

Onshore Petroleum Activity – NT EPA Advice

ENVIRONMENT MANAGEMENT PLAN – SANTOS QNT PTY LTD, MCARTHUR BASIN 2019 DRILLING PROGRAM EXPLORATION PERMIT (EP) 161

BACKGROUND

The Minister for Environment and Natural Resources has formally requested under section 29B of the Northern Territory Environment Protection Authority Act 2012 (NT EPA Act) that the Northern Territory Environment Protection Authority (NT EPA) provide advice on all Environment Management Plans (EMPs) received under the Petroleum (Environment) Regulations.

That advice must include a recommendation on whether the EMP should be approved or not, supported by a detailed justification that considers:

- whether the EMP is appropriate for the nature and scale of the regulated activity to which the EMP relates (regulation 9(1)(b));
- whether the EMP demonstrates that the activity will be carried out in a manner by which the environmental impacts and environmental risks of the activity will be reduced to a level that is as low as reasonably practicable and acceptable (regulation 9(1)(c));
- the principles of ecologically sustainable development (regulation 9(2)(a)); and
- any relevant matters raised through the public submission process.

In providing that advice, the NT EPA Act provides that the NT EPA may also have regard to any other matters it considers relevant.

ACTIVITY

Interest holder	Santos QNT Pty Ltd
Petroleum interest(s)	Exploration Permit 161
Environment Management Plan (EMP) title	McArthur Basin 2019 Drilling Program NT Exploration Permit (EP) 161
EMP document reference	Santos_EP161_2019_Drilling_EMP_Rev4
Regulated activity	Drilling of the Inacumba-1H pilot and horizontal well, drilling of the Tanumbirini-2H horizontal well, evaluation of Inacumba-1H and Tanumbirini-2H wells (including FIT, mudlogging, wireline, Cement Bond Logging (CBL), Diagnostic Fracture Injection Testing (DFIT) and coring, CBL and DFIT of Tanumburini-1, suspension and/or plugging and decommissioning of Inacumba-1H, Tanumburini-1 and Tanumbirini-2H wells, and care and maintenance. Rehabilitation of the Tanumbirini and Inacumba well sites is not included as part of this regulated activity as it is included in the Santos Civils and Seismic EMP. Hydraulic fracturing of the petroleum wells is not included as part of this regulated activity as it will be subject to a separate EMP.
Public consultation	Public consultation on the EMP was required under 8A(1)(b) of the Petroleum (Environment) Regulations as the EMP proposes

	the drilling of a well. The EMP was made available for public comment for a period of 28 days from 12 April 2019 – 9 May 2019.
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NT EPA ADVICE

1. Is the EMP appropriate for the nature and scale of the regulated activity (regulation 9(1)(b))

The technical works programme includes the drilling of one vertical pilot and horizontal petroleum exploration well at the Inacumba well site and one horizontal petroleum exploration well at the Tanumbirini well site on Tanumbirini Station. The Tanumbirini well site is approximately 18km N-NW from Inacumba. A number of well evaluation techniques will be conducted during and/or on completion of drilling at both well sites including mudlogging, logging while drilling, wireline logging, formation testing, core acquisition and fluid sampling. In addition well integrity verification and Diagnostic Fracture Injection Testing (DFIT) of the petroleum wells at all well sites will be conducted. The EMP does not include hydraulic fracturing (stimulation) of a petroleum exploration well and no produced water or flow back fluid will be produced as part of the regulated activities proposed under this EMP.

Diagnostic Fracture Injection Testing (DFIT) is proposed for all wells. This process involves injecting a small volume of water (without sand) into the target reservoir at low pumping rates and high pressure until the initiation of a fracture. The purpose of a DFIT is to obtain information on reservoir properties. A DFIT is conducted only after the well is complete and the overall integrity of the well has been tested. DFIT activities differ from hydraulic fracturing as it involves only a small volume (~ 5000 litres) of water and no proppant or sand. Conversely, hydraulic fracturing involves a high volume (> 1 megalitres) of water, chemicals and sand to produce and keep open fractures that may conduct hydrocarbons for extraction, as defined in the Petroleum (Environment) Regulations 2016. If hydraulic fracturing is later proposed at the three well sites it will need to be addressed in a separate EMP, available for public comment and approved by the Minister for Environment and Natural Resources

The drilling activities are expected to be undertaken over approximately 17 weeks during the second half of 2019. A temporary 40 person camp site will be established at each well site for the drilling operations. The interest holder has estimated up to 500m³ of drilling material, primarily comprised of drill cuttings, may be generated at each well site.

Approximately 12 megalitres (ML) of groundwater will be sourced from existing bores in accordance with a water extraction licence granted under the Water Act 1992. It is estimated that up to 20 truck movements per week will be required for each well site over the 17 week period. On completion of exploration well drilling and technical evaluation the exploration wells will either be suspended for future re-entry, or in a non-success case, a decision made to decommission the exploration wells with permanent cement plugs in accordance with the Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (the Code).

Information relating to the nature and scale of the regulated activity is provided in the EMP in a clear format. The drilling works proposed are clearly described in the EMP. The stratigraphic formations intersected by the petroleum well to be drilled at each site have been adequately described, including total vertical depths, through 2D seismic surveys conducted at both the Inacumba and Tanumbirini well sites and drilling logs from offset wells previously drilled in the local area. In addition, information gained from stratigraphic bore holes that have been drilled at both well sites to the base of the regional Cambrian Limestone Aquifer (CLA) system is provided in the EMP to inform planning and design of petroleum exploration well construction to isolate and protect the regional aquifer.

The existing environment has been adequately described through baseline surveys including groundwater quality characterisation at each site and is suitably understood. The EMP includes an impact and risk assessment based on information gathered during baseline surveys in 2018

and 2019, previous exploration experience of the interest holder in EP 161, and acquisition and analysis of local seismic, stratigraphic, geological and petrophysical subsurface data including an assessment of potential subsurface geohazards (e.g. faults and hazardous gases). The potential impacts and risks of the regulated activity are identified and relevant environmental performance standards and measurement criteria have been provided in the EMP.

The EMP demonstrates how the interest holder will comply with relevant requirements of the Code of Practice in undertaking this regulated activity. This includes a list of applicable ISO/API standards that have been adopted for the selection of materials for use in EP161 well construction; drilling program environmental controls and related engineering controls contained in the Well Operations Management Plan (WOMP); a brief summary of which was provided in the EMP. The risk assessment provided in the EMP cross references relevant sections of the Code that apply to the mitigation and management measures. This enables the reviewer to identify and confirm that the details provided of the drilling program activities in the EMP comply with the Code. The EMP provides a Wastewater Management Plan and Spill Management Plan, and specific petroleum well integrity criteria and performance monitoring programs specified in the Code that are used to demonstrate compliance with the Code.

The level of detail and quality of information provided in the EMP is sufficient to inform the evaluation and assessment of environmental risks and potential impacts, and meets the approval criteria under Regulation 9 for the Ministers decision about approval of the Environment Management Plan.

2. Principles of ecologically sustainable development (regulation 9(2)(a))

Conservation of biological diversity and ecological integrity

The potential impacts and risks to threatened flora and fauna species from clearing were assessed in the EMP for the Santos Civil and Seismic Program EP161. That EMP identified 17 listed threatened species as likely to occur on EP161, based on availability of suitable habitat. Of these, four species were considered to have a 'medium' likelihood of occurrence. The Civils EMP outlined mitigation measures to minimise impacts on threatened species and on affected environmental values including the management of threatening processes such as weeds and fire. The NT EPA advised that it considered the conservation of biological diversity and integrity of threatened species would be maintained.

The exploration drilling EMP identifies other potential impact and risks to biodiversity arising from vehicle strike, dust, erosion and spills. Adequate avoidance and mitigation measures are proposed to reduce these potential impacts and risks to levels as low as reasonably practicable. These include driving only on permitted designated access roads, complying with speed limits, use of water trucks to manage dust emissions and the implementation of the Spill Management Plan. Threatened species such as the Gouldian Finch and Mertens' Water Monitor were found to have more specific habitat requirements that were not present at either well pad. The proposed drilling activities do not pose a significant risk to threatened species or significant habitats and vegetation types.

The potential impacts and risks of the drilling activities identified in the EMP relate to animal welfare and do not pose a significant risk to threatened species at a population level due to the low likelihood of threatened species inhabiting the area and implementation of control measures to avoid impacts to fauna. The EMP outlines measures to minimise impacts on fauna, including control measures to prevent interactions of fauna and stock with open water storages and the drilling sump. The Proponent will undertake daily monitoring of the open drilling sump and water storage dams, and associated fencing, throughout the drilling program. Inspection records of these daily checks will be kept. Additional contingency measures may be required if incident reporting shows any impacts to fauna. This may include measures such as additional monitoring using fauna cameras and flagging, netting, screening or other measures to deter entry by birds and fauna. After completion of the drilling operations, the open sump will be closed out, removing the risk of fauna accessing the sump.

Where relevant, management measures are consistent with applicable mandatory requirements of the Code and the NT Land Clearing Guidelines. Cumulative impacts to flora and fauna from the regulated activity and the approved civils and seismic activities are not considered to be significant. The NT EPA considers that implementation of the EMP for the regulated activity will ensure the conservation of biological diversity and ecological integrity.

Integration of long-term and short-term economic, environmental, social and equitable considerations

The regulated activity is low impact, small scale and of short duration (17 weeks). It forms one component of a broader technical works exploration program to inform the interest holder on the potential for commercial gas production in the Beetaloo Basin.

Cumulative quantities of groundwater extraction and greenhouse gas emission estimates from the regulated activity and approved civils and seismic activities have been included in the EMP. The total volume of groundwater to be extracted is within the volume of groundwater the interest holder is permitted to extract under its water extraction licence granted under the Water Act 1992 on 8 May 2019 (Licence No. GRF10280). This extraction licence has a Maximum Water Entitlement of 193.5ML/year for five years. The water entitlement takes into account the requirements for related exploration activities on EP161 including civil works, camp requirements, petroleum well construction and potential hydraulic fracturing. Drawdown modelling was undertaken and considered as part of the groundwater extraction licence and DENR concluded the proposed extraction would have no change in reliability of spring flows at Bitter Springs or Rainbow Springs (both more than 200 km northwest of the well sites), or impact groundwater users. Groundwater extraction is informed by the NT Water Allocation Planning Framework, which states the total extraction from the GRF over the period of at least 100 years should not exceed approximately 1,412,800 – 2,825,600 GL. The proponent's water licence allocation is approximately 0.0007% of the 28 GL estimated maximum sustainable yield/annum of the Gum Ridge aquifer.

The cumulative greenhouse gas emissions estimate of 14,472 tCO_{2-e} for the Santos McArthur Basin civils and drilling activities represents 0.0027% of annual national greenhouse gas emissions and 0.09% of NT annual emissions. The level of emissions is low and the potential impacts not significant.

Due to the different nature of the proposed works for the drilling program compared to the civils and seismic works, no further cumulative impacts are expected. In EMPs for subsequent stages (if they proceed) the interest holder will need to address any further cumulative impacts.

In facilitating petroleum exploration, the EMP adequately assesses the environmental impacts and risks associated with the regulated activity and outlines appropriate avoidance and mitigation measures. This includes the assessment and management of social impacts and risks, including the appropriate management of cultural heritage. The interest holder has demonstrated on-going stakeholder engagement in the EMP as required by the Regulations with landholders and land managers, traditional owners, the Northern Land Council (NLC) and NT Government Agencies.

The regulated activity will be subject to requirements of an Aboriginal Areas Protection Authority Certificate.

There are no conflicting economic, environmental, social or equitable considerations associated with the regulated activity.

Precautionary principle

The NT EPA considers there is a very low threat of serious or irreversible damage from the regulated activity.

The Interest holder's investigations into the physical, biological and cultural environment provide a satisfactory scientific basis to assess potential environmental impacts and risks, and to identify measures to avoid or minimise those impacts and risks and address scientific uncertainty.

The NT EPA is of the view that the precautionary principle has been considered in assessing the regulated activity and has not been triggered due to the very low threat of serious or irreversible damage existing and the presence of a satisfactory scientific basis to assess potential impacts and risks.

Principle of inter-generational equity

The potential environmental impacts and risks associated with the regulated activity can be adequately avoided or managed through the management measures and monitoring programs proposed in the EMP.

The NT EPA considers that environmental values will be protected in the short and long term and that the health, diversity and productivity of the environment will be maintained for the benefit of future generations.

The NT EPA considers the estimated greenhouse gas emissions of 2,758 tonnes of carbon dioxide equivalent associated with the activity are minimal in the context of annual Northern Territory and National emissions, and potential impacts on the environment are not significant.

The proponent's water licence allocation is less than less than 0.01% of cumulative current groundwater extraction from the GRF and less than 0.0007% of the estimated sustainable allocation from the GRF.

Promotion of improved valuation, pricing and incentive mechanisms

The interest holder would be required to prevent, manage, mitigate and make good any contamination or pollution arising from the regulated activity, including contamination of soils, groundwater and surface waters through accidental spills.

All stages of the regulated activity, including progressive rehabilitation of all disturbed areas to an acceptable standard, would be at the cost of the Interest holder.

The interest holder has an adequate environmental rehabilitation security arrangement in place to indemnify the NT government.

3. Relevant matters raised through public submissions

Public consultation on the EMP was required under the Petroleum (Environment) Regulations as the EMP proposes drilling activities.

Twenty-three public submissions were received. The most frequent comments related to:

- Water - concern regarding potential overflow or spills of contaminated water, drilling into aquifers and risks to groundwater quality
- Social and cultural – potential impacts on Traditional Owners and cultural values, tourism, concern about lack of information provided to stakeholders during engagement, negative impacts on health and the community
- Waste - concern about the use of open wastewater sumps, lack of waste details, disposal of waste
- Chemicals – concern about lack of information on drilling chemicals in particular hydraulic fracturing chemicals, storage of chemicals

- Flora and fauna – impacts to fauna, particularly birds from open waste water sumps and tanks
- Regulation and compliance - separation of different regulated activities in EMPs, Code of Practice not yet finalised

In response to the public submissions, the interest holder provided a revised EMP that addressed relevant submissions and the EMP, including the WWMP and SMP, were updated in accordance with the final Code. The response to relevant matters raised through the public submissions includes:

Water

Issues raised regarding potential overflows from open sumps and spills of contaminated water from wastewater ponds have been adequately addressed by the mitigation and management measures provided in the Wastewater Management Plan and Spill Management Plan that were developed in accordance with the Code. The open cuttings sump will be lined with an impermeable barrier that will meet the standards specified in the Code of Practice. The cuttings sump will have a useable volume (not including freeboard) of approximately 4000m³ which is several times the estimated total of 500m³ of drill cuttings and residual drilling mud. The cuttings sump will be operated with a minimum 1000mm freeboard to manage potential extreme early season rainfall events. It will be surrounded by a 0.3m bund to prevent potential ingress of stormwater from overland flow. At the end of drilling operations, any wastewater remaining will be evaporated or transferred to enclosed tanks and removed offsite to a licensed facility for treatment. The EMP outlines a summary of specific controls identified in the Well Operations Management Plan to ensure isolation/protection of aquifers and overall petroleum well integrity is achieved. The well design and construction method described in the EMP meets the requirements mandated by the Code for the protection of aquifers, with multiple verified barriers that includes conducting cement bond logging (CBL) and a Well Barrier Integrity Validation (WBIV) report certified by an independent and reputable validator in accordance with Clause 302a of the Schedule of Onshore Petroleum Exploration and Production Requirements (2019). The WBIV must comply with the DPIR Well Barrier Integrity Validation Reporting guideline and will be uploaded to the DPIR website.

The NT EPA recommends that results of ongoing groundwater monitoring at each well site, undertaken in accordance with the Code and Guideline, must be submitted to the DENR every quarter for three years from the approval date of the EMP. The results of the groundwater monitoring will be published on the DENR website on a quarterly basis. To ensure a robust groundwater quality baseline dataset, the NT EPA recommends a minimum of seven sampling events be completed from the control monitoring bores (up gradient of the petroleum well) prior to completion of the drilling program. The baseline dataset will provide the establishment of well site specific performance targets to assure no adverse effects on water quality. These performance targets will be established following completion of the petroleum well and published on the DENR website.

Water regulation for the onshore gas industry is further complemented by recent amendments to the Water Act 1994, which has been updated to reflect the recommendations made in the *Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory*. Among other changes, recent amendments have made it an offence for any wastewater produced as a result of hydraulic fracturing activities to come into contact with any other waters in the Northern Territory.

Social and cultural

The interest holder has undertaken stakeholder engagement in accordance with the Petroleum (Environment) Regulations including with NT Government, landholders and land managers, Traditional Owners, the Northern Land Council (NLC) and the Aboriginal Areas Protection Authority (AAPA). The camp location for drilling personnel is located adjacent to the drilling locations, limiting daily light vehicle movements associated with the drilling activity and therefore minimising potential interactions with the general public.

Stakeholder engagement has been undertaken in accordance with:

- section 41(6) of the Aboriginal Land Rights (Northern Territory) Act 1976, when supplying information to Native Title holders for the purposes of negotiating an onshore gas exploration agreement
- clauses 7 and 9 of the Petroleum (Environment) Regulations 2016, during the preparation of an EMP

Engagement with Traditional Owners is co-ordinated through the Northern Land Council (NLC).

The regulated activity under this EMP is a short-term, small-scale exploration activity and social impacts are likely to be minimal and localised. Larger-scale social issues associated with the potential production phase of the industry will be addressed by the Social Impact Assessment as required by the Scientific Inquiry recommendation, overseen by the Department of Chief Minister, should the industry move beyond the exploration stage of development.

Waste

Submissions raised concerns about the use of open wastewater sump. The NT EPA notes that the regulated activity does not involve hydraulic fracturing as defined in the Regulations, and therefore does not generate produced water or flowback fluid. The risks associated with wastewater management from drilling are lower than hydraulic fracturing, as the relative volume of wastewater is significantly smaller and easier to manage. Sections C.4.2.2 (requirement for enclosed wastewater tanks) and C.7.1.1 (requirements limiting wastewater evaporation) of the Code apply to produced water and flowback fluid, and do not apply to this regulated activity. Drill cuttings will be stored in an open engineered sump with impermeable lining. The cuttings sump has a useable volume (not including freeboard) of 4000m³ which is several times the estimated total of 500m³ of drill cuttings and residual drilling mud at the end of the drilling operation. Residual drilling mud will be allowed to evaporate in the engineered sump. Evaporation is likely to take between two and four weeks, after which the waste will have reduced to a concentrated mud.

Mud levels in the drilling mud tanks will be monitored and alarmed in operational tanks to prevent overtopping as a standard operating procedure on the drill rig mud recycling system. If required, mud will be transferred from operational tanks to additional contingency storage tanks and or the drill cuttings sump. Residual drill mud at the end of the drilling operation will initially be stored in the drill cuttings sump and the fluid allowed to evaporate, leaving behind only solid material.

At the completion of the drilling operations, a suitably qualified independent third party approved by DENR, will undertake sampling for laboratory testing of the drill cuttings and residual drilling muds, including leachability testing of heavy metals, Naturally Occurring Radioactive Materials (NORMs) and other contaminants of potential concern, in compliance with the Code, to determine the suitability of in-situ disposal. A subsequent decision on an acceptable final disposal of the drill cuttings and drilling mud will be made by DENR on receipt of an assessment report of environmental impacts and environmental risks posed by the drill cuttings and residual drilling mud. The NT EPA recommends that the laboratory report on leachability testing of drill cuttings and drilling mud is provided to DENR within three months of completion of the drilling program

If certification and DENR approval cannot be obtained for on-site disposal then this waste will be disposed of to a licensed facility in Mount Isa.

Chemicals

Submissions raised concerns about the lack of information on drilling chemicals in particular hydraulic fracturing chemicals and storage of chemicals. The regulated activities proposed in this EMP do not include hydraulic fracturing. The drilling mud to be used is a water based, homogenous blend of water, bentonite clays, salt and other chemical additives that may be used to manage bacteria, pH, viscosity, equipment corrosion and potential losses to the formation. All chemicals to be used have been approved for use in drilling petroleum wells by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification

and Assessment Scheme. No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene.

Of the total volume of drilling mud used, only small volumes have the potential to move beyond the well bore to the formations due to the filter cake properties of the mud and their design. In addition, when drilling through local aquifers and until these aquifers are isolated by a minimum of two verified barriers, chemicals or other substances that have potential to leave a residual toxic effect in the aquifer, will not be added to the drilling mud in compliance with the Code.

A detailed well site layout that identifies storage and containment of chemicals on-site is provided in the EMP Appendices. Drilling mud will be stored in above ground engineered tanks located on the well lease pad. Spill containment will be installed that comprises a secondary barrier that sits under the above ground tanks and prevents leaks and spills from contacting natural ground surface and facilitates spill collection and clean-up.

Flora and fauna

The potential impacts and risk to fauna, particularly birds from open sumps and tanks were raised in public comments. This EMP is specific to drilling activities and open sumps will not contain oils, hydrocarbons, or hydraulic fracturing fluids that pose a risk to birds and other fauna. The interest holder has committed to implementing control measures to prevent interactions of wildlife that include fencing, installing escape routes/fauna ladders in the cuttings sump and open water storages, daily monitoring and keeping inspection records to quantify the potential use of open sumps by fauna. The NT EPA recommends that the interest holder be required to report any fauna observed interacting with open storage as an incident to determine whether additional contingency measures are required, to provide additional certainty.

Regulation and compliance

Issues were raised on compliance of the EMP against the finalised Code of Practice. The interest holder has revised the EMP as appropriate to meet the requirements of the final Code.

Nearly half of the public submissions were generally opposed to the unconventional shale gas industry and hydraulic fracturing. The NT EPA notes the findings of the Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory concluded the risks associated with onshore gas development could be managed and minimised to an acceptable level with the implementation of its 135 recommendations, adherence to the legally enforceable Code of Practice and by effective regulation. The NT EPA notes the Northern Territory Government's commitment to implementing all 135 of the recommendations in the Final Report, and that all of the recommendations that were required to be implemented prior to the commencement of onshore gas exploration, are now complete.

4. Environmental impacts and risks reduced to a level that is as low as reasonably practicable (ALARP) and acceptable (regulation 9(1)(c))

The interest holder has undertaken a process to avoid impacts on environmental values, informed by appropriate baseline studies and surveys and timing of the regulated activity. The timing of works will be managed to ensure the risks arising from inclement wet weather are managed to levels that are ALARP. The NT EPA has made a recommendation that the Proponent provides updated weather forecasts to DENR for the duration of the activity and submit a Rapid Response Site Demobilisation and Stabilisation Plan in the event of the onset of an early wet season.

The EMP demonstrates a systematic identification and assessment of environmental impacts and risks associated with the regulated activity. The key potential environmental impacts and risks are:

- surface water quality – a reduction in surface water quality due to overflow from cuttings sumps or spills associated with chemicals, wastewater, fuel storage, handling and transport
- groundwater quality – a reduction in groundwater quality due to chemical spills or leaks during drilling, well construction and well testing activities. A reduction in groundwater quality may also occur as a result of aquifer cross-flow due to inappropriate well construction failing to isolate each of the aquifers intersected by the petroleum well
- groundwater quantity – a reduction in groundwater quantity due to groundwater extraction associated with the activities
- terrestrial environmental quality – localised contamination of soil due to inappropriate storage of drilling mud and chemicals and spill or overflow of drilling mud
- terrestrial fauna - fauna interaction with open sumps containing drilling mud or cuttings may result in disturbance, injury or death to fauna

The EMP describes the management and monitoring measures appropriate for the nature and scale of the regulated activity to which the plan relates to mitigate the potential impacts and risks. Key measures include:

Surface water Quality

The interest holder has identified the impacts and risks to surface water quality and provided commitments in the EMP to implement mitigation measures to reduce those potential impacts and risks. These include the implementation of a Wastewater Management Plan and Spill Management Plan in accordance with the Code. The interest holder has conducted a wet season risk assessment of transport of chemicals and wastewater on unsealed roads and has committed to not transporting chemicals or drilling waste once the wet season rainfall has commenced that impedes heavy vehicle access. The NT EPA has made a recommendation that requires the interest holder provides updated weather forecasts to DENR for the duration of the activity and submit a Rapid Response Site Demobilisation and Stabilisation Plan in the event of early onset of the wet season that may result in early termination of the activity.

Groundwater Quality

The interest holder has adequately identified the impacts and risks to groundwater quality and provided commitments in the EMP to implement control measures to reduce those potential impacts and risks. These include implementing the requirements of the Code and not commencing activities until a Well Operations Management Plan has been approved by the regulator. The risks of chemical spills and leaks and aquifer cross flow are well known and the interest holder has extensive experience in drilling conventional and unconventional petroleum wells in the NT and other jurisdictions. All known controls measures for ensuring well integrity and aquifer isolation have been adopted. The NT EPA has made a recommendation regarding the groundwater quality monitoring requirements for each well site.

Groundwater Quantity

The interest holder has identified and addressed the potential impacts and risks to other groundwater users. Compliance with the groundwater extraction licence limits and conditions and ensuring groundwater extraction is metered and limited to the volumes required for the regulated activity, reduces the risk to ALARP and to an acceptable level. The groundwater monitoring program includes a requirement for monitoring groundwater level at the well site

Terrestrial Environmental Quality

The potential impacts and risks of contamination of soil, through inappropriate storage and handling of drilling muds and chemicals has been identified by the interest holder. The EMP includes commitments that include bunded and spill containment of chemicals and drilling muds and the implementation of the Wastewater Management Plan and Spill Management Plan, in accordance with the requirements of the Code. The interest holder has not deviated

from known industry codes and standards. The implementation of Code requirements of engineered cuttings sump with impermeable membrane and the requirement for laboratory testing of drill cuttings and residual drilling muds to determine disposal options, further reduces the risk of contamination of soil. At the completion of the drilling operations, a suitably qualified third party will undertake laboratory testing of the drill cuttings and residual drilling muds, including leachability testing of heavy metals, Naturally Occurring Radioactive Materials (NORMs) and other contaminants of potential concern, as required by the Code, to determine the suitability of in-situ disposal.

The EMP documents how the interest holder will comply with the relevant mandatory requirements of the Code as a minimum best practice standard. A Wastewater Management Plan (WWMP) and a Spill Management Plan (SMP) have been prepared that meet the requirements of the Code and include proven management practices.

Terrestrial Fauna

The interest holder has identified and addressed the potential impacts and risks to fauna with open storage of drill cuttings in an engineered sump and lined open water storages. Known control measures to reduce the risk have been provided by the interest holder and a monitoring program will be implemented to verify the control measures are effective in reducing interactions with fauna. The interest holder has experience in managing wastes to avoid risks to native fauna including camp waste. The interest holder has committed to closing out the open sump once they it is no longer required, removing the risk of fauna accessing the sump. The recommendation made by the NT EPA to report any fauna observed interacting with open water storages as an incident to determine whether additional contingency measures are required, reduces the risks to an acceptable level.

The NT EPA considers that all reasonably practicable measures will be used to control the environmental impacts and risks, considering the level of consequence and the resources needed to mitigate them.

The NT EPA considers that the environmental impacts and risks will be reduced to an acceptable level, considering the principles of ecologically sustainable development as discussed above, the sensitivity of the local environment, relevant standards and compliance with the Code.

5. Other relevant matters

Regulation 9 requires that an environment management plan provides a comprehensive description of the regulated activity, including provision of a detailed timetable for the activity. To meet this requirement, the NT EPA recommends that the Interest holder be required to submit a detailed timetable for the regulated activity to DENR prior to approval of the EMP. The timetable should address all aspects of the activity and include, but not be limited to: dates for the implementation of commitments and associated hold points. This should also include monitoring of weather conditions related to potential onset of the wet season and consequent demobilisation of the rig and ancillary infrastructure and stabilisation of the well sites. The NT EPA recommends that the timetable be updated each month or as seasonal weather forecasts emerge.

CONCLUSION

The NT EPA considers that, subject to the recommended EMP approval conditions, the EMP:

- is appropriate for the nature and scale of the regulated activity
- demonstrates that the regulated activity can be carried out in a manner that potential environmental impacts and environmental risks of the activity will be reduced to a level that is as low as reasonably practicable and acceptable.

In providing this advice the NT EPA has considered the principles of ecologically sustainable development.

RECOMMENDATION

The NT EPA recommends that should the EMP for Santos QNT Pty Ltd be approved, the following conditions be considered:

Condition 1: The interest holder must submit a report to the DENR where there is a non-compliance with an approval condition within 48 hours of becoming aware of the non-compliance.

Condition 2: The interest holder must submit to the DENR, an updated timetable for the regulated activity prior to the commencement of the activity and provide an updated timetable to the DENR each month.

Condition 3: The interest holder must submit to DENR:

- i. a fortnightly updated weather forecast, informed by meteorological forecasting services
- ii. within one month of approval of the EMP, a Rapid Response Site Demobilisation and Stabilisation Plan to manage the risk of early termination of the regulated activity in the event of onset of an early wet season
- iii. daily on-site reports and five-day activity forecasts for the duration of the regulated activity

Condition 4: The interest holder must provide to DENR a cementing report for the 13-3/8" steel Conductor casing through the Gum Ridge Formation aquifer as soon as practicable but not more than seven days after completion of the cementing job for Inacumba-1 and Tanumbirini-2 exploration wells.

Condition 5: The interest holder must provide to DENR:

- I. results of on-going groundwater monitoring in accordance with the Code and the Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin (DENR, 2018) every quarter for three years from the approval date of the EMP for publishing on the DENR website
- II. data from a minimum of seven groundwater quality sampling events to be completed from the control monitoring bores prior to completion of the drilling program
- III. well site specific groundwater performance targets that ensure no adverse effect to water quality. The performance targets must be developed based on the baseline dataset for each well site and submitted to DENR within 30 days of approval, following completion of each petroleum well.
- IV. results of ongoing water level monitoring using water level loggers and electrical conductivity loggers installed at the monitoring bores in the Gum Ridge Formation at each well site every quarter for three years for publishing on the DENR website
- V. a report on any exceedance of monitored parameters above established background levels within five days of discovery.

Condition 6: The interest holder must provide to DENR a report on the assessment and leachability testing of drill cuttings and drilling mud to determine final disposal options, within three months of completion of the drilling program. A suitable qualified independent third party approved by DENR must undertake sampling for laboratory testing of the drill cuttings and drilling mud. Leachability testing of drill cuttings and drilling mud must be undertaken in accordance with the Australian Standard Leaching Procedure (Australian Standards AS4439.2 and 4439.3) by a NATA accredited laboratory as specified in the Code.

Condition 7: The interest holder must provide to the DENR:

- I. an incident report under the Petroleum (Environment) Regulations for any fauna observed trapped, injured or deceased, that is attributable to an interaction with an open cuttings sump or open water storage, with appropriate corrective actions provided to prevent similar incidents occurring

- II. where incident reporting demonstrates any impacts to fauna a report on the implementation of additional monitoring and mitigation measures to reduce impacts to fauna, including birds within 30 days of instruction. These measures should include consideration of additional monitoring (fauna cameras) and/or flagging, netting or screening to deter entry by birds and fauna.



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12 JULY 2019