ARCHAEOLOGICAL SURVEY OF THE PROPOSED WICKHAM INDUSTRIAL ESTATE

10/22/2007

Indigenous and Historic Cultural Heritage Assessment

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Earth Sea Heritage Surveys
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ABBREVIATIONS USED IN THIS REPORT

AASL	Anti-Aircraft Search Light
AA Bty	Anti-Aircraft Battery
AIB	Australian Intelligence Bureau
Aust Fd Coy	Australian Field Company
AWM	Australian War Memorial
CO	Commanding Officer
Coy	Company
D/LMS	Director Lugger Maintenance Section
FCS	Fraser Commando School
FELO	Far Eastern Liaison Office
GHQ	General Headquarters
GIS	Geographic information systems
HAA	Heavy Anti Aircraft
LMS	Lugger Maintenance Station
NEFIS	Netherlands Forces Intelligence Section
RAN	Royal Australian Navy
SIA	Secret Intelligence Australia
SOE	Special Operations Executive
SRD	Services Reconnaissance Department
SWPA	South West Pacific Area
MVT	Monsoon vine thicket
WIE	Wickham Industrial Estate

EXECUTIVE SUMMARY

The Northern Territory Government has requested a cultural heritage survey of the proposed Wickham Industrial Estate located on the northern side of Channel Island Road, facing the Elizabeth River and East Arm of Darwin Harbour. The Industrial Estate will contain various plants plus utilities and infrastructure necessary for the operation of the estate. The area is divided into two areas, Area A and Area B.

An archaeological survey was undertaken in October 2007 to assess the Indigenous and historical cultural heritage sites located within the proposed Wickham Industrial Estate. The survey was undertaken with the assistance of Larrakia traditional owners participating on the survey.

The survey of Areas A and B identified a total of 20 Indigenous archaeological sites (one of which MA19 no longer exists) and one historic archaeological site. Therefore this report discusses 19 archaeological sites which consist of 27 identifiable site features and one historic World War II site. Seven localities containing 20 isolated artefacts were also recorded. The 2007 survey has identified ten new archaeological sites and four of the isolated artefact localities. Nine of the existing sites and three isolated artefact localities identified in this report are previously recorded from the NRETA Archaeological Sites Database and other consultancy reports. All of the archaeological sites, with one exception (WIE10), and three of the isolated artefact localities - are located in clusters in or within 100m of the mangrove/mudflat woodland fringe within Area A.

Accordingly an assessment of the cultural heritage values of these archaeological sites has been undertaken. The assessment of the Indigenous archaeological sites has shown that there are 3 sites with low archaeological significance, a further 3 with low to moderate, 7 containing moderate significance, 3 with moderate to high, and 1 site containing high cultural heritage values. 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. Research has also demonstrated that the Indigenous archaeological assemblage of the Middle Arm area has significant cultural heritage values to Larrakia traditional owners.

Major recommendations arising from this study include;

- The establishment of 3 cultural heritage conservation zones;
- further consultations with Larrakia traditional owners regarding future conservation and management;
- development of a construction and long term cultural heritage conservation and management plan;
- a program of further recording and archaeological salvage for sites that will be impacted by future development of the proposed industrial estate.

1.0. INTRODUCTION

1.1. Background

The Northern Territory Government has requested a cultural heritage survey of the proposed Wickham Industrial Estate and areas which may constitute the approach for a gas pipeline and or terrestrial approach for marine infrastructure (i.e. a wharf). The Industrial Estate will contain various plants plus utilities and infrastructure necessary for the operation of the estate. The area is divided into two areas, Area A and Area B (See Figure 1). The northwestern sections of Middle Arm Peninsula to be surveyed for the proposed Wickham Industrial Estate Development, divided into Areas A and B (of approximately 992ha and 1029ha respectively), are located on the northern side of Channel Island Road, facing the Elizabeth River and East Arm of Darwin Harbour.

The land will be modified to an appropriate level to minimise risks associated with inundation/storm surge and to maximise useable land. Hence low lying areas will be filled to above storm surge level. The proposed survey for the Wickham Industrial Estate on Middle Arm is to cover the terrestrial (above low water) part of the areas outlined. The area of highest priority is Area A.

The archaeological survey was undertaken by Dr Patricia Bourke and Bill Risk in October 2007. The assessment report has been prepared by Dr Bourke and Daryl Guse. Maps have been prepared by Daryl Guse.

1.2. Aims of the survey

The aim of the archaeological survey is to locate and record any prescribed archaeological places or objects as defined under the *Northern Territory of Australia Heritage Conservation Act 1991* and to assess the nature, distribution and significance of these materials. The survey should also identify historic places resulting from early non-indigenous settlement, mining or pastoral activities.

The specific aims of this study are to identify:

- the location, frequency, nature and significance of prescribed archaeological places or objects within the footprint of the proposed Wickham Industrial Estate development (Areas A&B)
- the constraints upon potential development and appropriate mitigation strategies (Areas A&B)

This study is to be undertaken to ensure that sites protected within the terms of the *Heritage Conservation Act* 1991 are not damaged or destroyed without the appropriate consideration and authority (in this case, the Minister for Environment).

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 should employ a stratified (landscape) random sampling methodology that will add to current knowledge of archaeological site distribution around Darwin Harbour and should provide survey coverage for approximately 10% of previously undisturbed land. A more intensive purposive sampling strategy that targets known areas of high sensitivity should also be employed. This purposive sampling should be achieved through the execution of pedestrian transects along the mangrove / tidal flats and woodland fringe that allow inspection of both environments. A single transect along the fringe will provide sufficient coverage (approximately 50kms of mangrove woodland fringe environment). At least 80% of the total length of this fringe should be subject to survey. Purposive sampling should also inspect rock outcrops or elevated points in the landscape.

1.2.1. The Survey

The survey will:

1. Be undertaken by a qualified archaeologist and will produce a report, the general headings and contents for which are provided below.

2. Incorporate a strategy for locating sites which takes into account the results of previous research in the area.

1.3. The Report

1.3.1. The Brief

Generally the information contained in the consultant's report should be detailed enough to permit an independent assessment of the results by Heritage Conservation Services. The consultant's report should, without infringing academic freedom, contain the information described below or its equivalent in the following or similar format.

The archaeological consultant shall provide the client with a digital copy and six bound hard copies of the report. While the report remains the property of the client, the report will be incorporated into the library of Heritage Conservation Services. The report or sections of the report may be provided to other clients of Heritage Conservation Services for the purposes of background research for future archaeological studies. Archaeological data within this report shall be entered into the archaeological site database maintained by Heritage Conservation Services. Lodgement of the report with Heritage Conservation Services satisfies Regulation 4 under the *Heritage Conservation Act*.

1.3.2. Contents of the Report

The following sections outline background data relevant to this study. The environmental context and ethnographic data are examined to develop a predictive model on the nature and distribution of archaeological places in the proposed development area. Known archaeological patterns provide a framework and context within which the significance of any newly recorded archaeological places may be assessed. The distribution of sites is also determined in part by current land use around the harbour, which is varied and may result in destruction of sites. Types of land use on Middle Arm peninsula include extraction mining, power and water facilities, access tracks used for hunting and fishing and other roads and utility corridors. In the past this coastal area has also been the focus of occupation by Allied Forces during World War II. Evidence of World War II activities has left a legacy on the landscape in the form of supply bases and encampments that often used the remains of Aboriginal occupation as a resource. After the background discussions are the results of the survey, with a summary of the finds and further detailed information. Discussion of the cultural heritage significance and relevant recommendations are found in the following chapters.

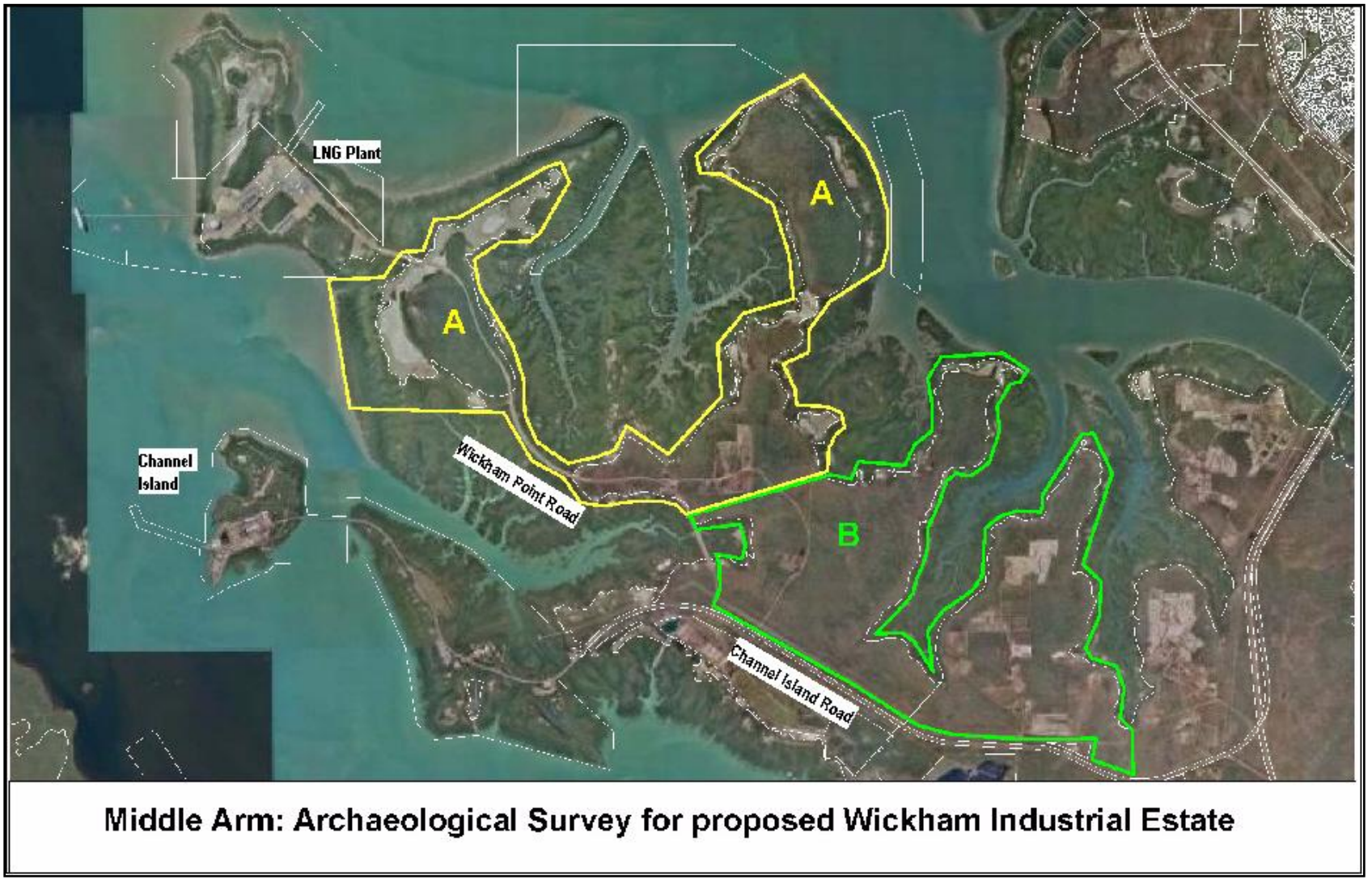

FIGURE 1 LOCATION OF THE PROPOSED WICKHAM INDUSTRIAL ESTATE AREAS A AND B

2.0. BACKGROUND ENVIRONMENT

The survey area is located on the north-west end of the Middle Arm Peninsula. 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. Some permanent soaks and paperbark swamps are noted in the study area. 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. Spits and Cheniers occur as elongated narrow sand/gravel deposits either attached to or separate from the island. Some bars of bedrock are exposed at places in the salt flats and tidal flats.

The mainland of this section of Middle Arm Peninsula is an area of low relief. Sediments of Cainozoic age over most of the region consist of Tertiary and Quaternary soils and laterite exposures. Quartz outcrops occur in the area that may have been suitable for the manufacture of stone artefacts. Quaternary sands, silty clay, laterites or ferruginous clayey sand are associated with drainage lines and low lying country (Pietsch 1986). The topography generally comprises dissected, rolling terrain and shallow drainage lines, with some areas of undulating rubbly rises, low strike-ridges and hills 15-40 m high mostly along the southern coastline, formed on shales, siltstones and sandstones of the Proterozoic Burrell Creek Formation (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 thicket (MVT) occur in wet, well-drained areas, with species such as *Dioscorea transversa* (long yam) and *Sterculia quadrifida* (Bush peanut). 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).

At the most northwestern end of the survey Area A is a small terrestrial island covered with MVT vegetation surrounded by tidal/supratidal flats and mangroves that are partly inundated by high tides and separated the island from the mainland before the Wickham Point access road was constructed. This island is similar to the adjacent island on which the Wickham Point LNG Plant is now located, comprising a central ridge being an outcropping of the Burrell Creek Formation, consisting of siltstone, shale and phyllite, fine to very coarse sandstone, quartzite and quartz pebble conglomerate (Pietsch 1986). The ridge decreases into rocky bars at places extending into the mangroves.

Also present are areas of the Koolpinyah Surface formed during the Late Tertiary and present as laterite deposits on the lower slopes of the ridges and as platforms near sea level. The vegetation on the island is dominated by dry rainforest with mid to dense canopy and an almost impenetrable understorey, which, along with a deep cover of leaf litter, hinders the detection of archaeological material. There are stands of *Melaleuca* and *Pandanus* sp. growing in areas of freshwater flow or seepage on lower ground between the vine forest and mangroves.

The remaining headlands that make up the northwestern section of the peninsula study area comprise dissected, rolling terrain and shallow drainage lines with remnants of the Koolpinyah plateau surface; long slopes and low domed crests with shallow and lateritic gravels, and open eucalypt woodland with patches of rainforest and monsoon vine forest. The most northerly of the headlands in Area A is also separated from the

mainland by a narrow strip of sandy flats and the plateau surface terminates in a low cliff overlooking the harbour to the north and mangrove-fringed sandy beach that extends as sandy spits to the east and west. Area B is comprised of mainland sections north of Channel Island Road that extend as two headlands north toward the mouth of Elizabeth River. The most westerly of the headlands in Area B is also fringed by a narrow chenier/sandy spit at the harbour end.

3.0. BACKGROUND CULTURAL HERITAGE

3.1. BACKGROUND ETHNOGRAPHY

According to ethno-historical sources, Middle 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 situate, 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.

3.2. BACKGROUND HISTORY

A total of 10 previously recorded World War II sites are located within the Middle Arm and East Arm area (Figure 2). 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. Static air defence included 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 1).

FIGURE 2 PREVIOUSLY RECORDED WORLD WAR II SITES IN THE MIDDLE ARM AREA

TABLE 1 PREVIOUSLY RECORDED WWII SITES IN THE MIDDLE ARM AREA

Name	Easting	Northing	Theme	Description
East Arm Flying Boat Base	706400	8618600	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	706500	8618800	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	707600	8620000	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	702200	8616700	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	702800	8616300	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 HAA	702400	8616900	Defence - air static	Heavy anti aircraft gun battery established 1943 for 3.7-inch A-A guns. Current condition and features are poorly recorded and condition is unknown.
Middle Arm AASL	708200	8615700	Defence - air static	Searchlight battery positions Darwin Harbour - Sites feature foundation slabs, reinforced positions, pathways, causeways over mangroves, roadways of midden material and artefact material including refuse pits and dumps. Access to the sites is limited due to their remote nature
Middle Arm AASL	712600	8612700	Defence - air static	Searchlight battery positions Darwin Harbour - Sites feature foundation slabs, reinforced positions, pathways, causeways over mangroves, roadways of midden material and artefact material including refuse pits and dumps. Access to the sites is limited due to their remote nature
Peak Hill Z-Force Training Camp	703100	8615200	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.
Haycock Hill AASL	710050	8608350	Defence - air static	Recorded as NRETA Site 5072-0021. Consists of site features such as foundation slabs, reinforced positions, pathways, roadways of midden material and artefact material including refuse pits and dumps.

3.2.1. World War II and Middle Arm Peninsula

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. Later in 1943, The 65 AASL Company (65 AASL Coy) and 70 AASL Company (70 AASL Coy) began scouting for searchlight locations at Haycock Hill, Mickets Creek, and Elizabeth River. The search parties encountered swamps and difficult conditions that prevented them reaching some of the locations (Rayner 2001:216-217).

Rayner (2001) indicates that a search light position was operating on Middle Point by April 1943. It is likely that this search light position was situated either at the old leprosarium on Mud Island at the very end of Wickham Point or on Middle Arm. 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).

In 1943 officers carried out a reconnaissance of the approaches to Middle Point and Peak Hill to station a Heavy Anti-Aircraft (HAA) gun station on that side of the Harbour (Rayner 2001:259). According to Rayner (2001:265) on the 12 June 1943 a working party was sent to Middle Point to clear an area on the beach to facilitate the landing of the HAA guns. The battery was functioning by May 1944. The Middle Point battery was generally manned by 1 officer and 20 other ranks (Rayner 2001:581).

The 359th Australian HAA Troop vacated the Fanny Bay battery and embarked for Middle Point on the 18 November 1944. They started immediately to bring the new station into action and assisted in emplacing the mobile 3.7 inch guns delivered by B Troop 133 Aust HAA Bty (101 Aust AA Regt). By the 21 November 1944 the personnel of Troop 359 at Middle Point advised that 4 of the mobile 3.7 inch Mark III guns were ready for action (Rayner 2001:582). Asphalting of the gun pits at Middle Point was commenced on the 11 December 1944 with a proofing shoot by the guns undertaken shortly thereafter.

The general camp work included improvements to the camp kitchen and the GLR (Gun Laying Radar) equipment put into action by the 28th November 1944. Middle Point was to become known as gun site H6. Work was proceeding into December 1944 on the new command post at H6 Middle Point with plotting exercises conducted at this location for the first time. Work was reported as continuing on construction of the camp on the 19th December 1944. The units stationed at Middle Point also reported difficult conditions owing to mosquitoes and sand flies.

In July 1944 the strategic situation had undergone significant change and mainland Australia was no longer considered to be under general threat of air attack by the Japanese. The Australian Lieutenant General, (Chief of the General Staff) believed that large-scale attack on the Australian mainland was a remote possibility.

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). The 129 Aust Heavy S/L Troop previously operating on the Cox Peninsula was now concentrated at Battery HQ Berrimah. By the November 1944 searchlight Stations Micket Creek Landing, Noogoo Swamp, Knuckeys Lagoon, Marlow Lagoon, Elizabeth River and Haycock Hill ceased to be operational (Rayner 2001:577). Personnel from these evacuated sites then took over stations at East Arm, Middle Point, Flagstaff Hill and Harpers Folly from the 69 AASL Coy and their personnel were to be concentrated at their Battery HQ (Rayner 2001:577). Later, search light stations Casuarina and Talc Head were withdrawn from the search light layout.

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). The 55 Aust (Comp) AA Regt and the Fanny Bay personnel were to move to the new AA gun station at Middle Point. At East Point the manning of the 9.2 inch and 6 inch batteries ceased and at Emery Point the 6 inch battery manning also ceased. Care and maintenance was now the order of the day (Rayner 2001:580).

3.2.2. Z Special Unit in Darwin

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.

From August 1943, under the supervision of one Australian Army Officer, 10 Timorese general hands and 6 Timorese trainees, construction began on the training camp. Over the course of six months they constructed a

causeway, dug a well, shifted stone for the causeway, cleared a rifle range, built a water pipeline, installed a water tank and used light rail for the causeway to haul equipment and supplies onto the island from barges. The 19 Australian Field Company No 2 Platoon also assisted the Timorese in camp construction during March 1944. The 19 Aust Fd Coy constructed most of the living quarters that are represented by the concrete slabs at the Wickham Point historic WWII site. Structures at the site were fairly rudimentary consisting of mosquito proof shelters and three larger buildings that formed the store, office/classroom and mess.

The Peak Hill Camp was used as a sorting area to identify those Timorese trainees that would be suitable for SRD operations. Trainees would be sent to Brisbane to attend the Fraser Commando School (FCS) on Fraser Island. A School for Eastern Interpreters was established at Mount Martha and then later at Park Orchards, Victoria for the Timorese trainees.

3.3. BACKGROUND ARCHAEOLOGY

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 Middle Arm, Wickham Point, and Channel Island area. Figure 3 illustrates the distribution of previously recorded sites from the NRETA archaeological site database on 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 four historic and over 90 pre-contact sites on the database have been recorded for Middle Arm Peninsula (Bourke 1994, 1996a, 2000, 2004, 2005a; 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, 2006b). 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 peninsula (Bourke 1994, 2005a, Hiscock and Hughes 2001, Richardson 1996). The rock art (petroglyph) sites, described by (Bourke 1994, Bourke and Mulvaney 2003) as part of midden site MA9 on the sites register database, have been nominated to be listed on the NT Heritage Register.

FIGURE 3 PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES FROM THE NRETA ARCHAEOLOGICAL SITE DATABASE

There are ten previously recorded archaeological sites within the defined survey Areas A and B of the Wickham Industrial Estate; recorded by Heritage Surveys (2001) for the development of the Wickham Point Road and by Bourke as part of Honours research in the early 1990s and the Darwin Harbour surveys in 2005 (Bourke 1994, 2005a). Of these sites, two shell mounds and a shell and stone artefact scatter are located on the small, terrestrial MVT-covered island in the survey Area A. One of these sites, a shell and stone artefact scatter (Site MA19) located one kilometre south of this island on the point of a low, mid-westerly headland, now cut through by the Wickham Point Road, is likely to have been destroyed by the road construction (Heritage Surveys 2001).

Another five shell mounds, one shell and stone artefact scatter, one artefact scatter and two site complexes (MA52 and MA6) of high significance, are all located in close proximity in Area A, on the small mid-westerly headland two kilometres southeast of this island (Bourke 1994, 2000, 2005a,b). Three localities with isolated artefacts, mostly flaked quartz, have also been previously recorded within the defined areas (Bourke 2005; Crassweller 2006a, 2007).

4.0. METHODOLOGY

4.1. Defining Sites in the Darwin Region

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.

There are a variety of archaeological site types and features previously recorded as occurring in the Darwin region. According to Burke and Smith (2004:63) the two broadest categories of archaeological site types can be defined as Indigenous archaeological sites and non-Indigenous archaeological sites (more commonly referred to as European or historical sites). 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.

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.

Site features that are known to occur in the Darwin region are listed below:

- *Artefact scatters* may contain flaked or ground artefacts and hearthstones. Artefact scatters may occur as surface scatters of material, as stratified deposits where there have been repeated occupations, or as knapping floors (see below). 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* are discrete scatters of artefacts, anywhere in the landscape, resulting from stone being worked or reduced 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 (Hiscock and Mitchell 1993). A knapping floor exists as a feature within the context of an open site or archaeological deposit. However there are certain methodological problems in identifying such features arising from post-depositional processes.

- *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 of 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.

- *Shell middens* are deposits containing shells occurring somewhere in the open, near a beach or estuary or rocky shoreline, or an inland lake or river (see Meehan 1977). These shells have been accumulated in these deposits by humans exploiting marine resources. Middens may take the form of a thin veneer of shell over the land surface or a thick mound of shell. A subsurface midden layer or horizon (from 1cm in thickness) may occur within mounds or chenier ridges.

- *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.

- *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.

- *Contact sites* contain foreign materials, such as glass, ceramics or metal that exhibit modification by Aboriginal people. Alternatively a contact site may be identified by the presence of European objects which may be unmodified but are the result of transportation to that locality by Aboriginal people. Contact sites represent the interface between Aboriginal, European, and others (i.e. South East Asian peoples) during early forays to Northern Australia.

4.2. Defining a Site Boundary

For the purposes of this project it was necessary to define site boundaries for description and management. 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, can be easily defined. Other sites such as shell middens also have definable limits to the extent of the cultural material. The start and end of stone artefact scatters and quarries however can be difficult to distinguish against the background scatter. According to Burke and Smith (2004:220) the decision on defining the extent of an open 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 possible mitigation work in relation to the proposed development. An archaeological open site is 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 scatters and shell scatters.

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

- An average density of artefacts of more than five times greater than the average density of the background scatter.
- 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.

The survey area has a background scatter characterized by, or made up of, isolated artefacts. For this project, isolated finds are recorded in the following manner:

- Location, recorded by hand held GPS using MGA94 coordinate system.
- Groups of stone artefacts identified in the landscape, that 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 scatter localities**.
- Site environment: basic details of environmental context.
- Artefact dimensions: basic dimensions of the artefact measured by ruler.
- 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.

4.3. Stone Artefact Identification

A requirement for successful archaeological projects involves the accurate identification of archaeological materials. 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 further discussed in 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, 1989). 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; and
- 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 the region are listed below following characteristics as outlined by McCarthy (1976), Cundy (1989), Kamminga (1982) 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.
- Grindstones are characterised by a worn and abraded surface(s). The surface may either have concave depression or a convex surface.
- Pounders are characterised by abraded and pitted surfaces on the margin of the stone from processing plant foods and shellfish rather than used as hammerstones for stone tool working.
- Hammerstones show use wear on the surface in the forms of abrasion, pitting and edge fracturing with some negative scarring.

4.4. 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. The resultant veins may vary in width from a few millimetres to a metre or more (Thorpe & Brown 1990:16). 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).

4.5. 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 2, after Burke and Smith 2004:232) and Table 3 lists the most frequently occurring shell species that have been identified in archaeological assemblages in northern Australia.

TABLE 2. 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 3 COMMON SHELL SPECIES IN NORTH AUSTRALIAN SHELL MIDDENS AND SCATTERS.

Name	Family	Species*	Habitat*	Reference
Granular Mud Ark	*Arcidae*	*Anadara granosa*	Mud, associated with mangroves, in intertidal zone	Bourke (2000); Clarke (2000)
Oysters	*Ostreidae*	*Ostrea echinata (aka Saccostrea Cucculata)*	Rocks, intertidal zone	Bourke (2000); Clarke (2000)
Venus Cockles	*Veneridae*	*Tapes hiantina Marcia hiantina Tapes turgid*	Sand	Clarke (2000), Mitchell (1994)
Horse Mussel	*Mytilidae*	*Modiolus sp*	Flat areas in Intertidal zones	Clarke (2000)
Nerite	*Neritidae*	*Nerita* sp	Middle, upper intertidal zone on rocky shores	
Murex	*Muricidae*	*Chicoreus* sp	On rocks in the intertidal zone	Bourke (2000)
Cockle	*Veneridae*	*Marcia hiantina*	Mangrove mud, 30 to 90 cm deep.	http://www.oceans.gov.au/pdf/KeySpecies_North/17.pdf
Mud Creepers	*Potamididae*	*Telescopium Telescopium Terebralia semistriata Terebralia palustris Cerithidea obtuse*	Intertidal muddy habitats & mangroves	Bourke (2000)
Pearl Oysters	*Pteriidae*	*Pinctada* sp	Rocky substrate of intertidal zone to depths up to 30m	
Mud Cockle	*Corbiculidae*	*Polymesoda erosa* (aka: *Geloina coaxans*)	Muds on inshore fringes of mangrove forests	Bourke (2000)
N/A	*Melongenidae*	*Volema cochlidium*		Bourke (2000)

* after Wilson (2002); Willan and Dredge (2004)

4.6. 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.

4.7. 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 approximately 40kms of 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.

5.0. RESULTS

5.1. Archaeological Survey

The total area for the proposed survey for development of the Wickham Industrial Estate is approximately 2020ha, divided into Areas A (of 991.9ha) and B (1028.9ha) for the purposes of designating level of priority for this study. It is estimated that approximately 700ha was able to be visually inspected across the proposed survey area with a combination of vehicular and pedestrian transects.

The survey covered the terrestrial (above low water) part of the areas outlined, concentrating on areas that had not been significantly impacted within Area A - the area of highest priority as per the Heritage Conservation Services (HCS) Scope Of Works. A proportion of the area was not surveyed, being some intertidal and sub-tidal areas of mud flats and mangroves, thickly grassed areas of less than 5% visibility on the most westerly of the headlands in Area B and areas of prior extensive ground disturbance activities. The most easterly of the headlands in Area B has been heavily impacted by extractive mining activities.

The archaeological survey was conducted by archaeologist Patricia Bourke and Larrakia consultant Bill Risk, over ten days in early October 2007 and consisted of both vehicular and pedestrian transects. Ground surface visibility ranged across the survey area, from less than 5% in areas of monsoon vine thicket with dense leaf litter, to 95% in burnt areas, on open eroded laterite platform surfaces and open mudflats. Apart from the densely vegetated and highly disturbed areas, ground surface visibility was generally high as much of the area was burnt off, which ensures a high archaeological site and artefact discovery rate.

5.2. Results Summary

The archaeological investigation for the proposed Wickham Industrial Estate (WIE) Areas A and B identified 20 archaeological sites, of which MA19 no longer exists (Table 4). Therefore this report discusses 19 archaeological sites which consist of 27 identifiable site features and one historic World War II site (Figure 4). Seven localities containing 20 isolated artefacts (Table 5) were also recorded. During this 2007 survey, ten of the 19 archaeological sites and four of the isolated artefact localities were located (and one additional feature identified in a previously recorded site). Nine of the existing sites and three isolated artefact localities identified are previously recorded, from the NRETA Archaeological Sites Database and other consultancy reports.

All of the sites, with one exception (WIE10), and three of the isolated artefact localities - are located in clusters in or within 100m of the mangrove/mudflat woodland fringe within Area A (Figures 4, 5, 6 and 7). Of the 20 sites, three are **site complexes** (WIE10, MA6 and MA52) that cover relatively large areas and contain a high density and/or diversity of archaeological features. Archaeological site features recorded include shell middens (14), 12 of which are mounded (shell mounds), shell and stone artefact scatters (8), one definite and two possible sub-surface middens, two contact period sites - with Aboriginal selected/modified historic 19th century bottle glass - and one World War Two site. One new feature – a sub-surface midden - was recorded at site MA22, which was previously identified as a surface scatter only; thus this site has been renamed WIE1 (also the name MA22 already exists for another Middle Arm site).

Surveys for this study and for research undertaken through Charles Darwin University, are resulting in a growing number of Aboriginal "contact period sites" being recorded around Darwin Harbour (Bourke and Williams 2004, Bourke 2005a). Some sites contain material from both the pre-contact as well as post-contact periods. Radiocarbon dating has previously confirmed one example of these multi-component sites (Site Complex MA52) within the WIE area. One site (Complex WIE 10), containing archaeological material from both the pre-contact and post-contact period was recorded during this study.

TABLE 4 SUMMARY OF ARCHAEOLOGICAL SITES RECORDED WITHIN THE PROPOSED WICKHAM INDUSTRIAL ESTATE AREAS A AND B.

Site Name	Easting	Northing	Site type	Size (m)	Cultural material	Area/Ref.*
WIE1 (Prev. MA22)	705671	8612946	Shell scatter /sub-surface midden	12x15	Mollusc shell; (surface *Tel.,* poss. flaked quartz sub-surf *Anadara, Tel, Ter. Vol.* sp.)	A#
WIE2	705071	8614390	Shell mound	18x20	Mollusc shell (*Anadara, Tel., Ter.* sp.)	A*
WIE3	705047	8614601	Shell mound	7x7	Mollusc shell (*Anadara, Tel., Ner.* sp.)	A*
WIE4	704980	8614113	Shell mound	30x30	Mollusc shell (*Anadara, Tel., Ter. Vol. Gel.* sp.)	A*
WIE5	705050	8614178	Shell mound	20x25	Mollusc shell (*Anadara, Tel., Ter. Vol. Ner. Chic.* sp.)	A*
WIE6	705051	8614094	Shell mound	40x30	Mollusc shell (*Anadara, Tel., Ter. Chic. Vol.* sp.)	A*
WIE7	708363	8612730	Shell/ stone artefact scatter	15x15	Mollusc shell - surface *Tel.* sp.	A*
WIE8	704905	8614435	Shell mound	35x7	Mollusc shell (*Anadara, Tel., Ter. Vol. Gel. Pinctada. Chic. Melo* sp.)	A*
WIE9	704939	8614627	Shell mound	5x5	Mollusc shell (*Anadara, Tel., Vol. Chic.* sp.)	A*
WIE10a	710734	8613124	Shell/ stone artefact scatter/ possible sub-surf midden	70x10	Mollusc shell - surface *Tel.* oyster, *Anadara, Melo* sp. Flaked quartz (poss sub-surf *Anadara*)	B*
WIE10b	711198	8613055	Shell/ stone artefact scatter/ possible sub-surf midden	35x10	Mollusc shell - surface *Ner. Tel. Ter. Vol. Chic. Gel. Anadara*, oyster, *Melo and Syrinx* sp. Flaked quartz; (poss sub-surf *Anadara*), hist. bottle glass	B*
WIEWW2	708440	8616008	WW2 site		Iron, wood, cement, *Anadara, Ter.*	A*
MA6	708130	8613350	Shell mound	14x12	Mollusc shell (*Anadara, Tel., Ter. Vol.* sp.)	A/Bourke 1994
MA6a	708145	8613362	Shell mound	10x10	Mollusc shell (*Anadara, Tel., Ter.* sp.)	A/Bourke 2005
MA6b	708177	8613286	Shell midden	4x4	Mollusc shell (*Anadara, Tel., Ter. Vol.* sp.), flaked quartz, core, dolerite	A/Bourke 2005
MA10	708260	8613611	Shell midden	9x7	Mollusc shell (*Anadara, Tel., Ter. Vol..Syrinx* sp.)	A/Bourke 1994
MA51	708352	8612730	Shell/ stone artefact scatter	30x30	Mollusc shell (*Tel., Chic.* sp.), flaked quartz, dolerite	A/Bourke 2005

Site Name	Easting	Northing	Site type	Size (m)	Cultural material	Area/Ref.*
MA52	707986	8612580	Shell mound/ Shell/ stone artefact scatter	12x12 100x30	Mollusc shell (*Anadara, Tel., Ter., Chic., Vol., Melo* sp.), flaked quartz, cores, dolerite, quartzite pounder	A/Bourke 2005
MA52a	707913	8612607	Shell/ historic glass scatter	100x30 1x1	Mollusc shell (*Tel., Ter., Chic., Vol., Melina,* sp.), Aboriginal modified historic dark green bottle glass	A/Bourke 2005
MA53	707850	8612521	Shell midden	7x7	Mollusc shell (*Anadara, Tel., Ter.* sp.)	A/Bourke 2005
MA54	707869	8612588	Shell/ stone artefact scatter	5x5	Mollusc shell (*Anadara, Tel.,* sp.), flaked quartz, core	A/Bourke 2005
MA19	706396	8611795	Shell/ stone artefact scatter	10x10	Likely to have been destroyed	A/Heritage Surveys 2001
MA20	705016	8614435	Shell mound	40x10	Mollusc shell (*Anadara, Ter. Ner.* sp.)	A/Heritage Surveys 2001
MA21	705070	8614383	Shell mound	20x15	Mollusc shell (*Anadara, Tel.,* sp.), quartzite manuport	A/Heritage Surveys 2001
MA22 (renamed WIE1 see above)	705662	8612933	Shell/ stone artefact scatter	18x15	Mollusc shell (*Tel.* sp.), flaked quartz	A/Heritage Surveys 2001

* Sites recorded this survey; # New feature recorded – sub-surface midden under surface scatter.

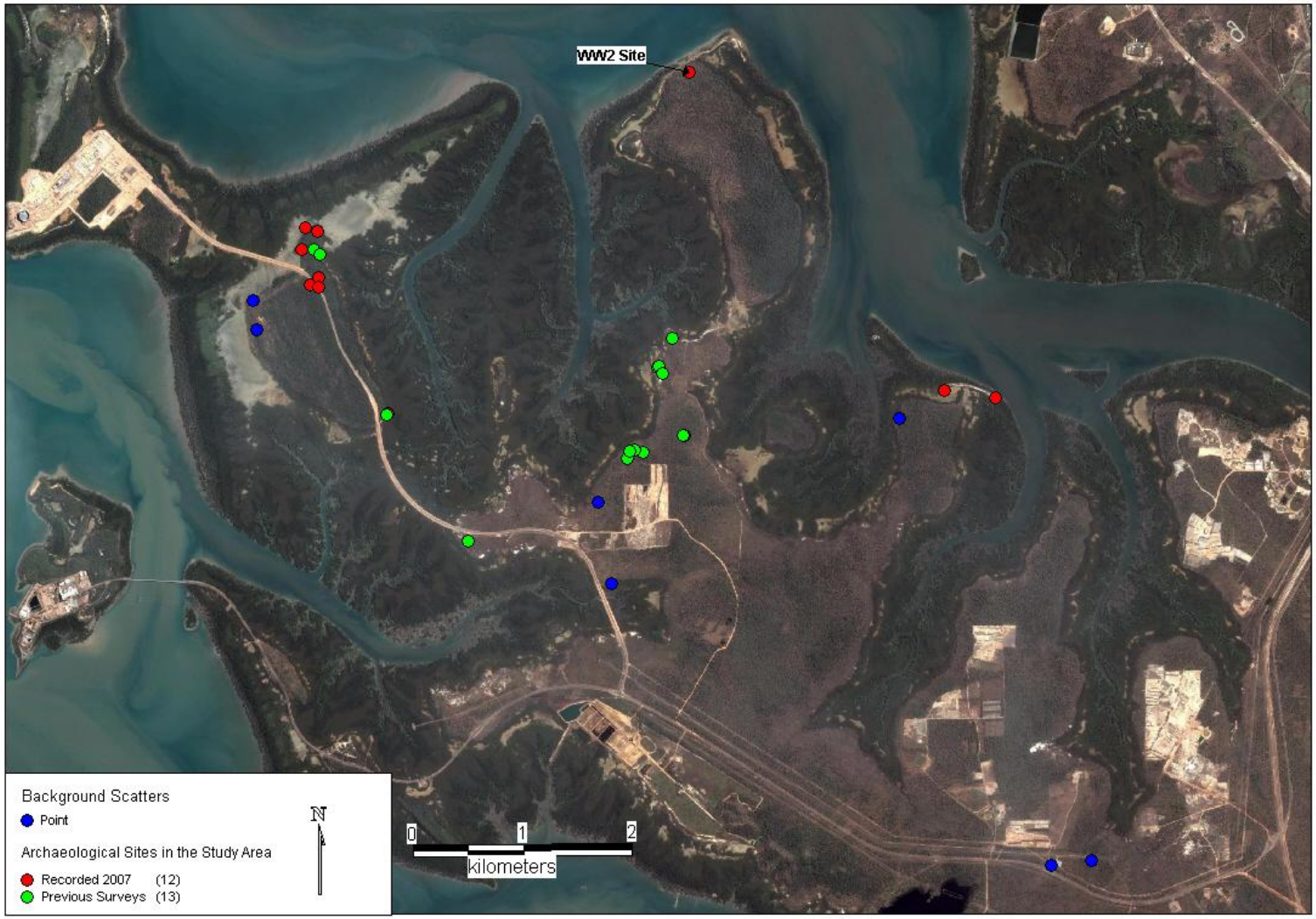

FIGURE 4 LOCATION SUMMARY OF ALL ARCHAEOLOGICAL SITES AND BACKGROUND SCATTERS RECORDED IN THE PROPOSED WICKHAM ESTATE AREAS A AND B.

FIGURE 5 LOCATION OF SITES ON THE WIE AREA A TERRESTRIAL ISLAND AND MUDFLATS

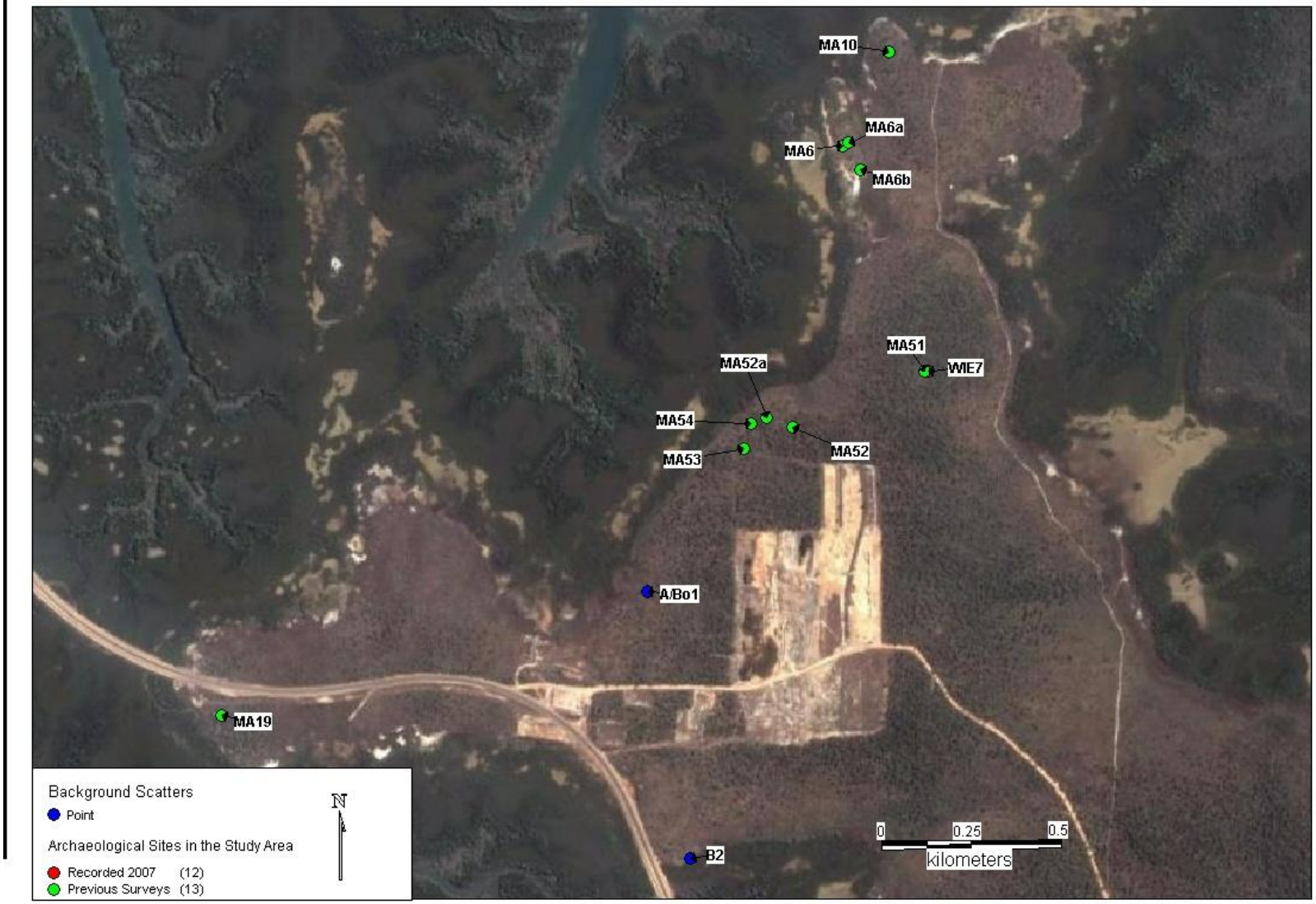

FIGURE 6 LOCATION OF SITES RECORDED ON THE MAINLAND MID-WESTERLY HEADLAND OF AREA A

FIGURE 7 LOCATION OF ARCHAEOLOGICAL SITES AND BACKGROUND SCATTERS IN AREA B

5.3. Background Scatters

Seven localities with 20 isolated artefacts have been identified within the study area (Table 5; Figure 4). Average density of the artefact background scatter was noted to be relatively low at 0.0001/m^2 to 0.001/m^2, compared to patterns previously recorded for the wider Darwin region (Bourke 1996, 1999; Guse 1995). Most background scatter was observed in eroded laterite sections of the study area. No archaeological material was observed in low-lying alluvial flats. One piece of an historic Chinese ceramic pot was located in Area A (Figure 8). Types of isolated stone artefacts observed are all quartz flakes apart from one flake made from volcanic tuff (Table 4).

TABLE 5 SUMMARY OF ISOLATED ARTEFACTS RECORDED IN THE PROPOSED WICKHAM ESTATE AREAS A AND B.

B/S Area	Artefact No.	Easting	Northing	L	W (mm)	T	Raw material	Type	Environment
A1	Iso1	704459	8613975	90			19thCent. Glazed black slipware	Historic Ceramic Pottery	Scrubfowl mound with midden material, chenier ridge on mudflats
B2	Iso2	707692	8611393	40	27	8	Quartz plus 3 shells	Flake Telescop	Laterite platform / mangrove-fringed creek
	Iso3			30	24	16	Quartz	Core	as above
B3	Iso4	710327	8612865	70	50	8	Quartz	Flake	Laterite platform /mangrove fringing narrow tidal inlet
	Iso5			30	20	3	Quartz	Flake	as above
	Iso6			50	40	20	Quartz	Core	as above
A4	Iso7	704488	8613714	50	10	3	Quartz	Flake	Chenier ridge at mudflat edge
	Iso8			45	25	3	Quartz	Flake	as above
	Iso9			35	25	3	Quartz	Flake	as above
	Iso10			28	15	2	Quartz	Flaked piece	as above
***A/ Bo**	Iso25	707578	8612129				Quartz	4 Flaked pieces	Hinterland margins/ mangrove
							Tuff	1 Flaked piece	as above
***B/Cr**	BS1	711672	8608824	20	18	5	Quartz	Flake	Laterite slope 300m W of creekline
				13	11	2	Quartz	Flake	as above
				12	8	2	Quartz	Flake	as above
				32	34	12	Quartz	Core	as above
***B/Cr**	BS2	712038	8608866	19	15	5	Quartz	Flake	Laterite slope 20m E of creekline

- Previously recorded (Bo = Bourke 2005; Cr = Crassweller, 2006a, 2007).

WIE isolated potsherd

WIE isolated potsherd side 1

FIGURE 8 HISTORIC CHINESE CERAMIC LOCATED AT BACKGROUND SCATTER A1

5.4. 2007 Site Recordings

Descriptions of eleven archaeological sites (Aboriginal sites WIE 1 to 10 and World War II site WIEWW2) identified during this survey for the proposed Wickham Industrial Estate (Table 4; Figures 1 and 4) are provided below. Descriptions include site location compliant with the GDA94 Datum, and map sheet reference, site integrity (disturbance), environmental context, distance to water, site dimensions and structure, artefact densities, raw materials and artefact types and type of faunal remains.

5.4.1. Site WIE 1 (previously MA22)

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 705671E, 8612946N

Site Type: Shell scatter and sub-surface midden

Site WIE 1 is a shell scatter and sub-surface shell midden site located at the mangrove / mudflat woodland fringe on the south-east point of the north-western terrestrial MVT island within WIE Area A and about 30m east of the Wickham Point Road (Figure 5). The site is situated at the southern edge of a low rocky ridge covered with monsoon vine-thicket and overlooks mangroves that extend a couple of hundred metres east to a tidal creek off East Arm. Ground surface visibility was around 5-10% as the area was not burnt off, and at the time of survey the site was covered in leaf litter. and therefore the approximate site size of 15x12m is an estimate only. The low ground surface visibility means that the additional sub-surface midden feature identified at this site (previously MA22) for the WIE survey, is only evident due to midden material brought the surface by fresh animal burrowing.

The site comprises a scatter of *Telescopium telescopium* shell in densities 15-20/m^2, covering an area about five metres in diameter at the southern end of the ridge (Figure 9). At the northern end of the ridge several weathered shells of *Anadara granosa*, *T. telescopium* and *Volema cochlidium* in a dark brown/black silt matrix had been dug up, possibly by scrubfowl, indicating a buried midden deposit. Quartz rock was seen on the surface, but no diagnostic artefacts. The nearest source of water may be an area of erosion indicating

seasonal water runoff, with paperbark and pandanus sp. present, less than 200m north-east of the site at the mangrove edge.

Site WIE1

WIE1Shells on leaf litter

FIGURE 9 SITE PHOTOS OF WIE 1

5.4.2. Site WIE 2

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 705071E, 8614390N

Site Type: Shell Midden

Site WIE 2 comprises a 20x18m shell mound, located toward the northern point of the northwestern terrestrial MVT island within WIE Area A (Figure 5). The midden is situated along a rocky ridge in monsoon vine thicket on the east side of the Wickham Point Road and about 50m southwest of the mangrove fringe. Site WIE2 is composed almost exclusively of *Anadara granosa* shells, which are present in densities exceeding 50/m^2, and no other taxa were observed.

However, a low ground surface visibility around 5-10% due to the thicket and leaf litter cover means that site content and size are estimates only. The mound is partly buried at the northern end and partly bounded on the eastern side by a large sandstone outcrop (Figure 10). Disturbance by scrubfowl activity was evident. Paperbark soak areas at the edge of the mangrove fringe may have provided a seasonal water source.

WIE2 rock outcrop WIE2 Shell WIE2 site

FIGURE 10 SITE WIE2 ILLUSTRATING SANDSTONE OUTCROP AND SHELL DEPOSIT

5.4.3. Site WIE 3

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 705047E, 8614601N

Site Type: Shell Midden

Site WIE 3 comprises an *Anadara*-dominated shell mound, located on the northeast point of the northwestern terrestrial MVT island within WIE Area A (Figure 5). The midden sits on a lower ledge of a sandstone outcrop at the edge of mangroves and supratidal mudflats (Figure 11). At the time of survey, the mound was covered in monsoon vine thicket and leaf litter, so site size is an estimate only, at 7m diameter. The mound contains mainly *Anadara* shells in densities exceeding 50/m^2, with a few *T. telescopium* and *Nerita* sp. shells observed (Figure 10). Minor disturbance by scrub fowl activity was evident. Quartz rock was also seen on the surface. Paperbark soak areas at the edge of the mangrove fringe may have provided a seasonal water source.

WIE3 Close Up of Shells WIE3 shells WIE3 site area

FIGURE 11 SITE PHOTOS OF WIE3 FACING SOUTH ILLUSTRATING SANDSTONE OUTCROP AND SHELLS

5.4.4. Site WIE 4

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 704980E, 8614113N

Site Type: Shell Midden

Site WIE 4 is a shell mound about 30m in diameter, located on a ridge on the northwestern terrestrial MVT island within WIE Area A, on the western side of Wickham Point road and about 30m southeast of the mangrove fringe (Figure 5). The midden, which is partly buried in a dark brown/black silt matrix and covered in leaf litter, extends down the sloping ridge toward the mudflat edge in monsoon vine thicket (Figure 12). Site WIE 4 is composed of mainly *Anadara granosa* at densities exceeding 50/m^2, with some *Telescopium, Terebralia, Geloina,* and *Volema* taxa observed. Visibility is less than 10%. Extensive paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

WIE4 shells | WIE4 site in monsoon thicket | WIE4 tree shows stratigraphy

FIGURE 12 SITE PHOTOS OF WIE4 IN MONSOON VINE THICKET

5.4.5. Site WIE 5

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 705050E, 8614178N

Site Type: Shell Midden

Site WIE 5 is a shell mound located on a ridge on the northwestern terrestrial MVT island within WIE Area A (Figure 5), on the eastern edge of the Wickham Point Road, where shells can be seen cascading down the side of rock that has been cut through by the road (Figure 13). The mound lies covered in leaf litter about 50m south of the mudflats and extends 20 m N-S along the road edge and 25m E-W into the monsoon vine thicket, where visibility is less than 10%. The mound comprises mainly *Anadara granosa* at densities exceeding 50/m^2, with a few *Telescopium, Terebralia, Nerita, Chicoreus,* large *Volema* sp. and a piece of Baler shell observed (Figure 12). Extensive paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

WIE5 baler WIE5 site WIE5 volema

FIGURE 13 SITE PHOTOS OF WIE5 NEAR WICKHAM POINT ROAD

5.4.6. Site WIE 6

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 705051E, 8614094N

Site Type: Shell Midden

FIGURE 14 SITE PHOTO WIE6 IN DENSE VEGETATION

Site WIE 6 is a shell mound located on a ridge on the northwestern terrestrial MVT island within WIE Area A (Figure 5), on the western edge of the Wickham Point Road, where shells can be seen on the edge of rock cut through by the road. The mound extends for 40m alongside the road gradually sloping down toward mudflats 100m to the north, and 20m along the ridge into the monsoon vine thicket area. Visibility is less than 10% as the mound is partly buried and covered by leaf litter (Figure 14). Site WIE 6 is composed mainly of *Anadara granosa* shell at densities exceeding 50/m^2, with a few specimens of *Telescopium, Terebralia* and *Chicoreus* sp. seen. Paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

5.4.7. Site WIE 7

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 708363E, 8612730N

Site Type: Shell and stone artefact scatter

Site WIE 7 is a sparse shell and stone artefact scatter located on a laterite surface on the crest of a hillock that lies in WIE Area A, midway between the mangrove fringe to the east and west (Figure 6). Vegetation was open eucalypt woodland that had been burnt off, so visibility was good at 90% (Fig 18). The scatter comprises a 15m diameter scatter of *Telescopium telescopium* shell (Figure 14), with two flaked pieces of quartz observed. Shell density ranged from 3/m^2 to approximately 5/m^2. Maximum density of the quartz stone artefacts was estimated at 1/m^2. The nearest source of water may be small patches of paperbark soak areas at the edge of mudflats a few hundred metres north.

WIE7

WIE7 shell

FIGURE 15 SITE PHOTOS OF WIE7

5.4.8. Site WIE 8

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 704905E, 8614435N

Site Type: Shell Midden

Site WIE 8 is a shell mound located on mudflats less than 50m from the northeastern edge of the terrestrial MVT island in WIE Area A (Figure 5). The site appears as an elongated mound 35x7m, with an apparent depth of 2m, and was covered by mangroves (Figure 16). The mound exhibited relatively high integrity, with only minor scrubfowl activity at one end.

The mound is composed of mainly *Anadara granosa* sp. at densities exceeding 50/m^2, with *Telescopium, Terebralia, Chicoreus, Volema, Geloina,* Baler(*Melo amphora*) and a piece of *Pinctada* sp. shell. More recent small chenier shell species of *Ceritihidea*, *Cassidula* and *Ellobium*, that may have been brought in by high tides, were observed around the mound edges. Quartz and sandstone rocks were seen on the surface. Paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

WIE8

WIE8 surface

FIGURE 16 SITE PHOTOS WIE8 ON MUDFLATS

5.4.9. Site WIE 9

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 704939E, 8614627N

Site Type: Shell Midden

FIGURE 17 SITE PHOTO OF WIE7 IN DENSE SCRUB

Site WIE 9 is a shell mound located on mudflats less than 100m from the northeastern edge of the terrestrial MVT island in WIE Area A (Figure 5). The site appears as a compacted, roughly circular mound of high integrity, with a cover of a few small mangrove bushes around the edges (Figure 17). Site dimensions are 5m in diameter, with an apparent depth of one metre. The mound is mainly composed of *Anadara* sp. at densities exceeding 50/m^2, with a few *Telescopium, Chicoreus* and *Volema sp.* observed on the surface, along with a couple of WW2 shell casings. Paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

5.4.10. Site Complex WIE 10

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 710734E, 8613124N to 710800E, 8613162N

Site Type: Shell and stone artefact and historic scatter

Site Complex WIE 10 is located on a narrow chenier/sandy spit at the harbour end of the most westerly of the headlands in Area B (Figure 7). The spit curves around the shoreline adjacent to a narrow strip of mangroves on the banks of the Elizabeth River. The site complex comprises two concentrations of scattered shell and stone artefacts (WIE 10a and WIE 10b - with historic glass) at opposite ends of a long, narrow chenier, and a low density scatter of shell and stone artefact material extending along the landward edge of the spit between the two areas of highest concentration.

WIE10a

WIE 10a is a 70x10m shell and stone artefact scatter located on the western end of the spit. The spit is fringed on either side by mangroves and mudflats and the sandy surface has been dug up and mounded by scrubfowl (Fig 18). The scatter consists of mainly *Telescopium* shell, with some oyster and very weathered *Anadara* that seemed to have been dug up from the mound (Fig 18), indicating a possible subsurface midden. A few pieces of flaked quartz WW2 shell casings were also observed on the surface.

Average density of the shell was estimated at $1/m^2$ with a maximum of $4/m^2$. Average stone artefact density was estimated at $0.1/m^2$ with a maximum of $1/m^2$. A large Baler shell (*Melo amphora*) was recorded embedded in the sand a couple of hundred metres east of the main concentration (Figure 18), and a low density background scatter of shell continued east along the landward side of the spit toward WIE 10b.

WIE10a mound WIE10a shells WIE10a baler

FIGURE 18 SITE PHOTOS OF WIE10

WIE 10b

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 711198E, 8613055N

Site Type: Shell and stone artefact and historic glass scatter

WIE 10b is a 35 m x 10 m scatter of shell and stone artefacts and historic bottle glass, located on the eastern end of the sandy spit, along the landward side. The site is very close to the banks of the Elizabeth River, which can be seen less than 30m away through a narrow strip of mangroves. Shell taxa observed include *Nerita*, *Telescopium, Terebralia, Chicoreus, Volema, Geloina* and oyster sp. as well as Baler (*Melo amphora*) and Trumpet shell (*Syrinx aruanus*).

A few weathered *Anadara* on the surface appeared to have been dug up, possibly by scrubfowl, suggesting the presence of sub-surface midden material. The main shell concentration is > 100/ m^2 and average density 10/m^2. A quartz core and flaked piece, quartzite pounding stone and selected base and neck parts of two types of historic dark green bottle glass was observed. Average stone artefact density was estimated at 0.1/ m^2 with a maximum of 2/m^2. Paperbark soak areas at the edge of the mudflats may have provided a seasonal water source.

5.4.11. Site WIE WW2 site

Location Map: Middle Arm 5072-3, 1:50,000 mapsheet

Grid Reference: 708420E, 8616054N

Site Type: Historic

Site WIE WW2 is located on the most northerly of the headlands in Area A on the plateau that forms a low cliff overlooking the harbour to the north and mangrove-fringed sandy beach. This site consists of a complex of features relating to the World War II occupation of the Middle Arm area (Table 1). The site appears to be a searchlight battery position associated with the main searchlight battery emplacements to the south at Haycock Hill.

The site extends over an area 100m EW by 60m NS along the margin of the coastal cliff. Features recorded at the site are listed in Table 6 below. Two concrete slabs are position above the cliff and have been reused in post war times with concrete blocks and other materials added to the site. A slab for a water tank is adjacent to the main building slab. The building slab is typical of the style used for constructing World War II shed structures. A background scatter of post war and World War II artefacts can be found in the surrounding area. Several buried pits are evident. Corrugated iron sheets and wooden beams are collapsed over a 4x3m trench, with midden material mounded around the edges of the trench. The trench is approximately 50 south of the slabs. To the east of the slabs is a single concrete foundation block that appears to be for the base for a generator. Communication insulators and wire are found in a number of bloodwood and ironbark trees to the south of the site. The insulators are found intermittently in trees up to a kilometre south of the site.

TABLE 6 WWII FEATURES RECORDED AT SITE WIE WW2

Feature	Easting	Northing	Description
Concrete Slabs	708453	8616037	Several concrete slabs
Concrete Base	708494	8616097	Possible searchlight foundation
Refuse	708440	8615957	Rubbish pit of WWII materials
Insulator	708830	8614645	Insulators in trees
Insulator	708941	8614073	Insulators in trees
Shelter	708420	8616054	A bomb shelter trench

WW2 Generator Foundation

WW2 Shelter

WWII Concrete Slab

FIGURE 19 WW2 FEATURES RECORDED AT THE SITE

WW2 Insulators in Tree

WW2 Insulators

WW2 Star Pickets

FIGURE 20 WW2 FEATURES

WIEWW2 shell platform

WIEWW2 shell platform 2

WIEWW2shellplatform

FIGURE 21 SHELL PLATFORM USED TO MIX SHELL FOR MORTAR

5.5. Descriptions of Previously Recorded Sites in the Proposed WIE

Nine of the 20 archaeological sites identified within the proposed Wickham Industrial Estate (WIE) Areas A and B were previously recorded. Brief details of these sites are provided below. Full descriptions are given in previous reports (Bourke 1994, 2000, 2005).

5.5.1. Site Complex MA6

Site Complex MA6 comprises a line of two shell mounds and a shell midden in close proximity (20-30m apart) located along a low rocky knoll outlier of a small headland in WIE Area A (Figure 6). The middens overlook a small saltpan area and mangroves that extend a few hundred metres west to a tidal creek (Figure 22). At the time of survey, the area was burnt off, so visibility was high at around 80%. Fire and animal activity evident by fresh burrows in the mounds are two disturbance factors at these sites, which nonetheless, exhibit relatively high integrity.

FIGURE 22 SHELL MOUND AT THE MA6 SITE COMPLEX

Each of these middens is similar in size and content, being roughly circular (12x14m, 10x10m and 4x4m) and composed mainly of *Anadara* at densities exceeding 50/m^2, with a few *Telescopium* and *Terebralia* and *Volema* sp. shells. MA6b, the smallest of the middens, appear compacted and deflated, with very weathered shells. Quartz (mainly) flakes and cores and dolerite flakes were observed on the surface. The upper reaches of small creeks and paperbark soak areas nearby may have provided a seasonal water source (Bourke 2005).

5.5.2. Site MA10

Site MA10 is a shell midden located in WIE Area A about 50-100m north of Site complex MA6 (Figure 6), on a rocky knoll that rises over four metres from the saltpan and overlooks the mangrove fringe. The midden is composed mainly of *Anadara* at densities exceeding 50/m^2, with a few *Telescopium* and *Terebralia* and *Volema* sp. shells and one *Syrinx* sp. shell. Excavation of MA10 in the 1990s (Figure 23) revealed a layer of shell, some mammal bone and a kangaroo tooth and flaked quartz artefacts in a matrix of clumpy, dark greyish brown silt, merging into a base of clay and rocks. Radiocarbon dating of *Anadara* shell showed that the mound was used

FIGURE 23 EXCAVATION AT MA10

around 1500 AD (Bourke 2000).

5.5.3. Site MA51

Site MA51 is a stone artefact and shell scatter located a few hundred metres inland from the mangrove/ mudflat fringe in WIE Area A (Figure 6). The site is exposed on a laterite surface on a low rise at the edge of lower slopes of open eucalypt woodland. The site comprises a 12x20m scatter of mainly *Telescopium* shell (one *Chicoreus* shell was observed), and wider sparse scatter over a 30m radius of stone artefacts – mainly flakes and a few cores made from quartz. Average density of stone artefacts was estimated at 1-5/m^2 (Bourke 2005).

5.5.4. Site Complex MA52

Site Complex MA52, recorded in 2004 on Middle Arm Peninsula as part of the Darwin Harbour survey, is a multi-component site comprising a pre-contact shell mound, flaked historic green bottle glass and a surface scatter of stone artefacts and shell (Bourke 2005a; Table 3). Site Complex MA52 is located in open eucalypt woodland with a dense cycad understorey, less than 100 m fringe from the mangrove and mudflats, within WIE Area A (Figure 6). The site overlooks the mangroves and a small tidal/ seasonal creek that flows into East Arm. A dirt track runs along a saltpan strip between the higher ground on which the site is located and mangroves. MA52 site complex comprises a number of components previously interpreted as representing different periods of use that reflect environmental and cultural change (Bourke 2005):

- A pre-contact *Anadara*-dominated shell mound dated to AD 1120-1240 (Table 7).
- A scatter of mangrove taxa shell and stone artefacts, covering an area 100 m in diameter, dated to AD 1890-1930;
- A one metre wide scatter of the mangrove tree oyster *Melina ephippium*; and
- A one metre wide scatter of Aboriginal flaked historic green bottle glass.

Materials in the stone artefact scatter include flakes and cores made from locally available milky quartz and rose quartz as well as imported dolerite, sources of which are tens of kilometres inland. A quartzite pounding stone was also found on the mound surface. The WIE survey located an additional large piece of Baler shell on the shell mound (Figure 24).

Inclusions in the flaked historic green bottle glass and impurities that react from sun bleaching to give the glass an observed metallic sheen, indicate that the bottle was hand-blown and its manufacture pre-dates the turn of the nineteenth century[1]. The very small scatter of one type of glass indicates an episode of knapping that is likely to represent one event, perhaps to produce a glass point for trade with other Aboriginal groups, or Europeans in the nearby Port Darwin settlement (Bourke 2005).

TABLE 7 RADIOCARBON DATES FOR SITE MA52, CONTAINING PRE AND POST-CONTACT ARCHAEOLOGICAL REMAINS. (CALIBRATED AT WAIKATO RADIOCARBON DATING LABORATORY).

Site name	Code	Radiocarbon age	Calibrated date (rounded) (68% probability)
MA52a	Wk14391	1298±40	1120-1240 AD
MA52b	Wk14394	344±34	1900-1930 AD

[1] Guse pers comm. 2004


MA52 baler 1


MA52 baler2


MA52 glass


MA52 pounder


MA52 Baler on mound


MA52mound

FIGURE 24 SITE PHOTOS OF MA52 ILLUSTRATING GLASS ARTEFACT, POUNDER, AND BALER SHELL (PHOTOS LORRAINE WILLIAMS)

5.5.5. Site MA53

Site MA53 located about 100m west of MA52 about 50m inland from mangroves, in open eucalypt woodland with stands of cycads, on the headland within WIE Area A (Figure 6). The site is situated next to bend on a track close to the Woodside plant ingress road. This roughly circular (7m diameter) shell midden is very disturbed, comprising a high earth content with numerous burrowings, possibly by goanna. Weathered shells of mainly *Anadara granosa* at densities exceeding 50/m^2, and a few *Telescopium telescopium* and *Terebralia* sp. that had been dug up, were observed on the mound surface (Bourke 2005).

5.5.6. Site MA54

Site MA54 is a shell and stone artefact scatter located at the mangrove/ mudflat woodland fringe within WIE Area A (Figure 6), on a laterite outcrop on the west side of the drainage line bordering Site MA52 complex. The scatter comprises a 5 m diameter scatter of *Anadara* and *Telescopium* shell, quartz flakes and a quartz core. Average density of the quartz stone artefacts was estimated at 1-2/m^2 (Bourke 2005).

5.5.7. Site MA19

Site MA19 located on the point of a low headland, now cut through by the Wickham Point Road, is likely to have been destroyed by the road construction (Heritage Surveys 2001).

5.5.8. Site MA20

Site MA20 is located on the crest of a low rise on the northwestern terrestrial MVT island within WIE Area A (Figure 5). The site is located in dense MVT and overlooks mangrove flats immediately to the east. Quartz rock was seen on the surface. This mounded midden covers an area 10 m E-W by 40m N-S along the crest of the ridge. Site MA 20 is composed of mainly *Anadara* at densities exceeding 100/ m^2, and a few *Terebralia* and *Nerita* sp. were observed on the mound surface (Heritage Surveys 2001).

5.5.9. Site MA21

Site MA21 is located on the northwestern terrestrial MVT island within WIE Area A (Figure 5). This 20 m N-S x 15 m E-W mounded shell midden is located on a slight sandstone rise overlooking mangrove flats immediately to the east. Site MA 21 is composed of mainly *Anadara* at densities exceeding 100/ m^2, and a few *Telescopium* sp. and one 50mm diameter quartzite cobble were observed on the mound surface (Heritage Surveys 2001).

5.5.10. Site MA22 (now renamed WIE1 – see above)

Site MA22, was identified by Heritage Surveys (2001) as 15 m N-S x 18 m E-W surface scatter of *Telescopium* sp. shell and quartz stone artefacts on a low sandstone promontory projecting into the surrounding mangrove flat, on the northwestern terrestrial MVT island within WIE Area A (Figure 5). This scatter is located in dense MVT, with leaf litter reducing visibility to less than 10%. The additional sub-surface midden feature identified at this site (now renamed WIE1) for the WIE survey, is only evident due to midden material brought the surface by fresh animal burrowing and may not have been discernible at the time of the 2001 survey.

6.0. CULTURAL HERITAGE SIGNIFICANCE

6.1. Introduction

The following section assesses the significance of archaeological sites within the WIE study area. 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 Middle 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.

6.2. 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.

6.3. Archaeological/Scientific Significance

Archaeologists assess the scientific significance of archaeological sites through consideration of two characteristics. The first is the extent to which the archaeological material in a particular site is *representative* of other sites of the same type in the region. Sites that are unusual or unique are defined as having higher archaeological significance than sites that are common. Given that all sites are in a sense unique (Bowdler 1984:2), they are usually considered in terms of which type of site they are (e.g. A midden or stone artefact scatter) when assessing how common they are. The second characteristic used to assess significance is *research potential*, which refers to a site's potential to provide information, which may contribute to archaeological

research questions. Well preserved sites and/or those that reflect a wide range of past human activities have a high research potential (after Heritage Surveys 1995).

According to Sullivan and Bowdler (1984) archaeological significance means that it has scientific, archaeological or research value, that is, it has the potential to assist current or future research into problems of human history or other areas of enquiry. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance, otherwise known as the Burra Charter, states that the scientific value or research potential of a place depends upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place or object may contribute to further substantial information. The cultural heritage significance of a place or object indicates its *aesthetic, historic, scientific* or *social values* for past, present and future communities (Marquis-Kyle and Walker 1992):

- *Aesthetic Value*. This 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*. This 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*. The 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.
- *Social Value*. 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.

Scientific significance, of an artefact scatter for example, depends on a number of factors including, but not limited to, site components, diversity, location, representativeness, and rarity. Therefore the significance of a site is firstly related to the intactness or integrity of the site, that is, the state of preservation as well as the stratigraphic reliability of the cultural material. Secondly, the representativeness of a site is important either because a site is unusual or because the site has research potential individually, or when taken in conjunction with other sites. Thirdly, a site may provide chronology extending back into the past.

However, it should be noted that even though individual sites are identified from low to high levels of individual site significance, when combined together as a cultural landscape unit, have a high potential to contribute to archaeological research questions such as seasonality and long term timings of resource exploitation and adaptations to environmental change, and contribute significantly to investigating questions arising on timings of occupation of Indigenous people in the landscape. The general explanation of the cultural heritage significance ranking used in this report is as follows:

- **Limited Archaeological Significance**: Sites assigned a limited level of archaeological significance have very limited archaeological significance have generally undergone significant disturbance from natural and cultural processes (i.e. bulldozing). The site is still identifiable from remaining cultural materials. Archaeological materials in these sites are likely to be extensively broken, damaged, crushed, and fragmented. These sites have little or no ability to contribute to meaningful archaeological interpretations and analysis.
- **Low archaeological significance**: These sites are unlikely to be nominated to any State or Commonwealth heritage register as they would not satisfy any of the heritage criteria. In addition, sites in this category often occur in large numbers in the north Australian landscape (i.e. isolated artefacts.) These sites can add to our understanding of past lifeways through analysis of spatial and possibly temporal distributions. Some may demonstrate limited information about Indigenous settlement patterns, technologies, and land

use in the region. Sites with low archaeological significance are generally recommended for permission to be sought to be disturbed in most development situations.

- **Low to Moderate significance**: These sites are unlikely to be nominated to the any State or Commonwealth heritage register as they would not satisfy any of the heritage criteria. These sites are important within a landscape to understanding of past lifeways through analysis of spatial and possibly temporal distributions. Some may demonstrate limited information about Indigenous settlement patterns, technologies, and land use in the region. Sites with low-moderate archaeological significance are generally recommended for permission to be destroyed or disturbed in most development situations with a low to moderate level of further recording, documentation and analysis.
- **Moderate Archaeological Significance**: These sites may have characteristics that are assessable under one or two heritage assessment criteria for State and Commonwealth heritage registers; however they are generally unlikely to reach the thresholds necessary for permanent declaration to such lists. These sites have more potential to add to our knowledge of past lifeways and specific archaeological research questions (i.e. stone tool technologies; faunal exploitation; food processing etc) and are considered to largely have local and State heritage significance. Although these sites have some capacity to add to archaeological knowledge, sites with moderate levels of archaeological significance may be permitted to be disturbed following more detailed site documentation and in some cases salvage.
- **Moderate to High Archaeological Significance**: These sites may have characteristics that are assessable under one or more heritage assessment criteria for State or Commonwealth registers. These sites may be assessed as having special significance and could potentially be recommended for inclusion on relevant heritage lists. These sites have the potential to add significantly to our knowledge of past lifeways and are still considered to have local and State heritage significance. These sites are usually recommended to be avoided by the proposed development and for proponents to redesign the development (if possible) and make attempts not to disturb these sites. However, it is also likely that permission may be sought to disturb after extensive salvage and recording of the archaeological sites.
- **High Archaeological Significance**: Sites with high or outstanding archaeological significance would typically highly meet most criteria for registration according to State and Commonwealth heritage registers; and are typically assessed as having special significance. These types of sites are generally considered to have significant local, State and National heritage value. Typical management regime recommended for such sites includes no disturbance and the implementation of conservation and management strategies.

6.4. Assessing the Significance of Archaeological Shell Deposits

According to Bourke (2000), shell middens and scatters in the Northern Territory arguably have high levels of cultural heritage significance in demonstrating changes and settlement patterns in the Northern Territory's cultural history. The amount and diversity of archaeological material in a complex of archaeological sites is important especially with regard to its integrity when assessing archaeological significance. Generally, shell mounds possess aesthetic qualities through their large size as prominent cultural markers in the landscape. Researchers have documented that large *Anadara granosa* shell midden sites exist on the Cape York Peninsula which has considerable cultural importance (Bailey 1994; Beaton 1985).

As an archaeological investigation, this report focuses on such criteria that help determine the scientific value of sites. However, the aesthetic, historic and social values of archaeological sites also contribute to assessments of their significance. Generally, shell mounds possess aesthetic qualities through their large size as prominent cultural markers in the landscape. The high cultural significance of large mounds at Weipa on Cape York has been recognised since 1980, when they were placed on the Register of the National Estate (Bailey 1994). Groups of mounds and scatter sites possess historic values due to their representing past periods of Aboriginal life prior to and around the "contact period" of European colonisation. Shell midden and scatter sites

represent the material remains of Aboriginal ancestors and therefore because of special spiritual or economic (in terms of food resources) association, may possess social significance for traditional owners, who in this case are the Larrakia community.

In a draft management strategy for shell middens in the Darwin region, Gregory (1996:38) identified values for the assessment of archaeological significance. After reviewing archaeological data, Gregory (1996) developed a range of characteristics for shell middens that had a high, moderate and low level of archaeological significance. Gregory (1996) noted that it is not necessary for a site to meet all the criteria in order to be accorded a certain level of archaeological significance. The significance of the archaeological sites was assessed against criteria as set out by Gregory (1996) for assessing archaeological sites (Tables 8 and 9). These criteria are:

- little or no disturbance;
- unusual size;
- presence of stratified deposit;
- presence of other cultural materials such as stone artefacts, bones, and charcoal;
- unusual species composition i.e. *Anadara granosa* not the dominant species;
- high densities of cultural materials;
- unusual structure;
- unusual environmental location i.e. some distance from mangrove areas;
- location within the wider region

6.5. Significance of Wickham Industrial Estate Archaeological Sites

6.5.1 Previous significance assessments

The three *Anadara* middens in site complex **MA6**, midden sites **MA10** and **MA53**, two shell and stone scatters **MA51** and **MA54** in WIE Area A, which form a cluster on a small headland of woodland and outlier rocky knolls overlooking the 500m wide mangrove fringe west to a small tidal inlet off East Arm (Figure 5), have previously been assessed as holding a moderate level of archaeological significance (Bourke 2005).

Complex site MA52, however, which is a multi-component site within the same cluster, has been previously assessed as holding a high level of archaeological significance due to its high research potential (Bourke 2005). The *Anadara* mound and surface scatter of shell, stone artefacts and Aboriginal modified historic bottle glass at this site represents historic Aboriginal activity on top of older, pre-contact sites. The site has the research potential to provide information on continuity and change in Aboriginal occupation of the Darwin region over many hundreds of years, and on the incorporation of new technological products such as European glass into existing Indigenous systems.

Sites MA20 and MA21 have been previously assessed as holding moderate significance due to their potential to provide information on environmental change and the chronology of human settlement in the Darwin region, while MA22 was assessed as holding low significance due the limited information available from low density, non-stratified scatters (Heritage Surveys 2001).

Summary assessment archaeological sites in areas A & B according to scientific significance criteria (after Gregory 1996)

TABLE 8 ASSESSMENT ARCHAEOLOGICAL SITES IN AREAS A & B ACCORDING TO SCIENTIFIC SIGNIFICANCE CRITERIA (AFTER GREGORY 1996)

Significance Criteria	WIE1	WIE2	WIE3	WIE4	WIE5	WIE6	WIE7	WIE8	WIE9	WIE10.	MA6	MA10	MA51	MA52.	MA53	MA54	MA20	MA21
Little or no disturbance	animal burrowing, scrubfowl, root growth,						fire	tides	tides	scrub fowl	fire, animal burrowing, scrubfowl, root growth						animal burrowing, scrubfowl, root growth	
Unusual size	No	large	no	v large	large	v.large	no	large	no	complex	complex	no	no	complex	no	no	large	no
Presence of stratified deposit	Yes	yes	yes	yes	yes	yes	no	yes	yes	possible	yes	yes	0	yes	yes	no	yes	yes
Presence of other cultural materials i.e. stone artefacts, bones, charcoal	poss.	poss	poss	possble	Baler shell	possble	yes	possible	possible	stone artefacts, historic glass	stone artefacts	stone artefacts Trumpet shell	yes	stone artefacts Melina, Baler shell	possible	yes	possible	possible
Unusual species composition eg. Anadara not dominant taxa	0	0	0	0	0	0	Telesc	0	0	Nerita, Telescop	0		Telescop	Plus scatter Telescop etc.	0	0	0	0
High densities of cultural materials	Yes	yes	yes	yes	yes	yes	No	yes	yes	no	yes	yes	no	yes	poss	no	yes	yes
Unusual structure	sub-surface	no	no	no	no	no	no	elongated poss sub-surface	poss. sub-surface	no	no	no	no	no	high earth content	no	no	no
Unusual environ. location i.e. some distance from mangrove	No	no	no	no	no	no	>300m	on mudflats	on mudflats	sandy spit	no	no	no	no	no	no	no	no
Within context of wider region	Sub. rare	no	no	v.large rare	no	v.large rare	no	mudflats rare	mudflats rare	contact period	no	no	no	contact period	no	no	no	no
Overall Significance	Mod	mod	low-mod	mod	mod	mod	low	mod-high	mod-high	mod-high	mod	low-mod	low	high	low-mod	low	mod	mod

6.5.2 Significance assessments for this study

The assessment of the Indigenous archaeological sites in Table 8 has shown that there are 3 sites with low significance, a further 3 with low to moderate, 7 containing moderate significance, 3 with moderate to high, and 1 site containing high cultural heritage values. The significance of archaeological sites in the proposed development areas is discussed in groups according to their geographic location and similarity in morphology and contents. The following archaeological site significance assessments and management recommendations arise from this survey:

Sites on the Mudflats off the North-East End of the Terrestrial MVT Island (WIE Area A)

Shell mound **sites WIE8 and WIE9** are rare site types with regard to their location on the mudflats, and of relatively high integrity. Although shell mounds are recorded on the saltflats at Hope Inlet, 25km to the northeast, these are the first and only examples of sites recorded on mudflats in the Darwin Harbour area. Site WIE8 is also an unusual in being large, and elongated rather than the more common circular form. Their unique location, unusual form and high integrity mean that **sites WIE8 and WIE9 are defined as having moderate-high archaeological significance.**

Terrestrial MVT Island Sites– South East End (WIE Area A)

Sites WIE1 -a shell scatter with a sub-surface midden deposit. Shell and stone artefact scatters are common site types around Darwin. Sub-surface sites are still uncommon, though more are being recorded as further surveys are undertaken around Darwin (Bourke 2005). The research potential of this site is moderate in terms of information that may be gained on whether there is a temporal and/or economic relationship between the different site features (i.e. scatters on top of sub-surface middens). **Thus site WIE1 is considered of moderate significance.**

Terrestrial Island Sites – North East End (WIE Area A)

Sites WIE2, WIE3, WIE4, WIE5, WIE6, MA20 and MA21 are all *Anadara*-dominated shell mound sites that form a cluster on the northeast end of the terrestrial island in WIE Area A. While these site types are typical, in terms of content, morphology and environmental context, to middens recorded at Wickham Point a few kilometres to the northwest and more generally across the Darwin region, they differ in terms of the relatively large size of five of these deposits. As such, they may contain information on the chronology of past Aboriginal settlement and subsistence patterns, as well as temporal and/or economic relationship between sites in close proximity, which may not be available at other site localities.

The dominance of the now rare mudflat bivalve *Anadara granosa* in these mounds, and their environmental context today of being covered by monsoon vine thicket, also suggests major environmental changes before and after the middens were deposited. Moreover, dating of eleven middens at Wickham Point by Crassweller (2006) found a hiatus of a couple of hundred years between 1000 and 800 years BP. As Crassweller (2006) suggests, additional radiocarbon dates could be used to further assess the hypothesis that there was a period of decrease or break in the reliance on shellfish when there were either changes in the environment with *Anadara* becoming less available and / or there were changes in the behaviour of the mound builders. Therefore the middens have the potential to not only address questions on the chronology of human occupation and changes in human use of the Darwin coastal environment, but to investigate in finer detail the environmental history of the area. **Thus the group of sites WIE2, WIE3, WIE4, WIE5, WIE6, MA20 and MA21 are considered to hold a moderate level of archaeological significance.**

Small, Mid-Westerly Headland (WIE Area A)

Sites WIE7 and MA51 about 100 m apart on this headland are typical of many small shell and stone artefact scatters dominated by *Telescopium* shell and quartz stone recorded in the Darwin region (eg. Bourke 2005), with a relatively low artefact type diversity (in raw material) and low density. Site WIE7 differs from the usual pattern in being more than 300 m from the mangroves, but the difference is slight as it is still within 500m. Information that may be available from **Sites WIE7 and MA51** is likely to be repeated at other localities, so they **are considered of low archaeological significance**.

Site Complex MA52, shell mound **site MA53 and** shell and stone scatter **site MA54** that form a cluster on the woodland/ mangrove/ mudflat fringe on the small, mid-westerly headland in WIE Area A are assessed here as a group with high research potential. As previous discussed, MA52 represents historic Aboriginal activity on top of older, pre-contact sites, and has high research potential in terms of providing information on continuity and change in Aboriginal occupation of the Darwin region, and on the incorporation of new technologies into existing Indigenous systems. Individually, sites MA53 and MA54 hold moderate and low significance respectively. However, shell mound MA53 is unusual in containing a relatively high earth content, and the presence of *Anadara*, in MA54 is unusual in that scatters usually contain only mangrove taxa such as *Telescopium*. The potential is high for information to be gained on temporal and/or economic relationship between these different site types that are in close proximity. **Thus as a group the sites complex MA52, MA53 and MA54 are considered to hold a high level of archaeological significance.**

Site complex **MA6** of two shell mounds and a midden and midden site **MA10**, are different in being located on outlier rocky knolls off the small mid-westerly headland in WIE Area A. Although typical of these site types recorded across the Darwin region, as a group these sites have the potential to provide information on the chronology of past Aboriginal settlement and subsistence patterns, as well as temporal and/or economic relationship between sites in close proximity. **Thus Site complex MA6 and site MA10 are assessed (as previously) as holding a moderate level of archaeological significance.**

Site Complex WIE10, as a site spread over a large area comprising shell and stone artefact scatters and Aboriginal-modified historic material, and a possible sub-surface pre-contact midden, also potentially represents historic Aboriginal activity on top of older, pre-contact sites. As such this site complex has high research potential in terms of providing information on continuity and change in Aboriginal occupation of the Darwin region, and on the incorporation of new technologies into existing Indigenous systems. **Thus site complex WIE10 is considered to hold a moderate-high level of archaeological significance.**

TABLE 9 SUMMARY ASSESSMENT OF THE INDIGENOUS ARCHAEOLOGY ACCORDING TO SCIENTIFIC SIGNIFICANCE CRITERIA (AFTER GREGORY 1996)

Significance Criteria	WIE Survey Archaeological Sites
Little or no disturbance	The majority of shell deposits within the WIE area have been subjected to moderate levels of post-depositional disturbance, by fire, tidal inundation and erosion, animal burrowing and destruction/collection by human activity
Unusual size	The shell mounds within the monsoon vine thicket appear extend over an unusually large area, with 6 of 9 >200m^2 and 2 of these >700m^2. and MA52 covers an area >3000m^2, which is unusually large for the Darwin region.
Presence of stratified deposit	The twelve mounded shell deposits within the WIE area are more than 20 cm in depth and therefore likely to be stratified.
Presence of other cultural materials such as stone artefacts, bones, and charcoal	Stone artefacts occur on the surface of many of the midden sites. No other faunal remains were observed on the surface in conjunction with the shell middens and scatters. However excavations of some middens in the region have shown that bone, charcoal and stone artefacts commonly occur within the middens.
Unusual species composition in middens i.e. *Anadara granosa* not the dominant species	*A. granosa* is the dominant species (100%)
High densities of cultural materials	Shell mounds and middens are high density sites. Scatters in this area are few, small and lower in density of stone artefacts within scatters than elsewhere in the Darwin region.
Unusual structure	The structure of all the sites is consistent with other shell middens and shell and stone artefact scatters recorded in the region.
Unusual environmental location i.e. some distance from mangrove areas	Sites are found in an area that is typical for the presence of shell deposits near the coastal margins.
Location within the wider region	Shell middens and shell and stone artefact scatters are also represented around Darwin Harbour.

6.6. 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 (Guse and Mowat 1993; Hiscock 1992), Middle Arm peninsula (Crassweller 2002, 2006; Bourke 2000; Burns 1994; 1996b) 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 2004b, 2005b; 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.

Table 9 provides a summary overview of the significance of the Indigenous archaeological sites according to Gregory's (1996) scientific values. The shell deposits and stone artefacts of the Middle 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.

6.7. World War II Site Assessment.

According to Alford (2002) the wartime role of units stationed in the Northern Territory was important during an important period of Australia's history. 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.

Table 9 lists previously documented known sites in the Darwin region that were involved in the static air defence operations (Alford 2001). A review of Rayner (2001) shows that this is not an exhaustive list of static air defence operation sites in the Darwin region.

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[2] 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 Fannie Bay HAA battery is incorporated in the greater East Point Fortifications which are valued for their social associations with the events of World War II in Northern Australia[3]. The Fannie Bay 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.

There currently appears to be a paucity of cultural heritage assessments for anti-aircraft searchlight battery sites in the Darwin region when examining other World War II sites. These installations formed an essential part of the Darwin air defence system. It would seem that the lack of inclusion of this WWII site type on the Heritage Register would diminish the overall significance of the HAA battery sites in the defence of Darwin. Without the AASL, the HAA batteries would not be able to operate in night time conditions, which would have been considered an essential part of the overall defence strategy. 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.

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

Consequently, Alford (2001) 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.

Without a detailed assessment of the heritage value or current condition of search light battery sites in the Darwin region, it is difficult to assess the significance and ranking of the WIE WWII site recorded in this report. The WIE WWII site is poorly conserved and has been disturbed from sporadic occupation since the end of World War II. At this stage it is difficult to undertake a comparative assessment of this AASL site and that of features and materials from other AASL sites in the Darwin region.

The WIE WWII site is part of the larger AASL network of the Darwin area. The site appears to be linked to the other AASL sites on Middle Arm and is representative of a typical AASL outpost. The site is in poor condition, contains few intact features, and therefore would be unlikely to be entered onto the Northern Territory Heritage Register. Notwithstanding the likelihood of being entered to the Northern Territory Heritage Register, the site still has a moderate level of heritage significance as it is able to provide information about AASL operations in Darwin.

TABLE 10 WWII STATIC AIR DEFENCE AND RELATED SITES IN THE DARWIN REGION

Name	Locality	Theme	Current Heritage Status	Description	Current Condition
Darwin Oval HAA Battery	Darwin City	Defence - air, static	No heritage listing	Established as heavy anti aircraft battery site for four 3.7-inch A-A guns in 1941.	No extant remains of the battery however may be sub-surface features.
RAAF Station	Winnellie	Air operations - defence, offence, accommodation	Historic precincts on Register National Estate.	Constructed from 1937 it was officially opened on 1 June 1940 and has served as the major RAAF Base in the north.	Extant administrative and accommodation buildings and associated facilities remain as defined precincts
Fannie Bay HAA Battery	Fannie Bay	Defence - air, static	Declared Heritage Place	Established on Darwin's golf course in late 1941, it was the site for four 3.7-inch A-A guns and command infrastructure to war's end.	The gun bases, command post and associated concrete slabs remain along with some artefact material
No 31 RDF Station site,	Dripstone	Defence - air static	No heritage listing	Site of first operational radar in the Northern Territory and North Western Area of Operations, it plotted the 22 March 1942 raid on Darwin and Katherine.	Concrete foundation slab for aerial and a commemorative cairn and plaque identify the site within the Casuarina Coastal Reserve
'Quarantine' HAA Battery	East Arm	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.
Operations Room RAAF No 5 Fighter Sector	Berrimah Farm	Defence - air static	Declared Heritage Place.	Established in late 1942 as the headquarters and plotting room for No. 5 Fighter Sector and later developed as a RAAF wing HQ.	Concrete foundation slab and artefact material remain
No 132 Radar Station site	Knuckeys Lagoon	Defence - air static	No heritage listing	Established in 1943 the site was camouflaged as a race track and served to war's end.	Horticultural development has overtaken the site, but some scatters and infrastructure remain
Mica Beach AASL	Cox Peninsula	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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

Name	Locality	Theme	Current Heritage Status	Description	Current Condition
Talc Head AASL	Cox Peninsula	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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
Swires Bluff AASL	Darwin Harbour	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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
Harpers Folly AASL	Darwin Harbour	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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
Flagstaff Hill AASL	Darwin Harbour	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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 Site 1	Middle Arm	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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 Site 2	Middle Arm	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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 Arm AASL Site 3	Middle Arm	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL	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

Name	Locality	Theme	Current Heritage Status	Description	Current Condition
				Batteries.	
Middle Arm AASL Site 4	Middle Arm	Defence - air static	No heritage listing	Searchlight battery positions Darwin Harbour - established at remote locations around the harbour in 1942 as part of the AA defences of Darwin and manned by the 65th and 70th AASL Batteries.	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 HAA Battery	Middle Arm	Defence - air static	No heritage listing	Heavy anti aircraft gun battery established 1943.	Current site condition unknown.

7.0. RECOMMENDATIONS

As a result of field surveys conducted for this study and previous surveys, 19 archaeological sites and seven localities containing 20 isolated artefacts have been identified within the proposed Wickham Industrial Estate Areas A and B (Figure 3), Of the 19 sites, three are multi-component site complexes (WIE10, MA6 and MA52) that cover relatively large areas and contain a high density and/or diversity of archaeological features. All of the sites, with one exception (WIE10), and three of the isolated artefact localities - are located in clusters in or within 100m of the mangrove / mudflat woodland fringe within Area A. Management recommendations arising from the significance assessments of these site complexes and groups of these sites that are clustered in close proximity in the landscape, are provided in detail below and in summary in Tables 11 and 12.

However, until final details of the Wickham Industrial Estate plan are finalised, specific recommendations for site management are limited. 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.

7.1. Indigenous Consultations and Involvement

It is recommended that:

- The proponent, in cooperation with local traditional owners and native title claimants develop an appropriate Cultural Heritage Management and Conservation Plan for the Indigenous archaeological materials recorded within the survey area. A general Indigenous community communications strategy should be developed given the high profile of indigenous cultural heritage in the Darwin region.

- A communications plan is necessary to effectively communicate to affected parties that consider the cultural heritage values of the Middle 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.

7.2. Proposed Conservation Zones

The three zones marked on the following map (Figure 25) indicate areas with high densities of cultural heritage features and materials which also contain moderate to high archaeological values. Given the high archaeological values that are held in these groups of sites, it is important to consider conserving these values with a landscape approach. Creating conservation zones allows for the protection and long term conservation of a complex of Indigenous archaeological sites that have interrelated spatial and temporal characteristics. A conservation zone also allows for the preservation of site aspect and its location within the landscape and related environmental features. These zones are a guideline for future planning of the Wickham Industrial Estate area.

7.3. Development of a Wickham Industrial Estate Cultural Heritage Management Plan

All archaeological sites located within the survey area and will require further conservation measures to ensure successful conservation of the archaeological heritage values during construction and in the long term management of the estate area.

Therefore it is recommended:

- That the NTG put in place a cultural heritage management plan for the construction phase of the project and the long term management and conservation of cultural heritage values of the Wickham Industrial Estate.

7.4. General Recommendations

In the first instance, it is recommended that the Northern Territory Government should attempt to design the future Wickham Industrial Estate to avoid areas of moderate to high archaeological significance as identified in this report.

These archaeological sites contain a representative sample of the significant archaeological features of the area. Nonetheless, it is also noted that features located within these site complex 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.

Therefore it is possible for a future program to be developed that would conserve certain features within these site complexes after further investigation and permission to be sought to disturb other features that are less archaeologically significant. 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 Wickham Industrial Estate plan to undertake a comprehensive expansion in the lease area that will impact on these sites, in order to assist in answering major research issues identified in this report, it is recommended that the following archaeological mitigation works are implemented for any site disturbance approval:

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

b. 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.

c. 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).

d. GIS analysis and modelling of the spatial and temporal distribution of the archaeological materials, features, and sites in the survey area.

TABLE 11 SUMMARY OF ARCHAEOLOGICAL SITES IN THE PROPOSED WIE AREAS A AND B, RECORDER, SIGNIFICANCE AND RECOMMENDED MITIGATION MEASURES IF REQUIRED.

Site Name	Easting	Northing	Site type	WIE Area/ environment	Recorder	Significance	Recommended conservation/ impact mitigation measures
WIE1 (prev MA22)	705671	8612946	Shell scatter /sub-surface midden	A/ MVT island Fringe	HS 2001/2007 Survey	Mod	Fence off, monitor/ Excavate, salvage, radiocarbon dating
WIE2	705071	8614390	Shell mound	A/ MVT island Fringe	2007 Survey	Mod	Fence off, monitor/ Excavate, salvage radiocarbon dating
WIE3	705047	8614601	Shell mound	A/ MVT island Fringe	2007 Survey	Mod	Fence off, monitor/ Excavate, salvage radiocarbon dating
WIE4	704980	8614113	Shell mound	A/ MVT island Fringe	2007 Survey	Mod	Fence off, monitor/ Excavate, salvage radiocarbon dating
WIE5	705050	8614178	Shell mound	A/ MVT island Fringe	2007 Survey	Mod	Fence off, monitor/ Excavate, salvage, radiocarbon dating
WIE6	705051	8614094	Shell mound	A/ MVT island Fringe	2007 Survey	Mod	Fence off, monitor/ Excavate, salvage, radiocarbon dating
WIE7	708363	8612730	Shell/ stone artefact scatter	A/ woodland hillcrest	2007 Survey	Low	Nil
WIE8	704905	8614435	Shell mound	A/ mudflats	2007 Survey	Mod-high	Fence off, monitor/ Excavate, salvage, radiocarbon dating
WIE9	704939	8614627	Shell mound	A/ mudflats	2007 Survey	Mod-high	Fence off, monitor/ Excavate, salvage, radiocarbon dating

Site Name	Easting	Northing	Site type	WIE Area/ environment	Recorder	Significance	Recommended conservation/ impact mitigation measures
WIE10a Complex	710734	8613124	Shell/stone artefact scatter/ poss sub-surf midden	B/ Sandy spit Fringe	2007 Survey	Mod-high	Fence off, monitor/ Conservation Zone
WIE10b	711198	8613055	Shell/stone artefact scatter/ poss sub-surf midden				
WIEWW2	708440	8616008	WW2 site	A/ headland edge Fringe	2007 Survey	Low-mod	Further recording and documentation prior to development.

TABLE 12 RECOMMENDATIONS FOR PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES IN THE PROPOSED WIE AREAS A AND B, RECORDER, SIGNIFICANCE AND RECOMMENDED MITIGATION MEASURES IF REQUIRED.

Site Name	Easting	Northing	Site type	WIE Area/ environment	Recorder	Significance	Recommended conservation/ impact mitigation measures
MA6 Complex	708130	8613350	Shell mound	A/ Rocky knoll Fringe	Bourke 1994	Mod	Fence off, monitor/ Excavate, salvage radiocarbon dating
MA6a	708145	8613362	Shell mound				
MA6b	708177	8613286	Shell midden				
MA10	708260	8613611	Shell midden	A/ Rocky knoll M/f/w	/Bourke 1994	Low-mod	Nil
MA51	708352	8612730	Shell/stone artefact scatter	A/ Woodland Fringe	Bourke 2005	Low	Nil
MA52 Complex	707986	8612580	Shell mound/Shell/ stone artefact scatter	A/ Woodland Fringe	Bourke 2005	High	Fence off, monitor/ Conservation Zone
MA52a	707913	8612607	Shell/ historic glass scatter				

Site Name	Easting	Northing	Site type	WIE Area/ environment	Recorder	Significance	Recommended conservation/ impact mitigation measures
MA53	707850	8612521	Shell midden	A/ Woodland Fringe	Bourke 2005	Mod	Fence off, monitor/ Conservation Zone
MA54	707869	8612588	Shell/ stone artefact scatter	A/ Fringe	Bourke 2005	Low	Fence off, monitor/ Conservation Zone
MA20	705016	8614435	Shell mound	A/ MVT island Fringe	Heritage Surveys 2001	Mod	Excavate, salvage
MA21	705070	8614383	Shell mound	A/ MVT island Fringe	Heritage Surveys 2001	Mod	Fence off, monitor/ Excavate, salvage

Fringe = mangrove / tidal flats and woodland fringe

7.5. Site Recommendations

The following recommendations arise from this survey:

Background Scatters: Average density of background scatters of archaeological material is relatively low within the proposed Wickham Industrial Estate Areas A and B. **It is recommended that in the event that construction activities are likely to proceed, that permission to disturb the background scatters is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Sites WIE8 and WIE9 within the proposed Wickham Industrial Estate Area A are assessed as having moderate-high archaeological significance. In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the sites would require fencing off and continued monitoring to ensure no further disturbance to archaeological material**. If these options are not feasible in terms of cost and effectiveness and the development is likely to impact upon these sites, given their high significance, **it is recommended that, in consultation with traditional owners, detailed on-site recording, excavation and salvage collection of samples of material, including dating of samples, from Sites WIE8 and WIE9 should be undertaken before permission to disturb the sites is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Site WIE1 within the proposed Wickham Industrial Estate Area A is assessed as having moderate significance. In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the site would require fencing off and continued monitoring to ensure no further disturbance to archaeological material**. If these options are not feasible in terms of cost and effectiveness, and the development is likely to impact upon this site, given its moderate significance, **it is recommended that detailed on-site recording, excavation and salvage collection of samples of material, including dating of samples, from site WIE1 should be undertaken before permission to disturb the site is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Sites WIE2, WIE3, WIE4, WIE5, WIE6, MA20 and MA21 within the proposed Wickham Industrial Estate Area A are assessed as **holding a moderate level of archaeological significance as a group.** In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the sites would require fencing off and continued monitoring to ensure no further disturbance to archaeological material**. If these options are not feasible in terms of cost and effectiveness, and the development is likely to impact upon these sites, given their moderate significance, **it is recommended that detailed on-site recording of all these sites, and excavation and salvage collection of samples of material, including dating of samples, from a selected few of these sites, should be undertaken before permission to disturb the sites is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Sites WIE7 and MA51 within the proposed Wickham Industrial Estate Area A, **are considered of low archaeological significance. It is recommended that in the event that construction activities are likely to proceed, that permission to disturb Sites WIE7 and MA51 is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Site complex MA6 and site MA10 within the proposed Wickham Industrial Estate Area A are assessed as **holding a moderate level of archaeological significance as a group.** In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the sites would require fencing off and continued monitoring to ensure no further disturbance to**

archaeological material. If these options are not feasible in terms of cost and effectiveness, and the development is likely to impact upon these sites, given their moderate significance, **it is recommended that detailed on-site recording, excavation and salvage collection of samples of material, including dating of samples from Site complex MA6 should be undertaken before permission to disturb the sites is granted under the** *Northern Territory of Australia Heritage Conservation Act 1991*.

Sites complex MA52, and sites MA53 and MA54 within the proposed Wickham Industrial Estate Area A **are considered as a group to hold a high level of archaeological significance.** In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the sites would require fencing off and continued monitoring to ensure no further disturbance to archaeological material. It is recommended that the area containing these sites be excluded from the proposed Wickham Industrial Estate development. Should these sites not be able to be avoided, further consideration and assessment of the cultural and archaeological significance of these sites must be undertaken in consultation with Larrakia traditional owners prior to any application to disturb.**

Site complex WIE10 within the proposed Wickham Industrial Estate Area B **is considered to hold a moderate-high level of archaeological significance.** In the event that the proposed development activities proceed, **it is recommended that to avoid disturbing archaeological material, the sites would require fencing off and continued monitoring to ensure no further disturbance to archaeological material It is recommended that the area containing this site be excluded from the proposed Wickham Industrial Estate development. Should this site not be able to be avoided, further consideration and assessment of the cultural and archaeological significance must be undertaken in consultation with Larrakia traditional owners prior to any application to disturb.**

Site WIE WWII within the proposed Wickham Industrial Estate Area A is assessed as having moderate cultural heritage significance. In the event that the proposed development activities proceed, **it is recommended that the site should be avoided and the site will require fencing off and continued monitoring to ensure no further disturbance to archaeological material.** If this option is not feasible and the development is likely to impact upon this site, given the moderate significance, **it is recommended that further detailed on-site recording of the site should be undertaken before development proceeds.**

FIGURE 25 PROPOSED CULTURAL HERITAGE CONSERVATION ZONES IN AREA A

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