

Appendix I

Environmental Impact Statement for the Proposed
Blacktip Gas Project Archaeology and Historic
Heritage prepared by Begnaze



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Archaeology and Historic Heritage

Prepared for: EcOz Environmental Services

Prepared by: Begnaze Pty. Ltd.

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DOCUMENT CONTROL:

Project number:	Wood0303
File ref:	Z:\OldServer\Documents\ecoz_projects\WOOD0303 - Blacktip\05 Archaeological and cultural heritage\Reports\Final\Blacktip Archaeology and Historic Heritage vFinal .doc
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EXECUTIVE SUMMARY

The consultant was engaged by EcOz Environmental Services to identify any archaeological and historic sites that may be impacted upon by the proposed development of the Blacktip Gas Plant and on-shore pipeline near Wadeye, Northern Territory. The report includes a description of the findings, and recommendations are made for the mitigation of any archaeological or historic sites that may be disturbed during the design, construction and operational phases of the project.

Background research was carried out to find any previously recorded archaeological and heritage sites in the area of the proposed development and in 2003 archaeological surveys were carried out over the areas that will be disturbed by the development. The surveys consisted of pedestrian transects over the Blacktip gas plant area and pedestrian and vehicle transects along the proposed pipeline alignment.

No previously recorded archaeological or heritage sites were identified in the project area. One archaeological site, Shell Midden 1, was located during the field survey. This site will be disturbed during the construction of the on-shore pipeline. No archaeological or historic sites or objects were located in the vicinity of the proposed Blacktip Gas Plant.

There are three recommendations for ensuring the protection of unidentified archaeological material during the construction stage of the on-shore pipeline. Firstly, an archaeologist should be present during the flagging of the pipeline alignment from the seabed to the proposed gas plant and full survey of the construction corridor should be undertaken. Secondly, before areas are selected for access roads, borrow pits etc, it is recommended that the predictive model developed in this report for the location and frequency of archaeological sites is used to avoid areas that have a high probability for the presence of archaeological sites, and all sites chosen should be surveyed by an archaeologist. Thirdly, it is possible that during the construction stage of both the on-shore pipeline and the gas plant subsurface archaeological material may be located. It is recommended that response mechanisms are set up to ensure that this material is protected.

As Shell Midden 1 has been attributed a high level of archaeological significance, the following mitigation procedures are recommended:

Design stage.

- *The pipeline should be located so that it leaves the seabed in the northern section of the beach so that it crosses the sand dunes at approximately 8425488N.*
- *The site should be formally recorded and described in detail by an archaeologist prior to any works being undertaken.*

Construction stage.

- *Permission is obtained from the Heritage Conservation Services NT to disturb the site only after a thorough recording of the site has been completed.*
- *The boundary of the pipeline alignment through the dune and midden site is fenced and no activity occurs outside this area.*

Operational stage.

- *The sides of the sand dune on either side of the pipeline are stabilised so that no further damage occurs through erosion.*
- *All appropriate personnel are notified of the site's location and all operations occur within the pipeline's boundary fences.*

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Figure 1 Location of archaeological site, Shell Midden 1.

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APPENDICES

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1. INTRODUCTION

This report describes the archaeological component of an environmental assessment for the proposed Blacktip Project that is located west of the town of Wadeye. As part of the environmental assessment a preliminary survey was carried out to define a suitable plant site near Wadeye and a 100 metre wide pipeline corridor from the plant to the coast, a distance of approximately 2kms. Included in this report are the findings of archaeological surveys made over the above areas, and assessments of any sites identified from previous archaeological research that may be impacted upon by the development.

To ensure that archaeological and historic sites and objects are not damaged or destroyed during the proposed development and are protected within the terms of the *NT Heritage Conservation Act 1991*, the aims of the archaeological and cultural heritage project are:

1. To develop a predictive model of the distribution of archaeological places and objects to guide the archaeological survey strategy for the on-shore gas plant and pipeline route.
2. To locate and record archaeological and historic objects or places.
3. To assess the nature, distribution and cultural significance of the materials within a regional, Territory and national context.
4. To provide recommendations for the management of particular archaeological or historic places or objects.
5. To provide recommendations for generalised mitigation procedures and management of prescribed archaeological places and objects.
6. To carry out mitigation and conservation strategies designed to minimise loss of heritage values to the Northern Territory.

This report is only a preliminary assessment as the archaeological survey was carried out prior to finalisation of the site layout. The aim for the 2003 survey team was to identify a 100 metre wide pipeline corridor within the already identified 10 kilometre wide corridor, and a location for the gas plant that is acceptable from the view of the potential impacts of the project on archaeological and historic heritage. Consequently the area surveyed by the archaeological team did not cover the entire project footprint.

2. HERITAGE LEGISLATIVE FRAMEWORK

2.1. Northern Territory legislation

There are two kinds of heritage sites protected under the *NT Heritage Conservation Act (1991)* that places legal constraints on owners of private property, local government and the Crown. These are:

- places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the Act; and
- prescribed archaeological places and objects that are protected under sections 29 and 39 of the Act.

It is an offence under the Act to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister or Minister's delegate.

2.1.1. Declared heritage places and objects.

To date there have been more than three hundred nominations to the Northern Territory Heritage Register, leading to the registration of more than 150 places. Categories which describe the status of each site on the Northern Territory Heritage Register database are listed in Table 1.

Table 1 Site status on the Northern Territory Heritage Register database.

Status	Description
D	Declared heritage place.
NR	Not recommended. HAC* determined that the place did not meet heritage assessment criteria and did not hold sufficient value to warrant declaration under the act.
RF	Refused by the Minister. HAC* recommended for declaration and minister refused to do so.
P	Proposed. HAC* has determined that the place warrants declaration under the Act but has not yet made its recommendations to the minister.
RV	Revoked. Declaration as a heritage place pursuant to Section 26(1) of the Act is revoked.
N	Nominated. HAC* has yet to complete its assessment of the heritage value of the place.

*Heritage Advisory Council

The Northern Territory Heritage Register contains places which have been recognized for a wide range of natural and cultural values. As a result it includes places specifically recognized as significant owing to their environmental characteristics (e.g. Alcoota Fossil Beds) and prehistoric sites (e.g. N'dhala Gorge). For the purposes of the current report, only places of historic or archaeological significance have been included.

2.1.2. Prescribed archaeological places and objects.

The NT Heritage Conservation Services, Department of Infrastructure Planning and Environment (DIPE) holds the Archaeological Sites Register. Listing on this register does not necessarily mean that a site is protected or holds legal significance under the *NT Heritage Conservation Act 1991*. Included in this register are the protected prescribed sites that consist of all archaeological sites and objects pertaining to the past occupation by Aboriginal or Macassan people.

2.2. Commonwealth legislation

The Commonwealth Government protects heritage sites under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Environment and Heritage Legislation Amendment Act (No 1) 2003*. There are two lists of protected heritage sites that may be relevant to this study. The lists are available on the internet at <http://www.deh.gov.au> and they are:

- *The Register of the National Estate* which consists of “...an inventory of places in Australia with aesthetic, historic, scientific, or social significance or other special value for present and future generations” (Pearson and Sullivan 1995:45). It represents a national database of places with significant Aboriginal, historic or environmental values.
- *The National Heritage List* that protects places of exceptional natural and cultural significance with penalties for any breaches. Approval by the Minister of Environment and Heritage is needed before any sites are disturbed.

2.2.1. Register of the National Estate

The Register of the National Estate database contains not only places that are registered but also places that have been nominated to the register and are yet to be assessed, as well as nominated places which have been rejected or removed from the Register of the National Estate (Table 2). Sites are divided into places of historic, Aboriginal or environmental significance. A total of 290 places of historic significance are listed on the Register of the National Estate database for the Northern Territory, of which approximately 150 are registered (February 2004). The entry of a place on the Register of the National Estate does not place any direct legal constraints or control over the actions of state or local government or private owners, but does impose other legal obligations.

Table 2 Site status on the Register of the National Estate database.

Status	Description
R	<i>Registered.</i> The place is listed on the Register of the National Estate.
ID	<i>Identified.</i> The Commission has formally considered the values of this place and decided that it should be publicly proposed for entry in the Register. The place is awaiting publication in the gazette and the press to give full effect to this decision.
RE	Removed from the Register or Interim List. The place has been removed from the Register or list via a public process that provides for the submission of objections.
IL	<i>Interim list.</i> The place has been publicly proposed for entry in the Register and the AHC may be awaiting objections, considering objections, or seeking other data before making a decision on whether the place should be entered on the Register proper.
IP	<i>Indicative place.</i> Data provided to or obtained by the Commission has been entered into the database and the place is at some stage in the assessment process. The AHC has not made a decision on whether the place should be entered into the Register.
D	<i>Destroyed.</i> The place has been destroyed before being assessed or listed.
REJ	<i>Rejected.</i> The AHC has assessed the place and found that it does not warrant entry in the Register in its own right.

While the database is large, relatively comprehensive and national in focus, individual site listings vary enormously in terms of the amount and the accuracy of information contained with them. Some site listings contain no information other than a site name and approximate location, while other listings contain inaccurate information or represent duplicate listings. Only places of historic or archaeological significance have been included in this current report.

2.2.2. National Heritage List

This list commenced on 1st January 2004, and as at April 2004 there were only two heritage or Indigenous sites recorded in the Northern Territory (being Kakadu National Park and Uluru-Katatjuta National Park). This will probably change as the Australian Heritage Council enters more sites onto the list.

3. ENVIRONMENTAL SETTING

There have been several archaeological studies in the Top End that have used environmental and archaeological data to predict the type and distribution of sites using factors such as climate, landforms geology, soils and vegetation. (Hiscock and Mitchell 1992, Hughes and Baker 1983, Heritage Surveys 1997, Gregory 1998, Guse 2001, Thorley 2002). The environmental setting of the onshore project area is described in this section along with a discussion of the implications for the distribution and visibility of archaeological and heritage sites.

The region is under the influence of the northwest monsoons, with a summer wet season and a dry winter from May to October. In the Wadeye area the average rainfall is approximately 1210 mm, most of which falls in the months of January and February (Aldrich et al. 1977). This can lead to severe flooding of the lowland areas around rivers and creeks during this period. In the dry season smaller creeks in the region are dry while others may have become a series of billabongs.

The area around the proposed gas plant lies on part of the tectonic unit of the Bonaparte Gulf Basin, which is a deep structural and sedimentary basin containing thick Palaeozoic and Mesozoic sediments. Overlaying the basin is the Cambridge Gulf Lowlands that form the Western Plains geomorphological region, a coastal strip up to 55 kilometres wide (Wilson et al. 1990, Morgan 1972). Within approximately 20 kilometres of the proposed gas plant there are outcrops of the Permian Port Keats Group that consist of siltstone, silty sandstone, mica, limestone and basal conglomerate (Morgan 1972).

The proposed gas plant and the majority of the on-shore pipeline are located on the Moyle Land System. The section of the pipeline that crosses the coast is located on the Littoral Land System. A brief description of each of these is provided below.

3.1. Moyle Land System

The Moyle Land system consists of gently undulating plains and sandy/laterised soils and occasional isolated mesa-like hills of the Mullaman Land System. The geology consists of sandstones, limestones and shales. The area is drained by small mature creeks with their flat areas prone to flooding in the wet (Christian and Stewart, 1953). Tall open forest of Woolly butt, *Eucalyptus miniata*, and Stringy bark, *Eucalyptus tetradonta* with some Ironwood *Erythrophleum chlorostachys*, dominate the area (Wilson et al. 1990). The grass *Sorghum intrans* (recently changed to *Sarga intrans*) is the dominant grass (Aldrich et al. 1977) and there are areas with a dense understorey of *Livistona* sp. palms. The creeks are lined with narrow Melaleuca fringing forests. Near the coastward edge of the plain the communities change to Pandanus and *Eucalyptus grandiflora*.

3.2. Littoral Land System

This narrow coastal land system in the area of the pipeline alignment contains mangrove mud flats, sand beaches and low sand dunes above the beaches. The vegetation on the sand dunes consists of spinifex grass and *Ipomoea* vines. Fresh water can occasionally be found in soaks behind the sand dunes (Christian and Stewart 1953). The mudflats and saltpans are recent saltwater deposits and the sand dunes are windblown marine deposits.

3.3. Possible influences of environmental factors on locating archaeological material.

There have been several archaeological studies in the Top End that have used environmental and archaeological data to predict the type and distribution of sites using factors such as climate, landforms geology, soils and vegetation. (Hiscock and Mitchell 1992, Hughes and Baker 1983, Heritage Surveys 1997, Gregory 1998, Guse 2001, Thorley 2002). Environmental factors also affect the visibility of archaeological remains.

As the Moyle land system has only isolated mesas that could provide terrain suitable for rock shelter sites or as a source of raw material for the manufacture of stone artefacts, it is expected that any sites that may be impacted by the development will be open artefacts scatters.

Environmental factors also affect the visibility of archaeological remains. Archaeological material tends to be visible on either eroding surfaces where the soil has been removed exposing the artefacts or stable surfaces where sediments have not accumulated over the artefacts. In the area of the proposed gas plant and on-shore pipeline artefacts will be exposed on creek banks that have been significantly eroded or on gravelly laterised surfaces that are indicative of an erosional surface (Thorley 2002:21). Artefacts will not be exposed in the sandy surfaces located near the coast or lowlands around creeks as they tend to move downward through the sand. Ground visibility is expected to be low in areas where the grass understorey has not been burnt.

4. CULTURAL SETTING

The data sources used for this section have been compiled from four principle sources:

1. The archaeological sites register held by the Heritage Branch, (DIPE).
2. The Register of the National Estate, maintained by the Australian Heritage Council.
3. The register of significant places maintained by the National Trust of Australia (Northern Territory Branch).
4. The Northern Territory Heritage Register held by the Heritage Branch (DIPE).

In addition to these sources published and unpublished documents and reports describing Northern Territory historic places were used. These documents are held by the State Library of the Northern Territory, the Darwin office of the National Trust, Heritage Branch (DIPE) and the Northern Territory Museum.

4.1. Ethnographic background

Stanner (1933a & b) who carried out ethnographic research in the region in the 1930s, noted that economic life and subsistence strategies for the Aboriginal people around the Daly were somewhat controlled by seasonal changes which changed the availability of water and food resources. The wet season made the flood plains inaccessible and by the end of the dry season people were forced to congregate around permanent waters. Ceremonial life was mainly confined to the dry season when traditional food such as macropods, waterfowl, fish, turtle and snake were plentiful.

When Gregory (1998:65-66) compiled ethnographic and historic evidence to investigate hunter-gatherer settlement patterns in the Ord-Victoria River region she concluded that coastal areas may have been quite densely populated during the early years of European settlement with sites situated on sand hills, shorelines, mangroves, rocky points, headlands, lagoons and swamps. The resources used were both marine and terrestrial and included fish, shell, turtles, crabs, flying foxes, crocodiles and their eggs. Fish were caught by hand, with spears or fish traps. Water lilies, palm nuts, grass seeds long yams and mangroves supplemented their dietary needs. In the lowland area Gregory (1998:66-68) noted that swamps, lagoons, grassy plains and woodland areas were exploited for resources such as yams, berries, lilies, freshwater mussels, water rats, geese, crocodiles, emus, pandanus nuts and cattle.

4.2. Historic record

Port Keats, now Wadeye, was discovered by Europeans in 1819 as King explored the coastline, however Europeans did not settle the Port Keats area until 1935 when a Catholic mission was set up just behind Lounga (Docherty Island), (Pye n.d.).

In 1939 the mission moved to the present location of the town of Wadeye. An airstrip was built in 1939 mainly for emergency use and the first vehicle to arrive was not until 1950 when the drivers followed the foot track used by Aborigines to reach the Daly River. The closest European settlement was in the Daly River Region approximately 150kms to the north. The Daly was first briefly occupied in the late 1880s by missionaries and European and Chinese farmers. Since 1881 there has been various European activity in the Daly River area such as sugar and peanut farming, and in 1880-90s there was a copper mine (Forrest 1994).

While the European settlement in the Port Keats area was much later than in the Daly River, European influence was still felt by Aborigines in the region (Stanner 1933a, 1933b and Gleeson and Richards 1985). Aboriginal people were displaced from the Daly and moved into areas south of the Daly River while others moved onto the European settlements. Their numbers were decreased by disease in 1890 and their traditional way of life was weakened by their dependence on European goods especially opium, alcohol and tobacco.

The region south of the Daly including the Port Keats area was made an Aboriginal Reserve in 1885. In 1948 and 1963 this Reserve was increased and in 1976, under the *Aboriginal Land Rights (Northern Territory) Act 1976*, ownership was handed over to the Aborigines living in the reserve, (Stanley 1985).

4.3. Archaeological background

The Heritage Branch (DIPE) have only three archaeological sites recorded in the Port Keats region. Yarrar, located approximately 12 kms south of the proposed pipeline, is a rock shelter that contains rock art, rock engravings, stone artefacts and a low stone wall. Most of the paintings are of abstract designs in red and white pigment and there are also a series of short parallel lines engraved on the rock surface. Papangarla is a rock art shelter located in a dissected weathered sandstone scarp southwest of Wadeye. The main designs at this shelter are parallel red and white lines. There are also five grinding hollows. The third, approximately 30 kms north of the proposed pipeline alignment consists of a tamarind tree, a jetty and a fish trap. An artefact scatter, Nyik (Gregory 1998), has also been located 2-3 kms southwest of Yarrar, however this site has not been registered with DIPE.

Stanner excavated both Yarrar and Nyik in the late 1950s and the excavated material was re-analysed by Flood (1967) and Gregory (1998). Both sites would have been occupied in the late wet to early dry, as they are located near creeks that contain water only in the wet season.

At Nyik the majority of stone artefacts were manufactured from quartzite with minor quartz, silcrete and volcanic material. Types of artefacts identified were cores, retouched flakes and points. Gregory (1998) proposed that this site was used as a base camp or procurement site.

Yarrar also had a similar assemblage of stone tool types and raw materials. A radiocarbon date of approximately 3400 years BP was obtained from the middle parts of the excavated deposit. The patterns of the archaeological material found indicate that occupation intensity was greater after this date than in the lower part of the deposit (Gregory 1998:162). There were also changes in the raw stone material types with locally found quartz, silcrete and fine sedimentary rock in the lower levels and dolerite, a raw material found further a field, identified in the upper levels of the excavation. Gregory (1998:180) suggests that this indicates that there was either an expanding territorial range which was a reaction to either environmental changes occurring during this period or because there was an expansion of trade activities.

Gregory (1998:124-130) also appraised archaeological data to explain hunter-gatherer settlement patterns on coastal areas and the adjacent lowlands around the Cambridge Gulf. Only three sites, two fish traps and one shell midden were located on coastal areas (the Littoral Land System) in the regional archaeological record. Two were more than 2km from the nearest freshwater and the other was within 200m of a swamp. Ninety four sites have been recorded in the coastal lowland plain areas. Most were located in rock shelters (67%) and along rivers and streams (13%) and only 5% were located on the open plains. The majority of sites were located within 200 metres of either an ephemeral or permanent water source.

An archaeological survey (Crassweller 2001) located a highly disturbed shell scatter on a grass-covered coastal sand dune on the northern end of Munda Beach approximately 15 kilometres north of the proposed pipeline alignment. This scatter consisted of a low density (12 shells/ square metre) of mostly highly fragmented *Telescopium telescopium* and a few *Anadara granosa* and *Terebralia sp.* The dimensions of the shell scatter were 22 x 10 metres. The presence of a green coloured glass flake on the shell scatter indicates that this is a contact site. Crassweller (2001:8) also noted four large shell scatters of mostly *Terebralia sp.* on sand dunes that ran south along the back of Munda Beach for approximately 5 kilometres.

4.4. Possible cultural factors influencing the presence of archaeological or historic material

As entry into the area around Port Keats has been restricted to Europeans since 1885 there has only been minor physical European intrusions, mainly related to the mission located north east of the development and therefore it is highly unlikely that any historic sites will be located in the area of the proposed gas plant or on shore pipeline.

Previous archaeological research in the north Australian coastal areas (Bourke 2000) indicate that there was a high reliance by Aborigines on marine resources, the most visible of which are the shell middens and scatters. The presence of shell scatters located north of the study area indicates that Aboriginal people in the area also used shell food.

The ethnographic evidence by Stanner and archaeological research into environments similar to that around the Port Keats (Gregory 1998) indicate that fresh water sources were a focal point for past Aboriginal activities and are the most likely location for the presence of archaeological sites. The sites will most likely be located less than 200 metres from the water source.

The only items that had been used by Aborigines in the past that are likely to have survived in the archaeological record are shell fish hooks, hearths, stone tools such as spear heads, axes, and grindstones and shells used either in the manufacture of implements or large shells such as *Melo amphora*, used as water vessels Brockwell (1995). After the arrival of Europeans the raw materials used in the manufacture of these items were substituted with iron, porcelain, glass and wire.

5. METHODOLOGY

The archaeological and historic heritage survey scope of works submitted to the NT Office of Environment and Heritage for the proposed project divided the archaeological and heritage component into several stages of survey intensity. Overall the stages will result in full coverage of the project area ensuring that heritage sites are not damaged or destroyed.

Stage 1. ~ Use previous archaeological research to prepare a predictive model of archaeological distribution along the pipeline alignment. The predictive model will use Land Systems or Land Units to target sections of the proposed alignment for further archaeological inspection.

Stage 2. ~ An archaeological inspection of portions of the proposed pipeline alignment that cross Land Systems that are predicted to have high densities of archaeological materials. The results of this initial survey will detect the variability and density of archaeological material that will be used to test the predictive model and identify areas that will need a more intensive archaeological inspection.

Stage 3. ~ Inspect the entire pipeline alignment at the time the centre line is cleared for survey pegging.

Stage 4. ~ Archaeological surveys will be made over areas that are located beyond the centre line. The selection of these areas will be based on previous survey results and the refinement of the predictive model. This stage will include an assessment of the likelihood of encountering sub-surface materials.

As noted in Section 1 of this report, the timetable for the archaeological assessment, as set out by the scope of works, has altered slightly. As the preliminary survey of the proposed pipeline required the presence of an archaeological team, a vehicular survey with pedestrian transects (a modified Stage 2 process) was carried out before the first stage.

5.1. Preliminary survey 2003

The 2003 survey was carried out to identify the physical location of the Blacktip Gas Plant and a 100 metres wide pipeline corridor that would not adversely impact upon sacred sites, cultural heritage places or the environment. The survey group included archaeologists, flora specialists, geo-technical terrain specialists, and Aboriginal traditional owners. The geo-technical team was required to drill holes a maximum of five kilometres apart along the route to assess soil depth and structure. In reality the distances between drill holes was less than five kilometres as holes were also drilled when the geomorphology of an area changed. The flora specialists were required to note vegetation changes along the route and the traditional owners were required to identify areas of cultural significance.

Begnaze was required to carry out two archaeological undertakings. The first was to ensure that the area to be drilled by the geo-technical team contained no archaeological material that would be disturbed by the drilling. The second was to identify any archaeological sites or objects located on or near the proposed pipeline route and gas plant. The findings from the survey were then used to identify archaeologically sensitive areas to be avoided, or when avoidance is not possible, to recommend alternate routes or mitigation strategies to lessen the impact of the loss or damage of archaeological and heritage places and objects.

5.2. Survey procedures

The aims of the fieldwork were to locate and record any archaeological objects or places to ensure that the provisions of the *Northern Territory Heritage Conservation Act 1991* are not contravened. The archaeological survey was to be carried out as follows:

- The archaeological and heritage study will identify archaeological material within the designated area by means of a survey carried out in a manner that will ensure the highest possible coverage of the area.
- Any archaeological or heritage places, objects or classes of objects located during the survey will be recorded in such detail as to permit independent assessment of their significance. The location of any archaeological places and objects will include coordinates obtained by a Global Positioning System. All sites will be named in order to identify the sites on the ground.
- After assessing the significance of the archaeological place or object, recommendations will be made regarding compliance with the provisions of the *Northern Territory Heritage Conservation Act 1991*.

The archaeological survey of the pipeline section between the coast and the proposed gas plant consisted of both vehicular and pedestrian transects. The vehicular transects were made as close as possible to the centre of the pipeline alignment. Pedestrian transects were made every time the survey party stopped, that is every time a hole was drilled, when the flora survey crew found vegetation of interest, when mechanical failures occurred, or when there was a location where there was a higher potential for locating archaeological sites, such as areas adjacent to waterways, higher ground or eroded areas. This method resulted in both random and purposive pedestrian transects. The archaeological survey of the gas plant area was carried out using pedestrian transects only. The surveys were carried out by Christine Crassweller and Helen Haritos.

5.2.1. Blacktip Gas Plant survey

Pedestrian transects by two archaeologists walking approximately 20 metres apart were made over the 750 x 750m proposed gas plant area (Table 3) and included one transect around the border of the area to be disturbed, transects between four drill holes and six transects across the area in a northeast to southwest direction. This method resulted in an average of one transect by one archaeologist every 50 metres across the gas plant area.

Table 3 The co-ordinates of the four corners of the gas plant site.

Corner	GDA 1994		1:100,00 map sheet, Pearce 4769	
	East	South	Easting	Northing
W	129°25'52.09"	14°14'33.60"	546 509	8 425 392
N	129°26'05.87"	14°14'13.22"	546 924	8 426 018
E	129°26'26.77"	14°14'26.66"	547 549	8 425 603
S	129°26'12.99"	14°14'47.04"	547 135	8 424 978

5.2.2. Onshore pipeline survey

A vehicular survey (Table 4) was made as near as possible to the pipeline alignment from the gas plant site to the coast where the pipeline emerges from the sea. Two pedestrian transects (Transects 1 and 2) (Table 5) were also made along the pipeline. The coastal area was surveyed in a north-south along the length of the sand dunes behind the beach (Transect 3) and another transect was made 250 metres inland from the sand dunes in an east-west along the pipeline alignment (Transect 4). The location given in Table 4 for Transect 3 and 4 represents a point on the sand dunes from which the transects were made.

Table 4 Location of vehicular transects made between the gas plant site and the coast.

	1:100,00 map sheet, Pearce 4769 Datum: WGS84			
Transect	Lat	Long	Easting	Northing
From	-14.5861	132.1298	52 546773	8425279
To	-14.2430	129.4123	52 544475	8425359

Table 5 Location of pedestrian transects made between the gas plant site and the coast.

	1:100,00 map sheet, Pearce 4769 Datum: WGS84			
Transect	Lat	Long	Easting	Northing
1	-14.5861	132.1298	546773	8425279
2	-14.5859	132.1298	545525	8425371
3 & 4	-14.5809	132.1218	545459	8425283

The following sections contain information about fieldwork methods employed in this study including the identification and recording of archaeological sites and materials and the criteria used for the assessment of their significance.

5.2.3. Types of archaeological sites

There are five types of sites previously recorded in the region and they can broadly be defined as follows:

- *Artefact scatters*. These may contain flaked or ground artefacts and hearthstones. They occur as surface scatters of materials or as stratified deposits when there has been repeated occupations.
- *Shell middens* contain mollusc material in the form of surface scatters or mounded deposits (Gregory 1998:222), which represent the remains of human meals.
- *Stone arrangements* range from simple cairns to more elaborate arrangements. These stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone arrangements were constructed for route or territory markers, the walls of huts, fish traps or small walls to stop water from entering a rock shelter or to retain the floor.
- *Art sites* include stencils and paintings where material was added to the rock surfaces or engravings or poundings where the pictures or designs are produced by the removal of material from the rock surface (Clegg 1983).
- *Rockshelter sites* contain a deposit of cultural material that has built up over time and contain flaked or ground stone artefacts, faunal material and other Aboriginal cultural remains.
- *Stone quarries* are generally sites where stone for flaked or edge ground artefacts has been extracted from an outcropping source of rock (Hiscock and Mitchell 1993).

5.2.4. Site definition

An archaeological site is defined for this survey as a concentration of artefactual material with an average density that is 5 times greater than the average density of the background scatter and there are more than five artefacts or shells which cover an area of at least 1m². A site will have an identifiable boundary where either artefact densities decrease to the extent as to be classified as background scatter or environmental features determine the boundary.

Background scatter is generally a very low density, more or less continuous distribution of isolated artefacts over the landscape. Although these artefacts do not constitute a site they are still protected under the *NT Heritage Conservation Act* (1991) as prescribed objects and will be given location details and general descriptions for research purposes.

5.2.5. Artefact identification

A requirement for a successful archaeological project involves the accurate identification of archaeological materials. For an object to be identified as a flaked object it needs to possess one or more of the following:

- a positive or negative ring crack.
- a distinct positive or negative bulb of percussion.
- a distinct erailure scar in an appropriate position below the platform.
- definite remnants of flake scars on dorsal surface or ridges.

Stone artefacts are divided into four main types of cores, unretouched flakes, retouched flakes and flaked pieces (Hiscock 1984:128-129). They are defined as follows:

- *cores* are pieces of stone that have one or more negative flake scars and the absence of positive scars.
- *unretouched flakes* are pieces of stone that have been struck off another piece of stone and ideally possess platforms, positive bulbs of percussion, concentric ripples, ring cracks and /or erailure scars on the ventral surface.
- *retouched flakes* are flaked flakes. They are identified by the presence of negative scars that must have been created after the ventral surface of the flake had been created. There will be either negative scars on the ventral surface or negative scars on the dorsal surface, which have been formed by the flake being hit on the ventral surface.
- *flaked pieces* are stone artefacts that have been formed by knapping but cannot be identified as either a core or a flake.

Other artefact and implement types that have been identified in the top end of the Northern Territory are listed below following characteristics outlined by McCarthy (1976).

- *Unifacial points* are flakes that have been retouched along the margins from one surface, either ventral or dorsal to give or enhance its pointed shape. They are sometimes symmetrical or leaf shaped.
- *Bifacial points* are retouched along both ventral and dorsal surfaces of a flake to enhance or give the artefact its pointed shape. They may have the platform removed and the proximal end rounded.
- *Edge ground axes* have been shaped by the process of flaking, pecking and polishing. They generally have only one working edge that has been ground to a sharp margin although occasionally they may have two leading edges.
- *Grindstones* are characterized by a worn and abraded surface or surfaces. There also may be a concave surface.
- *Hammerstones* have use wear on the surface in the form of abrasion, pitting, and edge fracturing with some negative scarring.
- *Manuports* are stone material that are not found naturally in an area and must have been carried in by humans.

5.2.6. Assessment of significance and heritage management principles

According to Sullivan and Bowdler (1984) archaeological significance means that it has scientific, archaeological or research value, that is, it has the potential to assist current or future research into problems of human history or other areas of enquiry. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance, otherwise known as the Burra Charter (Maquis-Kyle

and Walker 1992:73) states that the scientific value or research potential of a place depends upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place or object may contribute to further substantial information.

Therefore the significance of a site is firstly related to the intactness or integrity of a site, and the state of preservation of the archaeological material. Secondly, if the site has stratigraphic reliability then it may be possible to use the cultural material for dating which will provide a chronology extending back into the past. Thirdly, the representativeness of a site is important either because a site is unusual or because the site has research potential when taken in conjunction with other sites.

6. RESULTS

6.1. Summary

As a result of the archaeological survey over the proposed Blacktip Gas Plant and on-shore pipeline one archaeological site a shell midden, was located on the sand dunes behind the beach where the pipeline emerges from the sea. The presence of the shell midden suggests that marine resources were as important in this region as other coastal areas in the Top End.

No other archaeological or historic sites or objects were located in the area of the gas plant or along the pipeline alignment. As there has been very little impact by European developments or settlement around the proposed gas plant and on-shore pipeline it is highly unlikely that any historic sites or objects are located in the area.

The archaeological and environmental background research indicate that sites in the area would likely consist of open artefact scatters near a source of water, or as rock shelters on rocky outcrops and would be rare on the plains. As the survey areas consisted of level ground with only minor waterways there is a low probability for the presence of any sites using the above criteria.

While it is likely that there are no archaeological sites or objects in the vicinity of the on-shore project area there are several factors that may have influenced the visibility of any archaeological material.

- Ground visibility during the survey of the on-shore pipeline ranged from 15 – 70%. In areas where visibility was 15% it is highly likely that less dense artefacts scatters and isolated object would not be visible. In areas with 70% visibility artefacts scatters would most likely be visible but isolated objects may be missed.
- Sandy soils in sections of the on-shore pipeline would cover any archaeological material.
- Artefacts close to waterways in the Moyle Land System are prone to flooding and would be visible only in eroded areas.

6.2. Sites of heritage significance

6.2.1. Register of National Estate.

There are no historic or archaeological sites recorded on the Register of the National Estate located on or near the Blacktip Gas Plant and on-shore pipeline.

6.2.2. Sites recorded on Commonwealth and/or NT Heritage Registers

There are no historic or archaeological sites recorded on the National Heritage List and there are no declared or prescribed places or objects as described by the *Northern Territory of Australia Heritage Conservation Act 1991* that are in the vicinity of the proposed Blacktip Gas Plant or the on-shore pipeline.

6.2.3. Macassan sites and Aboriginal and ATSI archaeological and heritage places and objects

The archaeological survey over the area located only one site, a shell midden that will be disturbed by the development. This site is a prescribed site under the *NT Heritage Conservation Act 1991* and is therefore a protected site.

6.2.4. European historic sites

No European historic sites were located during the survey of the proposed gas plant and on-shore pipeline.

6.3. Blacktip Gas Plant survey

The proposed gas plant is located on level ground of red soils covered in tall eucalypts. While three quarters of the area had been recently burnt the leaf litter on the ground lowered the average ground visibility to 70%. The unburnt area had an average ground visibility of less than 10%.

No archaeological or historic material was located in the area of the proposed gas plant.

6.4. On-shore pipeline survey

The pipeline alignment from the gas plant site to the coast is over level ground covered in tall eucalypts. As the proposed pipeline nears the coast the soil becomes more sandy and the vegetation changes to scrubby woodlands. A large shell midden was located during pedestrian transects along the dunes above the beach. No archaeological material was identified inland from the beach / sand dune area. Details of the pedestrian transects are found in Table 6.

Table 6 Details of pedestrian transects made between the gas plant site and the coast.

Transect	Ground Visibility %	Distance (m)
1	70	200
2	15	500
3	40	1200



Site 8 - Shell Midden 1.

Location:

Between 52 544509E 8425508N and 52 544186E 8424816N
1:100,000 Mapsheet Pierce, 4769 Datum: WGS84

Geomorphological context: Sand dunes

Land System: Littoral.

Dimensions. N-S 600m, E-W 40m.

Ground visibility: Minimum - 90%. Maximum - 100%. Average- 95%

The site is located over the length of the sand dunes, which run in a north to south direction parallel to the beach (Plates 1 and 2). Sections of the dunes are covered in grasses and vines and there are large areas that have been wind eroded. The back of the sand dunes drop quickly to a low ironstone area covered in a closed forest with patches of pandanus and a larger area of monsoon forest in the south. There are stands of mangroves to the south of the beach. A track runs along the length of the dunes and approximately 20 metres north of the most northerly eroded area is a 30 x 20 x 3 metre section where the sand had been removed by mechanical means (Plate 5). Traditional owners stated that this occurred during the 1960s. The location of this disturbed area is 52 544495E 8425488N.

The highest density of archaeological material (60 shells per square metre) appears in the eroded areas along the western side of the highest part of the most easterly sand dune. The deepest section of the eroded areas is estimated to be half a metre. A lower density of archaeological material (10 shells per square metre) is eroding from patches of smaller eroded areas closer to the beach on a more level section of the sand dunes (Plate 6).

The highly fragmented shell consists of 90% *Terebralia sp.*, 5% *Telescopium sp.*, 2% *Saccostrea sp.* (oyster) with smaller numbers of *Volema sp.*, *Nerita sp.*, *Turbo sp.*, and *Anadara sp.* The stone artefacts noted during the survey consisted of ten hammerstones, one ground edge axe and one ground axe (Plate 3) (both also used as hammerstones), one sandstone rock with drill marks (Plate 4) and possible cooking stones carried from a type of ironstone that is found outcropping from the promontories at both ends of the beach. There were also small sandstone manuports eroding from the sand. Macropod, fish and possibly dugong bone were located over the southern section of the sand dunes.

6.4.1. Relationship to proposed development

The proposed onshore pipeline will cross over the shell midden site in a west to east direction.

6.5. Assessment of heritage significance

While there has been detailed archaeological research into past Aboriginal settlement patterns or use of coastal resources in other areas of the Northern Territory (Bourke 2000, Crassweller 2002, Sim 2002, Mowat 1995, Hiscock 1997, Woodroffe *et al* 1988) there has been no research work and few surveys carried out along the coast between Darwin region and the Victoria River. Therefore it is difficult to assess whether the presence, and the archaeological attributes of Shell Midden 1, are a rare occurrence in the region or not. However when compared to shell midden sites in other areas of coastal Northern Territory its size, the surface archaeological material and site integrity would suggest that this site has a high potential for further research and therefore the site has a rating of high archaeological significance.

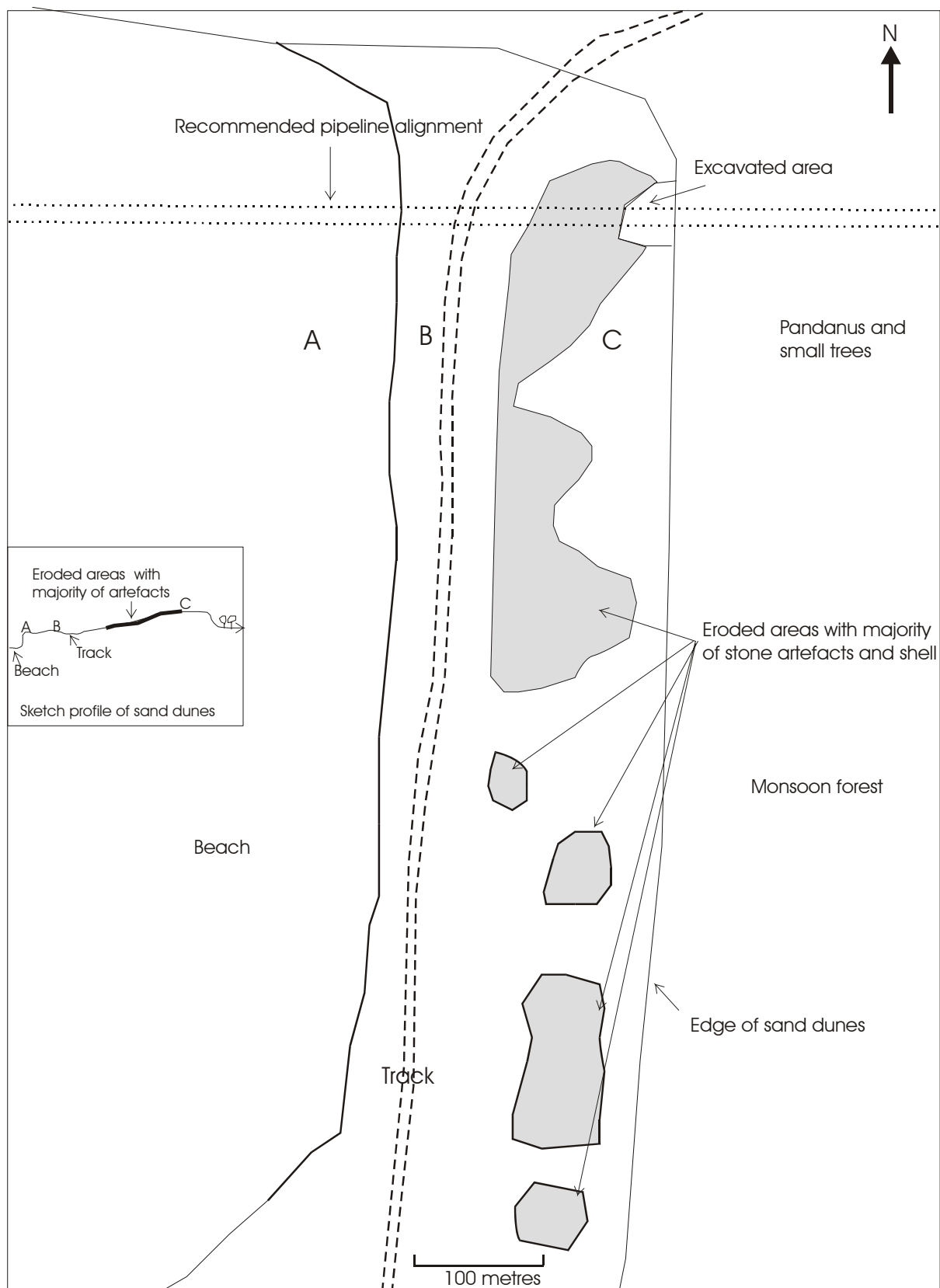


Figure 2 Sketch map of Shell Midden 1.

7. POTENTIAL PROJECT IMPACTS

While the lack of previous archaeological research in the area of the on-shore pipeline makes it difficult to assess the frequency and distribution of sites that are likely to be encountered during the development there is enough data from neighbouring regions and ethnographic research to predict that any areas within 200 metres of a source of freshwater are archaeologically sensitive.

The preliminary survey failed to locate any sites within the areas of the proposed gas plant and the on-shore pipeline after it leaves the sand dunes at the back of the beach. However as ground visibility was low in some areas during the survey of the pipeline alignment, all which were not surveyed, it is possible there are sites in the area that will only be located after the exact route has been examined.

7.1. Design phase

There were no archaeological objects or sites identified on the proposed gas plant. However there was one archaeological site, Shell Midden 1, identified during the preliminary survey of the proposed on-shore pipeline alignment. The shell midden is located on sand dunes behind the beach where the pipeline leaves the seabed. As this site covers the full length of the sand dunes, it is impossible for the pipeline to detour around the site. Damage to the archaeological site can be mitigated if the pipeline leaves the seabed further north than the original proposal so that it crosses the sand dunes at 8425488N where a section of the sand dunes had been previously destroyed.

The sections of the pipeline that have not been surveyed should have an archaeological inspection when the surveyors are pegging the pipeline route. Any areas selected for the construction of associated roads, access routes, construction camps quarries, borrow pits and laydown areas should also be surveyed for archaeological material. There are no archaeological concerns for the area on which the gas plant will be constructed.

7.2. Construction phase

The construction of the pipeline through the sand dunes will destroy and disturb a section of the archaeological site, Shell Midden 1. Therefore processes should be set up to limit the area to be destroyed.

During the initial clearing of the pipeline alignment and during the construction phase there is a possibility that there will be disturbances to sub-surface archaeological materials such as human skeletal remains, stone artefacts, shell middens and the remains of hearths.

7.3. Operational phase

At this stage the main concern for the archaeological site, Shell Midden 1, is the stabilisation of the area so that there is no erosion of the sand dunes in the area where the sand has been removed and / or disturbed.

8. RECOMMENDATIONS

An archaeological site, referred to as Shell Midden 1, is located over the full length of sand dunes that run parallel to the beach where the pipeline emerges from the seabed. A number of recommendations for actions to protect this site, that include a full archaeological survey of the construction corridor during the pegging of the final pipeline alignment, are made in this section. There was no archaeological material identified on the area on which the proposed gas plant is to be constructed and therefore there are no specific controls that need to be implemented for this site. When areas are to be selected for the construction of access roads or other areas that need to be cleared during construction, then the predictive model developed in Section 4.5 of this report should be used to avoid areas that have a high probability for the presence of archaeological sites, such as areas near a source of fresh water. Specific recommendations are provided below.

8.1. Design phase

It is recommended that during the design phase of the project:

1. The pipeline route takes advantage of the previously disturbed section of the sand dunes and leaves the seabed further north than the original proposal so that it crosses the sand dunes at 8425488N.
2. A full archaeological survey of the onshore pipeline corridor should be conducted at the time of pegging of the final alignment. The archaeologist can make decisions in the field as to the correct procedures for protection of sub-surface material.
3. All access tracks, borrow pits, laydown areas etc. are chosen in accordance with the predictive model developed in this report, and final locations are subject to an archaeological survey.

8.2. Construction phase

It is recommended that prior to construction:

4. The proponent obtain permission from the Heritage Conservation Services, Department of Infrastructure, Planning and Environment, as directed by the *NT Heritage Conservation Act 1991*, to disturb the Shell Midden 1 site only after a thorough recording and collection is made of the archaeological materials located within the site.
5. The area to be disturbed is minimised and the boundaries of the pipeline construction area over the shell midden is appropriately fenced. The area outside the fence line should be delineated as a “no go” area with no pedestrian or vehicular movement, heavy machinery, drilling or grading occurring outside this fenced area.

It is recommended that during construction:

6. A response mechanism is set up to ensure that subsurface material is not disturbed and is protected. This response should include informing contractors of the importance of site protection and a mechanism for the cessation of work around discovered archaeological material until advice from the Heritage Conservation Services is obtained to ensure that the conditions of the *NT Heritage Conservation Act 1991* are not contravened.

8.3. Operational phase

It is recommended that during the operation phase of the project:

7. The sides of the sand dune on either side of the pipeline alignment are stabilised so that further damage does not occur through erosion.
8. All appropriate Woodside Energy personnel and contractors are notified of the site location and operate strictly to avoid disturbing the site.

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Appendix 1 Plates referred to in text.



Plate 1 Shell Midden 1 on sand dunes -facing south.



Plate 2 Shell midden 1 facing north



Plate 3. Edge ground axe and broken axe used as hammer stones



Plate 4. Stone with drill hole



Plate 5. Area of sand dune that has been mined for sand.



Plate 6. Shell scatter on fore dunes, near the beach.