



Brokenwood-1, 2, 3 cluster Appraisal
Wells
Environment Plan: Public Summary
February 2009

This summary of the Brokenwood-1, 2, 3 EP has been submitted to comply with Regulation 11(7)(8) of the Petroleum (Submerged Lands) (Management of Environment) [P(SL)(MoE)] Regulations 1999.

Introduction

Apache Energy Limited (Apache) proposes to drill the Brokenwood-1 appraisal well, Brokenwood-2 and Brokenwood-3 deviated sidetrack wells in Commonwealth waters off the Western Australian coast in Exploration Permit WA-356-P using the *Stena Clyde* semi-submersible drill rig. The Brokenwood-1, 2, 3 cluster is located 141 km northwest of the nearest mainland, and 47 km northwest of the nearest Montebello Islands (**Figure 1**). Drilling is scheduled to commence late February 2009.

Apache's generic Environment Plan (EP) for its drilling program on the North West Shelf (NWS) in State and Commonwealth waters will be used to manage the well (EA-00-RI-164). A bridging document to this EP for the Brokenwood-1, 2, 3 cluster was approved by the Department of Mines and Petroleum (DMP), in accordance with the Petroleum (Submerged Lands) (Management of Environment) (PSL MoE) Regulations 1999.

Project Description

The proposed Brokenwood-1, 2, 3 cluster drill site is located at the following coordinates (GDA 94, Zone 50) in a water depth of 166 m:

	Degrees	Decimal degrees
Latitude	20° 00' 52.820" S	20.014672
Longitude	115° 09' 48.533" E	115.163481

The wells will be drilled with synthetic-based mud (SBM) and drill cuttings will be discharged to the seabed after being dried and centrifuged.

The drilling procedure for the Brokenwood-1, 2, 3 cluster will be to drill a 914 mm (36") hole to 241 m with seawater/pre-hydrated gel (SW/PHG). A 762 mm x 508 mm conductor will then be run and cemented after which a 406 mm (16") hole will be drilled to 1,520 m using SW/PHG. A 340 mm (13") casing will then be run and cemented, after which the blow-out preventor (BOP) and marine riser will be run. A 311 mm (12¼") hole will then be drilled to 4,176 m with SBM (Brokenwood-1). The well will then be evaluated, plugged and abandoned. If Brokenwood-1 is not successful, the well will be plugged back to the 340 mm casing shoe (at 1,250 m) and the drilling of Brokenwood-2 will commence by drilling a 311 mm hole to 4,174 m using SBM. This well will also be evaluated, plugged and abandoned.

If Brokenwood-1 is a successful discovery the well will be plugged to 2,500 m, after which first Brokenwood-2 and then Brokenwood-3 will be drilled. In this case, Brokenwood-2 will be drilled as stated above and Brokenwood-3 will be drilled with a 311 mm hole to 3,975 m using SBM. After evaluation of the well, Brokenwood-3 will be plugged and abandoned.

After abandoning the wells the rig will then pull up anchors and move off location.

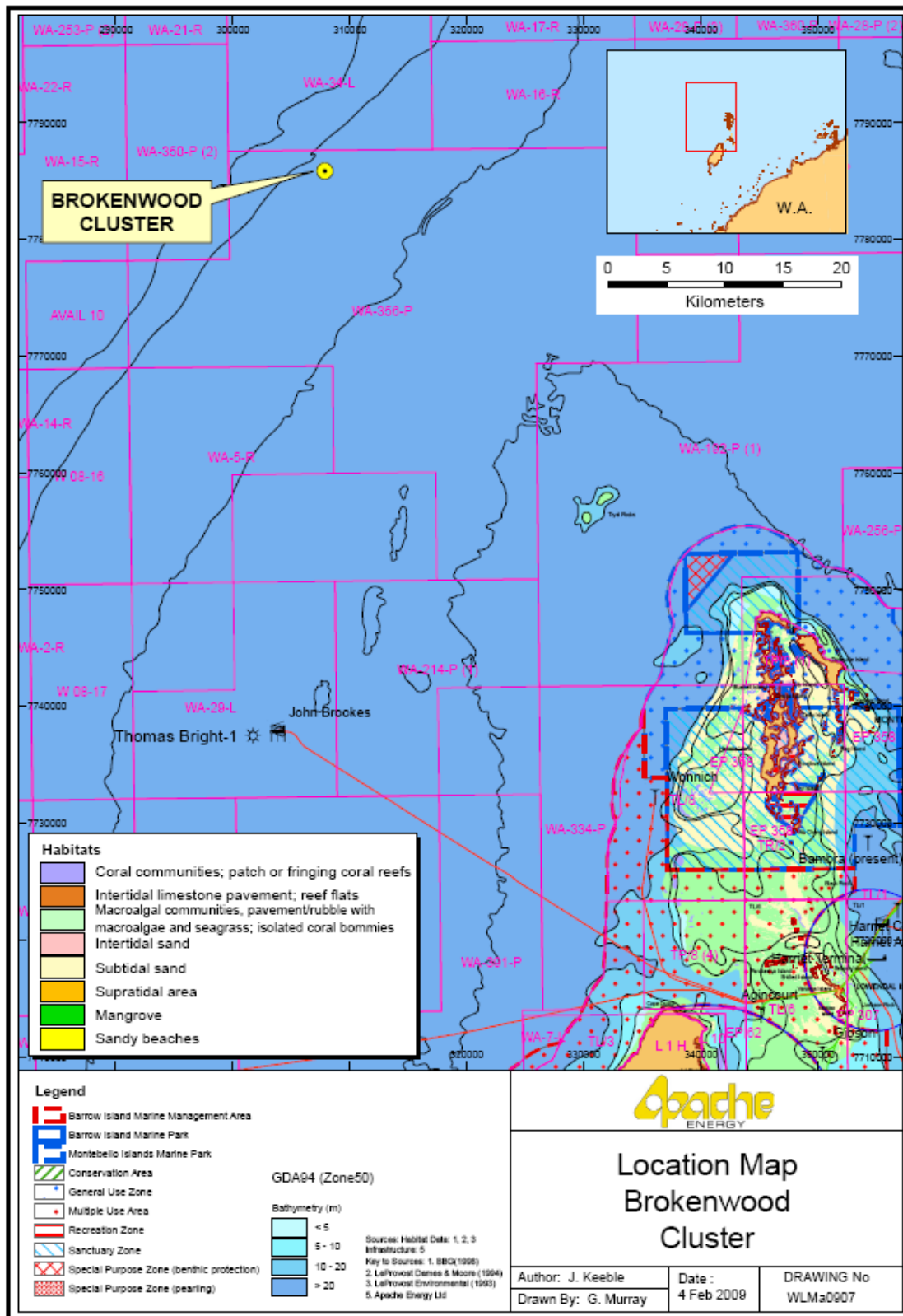


Figure 1 Location of the proposed Brokenwood-1, 2, 3 cluster drill site

Receiving Environment

Physical Environment

The NWS lies in the arid tropics region of Australia, which experiences high summer temperatures and periodic cyclones (with associated rainfall). Rainfall is generally low, with evaporation exceeding rainfall. Mean ocean temperatures range from a minimum of 11°C in winter to a maximum of 37°C in summer. Shelf waters are usually thermally stratified at a depth of about 20 m.

Wind patterns are monsoonal with a marked seasonal pattern. From October to March, the prevailing non-storm winds are from the south-west, west and north-west at an average speed of less than 10 knots. From June to August, winds are generally lighter and more variable in direction than in spring and summer.

Non-storm winds prevail from north-east through to south-east at average speeds of 5-6 knots. Transitional wind periods, during which either pattern may predominate, can be experienced in April, May and September each year.

Biological Environment

The drilling programme during February/March coincides with the the dugong breeding period and the whaleshark migration period (see **Table 1**).

The proposed drilling location for the Brokenwood-1, 2, 3 cluster is in deep water over 45 km distant from the nearest island and therefore it is not expected that dugongs (or turtles and seabirds) will be affected by the drilling program. Helicopters will be routed to avoid flying over sensitive breeding areas.

The drilling of the Brokenwood-1, 2, 3 cluster wells will not coincide with the migration of humpback whales (*Megaptera novaeangliae*) in the Exmouth to Port Hedland region. The humpback whale is a cetacean listed as 'threatened' under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*.

The drilling will coincide with the whale shark migration period. Whale sharks (*Rhincodon typus*) aggregate in and near the waters of the Ningaloo Marine Park during autumn (usually late March to June). Numerous aerial surveys and scientific research indicates that they are generally not spotted in waters deeper than 100 m. As drilling will be undertaken a significant distance north of the marine park, drilling is not expected to impact on whale shark migration or aggregation activities.

It is not anticipated that vertical seismic profiling (VSP) will be undertaken as part of the evaluation package, but if it does, this will be of short duration (generally less than 8 hours per well) and thus this potential source of underwater noise will be limited. To mitigate any potential impacts on humpback whales or whale sharks from VSP, DMP's (formerly DoIR) *Guidelines on Minimising Acoustic Disturbance to Marine Fauna* (1997) will be followed when undertaking VSP. All cetacean sighting records will be reported to Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) at the end of the drilling program. Using the DMP guidelines, the following measures will be undertaken on the rig at the commencement of the VSP:

- Not commencing VSP unless whales/whale sharks are a minimum distance of 3 km from the rig;
- Soft-start over a 20 minute period;

- Rig crew being alert for whales/whale sharks during VSP, with a dedicated whale-watcher on post if a whale or whale shark is sighted with 3-5 km of the rig; and
- Shut down of VSP if whales or whale sharks are observed within 1 km of the rig.

Socio-Economic Environment

Dampier and Karratha are the main service and population centres for this region. Local people seeking aquatic recreation such as boating, diving and fishing use the coast and islands of the Pilbara. The open waters of the Commonwealth permit areas do not support significant recreational or tourism activity.

Commercial fisheries are active along the Pilbara coast; however fishing effort in the open Commonwealth waters is low, with operators favouring the inshore areas.

Table 1. NWS biological and human activity seasons

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dugong breeding	breeding								breeding			
Hawksbill turtle nesting												
Flatback turtle nesting												
Green turtle nesting												
Loggerhead turtle nesting												
Coral spawning												
Whale migration						north			south			
Whale sharks												
Algae	growing				Shedding fronds				growing			
Seabird nesting												
Prawn trawling												
Tourism												
Brokenwood cluster												

Key

	Peak activity, presence reliable and predictable
	Low level of abundance/activity/presence
	Activity not occurring within the area

Major Environmental Hazards and Controls

The potential environmental impacts resulting from offshore drilling on the NWS are outlined in detail in the Generic Drilling Program EP. **Table 2** summarises the potential impacts of the Brokenwood-1, 2, 3 cluster drilling program.

Table 2. Summary of potential environmental impacts from offshore drilling on the NWS

Potential hazard (risk)	Potential environmental effect (consequence)	Risk ranking
Drill rig and vessel anchoring	Localised disturbance to seabed, such as shallow furrows, dependent on seabed type. Effects are temporary.	Negligible – semi-submersible rig with anchoring to seabed.
Artificial lights from drill rig	Potential disorientation of fauna by lights at night, especially turtle	Negligible – wave direction and magnetic cues are

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(must be kept on 24 hrs due to safety regulations)	hatchlings.	primary influences on turtle hatchlings once they have left the beach. Brokenwood cluster is distant from nesting beaches.
Impacts to marine species from noise generated by the drill rig and support vessels	Potential short-term physiological effects or disruption to behaviour patterns of cetaceans, birds, turtles, fish and other marine life.	Negligible – observations have shown whales resting and swimming in close proximity to operating rigs.
Drill cuttings and fluid discharges	Drilling activities and disposal of drill cuttings and fluids will produce suspended sediments in the water column increasing turbidity, will bury and smother infauna and epifauna and may lead to toxicity and bioaccumulation to marine organisms.	Acceptable – WBMs and SBMs used. Studies on NWS reveal few long-term impacts on benthic fauna from WBMs. SBM on cuttings reduced through use of cuttings dryer/centrifuge system.
Sewage, putrescible and solid domestic wastes	Potential localised reduction in water quality - nutrient enrichment. Modification of feeding habits of local fauna.	Negligible – sewage treatment available on rig.
Waste oil, chemicals and oil-contaminated drainage water	Potential localised reduction in water quality.	Negligible – decks kept clean during operations, oily-water separator collects any spilled material.
Cooling water and atmospheric emissions	Potential localised reduction in water quality. Emissions of greenhouse gases. Potential localised reduction in air quality.	Negligible – discharged above water line to allow cooling and oxygenation.
Introduction of foreign marine organisms from drill rig and support vessels	Competition with local marine life and absence of natural predators can alter ecological balance of flora and fauna communities, favouring the introduced species and resulting in loss of flora and fauna diversity and abundance.	Negligible
Impacts to humpback whales from vertical seismic profiling (VSP) noise	VSP is a more benign activity than conventional seismic surveys. Potential short-lived impacts include disruption to navigation and communication, with some research indicating no disruption from normal activities when seismic activity is occurring several kilometres away.	Negligible - VSP will not be carried out. DMP (DoIR) guidelines for minimising acoustic disturbance to fauna will be followed if VSP is carried out.
Oil or diesel spills	Severe damage of marine habitats (e.g., coral reefs, mangroves, beaches) and death or injury to marine life (e.g, birds, mammals).	Acceptable – Oil spill management procedures are in place.

Environmental Management

Extensive environmental management guidelines are prepared for each Apache-drilled well. Apache management documents used to guide the implementation of well-specific environmental management procedures are listed below:

- Environmental Management Policy (April 2006).
- Contaminated Waste Management Procedure (VI-SA-ON-EN-000).
- Incident Reporting Procedure (AE-91-IF-002).
- Lighting Management Plan (EA-60-RI-153).
- OSCP Volume 1 – Operations (NWS) (AE-OO-EF-008).
- OSCP Volume 2 – Resource Atlas (NWS) (AE-OO-EF-008/2).
- Quarantine Procedure (AE-91-IQ-189).
- Refuelling Management Plan (DR-91-IG-001).
- Refuelling Operational Procedure Guide.
- Vermin Management Plan (EA-60-RI-131).
- Waste Management Plan (EA-60-RI-167).

Consultation

In preparing the Generic NWS Drilling Program EP, Apache consulted with numerous stakeholder representatives, including:

- Department of Mines and Petroleum (formerly DoIR).
- Department of Environment (DoE) (now Dept of Environment & Conservation [DEC]).
- CALM (Marine branch) (now DEC).
- Fisheries WA.
- Marine and Coastal Community Network (MCCN).
- Environment Protection Agency (EPA).
- Marine Parks Reserve Authority (MPRA).
- DEC (Environmental Protection).
- WA Fishing Industry Council (WAFIC).

Further Details

For further information about the Brokenwood-1, 2, 3 cluster drilling program, please contact:

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