DESKTOP ANALYSIS

AND

RECOMMENDATIONS ON THE

PHASE 1 PRE-DISTURBANCE SURVEY

OF THE AREA DESIGNATGED FOR

SOUTH AFRICAN SEA AREAS

PROSPECTING LICENCE 7b

Compiled for Concession Holder:

DE BEERS CONSOLIDATED MINES LTD

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INTRODUCTION

This study was commissioned to assess the maritime archaeological potential of South African Sea Area (SASA) Diamond Concession 7b. It forms part of the Environmental Management Plan submitted to the Department of Minerals and Energy by De Beers Consolidated Mines LTD (DBCM), and was requested by the South African Heritage Resources Agency (SAHRA) before physical exploration in the area commences.

The study aims to establish the possibility and probability of archaeological material being present on or under the seabed of the prospecting area. It includes a description of the area and discusses the environmental and historical factors which would have contributed to the occurrence of archaeological sites and material. The various categories of archaeological material which may be affected by the exploration program are discussed and a list of known shipwrecks in the area is included.

De Beers Marine's current survey strategy and equipment is discussed in terms of how effective it would be in locating unknown shipwrecks and maritime material, as well as the measures that should be taken if any cultural material is found during survey and mining operations. The information would hopefully contribute to the prevention of damage to both sensitive cultural material and valuable exploration equipment.

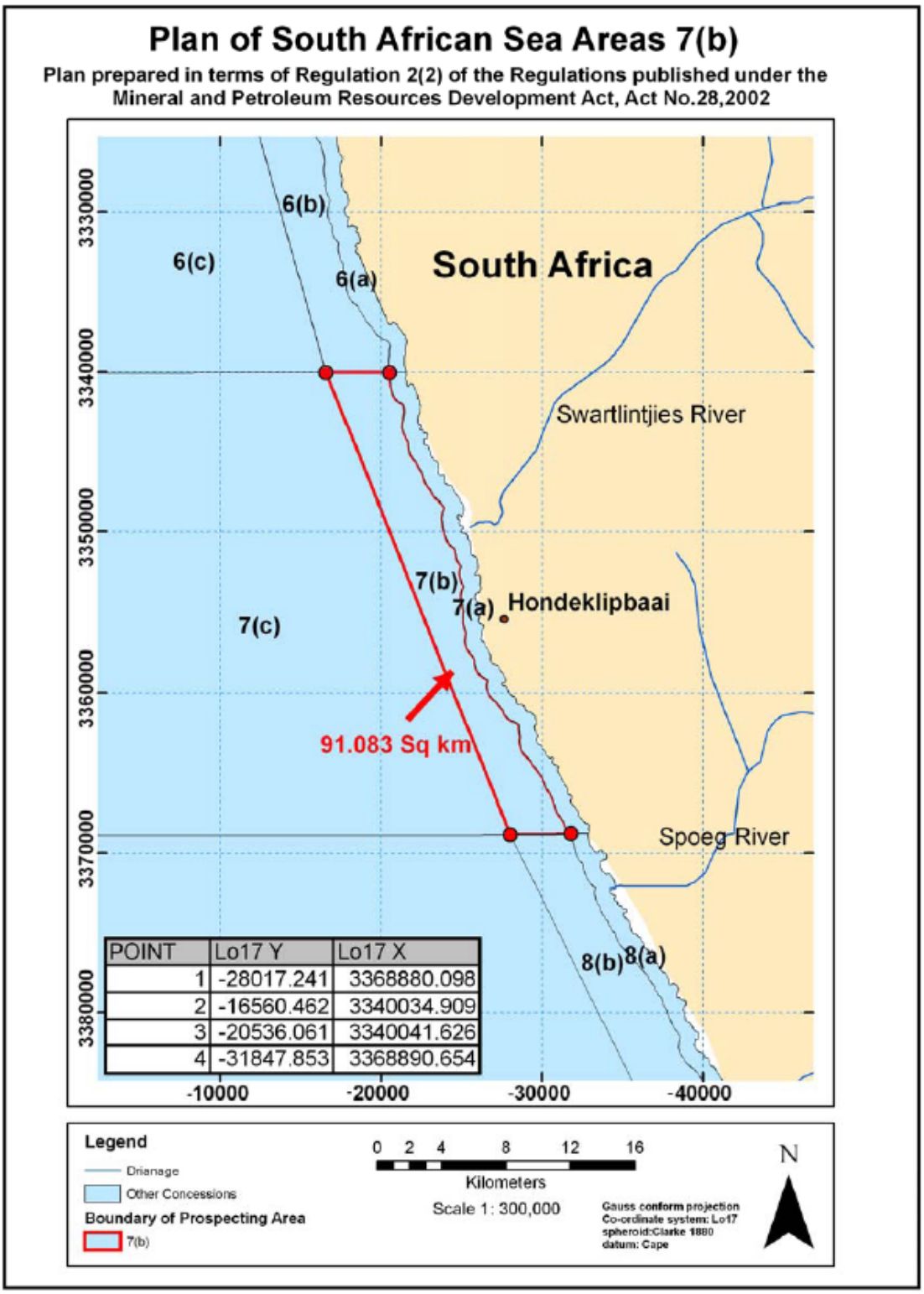

Figure 1. Plan of South African Sea Areas 7b (from Roos 2006)

ENVIRONMENT AND HISTORY

1. Location of Concession Area 7b

Concession SASA 7b is situated offshore, in the vicinity of Hondeklip Bay in the Northern Cape Province and spans an area of 91,083 km². It shares a common boundary with SASA 7c, 6b, 7a and 8b. The area lies 5km from the coast and stretches seaward from a depth of approximately 30m below mean sea level to approximately 120m below mean sea level (Roos 2006). The northern boundary is approximately 19km North of Hondeklip Bay and the southern boundary approximately 14km South of Hondeklip Bay.

2. Environment

The concession area is situated next to the Namaqualand coastal region, a sparsely populated semi-desert environment with average rainfall of less than 200 mm annually, with some areas less than 100 mm - although coastal fogs deliver additional moisture. Winds vary seasonally with predominantly S-SE winds in summer and W-NW winds in winter. Wind direction and strength are governed by the interaction between the south Atlantic anticyclones, mid-latitude cyclones and the pressure field over the subcontinent (Penny 2005). In summer temperatures can reach up to 40 degrees Celsius although the immediate coastal region is protected from extreme temperatures by cool air and morning fog from the sea. Winter temperatures are between 25 and 30 degrees Celsius, while night temperatures are usually much colder. The region is characterised by sandy soils which supports scrubby strandveld vegetation. Although adapted to the extreme temperatures and limited moisture the vegetation is sensitive to disturbance.

The occurrence of the cold Benguela current, flowing northwards along Southern Africa's West coast is the main factor determining the climate, vegetation and sea life of the area. The current delivers cold nutrient rich water from Antartica. Southerly and South Easterly winds cause an upwelling of the Benguala's nutrient-rich seawater, the catalyst for the marine environment's high biological productivity. The upwelling off Hondeklip Bay has some of the highest concentrations of phytoplankton and zooplankton on the Southern African coast (Sparks 1996). Although relative few in species, blooms of phytoplankton and extensive kelp bed, supports very high densities of hake, anchovy, pilchard and rock lobster which in turn supports a large fishing industry as well as seal and seabird colonies (Coastal Management Policy Programme 1998). Kleinzee north of Hondeklip has the largest seal colonies in South Africa.

Water depth in concession area 7b varies between 30m below mean sea level on the eastern boundary to 120m below mean sea level on the western boundary. Up to a depth of 65m the seabed typically comprises wave-scoured rocky platforms, mainly attributed to sediment disturbance by powerful storm surges during winter months.

Between 65m to 105m the seabed is smooth and relatively featureless consisting of unconsolidated marine muds, sands and gravels. (Roos 2006).

Palaeo Environments
Since the Last Interglacial, roughly 125 000 years Before Present (BP), significant sea level fluctuations took place along the South African west coat, mainly due to worldwide eustatic fluctuations caused by the expansion and contraction of the polar icecaps. The consensus is that the Last Interglacial sea level was about 6m above the present. The presence of warm water mollusca indicates that minimum water temperatures on the west coast were 4-6 degrees Celsius warmer than at present and did not fall below 18 degrees Celsius. There is further evidence of warm and dry conditions, with minimal surface run-off, during this period based on analysis Calcium-gypsum-halite evaporates found near Elands Bay on the west coast (Deacon and Lancaster 1988). During the much colder conditions of the Last Glacial Maximum (LGM), roughly 18000 years BP, sea levels had retreated to 110 - 130m below present sea level. A large area of the continental shelf zone was exposed allowing extensive incision of river valleys. Since the LGM sea levels rose to 2-3m above present levels at 5-6000 years BP before retreating to the current sea level (Woodborne 1989)

Historical Background

1. Pre-colonial

Despite the dry and harsh conditions of the region the Archaeological Contracts Office has documented literally thousands of open-air archaeological sites along the Namaqualand coast. Most of the sites are shell-middens from Late Stone Age cultures, however some sites could be described as Middle Stone Age based on artifact typology, and a small selection of Early Stone Age artifacts have also been found. Initial studies on the distribution of these sites revealed that groups were not necessarily selecting obvious landscape features, such as rivers and rock shelters, for settlement sites. There is no difference between the number of sites in dry areas and those along water courses. This indicates that the west coast inhabitants had successfully adapted to survive in a harsh environment and had a keen knowledge of how to exploit the available faunal, floral, and water resources. There does seem to be preponderance for mid-Holocene sites to be situated within large sand dune plumes close to rocky bays. These people probably found shelter from winds among the dunes while the rocky areas provided access to marine food sources (Dewar et al. 2005).

No evidence have been found that pre-colonial inhabitants of the area made use of seagoing crafts or vessels. Seals, sea birds, stranded whales, fish and shellfish were hunted, netted, scavenged or collected along the shore and shallow water areas. Spoegriver Cave, 30 km south of Hondeklip Bay, is especially important as it contains some of the earliest evidence for domestic sheep in South Africa, providing valuable information on the origins and dispersal of Khoikhoi herders from Botswana. The site

dates to 2100 year BP and, although 2 km from the sea, the bulk of the deposit consist of vast amounts of mussel, limpet and crayfish remains along with seal bones (Webley 1995).

The relatively fewer Early and Middle Stone Age sites could be attributed to being older and thus more likely to have been destroyed, and/or a lower population density. Sea level fluctuations might also have played a role in their destruction, and preservation, of archaeological sites. As the sea offered the most stable source of food in the region some groups of hunter-gatherers would have stayed close to the coast as sea levels retreated after the Last Interglacial. A large section of the south western continental shelf was exposed during and around the LGM when sea levels retreated to roughly 110m below present levels. After the LGM numerous sites would thus have been scoured away by wave action as sea levels crept back towards the present coast line. The only evidence for these sites are likely to be bones and stone tools washed among alluvial diamond gravels.

2. Colonial – Hondeklip Bay

In 1685 Simon van der Stel, VOC governor of the Cape of Good Hope, found rich deposits of copper during an expedition through Namaqualand. He was led by reports form early explorers that the indigenous Khoi people of the area were mining copper ore at ‘Koperberg’(Copper Mountain) an area today called the O’okiep Copper District.

Figure 2. Simon van der Stel’s camp in the Copper Mountains, Namqualand (1685)

Unable to find a suitable harbour from which to transport ore to the Cape 158 years passed before copper mining was started in 1843. Pioneer miners attempted to transport ore by ox wagon, or by boat from the mouth of the Orange River. Due to isolation and the harsh environment these attempts were not profitable and miners

became increasing despondent. In 1846 ship's captain Thomas Grace discovered a small natural harbour between the Swartlintjies and Spoeg Rivers. He named the place 'Hondeklip Bay', inspired by a large rock resembling a dog. In 1852 the first copper ore was shipped by the Bosphorus from the new settlement of Hondeklip Bay to Wales (Hough 2006).

By 1862 operations had grown to such extend that Hondeklip Bay was declared a magisterial district mainly to safeguard the property and merchandise in the bay. In 1865 a visitor to Namaqualand described the settlement:

'Hondeklip is a loose, straggling place on a low sandy beach. It appears from the sea larger than you would expect, and longer than it is. The houses are of one storey; but the huge stacks of copper ore and of fuel quite overtop them, rising to a height of thirty or forty feet, and of such odd shapes that the stranger is rather puzzled to know what they are…'

Figure 3. Hondeklip Bay -1863 - sketch made by Charles Stuart Pillans.

The copper ore was transported on rough trails roads through the mountains and over the sandy coastal plain to Hondeklip Bay by ox-wagon. Between 1867 and 1871 there was an attempt to construct a road with the use of prisoners shipped from Cape Town. Work on the road was abandoned when it was decided to use Port Nolloth as the preferred harbour for transport, partly due to the scarcity of fresh water at Hondeklip Bay. The completion of the first section of the Cape Copper Mining Company's railway line between Port Nolloth and Muishond caused a rapid decline in the size and economic life of Hondeklip Bay – between 1873 and 1875 the population dwindled from 200 to 103. By 1877 Hondeklip Bay lost it status as separated magisterial district and only operated as a small harbour for shipment of agricultural produce to Cape Town and to support the local fishing activities (Hough 2006).

Figure 4. Hondeklip Bay circa 1920 (Photographer unknown)

In 1925 a crayfish and white fish factory was establish which continued to be the main source of income for local inhabitants until diamond operations was commenced in 1970. 1925 was also the year when diamonds was found in marine terraces at Kleinzee, just North of Hondeklip Bay. Even though the Cape Coast Exploration Company bought out all diamond prospects in Hondeklip Bay in 1927 no large-scale diamond mining took place until 1980.

3. Maritime – West Coast

Details on the early maritime history off the Namaqualand coast is sketchy at best. As far as we know the Portuguese explorer Vasco Da Gama was the first to sail past the Namaqualand coast, without seeing it, before reaching St Helena Bay in 1497. Marine resources such as fish, seals, whales and guano was what eventually drew maritime traffic to or through the area.

As the market for whaling products started to grow in 17th century Europe, French, Dutch, American and English whalers entered west coast waters. By 1791 a fleet of 32 British ships were operating from St Helena Bay catching over 1200 whales over a two year period. The apex of whaling on the west coast took place during the 19th century as whale blubber provided the oil for lubricating the machinery of the Industrial Revolution before petroleum based lubricants were manufactured. During the Victorian era the baleen plates of whales were used to make brushes, corset stays, collars and umbrellas (Avery 1998).

Before Jan van Riebeeck settled the Cape Colony for the VOC in the mid 17th century, French sealers were already undertaking regular sealing expeditions to the western Cape coast. Early Dutch sealers quickly destroyed most of the sealing colonies close to Cape Town causing American and British sealers to became active on the west coast during the late 18th and early 19th centuries.

By the 1830's Europe realized the value of guano as fertilizer. In 1843 the first consignment of guano was shipped from Ichaboe Island off Namibia. The industry developed quickly and several islands of South Africa and Namibia were mined for guano. By 1843 up to 450 guano trading vessels were reported at Ichaboe Island alone (Shaughnessy 1984).

As far as the immediate area surrounding Hondeklip Bay is concerned, local and large scale fishing, the 19th century shipping of copper, and the shipment of agricultural products attributed mostly to marine traffic and wreck incidents.

FINDINGS

1. Pre-colonial Remains

We know that sea levels fluctuated significantly during at least the past 125 000 years and 18000 year BP the sea level was at least 110m lower, exposing most of the area now included in SASA 7b . Coupled with the fact that there are thousands of archaeological sites along the Namaqualand coast spanning the Early-, Middle and Late Stone Age most of them with evidence for the exploitation marine food sources it would be logical to assume that terrestrial archaeological sites did occur in SASA 7b. However the chances of these sites being preserved is very slim. Stone artifacts from these sites might be present among alluvial gravels, although the screening processes during sampling and mining operations might exclude them from being found. Thus chances of finding pre-colonial archaeological material, though valuable from an archaeological perspective, is slim.

2. Shipwrecks

Of the 17 known ships wrecked in the vicinity of Hondeklip Bay most have drifted onto rocks on or near the coast or have grounded on to the sand bar near Hondekilp Bay – these wrecks are not within SASA 7b (SAHRA Shipwreck Database 2006, Cumming et al. 1961). Only the approximate position of the Rachel (1854), Maria Smith (1858), and Marsden is uncertain, although these ships might lie within the mining area they are most likely closer to shore. Unknown wrecks could be in the area.

3. Other Maritime Related Material

The area was frequented by vessels from both the local and regional fishing industry, as well as merchant vessels transporting ore and agricultural products and general

trade goods. Maritime traffic from the sealing, whaling and guano industries was also likely due to the relative proximity of those marine resources. There is thus high probability of flotsam and Jetsam being present in the area. A drawing and description of an anchorage (see plate 4, below) was drawn by C. S. Pillans (1863), describing an area 2 miles offshore (presumably nautical miles, thus 3.7km) from Hondeklip Bay in 20 fathoms of water. One fathom roughly equals 6 feet, thus 37 metres (see figure 5).

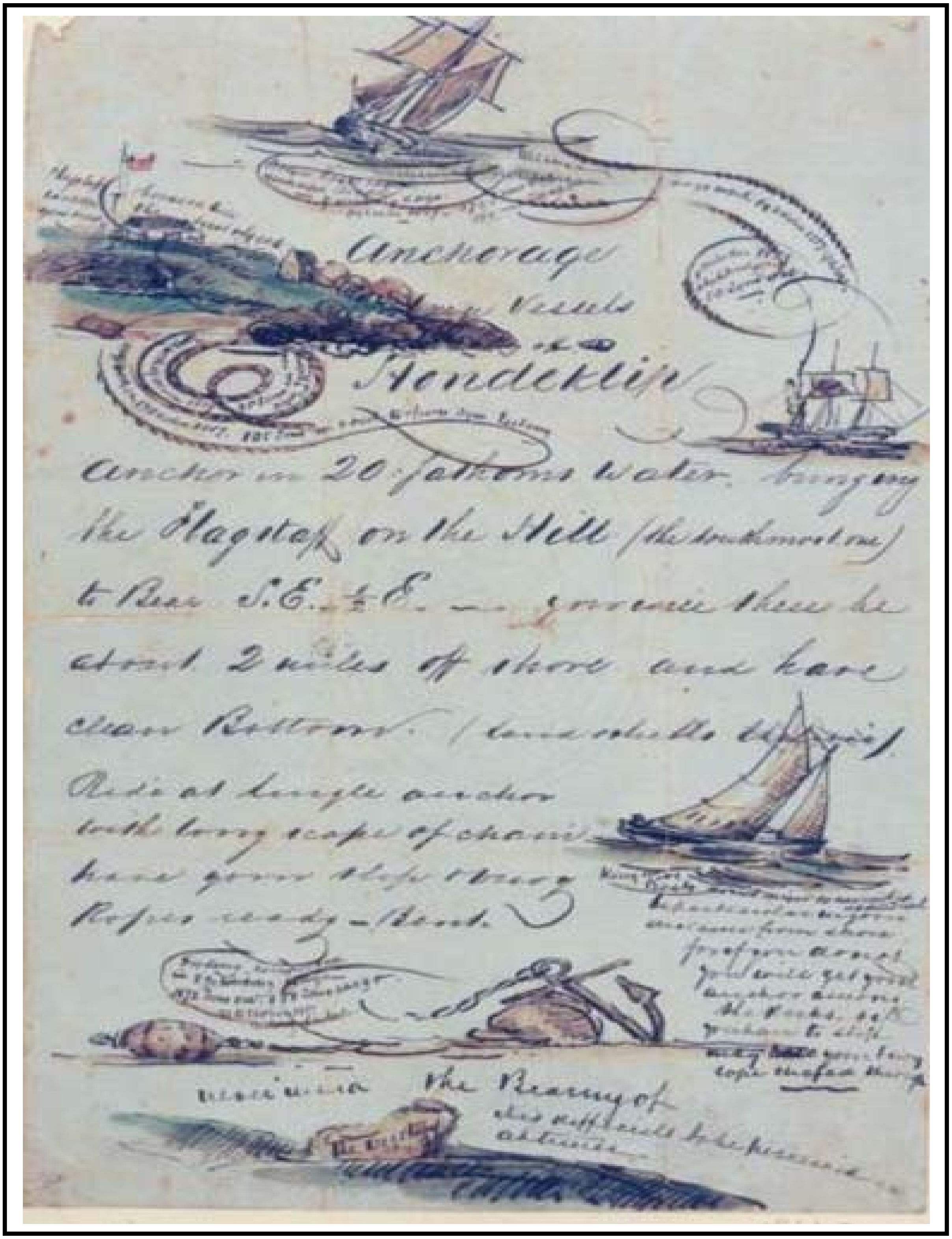
Anchorage
Vessels
Hondeklip
Anchor in 20 fathoms water, bringing
the Flagstaff on the Hill (the southmost one)
to Bear S.E.½E.
about 2 miles off shore and have
clear Bottom.
Ride at single anchor
with long scope of chain
have your slip strong
Ropes ready – Boat.

Figure 5. Anchorage for large vessels at Hondeklip Bay C. S. Pillans

Table 1. List of Shipwrecks in the Hondeklip Bay area.

Ship Name	Place	Event Type	Type	Year Wrecked	Notes
Volunteer	Espiegle Rock	Wrecked	Schooner	1869	No lives lost.
Robert Brown	Hondeklip Bay	Grounded	Schooner	1867	Went in shore at Hondeklip in NE corner of Bay. Captain had to beach her.
Rachel	Hondeklip Bay	Foundered	Schooner	1854	
Queen	Bar	Wrecked	Schooner	1882	The Gov. Gazette notice for 1880 has the skipper listed as Garcia, and the vessel registered in Cape Town. She is listed as carrying a cargo of grain.No lives lost. The 1882 Gazette notice mentions that the Queen was cleared to leave Cape Town, bound
Natal	Espiegle Bay (west of)	Wrecked	Schooner	1852	Wrecked west of Espiegle Bay in a south easterly gale. No lives lost.
Marsden	Hondeklip Bay				
Maria Smith	Hondeklip Bay		Cutter	1858	
Maria	Hondeklip Bay	Grounded	Cutter	1862	Grounded on bar.
Luna	Off / near Hondeklip Bay	Wrecked	Coaster	1945	The vessel was originally owned by the Stephan Brothers, who sold her to J Clare Burt of Cape Town. She was subsequently acquired by Dart & Howes and used on the West Coast run, carrying general cargo, including mining equipment, to the desert coast.
Jonquille	Jonquille Rock		Schooner	1866	Wrecked. No lives lost.
Gambia	Hondeklip Bay			1871	
Espiegle	Espiegle Rock	Wrecked	Schooner	1852	According to Jobling, the vessel was wrecked in Espiegle Bay in a south-westerly gale. No lives were lost.
Diligence	Hondeklip Bay	Wrecked	Schooner	1863	Wrecked on the rocks at Hondeklip Bay after becoming becalmed.
Clipper	Hondeklip Bay	Wrecked	Schooner (Coasting)	1873	Wrecked on the rocks in an easterly wind when leaving the bay. Date = 22 February 1873. Left Hondeklip on morning of 23rd in a light easterly wind drifted on to rocks and became total wreck.
Catherine Marie	Bar	Wrecked	Schooner	1892	Stranded on the bar after her cables parted. Became a total loss.
Aristea	8 cables SSE of Platklip Point	Wrecked	Trawler	1945	4.8 km south of Hondeklip Bay Wreck still visible in 1992 - Van der Bosch Latitude 30.20.94S Longitude 17.16.75E Her dimesions were: Length = 38,36m,Beam = 7,16m,Depth = 3,9m
Jahleel	Hondeklip Bay	Wrecked	Diamond Vessel ?	2003	Sunk in Hondeklip Bay in 2003 after her moorings broke.

Compiled from SAHRA Shipwreck Database 2006 and Cumming et al 1961.

Notes:
1. The positions of the Rachel (1854), Maria Smith (1858), and Marsden are uncertain but like the other vessels on the list most likely close to shore and NOT in SASA 7b.

2. There is a legend of a pirate ship called ‘Yankee John’, wrecked on a reef of that name off Hondklip Bay. However 'Yankee John's rock' is also mentioned during the Captain's evidence after the sinking of the SS Namaqua in Port Nolloth (1889). There seem to be confusion over the location (Hough 2006).

PHASE 1 SURVEY

A phase 1 archaeological survey to locate possible cultural remains must be concluded before destructive development or mining activities commences in an area. The survey includes:

- A magnetometer survey along a pre-determent survey grid. The grid spacing should ideally be not wider than 20 metres to assure most anomalies are registered on the equipment. Although several types of remote sensing equipment can be successfully used depending on seabed and sediment profiles, a magnetometer survey should be included because of its ability to register ferrous metals in most environments.

- Positions of targets should be recorded with differential GPS positioning.

- Where water depth allows it all anomalies identified will be inspected visually through diver searches.

- The seabed will be visually inspected to gather information regarding bathymetry and sediment nature.

- Any archaeological sites or material will be documented and mapped

- The survey and desktop study data will be combined to produce a set of recommendations that can be submitted to the relevant authorities during permit and permission applications. The data will be used to produce a set of recommendations and mitigation measures for use during development.

De Beers Marine (Pty) LTD is in the fortunate position of operating a variety of state of the art remote sensing survey equipment, as well as having access to highly skilled technicians which they deploy during their normal exploration surveys. The survey for potential archaeological material will thus be done by De Beers during their reconnaissance and detail surveys of SASA 7b. It should be noted that the whole area will not be surveyed, but only certain geological areas previously identified through desktop studies.

SURVEY PROCEDURES AND EQUIPMENT

The survey strategy De Beers will follow in 2007 have not been finalised at time of writing (July 2006), but would include the following procedures and equipment:

1. Reconnaissance Surveys.
Through desktop exploration programmes certain geologically specific targets will be identified for initial reconnaissance surveys. Spacing between survey lines will be 200 metres (Correspondence between L. Roos and L. Ricketts 2006).

2. Detailed Surveys.
Selected areas identified through the reconnaissance surveys will be further surveyed using a narrower grid spacing of 25m. The same equipment used during the initial surveys will be deployed but with higher resolutions to gather more detailed information (Correspondence between L. Roos and L. Ricketts 2006).

The survey equipment will include:

Swath bathymetry
Swath bathymetry systems emit sound waves from directly beneath a ship's hull to produce fan-shaped coverage of the seafloor. These systems measure and record the time elapsed between the emission of the signal from the transducers to the seafloor or object, and back again. Most measurements are at an angle to the bottom. Depth is determined from knowing the angle of emission from the transducer and strength of the signal returning to the ship.

Side scan sonar
Side scan sonar is the most commonly used for detecting shipwrecks lying on the seabed. Side scan sonar consists of three basic components: a towfish, a transmission cable and the topside processing unit. The towfish is dragged behind a ship near the seafloor where it transmits sound energy in the shape of a fan and receives echoes from the surrounding seabed. The strength of the return echo is recorded creating a “picture” of the seafloor where objects protruding create a dark image (return) and shadows from these objects are light areas (little or no return). Depending on the resolution small objects can be accurately located and measured. It is most useful to locate seafloor features and possible obstructions, but does not provide depth information (Klein 2002).

Certain frequencies work better than others, high frequencies such as 500kHz give excellent resolution (<10cm) but the acoustic energy only travels a short distance limiting the scan range to about 100m per channel. Lower frequencies such as 100kHz give relatively lower resolution but the distance that the energy travels is greatly improved being typically up to 300m range per channel. The side scan sonar will show any shipwreck or part of a wreck above the ocean bed.

Shallow and medium penetration Chirp seismic sonar
These are swept frequency sources capable of producing high-resolution imagery to a sub-seabed depth of roughly 20m in fine grained sediment. High-resolution chirp sonar has demonstrated its ability to detect shipwrecks buried beneath the seabed. Penetration does vary according to sediment type, with fine grained sand giving better penetration than gravels (Dix, J. et. al. 2003).

Magnetometer
A magnetometer is dragged inside a towfish housing behind a vessel. It collects information about the magnetic field of the area through which it travels. The earths

magnetic field acts as baseline for the instrument. Ferrous objects, with their own magnetic field, will distort the magnetic field of the surrounding area. The changes in strength are registered and plotted with GPS and presentation software to determine the anomalies' positions (Mavrodinov, N. 2005). The larger the metal object the stronger the distortion. Experience has shown that a magnetometer survey is the most reliable method to locate shipwrecks under the seabed (due to the metal content in most wrecks), and is least influenced by factors such as concretion of the wreck, seabed and sediment profiles (Clausen, C. J., Barto Arnold, J. (1976), Green, J (2002)). The SeaSPY magnetometer deployed by De Beers Marine makes use of the 'overhauser effect' – known for its accuracy.

CONCLUSIONS

Most, if not all shipwreck incidents near SASA 7b occurred on the coast, thus outside the area. There is however a possibility of unknown wrecks lying within the prospecting area. The probability of finding other maritime related material, such as nets, cables and anchors, within the prospecting area near Hondeklip Bay can not be discounted as it is the only natural harbour on that stretch of the coast and was used by both local and regional shipping.

The survey grid lines for archaeological assessments are usually 20m apart. De Beers Marine's reconnaissance surveys of SASA 7b, with 200m grid line spacing, can possibly miss maritime material in the area.

The detailed surveys with 25m grid line spacing, with the combined use of chirp seismics, side scan sonar, swathe bathymetry and a magnetometer will be sufficient to locate any shipwreck and most maritime related material present in the area. It is recommended that a magnetometer must be used when surveying the area as it has been proven to be most reliable way of locating shipwrecks

Should any shipwrecks, archaeological sites or historical material be found during survey or mining activities it should be noted that such sites and material are protected under the National Heritage Resources Act (Act No 25 of 1999) and that the following procedures should be followed:

- The position of the site should be documented as accurately as possible.

- The maritime archaeologist at the South African Heritage Resources Agency (SAHRA) head office in Cape Town should be notified.

- The Maritime Archaeology Unit of Iziko Museums of Cape Town should be notified.

- Mining in the immediate area of the find should be avoided to prevent damage until feedback from the relevant authorities were received.

The above report has outlined the baseline environment of the South African Sea Areas Prospecting Licence 7b. It has examined the historical and physical features of the area which would have influenced human activities and the distribution of potential archaeological sites and material. It is the conclusion of this report that based on historical research the likelihood of encountering shipwrecks and archaeological sites is low, and the equipment used by De Beer's Marine during their future surveys would be capable of accurately locating any unknown shipwreck in the immediate survey area.

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