**Attachment A: Change notice – Regulation 22**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Interest holder** | Origin Energy B2 Pty Ltd | **EMP Title** | Beetaloo Basin Kyalla drilling hydraulic fracture stimulation and well testing program EP117 N2 | **Unique EMP ID** | ORI-3 | **Mod #** | 1 | **Date** | 20 April 2021 |
| **Brief Description** | Transfer of approximately 228,946 L (0.23 ML) of residual wastewater from Amungee EP 98 to Kyalla EP 117. The Amungee wastewater is currently held in an enclosed tank. By transferring it to Kyalla, Origin can maximise evaporation during the 2022 dry season and reduce the residual wastewater volume across both sites.<br>Kyalla currently has sufficient enclosed (and open) wastewater storage to support this activity. The transfer of the residual wastewater held in the enclosed tank at Amungee EP 98 to Kyalla EP 117 will consolidate wastewater in one location and optimise Origin's ability to reduce wastewater inventories across the two sites and decommission redundant infrastructure at Amungee EP 98. | | | | | | | | |
| **Geospatial files included?** | Not applicable | | | | | | | | |

| **Does the proposed change result in a new, or increased, or potential or actual environmental impact or risk?** | **If an INCREASE in the existing potential or actual environmental risk, is it provided for in the EMP?** | **Does the proposed change require additional mitigation measures to be included?** | **Has additional stakeholder engagement been conducted?** | **Does it require additional environmental performance standards and measurement criteria?** | **Does it affect compliances with Sacred Site Authority Certificates?** | **Does it affect current rehabilitation, weed fire, wastewater, erosion and sediment control, spill or emergency response plans?** | **Will the environmental outcome continue to be achieved and will the impacts and risks be managed to ALARP and acceptable?** |
|---|---|---|---|---|---|---|---|
| No.<br>Risks associated with flowback transportation, storage, treatment and offsite disposal included in the existing EMP. Flowback quality of Amungee NW-1H Flowback for superior to Kyalla 117 N2-1H. | N/A<br><br>No increased impact or risk, with volumes anticipated to be less than the maximum predicted in the EMP. The volumes of wastewater anticipated to be generated/ stored and treated onsite was 4 – 16 ML.<br><br>The total volume is anticipated to be less than 10 ML with the Amungee NW-1H flowback addition. | No.<br><br>Existing mitigation measures are in place covering wastewater transportation, storage, treatment and final offsite disposal. | Yes.<br><br>The regulated activity of transportation, storage and treatment of wastewater onsite is covered under the existing stakeholder engagement. The stakeholder has been notified of the proposed activity and additional information has been provided. | No.<br><br>Environmental performance standards associated with wastewater transportation, storage, treatment and offsite disposal are sufficient. | No.<br>Wastewater management is a regulated activity covered by the existing AAPA certificate C2020/003. | No.<br>Origin operates all sites under a suite of management plans which contain common elements for all operating sites.<br><br>Existing plans remain valid and appropriate to cover any potential risk covered under the proposed modification in alignment with the existing approved EMP. | Yes.<br>Transferring the residual wastewater water from Amungee EP 98 to Kyalla EP 117 to increase evaporation reduces the long-term residual volume and risks associated with trucking interstate.<br><br>Environmental outcomes pertaining to the protection of soils, surface water, groundwater, ecology and community are covered in the existing EMP and will not be impacted. |

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| Current EMP text | Amended EMP text |
|---|---|
| 3.10.3 Flowback<br><br>Production from the Kyalla formation is anticipated to be composed of formation reservoir hydrocarbons only, with an absence of movable indigenous water from the reservoir due to a combination of the extremely low reservoir permeabilities and clay adsorption effects. Origin anticipates that a potential load fluid recovery of between 20- 80% of injected stimulation fluid over the well testing duration. For each of the proposed wells, this may equate to 4-16 ML of flowback fluid to be recovered.<br><br>Given the geological similarities between the Kyalla and Velkerri shale, the quality of flowback is expected to be similar to that encountered during the Amungee NW-1 well test. It is likely the flowback will be saline, with beneficial reuse of the fluid not considered feasible during exploration. A summary of the anticipated parameters is provided in Table 8. All flowback fluids will be stored in above-ground tanks and managed in accordance with the NT Petroleum CoP and the Beetaloo Wastewater Management Plan (WWMP).<br><br>All flowback wastewater will be stored in enclosed tanks, with enough enclosed storage capacity onsite to manage all predicted wastewater volumes. Open treatment tanks will be used in addition to enclosed storage tanks. Open treatment tanks will allow for wastewater to evaporate, to reduce the volumes of wastewater requiring offsite transportation and disposal. As the volume of wastewater onsite reduces, enclosed tanks may be converted to treatment tanks to increase the level of wastewater evaporation. This will only occur when the available enclosed wastewater tank capacity allows for such a conversion. Additional information on the wastewater tanks is provided in section 3.4.3.<br><br>For enclosed tanks, a cover will be installed with stormwater diversion and collection points. All clean stormwater will be removed from the top of the liner and discharge to grade or re-used. To reduce the risk of vapour build up, T-vents will be used to allow any entrained gas to escape. A schematic of the proposed pond covers and vent is provided in Figure 20.<br>Mechanical enhanced evaporators will be utilised in each wastewater treatment tank to enhance natural evaporation. It is anticipated that up three evaporator units will be deployed on each tank, with a combined water treatment rate of up to 550L/minute. An estimated diesel consumption of 13L/hour will be required whilst in operation. To mitigate the drift of wastewater outside of the tank, the units will have an automated wind speed and direction cut-off mechanism to stop operations during periods of moderate wind. The exact wind speed cut-off will be determined during the installation of the units and tested with fresh water. This proposed approach was used successfully utilised during the flowback operations at the Amungee NW-1H well.<br><br>Where a significant rainfall event is predicted (defined as a 300m rainfall event predicted over 4 days as per the WWMP), the total volume of flowback stored on-site will be transferred to the covered storage tanks 8 hours prior to the onset of the event. The 7 day Bureau of Meteorology 4 day total rain forecast (http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp) will be reviewed daily to identify periods of significant rainfall. This type of rainfall level is consistent with that from a significant rainfall event; such as a monsoonal trough, tropical low or a cyclone.<br><br>Origin will have up to six (6) x 6-inch transfer pumps onsite capable of transferring up to 23Ml/day each. The onsite pumping capacity is significantly more than the total worst case volume of wastewater that will be stored onsite. Commencement time to begin transfer the flowback fluid will be selected to ensure that it is completed at least 8 hours prior to the predicted commencement of the significant rainfall event.<br><br>Monitoring of wastewater levels within sumps and tanks will be undertaken least daily during drilling and well testing, with wastewater pond storage curves compiled and updated to track wastewater volumes onsite. Each wastewater tank will be equipped with level sensors to monitor the fluid volumes real time. Automated cut off sensors will also be deployed to ensure wastewater tank levels do not exceed the safe operating level and 1:1000 ARI freeboard requirements. Where freeboard requirements are exceeded, well operations will cease in accordance with the response criteria outlined in the WWMP. | 3.10.3 Flowback<br><br>Production from the Kyalla formation is anticipated to be composed of formation reservoir hydrocarbons only, with an absence of movable indigenous water from the reservoir due to a combination of the extremely low reservoir permeabilities and clay adsorption effects. Origin anticipates that a potential load fluid recovery of between 20- 80% of injected stimulation fluid over the well testing duration. For each of the proposed wells, this may equate to 4-16 ML of flowback fluid to be recovered.<br><br>Given the geological similarities between the Kyalla and Velkerri shale, the quality of flowback is expected to be similar to that encountered during the Amungee NW-1 well test. It is likely the flowback will be saline, with beneficial reuse of the fluid not considered feasible during exploration. A summary of the anticipated parameters is provided in Table 8. All flowback fluids will be stored in above-ground tanks and managed in accordance with the NT Petroleum CoP and the Beetaloo Wastewater Management Plan (WWMP).<br><br>All flowback wastewater will be stored in enclosed tanks, with enough enclosed storage capacity onsite to manage all predicted wastewater volumes. Open treatment tanks will be used in addition to enclosed storage tanks. Open treatment tanks will allow for wastewater to evaporate, to reduce the volumes of wastewater requiring offsite transportation and disposal. As the volume of wastewater onsite reduces, enclosed tanks may be converted to treatment tanks to increase the level of wastewater evaporation. This will only occur when the available enclosed wastewater tank capacity allows for such a conversion. Additional information on the wastewater tanks is provided in section 3.4.3.<br><br>For enclosed tanks, a cover will be installed with stormwater diversion and collection points. All clean stormwater will be removed from the top of the liner and discharge to grade or re-used. To reduce the risk of vapour build up, T-vents will be used to allow any entrained gas to escape. A schematic of the proposed pond covers and vent is provided in Figure 20.<br><br>Mechanical enhanced evaporators will be utilised in each wastewater treatment tank to enhance natural evaporation. It is anticipated that up three evaporator units will be deployed on each tank, with a combined water treatment rate of up to 550L/minute. An estimated diesel consumption of 13L/hour will be required whilst in operation. To mitigate the drift of wastewater outside of the tank, the units will have an automated wind speed and direction cut-off mechanism to stop operations during periods of moderate wind. The exact wind speed cut-off will be determined during the installation of the units and tested with fresh water. This proposed approach was used successfully utilised during the flowback operations at the Amungee NW-1H well.<br><br>Where a significant rainfall event is predicted (defined as a 300m rainfall event predicted over 4 days as per the WWMP), the total volume of flowback stored on-site will be transferred to the covered storage tanks 8 hours prior to the onset of the event. The 7 day Bureau of Meteorology 4 day total rain forecast (http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp) will be reviewed daily to identify periods of significant rainfall. This type of rainfall level is consistent with that from a significant rainfall event; such as a monsoonal trough, tropical low or a cyclone.<br><br>Origin will have up to six (6) x 6-inch transfer pumps onsite capable of transferring up to 23Ml/day each. The onsite pumping capacity is significantly more than the total worst case volume of wastewater that will be stored onsite. Commencement time to begin transfer the flowback fluid will be selected to ensure that it is completed at least 8 hours prior to the predicted commencement of the significant rainfall event.<br><br>*Flowback fluid may also be periodically transported from other exploration sites across the Beetaloo sub-basin to the Kyalla 117 N2 site to assist in managing regional wastewater volumes. This will reduce the number of active sites where wastewater volume is being stored and allow wastewater to be treated prior to trucking. It is anticipated that trucking volumes from other sites will not exceed the maximum 16ML of flowback predicted under this EMP.*<br><br>Monitoring of wastewater levels within sumps and tanks will be undertaken least daily during drilling and well testing, with wastewater pond storage curves compiled and updated to track wastewater volumes onsite. Each |

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| Current EMP text | Amended EMP text |
|---|---|
| Monitoring of flowback and gas samples will be undertaken in accordance with Section 3.23. It is also anticipated that independent external testing will also be undertaken by CSIRO and the Australian Government's Geological and Bioregional Assessment program.<br><br>When the tanks are decommissioned, the associated residual solids, brines and liners are removed and disposed of at an appropriately-licensed waste disposal facility. Any remaining flowback fluid will be transported by road to a licenced disposal facility. It is anticipated that all flowback will be sent interstate, with a number of providers available to manage the waste (such as Westrex in Jackson, Qld). All interstate transfers of controlled wastes will require an interstate / territory consignment authority to authorise the movement of waste between administration boundaries. | wastewater tank will be equipped with level sensors to monitor the fluid volumes real time. Automated cut off sensors will also be deployed to ensure wastewater tank levels do not exceed the safe operating level and 1:1000 ARI freeboard requirements. Where freeboard requirements are exceeded, well operations will cease in accordance with the response criteria outlined in the WWMP.<br><br>Monitoring of flowback and gas samples will be undertaken in accordance with Section 3.23. It is also anticipated that independent external testing will also be undertaken by CSIRO and the Australian Government's Geological and Bioregional Assessment program.<br><br>When the tanks are decommissioned, the associated residual solids, brines and liners are removed and disposed of at an appropriately-licensed waste disposal facility. Any remaining flowback fluid will be transported by road to a licenced disposal facility. It is anticipated that all flowback will be sent interstate, with a number of providers available to manage the waste (such as Westrex in Jackson, Qld). All interstate transfers of controlled wastes will require an interstate / territory consignment authority to authorise the movement of waste between administration boundaries. |

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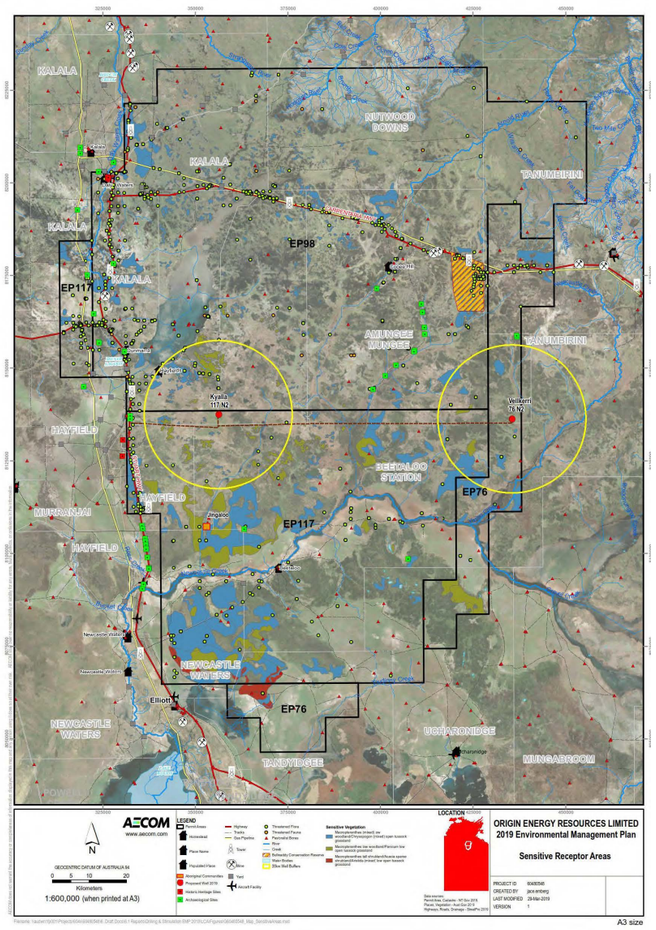
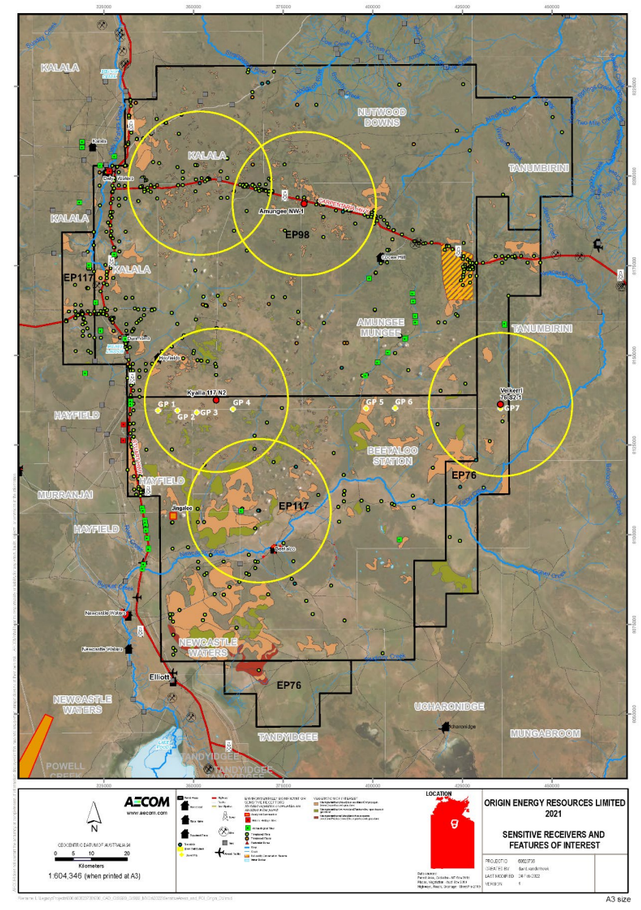
| Current EMP text | Amended EMP text |
|---|---|
| 3.1 Site Selection- Kyalla 117-N2 Pad<br>  <br><br>**Figure 6 Kyalla 117 N2 proximity to sensitive receptors** | 3.1 Site Selection- Kyalla 117-N2 Pad<br>  <br><br>**Figure 6: Kyalla 117 N2 proximity to sensitive receptors** |
| **Comments from DEPWS letter, dated 10 September 2021 (File reference: NTEPA2019/0042-007-0055)** | **Origin Response** |
| We identified two items in the modification notice that require attention:<br>1. The modification only pertains to the text in the EMP and has not considered the impacts in the Kyalla wastewater management plan. In particular, figure 1 only depicts two well pad and transport routes with a sensitive receptor buffer. It is unclear if this is still accurate for the inclusion of Amungee NW.<br>2. The spill scenarios for transport only depict incidents on the Stuart highway. Expansion on the spill scenarios may need to consider the internal track movements. | **Appendix D is replaced with Spill Management Plan (attached)**<br>Document # NT2050-15-27, Rev 1.9 dated 17/02/21<br><br>The DEPWS comments pertain to content in Appendix D Spill Management Plan (SMP).<br>1. **Figure 1:**The revised SMP (attached) contains an updated *Figure 1 Location of activities and potential receptors.*<br>2. **Spill scenarios:** There is no material change to spill scenarios. Origin takes all losses of containment seriously and does not expect any difference to the management of such an incident whether it were to occur on an access track or highway. However, the likelihood of impact is greater on a highway due to other road users and higher volumes of traffic. |

# THE BEETALOO EXPLORATION PROJECT

## Spill Management Plan

**Review record**

| Rev | Date | Reason for issue | Authors | Consolidator | Approver |
|---|---|---|---|---|---|
| 1.5 | 01/07/2021 | Minor update to include Amungee Beetaloo W-1 | | | MK |
| 1.6 | 25/08/2021 | Minor update to address DEPWS comments | | | MK |
| 1.7 | 15/11/2021 | Inclusion of Kalala S1 | RU | | MK |
| 1.8 | 21/11/2021 | Inclusion of Multiwell EMP | TK | | MK |
| 1.9 | 17/02/2021 | Updates based on feedback from NTG during EMP submission | LP | | MK |

Review due: 18/05/2023

# Spill Management Plan

NT-2050-15-027

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## Appendices



Review due: 18/05/2023

## 1. Purpose

This Spill Management Plan (SMP) has been prepared to support Origin's Beetaloo exploration program. The SMP is a mandatory requirement prepared in accordance with the Code of Practice for Petroleum Activities in the Northern Territory (the Code of Practice). This SMP is designed to provide the strategy for the management of spills across Origin's Beetaloo exploration activities.

The Environmental Management Plans (EMPs) covered by this plan are:

- NT-2050-15-MP-025 Origin Energy Beetaloo Kyalla 117 N2 Drilling, Stimulation and Well Testing EMP
- NT-2050-15-MP-032 Origin Energy Beetaloo Velkerri 76 S2 Drilling, Stimulation and Well Testing EMP
- NT-2050-15-MP-038 Origin Beetaloo Sub-Basin Kyalla 117 N2 Multiwell Drilling, Stimulation and Well Testing EMP
- CDN/ID NT-2050-35-PH-0018 Origin Beetaloo Sub-Basin Amungee NW-1H EMP
- NT-2050-15-MP-039 Beetaloo W-1 EMP
- NT-2050-MP-040 Kalala S1 EMP
- NT-2050-15-MP-041 Beetaloo Sub-Basin Multiwell Drilling, Stimulation and Well Testing EMP

This plan will reference the relevant sections within each of the various EMPs to avoid duplication.

## 2. Key legislation

Key legislation and documents consulted in the development of this plan are provided below (a full list of applicable legislation is provided in the corresponding management plans):

- **Code of Practice: Onshore Petroleum Activities in the Northern Territory:** Mandatory code of practice legislating the management of chemicals and wastewater onsite, including the use of secondary containment, lined tanks and spill management plan,
- ***Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010:*** Covers the transportation of goods by road in the NT. This also covers licences for vehicles and drivers carrying dangerous goods.
- ***Workplace Health and Safety (National Uniform Legislation) Act 2011:*** Covers the storage and handling of chemicals on site.
- ***Waste Management and Pollution Control Act 1998:*** Covers the requirements for the transportation and disposal of waste within the NT. This includes the requirements for contractors, vehicles and facilities managing listed wastes to be licenced.

## 3. Chemicals and wastewater description

The chemicals and wastewater typically stored onsite includes:

- Chemicals used for drilling
- Waste drilling fluids
- Chemicals used for stimulation
- Flowback wastewater
- Completions and well suspension fluids

- General use chemicals such as condensate and oil, diesel and fuels, general equipment maintenance chemicals (hydraulic oils, degreasers etc.)

The full list of chemicals and wastewater stored onsite, including their volume and location are provided in Appendix A. For chemicals and maximum volumes for other EMPs refer to Table 1. Where available, links are provided to the relevant sections and appendices. The assessment of chemicals, including evaluation of the environmental hazard of the chemical additives in the hydraulic fracturing fluid systems, based on their environmental persistence, bioaccumulation and aquatic toxicity properties; evaluation of human health effects; and exposure assessment is provided in the hydraulic fracturing chemical risk assessment (EMP Appendix E).

**Table 1: Types of chemicals and wastewater relevant to each EMP**

| EMP | Drilling chemicals and waste fluids | Stimulation chemicals | Flowback wastewater | Completion and well suspension fluids | General use |
|---|---|---|---|---|---|
| NT-2050-15-MP-025 Kyalla 117 N2<br>Appendix D | x | x | x | x | x |
| NT-2050-15-MP-032 Velkerri 76 S2<br>Appendix D | x | x | x | x | x |
| NT-2050-15-MP-038 Kyalla 117 N2 Multiwell (ORI6)<br>Appendix I | x | x | x | x | x |
| CDN/ID NT-2050-35-PH-0018 Amungee NW-1H (ORI7)<br>Section 2.1.1, Table 2 and Table 3 | N/A | N/A | x | x | x |
| NT-2050-15-MP-039 Beetaloo W-1 EMP (ORI8)<br>Section 3.9, Table 8 | N/A | N/A | N/A | Incidental volumes may be generated | x |
| NT-2050-MP-040 Kalala S1 EMP (ORI9)<br>Section 3.8, Table 8 | N/A | N/A | N/A | Incidental volumes may be generated | x |
| NT-2050-15-MP-041 Beetaloo Sub-basin Multi-well EMP (ORI10) | x | x | x | x | x |

## 4. Spill failure scenarios

Potential spill scenarios associated with exploration activities are summarised in Table 2. These scenarios include:

- Spills from chemical and wastewater handling and storage activities onsite
- Spills from chemical and wastewater during transportation (offsite)
- Tank, drilling sump and containment vessel overflows and structural failures

The loss of containment due to the failure of well barriers is covered under the Well Operations Management Plan (WOMP).

**Table 2: Spill scenario summary table**

| Spill scenario | Activity duration | Mechanisms | Location | Quality | Quantity | Key management controls | Monitoring | Receptors |
|---|---|---|---|---|---|---|---|---|
| Spills from chemical and wastewater handling and storage activities onsite | • Drilling–45 days<br>• Stimulation–15-30 days<br>• Well testing 30–180 days | Container rupture<br>Spill during chemical handling and mixing | • Chemical storage area<br>•Drilling rig<br>• Stimulation spread<br>• Drilling sumps<br>• Flowback storage tanks<br>• Well testing equipment | • Saline and synthetic based mud (SBM) drilling fluids<br>•Saline flowback<br>• Chemicals listed in EMP | <1,000L<br><1,000L<br><200L | • Designated storage areas with appropriate segregation of incompatible chemicals<br>• Secondary containment to be deployed under high-risk spill/leak storage and handling areas<br>• Spill kits available<br>• Routine inspection of chemical stores<br>• Sites are manned during operations, with continuous leak detection and level monitoring at all other times<br>• Wastewater management plan | Routine inspection of chemical stores, sumps and tanks during operations<br>Tank leak detection | Retained on-site |

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| Spill scenario | Activity duration | Mechanisms | Location | Quality | Quantity | Key management controls | Monitoring | Receptors |
|---|---|---|---|---|---|---|---|---|
| Loss of containment during transfer onsite (leakage from pipes, hoses, fittings etc) | • Drilling–45 days<br>• Stimulation– 15-30 days<br>• Well testing 30–180 days | Coupling, valve, hosing and equipment failure | Chemical mixing and transfer areas on the drill rig, mixing hoppers and wastewater storages | • Saline and SBM drilling fluids and wastewater<br>• Chemicals listed in EMP | <5,000L | • Secondary containment to be deployed under high-risk spill/leak storage and handling areas<br>• Spill kits available<br>• Routine inspection of chemical stores<br>• Sites are manned during operations, with continuous leak detection and level monitoring at all other times<br>• Wastewater management plan | Routine inspection of all chemical handling areas, including wastewater transfer points and chemical mixing areas | Retained on-site |
| Spills from chemical and wastewater during transportation (off-site) | • Drilling chemical transfer—1–5 days of bulk chemical transfer generally pre-drilling<br>• Stimulation chemical transfer 2–3 truckloads of | Transport spill<br>Traffic accident (total or partial release) | Off-site along highway | • Various chemicals as listed in EMP<br>• Saline wastewater | <1,000L for transport spill<br><50,000L | • All transport companies to be appropriately licenced to transport chemicals and waste *(Dangerous goods and Waste Management and Pollution Control Act)* including the | Performance of contractors to be monitored as a part of transportation contractors | • Chemical transport between Darwin/South Australia and Queensland/ and Daly Waters<br>• Wastewater transportation |

| Spill scenario | Activity duration | Mechanisms | Location | Quality | Quantity | Key management controls | Monitoring | Receptors |
|---|---|---|---|---|---|---|---|---|
| | chemicals per week for ~6 weeks<br>• Wastewater disposal over 3 weeks—up to ~22 truck movements total over the duration | | | | for total loss of B-triple carrying flowback | requirement to detect and respond to spills<br>• Wastewater management plan | | between Daly Waters and Queensland Via Tennant Creek |
| Tank, drilling sump and containment vessel overflows and structural failures | • Duration of all activities plus ongoing wastewater storage which may be extended beyond 12-months to allow for ongoing evaporation of fluids | Overfilling of a sump and flowback tank<br>Structural failure of embankment or tank wall | Sumps and Tanks on lease | Saline wastewater with TDS<br>>50,000mg/L | >10,000L | • Lease pads bunded during the storage of flowback<br>• Enclosed tanks used during wet seasons operations<br>•Open tanks with 1:1000ARI freeboard<br>• Tanks constructed to Australian Standards Routine tank and sump inspections | Routine tank and sump level and structural integrity (visual) inspections | Retained on lease pad within bund |

## 5. Potential receptors

The location of Origin's Beetaloo exploration activities is remote. A description of the environment, including environmental and cultural sensitivities, with the potential to be impacted by a spill is provided in each of the EMPs. Figure 1 illustrates the separation distance from sensitive receptors such as:

- Watercourses
- Communities
- Homesteads
- Heritage places
- Vegetation communities
- Protected areas

Maps regarding Sacred Sites and restricted work areas are also applicable and will be provided to work crews to ensure awareness of these features.

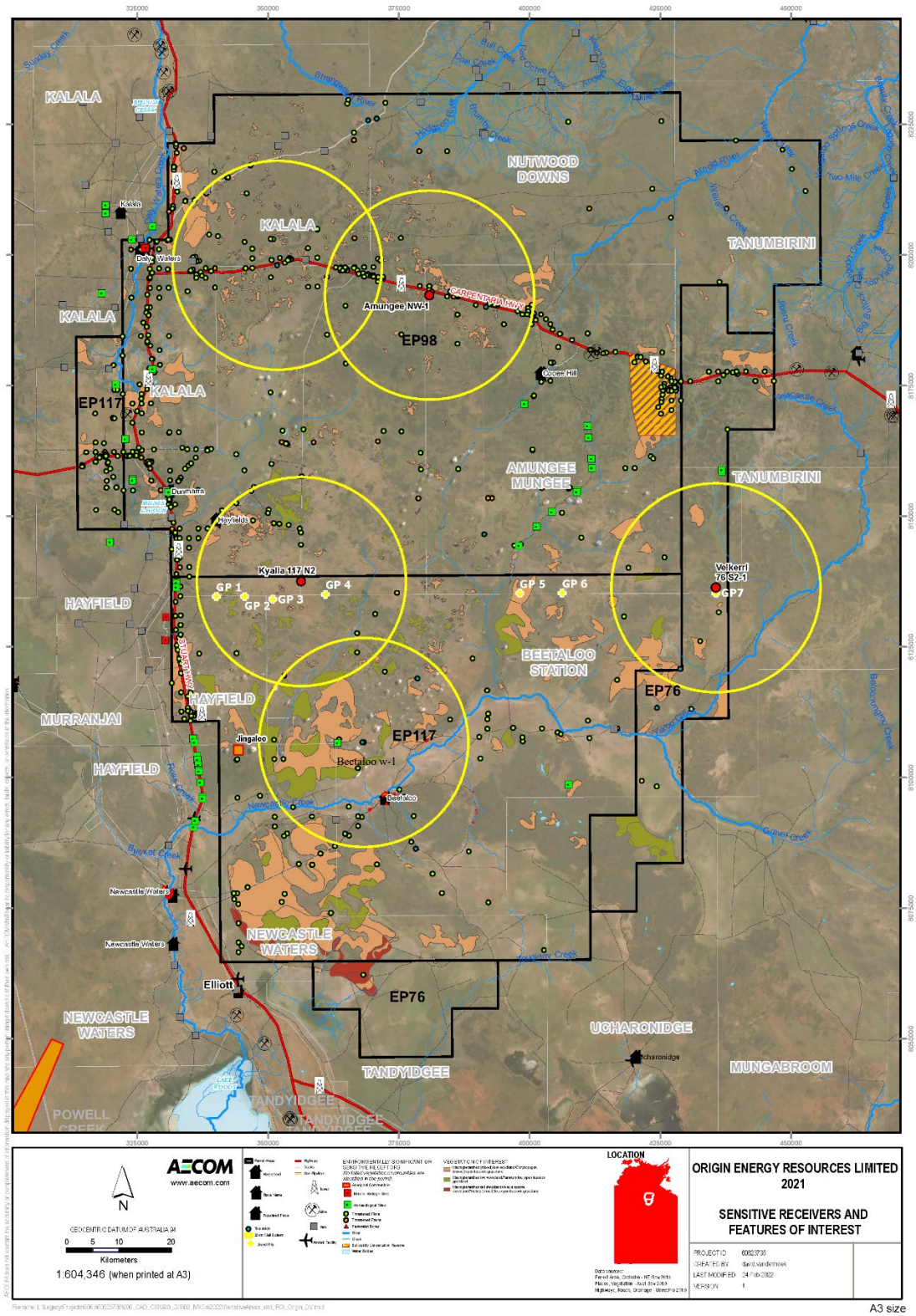


**Figure 1: Location of activities and potential receptors**

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## 6. Risk assessment

The risk of spills associated with all drilling, stimulation and well testing activities is covered under the EMPs.

## 7. Control measures

Controls measures to manage spills associated with exploration activities are provided in the EMPs and summarised in Table 2. The key management controls include:

- Contractors are required to develop spill management procedures to comply with the requirements of this plan
- All flowback, completion fluids, chemicals, oil and fuel storage will be equipped with secondary containment (or dual liners), as per the codes of practice
- Drilling will be lined, with enough freeboard to manage a 1:1000ARI wet season (~1300mm)
- Flare pits will be designed to manage a 1:1000ARI 24-hour storm event (377mm)
- Tanks will be designed, installed and operated as per the manufacturer's specifications and COP
- Where flowback is being stored on a lease pad, the wastewater tanks shall be earthen bunded to prevent release to surrounding areas in the case of a catastrophic failure.
- The earthen bund shall be designed to hold 110% of the volume of the largest wastewater tank onsite
- The earthen bund shall be constructed to withstand a failure event, with the bund appropriately compacted and stabilised
- Well sites are designed and constructed to prevent spills of hazardous chemicals; this includes
  - compacting the lease pad surface to 100kpa prevent infiltration
  - provision of bunded (lined) chemical segregation areas
- Monitoring to detect spills will be undertaken in accordance with Section 9
- Procedures will be developed by contractors designed to detect, remediate and report any spills. This includes:
  - Chemical handling procedures
  - Chemical storage and handling inspection procedures
  - Spill prevention, detection and response procedures
- The transport of hydraulic fracturing chemicals and wastewater during the wet season will be avoided, unless a site-specific risk assessment indicates the risk is equal to or below a moderate
- Effective spill clean-up material readily available at each work site and on all mobile service trucks or vehicles, where hydrocarbons and chemicals are stored and/or used
- Inspection reports and maintenance records of secondary containment shall be kept and available for review upon request
- Spill response mock-up drills to be completed as a part of routine emergency response.

# 8. Spill response and management

The following section provides an overview of the response to spills during drilling, stimulation and well testing activities. Where the spill is the result of an emergency situation that is still active, the Beetaloo Exploration Emergency Response Plan (NT-2050-15-MP-024) will take precedence over this plan.

## 8.1 Rapid spill assessment

When a spill occurs, the on-site Supervisor will carry out a rapid assessment to determine the potential hazards and the type and location of emergency assistance required. This assessment shall include the following:

- Determine the physical (volume and state) and location of the spill
- Determine the appropriate spill category and type of response as per section 12.1.
- Assess the hazard of the material spilled, including any potential hazards associated with chemical mixing (such as oxidising and reducing agents)
- Determine the safety hazard to immediate response personnel and whether additional resources (such as emergency services or specialised equipment or advice) are required to manage the spill safely
- Determine spill movement, factors affecting the movement (i.e. impending weather, topography, drainage lines, etc) and spill response priorities, as per Table 3.

**Table 3: Spill response priorities**

| Spill priority | Response considerations |
|---|---|
| People and communities | • Evacuate and muster (if deemed necessary)<br>• Account for all people and determine missing persons<br>• Stop unauthorised access<br>• Provide a technical resource to the Emergency Services (if required)<br>• Protect community and pastoralists |
| Environment and sacred sites | • For emergencies that are safeto manage, onsite personnel will respond with available resources to limit the extent of the impact to the environment or a protected site<br>• For larger incidents, or where it is unsafe for onsite personnel to respond, trained people will be mobilised to control and contain the emergency to minimise the impact to the environment or protected site |
| Regulators | • Notify Regulators as per incident reporting requirements |
| Assets | • Monitor automatic shutdown of the equipment or part thereof, or initiate manual shutdowns where it is safe to do so<br>• Mobilise emergency services to intervene |
| Reputation | • Notify neighbours (if required) |

## 8.2 Spill containment and clean up procedures

Generic spill containment clean-up procedures must be developed and implemented by each drilling, stimulation and well testing contractor aligning with the requirements of this plan. These procedures shall be adapted (where appropriate) to consider the site and chemical specific hazards associated with each spill event.

The procedures shall consider the following generic spill containment and response procedure:

- Move all people out of harm's way
- Alert others nearby
- Assess the situation—determine what substances are involved, the potential receptors (people and the environment) and if additional support is required. The substance must be known prior to taking any action (refer to SDS)
- If applicable; remove any possible risk escalating factors (e.g. ignition hazards in case of flammable/combustible spills); approach from up-wind to reduce fume risks, isolate the spill source (close containment valve, similar). Ensure appropriate controls requirements are met, e.g. PPE, first aid support, etc., prior to conducting spill clean up
- If it is safe to do so; stop the source of the leak (if possible) and contain the spill using onsite equipment to
- Prevent from leaving site or entering a waterway or sensitive feature
- Recover free liquid and contaminated material as soon as practicable (i.e. immediately) to mitigate infiltration. Material recovery should consider the benefit of recovery versus the additional impact that recovery of all contaminated material could cause as per the National Environment Protection (Assessment of Site Contamination) Measure
- Prevent people, livestock and wildlife access to hazardous material through fencing or other barriers
- Store contaminated material in a manner to minimise the risk of additional contamination
- For Level 2 spills and higher, the Project Manager shall be notified as soon as it is safe to do so, but within 2-hours
- Project Manager to ensure appropriate external incident reporting requirements are actioned in accordance with the impact of the spill
- For Level 2 spills and higher, Origin Project Manager to seek expertise as to whether additional testing and remediation is required upon completion of the initial containment and clean up. This consideration will be undertaken in in accordance with the National Environment Protection (Assessment of Site Contamination) Measure
- Upon rectification of a reportable spill, an incident investigation shall be completed as per the Petroleum (Environment) Regulations. This shall include the root cause of the incident, actions taken to mitigate the impact and ongoing monitoring and maintenance required to ensure the site is stable and non-polluting.

## 8.3 Contaminated material disposal

Contaminated material disposal will be undertaken in consideration of the following:

- During a spill clean up, the storage of contaminated material must be undertaken in a manner that minimises additional contamination
- Offsite disposal must be undertaken in accordance with the NT *Waste Management and Pollution Control Act 1998*

- All listed waste transportation shall be undertaken by licenced contractors, be tracked and disposed of at approved waste management facilities.

## 9. Monitoring and inspections

The monitoring and inspection programs to identify spills is summarised in Table 4.

**Table 4: Spill monitoring and inspections**

| Monitoring Program | Frequency | Methodology | Purpose | Minimum volume of leak |
|---|---|---|---|---|
| Tank and sump level monitoring (when wastewater is stored on-site) | During operations: Daily<br><br>All other times:<br>• Weekly during the dry season<br>• Daily during the wet season | Instrument<br><br>Or Level dip/ visual assessment | Prevent the overtopping of tanks | 10's of litres |
| Tank leak detection (when wastewater is stored on-site) | Continuous | Instrument | Detect the migration of fluid through primary containment | 10's of litres |
| Chemical storage areas (when chemical stored On-site) | During operations: Daily<br><br>All other times: Weekly | Visual (a camera may be utilised where sites are umanned) | Detection of leaks | Litres |
| Tank structural integrity (when wastewater is stored onsite) | Weekly | Visual inspection | Detect potential structural weakness | N/A |

## 10. Roles and responsibilities

The critical roles and responsibilities set out in Table 5 are for the main members of the Spill Response Group. This team represents the core group of resources that will lead a spill response with the support of the broader Origin Energy Team.

**Table 5: Roles and responsibilities**

| Position | Role and responsibility |
|---|---|
| Project Manager | Ultimately accountable for the implementation of the spill management plan (SMP). Role, or delegate, will liaise with Origin Environment Specialists to determine remediation requirements and external reporting obligations. |
| On-site Supervisor | Responsible for the initial response to a spill. This role will be delegated to the well site representative or nominated contractor in charge of a work program. Role will undertake the initial spill assessment, engage emergency services (if required) and co-ordinate immediate spill clean-up operations associations to minimise the potential impacts to people, places and the environment. |
| Environment/HSE Lead | Report Spill to Regulatory Authorities. Provide expertise on clean up requirements and ongoing monitoring and management requirements. Interface with government and regulatory bodies for communication and consents. |
| Emergency Response Lead | Provide specialist technical advice (Emergency Response) to support spill management activities. |

## 11. Waste transportation and disposal

All contractors engaged to perform drilling, stimulation and well testing will be required to comply with this plan. A bridging SPMP will be developed by each contractor summarising the activities to be undertaken to comply with this plan and the CoP.

## 12. Spill reporting

### 12.1 Spill rating

Table 6 provides a summary of the spill classification based upon the volume and location of spill. The hazards of the potential spill to people and the environment should be assessed independently, to ensure incident specific hazards are considered in the spill response. This table provides guidance as to the likely spill scenarios that may trigger the different incident reporting requirements.

When classifying spills and determining the reporting requirements, Ministerial conditions and environmental performance objectives and criteria should also be considered when determining the whether the event is a recordable or reportable event.

The spill tiers include:

- **Level 1:** Spills that can be contained within the well site and can be cleaned up by the operator without involvement of external organisations. Most Tier 1 spills are likely to be less than 2,500L and would include diesel spills during fuel transfer, oil spillage during

routine maintenance or small wastewater spills during well testing. Clean up time is generally less than 1-day. These spills will most likely be classified as recordable incidents as per Section 12.

- **Level 2:** Spills that have not been completely contained within the site boundary and/or may require additional resources to clean up. Clean up time is generally less than a week. Level 2 spills are typically reportable incidents as defined in section 12 and may also require notification under the *Waste Management and Pollution Control Act.*
- **Level 3:** Severe spills that cannot be contained by the operator and requires substantial additional resources to manage the spill. Clean up time is generally greater than a week. Level 3 spills are reportable incidents.

**Table 6: Spill tier levels**

| | | Spill (L) | | |
|---|---|---|---|---|
| | | 20-200L | 200-2,500 L | >2,500 L |
| Receiving environment | Bund or contained impervious area | **Not reportable*** | **Level 1** | **Level 1** |
| | Onsite *(lease pad, camp pad, hardstand, road or work area)* compacted or sealed surface** | **Not reportable*** | **Level 1** | **Level 2** |
| | Offsite permeable surfaces- areas adjacent to lease pads, camp pads, roads where spills have moved beyond the approved activity area. ** | **Level 1** | **Level 2** | **Level 3** |
| | Sensitive environmental or cultural feature (such as a waterway, drainage lines, wetland, high valued habitat and sacred site) or where the spill has, or has the potential to, cause material or serious environmental harm ** | **Level 2** | **Level 2** | **Level 3** |

**Notes:** * *Non-reportable spills must be recorded in Origin's OCIS (and made available for review by Contractor), with monthly reviews. For certain substances, such as flowback, there may be site specific requirements outlined int eh approval notice. The approvals notice should be reviewed. ** spills of Dangerous goods or wastes offsite may need to be reported under NT Dangerous Goods Act or Waste Management and Pollution control Act 1998.*

## 12.2 Incident reporting

Incidents may require reporting under the *Petroleum (Environment) Regulations and Waste Management Pollution Control Act.*

### 12.2.1 *Petroleum (Environment) Act* incident reporting

#### 12.2.1.1 Reportable environmental incident reporting

*The Petroleum (Environment) Regulations* define a reportable incident as an incident arising from a regulated activity that has caused, or has the potential to cause, material environmental harm or serious environmental harm as defined under the *Petroleum Act.*

An interest holder must notify (this may be oral or in writing) DEPWS of a reportable incident as soon as practicable but no later than two-hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident.

DEPWS can be notified through the DEPWS Onshore gas non-compliance hotline on 1800 413 567.

Any verbal report to DEPWS must be followed up by a written report from the Project Manager within three days in accordance with the *Petroleum (Environment) Regulations.*

#### 12.2.1.2 Recordable incidents

The *Petroleum (Environment) Regulations* define a recordable incident as an incident arising from a regulated activity that:

I. Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or
II. Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or
III. Is inconsistent with an environmental outcome specified in the current plan for the activity; and
IV. Is not a reportable incident.

These types of spills are typically a Level 1 type spill as defined in Table 7.

An interest holder must notify (this may be oral or in writing) DEPWS of a recordable incident as soon as practicable but no later than 15-days after the reporting period (agreed period or each 90-day period after the day on which the EMP is approved).

### 12.2.2 *Waste Management and Pollution Control Act* incident reporting

In accordance with the *Waste Management and Pollution Control Act,* where contaminants or waste is not confined within the land on which the petroleum activities are undertaken (i.e. the approved disturbance areas where the petroleum activity is occurring), Origin will notify the EPA of any incident causing or threatening to cause pollution as soon as practicable, but no less than 24 hours after becoming aware of the incident.

A notifiable incident is defined as an incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm.

A notification must include:

a) the incident causing or threatening to cause pollution;
b) the place where the incident occurred;
c) the date and time of the incident;
d) how the pollution has occurred, is occurring or may occur;
e) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and
f) the identity of the person notifying.

The notification shall be made to the NT EPA Pollution Hotline 1800 064 567.

## Appendix A Chemical volumes per well and storage areas

| Material name | Typical volume | Maximum volume | Unit | Storage area |
|---|---|---|---|---|
| Acetic acid – 60% | 3,000 | 6,000 | L | Stimulation chemical storage area |
| BE-9 Biocide | 17,000 | 34,000 | L | Stimulation chemical storage area |
| Caustic Soda Liquid | 15,000 | 30,000 | L | Stimulation chemical storage area |
| DCA-11001 Breaker Activator | 5,000 | 10,000 | L | Stimulation chemical storage area |
| DCA-13002 Breaker | 300 | 600 | kg | Stimulation chemical storage area |
| DCA-13003 Breaker | 10,000 | 20,000 | L | Stimulation chemical storage area |
| DCA-16001 Clay Stabiliser | 42,000 | 84,000 | L | Stimulation chemical storage area |
| DCA-17001 Corrosion Inhibiter | 1,000 | 2,000 | L | Stimulation chemical storage area |
| DCA-19001 Crosslinker | 600 | 1,200 | kg | Stimulation chemical storage area |
| DCA-19002 Crosslinker | 10,000 | 20,000 | L | Stimulation chemical storage area |
| DCA-23001 Friction Reducer | 5,000 | 10,000 | kg | Stimulation chemical storage area |
| DCA-23003 Friction Reducer | 18,000 | 36,000 | L | Stimulation chemical storage area |
| DCA-25005 Gelling Agent | 35,000 | 70,000 | kg | Stimulation chemical storage area |
| DCA-30001 Scale Inhibitor | 15,000 | 30,000 | L | Stimulation chemical storage area |
| DCA-32002 Surfactant | 15,000 | 30,000 | L | Stimulation chemical storage area |
| DCA-32014 Surfactant | 200 | 400 | L | Stimulation chemical storage area |
| FE-2 Buffer | 200 | 400 | kg | Stimulation chemical storage area |
| Hydrochloric Acid – 32% | 50,000 | 150,000 | L | Stimulation chemical storage area |
| 100 Mesh Sand | 91,000 | 182,000 | kg | Stimulation chemical storage area |
| 4070 Sand | 1,650,000 | 3,300,000 | kg | Stimulation chemical storage area |
| 30/50 Sand | 610,000 | 1,220,000 | kg | Stimulation chemical storage area |
| Sodium Chloride | 15,000 | 30,000 | kg | Completion chemical storage area |
| ALDACIDE G | 500 | 1,000 | L | Completion chemical storage area |
| OXYGON | 100 | 200 | kg | Completion chemical storage area |
| BARACOR 100 | 2,000 | 4,000 | L | Completion chemical storage area |
| CON-DET | 50 | 100 | kg | Drilling chemical storage area |
| SAPP | 50 | 100 | kg | Drilling chemical storage area |
| Bentonite | 3,000 | 6,000 | kg | Drilling chemical storage area |
| Caustic Soda | 1,400 | 2,800 | kg | Drilling chemical storage area |
| EZ MUD DP or EZ MUD Liquid | 2,000 | 4,000 | kg | Drilling chemical storage area |

| Material name | Typical volume | Maximum volume | Unit | Storage area |
|---|---|---|---|---|
| ALDACIDE G | 336 | 672 | kg | Drilling chemical storage area |
| STOPPIT | 1,000 | 2,000 | kg | Drilling chemical storage area |
| Soda Ash | 350 | 700 | kg | Drilling chemical storage area |
| BARACOR 100 | 250 | 500 | kg | Drilling chemical storage area |
| Sodium Chloride (Flossy Salt) | 96,000 | 192,000 | kg | Drilling chemical storage area |
| Barite | 500 | 1,000 | kg | Drilling chemical storage area |
| BARACARB | 500 | 1,000 | kg | Drilling chemical storage area |
| Citric Acid | 500 | 1,000 | kg | Drilling chemical storage area |
| BARADEFOAM HP | 500 | 1,000 | kg | Drilling chemical storage area |
| Sodium Bicarbonate | 500 | 1,000 | kg | Drilling chemical storage area |
| PERFORMATROL | 500 | 1,000 | kg | Drilling chemical storage area |
| SOURSCAV | 500 | 1,000 | kg | Drilling chemical storage area |
| DRIL-N-SLIDE | 500 | 1,000 | kg | Drilling chemical storage area |
| STEELSEAL | 500 | 1,000 | kg | Drilling chemical storage area |
| BARAZAN D or BARAZAN D Plus | 4,150 | 8,300 | kg | Drilling chemical storage area |
| PAC L | 2,300 | 4,600 | kg | Drilling chemical storage area |
| Potassium Chloride | 22,500 | 45,000 | kg | Drilling chemical storage area |
| GEM CP/GP | 500 | 1,000 | kg | Drilling chemical storage area |
| QUIK-FREE | 500 | 1,000 | kg | Drilling chemical storage area |
| BAROFIBRE, BAROFIBRE Superfine and BAROFIBRE COARSE | 500 | 1,000 | kg | Drilling chemical storage area |
| BaraBlend-657 | 500 | 1,000 | kg | Drilling chemical storage area |
| N-DRIL HT Plus | 500 | 1,000 | kg | Drilling chemical storage area |
| DEXTRID LTE | | | kg | Drilling chemical storage area |
| BARABUF | 500 | 1,000 | kg | Drilling chemical storage area |
| BORE-HIB | 500 | 1,000 | kg | Drilling chemical storage area |
| BDF 933 or BaraLube W-933 | | | kg | Drilling chemical storage area |
| BAROLIFT | 500 | 1,000 | kg | Drilling chemical storage area |
| OXYGON | 500 | 1,000 | kg | Drilling chemical storage area |
| ENVIRO-THIN | 500 | 1,000 | kg | Drilling chemical storage area |
| Lime | 500 | 1,000 | kg | Drilling chemical storage area |
| BDF 677 | 4,770 | 9,540 | kg | Drilling chemical storage area |
| BDF 988 | 3,390 | 6,780 | kg | Drilling chemical storage area |

Review due: 18/05/2023

| Material name | Typical volume | Maximum volume | Unit | Storage area |
|---|---|---|---|---|
| Waste Drilling Fluids | 2,500 | 2,500 | $m^3$ | Drill mud sump |
| Completion Fluids | 1.4 | 1.4 | ML | Drilling sump/onsite tank |
| Condensate | 160 | 320 | KL | Condensate storage area |
| Diesel | 250 | 500 | KL | Diesel storage tanks |
| Hydraulic Oil | 1,000 | 3,000 | L | Workshop |
| Engine Oil | 1,000 | 3,000 | L | Workshop |
| Degreasers | 100 | 300 | L | Workshop |
| Flowback | 0.5 – 1 | 6.8 | ML | Flowback tanks |