Beach Energy in Mid-West WA
Overview of Activities


Typical farm land in the Perth Basin

Update | February 2020

Overview

Beach Energy is planning to undertake seismic surveys in the north Perth Basin, around 40 kilometres south east of Dongara, over the next few years. The aim of these surveys is to identify natural gas reserves within our existing exploration permits and production licenses (see map overleaf). The data collected will be used to inform future exploration activities in the area which may lead to natural gas production activities over the next 20 years.

This update includes information on:

- Beach Energy and our activity in the mid-west
- Beach's operations at Beharra Springs, near Dongara
- Trieste 3D Seismic survey currently underway
- A potential future 3D seismic survey planned for early-mid 2020s
- Beharra Springs Deep-1 exploration well
- How seismic surveys are undertaken, including regulatory approvals, environmental protection and community consultation
- Questions and Answers.

About Beach

Beach Energy (Beach) is an ASX listed oil and gas exploration and production company headquartered in Adelaide. Beach has operated and non-operated, onshore and offshore, oil and natural gas production from five producing basins across Australia and New Zealand and is a key supplier of domestic natural gas to Australia.

Beach in the Perth Basin

The Perth Basin is a large basin of approximately 174,000 square kilometres that encompasses both onshore and offshore parts of south-western Western Australia. The basin extends about 1300 km from south of Perth to its northern tip offshore from Carnarvon.

Beach's Perth Basin operations consist of the Waitsia project (non-operated) and Beharra Springs (operated) projects.

The Beharra Springs project is located outside Dongara in Production Licence L11. The project consists of the Beharra Springs, Redback Terrace and Tarantula gas fields, the Beharra Springs Gas Processing Facility (BSGPF), gas pipeline (PL18) and associated infrastructure. Gas processed at the BSGPF is sold to Western Australian gas customers. The BSGPF employs approximately six people.

Beach has recently made a gas discovery at the Beharra Springs Deep-1 exploration well which will re-invigorate the Beharra Springs project and stimulate further exploration for natural gas within the northern part of the Perth Basin. Beach continues to explore for additional gas reserves, as exploration underpins ongoing delivery of domestic gas supply through the facility.

For more information on Beach's operations in the Perth Basin visit www.beachenergy.com.au/perth-basin/

Traditional custodians and cultural heritage

Beach respectfully acknowledges the Southern Yamatji people, the traditional custodians of the land on which Beach's Perth Basin operations are located. Beach respects their historical and ongoing connection to country through cultural and spiritual sites, language and ceremony, and pays respect to their Elders past, present and emerging.

Beach works closely with the Southern Yamatji people to ensure operational activities do not impact cultural heritage sites and areas of significance. This is conducted through ongoing engagement and communication on projects, and as applicable, on the ground cultural heritage field surveys.

Trieste 3D seismic survey

Beach has commenced the acquisition of the Trieste 3D seismic survey. The survey will help map geological formations and assist in the search for natural gas reserves in the Perth Basin. The survey area and associated seismic lines are located on unallocated crown land and private property.

Location and timing

The Trieste 3D seismic survey is currently underway and is planned to be completed by the end of February 2020.

A potential future seismic survey

Beach and its Joint Venture Partner Mitsui E&P Australia are considering a further seismic survey in the region to provide more mapping information of potential natural gas reserves in the Perth Basin. This survey is in the very early stages of planning with the objective to provide additional high-quality data to existing 2D and 3D seismic data that has been previously acquired in the region. This survey will assist in 'filling in' seismic data gaps between past surveys and provide valuable insight to shaping future exploration activity in the region.

This survey will be designed to:

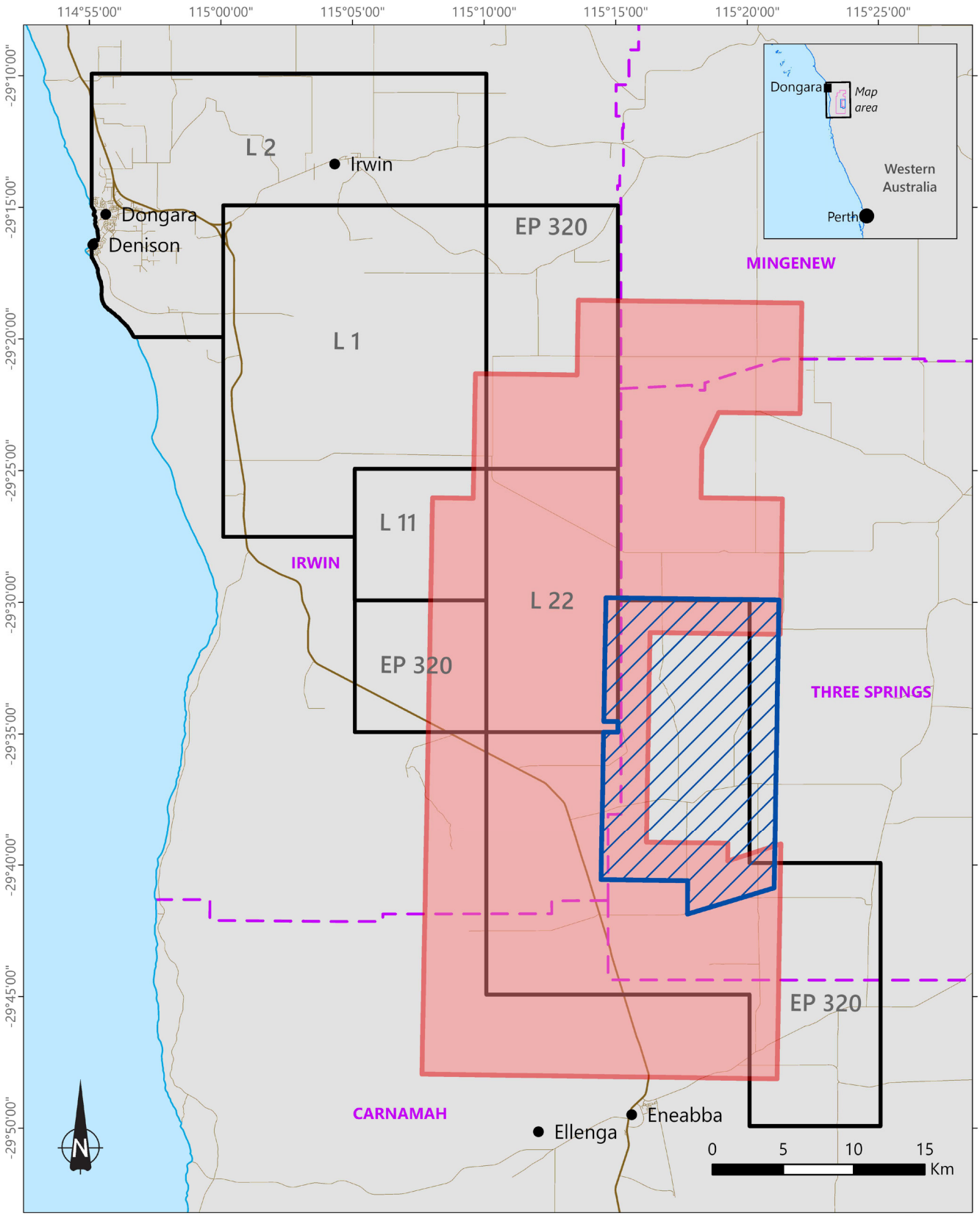
- Provide high quality information
- Reduce timeframes (including for environmental rehabilitation)
- Reduce disruption to the community, traditional owners, landholders and the environment.

The survey is subject to internal, Joint Venture Partner and regulatory approvals.

Location and timing

Our early stage planning has identified a survey area of approximately 967 km^2 of land. We are targeting commencement in the early-mid 2020's. However final timing and durations are subject to all approvals, weather windows, cropping schedules and availability of contractors. The approximate survey duration is 90 days from commencement to completion.

Trieste 3D seismic survey area and potential future seismic survey activity



Coordinate System: GDA 1994

Legend

- Roads
- Local government Shires
- Trieste 3D seismic survey area
- Potential 3D Survey
- Beach Operated Permits

Safety and the environment

For Beach, the safety of our people and the local environment are the highest priorities for our operations and projects. Beach operates within a highly regulated industry and must meet stringent environmental and safety standards.

A comprehensive Environment Plan must be accepted by the regulator before the activities can proceed. Other submissions include referrals under the state and federal environmental legislation, rehabilitation plans, native vegetation offsets plans, and numerous state government permit applications.

What is a seismic survey?

Beach will use a safe and sustainable exploration method called 'seismic surveying' to determine the size and location of subsurface natural gas reserves in the area. Seismic surveys are a reliable non-invasive strategy for establishing a detailed subsurface image of geological structures to determine suitable drilling locations. This activity traditionally results in minimising the number of wells being drilled in a region as it reduces uncertainty.

Seismic surveys send sound waves (vibrations) into the ground and record the energy that bounces back from rock layer boundaries below the surface (e.g. sandstone and shale).

The sound is generated by 30 to 40-ton vehicles commonly referred to as a Vibroseis Buggy. The Vibroseis Buggies are lifted off the ground with hydraulics and then vibrate between 2 and 200 times per second to create vibrations which are almost undetectable at the surface, near the buggy.

The reflected sound is recorded by sensors (receivers) that are highly sensitive to vibration. These surveys can be acquired in 2D (along fairly straight tracks) or in 3D whereby the equipment is distributed across a grid of right-angle tracks. The tracks which the Vibroseis Buggies traverse is commonly referred to as a "source line". A 3D receiver grid typically consists of 5000 to 30000 sensors over an area of 20 to 80 km^2. This grid of receivers is moved daily until the entire survey area is completed.

The sensors are placed into the ground using a short spike (less than 15 cm). The vibrations recorded by the sensors are used to create a picture of the geological layers and faults many kilometers below the surface.

Typically, seismic surveys have required tracks to be cleared to enable access for the 4WDs to assist in positioning sensors. However, the size and weight of the sensors has evolved, and a majority of sensors will be deployed efficiently on foot on the new 3D survey.

Approach and equipment

Beach will use low-impact clearing methods to enable safe access for the equipment. Vegetation is only cleared from areas that have been approved for clearing by the relevant regulatory authorities and excludes cutting any cultivated or cleared pastoral land. All cleared areas will be rehabilitated immediately following completion of the survey.

The following steps outline the entire approach in undertaking the seismic acquisition:

1. Ecology and cultural heritage surveys to optimise path of seismic lines
2. Vegetation clearing
3. Layout of the seismic sensors at set intervals on the receiver lines
4. Traverse the north-south seismic lines with the Vibroseis Buggies
5. Retrieve the seismic sensors
6. Rehabilitation
7. Post survey inspection of each property and sign off from the landowner and / or occupier.

The following equipment will be used to conduct the survey:

- Tractor (from a local contractor) to clear vegetation for seismic grid lines
- 4WD pick-ups and All-Terrain Vehicles (ATVs)
- Vibroseis Buggies fitted with balloon tyres plus a service vehicle
- Recording control vehicle (used as a control hub)
- Seismic equipment container/truck
- Rapid response fire units.

Environment protection

Beach takes the protection of the environment seriously and has designed the seismic surveys to minimise the impacts by:

- Optimising the seismic line spacing to avoid sensitive areas and minimise clearing
- Adjusting the placement of some seismic lines to avoid known threatened flora, riparian vegetation (Arrowsmith River), key habitat for Carnaby's black cockatoo, conservation estate and other sensitive areas as identified
- Avoiding the flowering period for threatened orchids
- Using low-impact vegetation clearing techniques (i.e. mulching and/or rolling vegetation) which leave the soil surface intact and encourage natural regeneration
- Deploying up to 80% of receivers by hand during the new survey to reduce clearing and vehicle use in sensitive areas
- Undertaking independent research to determine the best techniques for achieving successful rehabilitation
- Implementing hygiene management procedures to prevent introduction or spread of dieback and weeds
- Implementing wildfire prevention and response procedures, such as having water trucks onsite during vegetation clearing
- Rehabilitation will commence after the seismic acquisition and ongoing monitoring will be put in place
- Offsets for any native vegetation clearing will be addressed via the potential to purchase native vegetation within the Geraldton Sandplains Bioregion.

Managing property and environmental impacts

Prior to the seismic survey commencing, Beach will commission several surveys to identify areas of environmental significance (such as any populations of threatened species). Beach will also undertake a logistical scouting activity, preferably with the owner of the land to identify farm tracks, fences and other farm infrastructure that Beach needs to be aware of during the survey.

Beach aims to minimise impacts on landholders and the community as much as possible by conducting the survey outside of the cropping season and utilising existing infrastructure where possible to minimise additional disturbance.

Landholder agreements

Beach will enter into an agreement with each impacted landowner and occupier of the area prior to commencement of surveys, both to identify vegetation required for clearing and for the seismic survey activity. Beach's Land Access team will be in contact with landowners and occupiers to explain the surveys and discuss arrangements.

Access Authority agreements

As part of the activity approval, Beach may require an access authority over the areas outside of the Exploration Permit (Access Authority). Section 106(5A) of the Act provides for such arrangements. Beach will enter to an agreement with each impacted title holder.

Beharra Springs Deep-1 exploration well

Beach announced its conventional gas discovery at Beharra Springs Deep-1 in Licence L11 in the Perth Basin on 28 October 2019. The Beharra Springs Deep-1 exploration well was drilled to a depth of 4170 m and targeted gas within deeper reservoirs below the existing Beharra Springs Gas Field. The well successfully recovered gas from the Kingia Sandstone from a depth of approximately 3900 m. The well was drilled 450 m from the existing Beharra Springs Gas Processing Facility and has proved the existence of gas in the same geological formation as the Waitsia gas field discovery which is 15 km north of Beharra Springs, and Strike Energy's West Erregulla-2 gas discovery which is 15 km to the north east.

The next phase of the Beharra Springs Deep-1 exploration program is to assess the size of the gas reservoir through the drilling of appraisal wells which could commence within the next year, subject to all approvals.

Beach holds a 50% interest in the Beharra Springs project in the Perth Basin. Beach also holds a 50% interest (non operated) in Waitsia, which consists of the Waitsia Gas Project, an interest in the Xyris production facility and other in-field pipelines. Gas from two production wells is processed at the Xyris gas processing facility.

Community consultation

Beach is committed to working with the local community, ensuring people are informed of proposed operations and can ask questions or raise issues about its projects if required. Stakeholder consultation is an important part of preparing Environment Plans for our activities as it helps identify local issues and concerns and ensures our planning includes an approach to managing potential impacts. The regulator will be provided a report on all stakeholder consultation in the course of developing the relevant environment plans.

From exploration to development

When assessing exploration activities, projects go through three major phases: Exploration, Appraisal/ Development and Production. The typical timeframe from seismic survey acquisition to gas production is approximately 5 years, and production from the resulting wells may last up to 20 years.

For a brief summary of project phases refer to the table below.

1	2	3
Exploration Phase	**Appraisal and Development Phase**	**Production Phase**

Identify and drill exploration prospects
• Seismic surveys
• Interpretation of the seismic data
• Detailed planning for drilling
• Drill Exploration wells:
  ○ if viable, progress to Appraisal and Development phase
  ○ if not viable, discontinue wells and rehabilitate land.
	Determine discovered field size and field development plan
	• Assess the resource size of a discovery
	• Determine and gain approval for full field development plans
	• Undertake field development including drilling infill development wells, and building/upgrading production processing plants and pipelines using existing infrastructure where possible
	  ○ if viable, progress to Production Phase
	  ○ if not viable, discontinue wells and rehabilitate land.
		Production Phase
		• Production wells and facilities may have a life of up to 20 years
		• Operations ongoing to optimize production and ensure safe and reliable operations throughout the field life all the way to field discontinue and rehabilitate.

Discontinue wells and rehabilitate land		

Questions and Answers

Will you be hydraulic fracturing ('fracking') when you drill any wells?

Beach has no plans to undertake hydraulic fracture stimulation activities in the Perth Basin. Beach prides itself on working within the stringent conditions set by regulatory bodies across Australia, including Western Australia.

Why are 3D seismics surveys required in this area?

Recent discoveries at the Waitsia, West Erregulla-2, and Beharra Springs Deep-1 have shown that the region is prospective for natural gas reserves. High quality 3D data acquisition allows further exploration drilling and gives potential for further future gas development projects. 3D seismic data improves the imaging of the subsurface and allows wells to be drilled in the correct locations for successful intersection of gas resources. The high-quality data also ensures safe drilling operations as detailed mapping of high quality seismic allows imaging of faults and definition of shallow aquifers which can be protected and avoided if mapped in detail.

Will you need to conduct any other seismic surveys in future?

A regional 2D seismic survey may also be required to improve understanding of the structural geology of the basin. The potential 2D survey will likely only require access to road reserves.

Why are Beach able to conduct surveys outside of the permit area?

To accurately create an image of the deep targets directly beneath Beach's permits, survey areas on the surface are required to expand beyond our operating boundary. This enables us to generate a clear picture of those deep targets (up to 5000 m deep). Additionally, data collected in these surveys together with datasets from past surrounding surveys requires a significant overlap (approx. 2000 m) in order to be merged to provide seamless coverage of subsurface natural gas reserves in the area. Beach will consult with landholders and occupiers and other permit holders to seek permission to survey outside of Beach permit zones, however, there are no regulatory restrictions to undertaking surveys outside our permit areas.

Are you experienced in conducting seismic surveys?

Yes, Beach has over 50 years' experience in seismic acquisition and the drilling of complex, high integrity wells. Beach has a team of highly skilled gas industry professionals with extensive industry experience to deliver these operations.

Why do we still need natural gas?

Natural gas has a wide variety of uses in our daily lives including ensuring a clean and stable supply of domestic gas and electricity supporting Western Australian manufacturing and industrial customers. Natural gas is an ingredient used to make fertilizer, plastics, pharmaceuticals and fabrics and it is used as a heat source in making glass, steel, cement, bricks, ceramics, tiles, paper and food products. It is also the key component in ensuring your barbecue runs at home.

Will there be thousands of wells, like in Queensland?

This project, unlike LNG produced in Queensland, does not require a significant number of wells to extract gas. A typical gas field development in the Perth Basin area would use a spacing of 1 to 3 kilometres between wells. The total number of wells is dependent on the size of the field, although a single field is not expected to have more than approximately 10-15 wells.

What if the surveys find there is no gas in the area?

If no prospects are identified, then no drilling will be undertaken. Should an exploration well be drilled and not find gas, then the well is plugged with cement, with aquifers safely isolated by permanent secure barriers. The wellsite is then remediated.

What environmental approvals are required before you can conduct exploration activities?

Beach's exploration activities are subject to both Commonwealth and Western Australian legislation including the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*, the *Petroleum and Geothermal Resources Act 1967* and the *Environmental Protection Act 1986.* For the proposed new 3D seismic survey, Beach will submit an EPBC referral to the Commonwealth Department of Environment and Energy for assessment. An Environment Plan will be submitted to the WA Department of Mines, Industry Regulation and Safety and a referral to WA's Environment Protection Authority (EPA). Additional permits may also be required as these departments review and assess Beach's submissions. As part of the submission Beach will also prepare a rehabilitation plan and a native vegetation offsets plan. The seismic surveys will not be able to commence until Beach has received the approvals from all regulatory agencies.

The Trieste 3D survey has received all required environmental approvals under both Commonwealth and Western Australian legislation. The Trieste 3D survey Environment Plan was approved under the *Petroleum and Geothermal Resources Act 1967* and a vegetation clearing permit has been issued with conditions set by both the WA Department of Mines, Industry Regulation and Safety and the Commonwealth Department of Environment and Energy under the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*. As a condition of these approvals, Beach will undertake regular environmental monitoring and report to the regulators against the conditions for the life of the project, including vegetation rehabilitation.

What's in an Environment Plan?

Environment Plans include an environmental impact assessment covering cultural heritage; flora and fauna; landscape; surface and groundwater; geotechnical; air quality; noise; community impacts and consultation. Its preparation requires a risk assessment to be undertaken to ensure that measures will be in place to minimise potential impacts to as low as reasonably practicable. Environment Plans are developed for each major activity.

How long will the seismic surveys take?

Approximate duration of seismic surveys relevant to the Perth Basin are:

- Trieste 3D: 60 days to complete activities
- Early stage planning for a proposed larger 3D survey indicates up to 90 days to complete activities

Planned dates and activity durations can change due to internal project approvals; regulatory approvals; weather conditions; contractor availability; and technical challenges that may arise throughout operations.

Will the survey activities run day and night?

All survey operations and associated activities will be done during daylight hours only.

Are the seismic surveys safe and will there be any impact to landholders or occupiers?

Seismic surveys are a safe and sustainable exploration method. The only output from the surveys will be low level noise similar to a truck. However, this will not affect landowners and occupiers and the activities are not carried out near residences. Seismic surveys do not cause any sub surface structural disturbance.

Will there be any road closures?

No. Traffic control will be in place for any activity on roads.

How many people will be working at the survey sites?

There will be approximately 40-50 people included in each seismic survey. All staff and contractors working in the survey area must undergo mandatory training which will include safety, environment, and community considerations.

Where will those people stay?

A temporary accommodation camp 'Eneabba' has been established at a separate site nearby. Other workers and contractors will travel to site on a work-needs basis and will arrange local accommodation as required.

How will you rehabilitate the sites after the seismic surveys?

The low-impact clearing methods used in native vegetation (rolling and/or mulching of vegetation) remove vegetation close to the ground without disrupting the soil surface. This leaves the plant rootstock and soil seedbank intact and helps to prevent erosion and weed incursion. The cleared vegetative material is spread over the cleared areas, providing shelter for small animals (particularly burrowing invertebrates), and returning organic matter and seeds to the soil. This allows vegetation to regenerate naturally, without the need for intensive on-ground management.

Rehabilitation will be monitored by experienced environmental specialists annually and compared against a set of completion criteria pre-determined in consultation with relevant authorities. If rehabilitation in a particular area is not meeting completion criteria,

additional active rehabilitation will be undertaken as required, such as targeted weed control or infill planting. Rehabilitation monitoring will continue until environmental commitments have been met.

How will you consult with the community?

We meet face to face with landholders, occupiers, nearby neighbours and representatives of the Southern Yamatji (the Traditional Custodians), to explain the operations and work with them to identify the best way to manage any impacts. We also consult directly with regulators, relevant government departments and agencies, and local government. For our local communities, we consult with community representatives, provide briefings at community group meetings, and provide information via email or post. All questions, feedback or concerns are considered and responded to. Beach is committed to keeping the community up to date on its activities, throughout all phases of its projects.

Vibroseis Buggy with balloon tyres with a sensor (receiver) in the foreground

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