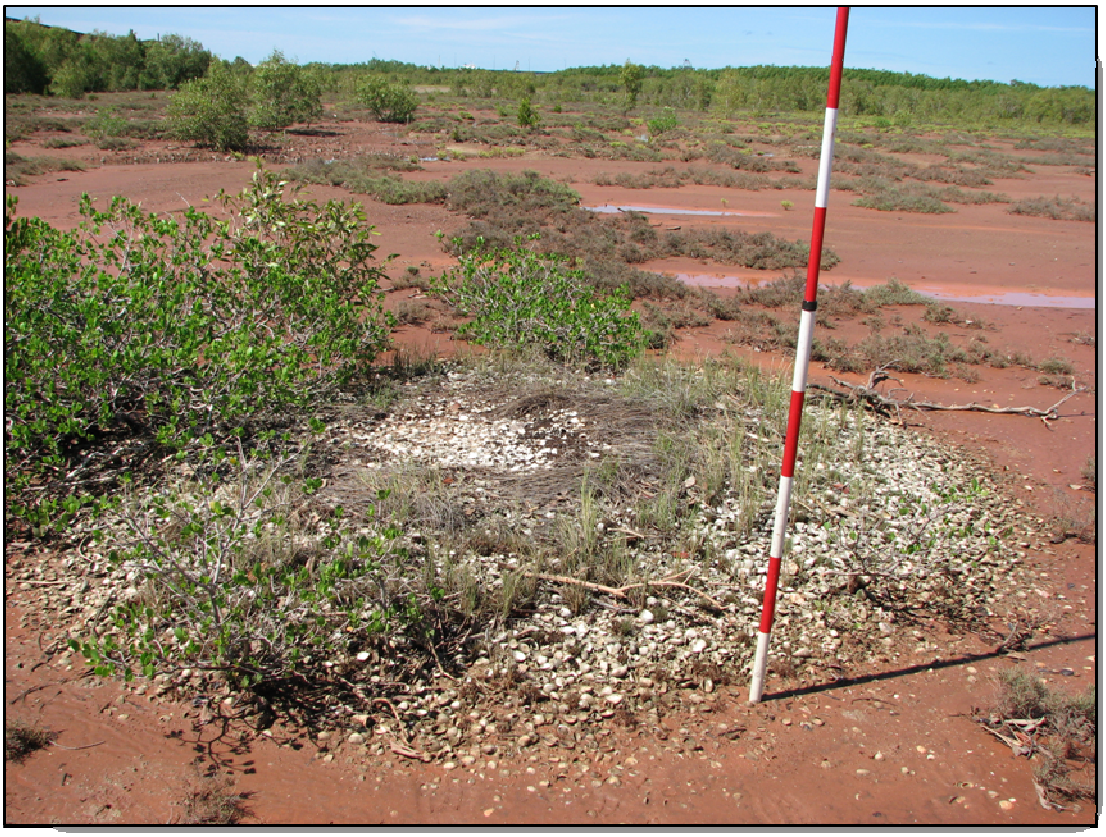
C

Appendix C Archaeological Survey of the East Arm Wharf Expansion and Surrounding Area Darwin NT

Archaeological Survey of the East Arm Wharf Expansion and Surrounding Area, Darwin NT



Archaeological Survey of the East Arm Wharf Expansion and Surrounding Area, Darwin NT

URS Corporation, Darwin.

Prepared by: Daryl Wesley

Incorporating background information compiled by Ben Keys and Richard Woolfe of Earthsea Pty Ltd.

Darwin:
PO Box 1242,
Darwin NT 0801

Brisbane:
PO Box 351, The Gap,
Brisbane QLD.

Contact:
Phone: 07 35111703
Mobile: 0439722438
0428547342

EARTH SEA HERITAGE SURVEYS,
Earthsea Pty Ltd
ABN: 18130222650
ACN: 130222650

TABLE OF CONTENTS

TABLES

FIGURES

Glossary of Terms

Definitions of abbreviations referred to in this report are listed below:

AAPA:	Aboriginal Areas Protection Authority.
ALRA:	*Aboriginal Land Rights Act* (Northern Territory) *1976*.
CCHMP:	Construction Cultural Heritage Management Plan.
CEMP:	Cultural Environmental Management Plan.
EMP:	Environmental Management Plan.
FBB	Flying Boat Base.
HAA	Heavy Anti Aircraft.
HAC:	Heritage Advisory Council.
HCA:	*Heritage Conservation Act* 1991, Northern Territory of Australia.
MGA:	This report uses Map Grid Australia as the UTM grid reference system.
NRETA:	Department of Natural Resources, Environment and the Arts.
RAAF	Royal Australian Air Force.
UTM	Universal Transverse Mercator, the grid reference system developed by the USA in 1947, and adopted by Australia thereafter.

Use of Historic Images Disclaimer

This report incorporates several historic images associated with archaeological and/or heritage features located within the East Arm subject area. Otherwise cited, all historic images presented in this report were taken before 1 January 1955 and are therefore out of copyright.

The laws of copyright apply to works which are still within the period of copyright protection ie. post 1 January 1955. Material which is out of copyright is said to be in the 'public domain' and may be used freely. As a result of the Australia/US Free Trade Agreement (AUSTFA) the duration of copyright in artworks has changed significantly. Under new rules, photographs that were protected by copyright on 1 January 2005, or which have been created on or after this date, are protected by new copyright laws under the AUSFTA.

Executive Summary

This report presents the results and recommendations arising from an archaeological assessment of the proposed East Arm Warf Expansion and surrounding area, Darwin Harbour. This assessment included both a physical survey and desktop study of the associated areas. The survey was conducted by Daryl Wesley, of Earth Sea Heritage Surveys, with Larrakia representatives, during December 2010.

The archaeological survey was designed to sample the representative range of landform elements and areas that had not been previously disturbed within the study area. The archaeological study has identified the following Indigenous cultural heritage place located within the vicinity of the proposed development area:

- Indigenous Site 1 — Midden; Stone Artefacts
- Unidentified shipwreck — Possible Vietnamese refugee boat shipwreck

The following Indigenous and historic terrestrial cultural heritage places and maritime wreck sites have been located outside of the proposed development area and should be considered in terms of off-site impacts:

- Indigenous Site 2 — Stone Artefacts
- WWII Dump F1 — 44 gallon drum dump
- WWII Dump F2 — General refuse dump
- WWII Dump 3 — Scatter of personal refuse
- WWII Site 1 — Incinerator Drum features
- ID3408 — *Con Dao 3* Vietnamese Refugee Boat shipwreck
- ID3430 — Boat 2 Vietnamese Refugee Boat shipwreck
- ID3584 — *Pk76* Vietnamese Refugee Boat shipwreck
- ID3427 — World War II East Arm Barge 2
- ID3428 — World War II East Arm Two Part Barge
- WWII Catalina 2, 3, 6 — RAAF and USN Catalina wreck sites
- *Kelat* — World War II shipwreck

The Indigenous archaeological site located within the vicinity of the proposed development area (ie Indigenous Site 1) is viewed with a high level of cultural significance by the Traditional Owner group. From a scientific perspective the consultant also assessed this site as having high heritage significance. This assessment is based on the uniqueness of the site and its potential value in providing specific scientific information, which may include: regional chronologies of human occupation, trade/exchange networks, intra-site use, marine resource exploitation and stone tool technologies. It is recommended that the site is not disturbed in the course of the development.

The terrestrial and maritime non-Indigenous historic archaeological sites are assessed according to their social, archaeological, and historical values. The sites are mostly associated with World War II, specifically the 19th February 1942 bombing of Darwin, and other general wartime activities after this event. The other wreck sites are associated with the period of Vietnamese refugee arrivals during the late 1970s. These sites have a range of values from very high to low cultural heritage significance.

General Recommendations:

The recommendation briefs resulting from the survey included (refer to Section 7 for detailed specific recommendations):

Table 1: Site Specific Recommendation Briefs

Site Name – ID	Heritage Assessment Value	Current Legislative Protective Mechanism	Recommendations Summary
Indigenous Site 1	Very high cultural and archaeological significance.	Section 29 and 39, NT *Heritage Conservation Act* 1991.	If engineering solution cannot avoid seek permit for salvage from NT Minister for Environment. Involve Larrakia community participation. Recommend further archaeological research of salvaged artefacts.
Indigenous Site 2	High cultural and archaeological significance.	Section 29 and 39, NT *Heritage Conservation Act* 1991.	Outside project area. CEMP and EMP will refer to this site, manage any potential impacts.
WWII Dump Feature 1	Low cultural and archaeological significance.	None.	CEMP and EMP will refer to this site, manage any potential impacts.
WWII Dump Feature 2	Low cultural and archaeological significance.	None.	CEMP and EMP will refer to this site, manage any potential impacts.
WWII Dump Feature 3	Moderate cultural and archaeological significance.	None.	CEMP and EMP will refer to this site, manage any potential impacts.
WWII Site 1	Moderate cultural and archaeological significance.	None.	CEMP and EMP will refer to this site, manage any potential impacts
Unidentified Shipwreck	Unknown Cultural and archaeological significance.	None.	Locate and identify shipwreck Undertake historic and social research regarding wreck cultural significance CEMP and EMP to refer to this wreck site and manage any potential impacts.
Shipwrecks - ID3408 ID3430 ID3584 Pk76	Limited archaeological significance Moderate social and cultural significance.	None. Currently on Australian National Shipwrecks Database.	CEMP and EMP will refer to these sites, manage any potential off-site impacts.
Shipwrecks - ID3427 ID3428	Limited archaeological significance Limited social significance Moderate historical significance	None. Currently on Australian National Shipwrecks Database.	CEMP and EMP will refer to this site, manage any potential impacts.
Aircraft Wrecks - Catalina 2 Catalina 3 Catalina 6	Very high archaeological, historical, and social significance	Nominated to the NT Heritage Register *Heritage Conservation Act* 1991.	CEMP and EMP will refer to this site, manage any potential impacts Pre & Post construction dive inspection Establish mooring and conservation zones.
Kelat (WWII Shipwreck)	Very high archaeological and cultural significance	Declared Heritage Place *Heritage Conservation Act* 1991	CEMP and EMP will refer to this site, manage any potential impacts Pre & Post construction dive inspection. Establish mooring and no-go zones

1.0. INTRODUCTION

1.1. Introduction

This report presents the results and recommendations arising from an archaeological assessment and desktop study of the East Arm Wharf Expansion project and surrounding area. This project area is presented in Figure 1. The surveys were conducted during December 2010 by Daryl Wesley of Earth Sea Heritage Surveys and accompanied by members of the Larrakia community.

The objectives of the archaeological assessment are to:

- Locate and record prescribed archaeological objects or places as defined under the Northern Territory of Australia *Heritage Conservation Act* 1991 (HCA);
- Assess the nature and distribution of any archaeological materials located;
- Assess the significance of any archaeological places or materials according to the heritage significance criteria established under the HCA;
- Advise the client regarding mitigation of impacts on any archaeological places or objects; and
- Advise the client on the future management of any located places or objects.

Previous archaeological studies of Darwin Harbour have revealed the highest areas of archaeological sensitivity occur along the mangrove and woodland fringe. Away from these areas significant sites have also been shown to occur in association with rock outcrops or elevated points in the landscape.

The current study employed a sampling methodology that will add to current knowledge of archaeological site distribution around Darwin Harbour and should provide survey coverage for approximately 45% of previously undisturbed land. This purposive sampling was achieved through the execution of pedestrian transects along the mangrove / tidal flats and woodland fringe that allow inspection of both environments. A transect along the fringe will provided sufficient coverage. At least 80% of the total length of this fringe was subject to survey. Purposive sampling also inspected rock outcrops and elevated points in the landscape.

1.2. Structure of the report

The information contained in the report attempts to demonstrate why cultural heritage is important, what constitutes 'significance' to different cultural groups and how cultural heritage sites are defined, recorded and managed. It then outlines the methodology used to adequately survey and then analyse the results.

The report is designed to:

1. Provide an overview of Commonwealth and the Northern Territory heritage legislation.

2. Give an archaeological, environmental and ethnographic background to the area with a particular focus on how past research results will apply to the archaeological results of this survey.

3. Present the results of the field survey including physical descriptions of the features, their location in UTM (coordinate system MGA94 datum GDA 94) and images of the features.

4. Present an archaeological assessment of the heritage significance for the sites/ features.

5. Present recommendations concerning the desirability of conserving the places and the practical issues with their ongoing management.

6. Analyse and discuss the archaeological features of the places, in particular their ability to add to the archaeological knowledge of the local and wider north Australian region.

1.3. Project Area Location

The project area is located approximately 6 km south east of Darwin city, on the East Arm Peninsula (Refer Figure 1). As presented in Figure 2 the proposed East Arm Wharf expansion areas include: a new rail spur and the subdivision along Muramats Road; a marina for customs, tugs and small vessel mooring; a marine supply base; Defence laydown area and channels which require dredging. Note – the specific location and type of infrastructure should be considered as preliminary and may be subject to change following this assessment.

Figure 1: Project area, East Arm Port, Darwin (base image: Google Earth Pro)

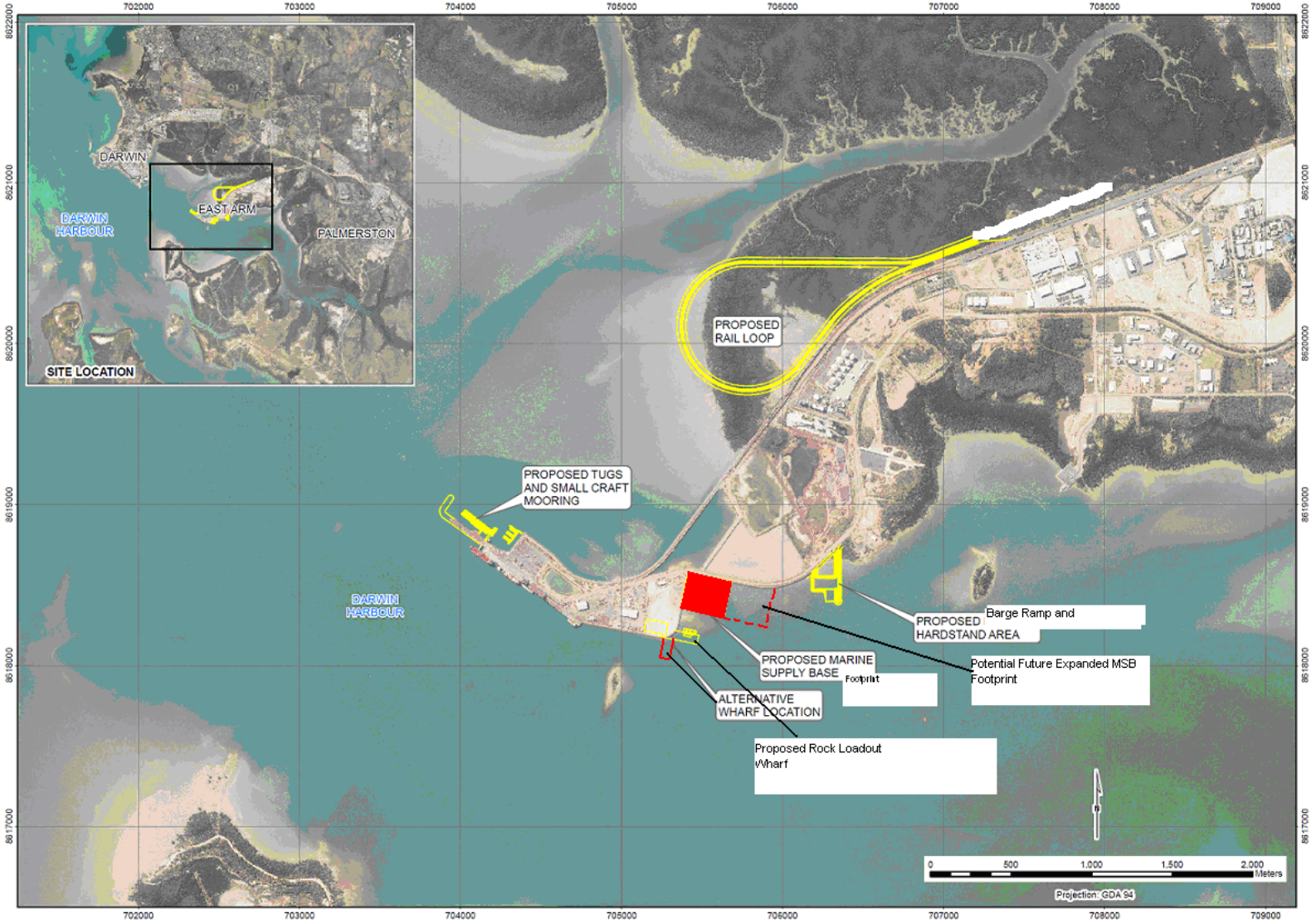


Figure 2: Proposed East Arm Wharf Expansion Areas.

1.4 Consultation with Traditional Owners

The survey methodology used a participative resource management strategy to engage Traditional Owner representatives in the physical survey process and the cultural heritage assessment of sites located during the survey. Accordingly, Lorraine Williams of the Larrakia Nation accompanied the consultant during the field work component of the East Arm Survey.

2.0 Legislative and Register Background

2.1. The legislative and social basis for Cultural Heritage Protection

Cultural heritage conservation legislation is complicated in Australian jurisdictions. This is the result of the evolution of the Australian constitutional framework, particularly the inclusion of new themes, such as Aboriginality, heritage and the environment into an existing regulatory framework. The result of this evolutionary change is that the Commonwealth retained responsibility for Indigenous issues, including some cultural heritage issues, while the States and Territories retained control of land use and development control.

Cultural heritage in the Northern Territory is protected via several different legislative mechanisms. Protected cultural heritage places can be divided into three main themes, Indigenous sacred sites, Indigenous archaeological places and objects, and general heritage places. Cultural heritage conservation in the Northern Territory is regulated at the Territory and Commonwealth levels. Local government has limited powers regarding the protection of cultural heritage places.

2.1.1 Commonwealth Acts:

1. *Native Title Act 1993*. Aboriginal cultural heritage moved to the Commonwealth's jurisdiction following the Constitutional referendum of 1967. The result of this referendum amended Section 51 and gave the Commonwealth powers to legislate on Aboriginal issues. The *Native Title Act* gives some Aboriginal people the ability to access and use traditional lands for some purposes. Agreements, known as Indigenous Land Use Agreements, may be entered into by Native Title claimants and other interested parties on the nature of land use and access to land, including the protection of cultural heritage resources.

2. *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*. This Act is a site protection Act of 'last resort', meaning that the Act is meant to provide emergency protection for Aboriginal and Torres Strait Islander heritage sites when all other avenues have been exhausted. Generally an Indigenous group must apply to the Minister to have protective covenants placed over an area or site. The power to provide such protection resides in Section 51 of the Constitution giving the Commonwealth powers on Aboriginal issues. Therefore this Act may override all State and Territory cultural heritage acts.

3. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) commenced on 16 July 2000. On 1st January 2004, a new Commonwealth heritage regime came into effect following amendments to the EPBC. The legislation proscribes the criteria for listing National Heritage places and Commonwealth heritage places and management principles for National Heritage and Commonwealth Heritage places. The Heritage Division of Department of Environment and Heritage is the Commonwealth agency responsible for the administration of the EPBC Act and providing support to the Australian Heritage Council. The Australian Heritage Council is to be supported by an Indigenous Heritage Committee to advise the Council on sites of Aboriginal significance. The new Commonwealth heritage regime has created two new heritage registers, and is retaining the Register of the National Estate as a database.

4. The *Historic Shipwrecks Act 1976* protects historic wrecks and associated relics that are more than 75 years old and in Commonwealth waters extending from below the low water mark to the edge of the continental shelf. Each of the States and the Northern Territory has complementary legislation, which protects historic shipwrecks in State waters, such as bays, harbours and rivers. The Minister for the Environment, Heritage and the Arts can also make a declaration to protect any historically significant wrecks or articles and relics which are less than 75 years old.

As the Commonwealth has no powers in regards to land use, the power emanating from the Act resides in the Commonwealth's powers to negotiate funding and other arrangements in relation to conservation of heritage places.

2.1.2 Northern Territory Acts:

1. The *Heritage Conservation Act 1991*. This Act provides a mechanism to conserve heritage in the Northern Territory and the agency responsible for the administration of this Act is the Heritage Conservation Services, Department of Natural Resources, Environment and the Arts (NRETA). The Act provides for the creation of a Heritage Advisory Council (HAC). The HAC assesses and recommends places to the Minister for the Environment for inclusion on the Northern Territory Heritage Register.

NRETA plays a major role in promoting heritage conservation in the NT and maintains the Northern Territory Heritage Register. The *Heritage Conservation Act* provides legislative protection for declared heritage places in the Northern Territory. The *Heritage Conservation Act* also provides for the nomination and declaration of places and objects as 'Heritage Places' if they are significant to the Northern Territory. There are criteria that are to be applied to such places to assess whether they meet a sufficient level of heritage significance.

2. The *Northern Territory Aboriginal Sacred Sites Act 1989* (Sacred Sites Act). The Aboriginal Areas Protection Authority (AAPA) administers Sacred Sites Act, the aim of which is the protection and prevention of the desecration of sacred sites in the Northern Territory. A sacred site is defined as a site that is sacred to Aboriginals or otherwise of significance according to Aboriginal tradition, following the *Aboriginal Land Rights (Northern Territory) Act* 1976. Tradition is narrowly defined to spiritual beliefs and customs of Aboriginal people and generally does not include practices arising from traditional camping and living places, historic places, Indigenous archaeological sites, or hunting and gathering activities.

Included in the Act is the provision of a clearance mechanism for Government, industry and the public to seek advice regarding the presence of sacred sites. The AAPA does this through a Site Registration and Authority Certificate process and maintains a register of sacred sites. The AAPA consists of a Board made up of members from the Indigenous community which decides whether sacred sites meet a registration test. The functions of the Act are undertaken by Authority staff, such as preparation of site registration reports and Authority Certificate assessments. Assessment for an Authority Certificate is undertaken by anthropological staff members of the Authority in consultation with Aboriginal Custodians. The Authority Certificate should not be viewed as a *de facto* social impact statement from Aboriginal Traditional Owners. The Authority consults with Aboriginal Custodians only

in relation to sacred sites as defined by the Act and is not concerned with other social impacts on Indigenous communities.

Sacred sites are afforded a blanket form of protection under the Sacred Sites Act whether they are registered or not. However a sacred site that has the status of an AAPA 'recorded site', or is recorded in the course of a development assessment must meet the formal registration standards applied by the Aboriginal Areas Protection Authority Board.

3. The *Aboriginal Land Rights Act* (Northern Territory) *1976* (ALRA). The ALRA establishes the role of Aboriginal Land Councils in the Northern Territory. The ALRA also places protective measures on sacred sites within Aboriginal Land Trusts, but cannot protect sites outside of Aboriginal Land Trusts. The Land Councils are required to maintain a Land Information Register (LIR), which usually includes details of Traditional Aboriginal Owners and cultural site information. This register that is not available for public searches.

The definition of Aboriginal tradition for the purposes of ALRA is not as narrowly prescribed as that enforced by the AAPA to just spiritual beliefs and customs of Aboriginal people. ALRA allows for a much broader inclusion of culturally significant sites that are associated with practices arising from traditional camping and living places, historic places, Indigenous archaeological sites, or hunting and gathering activities. Therefore, it will be important to take into consideration other aspects of Indigenous cultural land use to ensure that appropriate planning and mitigation measures are taken to avoid culturally sensitive areas.

2.2. Register Searches

2.2.1. Northern Territory Heritage Register

A search of the Northern Territory Heritage Register indicated that no nominated or declared heritage places are located within the immediate East Arm Wharf expansion area. It was noted that the following declared heritage places are located within 5 km of the proposed development zones:

1. East Arm Quarantine Anti-Aircraft battery;
2. The *Kelat* shipwreck; and
3. WWII East Arm Quarantine Anti-Aircraft site.

Other notable historic places include the World War II Catalina Wreck Site #6 (refer Section 4.4), which is subject to Interim Conservation Orders under the Northern Territory Heritage Act. Additionally, the following World War II Catalina flying boat wreck sites, located between 1.5 km and 5km from the proposed development area have been nominated to the Northern Territory Heritage Register (refer also Section 4.4). Catalina 6 (US Navy Patrol Wing 10) is not shown in maps owing to sensitivity regarding its location and possible looting. In this study, Catalina wrecks 1, 2, and 6 are of the main concern regarding the proposed East Arm development works.

- WWII Catalina aircraft wreck sites: Catalina wreck sites 1 to 6
    - Catalina 1 RAAF A24-1
    - Catalina 2 RAAF A24-69
    - Catalina 3 RAAF A24-206
    - Catalina 4 US Navy Patrol Wing 10 28-5MNE
    - Catalina 5 US Navy Patrol Wing 10 PBY-4
    - Catalina 6 US Navy Patrol Wing 10 PBY-4

2.3.2. Northern Territory Archaeological Site Database

As presented in Table 1 and Figure 3, a search of the Northern Territory Government Department of Natural Resources, Environment, Arts and Sport, Archaeological Site Database indicated that there were a number of previously recorded archaeological sites located within the East Arm Wharf area. These sites include Aboriginal shell middens, historic sites and WWII infrastructure features. At the time of surveying, the consultant was unable to relocate East Arm 1 and it is likely that this site has been destroyed in the course of the East Arm Wharf development.

Table 2: NRETAS Database Archaeological Sites within East Arm Project Area

Site Name	Museum No.	Easting	Northing	Zone	Map sheet	Map Sheet	Site Type
East Arm 1	50730020	706500	8618600	52	5073	Darwin	Shell midden
East Arm Scatter 1		707738	8619267	52	5073	Darwin	Historic site / object
East Arm Scatter 2		707850	8619500	52	5073	Darwin	Historic site / object
East Arm Quarantine Station	50730021	706600	8619000	52	5073	Darwin	Historic object/place
East Arm 2	50730065	707100	8618500	52	5073	Darwin	Shell midden, isolated stone artefact
East Arm 3	50730066	705800	8619300	52	5073	Darwin	Shell midden

2.3.3. Sacred Sites Register Inspection

The Proponent has undertaken sacred site clearances with the Aboriginal Areas Protection Authority (AAPA).

2.3.4. Australian Heritage Database

There are no places listed on the Australia Heritage Database within the proposed study area.

2.3.5. Australian National Shipwreck Database

As presented in Table 2 and Figure 3, there are three shipwrecks within 1 km of the proposed development, and three further wrecks located between 1.25 km and 3 km to the southeast (including the Kelat shipwreck, refer Section 2.3.1). All six wrecks are registered on the Australian National Shipwreck Database. The consultant was unable to visit any wrecks during the course of the current project.

Table 3: Registered Historic Shipwrecks, East Arm

ID	Vessel Name	Vessel Type	Year Built	Year Wrecked	Type of Wreck	Construction Material
3408	Con Dao 3	Unrecorded	Unknown	1978	Unknown	Wood
3427	East Arm Barge 2	Barge	Unknown	1945	Unknown	Not Recorded
3428	East Arm Two Part Barge	Barge	Unknown	1945	Unknown	Not Recorded
3429	Vietnamese Refugee Boat 1	Unrecorded	Unknown	1976	Stranded	Not Recorded
3430	Vietnamese Refugee Boat 2	Unrecorded	Unknown	1976	Stranded	Not Recorded
3477	Kelat	Sailing	1881	1942	Japanese air raid	Steel
3584	Vietnamese Refugee Boat Pk76	Unrecorded	Unknown	Unknown	Unknown	Not Recorded

Figure 3: Registered/Recorded Shipwrecks and sites from the NRETAS Archaeological Site Database, East Arm (Google Earth base map)

3.0. PHYSICAL AND ENVIRONMENTAL SETTING

The project area is located along the margins of the East Arm Peninsula, approximately 6 km south east of Darwin city. This peninsula comprises areas of high ground with terrestrial savannah vegetation surrounded by intertidal mangrove forests which are partially or completely inundated by water at high tide. Swampy conditions develop in low lying areas between the high ground during the wet season. High proportions of the interior and southern peninsular' land units have been significantly disturbed through sustained developments which include: the existing wharf, main roads, Defence infrastructure and heavy industry. Only the northern peninsular coastal margins and those, west of Hudson Creek exhibit any remnant environmental zones.

The study area is surrounded by an extensive zone of tidal flats. The tidal flats are gently inclined surfaces underlain by sand in low tidal areas and mud in mid-high tidal levels. Mangroves typically occupy the mid-high tidal mud flats and form a peripheral belt. Within the high tidal mud flats, areas of salt flats and samphire flats have developed as a result of hypersaline groundwater conditions precluding mangrove establishment.

The general hinterland landforms around Darwin Harbour generally comprise dissected upland terrain, low strike-ridges and hills (approximately 15-40 m high mostly along the southern coastline, formed on shales, siltstones and sandstones of the Proterozoic Burrell Creek Formation) and intervening alluvial flats (Wood et al. 1985, Pietsch 1986, Burns 1997:1). Sediments of Cainozoic age cover most of the region consist of Tertiary and Quaternary soils and laterite exposures. Quaternary sands, silty clay, laterites or ferruginous clayey sand are associated with drainage lines and low lying country (Pietsch 1986).

Around the peninsula coastline a wide fringe of low closed mangrove forests merges into extensive tidal mudflats formed from marine alluvium and mud, clay and silt (Brocklehurst and Edmeades 1996). Sandy shelly chenier ridges and small areas of saltflats also occur (Pietsch 1986).

Vegetation on the mainland consists of open eucalypt woodland with *Eucalyptus miniata* (Darwin Woolly Butt), *E. tetradonta* (Stringybark) and *E. bleeseri* (Bloodwood), *Cycad*, Fan palm and *Sorghum* grass understorey (Fogarty et al. 1984; Wilson et al. 1990). Patches of rainforest and monsoon vine forest occur in wet, well-drained areas, with species such as *Dioscorea transversa* (long yam) and *Sterculia quadrifida* (Bush peanut).

Marine life in Darwin Harbour is extremely varied. The waters offshore of Hudson Creek abound with many different species of fish, as well as turtles, dugong and crocodiles (Crassweller 2006:5). Species commonly found in the mid-tidal regions include nerites, chitons, barnacles and oysters, while the mangrove zones contain crabs, mud lobsters and molluscs. The most commonly noted molluscs in the Mangrove zones are *Terebralia, Telescopium, Cerithidea* and nerite. (Crassweller 2006: 5)

4.0 Historic Cultural Heritage – East Arm

4.1 History of Darwin and its Environment

Darwin represents one of the most intensively occupied areas in the Northern Territory for the past 150 years. The history of the Darwin region has been well documented in Powell (1988) and Carment (1996) and a summary of the history of Darwin City are compiled from these references. European presence in the Northern Territory was beginning to have a significant increase. Darwin, or then known as Palmerston until 1911, was established in 1869. The city and port facility were to be located on a peninsula in Darwin Harbour and become an economic and administrative centre for the Northern Territory. In 1872 the Overland Telegraph line was established, cementing the small town's existence. Following this event, a port facility was constructed and a gold rush period began in the 1870's. A railway was built to Pine Creek in 1889 and further development of the town continued. Many of the historic structures in Darwin date from this period.

The development of the mining and pearling industries and the domestic economy attracted Chinese, Japanese, Phillipinos and Malay workers and families to settle in Darwin. Middle class Europeans in Darwin managed to establish a social hierarchy, which in turn segregated the locations that people settled in the township. This led to the demarcation of areas as being the white administration and residential zones the establishment of a "Chinatown" and shanty area where the dispossessed Larrakia people lived.

In 1911 administration of the Northern Territory was transferred from South Australia to the Commonwealth Government. A build-up of defence personnel in the 1930's saw the population of Darwin increase from a few thousand to approximately 15,000 by the outbreak of hostilities in 1941. World War II developments had a significant impact on the development of Darwin. During World War II many developments occurred in and around Darwin. The major developments were the construction of the Stuart Highway in 1941, air force airstrips, the stationing of large numbers of military personnel and use of the Harbour for naval purposes.

Destruction has also been as significant in the history of Darwin as development. Cyclones in 1897 and 1937 caused much damage and rebuilding. World War II also was a period of destruction and rebuilding. Much debris was left over from WWII and was not dealt with until 1951. The post-war period saw Darwin rebuilt however the existence of a Chinatown ended. Then in 1974, Cyclone Tracey had a large impact on the appearance and development of Darwin in the following decade.

As a result of the general historical events and growth of the township of Darwin, it is possible to predict the types of archaeological materials associated with each period. The table below attempts to list the types of materials that may be encountered in the East Arm area.

Table 4: History and likely relics encountered at Darwin archaeological sites.

Period	History	Archaeological Relics
1869-1911	Includes occupation of Darwin, specifically the 1880's period during the gold rush era, first major buildings.	Chinese pottery and ceramics, hand-made bottles and fragments, match tins, tobacco tins, gin bottles, Chinese artefacts, European ceramics
1911-1939	Commonwealth administration, Vesteys era, build up of Military, depression	Machine made modern bottles and glassware,
1939-1945	World War II construction, damage and reconstruction	spent ammunition casings, WWII beer bottles, other bottles & glassware, plain ceramics, metal fragments (ie star pickets, wire), building fragments (ie bricks, glass, CGI, tiles, pipes)
1946-1960	Post War Reconstruction	building materials and discard ie bricks, glass, CGI, tiles, pipes, food & beverage refuse
1961-1974	Growth of Darwin as a regional capital	Typically identifiable as modern manufactured items
1974-1980	Cyclone Tracy and modern development of Darwin	Building material discard, window glass, asbestos fibro sheeting, CGI, drink bottles, food & beverage refuse

4.2 World War II Archaeological at East Arm

There are 3 previously recorded World War II sites located in the East Arm area (Figure 4). World War II activities in the general area involved RAAF flying boat activities, covert operations training area and headquarters, and Army static air defence positions. WWII sites on Middle Arm are relevant to East Arm as these locales were often supplied and linked to the bases on East Arm, especially the Z Force operations and AASL positions. Static air defence including heavy anti aircraft positions consisting of four 3.7 inch guns were established at Quarantine (East Arm) and on Middle Point. In support of these HAA positions were a series of search light batteries and positions located from Middle Point and along Middle Arm (Table 5).

Figure 4: Previously recorded World War II sites in the Middle Arm and East Arm areas.

Table 5: Previously recorded WWII sites in the East Arm Area

Name	Theme	Description
East Arm Flying Boat Base	Air operations: Offence	Established in 1942 the base was used by the US Navy and later RAAF Catalina squadrons. Ramp, hangar foundation slabs and some artefact material remain. under threat by the East Arm Port development
Lugger Maintenance Section	Land operations: covert	Former 'Z' Special Unit base for covert operations against the Japanese from 1942, utilising the 'Snake' boats and RAAF and USAAF aircraft. Lugger ramp and work area, main camp and associated infrastructure and some artefact material remain. Under threat by East Arm Port development - access unknown
'Quarantine' HAA	Defence: air static	Declared Heritage Place. Constructed by the 14th HAA Bty and a Pioneer Company, the site featured four 3.7-inch A-A guns and command infrastructure. Extant gun sites, command post, camp area, extensive artefact material and fortified entry point remain. Evidence of searchlight battery occupation of high ground to the south exists in artefact material.
Middle Point AASL	Defence: air static	Searchlight battery positions Darwin Harbour - Sites feature foundation slabs, reinforced positions, pathways, artefact material including refuse pits and dumps. Access to the sites is limited due to their remote nature.
Middle Point AASL	Defence: air static	Searchlight battery positions Darwin Harbour - Sites feature foundation slabs, reinforced positions, pathways, artefact material including refuse pits and dumps. Access to the sites is limited due to their remote nature
Peak Hill Z-Force Training Camp	Land operations: covert	Z-Force established a training area on Wickham Point. Site consists of series of concrete slabs, concrete tiled hut bases, slip-way, well, and refuse areas and pits.

4.2.1 RAAF Catalina Squadrons and Flying Boat Base at East Arm

The RAAF Flying Boat Base occupied the northern and southern portions of Quarantine Island. The FBB accommodation area was sited on the north end of the island and the operations area and workshops to the south. The following is an extract from the Conservation Commission of the Northern Territory publication on the East Arm Flying Boat Base:

"During 1942-43, Darwin's East Arm was developed by No61 Works Wing to facilitate the long range mining and bombing operations carried out by the Catalina Flying Boats throughout the South West Pacific Area. Prior to this The American Navy had made use of the site to load Catalina's with magnetic mines."

Numbers 20 and 42 Squadron operating as part of No 76 Wing with Catalina's, mining harbours, performing air sea rescue duties, and generally harassing the enemy, which by then was retreating to the home islands. Despite No 42 Squadron moving east to Melville Bay near Gove in July 1944, the unit maintained a detachment at East Arm and, with the cessation of hostilities, Catalina's were involved in the planned evacuation of POW's from Singapore and other areas."

Figure 5: WWII Catalina Flying Boat Base circa 1960s. Courtesy NT Dept of Lands Collection, PH0139-1848

The Flying Boat Base was constructed in late 1942 and was ready for occupation on the 23rd September 1943 (Dermoudy 1993). No. 2 Flying Boat Maintenance Unit (2FBMU) was stationed at the Quarantine Island Flying Boat Base. In 1943 Catalina Squadrons were moved to Darwin to facilitate the long range mining and bombing operations in the 'North West Area'. On the 1st June 1944 No 42 Squadron joined 43 Squadron at Darwin moving to the East Arm flying boat Base (Alford 1991:66). According to Dermoudy (1993) the Catalina aircraft were also used for air-sea rescue and covert insertion operations. Catalina's provided support for the Operations of 200 Flight, a unit formed for use by the Allied Intelligence Bureau and its 'Z'

Special Unit operatives (Alford 1991:67). Alford (1991:65) provides a description of the RAAF Catalina operations:

"…the Catalina flying boats came and went for anything up to 24 hours at a time. Their missions, be they rescue, bombing or mine laying, were hazardous in the extreme; the 'Cats' were slow, vulnerable and lacking proper defences, however the managed to sink shipping and bottle up the Japanese with precision mine laying as far north as the Philippines, Hong Kong and Taiwan."

A significant mission undertaken by the Catalina aircraft from Darwin included the mine laying operation of Manila Harbour (Dermoudy 1989). According to Dermoudy (1989) this was one of the largest mine laying operations of the war. Alford (1991) describes this operation as one of the longest wartime operations conducted by the RAAF.

A total of 33 RAAF Catalina's were lost in operations throughout the war years with a loss of 64 Officers and 109 Airmen in total (Alford 1991:65). Mining operations in the Indonesian archipelago appeared to have a considerable impact on Japanese shipping during World War 2. The following extract by a senior Japanese commander illustrates the effectiveness of the Catalina operations:

"Mining countermeasures involved the use of 1500 men and 30 vessels in the area. Nevertheless, about 40% of all vessels over 1000 tons which sailed into Balikpapan and Sourabaya were sunk or damaged by mines. In many cases ships were salvaged only to be sunk the second time. Even before the capture of the Philippines the traffic to the Netherlands East Indies was reduced to a trickle. After February 1945, no attempt was made to sail large ships and only smaller vessels, schooners and wooden barges were employed." Extract from Powell (1988:175)

From 1944 to 1947, the RAAF operated five Air-Sea Rescue Flights in Northern Australia, New Guinea and Borneo. Equipped with Catalina and Martin Mariner flying boats, these units were used to carry out search and rescue operations, often involving the recovery of aircrew stranded in enemy territory. These hazardous missions frequently subjected the aircraft and its crew to enemy fire. Aside from its air-sea rescue role, the Catalina's flew medical supplies to remote Army units as well as providing regular courier runs throughout the region. (http://www.raafmuseum.com.au)

The last mine laying operation was conducted on 30 July 1945 (Alford 1991). The last weeks of the War were spent harassing the enemy wherever possible. At the end of hostilities of World War 2, Australian Prisoners of War held in Singapore were repatriated to Australia via the flying boats from Darwin. According to the Australian Prisoner of War Reception Group, approximately 13,428 Allied personnel were repatriated from Singapore, the majority by hospital ships (Vincent 1981:91). Catalina's and other aircraft evacuated only 1244 personnel, as only the fittest ex-prisoners of war were able to cope with this method of transport. RAAF flying boat operations ceased on Quarantine Island on 1947 when No 112 Air-Sea-Rescue Flight disbanded in October. This marked the end of Catalina operations from Quarantine Island.

4.2.2 Archaeology of the RAAF Flying Boat Base

There are few remaining terrestrial structures from the RAAF Flying Boat Base. These consist of the crash boat slipway, remnants of a jetty, a tarmac and parking apron, and ramp. The former crash boat slipway is a substantial structure consisting of a concrete structure and steel rail for the slipway trolley. This slip resembles in construction a lifeboat slipway common in Britain during the late 19th and 20th centuries. It is likely that the crash boat resided on the slip until launch then was retrieved via a winch and trolley. There are no visible remains of the trolley or the winch/cable. There are a number of extra rails lying parallel to the slip, possibly from the upper slip way where the rails are absent, or from the bituminised Catalina apron to the west. The concrete ramp used to bring Catalina Flying Boats out of the water is located to the south and below the tarmac and apron.

Located higher and to the north of the Crash Boat Slipway and the Catalina Ramp is a large level area with what appears to be old bitumen seal. Part of the apron has been cross sectioned by sea erosion showing the compressed gravel surface preparation. There is only one layer evident in this erosion section, indicating that the current surface is most likely to be the original 1943 sealed surface for the Catalina tarmac and apron.

The remains of the Flying Boat Base jetty are located to the north of the Crash Boat Slipway and approximately 30 metres south of the location of the LMS Jetty. According to the 1946 map the he Flying Boat Base Jetty was a much larger structure than the jetty used by the LMS. It is difficult to determine from the remains of the structure at low water springs the actual length of the original structure. There are two large mooring blocks located near the Crash Boat slip and the remains for the Flying Boat Base Jetty. It is possible that one or both these features relate to the WWII period of use. Both are constructed in multiple concrete pours, usually an indicator of age.

4.2.3 Anti Aircraft Operations at East Arm

When enemy air action against mainland Australia was anticipated, the Australian military command allotted nine anti-aircraft (AA) Composite Regiments for mobile AA defence of Darwin. In early August 1941 reconnaissance parties investigated Darwin Harbour to seek out suitable search light battery locations. Places surveyed included Talc Head, Picnic Cove and Swires Bluff on the eastern side of the Cox Peninsula. Other areas including an unnamed island on the West Arm of the Harbour, north of Kings Table, as well as Flagstaff Hill, Channel Island, Middle Point (the tip of Wickham Point) and East Arm Island were also selected as anti-aircraft search light (AASL) locations.

Rayner (2001) indicates that a search light position was operating at East Arm 1943. It is likely that this search light position was situated somewhere near the heavy anti aircraft battery. References indicate that the 70 AASL Coy and 65 AASL Coy were maintaining sites at East Arm, Middle Point, Flagstaff Hill and Harpers Folly by April 1943 (Rayner 2001:222). The AASL personnel would commonly rotate through the various search light positions as a strategy to combat boredom and keep morale positive. It was a common practice to rotate between the ‘land stations’ and the ‘over-water stations’. It appeared to be generally acknowledged that serving at the over-water stations was the more taxing on personnel of the two.

The remote stations had to be provisioned on a daily basis. 4th Australian Water Transport Coy (Small Craft) Royal Australian Engineers (RAE) and 15th Australian Water Transport Coy RAE conducted daily runs to military installations at West Point, Talc Cove, Swires Bluff, Harpers Folly, Flagstaff Hill, Middle Point, and East Arm and every alternate day to Channel Island (Rayner 2001:336).

By November 1944, a major reorganisation of the Anti Aircraft regiments took place in the Darwin area. Major changes to the AA defence of Darwin and planned reductions in the order of battle for Northern Territory Force involved the removal of static AA guns from the 19 Aust HAA Bty currently at Fanny Bay, McMillans, and Darwin Oval (Rayner 2001:578). The 67 AASL Coy received approval for the removal of search light station sites as a preliminary for the removal of the entire battery from the Darwin Harbour area (Rayner 2001:577).. Personnel from evacuated sites took over stations at East Arm, Middle Point, Flagstaff Hill and Harpers Folly from the 69 AASL Coy (Rayner 2001:577).

By the 20 July 1945, Victoria Barracks Melbourne issued the order to HQ Northern Territory Force confirming that AA artillery was no longer required and instructions were to follow for the withdrawal of the 54 and 55 Aust Composite AA Regt from the Darwin Area (Rayner 2001:633).

4.2.4 Z Special Unit at East Arm

A section of the Z Special Unit or Services Reconnaissance Department (SRD) operated from Darwin during WWII, with the area of operations mainly in East Timor and Borneo. Although SRD had a limited role In the South West Pacific sphere, it attracts greater public interest (being a Special Forces type operation) compared to the involvement of other divisions of the armed services.

The Lugger Maintenance Section (LMS) site at Quarantine Island, East Arm was allocated to SRD in April 1943. SRD was satisfied with the choice of location, as secrecy was a priority. LMS was the site of all SRD operations and administration for the Darwin area. Attempts to establish a satellite camp for training purposes began in July 1943 after SRD took over the LMS facility at Quarantine Island. By July 1943 Peak Hill (on the end of Wickham Point) was selected as the satellite training camp and LMS applied to Darwin Fortress Command for Peak Hill to be allocated for SRD use.

Timorese civilians and Portuguese nationals began arriving in Darwin after the Japanese invasion of Timor in February 1942. The last major evacuation of Timorese occurred in December 1942 when the Australian forces finally withdrew from Timor. SRD specifically organised the evacuation of Timorese civilians they considered as candidates for inclusion in future operations in Timor. Timorese civilians formed a work group at the LMS base at East Arm. Very little is known of the Timorese involvement in Darwin during World War II. However it is known that many of the Timorese evacuees were organised into labour groups by NEFIS (Netherlands Forces Intelligence Section) to conduct works in the Darwin Fortress area. It is assumed that they provided labour for capital works and general camp duties and possibly assisted Dutch/Australian Squadrons operating in the Northern Territory.

4.2.5 Archaeological Features of the Lugger Maintenance Section

A considerable number of features still remain from the Lugger Maintenance Section (LMS) at East Arm. Amongst the features exists the slipway feature, concrete structures for workshops, engine rooms, and battery charging rooms, mess complex, latrines, washhouse, stores, and various building foundations. The site is in a ruinous state. Amongst the ruins are scattered piles of refuse from consisting of broken glass, bricks and other masonry, broken fibro, and rusted tin. Around the slipway pieces of tin, aluminium and other metal off cuts from the workshops can be found.

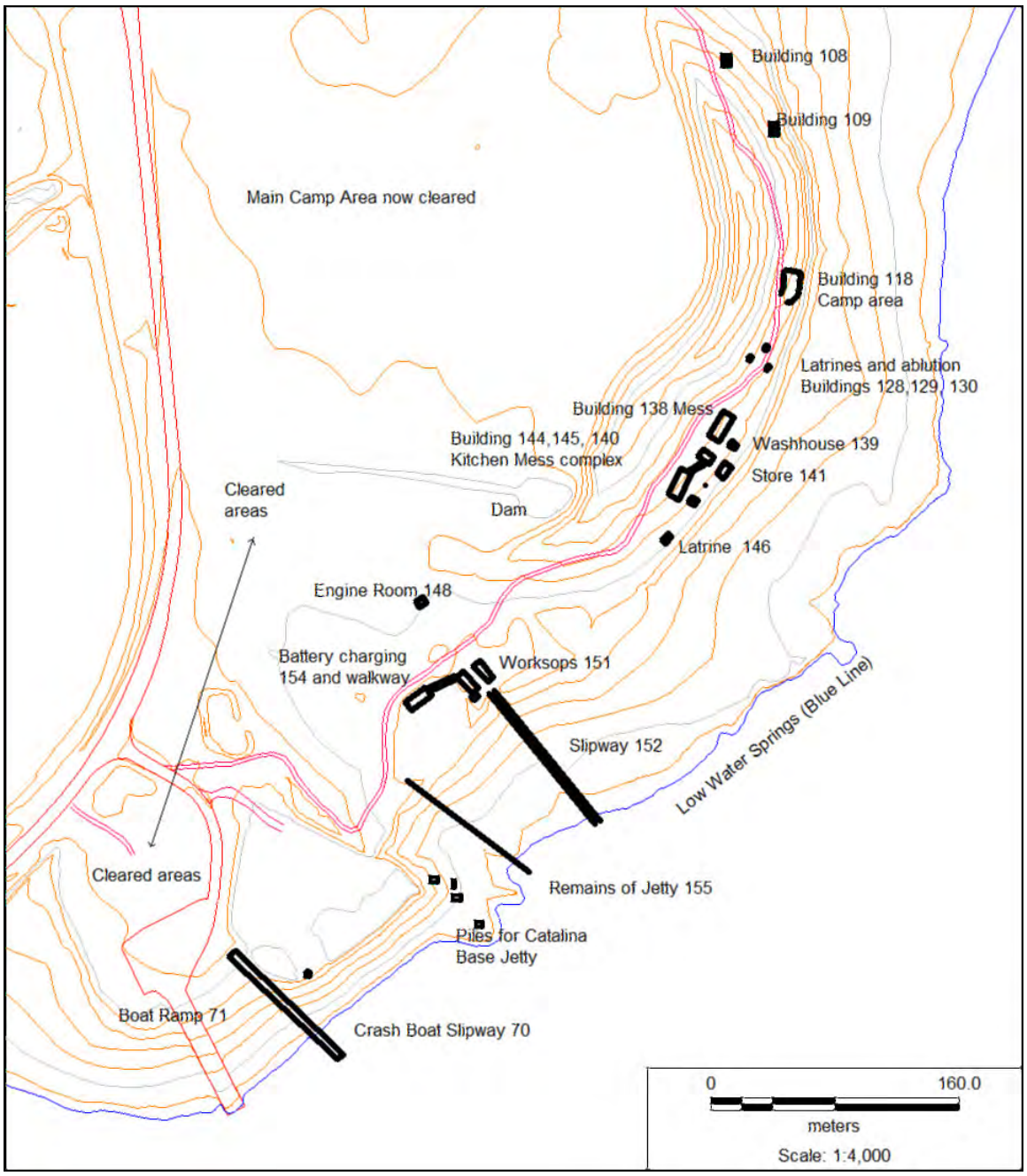


Figure 6: Map showing the location of WWII archaeological features at the LMS Base.

4.3 Maritime Cultural Heritage – Darwin Harbour

Little is known of previous non-Indigenous use of the Darwin Harbour prior to the settlement of Darwin in 1869. There is no archaeological evidence to suggest that Darwin Harbour was used as a processing place by Macassan trepang fishermen from Sulawesi. The chance discovery of an earthenware jar on the coast at Shoal Bay, Darwin provided a thermoluminescence to 490 years BP $\pm$ 25% (1513 $\pm$ 80 years AD) (Dwyer 2006) . Initial reports have suggested that the jar appears to be of southern European (Portuguese or Spanish) origin. However this single find and provenance is an unreliable indicator of previous maritime visitation to Darwin Harbour. The harbour was noted and briefly visited by colonial explorations during the 19th Century. Following Goyder's landing in 1869 in Darwin at the base of Fort Hill, the southern tip of the Darwin peninsula has been a major hub of shipping activity through to the present for northern Australia. During the 1870s and 1880s the Fort Hill area was used as the landing for ships' passengers and cargo accessed by a derelict timber and stone jetty and later the wreck of the vessel *Gulnare*. The bay formed by Stokes Hill and Fort Hill peninsulas remained essentially as a walkway along the foreshore and a jetty along with railway head were established at Stokes Hill.

Figure 7: Fort Hill Wharf area circa 1879.

By the late 1930s the threat posed by the Japanese throughout the Pacific was being taken seriously by the Australian Government. A rapid build up of defences commenced as early as 1932 with developing the naval oil tanks at Stokes Hill, thus strengthening the area as a major hub for naval shipping. World War II saw a major build up naval and shipping activity from 1939 to 1945. The Stokes Hill Wharf area continued to be in commercial and naval service through to today.

4.3.1 Shipwrecks in Darwin Harbour

Types of shipping that are known to have wrecked in Darwin Harbour include schooners, pearling luggers, a number of larger steel ships such as those sunk in WWII, several early types of steel steamship, small fishing vessels, a tank barge, trawlers, yachts, and miscellaneous small vessels. A summary of reported ships and the wrecking dates are provided in Table 5 (refer also Section 2.3.5 Table 2 for recorded shipwrecks proximal to the study area). This list is by no means exhaustive, but provides an overview of the diversity of shipping that used Darwin Harbour and that were wrecked here. Wrecking events for ships and aircraft can happen at any time, largely owing to accidents or poor maintenance and lack of seaworthiness. Gales and severe storms were known to have wrecked various water craft from time to time on the harbour. However, in the case of Darwin Harbour, there have been a number of significant wrecking events that have taken place which have contributed to the maritime archaeological record.

These events are:

1. 1897 Cyclone – approximately 6 vessels lost
2. World War II – approximately 10 vessels lost and a number of aircraft
3. 1974 Cyclone Tracy – approximately 20 vessels lost

Figure 8 illustrates the distribution of reported shipwrecks by decade in Darwin Harbour. Noticeable increases are seen in the decades of the major wrecking events. For example, on 7 January 1897 a cyclone killed approximately eighteen people on land and another ten at sea, and destroyed nineteen of the twenty-nine pearling luggers at anchor.

The most famous of the wrecks in Darwin Harbour date to World War II. Darwin was seen as a key port for the Allied ships, planes and forces defending the (now Indonesia and East Timor). Australia experienced the first attack on its mainland territory on 19 February 1942 with the Darwin bombing. One hundred and eighty-eight Japanese planes attacked both land targets and shipping. This first attack lasted forty minutes and was followed by a second only an hour after the first ended. It is estimated that 243 Australians and allies were killed that day. Six Allied ships, British Motorist, Mauna Loa, USS Meigs, USS Peary, Neptuna, and Zealandia were all sunk in Darwin harbour as a result of that first air raid on Darwin in 1942.

Cyclone Tracy accounts for the majority of shipping lost in Darwin Harbour, and like the 19 February 1942 bombing raids, resulted in a major loss of life. These vessels were generally smaller than the capital ships sunk in World War II. The large proportion of ships that were wrecked included fishing trawlers, ferry boats, yachts, and two RAN naval patrol boats.

Since Cyclone Tracy, the main contributor to shipwrecks in Darwin Harbour can be attributed to government policy rather than a particular wrecking event. At the end of the Vietnam War, dozens of Vietnamese refugee boats began to arrive at Darwin Harbour. Generally the ships and boats were in very poor condition and were scuttled, burnt, or left to rot in the mangroves of Darwin Harbour. Later border protection policy and apprehension of illegal Indonesian fishing vessels has resulted in similar vessel destruction.

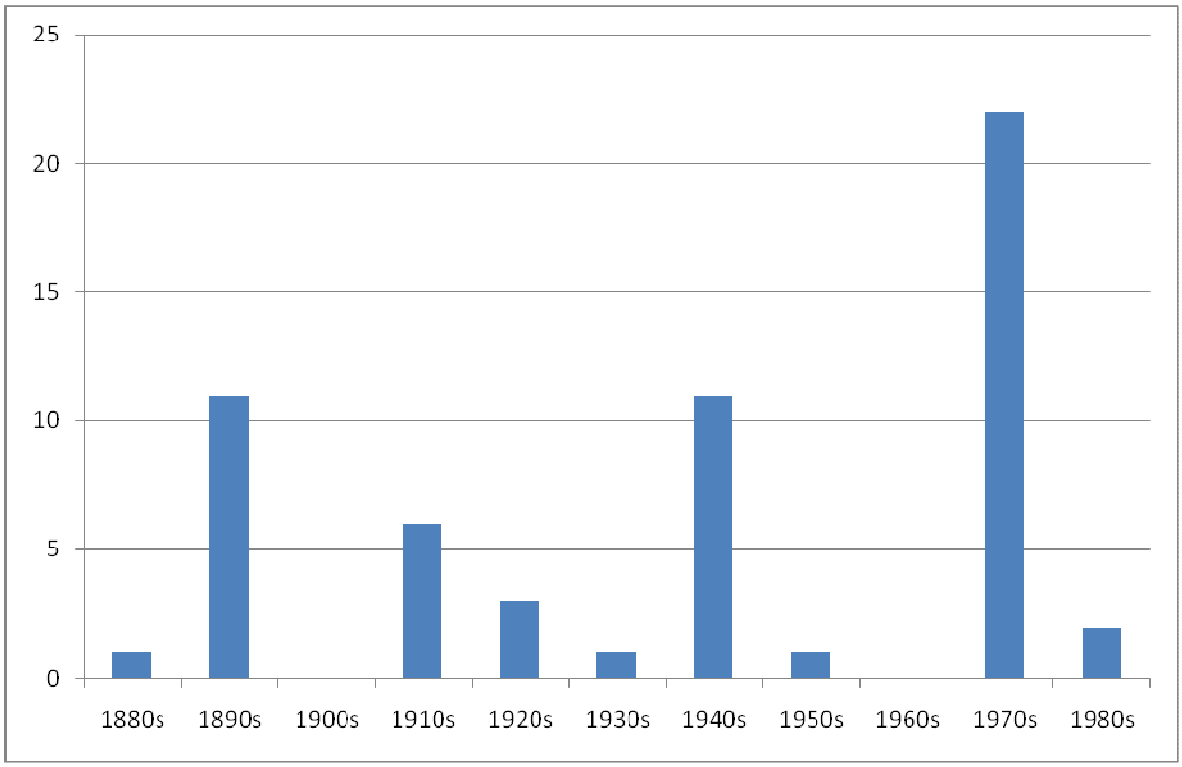


Figure 8: Chart showing reported wrecks per decade

Further wrecks continue to be identified in Darwin Harbour with the recent discovery of the Huddersfield (yet to be confirmed), a 174-ton schooner built in Jervis Bay, NSW in 1919 that was lost in Frances Bay on December 1928 (Schacht 2010:5).

Table 6: Wrecks in Darwin Harbour (compiled from Lewis 1992 and Loney 1994

Name	Vessel	Wrecking Event	Wrecking Date
Ellengowan	Iron steamer, 58/36 tons. Built Christiania, Norway, 1866; reg. Melbourne, Port Darwin. Lbd 79.7 x 15.1 x 8.4 ft.		1888
Dawn	Schooner	Loaded with cargo salvaged from S.S.Brisbane, foundered near Middle Point	1881
Levuka	Schooner, 79 ft	Broken up Port Darwin	1891
Dawn	Ketch, 51 tons. Built Port Darwin, 1869	Broken up Port Darwin, January 1893.	1893
Fleetwing	Wooden steamer, 31 tons. Built at Nowra, 1874	Broken up at Port Darwin	1894
Flying Cloud	Government sailing cutter	Sold to Japanese interests who were converting her for pearling when a storm drove her ashore, wrecked, at Darwin	1894
Good Intent	Ketch, 27 tons. Built 1874	Foundered at Port Emery near Darwin, November 1894	1894
Jessie Anderson	Schooner, 42 tons. Built 1874	Broken up Port Darwin	1895
Ark	Pearling cutter, 6 tons	Destroyed in cyclone off Darwin	1897
Blackjack	Pearling lugger, 6 tons	Destroyed in cyclone off Darwin	1897
Brisbane	Pearling lugger, 11 tons.	Destroyed in cyclone off Darwin	1897
Cleopatra	Pearling schooner	Destroyed in cyclone off Darwin	1897
Maggie	Pearling lugger, 14 ton	Destroyed in cyclone off Darwin	1897
Olive	Pearling schooner, 11 ton.	Destroyed in cyclone off Darwin	1897
Leichardt	Government schooner, two-masted, 127 tons, 80 ft.	Destroyed by fire while beached at Darwin for repairs.	1915
Spray	Launch	Destroyed in a cyclone in Darwin Harbour	1915
Unidentified	2 x Luggers	Two luggers were sunk during a cyclone in Darwin	1915
Cameo	Lugger	Destroyed in a storm at Darwin	1919
Lone Hand	Government launch	Destroyed in a storm at Darwin	1919
Maggie	Schooner	Destroyed in a storm at Darwin	1919
John Alce	Auxiliary ketch, 33 tons. Built Gosford 1906	Owned by the Commonwealth. Destroyed in heavy weather near the Darwin jetty	1921
Rachel Cohen	Wooden schooner, 171 tons. Built Manning River, NSW, 1871. Lbd 105.5 x 21 x 10.4 ft.	Swept by fire while anchored in Darwin Harbour and sank in Francis Bay	1924
Olga	Government launch	Burnt near Darwin	1926
Unidentified	Lugger	Destroyed by fire while in Darwin harbour	1939
British Motorist	Tanker, 6891 tons. Built Newcastle-on-Tyne, 1924. LBD 440.2 x 57 x 33.8 feet	Abandoned after being hit by two bombs during the Japanese air raid on Darwin, 19 February 1942.	1942

Name	Vessel	Wrecking Event	Wrecking Date
Kelat	Coal hulk, 1849 tons. Built 1881 Formerly the Hovding. Lbd 261 x 41 x 23.5 ft.	Requisitioned by the Royal Australian Navy in 1941. Sank several days after being machine gunned and badly damaged during the Japanese air raid on Darwin	1942
Mauna Loa	American transport ship, 5436 tons. Built San Pedro, USA, 1919, as the Golden Eagle. Lbd 410 x 54.4 x 27.2 ft.	While at anchor in Darwin Harbour during the Japanese air raid, was hit in an open hatch by two bombs, caught fire, broke her back, then sank by the stern	1942
Meigs	American transport ship, 11358 tons. Built San Pedro, California, 1921 as the West Lewart. Lbd 430.7 x 54.3 x 26.2 ft	On fire, sank, during the Japanese air raid on Darwin	1942
Neptuna	Steel vessel, 5952 tons. Ex Neptun 35. Built Kiel 1924. Lbd 393.3 x 51.9 x 25.3 ft. Owned by Burns Philp.	Destroyed in explosion during the Japanese air raid on Darwin	1942
Peary	United States destroyer, 1190 tons displacement. Built 1920. Lbd 314.5 x 30.8 x 9.3 ft.	Destroyed during the Japanese air raid on Darwin	1942
Zealandia	Steel steamship, 6683 tons. Built on the Clyde, Scotland, 1910. Lbd 410.3 x 54.7 x 31.1 ft.	Whilst unloading supplies, on fire and sank during the Japanese air raid on Darwin	1942
Dawn	Launch	Ashore and destroyed by a gale at Darwin	1943
Karalee	R.A.N. water lighter, wooden vessel, 117 tons. Built 1911	Temporarily repaired after being damaged in the first Japanese air raid on Darwin, sank there at her moorings	1943
Yampi Lass	Lugger	Ashore and destroyed by a gale at Darwin	1943
Peron	Motor launch	Disappeared near Darwin	1948
Unidentified	'Tank' landing barge	Sank, Darwin Harbour	1954
Chang	Vietnamese refugee boat	Scuttled on Fish Reef in Darwin Harbour	1970s
Arnhem Trader	Steel vessel, ex-trawler, 80 ft. Built Williamstown, Victoria,1938.	Scuttled under the Stokes Hill wharf after Cyclone Tracy struck Darwin	1974
HMAS Arrow	RAN patrol boat, 146 tons. Built 1968	During Cyclone Tracy, broke her moorings and was driven under the Stokes Hill wharf , Darwin	1974
Bell Bird	Fishing boat	Gollin Kyokuyo fleet, one of six of the 'Bird' fleet of prawn trawlers, Lost when Cyclone Tracy hit Darwin	1974
Betty Joan	Yach, Small craft	Lost Cyclone Tracy in Darwin	1974
Blue Bird	Fishing boat	Gollin Kyokuyo fleet, one of six of the 'Bird' fleet of prawn trawlers. Lost when	1974

Name	Vessel	Wrecking Event	Wrecking Date
		Cyclone Tracy hit Darwin	
Carina	Ferry	Lost in Cyclone Tracy at Darwin	1974
Charles Todd	Wooden launch, ferry, 14 metres	Lost in Cyclone Tracy at Darwin	1974
Darwin Princess	Steel ferry, 75 ft. Built Melbourne	Lost in Cyclone Tracy at Darwin	1974
Diemen	Fishing vessel, 73 ft	One of nine prawn trawlers owned by Northern Research company; Lost near the Stokes Hill wharf in Cyclone Tracy	1974
Edwina May	Ferry	Darwin Harbour Ferries Co. Was anchored at Frances Bay, when Cyclone Tracy hit Darwin	1974
Flood Bird	Fishing boat	Gollin Kyokuyo fleet. Lost when Cyclone Tracy hit Darwin	1974
Frigate Bird	Fishing boat	Lost when Cyclone Tracy hit Darwin. Gollin Kyokuyo fleet	1974
Gunyana	Wooden pilot boat, 13 metres	Moored inside Stokes Hill Wharf but broke free, drifted and sank during Cyclone Tracy	1974
Jenny Wright	Fishing boat, steel prawn trawler, 19 metres	Wright Bros fishing company. Lost when Cyclone Tracy hit Darwin	1974
La Pelican	Small craft	Lost when Cyclone Tracy hit Darwin	1974
Mandorah Queen	Ferry, 22 metres	Lost when Cyclone Tracy hit Darwin	1974
Nimrod	Navy workboat	Lost when Cyclone Tracy hit Darwin	1974
Rasta	Small craft	Lost when Cyclone Tracy hit Darwin	1974
Scallywag	Small craft	Lost when Cyclone Tracy hit Darwin	1974
Scynta	Small craft	Lost when Cyclone Tracy hit Darwin	1974
Song Saigon	Vietnamese refuge boat, ex steel tanker	Arrived Darwin with 34 people & was scuttled Darwin Harbour	1979
John Holland	barge	Scuttled Darwin Harbour	1984
DK 06 Ham Luong	Vietnamese refugee boat	Arrival date at Darwin not recorded. Scuttled in Darwin Harbour	1985

4.4 Flying Boat Wreck Sites in the East Arm Area

There are six PBY Catalina flying boat wrecks in the general East Arm area (See Table 7 and Figure 9 below). These Catalina flying boats sank during World War II. Of the 6 wrecks, 3 belong to the United States Navy Air Force and 3 to the Royal Australian Air Force. Most notably the 3 US Navy Catalina flying boats were sunk on the 19th February 1942 during the first major Japanese air raid on Darwin.

Table 7: List of PBY Catalina Flying Boat wrecks in the East Arm area

Name	Also known as	Location	Owner	Comments
Catalina 1	RAAF Catalina A24-1	Exposed at low tide in East Arm, Darwin Harbour	Commonwealth	Crashed in 1945 on mission to Singapore to retrieve POW's
Catalina 2	PBY-5A model A24-69 BAN 34056	Submerged in East Arm, Darwin Harbour	Commonwealth	Caught fire by accident on 14 December 1945
Catalina 3	PB2B-1 model A24-206 BAN 44217 ex RAF JX611	Submerged in East Arm, Darwin Harbour	Commonwealth	Sank from accidental depth charge explosion 20th June 1945
Catalina 4	28-5MNE #41 Ex Y41 Netherlands	Submerged in East Arm, Darwin Harbour	US Navy	Sunk in first air raid 19 Feb 1942 Only 1 of this type in harbour
Catalina 5	PBY-4 Model Unknown PBY 4	Submerged in East Arm, Darwin Harbour	US Navy	Sunk in first air raid 19 Feb 1942 (1 of 2 in harbour)
Catalina 6	PBY-4 Model Unknown PBY 4	Submerged in East Arm, Darwin Harbour	US Navy	Sunk in first air raid 19 Feb 1942 (1 of 2 in harbour)

4.4.1 19th February 1942 and the US Navy Catalina Aircraft

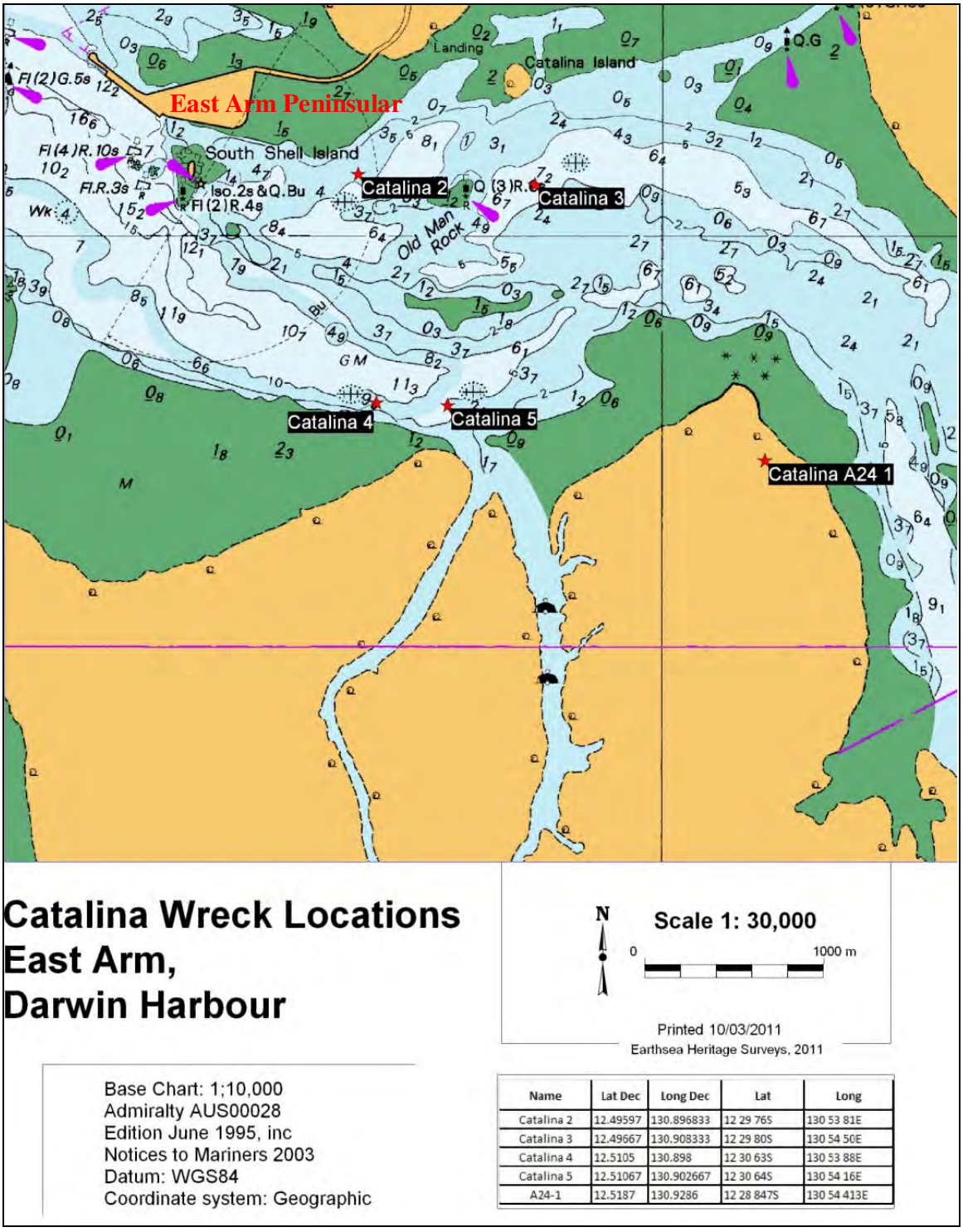
The United States Navy had Catalina aircraft stationed in Darwin with Patrol Wings 10 and 22. According to Alford (1991:14) the first aircraft destroyed by the Japanese force that bombed Darwin on the 19th February 1942 was a Catalina of the US Navy Patrol Wing 10. The Catalina was shot down off the northern tip of Bathurst Island. During the first air raid by the Japanese on Darwin a total of 23 ships were sunk or badly damaged. It was reported that some Japanese aircraft had also crashed into the sea (Alford 1991:20). The Japanese air raid on 19th February accounted for the loss of three US Navy Catalina aircraft in East Arm.

"Aircraft losses as a result of the raid were severe however; a total of some 26 were destroyed… Ten of the 33rd Pursuit Squadron's P-40s were lost, four PBY Catalina's three of which were strafed at their moorings on the harbour…" Alford (1991:20)

The distinct southern group of Catalina wrecks in East Arm concurs with and account that the USS William B. Preston having been moored with her three charges in a line. All three aircraft were sunk during the first Japanese air raid on 19th February 1942.The wreck known as 'Catalina 4' is a 28-5MNE Catalina flying boat. This wreck has been identified as United States Navy aircraft #41 (ex-Y 41, Marine Luchtvaart Dienst Royal Netherlands Naval Air Service). Catalina 4 has been identified as US Navy #41 on account of its non-cone shaped 'spinners', a distinctive feature of the PBY-5 model.

The wreck site known as 'Catalina 5' is a PBY-4 Catalina flying boat. These were United States Navy aircraft known as #4 (Bureau of Aeronautics Number: 1214 ex 101-P-27, ex 102-P-27, ex

102-P-12) and #8 (Bureau of Aeronautics Number: 1233 or 1238; ex 101-P-8). It is not known which of these two aircraft is found at the Catalina 5 wreck site.



Name	Lat Dec	Long Dec	Lat	Long
Catalina 2	12.49597	130.896833	12 29 76S	130 53 81E
Catalina 3	12.49667	130.908333	12 29 80S	130 54 50E
Catalina 4	12.5105	130.898	12 30 63S	130 53 88E
Catalina 5	12.51067	130.902667	12 30 64S	130 54 16E
A24-1	12.5187	130.9286	12 28 847S	130 54 413E

Figure 9: Location of wrecked Catalina Flying Boats – Catalina 6 not shown owing to request from NTG

Figure 10: A US Navy PBY Catalina flying boat turns towards two Australian corvettes. In the right background is a US Navy destroyer of the four-stack type, probably USS Peary taken on 19 February 1942 (AWM304462)

4.4.2 RAAF Catalina Aircraft Wrecks

The wreck site known as 'Catalina 2' is a PBY-5A (M) Catalina flying boat. It has been identified as RAAF aircraft A24-69 (Bureau of Aeronautics Number: 34056). This aircraft caught fire by accident on 14 December 1945. The wreck site known as 'Catalina 3' is a PB2B-1 Catalina flying boat and has been identified as RAAF aircraft A24-206 (Bureau of Aeronautics Number: 44217; Ex-Royal Air Force JX611). This aircraft sank as a result of an accidental depth charge explosion on 20 June 1945. Site inspections revealed the explosion occurred on the starboard wing. The starboard wing was blown off and lies some sixty metres away from the main wreck site.

On the 30 August 1945, aircraft A24-1 was wrecked as a result of a take-off accident. Dermoudy (1989) provides the following account of the A24-1 crash:

"August 1945 saw the cessation of hostilities, however the Catalina crews were involved in the planned evacuation of POW's from Singapore and other areas. The bid to become the first to Singapore had its consequences when A24-1 crashed on takeoff from East Arm on 30 August. The aircraft captain Wing Commander K. Bolitho had hoped that both A24-1 and A24-2, as the first two of the type in service would herald the start of the evacuations."

This aircraft was the first Catalina to see service in the RAAF. On the 6th January 1943 this aircraft sunk the Japanese troopship 'Nichiryu Maru'.

Figure 11: A photo of A24-69 undertaking maintenance at Lake Boga, Victoria

Figure 12: Catalina 5 A24-1 wreck site (Jung 2001, cited in Guse 2001)

5.0 Indigenous Cultural Heritage

5.1 Background Ethnography

According to ethno-historical sources, East Arm Peninsula falls within the traditional country of the Larrakia (eg. Foelsche 1882; Tindale 1974). Parkhouse, the paymaster of South Australian railways at Port Darwin for some years, wrote "The territory of the Larrakia, in which Port Darwin is situated, embraces the seaboard from Shoal Bay to Southport, and extends inland to the forty-sixth mile on the railway line" (Parkhouse 1895:638). He noted that the Larrakia were closely allied and intermarried with the Wulna people occupying the territory to the east and west of Adelaide River.

In the early days of European settlement ethno-historical documents describe the Larrakia as heavily dependent on fish, crabs and shellfish (Basedow 1907; Foelsche 1882). Fish and crabs were procured from reef pools or from constructed fish stone or wood traps using the tides, or from rivers, creeks and waterholes by spearing, netting or using certain poisonous barks or leaves to stupefy the fish (Basedow 1907:23; 1925; Foelsche 1882). Dugout canoes were used for fishing and hunting of dugong and turtles (Basedow 1907:22-25, 1925:131,162-4), and bark and dugout canoes used to transport items such as turtles and shellfish (King 1969:89).

The ethnographic and historical accounts reveal a rich material culture and ceremonial life practiced by the Larrakia and neighbouring groups (Basedow 1907; 1925:248-382; Foelsche 1882:4-7; 1886:255; Parkhouse 1895). A variety of ceremonies were held to celebrate gatherings and battles with neighbouring groups, and initiation of the young and funerals (Foelsche 1882:4-7; Spencer 1912:19). The anthropologist Ronald Berndt (1951:234) describes the cyclical seasonal ritual and ceremonies such as the *Kunapipi* which were performed by Northern Territory groups including the Larrakia, in order to ensure continuation of the human species and a constant supply of food. Large quantities of food were required to feed people gathered for ceremonies. Major camping places were usually found where there were permanent sources of fresh water. Kangaroos and wallabies could be ambushed along well-used paths to waterholes, and ducks, geese and other birds, along with swamp plants such as waterlilies, could be obtained (Basedow 1907:19-27; Foelsche 1882:12-14).

Material culture obtained from Aboriginal locals at Port Darwin in the early years of the European settlement demonstrates extensive use of natural resources. Much of the material culture consisted of perishable items, such as body ornaments made of reed beads, feathers, bark or fur, bamboo and reed spears, nets and bags and wood implements (Basedow 1907:31-39; Foelsche 1882; Kerr 1971:111). The most visible remains of subsistence and settlement activities in the region likely to be preserved in the archaeological record are mounds of shell. Preserved within these deposits are likely to be the skeletal remains of other animals that were exploited such as fish, crab, kangaroo, wallaby, snake and bird.

Other items of material culture likely to be preserved in the archaeological record include stone spear heads, stone axes, stone pestles (pounding stones) and grinding stones (mortars), hearths made from stone or lumps of termite nests, and stone or shell tools used for cutting or scraping (Foelsche 1882; Basedow 1907). Reports describe Aboriginal people along the Northern Territory coast, including Larrakia, using heated stones and termite nest material in

ovens in the ground to cook kangaroo and some plant foods such as yams, cycad palm nuts, wild rice and water lilies (seeds), which were gathered in the late dry from freshwater swamps and processed by grinding with mortars and pestles and cooked in earth ovens (Basedow 1907:27; Foelsche 1882:12-14).

Also likely to survive are pieces of ochre, used to decorate implements, weapons or message sticks (Basedow 1907:36, 46), or mixed with emu fat to paint youths for initiation ceremonies, warriors preparing for ceremonial battles, and also the bodies of the dead (Basedow 1925:184, 208, 249-250; Foelsche 1882:11). It is also possible that human skeletal remains may be found in sandy beach ridges or near shell mounds. Foelsche (1882:5-6) recorded that the Larrakia buried their dead in shallow graves.

The ethnographic information indicates that subsistence strategies would have been focused around certain landscape features, and these are likely to contain archaeological material. This includes localities in close proximity to sources of water and to sources of raw material suitable for stone artefact manufacture, such as creeks, waterholes, ridges and hills. In coastal areas the junction between tidal areas or the mangrove zone and the adjacent higher ground would be expected to have high archaeological potential.

5.2 Indigenous Archaeology of Darwin Harbour

An overview of previous archaeological investigations in the wider region provides a context for evaluating the significance of any materials found in the study area. A search of the Northern Territory archaeological sites database reveals some 250 recorded sites around Darwin Harbour. Of which 101 of these sites are located on the East Arm, Middle Arm, Wickham Point, and Channel Island area. Figure 13 illustrates the distribution of previously recorded sites from the NRETA archaeological site database on East and Middle Arm. About one third of sites on the database are historic and include Indigenous cultural heritage places and places of cross-cultural engagement, such as Aboriginal ceremonial grounds, the remains of the Channel Island and Middle Point Leprosarium, World War Two sites and Southport, as well as historic cemeteries and rubbish dumps.

Historic Indigenous cultural heritage places of cross-cultural engagement are generally referred to by archaeologists as contact period sites. Very few of these types of sites have been documented for the Darwin region. Two-third of sites on the register are “pre-contact” Indigenous Cultural Heritage Places that are archaeological sites such as Aboriginal shell middens, stone artefact scatters and quarries.

Information from the sites register and other consultancy reports indicates that historic and over pre-contact sites have been recorded in the Darwin Harbour area (Bourke 1994, 1996, 2000, 2004, 2005; Crassweller 2001a, 2001b, 2002a, 2002b; Dames and Moore 1997; Heritage Surveys 1997, 2001; Hiscock and Hughes 2001; Richardson 1996). In the Wickham Point area three of the historic sites contain features that date to World War Two and one is the Mud Island leprosarium. The pre-contact sites are mostly mounded Aboriginal shell middens (shell mounds) and some stone artefact scatters.

Most of the previously recorded pre-contact sites are clustered on Wickham Point and around Haycock Reach on the southern coastline of Middle Arm peninsula. The Wickham Point sites include eleven shell mounds recorded during surveys for development of the Phillips LNG

Plant (Crassweller 2001a, 2001b; Heritage Surveys 1997; URS 2002). Another forty-four sites were revealed within areas of dense monsoon vine thicket during construction work (half of which have been destroyed by the development). Eleven of these middens were analysed and radiocarbon dates obtained as part of salvage excavations (Crassweller 2002a, 2006). All middens in this region dated thus far belong to the pre-European period.

Radiocarbon dates have also been obtained on mounds and middens on the southern peninsula coastline around Haycock Reach (Bourke and Crassweller 2006). In addition to records of twenty-three shell middens and mounds, five stone artefact scatters and nine shell scatters, the only occurrence of rock art for the Darwin region has been recorded on this section of the southern coastline of the Middle Arm peninsula (Bourke 1994, 2005, Hiscock and Hughes 2001, Richardson 1996). The rock art (petroglyph) sites, described by Bourke (1994), and Bourke and Mulvaney (2003) as part of a larger midden site have been nominated to be listed on the NT Heritage Register.

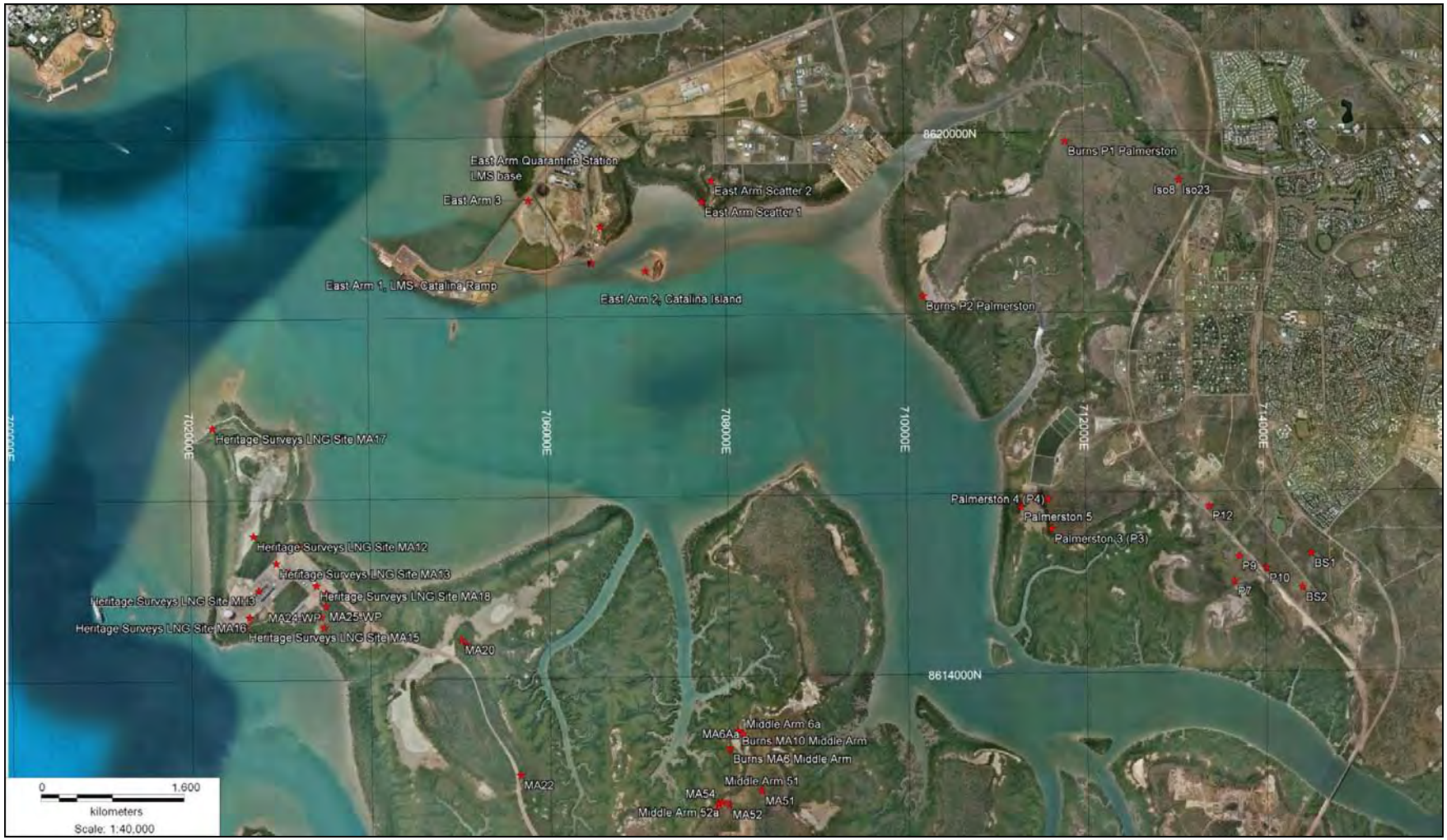


Figure 13: Distribution of previously recorded sites from the NRETA archaeological site database (Base map Google Earth Pro).

6.0 METHODOLOGY

Heritage conservation is based on a number of social and economic principles, including the recognition of competing interests in society and the requirement to maintain a level economic 'playing field'. This section outlines a methodological approach to heritage conservation based on the Burra Charter, what constitutes 'heritage' in the project area and the survey methodology to locate, describe and assess the significance of heritage within the project area.

6.1. Heritage Management Principles

Heritage management in Australia is underpinned by legislation and the ethics and principles established by heritage management practice. This practice has been codified by the ICOMOS Charter for the Conservation of Places of Cultural Significance (hereafter referred to as the Burra Charter). Legislative basis for the protection and conservation of Indigenous archaeological places and objects was discussed earlier in Section 1.

Heritage conservation definitions from the Burra Charter (Maquis-Kyle and Walker 1992:69) are listed below:

- *Place means site, area, building or other work, group of buildings or other associated works together with associated contents and surrounds.*
- *Cultural Significance* means aesthetic, historic, scientific, or social value for past, present or future generations.
- *Fabric* means all the physical material of the place.
- *Conservation* means all the processes of looking after a place so as to retain its c*ultural significance*.
- *Restoration* means returning the EXISTING *fabric* of a *place* to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material.
- *Reconstruction* means returning a *place* as nearly as possible to a known earlier state and is distinguished by the introduction of materials (new or old) into the *fabric*. This is not to be confused with either recreation or conjectural reconstruction, which are outside the scope of this Charter.

The Burra Charter applies these broad principles in Article 2 which states:

"The aim of conservation is to retain the cultural significance of a place and must include provision for its security, its maintenance and its future."

The principles outlined in the Charter are generally those by which most cultural heritage practices in Australia are determined, including the assessment of significance of individual heritage places. Cultural significance means aesthetic, historic, scientific, or social value for past, present or future generations. Significance assessments are a helpful tool in the management of archaeological resources by allowing managers to make informed decisions especially in land use issues. Definitions of these concepts of significance are listed below (Maquis-Kyle and Walker 1992:73)

- *Aesthetic value* includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture, and material of the fabric. The smells and sounds associated with the place and its use.

- *Historic value* encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out here. A place may have historic value because it has been influenced, or has been influenced by, an historic figure, event, phase, or activity.

- *Scientific value* or research potential of a place will depend upon the importance of the data involved, on its rarity, quality, or representativeness, and on the degree to which the place may contribute further substantial information to future research.

- *Social value* embraces the qualities for which a place has become a focus of spiritual, political, national, or other cultural sentiment to a majority or minority group. Aboriginal cultural heritage values fall into this category.

These values can be applied to the assessment of significance of archaeological sites and cultural heritage places in Darwin Harbour. Scientific value will be a considerable factor in the assessment of significance for the majority of Aboriginal pre-contact and historic sites. In addition, social and historical values are seen in a range of places in the region by the Aboriginal groups with native title or other title to the land. Therefore, this report takes a range of values into consideration in presenting recommendations after assessing the heritage significance of located places following the principles of heritage place management that are described in the Burra Charter.

6.2. Site definition

According to Burke and Smith (2004:63) an archaeological site is defined as "any place that contains the physical evidence of past human activity" which can take on an "enormous variety of forms". Archaeologists often make a distinction between relatively dense, localised concentrations of archaeological material and the sparsely distributed materials that surround them. In many areas of Australia there is a continuous scatter of stone artefacts often called a background scatter or referred to as off-site archaeological material (Burke and Smith 2004:220).

The density of background artefact scatter varies in response to the nature and amount of past human activity. The geomorphic context of artefacts also affects their visibility and the conclusions that can be drawn about their deposition: for example, artefacts covered in sediment are not visible, and artefacts moved by erosion have a distorted relationship with their original location. As a result, background scatter of archaeological debris is often very important in the reconstruction of prehistory. Within a landscape littered with archaeological material, archaeologists also call unique or rare types of debris or especially dense concentrations of archaeological material archaeological sites. These sites are taken to reflect that this point was a focus of particular activities, and their identification is usually regarded as important for management purposes.

According to Bird and Hallam (2006:11) the there are areas of Australian environment that should be considered as an integrated cultural landscape where there are local variations in the density of cultural material; however the distribution of cultural material is effectively continuous. The term or concept **site complex** is used in this study to group a number site features owing to the high density of archaeological materials in particular geomorphologic zones. For instance, around saline and freshwater drainage catchments, the density of archaeological materials may be such that grouping these materials would be a more efficient method to deal with the management of the cultural heritage. Site complex in this report does not necessarily imply a common temporal or occupation link between the sites, however it defines sites that are linked by a geomorphologic environment and erosion landscape.

According to McDonald (2005:172) a contiguous landscape approach, where multiple features are present, is current best-practice and represents a progression which recognises archaeological and cultural landscapes as an appropriate management scale. Where there are high densities of cultural materials, according to McDonald (2005:172) there is no choice but to define management units beyond the level of the isolated sites. This study attempts to utilise site complexes of archaeological features as a method to provide an adequate management system for the archaeology of the survey area.

There are a variety of archaeological site types previously recorded as occurring in the wider region that are documented in the Northern Territory Archaeological Site Register. Many of the previously recorded sites have been recorded over several decades and the recorders have most likely used different definitions for each site type. For this reason the authors have described these site definitions in the broadest sense. The following site definitions can also occur in conjunction with other types. Site types that are known to occur in the region are as follows:

- *Artefact scatters* may contain flaked or ground artefacts and hearthstones. Artefact scatters may occur as surface scatters of material or as stratified deposits where there have been repeated occupations. These scatters do not necessarily imply that prehistoric people actually camped on the site; rather, they may only indicate that some type of activity was performed there.

- *Knapping locations* consisting of one or more knapping floors, which are discrete scatters of artefacts, anywhere in the landscape, resulting from stone being worked at that spot. The criteria for a knapping floor are that the original block of stone can be at least partially reconstructed from scattered flaked stone pieces.

- *Stone Quarry* a site where stone for flaked or edge-ground artefacts have been extracted from an outcropping source of stone. This is a broad definition a stone quarry and there are further subdivisions of this site type (Hiscock and Mitchell 1993). According to Hiscock and Mitchell (1993) most surface hard stone quarries have associated reduction sites.

- *Stone arrangements* can range from simple cairns to more elaborate arrangements. Some stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone features were constructed by Aboriginal people as route markers, territory markers, and walls of huts, animal traps, hides, or seed traps.

- *Culturally modified trees (CMT),* typically result from a sectional removal of bark (and sometimes timber) from tree trunk or limb. CMTs range from small (15x5cm) lenticular apertures such as those resulting from sugarbag procurement, to large canoe CMTs which can present a scar several meters in length.

- *Aboriginal Wells* have resulted from water procurement activities. These sites can vary in size and form, from hand dug depressions to natural features such as sink holes. Wells are not always in land units with obvious water resources. Other site types including rock art (eg engravings), grinding groves, stone artefact scatters and sometimes burials are likely to be found in association with this site type.

- *Burials* practises differ considerably throughout the NT however in the Simpson Desert most sites are likely to be found in sand dunes. Skeletal material can vary from highly fragmented bones to large burial complexes containing many individuals.

- *Grinding hollows, grooves, and patches* are the physical evidence of grinding and processing materials on basement rock. Grinding hollows and patches where utilised to grind food and plant materials (i.e. wild rice, seeds, nuts, tubers, bulbs) as well as ochre for painting. Grinding patches and grooves may also have been utilised to prepare edge ground axes during production and maintenance.

- *Rock Art sites*, include two main types of rock art, engravings and pounding's where the pattern is one of relief and the pictures were apparently produced

by removing material from the rock surface and drawings, stencils and paintings where the material was added to the rock surface (Clegg: 1983). Can also include wax designs.

- *Rock shelter* an overhang, cave or cliff face that contains the remains of human activities such as rock art, stone artefacts, faunal remains or charcoal from fires.

- *Historic/contact sites* are located across the Territory. These can include sites of any ethno-cultural origin, including Aboriginal origin using 'modern' materials to manufacture flakes artefacts. Site which include foreign materials, such as glass, ceramics or metal that exhibit modification by Aboriginal people are regarded as *contact sites.*

6.2.2. Defining Site Boundaries

Following the above methodology it was necessary to define site boundaries for the description of heritage places and the mitigation of impacts upon these places. Indigenous archaeological sites can contain a wide variety of cultural materials and features. Boundaries of sites that are based on geographical features, such as a rockshelter and shell middens, can be easily defined. Other sites, such as stone artefact scatters and groups of culturally modified trees are more difficult to define.

According to Burke and Smith (2004:220) the decision on defining the extent of a site depends largely on the research and survey objectives. For this survey it is important to define site boundaries for the purpose of site management and mitigation in relation to the proposed development. In this project area, open sites or stone artefact scatters are by far the most common type of heritage place or feature. An open site is often defined as a concentration of cultural material with a moderate density relative to the background density of similar types of cultural debris at those or similar points in the landscape. This definition particularly applies to stone artefact densities.

The need for clearly identifiable site boundaries is significant for cultural heritage management purposes. For the purpose of this study, site and isolated artefacts are defined when the following criteria were met:

- *Sites* should have an average density of artefacts of more than five times greater than the average density of the background scatter or exceed 5 artefacts within a 20 metre diameter area.

- There is an identifiable boundary to a site where either artefact densities diminished sufficiently to be classified as background scatter or environmental features determined a boundary.

- Groups of stone artefacts (<5 in number) identified in the landscape, which were not in great enough densities to constitute a "site" according to the definition, but are located within a 20 metre diameter area, are defined as *background scatters.*

- *Isolated artefacts* are singular artefacts within a 20 metre diameter area.

For the purposes of mapping archaeological materials within the project area, isolated finds can be dealt with in a similar fashion as another category of archaeological site.

This method allowed the effective recording of single isolated artefacts or small numbers of isolated artefacts. Archaeologically this does not mean that isolated finds constitute archaeological sites, which is an arbitrary definition employed by archaeologists in an attempt to be able to analyse past Indigenous mobility, land use and settlement patterns. It is important to classify groups of archaeological materials into manageable units that can be compared and contrasted, and that may reflect different activities and uses of the landscape.

6.2.3. Identifying stone artefacts

A requirement for successful cultural heritage assessment involves the accurate identification of archaeological materials as highlighted by Burke and Smith (2004). Since the identification of stone artefacts is basic to the accurate recognition and measurement of the archaeological record it is imperative that people undertaking archaeological surveys be able to differentiate between natural objects and artefacts. Principles of artefact identification employed in this survey follow those recommended by Hiscock (1984) and Holdaway and Stern (2004).

Each time sufficient force is placed on the surface of an isotropic rock it will fracture into two pieces. The fragment that has been struck contains the ring-crack, where fracture was initiated, and is called the flake. The flake is usually the smaller of the two pieces of stone. The larger fragment, from which the flake has been removed, is called the core. On both the flake and the core the surface that is struck is called the platform. Flakes are identified by the distinctive surface created when they are removed from the core. The classification of artefacts in this survey was based on identifiable characteristics outlined by Hiscock (1984). For an object to be classed as a flaked artefact, it needed to possess one or more of the following characteristics:

- A positive or negative ring crack;
- A distinct positive or negative bulb of percussion;
- A definite eraillure scar in an appropriate position beneath a platform;
- Remnants of flake scars (dorsal scars and ridges).

These characteristics indicate the application of an external force to a core. Artefact morphologies will be described by using the four types of artefacts as defined by Hiscock (1984:128-129):

- Flake: Flakes exhibits a set of characteristics that indicate they have been struck off a core. The most indicative characteristics are ring-cracks, which show where the hammer hit the core. The ventral surface may also be deformed in particular ways, for example a bulb or eraillure scar.

- Core: A piece of stone with one or more negative flake scars, but no positive flake scars.

- Retouched Flake: A flake that has had flakes removed from it, identified by flake scars on or deriving from the ventral surface.

- Flaked Piece: This is a chipped artefact which cannot be classified as a flake, core, or retouched flake. This category is used only when an artefact was definitely chipped but could not be placed in another group.

Other artefacts and implement types that have been identified in northern Australia are listed below following characteristics as outlined by McCarthy (1976), Cundy (1989), and Holdaway and Stern (2004) include:

- Unifacial Points are flakes that have been retouched along the margins from one surface (either dorsal or ventral) to give or enhance its pointed shape. These unifacial points are sometimes symmetrical or leaf shaped.

- Bifacial Points are retouched onto both ventral and dorsal surfaces of a flake to enhance or give the artefact its point shape. These points may have the platform removed and the proximal end rounded.

- Serrated Points are bifacial flaked points that have serrated margins.

- Edge ground axes. Classified primarily by the shaping process of flaking, pecking and polishing. These generally have only one working edge that has been ground to a sharp margin but there are also examples with two leading edges.

- Grindstones are characterised by a worn and abraded surface (‘s). The surface may either have concave depression of a convex surface.

- Hammerstones show use wear on the surface in the forms of abrasion, pitting and edge fracturing with some negative scarring from the process of producing stone tools.

- Pounders are artefacts that are used primarily for processing food and plant materials.

6.3. Raw Material Identification

Certain stone raw materials are chosen over others for manufacture of stone tools. The identification of these stone raw materials is an important factor in the recording of archaeological sites. Distinguishing between raw material types is useful in the interpretation of stone tool technologies and past Indigenous settlement and mobility patterns. Definitions of different stone raw material types commonly found in northern Australia can be found below:

- Quartz: is a crystalline form of silica, colourless to white in colour, with a vitreous lustre and hardness of seven. It exhibits a conchoidal fracture and is extremely resistant to weathering. Although having an internal trigonal crystallography,

quartz crystals exhibit no recognised or predictable cleavage plane that would affect fracture path. It forms in either tabular or sheet-like veins that intrude by lithostatic pressure into pre-existing joints or newly developed joints in the bedrock. These veins form from hydrothermal and magmatic fluids released during syn- or post metamorphic and igneous periods. Quartz is one the most frequently encountered raw materials for stone implements in the Australian archaeological record (Cotterell & Kamminga 1990) and in the Darwin region.

- Chert: is a microcrystalline sedimentary rock composed of primarily of quartz (chalcedony SiO2). Chert has a microcrystalline granular texture, but rarely exhibits banding or translucency, thus often forming dull opaque masses. Usually chert has appreciable quantities of impurities, including water, with lustres ranging from earthy to sub-glassy to matte. Chert is also often tinted by ochre or haematite. Chert forms as the result of precipitation of silica bearing solutions in massive form or in nodules. Chert is frequently found in limestone, where microfossils such as radiolarians are often evident under a hand lens. (Pough 1988:270; Mottana et al 1978:245)

- Mudstone: consists of a mixture of clay minerals, together with detrital quartz, feldspar, and mica. Iron oxides are also often present. Mudstone is a very fine grained rock, and the grains cannot be seen with the naked eye. It shares many characteristics with shale and may contain fossils, though it has less well defined lamination compared to shale (Pellant 1992:232)

- Quartzite: Formed by metamorphism of sandstone. Since quartz grains, large or small, hot to cold, are about the same, heating and squeezing does little to sandstone except make a very hard rock. With deep burial and cementation, the sand grains eventually become so tightly welded that any fracture breaks across the grains instead of around, as in loosely bound surfaces of a sandstone. Quartzite is amongst the hardest and most resistant of all rocks. They show the same colours as sandstones: brown, yellow, grey, reddish, or white. Resistant to weathering, hard and brittle, outcrops lack the mellow rounding of sculptured sandstone or the fluting of soluble limestone, so they are not too hard to recognize (Pough 1988:34).

- Siltstone: By definition, siltstone is a fine grained sedimentary rock. It usually contains more quartz than either mudstones or shales. Siltstones are commonly laminated, due to variations in grain size. Organic content or amounts of calcium carbonate. The individual rock fragments and mineral grains in siltstone are too small to be visible to the naked eye (Pellant 1992:232). Post-depositional lithification of siltstone, such as silicification and/or laterisation, is often termed porcellanite (Langford-Smith, 1978:3).

6.4. Shell Species Identification

Shell species consumed by Indigenous societies in the past are diverse and abundant. Meehan (1982) identified up to 22 different species of bivalves alone consumed at the Anbarra mounds near Maningrida. Archaeological evidence of marine exploitation is generally found in open shell middens and shell scatters commonly found in coastal areas of the northern Australia, or shell midden deposits formed in rockshelters (Bourke 2000; Clarke 1994; Roberts 1994). As shell taxa occur naturally in the environment, it is important to be able to identify and distinguish between natural occurrences of shell and those of anthropogenic origin in an archaeological context (and those created in the recent past by both Aboriginal and non-Aboriginal people). The following diagnostic characteristics apply to identifying shell middens and deposits (Table 7, after Burke and Smith 2004:232) and Table 8 lists the most frequently occurring shell species that have been identified in archaeological assemblages in northern Australia.

Table 8: Natural and cultural characteristics of shell middens, scatters, and natural shell beds diagnostics (Burke and Smith 2004)

Characteristics of an archaeological shell midden or scatter	Characteristics of a natural shell bed
Should contain a greater proportion of edible species.	May contain a mix of edible and inedible species.
Should contain a smaller proportion of articulated shell.	Should contain a proportion of articulated shell
May contain artefacts.	Will not contain artefacts
May contain bones of vertebrates used for food.	
May contain evidence of fire or burnt rocks that have been moved from the original source (i.e. oyster rocks).	Should contain a greater proportion of marine life not used as food (i.e. corals).

Table 9: Common shell species that occur in shell middens and scatters in the Northern Territory (* taken from Wilson (2002); Willan and Dredge (2004)).

Name	Family	Species*	Habitat*	Reference
Gemmate Chiton	*Polyplac-ophora*	*Acanthopleura gemmata*	Rocks in upper intertidal zone	
Granular Mud Ark	*Arcidae*	*Anadara granosa*	Mud, associated with mangroves, in intertidal zone	Bourke (2000); Clarke (2000)
Venus Cockles	*Veneridae*	*Tapes hiantina Marcia hiantina Tapes turgida*	Sand	Clarke (2000), Mitchell (1994)
Oysters	*Ostreidae*	*Ostrea echinata*	Rocks, intertidal zone	Bourke (2000); Clarke (2000)
Common Razor Clam	*Pinnidae*	*Pinna bicolour*	Tidal flats	Clarke (2000)
Horse Mussel	*Mytilidae*	*Modiolus sp*	Flat areas in Intertidal zones	Clarke (2000)
Nerite	*Neritidae*	*Nerita* sp	Middle and upper intertidal zone on rocky shores	
Hanley's Trochus	*Trochidae*	*Trochus hanleyanus*	Under stones in the intertidal and shallow subtidal zones	
Mud Creepers	*Potamididae*	*Telescopium Telescopium Terebralia semistriata & palustris Cerethedia obtusa*	Intertidal muddy habitats & mangroves	Bourke (2000)
Pearl Oysters	*Pteriidae*	*Pinctada* sp	Rocky substrate of intertidal zone to depths up to 30m	
Murex	*Muricidae*	*Chicoreus* sp	On rocks in the intertidal zone	Bourke (2000)
N/A	*Melongenidae*	*Volema cochlidium*		Bourke (2000)
Mangrove Cockle	*Corbiculidae*	*Polymesoda erosa*	Muds on the inshore fringes of mangrove forests	Bourke (2000)

6.5 Taphonomic Processes affecting Archaeological Materials

Gregory (1998) investigated in detail the taphonomic processes at work on archaeological sites in northern Australia. Gregory (1998:123) found that a range of disturbance processes operate on archaeological sites, which include those associated with humans, animals, plants, wind, fire and water action. Overall, Gregory (1998:123) noted that fluvial action through wet season inundation was primarily responsible for post-deposition disturbance on open archaeological sites. In

coastal areas such as around Darwin, tidal inundation is another important taphonomic factor.

6.6 Survey methodology

As per the HCS brief, the survey employed a combination strategy of purposive sampling and a stratified (landscape) random sampling of approximately 10% of previously undisturbed land. The intensive purposive sampling strategy targeted known areas of high sensitivity along the mangrove / tidal flats and woodland fringe. Pedestrian transects with an interval spacing of 30m to 50m between two fieldworkers were conducted along the mangrove woodland fringe and mudflats, covering at least 80% of the total length of this fringe. Purposive sampling also inspected rock outcrops and exposed and elevated points in the landscape. Random sampling transects were conducted in areas vegetated with dense monsoon vine thicket and in burnt, undisturbed (by mining or construction) mainland areas of high ground inland from the mangrove fringe.

The following characteristics were recorded of each site location:

1. Location, recorded by hand held GPS using MGA94 coordinate system.
2. Site environment: basic details of land unit, geomorphology, vegetation etc.
3. Site mapping is a sketch map of the site locality in reference to topography, drainage, roads and other features.
4. Site dimensions: basic dimensions of the site estimated or measured by tape.
5. Site contents: basic details of types of artefacts, estimated density, raw materials etc,
6. Ethnographic origin: Aboriginal, European etc.
7. Disturbance factors, such as animal activity, mining or road works.
8. Site visibility: estimate of how much of the ground surface was visible on site and in the surrounding area.
9. Estimation of the potential for sub-surface artefacts.
10. Site and artefact images. Images of artefacts in larger sites are a representative sample.

7.0 Results

7.1 Terrestrial Archaeology

An archaeological survey of the study area was carried out in December 2010. The survey aimed to identify Indigenous and historic archaeological features within the subject area. The purpose was to identify areas of archaeological potential, particularly areas with the potential to contain intact archaeological deposits of scientific or cultural significance.

Owing to early onset of the wet season, ground surface visibility through the survey region was generally poor averaging <20%. Extensive grasses and vegetation covered most of the survey area.

It was also noted that large areas of the proposed East Arm Wharf expansion had been subjected to significant ground disturbance. The most intact areas were that of the mangrove mud flats and black soil areas. The majority of the high ground area had been significantly impacted from former ground disturbance.

7.1.1 Indigenous Cultural Heritage

The survey located two Indigenous cultural heritage places. These consisted of a shell midden and one stone artefact scatter. The shell midden is located on the mangrove mudflats adjacent to the existing railway and within the proposed rail loop area. The stone artefact scatter is located on the southern side of the East Arm towards the mouth of Hudson Creek, approximately 4 km from the project area. The former East Arm 3 Indigenous site recorded on the Northern Territory Archaeological Site Database has been destroyed by the current development of the East Arm Wharf. It no longer exists as an archaeological site. Refer to Table 10 for full site descriptions and Figure 14 for site locations.

The shell midden consists of a discrete mound primarily of *Anadara granosa* (granular mud ark), coupled with a relatively high density of quartz flakes. A diversity of other shell species were also noted. Based on the underlying geomorphology it is likely that the mound continues sub-surface below the mangrove mudflat. A low density background scatter of quartz stone artefacts surrounded the shell midden.

The artefact scatter located at the mouth of Hudson Creek consists of a low density scatter of quartz flakes, retouched flakes and cores. The quartz artefacts are located on a stony laterite bench surface, which is unlikely to present any depth of deposit.

7.1.2 Historic Cultural Heritage

As presented in Table 11, the historic cultural heritage places and features located within the subject area relate to the World War II use of East Arm. A series of dump features were found along the margin of the mangroves north of the current railway line.

Three refuse dump features were identified and a site complex of 44 gallon drums. The dump features were mostly typical collections of World War II refuse consisting of bottles, rusted tin fragments – presumably the remains of food tins, drums and

corrugated iron sheeting. Of particular note was the WWII Dump Feature 3 which consisted of what could be interpreted as barracks or workshop refuse. This feature had cotton reels, an 'Australia' badge, pieces of tin, and what appeared to be a piece of aircraft frame.

WWII Site 1 consists of five features where 44 gallon drums have been buried in the ground and filled with gravel sourced from elsewhere containing some *Anadara granosa*. These features were typically circular in shape or formed a cross pattern. The features were interspersed with bottle refuse and rusted tin fragments. The collection of features is difficult to interpret. Given the location, it is likely that these drums may have formed a series of incinerators located at the mangrove fringe for refuse disposal and burning waste.

Table 10: Indigenous Archaeological Site Descriptions from the East Arm Study Area

Sites	Site Features	Location	L x W (m)	Description
Indigenous Site 1	Midden, Stone Artefacts	On the mud flats adjacent to the current railway line. The site is in relatively good condition given its close proximity to the railway. Site centroid -706101E 8619839N	4m x 3.7m	A small *Anadara granosa* midden. Anadara consists of the majority of shell. Other species includes *Telescopium, Nerita* sp, *Terrebrailia, Volema*, and *Chicoreus*. Stone artefacts consis of quartz cores and flakes with a maximum artefact density of 10/m^2. Very highly likely to consist of subsurface midden deposit. Some shell is dispersed up to 50 metres surrounding the midden. The midden is approximately 30-40cm high above the mud flat. A scatter of quartz artefacts is also found surrounding the midden up to 50 metres radius.
Indigenous Site 2	Stone Artefacts	Located in the southern area of the proposed subject area on the fringe of the mangroves and laterite high ground. The area consists of a laterite outcrop on the edge of a black soil area with sparse woodland fringe, some paperbark trees and Livistonia sp. Site centroid -709143E 8619556N	30m x 15m	An artefact scatter of quartz stone artefacts consisting of flakes, cores, retouched flakes, and flake pieces, Artefact densities averaged 5/m^2 with a maximum density of 15/m^2.

Table 11: Historic Archaeological Sites and Features from the East Arm Study Area

Sites	Easting	Northing	Site Features	Location	L x W (m)	Description
WWII Dump Feature 1	707594	8620902	44gal drum dump	On edge of mangroves and ridge, northern side of railway	10m x 10m	A collection of WWII 44 gal drums, some pieces of broken concrete. Likely to have been bulldozed to this location during construction of railway.
WWII Dump Feature 2	707857	8620899	Artefact scatter	On edge of mangroves and ridge, northern side of railway	5m x 5m	An area of refuse dumped at the mangrove margin consisting of a partial water tank, metal boxes, high density of fragments of tin, and bottle fragments, Some pieces of sewer and water pipes, masonry fragments, some ceramics. All pieces typical of WWII infrastructure.
WWII Site 1	707912	8620876	Drum emplacement feature; artefacts	Located on mangrove fringe to the north side of the railway line	150m x 20m	Approximately five features where drums have been buried and filled with Anadara shells and gravel in circular patterns and are spaced approximately 20 metres apart along the mangrove fringe. The drums buried in the ground on their side and standing. A further four mounded built features with drums and gravel was found skirting the mangrove fringe. The drums are highly corroded. Interspersed are several dumps of WW2 era beer bottles, rusted tin. Molten pieces of aircraft type aluminium were noted in the assemblage.
WWII Dump Feature 3	708072	8620961	Scatter of artefacts	Located on mangrove fringe to the north side of the railway line	3m x 3m	A small assemblage of personal scrap and barracks rubbish consisting of cotton reels, wire, tin, an 'Australia' shoulder badge and some possible pieces of aluminium from an aircraft.

Figure 14: Location of sites recorded during survey (base map Google Earth Pro).

7.1.3 Heritage Site Images

The following figures present a selection of images of the sites recorded during the current survey.

Figure 15: Indigenous Site 1: Shell Midden

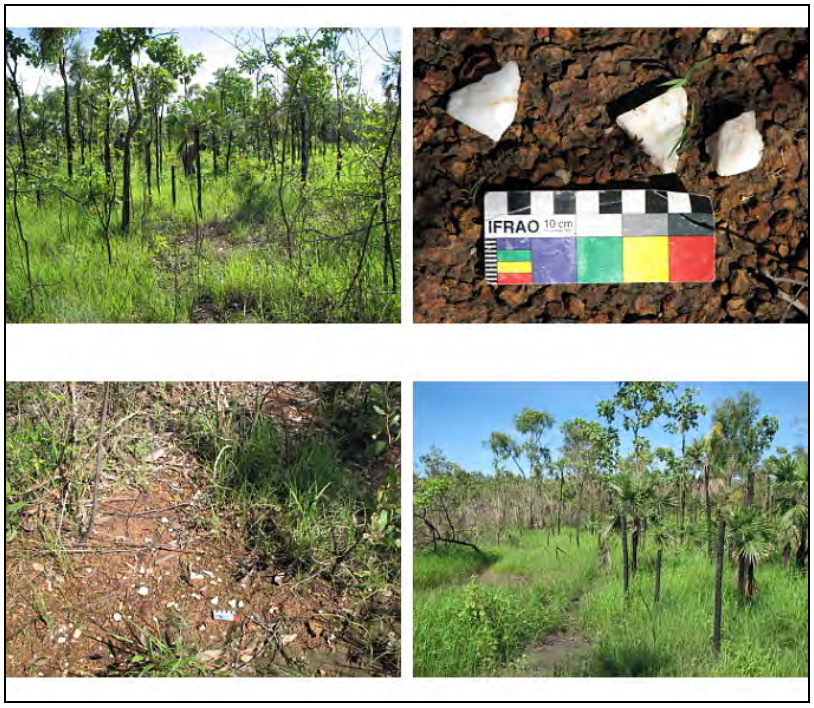


Figure 16: Indigenous Site 2: Artefact Scatter

Figure 17: WW2 Site 1 Drum Features

Figure 18: WW2 Drum dump

Figure 19: WW2 Dump Feature 2

Figure 20: WW2 Dump Feature 3

7.2 Maritime Archaeology within the Vicinity of Development Areas

The current East Arm Wharf is relatively close to the main area of traditional shipping operations of the Darwin Stokes Hill Wharf precinct. Seven shipwrecks and six Catalina Flying Boat wrecks have been identified in the East Arm area that could potentially be impacted by the proposed expansion and associated operations; however none of these sites are located within the immediate wharf development zone (refer Figure 21).

As presented in Section 2.3.5, at least six of the shipwreck sites are recorded on the Australian National Shipwreck Database. Of these, only the Kelat shipwreck has been placed on the Northern Territory Heritage Register. The Kelat is located approximately 2 kilometres south of the project area. The unrecorded wreck (*Unidentified Shipwreck 1*) lies 200m south of the wharf expansion footprint, as presented in Figure 22.

Shipwrecks close to the East Arm development are:

- ID3427 East Arm Barge 2
- ID3428 East Arm Two Part Barge
- The following shipwrecks are found over 2 kilometres from the proposed East Arm development:ID3408 Con Dao 3 (refer Figure 3)
- ID3429 East Arm Vietnamese Refugee Boat 1 (refer Figure 3)
- ID3430 East Arm Vietnamese Refugee Boat 2
- ID3584 Vietnamese Refugee Boat Pk76

None of the shipwrecks recorded on the Australian National Shipwreck Database were visible to the consultant at the time of surveying.

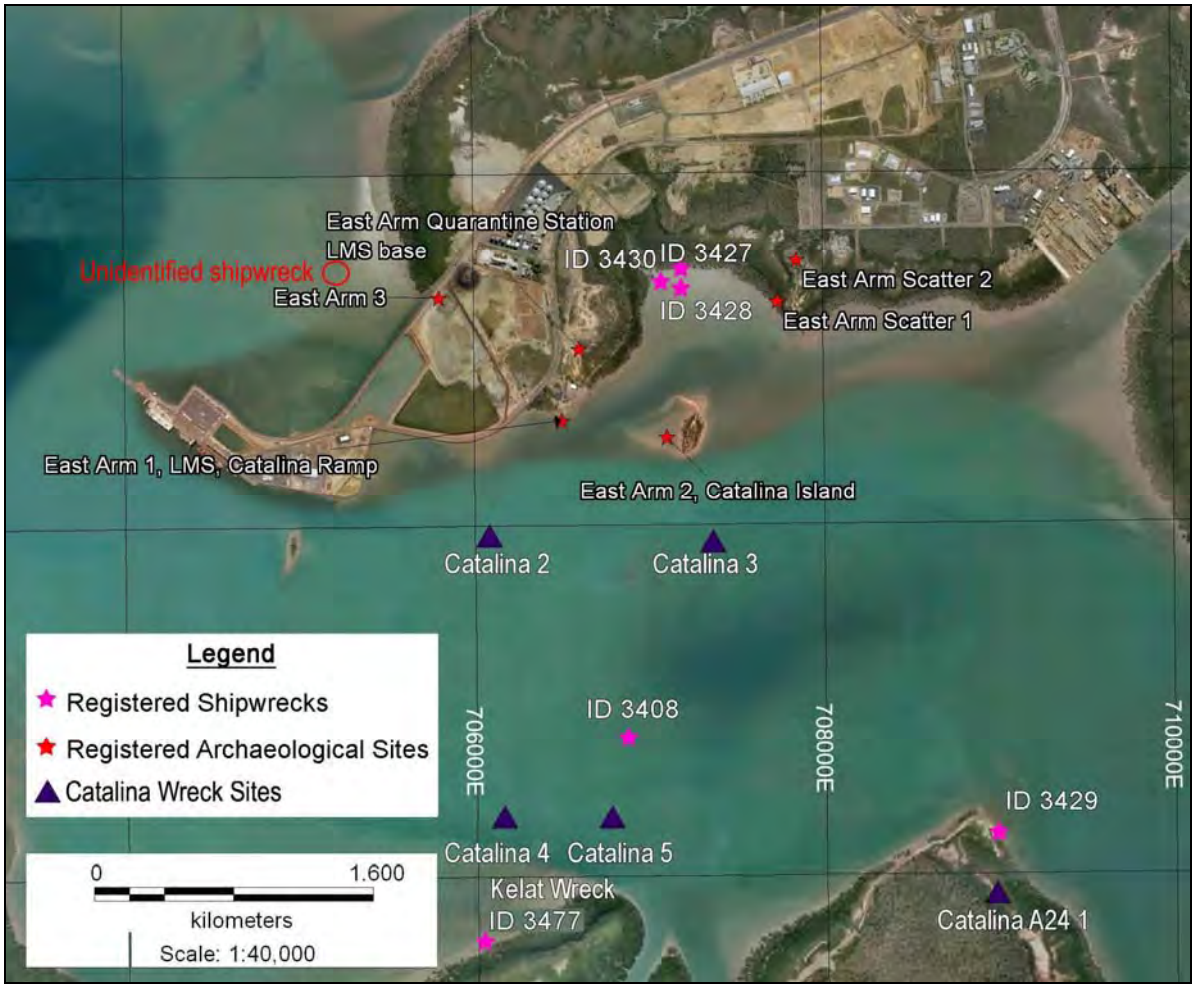


Figure 21: Archaeological Sites Proximal to East Arm (Base map Google Earth Pro)

Figure 22: Location of shipwrecks recorded on Australian National Shipwreck Database and from this study (Base map Google Earth Pro).

Unidentified Shipwreck 1

Unidentified Shipwreck 1 is located near the proposed railway loop of the East Arm Wharf expansion area and was a reported to the Northern Territory Government in 2002 (Figure 17). It is likely that this shipwreck is one of the Vietnamese refugee boats, or an Indonesian fishing vessel, that had been scuttled at East Arm. The shipwreck appears to be of some age, probably from the 1970s. However in recent examinations of the same area at low tide, there is little evidence of this shipwreck. It is likely that this shipwreck has been covered by marine sediments or has deteriorated significantly since the photograph had been taken and is now no longer visible. Some subsurface remnants of this shipwreck may be found in the marine sediments.

Figure 23: Unidentified shipwreck at the East Arm Port area circa 2001

Kelat Shipwreck

The only Heritage Registered shipwreck in the general East Arm vicinity is that of the Kelat (refer Figure 21). The Kelat was a coal barge built in 1881 and was requisitioned for use as a coal barge in World War II (refer Figure 24). It was damaged in the Japanese air raid on the 19th February 1942 and sank at its current location several days later. The site of the Kelat lies approximately 2 kilometres south of the proposed wharf expansion zone.

Figure 24: Kelat shipwreck 1942 (Figure courtesy Ron Urquart Collection, Northern Territory Library, PH0311/0023).

Catalina Aircraft Wrecks

There are two WWII Catalina aircraft wreck sites are located close to East Arm (refer Figure 21). These wrecks are approximately 1 to 2 kilometres east of the proposed development areas. A third Catalina wreck (Catalina 6) is located over 1 kilometre to the south; Catalina 6 (US Navy Patrol Wing 10) is not shown in maps owing to sensitivity regarding its location and possible looting. There may be some off-site risk to the wreck sites from maritime activities associated with dredging. Table 12 below, details these wrecks at potential risk from such activities (refer also Section 4.4).

Table 12: WWII Catalina wrecks which may be of some off-site risk from maritime activities associated with dredging.

Name	Also known as	Relationship to Development
Catalina 2	PBY-5A model A24-69 BAN 34056	Outside of development zone: however at risk from related maritime activities
Catalina 3	PB2B-1 model A24-206 BAN 44217 ex RAF JX611	Outside of development zone: however at risk from related maritime activities
Catalina 6	US Navy Patrol Wing 10 aircraft	Outside of development zone: however at risk from related maritime activities

8.0. Heritage Significance Assessment.

The heritage values for the cultural heritage places documented in this study are discussed in this section. Tables relating to the general results of the heritage assessment are found below.

8.1. Indigenous Cultural Heritage

The following section assesses the significance of the archaeological site within the proposed development area, and other archaeological sites within 5km of the proposed development. Sites that may hold contemporary significance according to Aboriginal tradition as provided for under the *Sacred Sites Act 1989* are dealt with under a separate process through the Aboriginal Areas Protection Authority.

Protection is afforded to all Indigenous archaeological places that correspond to the criteria set out in the *Heritage Conservation Act* 1991. Development proponents may apply to destroy or disturb a registered site. The Department assesses applications and provides advice to the minister who may then grant or decline consent. This regulatory framework is a specific sites-based approach.

Therefore, to deal with the regulatory regime individual sites have been ranked according to a set of archaeological assessment criteria (see sections below). This has been undertaken in order to achieve a better understanding of the spatial distribution of archaeologically significant features in the area that are able to assist in further archaeological investigations of major research questions.

Nonetheless, it is still important to view the survey results as part of an Indigenous cultural landscape. The archaeological record of the Darwin Harbour overwhelmingly demonstrates the importance of the region to Aboriginal groups in the past. Therefore the archaeological record of East Arm area has to be considered within the larger scheme of the Indigenous occupation of the Darwin region. Occupation of Middle Arm did not occur in a vacuum separated from the surrounding landscape. The ebbs and flows of Indigenous land use and occupation are reflected in the cultural materials found within the survey area.

Table 13: Cultural Heritage Assessment of sites likely to be affected by East Arm Wharf Development

Site Name – ID	Type	Discussion	Heritage Assessment Value
Indigenous Site 1	Midden; Stone Artefacts	Well preserved site Poorly documented in Darwin region High potential for archaeological information Valued by Larrakia	Very High cultural and archaeological significance
Unidentified Shipwreck 1	Wrecked boat – possibly Vietnamese refugee boat	Poorly preserved Unknown regarding ship/type/history Possibly S.E. Asian vessel. Social history and association with Vietnamese refugee history high	Limited archaeological significance Moderate social and cultural significance

Table 14: Cultural Heritage Assessment of sites located nearby the proposed East Arm Wharf Development

Site Name – ID	Type	Discussion	Heritage Assessment Value
Indigenous Site 2	Stone Artefacts	Well preserved site Poorly documented in Darwin region High potential for archaeological information Valued by Larrakia	High cultural and archaeological significance
WWII Dump F1	44 gal drum dump	Highly disturbed Site type widely represented Low scientific value	Low cultural and archaeological significance
WWII Dump F2	General refuse	Site disturbed Widely represented Limited diversity of material in site	Low cultural and archaeological significance
WWII Dump 3	Scatter of personal refuse	Relatively intact Poorly represented in region Some diversity of material	Moderate cultural and archaeological significance
ID3408 Con Dao 3	Vietnamese refugee	Poorly preserved	Limited archaeological significance

ID3430 Vietnamese Refugee Boat 2 **ID3584 Vietnamese Refugee Boat Pk76** **ID3429 Vietnamese Refugee Boat 1**	shipwrecks 1976-78	Relatively little information available about ships/type/history Generic S.E. Asian vessels Social history and association with Vietnamese refugee history high	Moderate social and cultural significance
ID3427East Arm Barge 2 **ID3428East Arm Two Part Barge**	WWII small water craft shipwreck sites	Generic WWII small craft Very poorly preserved with few visible remains Not suitable for recreational dive sites	Limited archaeological significance Limited social significance Moderate historical significance
WWII Catalina 2 and 3	RAAF Catalina wreck sites	Well preserved wreck sites Very well documented history Very well documented wreck sites Recreational dive sites Valued by WWII community (i.e. aircraft enthusiasts)	Very high archaeological, historical, and social significance
WWII Catalina 6	US Navy PatWing 10	Well preserved wreck sites Very well documented history Only recently discovered Valued by WWII community (i.e. aircraft enthusiasts)	Very high archaeological, historical, and social significance
Kelat	WWII shipwreck site	Declared Heritage Place NT Heritage Conservation Act	Very high archaeological and cultural significance
WWII Site 1	Drum features	Very poorly preserved but foundations intact Incinerator sites poorly represented in Darwin Limited diversity of refuse types	Moderate cultural and archaeological significance

8.1.1 Cultural Significance

Cultural significance of sites is determined by members of the Larrakia community according to their cultural world view. Indigenous people place a high cultural value on their archaeological sites and cultural heritage. This is partly because the archaeological record (information about the pre-European history of Australia) has been heavily impacted on by 200 years of European settlement. What remains is all the more valuable because it can never be repeated.

While archaeological assessment commonly focuses on material cultural remains of the archaeological record that have survived through time, from the Indigenous viewpoint, the archaeological record is part of a landscape that is a living existence, with a spiritual presence. Thus, people living within this landscape relate to the whole - all of the landscape - not particular parts. Within this whole, parts may have provided preferred living places; parts may have had more defined spiritual significance; parts may have provided specific resources. Thus cultural heritage significance relates to people's perspectives of place and sense of value, within the context of history, environment, aesthetics and social organisation.

8.2. Indigenous Archaeology Assessment Summary

The archaeology of the Darwin Harbour provides a unique example of the long-term Aboriginal occupation of a coastal landscape from northern Australia and has outstanding potential for archaeological research. The archaeological material provides evidence of complex adaptations to a distinctive and unique coastal environment on the margins of the present tropical savannah zone over the last 3000 years. Some sites demonstrate occupation through to the European Contact period. The Darwin Harbour area appears to have operated as an aggregation locale for groups particularly throughout the Holocene.

Shell middens and scatter have the potential to yield scientific information, not only about thousands of years of Aboriginal cultural lives and practices, but also about environmental change that has occurred over this period. Radiocarbon dates previously obtained on shell middens show that the main period of mound building is between 1500 and 500 years BP (see Bourke 2000:243-4; Bourke and Crassweller 2006). *Anadara granosa*, the dominant shellfish taxa in most of these sites, no longer occurs in any significant quantity in the local coastal environment of extensive mangrove-colonised flats, considered to have formed within the last 700 years (Hiscock 1997). At the time these shell middens formed, the shoreline is thought to have been characterised by open beaches with scattered stands of mangroves, because this environment would have provided a suitable habitat for the *Anadara* mudflat bivalve that dominates the middens. It is possible that the sandy saltpan between middens and mangroves was once intertidal mudflat colonised by *Anadara*.

Excavations of shell middens undertaken at Bayview Haven (Hiscock 1992), Middle Arm peninsula (Crassweller 2002a, 2006; Bourke 2000) and Hope Inlet, Shoal Bay (Bourke 2000) have revealed that although middens are composed of mainly large *Anadara granosa* cockle shells from the mudflats, there is variation in content (including bone and stone artefacts) and internal structure of middens that may be related to cultural practices, changes in foraging strategies and environmental change (Bourke 2004, 2005; Hiscock 1997). This research highlights the importance

of undertaking more detailed investigations on sites that may look similar on surface inspection.

The archaeology of the survey area when considered as a cultural landscape can assist with investigations on residential mobility, economy, and social organisation through investigation of the shell and stone artefact assemblages and evidence of grinding technologies. The current study area would certainly be able to contribute to investigations of seasonal use of Darwin Harbour and elsewhere in coastal northern Australia. There is no doubt that the Indigenous archaeological sites documented in the survey area have the potential to contribute to further understanding of the following aspects of Aboriginal prehistory:

- settlement and mobility of Indigenous people through time and space;
- the regional nature and distribution of archaeological sites;
- technological change and variability in artefact assemblage;
- adaptation to changing environments through time; and
- social complexity and intensification issues in coastal arid zones of north Australia.

The shell deposits and stone artefacts of the East Arm area are likely to be able to provide a meaningful contribution to investigating the above themes in conjunction with the complex archaeological assemblages of the Darwin region. Bird and Hallam (2006:11) state that the "significance of individual archaeological features and localities is greatly enhanced by the way they mirror the web of associations linking people and landscape through time". For example, investigation of technological activities, and which faunal communities were hunted and consumed aids in reconstructing settlement mobility and land use strategies.

In the survey area, shell midden accumulations can be dated, shells provide direct evidence of species consumed, stone artefacts can be analysed to investigate technological change and adaptation to environments, and overall these elements can contribute significantly to investigations of social changes in the late Holocene.

8.3. World War II Terrestrial Site Assessment.

Darwin's geographical position as the Australian gateway to SE Asia ensured its places in Australian military history. The strategic location of Darwin made it a target for bombing and possible occupation by the Japanese, regardless of their intentions for the rest of the country (see Alford 1991). Significantly, Darwin was the only Australia settlement to have sustained repeated bombing attacks and was involved in all types of action during the war years. The assessment and declaration of the World War II sites appears to be large based on the individual characteristics of the site rather than how the site fits into the defence landscape. World War II occupation of the Northern Territory was based on the larger strategic defence of Australia and the South West Pacific Area. Therefore an approach considering the defence landscape and the interrelatedness of the different military systems should be adopted for assessing the significance of World War II sites and features throughout the Northern Territory. Consequently, Alford (2000) recommended that a complete assessment of the known features and material culture at a select range of sites should be undertaken prior to any 'approvals' are granted - notwithstanding a lack of legislative

power other than through those of appointed Heritage Officers - to persons seeking to disturb or destroy WWII sites.

Previous heritage assessments of World War II static air defence infrastructure in the Darwin region have found that several sites have significant cultural heritage values. Two heavy anti-aircraft battery sites (Fannie Bay and Quarantine) have been declared to the Northern Territory Heritage Register. Recognition has also been made of defence infrastructure used in headquarter roles or pivotal parts of the defence coordination system (i.e. Darwin RAAF Base and Berrimah RAAF Fighter HQ).

The Quarantine Anti-Aircraft Battery is significant as the only complete gun-site of its type within the Darwin area. According to the Northern Territory Heritage Register[1] it is highly significant as it is of a design which was discontinued by the Defence Force in the mid 1940s and one which is unique to the Northern Territory. According to the Northern Territory statement of heritage value, the HAA battery is valued for their social associations with the events of World War II in Northern Australia[2]. The East Arm HAA is part of the larger site complex which has a variety of remains demonstrating the complexity of a defence installation of the WWII period.

The historic refuse remains that have been located in the current survey are likely to reflect the range of activities that were occurring on the East Arm Peninsula, from the Z-Force, the artillery positions, and the air force base. The only distinguishing factor found in the refuse areas was the debris of personal effects that indicated Australian Army units rather than Air Force. The refuse sites have been disturbed through the clearing activities for the current East Arm developments. The WWII drum features are however of some interest as they reflect perhaps the refuse disposal process of the units based in the area. However the current condition of these features is very poor and provides limited archaeological value. The personal effects from the small scatter provide some social heritage value. Overall, the heritage value of these sites is ranked low.

8.4. Heritage Significance of the World War II Aircraft Wreck Sites

Although all the Catalina aircraft were destroyed in World War 2, there are two major differences in heritage significance between the RAAF and US Navy wrecks. The RAAF Catalina wrecks are historically significant for their association with the operations from the Flying Boat Base during World War 2. The US Navy Catalina wrecks are historically significant for their association with the Allied withdrawal from the Dutch East Indies, the early Darwin defence preparations, and the first Japanese bombing raid on Darwin in 1942.

According to Dermoudy (1993) the heritage value of Quarantine Island lies in its pre and post war use as a quarantine station, holding Vietnamese 'Boat' people, a clandestine commando/intelligence base, and a RAAF flying boat base. As discussed previously, the RAAF flying boats from East Arm conducted specific tasks in World War Two that could not be achieved by other standard RAAF units. The Catalina aircraft had an operational range twice that of other aircraft and provided a unique form of logistical support. Given the extensive coastline of Australia and the many

[1] http://www.nt.gov.au/nreta/heritage/ntregister/declared/display.html?qackack
[2] http://www.nt.gov.au/nreta/heritage/ntregister/declared/display.html?eastpt

islands in the Indonesian archipelago, the RAAF Catalina aircraft were able to provide support to any coastal region.

Heritage significance of the Catalina wrecks believed to be US Navy aircraft is largely vested in their association with the initial bombing of Darwin by the Japanese on 19th February 1942. Shipwrecks in Darwin Harbour have been declared as heritage places owing to their association with the first bombing raid on Darwin on 19th February 1942. It would be sufficient to say that the US Navy Catalina aircraft sunk on this day are significant for similar reasons. The wrecks represent the only extant remains of the many aircraft destroyed on that day in February (approximately 23). The US Navy Catalina wrecks are historically significant for their association with the defence and withdrawal by Allied forces in the Philippines and the Dutch East Indies.

Research thus far indicates that there would be a minimum 16-18 Catalina wrecks in Australian waters. One of these is the Catalina lost in Northern Territory waters, Patrol Wing 10 aircraft #18 (PBY-5, Bu No: 2306, ex-22-P-4 of VP 22), under the command of Lieutenant Moorer. This was shot down near Bathurst Island, also 19 Feb. 1942. This wreck site has not been located.

Eight Catalina's were wrecked in a Japanese air raid 3 March 1942 at Broome, Western Australia. Some of these are exposed at very low tide in Roebuck Bay, while others occur in deeper water and have never been seen since they were destroyed in 1942. Two US Navy Patrol Wing 10 aircraft were included as well as two RAAF aircraft and four Dutch East Indies aircraft. Other Catalina wrecks are said to occur in Exmouth, Western Australia as a result of a cyclone.

Evidence shows that a number of Catalina aircraft are found in various localities around the world. However of the original 3272 aircraft manufactured, less than 3% still currently exist. These aircraft exist in varying state of integrity from operational, on static display in museums, and as submerged wrecks. However, only small numbers of these aircraft have been identified as RAAF aircraft used in World War 2. Even fewer aircraft are likely to remain, which were in service with the US Navy from the early years of the Asia-Pacific theatre of World War II.

8.5. Heritage Value of Maritime Shipwrecks

It has been established that the *Kelat* shipwreck has a high level of cultural heritage significance as it is a declared heritage place on the Northern Territory Heritage Register, *Heritage Conservation Act* 1991.

The other maritime shipwrecks that are noted within the survey area consist of the former World War II barge wrecks and the Vietnamese refuge boat shipwrecks. The shipwrecks are all located in the intertidal zone. In this zone the wrecks are subjected to major tidal influences and corrosion from constant exposure, and siltation of mangrove mud. Constant exposure to air will enhance corrosion combined with salt attack and tropical marine fauna that will destroy timbers. Therefore these wrecks are considered to be in very poor condition with little of the vessels remaining intact that can be seen from onshore or aerial observation. The location of the wrecks makes these sites relatively inaccessible owing to their position on the mud banks, therefore rendering site inspections and/or diving very difficult.

The WWII barges were used to facilitate movement of supplies and personnel to the various remote Heavy Anti Aircraft and Anti Aircraft Search Light stations around Darwin Harbour, as well as the Special Z Force training facility on Wickham Point. They played an important role in the functioning of the strategic defence of Darwin. The barges were generally of generic types and historically poorly documented in records. The archaeological wreck sites may be able to provide some limited information about the type of vessel. The social value of these vessels is probably low considering that they were a general work vessel.

The Vietnamese refugee boats on the other hand were probably reasonable well documented in records by Customs and Immigration. Although the manufacture and working life history of these vessels is probably relatively unknown to Australian records and given the length of time since the wrecking events, and the disruption of the Vietnamese War to Vietnamese governance, there is probably limited documentation about these vessels from their country of origin. These wreck sites will provide limited archaeological information about the ships. The shipwrecks will have some social and historic association with the Vietnamese refugee arrivals in the 1970s. This was a significant period of Australian immigration history, and Darwin was in the forefront of this migration event.

These shipwreck sites present limited interpretative opportunity and have very limited scope for recreational diving.

9.0. Cultural Heritage Recommendations

As a result of field surveys and desktop research conducted for this study the following Indigenous, historic and maritime archaeological places have been identified:

- Indigenous shell midden
- Indigenous stone artefact scatter
- Three WWII historic features relating to refuse dumps
- One WWII historic refuse incinerator complex
- Maritime wreck sites consisting of RAAF Catalina A24-69 (Catalina 2) and A24-206 (Catalina 3)
- Maritime wreck sites

It is noted that only one of these sites, Indigenous Site 1, is located with the proposed development area. A suite of general recommendations arising from this cultural heritage assessment addresses concerns regarding the long term conservation of cultural heritage values in the area (refer also Table 15).

9.1. Indigenous Consultations and Involvement

It is recommended that:

A general Indigenous community communications strategy should be developed given the high profile of indigenous cultural heritage in the Darwin region. Indigenous participants in the archaeological and cultural heritage survey expressed concern regarding the potential destruction of important ecological habitats for natural resources such as the mangroves. It is recommended that the proponents of the East Arm Wharf expansion ensure limited damage to the mangrove environments. Further communications with the Indigenous community may be required to discuss concerns regarding the mangrove environments on the northern side of East Arm and their possible conservation.

The proponent, in cooperation with local traditional owners and native title claimants are involved in the future cultural heritage mitigation works proposed for the East Arm Wharf Expansion.

A communications plan is necessary to effectively communicate to affected parties that consider the cultural heritage values of the East Arm area to be significant. The communication plan should state clearly how the potential impacts will be communicated to the general public, with special attention to the Indigenous community, and should be incorporated into a general Cultural Heritage Management Plan.

Table 15 Summary of recommendations for Cultural Heritage Places located in the East Arm Wharf Expansion area

Site Name – ID	Heritage Assessment Value	Current Legislative Protective Mechanism	Recommendations Summary
Indigenous Site 1	Very High cultural and archaeological significance	Interim conservation orders *Heritage Conservation Act* 1991	If engineering solution cannot avoid seek permit for salvage from NT Minister for Heritage Involve Larrakia community participation Further archaeological research
Indigenous Site 2	High cultural and archaeological significance	Interim conservation orders *Heritage Conservation Act* 1991	If engineering solution cannot avoid seek permit for salvage from NT Minister for Heritage Involve Larrakia community participation Further archaeological research
WWII Dump F1	Low cultural and archaeological significance	None	CEMP and EMP (for rail loop) will refer to these sites, manage any potential impacts
WWII Dump F2	Low cultural and archaeological significance	None	CEMP and EMP (for rail loop) will refer to these sites, manage any potential impacts
WWII Dump 3	Moderate cultural and archaeological significance	None	CEMP and EMP (for rail loop) will refer to these sites, manage any potential impacts
WWII Site 1	Moderate cultural and archaeological significance	None	CEMP and EMP (for rail loop) will refer to these sites, manage any potential impacts
Unidentified Shipwreck	Limited archaeological significance Moderate social and cultural significance	None	Locate, identify, and record remnants of wreck sites Documentation to be undertaken by maritime archaeologists Consultation and documentation with Vietnamese community of social history of ship wrecks

Site Name – ID	Heritage Assessment Value	Current Legislative Protective Mechanism	Recommendations Summary
ID3408 (Con Dao 3) **ID3430 (Vietnamese Refugee Boat 2)** **ID3584 (Vietnamese Refugee Boat Pk76)** **ID3429 (Vietnamese Refugee Boat 1)**	Limited archaeological significance Moderate social and cultural significance	None Currently on Australian National Shipwrecks Database	CEMP and EMP will refer to these sites, manage any potential impacts
ID3427 (East Arm Barge 2) **ID3428 (East Arm Two Part Barge)**	Limited archaeological significance Limited social significance Moderate historical significance	None Currently on Australian National Shipwrecks Database	CEMP and EMP will refer to these sites, manage any potential impacts
WWII Catalina 2 **WWII Catalina 3** **WWII Catalina 6**	Very high archaeological, historical, and social significance	Nominated to the NT Heritage Register *Heritage Conservation Act* 1991	CEMP and EMP will refer to these sites, manage any potential impacts Pre & during construction dive inspection Establish mooring and no-go zones for maritime craft operating in the area during construction and operation
Kelat	Very high archaeological and cultural significance	Declared Heritage Place *Heritage Conservation Act* 1991	CEMP and EMP will refer to these sites, manage any potential impacts Pre & during construction dive inspection Establish mooring and no-go zones for maritime craft operating in the area during construction and operation

9.2. Development of an East Arm Wharf Expansion Construction Cultural Heritage Management Plan

A construction cultural heritage management plan (CCHMP) should be implemented. The CCHMP should contain the recommendations, details, and the conservation steps to be taken in regards of the Indigenous, historic, and maritime cultural heritage places and features as identified in this report.

9.3. Indigenous Cultural Heritage Recommendations

The Indigenous archaeological sites located in this survey are afforded interim protection under the Heritage Conservation Act 1991 until the Minister for Heritage determines the otherwise. These archaeological sites contain a representative sample of the significant archaeological features of the general Darwin Harbour area. Nonetheless, it is also noted that features located within these site boundaries may, or may not be related to each other in a behavioural and temporal sense.

Currently, there is not enough archaeological data to properly assess the archaeological significance of each archaeological feature (i.e. radiocarbon dating determinations, stone artefact analysis). As per the guidelines from the Australia ICOMOS Burra Charter, it is necessary to obtain further data to inform future management and conservation decisions regarding these archaeologically significant sites.

However, this would be reliant on a program of archaeological investigation of shell deposits and stone tool technologies to address research issues as described earlier. This would include an attempt to characterise the stone tool technological system that is occurring in the region and further radiometric dating of the shell scatters and middens to obtain a comprehensive account of marine exploitation and environmental change which would also contribute to further understanding of residential mobility in the Darwin coastal region.

Therefore, should the proposed East Arm Wharf Expansion impact on the Indigenous archaeological site, in order to assist in answering major research issues identified in this report, it is recommended that the following archaeological mitigation works are implemented with the general disturbance approval:

- The excavation and recording of shell deposits and scatters to establish MNI & NISP and changes in marine utilisation strategies.

- The collection and submission of shell (and charcoal) samples for radiocarbon determinations to assess timings of marine exploitation, occupation of the area, for the Northern Territory coastline, and residential mobility patterns.

- The collection and metrical analysis of a reasonable sample size (25%) of the stone artefact assemblage of these sites to investigate stone artefact technology issues and residential mobility patterns (see Clarkson and Lamb 2006).

- Establish a protective buffer zone around each site of 100m until Ministerial approval has been sought for the disturbance of these sites and all mitigation works have been conducted.

9.4. Historic World War II Archaeological Sites

The review has identified four historic World War 2 archaeological features located in the vicinity of East Arm Wharf. Developments from World War II infrastructure had a large impact on the Darwin Harbour region, especially East Arm. It is unlikely that there will be an impact on these four WWII historic sites.

Historic archaeological sites are not afforded blanket or automatic protection under the *Heritage Conservation Act 1991* in the same way afford to Aboriginal archaeological places and objects. Currently none of these historic archaeological sites have been nominated, assessed, or declared under the *Heritage Conservation Act*. However should these heritage recommendations be made part of the environmental impact assessment under the *Northern Territory Environmental Impact Assessment Act*, then recommendations regarding historic archaeological sites made in the course of the Government assessment process are enforceable. Therefore, the proponent may be obliged to undertake conservation and mitigation works on the historic archaeological sites that may be impacted from the expansion project.

An important reason for consideration of the WWII cultural heritage is that there is generally a high level of interest from sections of the community is shown in the conservation and management of WWII sites. Although these interest groups would prefer that sites remain *in-situ*, a reasonable compromise may be to conduct recording and salvage operations before major impacts.

It is also important that proponent consider include notification regarding the impact and mitigation of the World War II sites in the communications strategy to the public.

- Therefore these sites are not recommended for protection owing to their low cultural heritage values.

- However it is recommended that the four WWII site features recorded in this study are only disturbed or destroyed by the proposed East Arm Wharf expansion after further mapping and documentation of the artefact assemblages and features of these sites is undertaken.

9.5. Maritime Wreck sites outside the proposed development area

There are four significant maritime wreck sites within 2 km of the proposed East Arm Wharf expansion area. These wreck sites are located to the south and east of East Arm and consist of the following sites:

- Catalina 2 (RAAF Catalina A24-69)
- Catalina 3 (RAAF Catalina A24-206)
- Kelat
- Catalina 6

These wreck sites are not protected under the Commonwealth Shipwrecks Act 1976. These aircraft wreck sites have been nominated to the Northern Territory Heritage Register. Ownership of the RAAF Catalina aircraft is still believed to be by the Commonwealth. These WWII aircraft have been assessed by the Northern Territory Heritage Branch as having a high level of cultural heritage significance; however a final assessment has not been made by the Minister for Heritage.

The wrecks have been well documented and mapped in maritime archaeological surveys in previous studies (see Jung 2006; Lewis 1992), however the wreck sites have not been inspected as part of this study.

The wreck sites are outside of the proposed East Arm Expansion development's direct impact zone. However there are concerns that dredging in the area may create instability in sediment flows and may have an adverse impact on the aircraft wreck sites. Such impacts may include deposition of sediments, water flows redistributing the wreck materials and the most damaging being anchor damage to the wreck site. The consequences of the wreck sites being covered with sediments in Darwin Harbour is poorly understood or studied in terms of impacts to corrosion and crushing, especially on aircraft frames.

It is recommended that the following actions are undertaken prior to construction commencing:

- Establish warning moorings at the location of the wreck sites for the duration of the construction. A no-go zone is enforced for all maritime traffic around the wreck sites with no anchorage and no works to be conducted in those areas.

- Maritime archaeologists to undertake a photo record and inspection of both wreck sites and establish monitoring points to assess any impacts from the construction at the end of construction.

- Communicate strategy in general communications plan regarding cultural heritage places.

9.6. Maritime Wrecks Site within the proposed development zone

There is one maritime wreck site identified near the proposed railway loop. This site is the unknown maritime wreck site that may be a Vietnamese refugee boat wreck. The wreck site appears to be in poor physical condition and preservation. If the site is a Vietnamese shipwreck, it is likely to have some social and historical value.

Therefore it is recommended that prior to construction a program of maritime archaeological documentation of the unknown shipwreck is undertaken by a maritime archaeologist. The shipwreck needs to be positively identified, documented and mapped prior to construction in the area.

It is recommended that the maritime archaeological work is part of the communications plan.

Reference List

Alford, B. 2000 *A Report on the Potential of Select World War II Heritage Sites in the Areas of Tourism and Recreation*. For Hon. Mike Reed MLA.

Alford, R.N. 1991 *Darwin's Air War 1942-1945: An Illustrated History*. Aviation Historical Society of the Northern Territory.

Basedow, H. 1907 Anthropological notes on the western coastal tribes of the Northern Territory of South Australia. *Transactions and Proceedings and Report of the Royal Society of South Australia* 31:1-55.

Basedow, H. 1925 *The Australian Aboriginal.* F.W. Preece and Sons, Adelaide.

Berndt, R. 1951 *Kunapipi.* F. W. Cheshire, Melbourne.

Bird, C., and S.J. Hallam 2006 *A review of archaeology and rock art in the Dampier Archipelago*. An unpublished report prepared for the National Trust of Australia (WA).

Bourke, P.M. 2005 Identifying Aboriginal "contact period" sites around Darwin: long past due for Native Title? *Australian Aboriginal Studies* 1:54-65.

Bourke, P. 2004. *Heritage baseline survey, Glyde Point development project.* Unpublished report prepared for Sinclair Knight Merz and Department of Infrastructure, Planning and Environment.

Bourke, P. 2000 Late Holocene indigenous economies of the tropical Australian coast: an archaeological study of the Darwin region. Unpublished PhD thesis, NTU, Darwin.

Bourke [Burns], P. 1996 *Northern Territory archaeological survey Stage 1, Darwin catchment region.* Unpublished report to the Australian Heritage Commission.

Bourke [Burns], P. 1994. *Mound over matter; origins of shell and earth mounds of North Australia.* Unpublished honours thesis, Department of Anthropology, NTU, Darwin.

Bourke P. and C. Crassweller 2006 Radiocarbon dates from middens around Darwin Harbour: cultural chronology of a pre-European landscape. *Australian Aboriginal Studies* 2:116-9.

Bourke, P.M. and K.J. Mulvaney 2003 Archaeology of the first recorded petroglyphs for the Darwin region. *The Beagle* 19:1-6.

Brocklehurst, P. and B. Edmeades 1996 *Mangrove Survey of Darwin Harbour, Northern Territory, CCNT/NFI Project 1994-5*. Technical Report No. 96/7. Department of Lands, Planning and Environment, Darwin.

Burke, H and Smith, C 2004 *The Archaeologists Field Handbook*. Unwin & Allen, Sydney.

Burns, T. 1997 *A Report on Aboriginal Shell Midden Sites at Winnellie, Darwin Harbour.* Unpublished report prepared for the Heritage Conservation Branch, Department of Lands Planning and Environment, Darwin, NT.

Carment D. 1996 *Looking at Darwin's Past: Material Evidence of European Settlement in tropical Australia*. North Australia Research Unit, ANU, Darwin.

Clarke, A. 1994 *Winds of Change: an archaeology of contact in the Groote Eylandt archipelago, Northern Australia.* Unpublished PhD Thesis, Australian National University.

Clarkson, C. and Lamb, B. 2006 Introduction: Casting new light on old stones, in *Lithics "Down Under": Australian Perspectives On Lithic Reduction, Use And Classification,* C. Clarkson and L. Lamb (eds). British Archaeological Reports International Monograph Series. Oxford: Archaeopress.

Clegg, J. 1983 Recording prehistoric art, in G. Connah (ed) *Australian Field Archaeology: A Guide To Techniques*. Australian Institute of Aboriginal Studies, Canberra.

Cotterell, B. and Kamminga J. 1990 *Mechanics of pre-industrial technology. An introduction to the mechanics of ancient and traditional material culture*. Cambridge University Press, Cambridge.

Crassweller, C. 2006 *The archaeological salvage of the shell middens on Wickham Point, Darwin Harbour, NT.* A report to URS (Australia) Pty Ltd on behalf of ConocoPhillips Australia Pty Ltd.

Crassweller, C. 2002a. *The excavation of two shell middens at Wickham Point, Darwin Harbour.* A Report to URS (Aust) Pty Ltd on behalf of Phillips Petroleum Company Australia Pty Ltd.

Crassweller, C. 2002b. *A World War II historic site on Mud Island, Wickham Point, Darwin Harbour.* A Report to URS (Aust) Pty Ltd on behalf of Phillips Petroleum Company Australia Pty Ltd.

Crassweller, C. 2001a. *A brief report on the archaeological sites on Mud Island, Wickham Point.* A report for Phillips Oil Company, Australia.

Crassweller, C. 2001b. *Additional archaeological sites located on Mud Island Wickham Point, Darwin.* A report for Phillips Oil Company, Australia.

Cundy, B.J. 1989 *Formal Variation in Australian Spear and Spearthrower Technology.* BAR International Series 546, Oxford.

Dames and Moore 1997. *Darwin LNG Plant. Draft Environmental Impact Statement*. A report for Phillips Oil Company Australia.

Dermoudy, P. 1993 *Heritage Assessment of East Arm Port Development EIS.* Report for ACER Vaughn Consulting Engineers, Darwin.

Dermoudy, P. 1989 *Airforce installations.* An interim working report for the Museums and Art Galleries Board of the Northern Territory.

Dwyer D. 2006 *The Boustead Jar: the discovery of an early modern earthenware vessel at Shoal Bay, Northern Australia.* Unpublished conference presentation, The Australasian Institute for Maritime Archaeology (AIMA) & the Australasian Society for Historical Archaeology (ASHA) conference, Darwin.

Foelsche, P. 1882 Notes of the Aborigines of north Australia [NT]. *Transactions of the Royal Society of South Australia*. 2: 1-18.

Fogarty, P.J., B. Lynch and B. Wood 1984 *The Land Resources of the Elizabeth, Darwin and Blackmore Rivers*. Technical Report Number 15, Land Conservation Unit, Conservation Commission of the Northern Territory.

Gregory, R. L. 1998 *Aboriginal settlement patterns in the Ord-Victoria River Region*. Unpublished PhD thesis. Northern Territory University.

Guse, D. 2001, WW2 *Catalina Wrecks Heritage Assessment Report.* Unpublished report to Heritage Branch, Department of Infrastructure, Planning and Environment, Section 3.3.

Heritage Surveys, 1997. *The Darwin LNG Plant. Draft Environmental Impact Statement. Wickham Point Archaeological Survey, Darwin Harbour, Northern Territory.* An unpublished report for Phillips Oil Company, Australia.

Heritage Surveys, 2001 *Archaeological survey, Wickham Point Road, Northern Territory.* Report prepared for NT Department of Works, April 2001.

Hiscock, P. 1997. Archaeological evidence for environmental change in Darwin Harbour. In R. Hanley, G, Caswell, D. Merigian and H.K. Larson (eds). *The Marine Flora and Fauna of Darwin Harbour, Northern Territory*. *Proceedings of the Sixth International Marine Biological Workshop.* Darwin: Museum and Art Galleries of the Northern Territory. pp. 445-449.

Hiscock, P. 1984 A preliminary report on the stone artefacts from Colless Creek Cave, Northwest Queensland. *Queensland Archaeological Research.* 1:120-151.

Hiscock, P. and Hughes, P. 2001 Prehistoric and World War II use of shell mounds in Darwin Harbour, Northern Territory, Australia. *Australian Archaeology,* 52:41-45.

Hiscock, P. and Mitchell, S. 1993 *Stone Artefact Quarries and Reduction Sites in Australia: A Type Profile.* Canberra: Australian Government Publishing Service. *Australian Heritage Commission Technical Publication Series* 4.

Holdaway, S. and N. Stern 2004 *A Record in Stone: The Study of Australia's Flaked Stone Artefacts.* Museum Victoria and AIATSIS, Canberra.

Jung, S. 2006 *Catalina Wrecks in Darwin Harbour.* Unpublished report to Heritage Conservation Services, Department of Natural Resources, Environment and the Arts.

Jung, S. 2001 *Wings beneath the sea: identification of Darwin Harbour Catalina flying boat wreck sites.* Unpublished Master of Arts thesis, Northern Territory University, Darwin.

Kerr, M. 1971 *The surveyors: the story of the founding of Darwin*. Rigby, Adelaide.

King, P.P. 1969 [1827] *Narrative of a Survey of the Intertropical and Western Coasts of Australia, 1818-1822*. Vol.1, John Murray, London.

Langford-Smith, T. 1978. A Select Review of Silcrete Research in Australia, in *Silcrete in Australia*, Langford-Smith eds., University of New England Press, Armidale.

Lewis T. 1992 *Wrecks in Darwin Waters*. Turton & Armstrong.

Loney J. 1994 *Wrecks on the Western Australian Coast*. Lonestone Press, Yarram, Vic.

Maquis-Kyle, P. and M. Walker 1992 *The Illustrated Burra Charter: Making good decisions about the care of important places*. Australian Heritage Commission, Canberra.

McCarthy F.D. 1976 *Australian Aboriginal Stone Implements*. Australian Museum, Sydney.

McDonald, J. 2005 *Desktop Assessment of Scientific Values for Indigenous Cultural Heritage on the Dampier Archipelago, Western Australia.* Report to the Heritage Division of the Department of Environment and Heritage, Australia, Commonwealth, Canberra.

Meehan, B. 1982 *Shell Bed to Shell Midden.* Australian Institute of Aboriginal Studies, Canberra.

Mottana, A., R. Crespi and G. Liborio 1978 *Guide to Rocks and Minerals*. Simon and Schuster, New York.

Parkhouse, T.A. 1895 Native tribes of Port Darwin and its neighbourhood. *Australasian Association for the Advancement of Science.* 6: 638-47.

Pellant, C. 1992 *Rocks and Minerals*. DK Publishing, New York.

Pietsch, B.A. 1986 *Bynoe 5072, 1:100 000 Geological Map Series*, *Explanatory notes.* Department of Mines and Energy, Northern Territory Geological Survey. Government Printer of the Northern Territory, Darwin.

Pough, F. H. 1988 *A Field Guide to Rocks and Minerals (5th Ed).* Houghton Mifflin Company, Boston.

Powell A., 1988 *Far Country: A Short History of the Northern Territory*. Melbourne University Press, Carlton.

Rayner, R 2001 *Darwin and Northern Territory Force.* Rudder Press, New South Wales.

Richardson, N. 1996 *Archaeological site survey and documentation - Darwin Region*. Unpublished report to the Australian Heritage Commission. Museums and Art Galleries of the Northern Territory, Darwin.

Roberts, A. 1994 Cultural landmarks: The Milingimbi mounds. In M. Sullivan, S. Brockwell, and A. Webb (eds), *Archaeology in the North*, pp176-87. North Australian Research Unit, Australian National University, Darwin.

Schacht, I. 2010 *What Wreck is it?* Newsletter of the Australasian Society for Historical Archaeology Inc. University of Sydney, NSW.

Spencer, W.B. 1912 An introduction to the study of certain native tribes of the Northern Territory. *Bulletin of the Northern Territory,* no.2.

Tindale, N.B. 1974 *Aboriginal tribes of Australia: their terrain, environmental controls, distribution, limits, and proper names*, University of California Press, Berkeley.

URS, 2002. *Public Environmental Report – 10 MTPA LNG Plant*. Report prepared for Phillips Petroleum Company Australia Pty Ltd, March 2002.

Vincent, D. 1981 *Catalina Chronicle - A History of RAAF Wartime Operations*. Published by The Catalina National Committee, Darwin.

Willan, R. and Dredge, M. 2004 *Molluscs in National Oceans Office Description of Key Species Groups in the Northern Planning Area.* National Oceans Office, Hobart.

Wilson, B. A., P.S. Brocklehurst, M.J. Clark and K.J.M. Dickinson 1990 *Vegetation Survey of the Northern Territory, Australia*. Technical Report No. 49. Conservation Commission of the Northern Territory, Darwin.

Wilson, B., 2002 *A Handbook to Australian Seashells on Seashores East to West and North to South.* Reed New Holland, Sydney.

Wood, B.G., P.J. Fogerty and K.J. Day 1985 *The Land Systems of the Darwin Region*. Technical Report Number 24. Conservation Commission of the Northern Territory, Darwin, NT.