation water • The adequacy of the human health risk assessment and its consideration of radionuclides <u>Agency comments</u> • The Department of Health reviewed the human health risk assessment (Bennett Resources 2022c) and advised that public health impacts are highly unlikely to occur due to the distance from fixed locations, and the infrequent exposure of non-fixed populations (such as pastoral station workers and traditional owners).	Human Health was identified as a preliminary key environmental factor when the EPA decided to assess the proposal; however, the EPA considers it to not be a key factor at the conclusion of its assessment. Having regard for: • the separation distance between the disturbance footprint (from the nearest proposed well site) and the nearest community (Noonkanbah) is approximately 28 km • human health impacts associated with occupational exposure are comprehensively regulated by other agencies and is not a consideration for the EPA's assessment • the separation distance between the disturbance footprint (from the nearest proposed well site) and the nearest fixed sensitive receptor (Quanbun Downs homestead) is approximately 21 km • analysis of produced water from the target Laurel Formation indicating levels of radionuclides may exceed drinking water levels in flowback water, but are unlikely to result in a significant risk to human health taking into account the management of flowback water, the proximity to receptors, and the lack of credible exposure pathways that would result in an unacceptable risk • regulation of transport and disposal of wastes under the *Radiation Safety Act 1975* if applicable, should flowback pond sediment analysis indicate elevated levels of radionuclides exceeding specified exemption quantities

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			• the proponent's monitoring program includes potential radioactive species, including radon • the HFS Inquiry finding that risks associated with NORM in produced fluids are likely to be low in the context of how flowback fluids are contained and managed (refer to section 2.1.9) • the likelihood of radon gas (or methane) migrating from the subsurface, such as via fractures or faults, is low (refer to section 2.1.9) the EPA considers it unlikely that the proposal would have a significant impact on human health. The EPA also had regard for the direct and indirect mitigation provisions relevant to human health and radiation exposure that are expected to be applied and enforced through the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, as well as the Well Management Plan required under the PGER (Resource Management and Administration) Regulations, and the Safety Case required under the Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022. It is not likely that the proposal will have a significant impact on human health, and the proposal is likely to be consistent with the EPA factor objective. Accordingly, the EPA did not consider human health to be a key environmental factor at the conclusion of its assessment

Appendix F: List of submitters

7-day comment on referral

Organisations and public

- 457 submissions were received from individuals and organisations.

Government agencies

- Department of Mines, Industry Regulation and Safety.

Public review of proponent information

Organisations and public

- 8,124 submissions were received from individuals and organisations, of which approximately 75% of which were proforma style submissions.

Government agencies

- Department of Water and Environment Regulation
- Department of Biodiversity, Conservation and Attractions.

Appendix G: Assessment timeline

Date	Progress stages	Time (weeks)
3 February 2021	EPA decided to assess – level of assessment set	
4 August 2021	Environmental Scoping Document released for public review	26
1 September 2021	Public review period for Environmental Scoping Document closed	4
8 November 2021	EPA approved Environmental Scoping Document	10
21 June 2024	EPA received final Environmental Review Document	136
30 July 2024	EPA accepted Environmental Review Document	5
12 August 2024	Environmental Review Document released for public review	2
7 October 2024	Public review period for Environmental Review Document closed	8
24 July 2025	EPA considers assessment at EPA Board meeting	41
12 November 2025	EPA accepted proponent's Response to Submissions	16
16 January 2026	EPA provided report to the Minister for Environment (following EPA member meeting)	25
20 January 2026	EPA report published	3 days
10 February 2026	Appeals period closed	3

Timelines for an assessment may vary according to the complexity of the proposal and are usually agreed with the proponent soon after the EPA decides to assess the proposal and records the level of assessment.

The EPA must give the Assessment report to the Minister so far as practicable no later than 6 weeks after the EPA completed its assessment or reassessment (s.44(2b)).

In this case, the EPA did not meet its timeline objective to complete its assessment and provide a report to the Minister. This was due to the complexity of the assessment and ensuring that the proposal received adequate consideration and time to complete the assessment.

Appendix H: Relevant policy, guidance, procedures and references

The EPA had particular regard to the policies, guidelines and procedures listed below in the assessment of the proposal.

Bennelongia 2023, *Valhalla Gas Exploration and Appraisal Program Subterranean Fauna Desktop Assessment*, [appendix S of Bennett Resrouces 2024]

Bennett Resources 2022a, *Valhalla Gas Exploration and Appraisal Program – Proposal Content Document,* [Attachment 2 to s43A Amendment Notice: CMS17936 - S43A Notice - 060522.pdf]

Bennett Resources 2022b, *Valhalla Gas Exploration and Appraisal Program Geotechnical Risk Analysis*, 10 January 2022 [appendix B of Bennett Resources 2024]

Bennett Resources 2022c, *Human Health Risk Assessment - Valhalla Gas Exploration and Appraisal Program*, 10 January 2022 [appendix N of Bennett Resources 2024]

Bennett Resources 2024a, *Valhalla Gas Exploration and Appraisal Program, Section 38 Assessment – Environmental Review Document, EPA Assessment Number 2281*, 21 June 2024

Bennett Resources 2024b, *Valhalla Gas Exploration and Appraisal Program – Valhalla Monitoring Plan,* 26 April 2024 [appendix E of Bennett Resources 2024a]

Bennett Resources 2025a, *Valhalla Exploration Drilling Response to Public Submissions – EPA Assessment No. 2281*, 10 June 2025

Bennett Resources 2025b, *Valhalla Gas Exploration and Appraisal Program – Groundwater Management Plan*, 29 May 2025 [appendix 7 of Bennett Resources 2025a]

Bennett Resources 2025c, *Valhalla Gas Exploration and Appraisal Program Greenhouse Gas Environmental Management Plan*, 23 May 2025

Bureau of Meteorology 2012, National Groundwater Dependent Ecosystems Atlas. Bioregional Assessment Source Dataset. Viewed July 2025, GDE Atlas Home: Water Information: Bureau of Meteorology

Buru Energy and Outback Ecology 2014, *Ophir, Paradise, Valhalla, Eden and Ellendale Flora, Vegetation and Fauna Survey Report*

Buru Energy 2018, *Buru Energy Submission to the Scientific Inquiry into Hydraulic Fracture Stimulation in Western Australia*, 16 March 2018,

https://frackinginquiry.wa.gov.au/sites/default/files/webform/submissions/buru_energy_submission_scientific_inquiry_fraccing_wa_final.pdf

Davies RJ, Mathias SA, Moss J, Hustoft S & Newport L 2012, *Hydraulic fractures: How far can they go?*, Marine and Petroleum Geology, Vol 37, Issue 1, pg 1-6 November 2012

Deep Woods Surveys (WA) 2021, *Report on the Ethnographic Aboriginal Heritage Survey of the Odin 2D & 3D Seismic Survey Areas and the Valhalla Gas Exploration and Appraisal Program Access Tracks, Well & Camp Sites, Blina & Noonkanbah Stations, Kimberley, Western Australia*, September to October 2021.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023a, N*ational Greenhouse Gas Inventory Quarterly Update: December 2022*. DCCEEW, Canberra, ACT. https://www.dcceew.gov.au/climatechange/publications/national-greenhouse-gas-inventoryquarterlyupdatedecember2023#:~:text=On%20a%20quarterly%20basis%2C%20national,in%20the%20fugitive%20emissions%20sector

DCCEEW 2023b, *Conservation Advice for* Tiliqua scincoides intermedia *(northern blue-tongue skink)*, Canberra, Australia.

DCCEEW 2024, *State and territory greenhouse gas inventories: annual emissions.* DCCEEW, Canberra, ACT. https://www.dcceew.gov.au/climatechange/publications/national-greenhouse-accounts-2022/state-and-territorygreenhouse-gas-inventories-annual-emissions

Department of Energy, Mines, Industry Regulation and Safety 2024, *Guideline for the development of Petroleum, Geothermal and Pipeline Environment Plans in Western Australia*, November 2024

Department of Energy, Mines, Industry Regulation and Safety 2016, *Guidelines to Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015 and Petroleum (Submerged Lands) (Resource Management and Administration) Regulations 2015*, Revision 6 September 2016.

Department of Mines and Petroleum 2016, *Guideline for the Development of an Onshore Oil Spill Contingency Plan*, July 2016.

Department of Water (DoW) 2012, *West Canning Basin groundwater allocation limit report,* Department of Water Report no. 52, Water Allocation and Planning Series.

Department of Water and Environmental Regulation (DWER) 2020, *Use of operating strategies in the water licensing process*, Policy document, October 2020

Department of Water and Environmental Regulation (DWER) 2023a, *Fitzroy Valley groundwater investigations 2015–2018*, Kimberley, Western Australia, Hydrogeological record series, report no. HG69.

Department of Water and Environmental Regulation (DWER) 2023b, *Environmental and heritage values and the importance of water in the Fitzroy*, Western Australia, Environmental water report series, report no. 33, October 2023.

Department of Water and Environmental Regulation (DWER) 2023c, *Aquatic GDE in the Fitzroy Water Planning Area (DWER-126)* Western Australia, Geospatial data layer accessed via SLIP, Last updated 19 December 2023.

Edwards, D.S., Grosjean, E., Boreham, C.J., Mory, A., Hong, Z., Jinadasa, N., Sohn, J., Buckler, T., Collaery, I 2020. *Geochemical composition of natural gases from the onshore Canning Basin, Australia*. Record 2020/04. Geoscience Australia, Canberra

EPA 2016a, *Technical guidance – Sampling of short range endemic invertebrate fauna*, Environmental Protection Authority, Perth, WA.

EPA 2016b, *Environmental factor guideline – Human health*, Environmental Protection Authority, Perth, WA.

EPA 2018, *Environmental factor guideline – Inland waters*, Environmental Protection Authority, Perth, WA.

EPA 2020, *Technical guidance –Terrestrial vertebrate fauna surveys for environmental impact assessment,* Environmental Protection Authority, Perth, WA.

EPA 2021a, *Environmental impact assessment (Part IV Divisions 1 and 2) procedures manual*, Environmental Protection Authority, Perth, WA.

EPA 2021b, *Environmental impact assessment (Part IV Divisions 1 and 2) administrative procedures*, Environmental Protection Authority, Perth, WA.

EPA 2023a, *Environmental factor guideline – Greenhouse gas emissions*, Environmental Protection Authority, Perth, WA.

EPA 2023b, *Statement of environmental principles, factors, objectives and aims of EIA*, Environmental Protection Authority, Perth, WA.

EPA 2024, *Environmental factor guideline – Greenhouse gas emissions*, Environmental Protection Authority, Perth, WA.

Evolveable Consulting 2024, *Valhalla Greenhouse Gas Environmental Management Plan, External Peer Review*, June 2024.

Gemec 2023, *Re: Targeted Soil & Groundwater Works – Valhalla Gas Exploration & Appraisal Program*, 20 October 2023. [Appendix G of the environmental review document]

Government of Western Australia 2019, *Implementation Plan - Implementation of the Government's response to the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia*, Government of Western Australia, July

2019. https://www.hydraulicfracturing.wa.gov.au/wp-content/uploads/2019/07/Implementation-Plan.pdf

Government of Western Australia 2021, *Monitoring, mitigation and offsetting of Greenhouse Gas Emissions for hydraulic fracturing proposals in Western Australia, Position Paper*, Government of Western Australia, Perth, WA.

Government of Western Australia 2023, *Water allocation planning in the Fitzroy, Policy Position Paper*, Government of Western Australia, Perth, WA.

Harrington GA, Stelfox L, Gardner WP, Davies P, Doble R & Cook PG 2011, *Surface water – groundwater interactions in the lower Fitzroy River*, Western Australia, CSIRO: Water for a Healthy Country National Research Flagship, August 2011.

Herring Storer Acoustics 2021, *Valhalla Gas Exploration and Appraisal Program – Environmental Acoustic Impact Assessment*. [Appendix P of the environmental review document]

International Standards Organisation 2017, *Petroleum and natural gas industries — Cements and materials for well cementing* — Part 1: Specification.

Intera 2024, *Revised modelling of drawdown impacts from proposed rig supply bores in the Bennett Resources Valhalla Gas Development Project*, Technical Memorandum, 16 May 2024 [Appendix L of the environmental review document]

Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (IESC) 2025, *Advice to decision maker on unconventional gas project, IESC 2025-160: Valhalla Gas Exploration and Appraisal Project (EPBC 2024/10006) – New Development*, 11 December 2025. IESC Advice - Valhalla Gas Exploration and Appraisal Project

Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia 2018. *Final Report*. Government of Western Australia, https://www.hydraulicfracturing.wa.gov.au

Lindsay RP & Commander DP 2005, *Hydrogeological assessment of the Fitzroy alluvium*, Western Australia, Department of Water, Hydrogeological record series HG16.

National Health and Medical Research Council & Natural Resource Management Ministerial Council 2011, *Australian Drinking Water Guidelines 6: National Water Quality Management Strategy*, Version 4.0, updated June 2025, Commonwealth of Australia, Canberra.

Nimbleng Energy Consultants 2021, *Valhalla Gas Exploration Program GHG Management Report - Report Prepared to Support Environmental Review Document WA EPA*, 23 July 2021 [Appendix B of Bennett Resources 2025b]

Rockwater 2016, *Hydrogeological Assessment of Paradise – Valhalla – Asgard Project Areas, Report for Buru Energy*, 28 September 2016 [Appendix B of Bennett Resources 2024]

State of Western Australia 2021, *Western Australia Government Gazette, No. 180*, *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2021,* 22 October 2021.

Tamboran Resources 2024, *Sturt Plateau Compression Facility - Appraisal Gas Environment Management Plan (TAM2-3) EP 98 & EP 117*, 14 November 2024, https://environment.nt.gov.au/__data/assets/pdf_file/0007/1468060/sturt-plateau-compression-facility-emp.pdf

Taylor, Andrew; Harrington, Glenn; Clohessy, Steven; Dawes, Warrick; Crosbie, Russell; Doble, Rebecca; Wohling, Daniel; Batlle-Aguilar, Jordi; Davies, Phil; Thomas, Mark; Suckow, Axel 2018, *Hydrogeological assessment of the Grant Group and Poole Sandstone - Fitzroy catchment, Western Australia*. A technical report to the Australian Government from the CSIRO Northern Australia Water Resource Assessment, part of the National Water Infrastructure Development Fund: Water Resource Assessments, CSIRO, 30 June 2018.

Threatened Species Scientific Committee (TSSC) (2015). *Conservation advice for Malurus coronatus coronatus (purple-crowned fairy-wren (western))*. Department of the Environment, Canberra. Retrieved from https://environment.gov.au/biodiversity/threatened/species/pubs/64442-conservation-advice.pdf

Threatened Species Scientific Committee (TSSC) 2019, *Conservation Advice* Falco hypoleucos *Grey Falcon*, 12 September 2019.

Wasko C, Westra S, Nathan R, Jakob D, Nielsen C, Evans J, Rodgers S, Ho M, Babister M, Dowdy A, Sharples W 2024. *Chapter 6, Climate Change Considerations. Book 1, Australian Rainfall and Runoff - A Guide to Flood Estimation*, Commonwealth of Australia.

Zhang L and Hascakir B 2021, *A review of issues, characteristics, and management for wastewater due to hydraulic fracturing in the U.S.* Journal of Petroleum Science and Engineering, Vol 202, July 2021.

Appendix I: Action 7.3 of the HFS Implementation Plan

Table I1: Checklist of assessment issues identified in Action 7.3 of the HFS Implementation Plan

Assessment matter	Addressed in assessment?
Action 7.3: Finalise update of administrative procedures and processes to ensure all onshore hydraulic fracture stimulation exploration and production proposals will be assessed under Part IV of the EP Act considering, among other things:	
cumulative impacts from hydraulic fracture stimulation exploration and production on public ecosystem fragmentation;	Yes, the cumulative impacts on ecosystem fragmentation were considered by the proponent in the ERD in the context of flora and vegetation and habitat for terrestrial fauna (Bennett Resources 2024). The EPA recognises that there has been a long history of petroleum exploration activities within the region that has contributed to the cumulative impacts on ecosystem fragmentation. However, the EPA considered that the nature and scale of past and present (including the proposal) activities in the region is unlikely to result in a significant incremental impact to ecosystem fragmentation. The EPA notes the significant public concern associated with cumulative impacts, including to ecosystem fragmentation, that may occur in the region in the event that a large scale petroleum production industry develops in the Canning Basin. The EPA has provided 'other advice' on this matter in section 5. Whilst the EPA recognises that this proposal has the potential to be an enabler of future petroleum exploration and production in the region, at the time of the EPA's assessment there were limited reasonably foreseeable petroleum proposals in the region, besides low impact exploration activities (e.g. seismic surveys).
the suitability of chemicals used in hydraulic fracture stimulation and their approval for use in Australia, including; - a presumption against approval of Benzene, Toluene, Ethylbenzene and	Yes, Section 2.1.9 discusses the management of wastewater, including flowback water and the composition of HFS fluids. The proponent has confirmed that BTEX will not be included in HFS fluids. All chemical additives proposed for use have been declared and related 'Material Safety Data

Xylene (BTEX) for use as drilling and hydraulic fracturing fluids; - recommending the minimisation or avoidance of the use of known or suspected carcinogens, mutagens, developmental toxicants and endocrine disruptors in drilling and hydraulic fracture fluids; - the cumulative, short and long-term public health risk from chemicals used in onshore hydraulic fracturing exploration and production and chemicals expected to be present in produced and flow-back water;	Sheets' (MSDS) provided in Appendix A of the proponent's ERD (Bennett Resources 2024). Ecotoxicity testing of the proposed HFS Fluid has demonstrated that the fluid combination has a very low toxicity to aquatic fauna (Bennett Resources 2024). The human health risk assessment, reviewed by the Department of Health, demonstrated that public health impacts from the proposal are high unlikely to occur (Bennett Resources 2022c).
the requirement for peer-reviewed, site-specific human health, air quality and noise risk assessments;	The human health risk assessment, reviewed by the Department of Health, demonstrated that public health impacts from the proposal are high unlikely to occur (Bennett Resources 2022c). The EPA's considered of air quality impacts is detailed in Appendix E – Other Environmental Factors. The EPA considered it unlikely that the proposal would have a significant impact on air quality. The EPA's consideration of air quality impacts was informed by technical advice provided by subject matter experts within the Department of Water and Environmental Regulation. The EPA's consideration of noise impacts is detailed in section 2.3.8 in the context of amenity. Given the sparsely populated location of the proposal, and the nearest population centre being 18 km from the development envelope, significant noise impacts are not expected and therefore a peer-reviewed noise risk assessment was not considered warranted for the assessment of this proposal.
baseline and routine surveillance groundwater quality monitoring, including methane concentrations;	Yes, the EPA's assessment of inland waters was informed by groundwater monitoring data for a comprehensive list of analytes in groundwater, including methane. The EPA concluded that sufficient information was available for the EPA to complete its assessment, and noted that the proponent has committed to undertaking baseline and surveillance groundwater monitoring prior to and during implementation. Baseline and

	surveillance groundwater monitoring is set out in the proponent's Groundwater Management Plan (Bennett Resources 2025b). The EPA has recommended a condition that will require revision of the plan in consultation with DWER and DMPE, and for drilling of exploration wells not to occur until the plan has been approved by the CEO of DWER.
the comprehensive list of analytes in groundwater, likely in produced and flow-back water, including geogenic chemicals and radon;	Yes, the management of potential impacts from flowback water is discussed in section 2.1.9, along with the expected composition of the flowback water, and likely radionuclides. The proponent's Groundwater Management Plan sets out a comprehensive list of analytes to be tested for as part of baseline and surveillance groundwater monitoring, including radon, uranium, dissolved gases (e.g. methane) and geogenic chemicals (Bennett Resources 2025b). The EPA has recommended a condition that will require revision of the plan in consultation with DWER and DMPE, and for drilling of exploration wells not to occur until the plan has been approved by the CEO of DWER.
the requirement for a site water balance, accounting for water produced, evaporated and disposed, to enable detection of significant leakage of fluids and determine whether remedial action to track any contaminants is warranted;	Yes, the proponent provided a site water balance in section 2.4.5 of the ERD (Bennett Resources 2024). The EPA has recommended a condition that will require the proponent to prepare a site water audit program to account for water produced, evaporated and disposed, such that significant leakage of fluids can be detected and remedied (condition B1-2).
impacts on Traditional Owners' cultural heritage;	Yes, the potential impacts to Aboriginal cultural heritage are discussed in section 2.3.5 and assessed in section 2.3.8. The EPA has also considered in detail the potential indirect impacts to cultural heritage values through impacts to water-related environmental values, including groundwater and the Fitzroy River.
the acceptability of the Aboriginal Heritage Management Plan;	The EPA's consideration of the mitigation of impacts to cultural heritage is set out in section 2.3.8. At the time of the EPA's assessment, cultural heritage management plans were no longer a requirement specified through Part IV of the EP Act. It is noted that cultural heritage management plan may be considered by the Department of Planning, Lands and Heritage under the *Aboriginal Heritage Act 1972*. It is noted that the proponent has an Indigenous Land Use Agreement in place with the Yungngora people and a 'Land Access and Use Agreement' in place with the Warlangurru People.

separation of 2,000 metres between any hydraulic fracture stimulation activity and gazetted Public Drinking Water Source Areas;	Yes, section 2.1.9 includes consideration for the 2,000 m separation distance between HFS activities and bores used for public drinking water. The nearest proclaimed water reserves are more than 50 km from the development envelope, and the nearest groundwater bore for potable community supply is more than 17 km away.
in the absence of a local health risk assessment indicating otherwise, separation of 2,000 metres between any hydraulic fracture stimulation activity and sensitive receptors, such as residences, schools and settlements;	Yes, the EPA's consideration of the proximity of the proposal to sensitive receptors is detailed in section 2.3 as part of the assessment of impacts to social surroundings. The proposal is in sparsely populated area and HFS activities are proposed to occur far away (far greater than 2,000 metres) from sensitive receptors such as residences, schools and settlements.
proposed national parks and places of iconic natural heritage;	The West Kimberley National Heritage Area (WKNHA) is approximately 7.5 kms to the south of the development envelope. The WKNHA is related to the Fitzroy River and potential impacts to this area have been considered in section 2.3.8.
baseline and ongoing air quality monitoring conditions over the lifecycle of the wells;	Yes, the proponent undertook baseline air quality monitoring and has proposed ongoing air quality and methane monitoring as part of the Valhalla Monitoring Plan (appendix E of the ERD [Bennett Resources 2024]). Given the distance of the proposal from sensitive receptors, the EPA considered that air quality impacts are unlikely to be significant. The EPA considered that air quality monitoring could be administered under the Environment Plan under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.
a social impact analysis, documenting potential impacts to social surroundings;	Yes, the proponent undertook an assessment of impacts to social surroundings, including Aboriginal cultural heritage and amenity, as documented in the ERD (Bennett Resources 2024). This included Aboriginal heritage surveys, human health risk assessment, noise modelling assessment, and baseline traffic monitoring data. The EPAs consideration of impacts to social surroundings matters is set out in section 2.3.8.
baseline monitoring for GHG prior to assessment;	Yes, the proponent conducted baseline methane monitoring within the proposal area between June and November 2021 as part of the baseline air quality monitoring program (Appendix H.1). The proponent has committed to undertaking continued

	methane monitoring as part of the Valhalla Monitoring Plan (appendix E of the ERD [Bennett Resources 2024]).
cumulative impacts of noise from hydraulic fracture stimulation and associated activities on places within proximity to people and domestic animals	Yes, the potential impacts from noise emissions are discussed in section 2.3.8. The proposal is not in proximity to sensitive human receptors and cumulative impacts are not expected given the absence of current and reasonably foreseeable proposals in the area.
cumulative impacts by volatile organic compounds and dust from hydraulic fracture stimulation exploration and production on local and regional ecosystems and public health;	Yes, the EPA considered the cumulative impacts on air quality, including dust, as part of the consideration of air quality impacts (Appendix E – Other Environmental Factors). The potential impacts of dust emissions on amenity values is also discussed in section 2.3.8 in the context of social surroundings. At the time of the EPA's assessment, and in the context of the current status of petroleum industry in the Canning Basin, the EPA considered that cumulative impacts to air quality from the release of volatile organic compounds and dust are unlikely to be significant. The EPA has recommended conditions that require the implementation of measures to minimise GHG emissions that will also have the effect of mitigating VOC emissions (condition B5-1).
proposed measures to minimise the generation of dust throughout all operations when compared to baseline monitoring;	Yes, the proponent has proposed a dust monitoring program (Appendix H.1 of the ERD [Bennett Resources 2024]) and will implement dust minimisation measures, such as water carts for dust suppression. The EPA's consideration of dust generation is provided in the context of the air quality factor in Appendix E – Other Environmental Factors.
baseline road use statistics, periodic monitoring and impacts; and	Yes, baseline road use data was provided as part of the proponent's ERD (Appendix Q of Bennett Resources 2024) and was considered as part of the EPA's assessment, as discussed in section 2.3.8. The EPA considers that the increase in traffic movements may adversely impact other road users for brief periods during mobilisation, however this is likely to be limited to residents and visitors to the Noonkanbah community. The EPA considered that the traffic impacts are unlikely to be significant and can be mitigated through ongoing consultation with the Yungngora people through the ILUA. Periodic monitoring during implementation was not considered warranted for this proposal.

acquisition of baseline information and developing processes to ensure the documentation and systematic monitoring of matters relating to amenity, aesthetics and sense of place in assessments.	The EPA notes that this item responds to Recommendation 24 of the HFS Inquiry, which recommended that baseline information on amenity should be collected. As noted in Recommendation 24, amenity and 'sense of place' is best determined by the people who live in communities proximate to HFS activities. In this case of this proposal the activities are proposed to occur in a remote area that has a long history of pastoral landuses. It is noted that the community whose amenity values are most at risk of being adversely impacted by the proposal are the members of the Noonkanbah community, who, via the Yungngora Aboriginal Corporation, are broadly supportive of the proposal and have previous experience and involvement with petroleum activities on their land. The EPA's consideration of impacts to amenity values are discussed in section 2.3.8. It is considered that impacts to aesthetics and amenity values are unlikely to be significant for this proposal. The EPA recognises that adverse impacts to amenity and 'sense of place' would require further consideration in the event that petroleum exploration and production activities in the Canning Basin intensify. The EPA has provided other advice in relation to the consideration of cumulative impacts associated with the development of the Canning Basin.