AIRBORNE MAGNETIC SURVEY, GREAT AUSTRALIAN BIGHT ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan for the Fugro Airborne Magnetic Survey in the Great Australian Bight has been submitted to the Division of Minerals and Energy Resources of Primary Industries and Resources South Australia (PIRSA) to comply with Regulations 11(7) and 11(8) of the *Petroleum (Submerged Lands) (Management of Environment) Regulations 1999* (P[SL]MoE Regulations).

INTRODUCTION

Fugro Airborne Surveys Pty Ltd (Fugro) proposes to undertake an Airborne Magnetic Survey (AMS) within Commonwealth waters in the Great Australian Bight (GAB), offshore from South Australia. The AMS will comprise of approximately 358 flight lines covering a maximum distance of 61,358 line kilometres.

COORDINATES OF THE PROPOSED ACTIVITY

The proposed AMS will be conducted in the eastern section of the GAB **(Figure 1)**, with a survey area covering a spatial polygon of approximately 134,000 km^2. The survey boundary coordinates are provided in **Table 1** below.

Table 1: Coordinates of the Proposed Survey Area

Latitude (S)			Longitude (E)		
Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
32	59	47.02	129	00	5.78
32	58	50.14	131	42	3.22
35	35	25.06	135	20	37.66
36	11	17.16	134	25	57.36
35	55	6.59	131	59	47.38
34	36	0.71	129	00	5.76

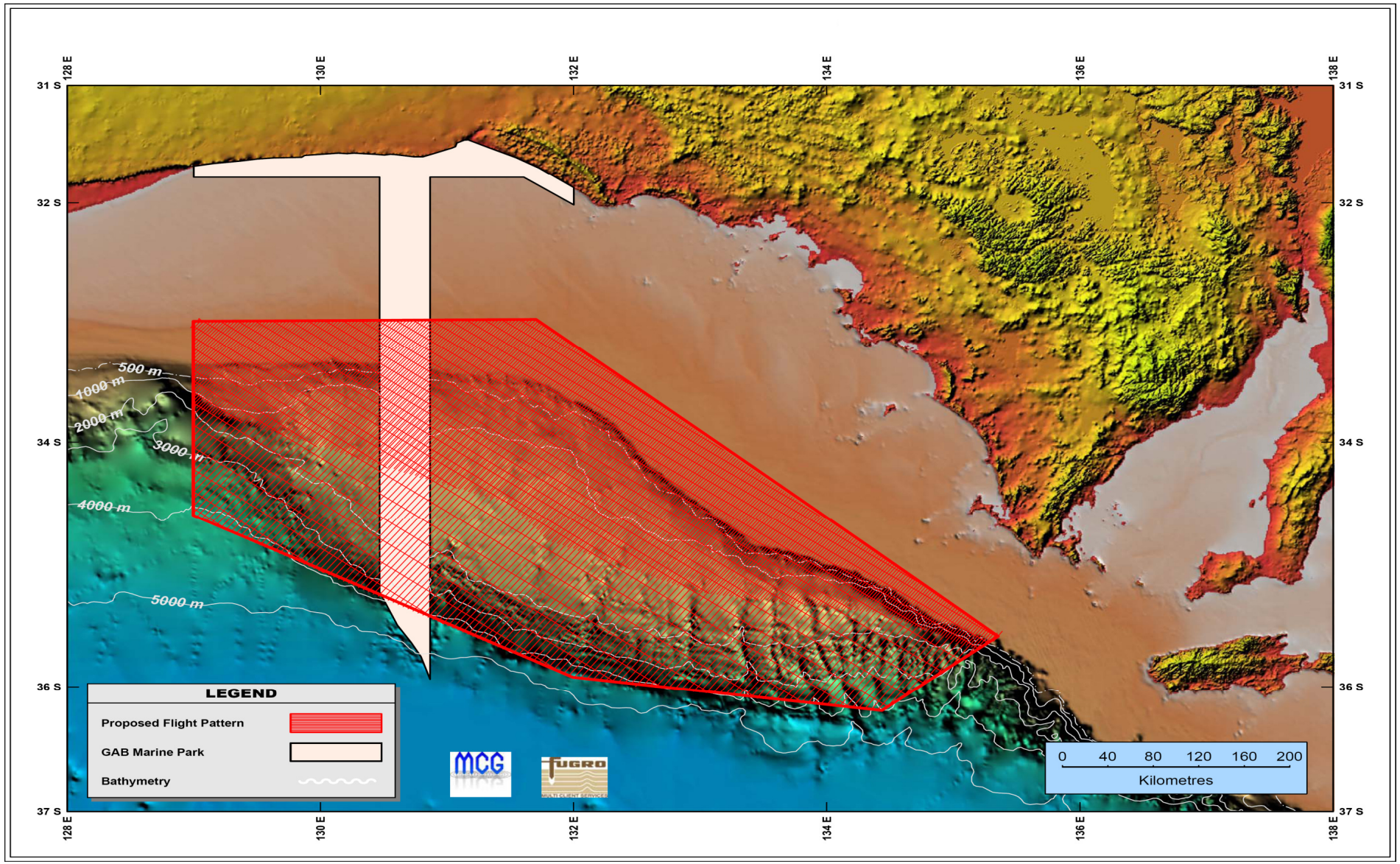
DESCRIPTION OF THE PROPOSED ACTIVITY

The AMS is comprised of a grid of flight lines extending across a water depth range of approximately 200 m (along the northern extent of the survey area) to 4,500 m (along the southern extent of the survey area). The survey is scheduled to commence in early January 2008, is expected to be of approximately 10 weeks duration, and will be completed by the middle of March 2009. The survey will be conducted during daylight hours only.

The AMS will be conducted using two light twin piston-engine aircraft (Rockwell Aero Commander AC50), which will usually be flying simultaneously. One survey aircraft will be based at the airport in Ceduna, and the other will be based at the airport in Port Lincoln.

During the proposed activity, the survey aircraft will fly at an altitude of 150 m above sea level, and travel at a speed of 140 knots (258 km per hour). The aircraft will traverse a series of pre-determined flight lines, which have a line spacing of approximately 2,000 m. As the aircraft travels along the flight lines, a magnetometer (which is a passive instrument used to measure the magnetic field of the earth), will take measurements. These magnetic field measurements will be recorded and the data will be processed to produce geophysical maps of the target area.

Figure 1: Survey Area and Flight Line Grid for the AMS, Great Australian Bight



DESCRIPTION OF THE RECEIVING ENVIRONMENT

Physical Environment

There are a number of ocean currents in the South-west Marine Region, including the Leeuwin Current, the deeper subsurface Leeuwin Undercurrent on the west coast, the Flinders Current on the south coast, and the seasonal, coastal Capes Current and Cresswell Current. During summer, the Leeuwin Current weakens to the point that its inflow to the Great Australian Bight is largely absent. The interactions of the Leeuwin Current with seafloor features at the shelf break also leads to the formation of meso-scale eddies. Such eddies are known to occur in predictable locations; including the area south of the Eyre Peninsula.

The proposed AMS covers the GAB physiographic province, which is characterised by:

- A broad, seaward-sloping shelf, with a shallow inshore terrace, an extensive middle shelf and a narrow outer shelf. The largest terraces in the Region occur on the mid-slope, dissected by several broad and shallow submarine canyons;
- Oceanographic processes that are dominated by southwesterly swells and storms, forming a high energy environment and a 'shaved shelf', where sediment erosion is greater than sediment accumulation. Seasonal upwelling brings nutrients onto the shelf, supporting prolific carbonate production on the outer shelf and upper slope;
- Surface sediments dominated by cool water carbonates, with bioclastic fragments of bryozoans, molluscs, sponges, coralline algae, foraminifera and echinoids. A thin sediment veneer of locally rippled carbonate sand patches is interspersed with outcropping hard substrate. The outer shelf and slope is covered by a thin layer of pelagic calcareous ooze and mixed terrigenous-carbonate sand, silt and mud; and
- A Late Quaternary history dominated by a large accumulation of sediment on the outer shelf and upper slope, which is a result of prolific carbonate production. Bryozoan mounds, essentially 'cool-water reefs', grew on the outer shelf due to higher levels of oceanic upwelling.

Biological Environment

With a total absence of fluvial inputs into the system and a lack of predictable eddies, upwellings and canyons cutting into the upper slope and shelf break, the GAB is very nutrient poor, particularly on the continental shelf. Generally, the shelf area of the GAB System is characterised by an extremely low concentration of chlorophyll at the surface, and higher concentrations at depth. Schools of small pelagic fish (e.g. pilchards) are commonly associated with small hills and other geomorphic features in inshore waters. A thermocline occurs at approximately 40 m across the shelf and appears to influence species distribution and potentially plays a role in nutrient upwelling. The shelf and slope is characterised by unconsolidated soft sediments which are likely to host infauna communities, but very little is known about species composition and abundance of this fauna

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To a large extent, the GAB System survives on inputs from other systems received in the depleted warmer Leeuwin Current flowing from the west, the colder more enriched Flinders Current from the east, and various mixes of these with coastal waters. The downwelling that predominates through this system in winter, would be expected to displace deeper waters and drive some level of winter overturn along the shelf break. However, as the slope is so gradual, this enrichment will be extensive and sparse. Fishermen who have tracked aggregations of school shark through this system describe pulses of "dirty water" that irregularly wash through the system from the west. These pulses are followed by an increased availability of baitfish and squid and, later, larger predators (e.g. dolphin, tuna, sharks). These productivity pulses are highly variable within and between years, with a tendency to be associated with La Niña years.

This episodic enhanced production manifests itself through the concentration of many species along the shelf edge, in turn causing sporadic aggregations of predatory species. Highly transitory, higher order predators which normally forage in other systems such as tuna, school and whaler sharks, seals and dolphins. Seabirds are attracted to the area by the ephemeral blooming of shelf edge plankton communities and they then track the food chains associated with these pulses of productivity as they move through the system. Other species caught by fishers may also be responding to these events (e.g. leatherjackets, latchets, stingrays, stingarees, gummy shark and angel shark).

Meso-scale eddies - Enhanced productivity; feeding aggregations.
The Kangaroo Island Pool and Eyre Peninsula upwellings are known to be associated with seasonal aggregations of marine life. The nutrient-rich upwellings enhance the production of plankton communities supporting seasonal aggregations of krill, small pelagic fish and squid which in turn attract marine mammals (e.g. toothed whales, dolphins and New Zealand fur seals), sharks, large predatory fish and seabirds.

Cetaceans
Cetaceans found in the South-west Marine Region include both inshore and offshore species as well as a mix of Southern Ocean species (for example, blue whales, southern right whales, and southern right whale dolphins) and species associated with warmer tropical waters (for example, short-finned pilot whales, and striped and spinner dolphins). Use of the Region's marine habitats and resources varies broadly among cetaceans. Some species are rarely sighted in the Region, others migrate annually from Antarctic waters into the Region while others are found throughout the year and are thought to be permanent residents of the Region.

Important feeding areas, calving areas and resting areas have been identified for cetaceans listed as Threatened or Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Some of these areas are within the South-west Marine Region, while others are under the jurisdiction of the South Australian Government.

The important areas identified for cetaceans listed as Threatened or Migratory that are adjacent to AMS area are:

- Head of the Bight – This area is of particular significance for southern right whales, and is one of the main calving areas in South Australia.
- Waters to the south of Kangaroo Island – This area is a feeding area for pygmy blue whales, fin whales, sperm whales and possibly sei whales.
- Fowlers Bay – This is one of the main calving areas for southern right whales in South Australia.
- Encounter Bay – This is one of the main calving areas for southern right whales in South Australia.

Pinnipeds
There are two otarid (fur seals and sea lions) pinniped species listed under the EPBC Act that have breeding sites in the South-west Marine Region – the Australian sea lion, and the New Zealand fur seal. Most of the population is found in South Australia. The species 'hauls-out' (or rests) and breeds on rocks and sandy beaches on the sheltered sides of islands, although there are some small colonies on the Australian mainland. Australian sea lions feed on the continental shelf in the Region, most commonly in depths of 20-100 m. They appear to be mainly benthic foragers and eat a wide variety of prey including fish, small sharks, invertebrates (such as rock lobster), cephalopods (octopus, squid, cuttlefish and nautilus) and occasionally seabirds.

New Zealand fur seals breed in the Region on rocky islands off South Australia and the southern coast of Western Australia. More than 80% of Australia's population of New Zealand fur seals occurs in South Australia. New Zealand fur seals feed at the surface to depths generally not exceeding 200 m and eat mainly fish and cephalopods. Lactating female New Zealand fur seals feed predominantly in mid to outer continental shelf waters. The males feed in deeper waters of the continental shelf, while juveniles forage in oceanic waters.

There are a number of breeding sites for both Australian sea lions and New Zealand fur seals on islands along the GAB coastline. The survey area is approximately 40 km from the nearest breeding colony, which occurs in the islands within the Investigator Group to the west of the Eyre Peninsula.

Sharks
Three species of sharks found in the Region are listed under the EPBC Act: the white shark; the Grey nurse shark – west coast population; and the whale shark. Important nursery and feeding areas in the Region have been identified for white sharks. These areas are located in both waters of the South-west Marine Region and in coastal waters under the jurisdiction of the South Australian Government.

The following areas are known to be particularly important for white sharks:

- The inshore waters of the Great Australian Bight – Small juvenile white sharks (under 2 m) are commonly encountered in this area. It is presumed that the apparent abundance of small white sharks in this area is due to pupping in this area or nearby.
- Head of the Bight – Movements of white sharks are known to increase seasonally at the Head of the Great Australian Bight and may be linked to the seasonal availability and movements of prey including snapper, gummy sharks and Australian salmon, and to the calving of southern right whales.
- Pinniped colonies – Evidence suggests that these are areas where white sharks can aggregate or frequently revisit to feed and are most likely areas of habitat critical to the survival of the species.

Seabirds

Of the 38 seabirds known to occur in the Region, 22 are listed as threatened and/or migratory under the EPBC Act. These include species of: albatrosses, petrels, shearwaters, noddies and terns. Important feeding areas for seabirds are identified in the South-west Marine Region and important rookeries are identified in areas under the jurisdiction of the South Australian Government. The important areas identified for seabirds include some inshore islands and coastal locations which are listed below:

- Eyre Peninsula – nesting area for ospreys and white-bellied sea eagles.
- Kangaroo Island – nesting area for ospreys.
- Lewis, Hopkins and Williams Islands (near Cape Catastrophe) – rookeries for short-tailed shearwaters.
- Greenly Island – rookery for short-tailed shearwaters.
- Investigator Group – rookeries for short-tailed shearwaters.

Socio-Economic Environment

There are currently five fisheries in the Region managed solely by the Australian Government and one managed jointly with the Western Australian Government. Fisheries managed solely by the Australian Government are active within Commonwealth waters. The jointly managed Demersal Gillnet and Longline Fishery operates in both Western Australian and Commonwealth waters.

Southern Bluefin Tuna Fishery

The Southern Bluefin Tuna (SBT) Fishery in the Great Australian Bight is largely concentrated as a live-capture purse seining operation in an area on and near the shelf break to the south-west of Ceduna. For this purse seine fishery, fishing for grow out farms located in and around Port Lincoln in South Australia occurs from January to March. The area targeted for tuna live-capture is within the survey area for the AMS, and there may be the potential for some interference with commercial spotter aircraft, which are used to spot schools of tuna at the surface and direct the purse seine vessels in towards the schools.

CSIRO Stock Assessment Aerial Survey

The index of juvenile SBT abundance is based on an annual scientific aerial survey in the GAB. The aerial survey was conducted in the GAB between 1991 and 2000, but was suspended in 2000-01 due to logistic problems of finding trained, experienced spotters and spotter-pilots. In 2005 and 2006, a full scientific line-transect aerial survey in the GAB was re-established, and this survey is now flown annualy between January and March. The survey area lies between 128°E and 135°E, running from the coast to just off the continental shelf. Fifteen north-south transect lines are searched by the observers. A complete replicate of the GAB consists of only 12 lines divided into 4 blocks, and the blocks are flown from west to east. Transects are flown at 120 knots and at an altitude of 1,500 ft.

Shipping

Ships transit through the Region on the way to and from Australian ports adjacent to the Region, the eastern seaboard of Australia and overseas destinations. In 2004, the total number of commercial voyages within/through the Region was 3,861.

Marine Protected Areas

There are no South Australian marine protected areas (MPAs) within or adjacent to the airborne survey area. The nearest state-managed MPAs to the survey area is the Neptune Islands Conservation Park, which is located south east of Port Lincoln in South Australian waters. This MPA is located approximately 90 km from

the survey area.

The Great Australian Bight Marine Park (Commonwealth Waters), declared in 1998, is currently the only Commonwealth marine reserve within the Region. The park, including its South Australia State waters components, stretches from 200 km west of Ceduna in South Australia along the coast to the Western Australian border (**Figure 1**). The park is managed cooperatively by the Australian Government and the South Australian Government.

A proportion of the proposed AMS will overlap the Benthic Protection Zone (BPZ) of the park. As shown in **Figure 1**, a number of flight lines cross the BPZ, in water depths ranging from approximately 200 to 4,000 m. The nearest flight line within the BPZ is located at least 195 km from the Marine Mammal Protection Zone of the Park (**Figure 1**). No regulatory approvals are required under the EPBC Act, or the Management Plan for the Great Australian Bight Marine Park (Commonwealth Waters), as the AMS has been defined as a 'commercial activity', rather than a 'mining operation'.

Defence Activities

There are no Military Training Areas or Exercise Areas within or immediately adjacent to the survey area. The closest Military Training Area is located between Cape Spencer and Kangaroo Island, approximately 120 km from the proposed AMS area.

MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

All aspects of the AMS have been subjected to risk analysis, which has been used to evaluate the potential environmental risks and effects, and characterize risk likelihood and severity. **Table 2** summarises the risk analysis for the key aspects of the survey.

Given the distance offshore, the water depths, and the absence of sensitive environmental resources within or adjacent to the survey area (e.g. pinniped haul out sites, seabird breeding colonies), and the management requirements for all environmental aspects of operations, the risk of significant adverse environmental effects from the proposed Airborne Magnetic Survey in the GAB is low. Potential interference with the CSIRO stock assessment aerial survey for SBT will be managed via ongoing, daily communication with the CSIRO aerial survey Project Manager and survey aircraft pilots and spotters (see below).

MANAGEMENT APPROACH

The environmental management approaches relevant to key aspects of the airborne magnetic acquisition programme are summarised in **Table 2**. The Fugro Airborne Magnetic Survey will be conducted in accordance with all legislative and regulatory requirements, to the satisfaction of the Designated Authority (PIRSA). Fugro's overall environmental objective for the programme is to avoid or minimise environmental risks to levels as low as reasonably practicable (ALARP).

Table 2: Summary of Environmental Risks and Management Approach for Key Aspects of the Airborne Magnetic Survey

Hazard/ Incident	Potential Hazard Consequence	Risk and Management Approach
Disturbance to marine fauna	Cetaceans - behavioural reactions (diving, increased dive times). Disturbance to pinnipeds. Disturbance to seabirds.	Low risk. Maintain 150 m altitude for flight lines within survey grid. Low altitude flying to take place only within survey area, apart from test lines outside the survey area, which will be performed up to twice daily at survey height (150 m). Flight path planning outside survey area to avoid inshore locations regarded as critical habitat for: • cetaceans (e.g. Head of the Bight, waters west of Kangaroo Island, Fowlers Bay, Encounter Bay); • sea lions and fur seals (e.g. the islands within the Investigator Group to the west of the Eyre Peninsula); and • seabirds (e.g. Eyre Peninsula, Kangaroo Island, Lewis, Hopkins and Williams Islands (near Cape Catastrophe), Greenly Island, Investigator Group).
Interference with shipping activities	Interference to commercial shipping operating in the vicinity of the survey areas or surrounding waters.	Low risk. Maintain 150 m altitude for flight lines within survey grid. Low altitude flying to take place only within survey area, apart from test lines outside the survey area, which will be performed up to twice daily at survey height (150 m). Measures taken to avoid flying directly over vessels, if possible
Interference with commercial fishing activities	Interference to commercial fishing vessels operating in the vicinity of the survey areas or surrounding waters. Interference to spotter aircraft operating in the SBT (Southern Bluefin Tuna) purse seine live capture operation. Interference with the survey aircraft conducting the CSIRO annual SBT stock assessment survey. Behavioural effects in SBT schools so that they are not detected by the CSIRO aerial survey.	Medium to high risk. Maintain 150 m altitude for flight lines within survey grid. Low altitude flying to take place only within survey area, apart from test lines outside the survey area, which will be performed up to twice daily at survey height (150 m). Adherence to air traffic control requirements to minimise interactions with SBT spotter aircraft. Consultation with fishing industry bodies and individual companies prior to airborne survey commencing, to inform them about the location of survey area, timing and nature of operations. Daily flight planning meetings/discussions with CSIRO aerial survey project manager and pilots/spotters in Ceduna to ensure maximum spatial and temporal separation between their transect lines and AMS flight lines. Measures taken to avoid flying directly over vessels, if possible.
Fuel spills	Acute toxicity effects on marine fauna such as pinnipeds, fishes and seabirds from spills of aviation fuel on to the sea surface.	Low risk. Aircraft to be re-fuelled only in designated re-fuelling locations at airports. Fuel spill contingency procedures are in place and operational. Any significant spills (>80 L) are reported to the relevant personnel within PIRSA Petroleum Division.

CONSULTATIONS

Consultation regarding the proposed AMS has been undertaken with stakeholder groups within the commercial fishing industry in South Australia. The following organisations have been contacted and informed of the proposed operations:

- Australian Fisheries Management Authority (AFMA);
- Commonwealth Fisheries Association (CFA);
- PIRSA Fisheries Division;
- South Australian Research and Development Institute (SARDI);
- Wildcatch Fisheries SA;
- Australian Southern Bluefin Tuna Industry Association (ASBTIA);
- Great Australian Bight Fishing Industry Association (GABIA); and
- CSIRO Division of Marine Research.

These consultations indicated that there were initial concerns from ASBTIA and CSIRO that the proposed AMS could impact on the annual CSIRO stock assessment aerial survey for SBT, either via direct interference with their survey aircraft flying in the same area at the same time, or indirectly via the Fugro aircraft scaring tuna schools away for the surface such that they could not be detected during the CSIRO survey.

There was detailed discussion of these aspects with ASBTIA and CSIRO, face-to-face and via telephone and email. Following this consultation and the exchange of further information both organisations confirmed that the Fugro AMS should not present any issues for them, apart from the logistical and air-safety issues associated with ensuring that there is spatial and temporal separation of the areas being surveyed by the respective planes between January and the end of March.

There will be ongoing consultation with the CSIRO Division of Marine Research immediately prior to the commencement of the AMS, and during the survey itself. This will be on a daily basis between the Fugro AMS Project Manager and the CSIRO aerial survey Project Manager, as well as between the pilots of the respective survey aircraft, in Ceduna and Port Lincoln.

FURTHER DETAILS

For further information about the Fugro Airborne Magnetic Survey in the GAB, please contact:

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