# ENVIRONMENTAL IMPACT STATEMENT LGP HOLDINGS PTY LTD PROPOSED AQUACULTURE FACILITY EDGECUMBE BAY

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**Prepared By :** 

# **WBM Oceanics Australia**

In association with :

Kuruma Australia Pty Ltd Ove Arup and Partners and Northern Archaeology Consultancies

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This is an excerpt of the EIS for the proposed Aquaculture Facility at Edgecumbe Bay, published in 1996, with relevant information on archaeological surveys of the Proserpine Prawn Farm.

# **16.0 ARCHAEOLOGY**

#### 16.1 EXISTING ENVIRONMENT

#### 16.1.1 Introduction

The cultural heritage component of the Environmental Impact Study was undertaken by Northern Archaeology Consultancies Pty Ltd (Townsville) in conjunction with Aboriginal people from the Giru Dala Council of Elders Aboriginal Corporation. This work was conducted over a period of several weeks between September and October 1995. All work was authorised by the Queensland Department of Environment and Heritage under permit number N26/EIS/95.

#### 16.1.2 Terms of Reference

The following terms of reference were addressed during the cultural heritage assessment:

- A review of archaeological and anthropological data relevant to the study area;
- Consultation with relevant Aboriginal groups in relation to the Aboriginal cultural heritage of the study area;
- A field survey to determine if any archaeological sites (Aboriginal or European) were located within or adjacent to the study area;
- Documentation of any identified sites and assessment of the scientific and Aboriginal significance of these sites;
- Assessment of the potential impacts of the proposed development on identified or potentially existing cultural heritage resources;
- Formulation of recommendations to mitigate the impacts of the proposed development on identified or potentially existing cultural heritage resources.

#### 16.1.3 Aboriginal Consultation

A major component of the cultural heritage assessment included consultation with Aboriginal people affiliated with the study region. Three representatives from the Giru Dala Council of Elders Aboriginal Corporation were involved in the project. Several discussions were held with Mr Jim Gaston who provided invaluable background information and additional Aboriginal contacts. Mrs Irene Butterworth and Mr Charles Butterworth participated in the archaeological field survey between the 19th and 22nd September, 1995.

Irene Butterworth and Jim Gaston are both direct descendants of the original inhabitants of the study area, the Birigaba people. Irene Butterworth reported that most of her family (including her mother, father and grandparents) were born on the coast of offshore islands between Proserpine and Bowen. Several of her ancestors are buried in the nearby Gregory area. There are several clan groups of the Birigaba people including the Gia, Biria, Ngaro, Juru and Janja who are spread throughout the Ayr, proserpine, Bowen and Collinsville regions (Jim Gaston pers. comm.).

During the cultural heritage assessment discussions were held with all three representatives of the Giru Dala Corporation in an attempt to record any oral history associated with the study area, information on cultural heritage sites, any Aboriginal concerns regarding the proposed development or any other issues



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pertinent to the impact assessment. Maps and background information pertaining to the development were provided to each representative. A draft copy of this report was forwarded to Mr Gaston and Mrs Butterworth for comment and approval before final submission. Site management recommendations have been confirmed with the Giru Dala representatives. A final copy of the report and a complete site map and photographic record will be lodged with the Giru Dala Corporation.

Over the field work period several on-site meetings were held between the Giru Dala representatives and Mr Dallas Donovan, Managing Director of Kuruma Australia. Information was provided regarding the proposed development and inspections were made of the proposed sea water intake and discharge sites, as well as several of the Aboriginal shell middens recorded during the fieldwork. Management recommendations relating to some of the shell middens were discussed on-site with Mr Donovan. Liaison between Mr Donovan and Giru Dala representatives has been ongoing since the fieldwork period. A further meeting was held with Mr Donovan on October 21st 1995 and an additional on-site visit with the Giru Dala Council of Elders is proposed for some time in the future, prior to development. These further meetings are to clarify some of the technical aspects of the proposed development, provide the opportunity for all members of the Giru Dala Corporation to visit the site and to discuss any additional queries or concern regarding the development.

# 16.1.4 Archaeological Background

Whilst no previous archaeological research has been undertaken in the study area, several projects have been conducted around Bowen, Proserpine, Mackay and the Whitsunday Islands. This work has been undertaken either as a component of environmental impact assessments or as academic research. A diversity of archaeological site types have been recorded including shell middens, fish traps, rock shelters with paintings, stone artefact scatters, stone quarries, burial places and stone arrangements. In the near vicinity of the study area coastal sites have been recorded at Woodwark Bay (Hall and Barker 1989), Midge Point (Barker 1990) and on Hook Island (Barker 1989).

Detailed archaeological studies have been undertaken at a rock shelter at Nara Inlet, Hook Island (Barker 1989, 1991; Rowland 1986). Excavations at this site have revealed that Aboriginal occupation extends back more than 8,000 years, pre-dating the marine transgression about 6,000 years ago. Other studies north of Bowen, around Mackay and on offshore islands along the Central Queensland coast, indicate intensive late Holocene Aboriginal occupation of the coastal environment (eg. Bird 1987; Border 1985, 1994; Greer 1991; Milne 1990; Morwood 1982; Rowland 1982, 1984, 1986; Small 1992). The majority of recorded coastal sites consist of shell middens and scatters which date to within the last 3,000 years.

Pioneering anthropological research for the Central Queensland coast was conducted by Roth (1898) and Ling Roth (1908). Numerous ethnohistorical sources provide data on initial contacts with Aboriginal people and post-contact history (eg. Curr 1887; Jukes 1847; Lamond 1960). Comprehensive ethnohistorical reviews for the region have been compiled by Rowland (1986) and Border (1985, 1994) and the reader is directed to these sources.

#### 16.1.5 Survey Methods and Constraints

An initial reconnaissance visit to the proposed development site was undertaken on September 5th 1995 in conjunction with Mr Dallas Donovan (Kuruma Australia) and Dr Rick Morton (WBM Oceanics Australia). At this time a substantial portion of the development site was inspected by slow vehicle traverse. The proposed intake and discharge points were inspected and Mr Donovan showed the consultant what he thought may be an Aboriginal shell midden near the proposed water intake point in the northern coastal margins of the study area. It was confirmed that this site was an Aboriginal shell midden, later recorded as Site 1 during subsequent fieldwork.





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The study area is comprised of a diversity of landforms including mangrove forests, saline tidal flats, estuaries, elevated beach ridges, wetlands, grazing lands, regrowth forest and remnant stands of open woodland. The objective of the survey was to sample all of these major environmental zones for archaeological resources. A combination of random stratified sampling designs was employed. Kinear transect surveys provided the most efficient means for comprehensive coverage of the study are (after Plog *et al.* 1978). The field survey was conducted over a period of three days by a field team of three, including the consultant and two Giru Dala representatives.

Surveys were mainly focused in environmental zones predicted to have high archaeological potential. "Archaeological potential" was assessed on the basis of numerous factors including the result of previous archaeological investigations, information from local Aboriginal people, topography, geology, vegetation, altitude, visibility, landscape disturbance, proximity to fresh water and food resources. Given the results of previous archaeological investigations along the central coast (eg. Border 1994), it was predicted that archaeological sites might be concentrated along the coastal margins on the northern extremities of the study area. In particular, beach ridges and elevated terrain adjacent to major water courses, mangrovelined estuaries and tidal flats were targeted.

Survey coverage of the coastal margins was comprehensive. Transect surveys were conducted with surveyors spaced at regular intervals of between 10 to 20 metres, or evenly spaced to cover mangrove margins, estuaries, tidal flats and the seaward margins of the hinterland. An estimated 80% of this area was surveyed on foot. The remaining 20% was covered by slow vehicle traverse or could not be accessed due to tidal inundation. Intensive surveys were focussed around the proposed sea water intake and discharge points on the Gregory River and Eden Lassie Creek. Considerable disturbance of these areas is expected from proposed construction work.

Random foot surveys, spot checks and slow vehicle traverses were undertaken at various places throughout the remainder of the development site, covering an estimated 55% of the total property area. Ground-surface visibility was negligible throughout much of the hinterland due to grass cover, *Melaleuca* regrowth forest and remnant stands of open woodland. Surveys were targeted to areas within improved visibility such as gullies, scrapes, creek banks, dams, fence lines, vehicle tracks, cattle pads and heavily-grazed areas (Plate 2). Sub-surface soil deposits were inspected whenever there was the opportunity to do so. Soil heaps, eroded creek banks, eroded beach ridges and animal diggings (mainly from feral pigs) were carefully examined for archaeological evidence. Remnant stands of forest were targeted as these areas appear to have undergone considerably less disturbance compared with many parts of the ceded area. Large trees were carefully examined for evidence of Aboriginal scarring.

For the purposes of the survey an archaeological site was defined as a discrete area exhibiting evidence indicative of prehistoric Aboriginal activity (after McNiven 1985). As archaeological sites were located they were fully recorded on site record cards from the Cultural Heritage Branch, Queensland Department of Environment and Heritage. Site location was precisely recorded with a GPS device and later transferred to aerial photographs and topographic maps. A full photographic record was compiled for each site. Geological samples were collected in the field and preliminary identifications were made by Mr Damian Foster, Department of Earch Sciences, James Cook University. Geological and vegetation maps for the study area were also consulted.

Three main constraints influenced the effectiveness of the archaeological survey :

#### (i) Archaeological visibility

Ground-surface visibility was variable throughout the study area and was mainly influenced by the degree of vegetation cover and cattle disturbance. While visibility was up to 100% on tidal flats along the coastal margins, it was significantly reduced on vegetated beach ridges and in regrowth and open woodland forest



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in the hinterland. Grass cover in these latter areas was particularly thick, especially after recent rains and the de-stocking of the property. Some existing archaeological materials may not have been detected in these locations during the field surveys.

#### (ii) Modern impacts on the landscape

Disturbance and modification of the natural environment of most of the study are has been extensive. Modern impacts have included cattle grazing, ploughing, vegetation clearing, construction of dams, fencelines, levee banks, etc. Such activities are generally detrimental to the long-germ preservation of archaeological resources.

#### (iii) Low lying terrain and erosion

A substantial proportion of the study area is relatively low lying and therefore subject to periodic tidal inundation and seasonal flooding. *Melaleuca* scrub is the predominant vegetation throughout most of the study area. This forest type is often indicative of seasonally-inundated, boggy terrain. Such areas generally have poor conditions for long-term archaeological site preservation.

The coastal margins in particular are low lying and are frequently inundated. Archaeological sites located in these areas have been significantly reduced and re-worked (see Section 4.13.6). It is highly likely that some sites have been completely destroyed.

Gully and sheet erosion is severe in some parts of the study area and appears to have been exacerbated by cattle grazing and land clearing. It is most severe on elevated ridges along the seaward margins and around water courses. Again, these conditions are not conducive to the long-term preservation of archaeological materials.

#### 16.1.6 Survey Results and Discussion

A total of 11 Aboriginal archaeological sites were located during the survey. They include:

- 4 shell middens
- 6 shell scatters
- 1 isolated find (stone artefact)

Site locations are shown in Figure 16.1 and a full site description is provided in Appendix H.

All of the archaeological sites are located on the northern perimeter of the study area along the coastal margins. Sites are located wither on elevated beach ridges, on saline tidal flats or on the landward edge of tidal flats. All sites are located in the general vicinity of the Gregory River or Eden Lassie Creek. Most sites are poorly preserved, especially those located on the tidal flats. There is clear evidence for sheet erosion, sit etruncation and re-working of deposits in the majority of sites (after Hughes and Sullivan 1974). Given their locations, most sites would be subject to inundation during spring tides and storm surges (cf. Bird 1992).

Shell middens and shell scatters were the most common sites recorded. These sites were distinguished from naturally-occurring shell deposits using established archaeological criteria for the identification of middens of Aboriginal origin (eg. Attenbrow 1992; Bailey *et al.* 1994; Bowdler 1983; Coutts 1966; Gill 1954; O'Connor and Sullivan 1994).

The shell middens and scatters were defined largely on the basis of their contents. Shell middens contained in a relatively high density of shell, as well as additional archaeological materials such as stone





LOCATIONS OF ABORIGINAL ARCHAEOLOGICAL SITES

FIGURE

16.1



artefacts and stone manuports (the latter were possibly used as hearth stone). These sites can be described as multi-component middens (after Border 1994:201) or base camps, in which a wide range of activities including food preparation, food consumption and the manufacture of stone artefacts took place. At this stage, the depth of the archaeological deposit in these sites has not been determined. Exposed sections in truncated ridge at some sites suggests a maximum depth of deposit of about 20 cm, but this has not been confirmed by auguring or soundings.

Shell scatters contained a low density of shell with no discrete concentrations of material. Apart from an occasional stone artefact or manuport most of these sites did not contain any additional archaeological materials. These sites are single component middens (Border 1994:201) and possibly represent ephemeral occupation or "dinnertime camps" (after Meehan 1982). A cautionary note should be made regarding these site classifications. It is possible that some of the sites recorded as shell scatters are actually the remains of more extensive shell middens which have been reduced by reworking and erosion. On the other hand, they might also represent recent exposure of intact middens which are still largely buried within the elevated beach and sand ridges.

All of the shell middens and scatters near the Gregory River consist predominantly of rock oysters (*Saccostrea commercialis*). While some other species are represented, they occur in very small numbers only (eg. *Telescopium telescopium, Nerita* spp., *Geloina coaxans*). Near Eden Lassie Creek a wide Range of species has been exploited and rock oysters occur in relatively small numbers. Common species in these sites include *Telescopium telescopium, Geloina coaxans, Nerita* spp., *Terebralia sulcata, Terebralia palustris* and *Anadra* spp.). This pattern of shell fish exploitation might represent the local availability of the various species within each of the estuarine micro-environments, resources seasonality or Aboriginal targeting for particular species in different areas (cf. Meehan 1982). previous archaeological research indicates that *Saccostrea commercialis* is probably the most common shellfish species exploited by Aboriginal people throughout the central coast region (cf. Border 1994).

Stone artefacts in sites throughout the study area consist mainly of small flakes and debitage. A small number of core fragments and stone axe-blanks were observed. Numerous stone manuports were also recorded. Many manuports appear to be burnt or heat-fractured and were probably utilised as hearth stone. All of the raw material for stone artefacts and manuports are locally available.

Most manuports were of granite, schist, diorite, shale or conglomerates. Sources of these materials are located at Ben Lomond and at various places along the Gregory River channel (Bowen 1:250,000 Geological map sheet, no. SF 55-3). Artefacts were manufactured from milky quartz, silcrete and andesite. Milky quartz occurs in vein outcrops in the granites on Bed Lomond. Andesitic and siliceous outcrops exist along the Gregory River and in several locations adjacent to the study area. Black chert appears to be the only imported raw material and is available in the vicinity of the study area at recorded stone quarry sites on South Molle Island (Jim Gaston and Andrew Border pers. comm.).

The number and distribution of archaeological sites recorded along the Gregory River indicate that this area was probably heavily exploited by Aboriginal people. It is likely that many large base camps once existed along the Gregory River channel. The sites recorded in this investigation probably represent the remnants of these base camps, given the high degree of site erosion, truncation and re-working which is evident. Patterns of site distribution recorded in this investigation, parallel the results of some other regional studies.

Border (1994:210) has proposed a predictive model for the location of Aboriginal sites in mangrove and estuarine environments in the central coast region. He proposes a "corridor model" which suggests that middens will tend to be located in places where the mangrove fringe is either thin or non-existent, providing easy access to resources on inter-tidal mudflats, estuaries or marine waters. The site locations recorded along the Gregory River provide further evidence to support this hypothesis.



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Despite a comprehensive survey coverage of the hinterland of the study area, no archaeological sites were located. This may be a result of several factors which to some extent, bias the results of the survey :

- (i) Less intensive surveys were conducted in hinterland areas compared with the coastal margins;
- (ii) Visibility is negligible in the hinterland due to grass cover. Conversely, visibility is at a premium along the coastal margins. Bleached shell, the major component of all sites, is particularly visible in this latter context;
- (iii) Previous disturbance of the hinterland has been dramatic and may have resulted in the obliteration of some sites.

#### 16.1.7 Site Significance Assessment

The scientific significance of archaeological sites is generally assessed according to a site's representativeness or its ability to provide data which can help to answer "timely and specific research questions" (Bowdler 1984:1). While the archaeological sites recorded in this investigation are mostly poorly preserved, they retain their archaeological significance. Research along the central coast has been undertaken for only a decade. Subsequently, very few archaeological sites have been recorded and few detailed systematic studies have been conducted. The sites at Edgecumbe Bay can contribute useful scientific data on Holocene prehistory and Aboriginal coastal economies in the central coast region.

Discussions with people who have traditional affiliations to the study area indicate that all of the archaeological sites at Edgecumbe Bay are significant to the Aboriginal community. All of the Giru Dala representatives have stated that they do not wish to see any of the sites destroyed or disturbed. These sites represent a tangible link between the contemporary Aboriginal community and their traditional heritage.

#### **16.2 IMPACTS OF DEVELOPMENT**

The results of the archaeological survey indicate that the most archaeologically sensitive areas within the proposed development site are the coastal margins on the northern extremities of the study area. Sensitive environmental zones include mangrove margins, beach ridges, tidal flats and the slightly elevated terrain abutting the tidal flats. The Gregory River and Eden Lassie Creek are particularly sensitive locations. Eleven archaeological sites have been recorded and many more sites may remain insitu, buried within elevated intact ridges.

Current development plans indicate that the majority of archaeological sites are outside the specific development area. Mr Dallas Donovan has confirmed that with the exception of the intake and discharge channels, the northern coastal margins will not be impacted by the development. Most archaeological sites are therefore unlikely to be directly impacted by construction and development work. However, it is possible that over time, some sites may be impacted by subsidiary activities associated with the development such as vehicle traffic, foot traffic, etc. The middens at sites 1 and 5 have already recently been traversed by vehicles. Additionally, most sites will continue to be subject to tidal inundation, reworking and ongoing erosion from natural elements.

Archaeological sites most susceptible to developmental impacts and sites 1 and 2. These sites are adjacent to the location of the proposed water intake pipeline from the Gregory River. Development work will involve construction of a channel running from the Gregory River to the hinterland. Across the tidal flats the channel will be 20 metres in width; as it reaches elevated terrain abutting the tidal flats it will expand to 50 metres in width. The original development plan was to locate this channel at a point adjacent to a narrow strip of mangroves lining the Gregory River. This location coincided with the location of the shell midden at site 1. During subsequent field surveys an attempt was made to locate an area along the



Gregory River channel where the intake pipeline could be constructed and where archaeological sites would not be impacted. Given the high density of sites along this coast there are few places which are conducive to the construction of the pipeline (eg. where there are narrow belts of mangroves) in which there are no archaeological resources.

To solve this dilemma, negotiations between the consultant, Giru Dala representatives and Mr Dallas Donovan were undertaken on-site. A solution was reached whereby it was decided that the intake channel should be relocated between the midden at site 1 and the shell scatters at site 2. The area of tidal flat lying between these sites is very low and extremely eroded. Surface water from the adjacent elevated terrain drains into this area and then into the river channel. Careful inspection has revealed no surface archaeology. Sites 1 and 2 will be located at least 600 metres away from the intake channel. While by no means a perfect solution, all parties agree that the new location for the intake channel is the best compromise between protection of cultural heritage sites and the construction work necessary for the aquaculture development. The relocation of the intake channel should be fenced to prevent possible interference (see Section 19.1). Some temporary fencing has already been erected around the extremities of site 1 to prevent further disturbance from vehicle and foot traffic.

The only alternative to the above solution is to relocate the intake channel further west along the Gregory River channel. This option is not recommended for two reasons. Firstly, as already noted, there is a relatively high density of archaeological sites along this coast. A number of these sites (eg. sites 4 and 5) appear to be more well-preserved than sites 1 and 2 and therefore should be avoided. Secondly, relocating the intake channel further west along the river would mean that relatively large swathes of mangrove forest would have to be cleared. This is an undesirable option as further clearing could contribute to the instability of this coastline and increase site susceptibility to erosion and tidal inundation.

The relocation of the intake channel was confirmed with Mr Donovan on 6 November, 1995. Development plans have been altered accordingly and now show the revised pipeline location.

#### 16.3 IMPACT MITIGATION

Although no sites of Aboriginal significance are present within property boundaries, particular care will need to be taken during facility construction and, to a lesser extent, during facility operation to avoid impacts to significant sites which occur in adjacent areas. measures to avoid such impacts are included in an Environmental Management Plan provided in Section 19.1.



# APPENDIX

#### **DESCRIPTION OF ABORIGINAL ARCHAEOLOGICAL SITES**

# SITE 1

Site type: Shell midden

Location: GPS: South 20 10' 52", East 148 26' 58"

**Description:** Very disturbed and deflated shell midden located on a remnant patch of slightly elevated ridge (about 30-50 cm asl) on sandy, saline tidal flats adjacent to the Gregory River. Site is composed almost entirely of rock oyster (Saccostrea commercialis). A small number of Telescopium telescopium and Nerita spp. were present. Shell is very fragmented and site has been traversed by vehicles and cattle. Shell density is high but difficult to estimate given shell fragmentation; may be up to 30 shells per square metre. Site is located adjacent to a narrow band of mangroves which provides easy access to the Gregory River. It is located less than 20 m from the river. Depth of the shell deposit is unknown, but the archaeological material is definitely eroding out of this slightly elevated terrain to the surrounding tidal flats. Stone artefacts include small flakes and fragments of clear quartz, milky quartz, silcrete, black chert and andesite (Plate 3). One fragment of flaked milky quartz pebble with cortex. Several stone manuports of coarse-grained granite, diorite, schist and possibly sandstone. Some manuports appear to have been heat-fractured and may have been used as hearth stone. Many of the larger stone artefacts and manuports have eroded down slope and are now located on the low lying saline flats on the seaward side of the site. Sheet erosion is evident at this site. A substantial proportion of the stone material is unlikely to be in situ. Site covers an area of about 15 square metres including the material which has been washed down slope towards the mangrove margins.

During fieldwork the approximate boundaries of this site were demarcated and some temporary fencing was erected to prevent further site disturbance from vehicles and foot traffic. Note that the property has now been de-stocked of cattle and this will mitigate some of the potentially detrimental impacts to this site. Site surface retains some small halophytic plants (eg. samphire, saltwater couch) which might assist in stabilising the site).

Approximately 50 m south-east of the midden at site 1 there are some further small exposures of *Saccostrea commercialis* along the landward edge of the tidal flats on slightly elevated terrain. One exposure contains several stone manuports including coarse-grained granite and schist. These further exposures are likely to be remnant parts of what was once a much larger site.

**Preservation:** Very poor. Site has been repeatedly traversed by vehicles. Site would be subject to periodic inundation from spring tides and storm surge. Reworking of site is evident. Site has been heavily impacted by erosion and may have been more extensive than it is today.

**Potential Impacts from Development:** Site is located in the direct path of the original proposed location for a water intake channel associated with the aquaculture development. On-site discussions were held between the archaeological consultant, Aboriginal people and a representative of the development company. A resolution was reached whereby the proposed intake channel will be re-located approximately 60 m west of the original location in a low lying and eroded part of the tidal flats between sites 1 and 2. This action will mitigate potential disturbance of the shell midden at site 1 and the shell scatter at site 2 (see section 5.11).

# \* <u>SITE 2</u>

# Site type: Shell scatter

Location: GPS: South 20 10' 50", East 148 26' 52"

**Description:** This site consists of two small, low density exposures of shell located on slightly elevated terrain on the landward margins of saline tidal flats. The archaeological material is exposed at the base of a low ridge. Material is eroding out of the ridge and down slope onto the tidal flats. Substrate is sandy. Site is located adjacent to mangroves on the Gregory River channel. Site has been exposed and truncated from tidal inundation. Some material is probably still buried within the intact portion of the ridge. This site is located about 60 m from the shell midden at site 1. Both exposures consist entirely of rock oyster (*Saccostrea commercialis*). They each cover an area of about one square metre and are about 10 m apart. These exposures may represent the extremities or remnants of the larger midden at site 1. Several stone artefacts and manuports were located on the tidal flats down slope from these exposures near the mangroves lining the Gregory River. This stone material has evidently eroded out of the elevated ridge and is not in situ. No stone artefacts were observed within these shell scatters.

<u>Preservation:</u> Very poor. Site would be subject to tidal inundation during spring tides and storm surge. It is evident that this site has been truncated and probably reworked during high tides. Run-off from the slightly elevated landward terrain to the low lying tidal flats is also evident and has contributed to erosion of this site.

**Potential Impacts from Development:** Site is located about 60 m from the new location of the proposed intake channel (see information for site 1). Site is unlikely

to be impacted by development work, but should be fenced to prevent future disturbance from vehicles, foot traffic, etc.

# SITE 3

# Site type: Shell midden

Location: GPS: South 20 10' 45", East 148 26' 50"

**Description:** Very disturbed and deflated shell midden exposed on low lying tidal flats adjacent to the Gregory River. This site is located approximately 250 m from the midden at site 1. Shell density is high but difficult to estimate as the material is extremely fragmented. Site is composed almost entirely of rock oyster (Saccostrea commercialis) with a small number of Telescopium telescopium. Site has clearly been inundated and reworked by the tide. A substantial number of stone artefacts and manuports were recorded on the seaward margins of this site. These are eroding down slope towards the mangroves lining the Gregory River. Artefacts include two stone axe-blanks made from andesite (Plate 4) and one large andesitic core with several flaking scars. One small flake and numerous fragments of milky quartz and chert were also noted. Most of the stones in this site are manuports. They include fragments of granite and schist; some of these appear to have been burnt and may have been used as hearth stones. No intact hearth features were noted but this was not unexpected given the degree of erosion and deflation at this site. The substrate of the site is sandy, but the nearby mangrove substrate is muddy. Site has been heavily disturbed by cattle; many tracks were observed over and around the site. The main shell concentration covers an area of about 4 x 6 m, but scatters of water-washed material occur over a much wider area of about 30 square metres.

<u>**Preservation:**</u> Very poor. Site is extremely deflated and has virtually been destroyed. Erosion, periodic inundation and reworking is evident.

<u>Potential Impacts from Development:</u> Site is located on the coastal margins outside the specific development area. Site is located up to 250 m from the proposed intake channel. Site is unlikely to be impacted by development work, but should be fenced to prevent future disturbance from vehicles, foot traffic, etc. Since this site is virtually destroyed a salvage collection of stone artefacts could be made from this site.

# \* <u>SITE4</u>

Site type:Shell middenLocation:GPS: vicinity of South 20 10' 42", East 148 26 '47"

Description: Scatters and concentrations of shell exposed on remnant patches of slightly elevated ridges on and adjacent to, low lying tidal flats. Sites are located near mangroves lining the Gregory River channel. The major concentration of shell is exposed on the tidal flat and is extremely deflated. Shell density is high but difficult to estimate given its poor preservation and fragmentation. Site is composed almost entirely of Saccostrea commercialis with a small number of Nerita spp., Telescopium telescopium and Terebralia sulcata. Site has clearly been inundated and reworked; high water mark is indicated by a distinct line of vegetation debri over the top of the site. Low density scatters of shell are exposed on the surface of an adjacent ridge and in section along the seaward margin of this ridge. It is likely that some archaeological material is located in situ within the intact parts of the ridge. The ridge retains pockets of halophytic vegetation which is stabilising its surface. Cattle have caused considerable disturbance along the top of the ridge. The concentration of shell and the adjacent scatter are located about 40-50 m apart. The scatter covers an area of about 5 square metres. The concentration of shell is located on the margins of the mangroves lining the creek and adjacent to a natural depression and drainage channel into the river. This drainage area contains some shell which has washed down slope from the site. Site was probably quite extensive before being impacted by erosion, etc. It is likely that most of the archaeological material in this site is not in situ given the extent of reworking. Several manuports were noted including coarse-grained granite, schist, andesite and possibly quartzite. A single stone artefact (a small milky quartz flake) was noted.

<u>Preservation</u>: Very poor. Site is extremely deflated and has virtually been destroyed. Erosion, periodic inundation and reworking is evident. Some in situ archaeological materials may exist in sub-surface deposits within intact parts of the low ridges.

<u>Potential Impacts from Development:</u> Site is located on the coastal margins outside the specific development area. Site is located up to 600 m from the proposed intake channel. Site is unlikely to be impacted by development work, but should be fenced to prevent future disturbance from vehicles, foot traffic, etc. Since this site is virtually destroyed a salvage collection of stone artefacts could be made from this site.

\* <u>SITE 5</u> <u>Site type:</u> Shell midden <u>Location:</u> GPS: South 20 10' 36'', East 148 26' 39'' **Description:** Three slightly mounded concentrations of shell on muddy tidal flats adjacent to mangroves and the Gregory River channel (Plate 5). Compact concentrations of shell each covering an area of about 3 to 4 square metres. Sites are composed almost entirely of *Saccostrea commercialis* with small numbers of *Nerita spp.* and *Anadara spp.* Shell density is very high but difficult to estimate given shell fragmentation; may be up to 30 shells per square metre. Sites are on muddy substrate and are highly visible given that the shell is bleached white. Numerous stone manuports of coarse-grained granite, diorite, schist and andesite; some of this stone appears to have been burnt. One stone artefact was recorded, a small black chert flake. Some parts of these concentrations have been traversed by cattle.

<u>Preservation</u>: Preservation is reasonable as shell is retained in slightly mounded concentrations. It is clearly evident that the sites have been inundated and reworked during spring tides, storm surge, etc. Some shell has been washed down slope of the sites towards the river channel. However, these sites are the most well-preserved of any of the middens or scatters recorded throughout the study area.

**Potential Impacts from Development:** Site is located on the coastal margins outside the specific development area. Site is located up to 800 m from the proposed intake channel. Site is unlikely to be impacted by development work, but should be fenced to prevent future disturbance from vehicles, foot traffic, etc.

# SITE 6

Site type: Shell scatter

Location: GPS: South 20 11' 02", East 148 25' 60"

**Description:** Low density shell scatter on an elevated strip of beach ridge (Plate 6). This ridge is surrounded by low lying tidal flats and is located about 1 km from the Gregory River. It is an estimated 2 to 4 m asl. The ridge is relatively undisturbed and retains coastal woodland vegetation. Predominant plant species include *Pandanus sp., Brachychiton sp., Acacia spp., Melaleuca spp., Eucalyptus spp., Exocarpus latifolius, Terminalia sp., Pleiogynium timorense, Dendrobium discolour, Sterculia quadrifida, Cupaniopsis anacardioides, Hibiscus tiliaceus. The margins of the beach ridge are very low lying and swampy; on the landward side there are some thick stands of <i>Melaleuca spp.* Some introduced plants occur including lantana and prickly pear.

Shell material is exposed on the surface of the ridge in a relatively thick patch of trees and shrubs. Shells include *Telescopium telescopium*, *Geloina coaxans* and *Saccostrea commercialis*. Scatter of shell covers an area of about 50 m along the top of the ridge. Several small concentrations of material; maximum shell density may

be up to 10 shells per square metre. Some site disturbance from cattle and native fauna including wallabies and scrub turkeys. Ground-surface visibility is poor due to vegetation cover and thick leaf litter; site may be more extensive than it appears. No stone material was observed at this site.

**Preservation:** Generally poor; shell material has been dispersed by cattle and native fauna.

<u>**Potential Impacts from Development:</u>** Site is located on the coastal margins outside the specific development area. It is unlikely to be impacted by development work.</u>

# \* <u>SITE7</u>

Site type: Isolated stone artefact

Location: GPS: South 20 11' 05", East 148 25' 50"

**Description:** Large block or possibly core fragment of andesite; it appears to have been reduced and has several flaking scars on one end. Note that this is the same stone material as that used to manufacture the stone axe blanks from site 3. No other artefactual material was associated with this site. Located on the southern end of the elevated beach ridge which also contains the shell scatter at site 6.

<u>**Preservation:**</u> Site consists of a single artefact which may not be in situ given cattle disturbance and down slope erosion along the beach ridge.

**<u>Potential Impacts from Development:</u>** Site is located on the coastal margins outside the specific development area. It is unlikely to be impacted by development work. Possible salvage collection of this artefact could be undertaken.

## \* SITE 8

Site type: Shell scatter

Location: GPS: South 20 11' 06", East 148 25' 25"

**Description:** Very sparse and low density shell scatter located on a small elevated beach ridge near a small tributary of Eden Lassie Creek. The southern end of this beach ridge is adjacent to dense mangrove forest. Site retains coastal woodland vegetation with similar species to those around site 6. Site has no real concentration of material, but the sparse scatter covers an area of more than 60 m along the top of the ridge. Ground-surface visibility is negligible due to leaf litter. Shell species include *Telescopium telescopium*, *Terebralia sulcata* and *Geloina coaxans*. Only one definite artefact was recorded; a milky quartz flake. Several fragments of milky quartz were noted.

**<u>Preservation</u>**: Generally poor; shell is very scattered with no concentration. Animal disturbance to some scatters (mainly wallaby and scrub turkey).

<u>Potential Impacts from Development:</u> Site is located on the coastal margins outside the specific development area. It is unlikely to be impacted by development work.

# <u>SITE 9</u>

# Site type: Shell scatter

Location: GPS: South 20 11' 35", East 148 25' 31"

**Description:** Low density shell scatter located on the landward margins of low lying saline tidal flats (Plate 7). Site is located on slightly elevated terrain (approx. 50 cm asl) and archaeological material is exposed at the base of a low ridge. Material is eroding out of the ridge and down slope onto the coastal flats. Substrate is sandy. Site is located adjacent to dense mangrove forest along the landward margins of Eden Lassie Creek. Archaeological material is scattered over an area of about 30 square metres, but density is low. Site was probably more extensive but has been heavily impacted by erosion. Some in situ archaeological material is possibly still buried within the low ridge. Shell species include small clusters of *Geloina coaxans* as well as *Telescopium telescopium, Terebralia sulcata* and *Terebralia palustris*. Stone artefacts include several small flakes and fragments of milky quartz and one large flake of andesite. Many small milky quartz pebbles were noted but these appear to be of natural origin. Nearby vegetation on landward terrain includes open woodland with a predominance of *Melaleuca spp*. Large stands of trees throughout this area are dead.

<u>Preservation</u>: Site preservation is poor. Site would be subject to tidal inundation during spring tides and storm surge. It is evident that this site has been truncated and probably reworked during high tides. Run-off from the slightly elevated landward terrain to the low lying mudflats is also evident and has contributed to erosion of this site.

**Potential Impacts from Development:** Site is located on the coastal margins outside the specific development area. Site is located more than 600 m from the proposed discharge channel on Eden Lassie Creek and should not be impacted by the development.

# <u>SITE 10</u>

Site type: Shell scatter

Location: GPS: South 20 11' 35", East 148 25' 35"

**Description:** Low density shell scatter located on the landward margins of low lying saline mudflats (Plate 8). Site is located on slightly elevated terrain (approx. 50

cm asl) and archaeological material is exposed at the base of a low ridge. Material is eroding out of the ridge and down slope onto the coastal flats. Substrate is sandy. Site is located about 60 m from site 9 and is adjacent to dense mangrove forest on the landward margins of Eden Lassie Creek. Exposure of archaeological material covers an area of about 2 m. Shell species include *Geloina coaxans* and *Telescopium telescopium*. Site may be a continuation of site 9; in situ archaeological material appears to be still buried within the ridge. No stone artefacts were observed in this site.

<u>Preservation</u>: Site preservation is poor. Site would be subject to tidal inundation during spring tides and storm surge. It is evident that this site has been truncated and probably reworked during high tides. Run-off from the slightly elevated landward terrain to the low lying mudflats is also evident and has contributed to erosion of this site.

<u>Potential Impacts from Development:</u> Site is located on the coastal margins outside the specific development area. Site is located more than 650 m from the proposed discharge channel on Eden Lassie Creek and should not be impacted by the development.

# \* <u>SITE 11</u>

Site type: Shell scatter

Location: GPS: South 20 11' 41", East 148 25' 51"

**Description:** Very low density shell scatter located on the landward margins of low lying saline mudflats. Site is located on slightly elevated terrain (approx. 50 cm asl) and archaeological material is exposed at the base of a low ridge. Material is eroding out of the ridge and down slope onto the coastal flats. Substrate is sandy. Site is located adjacent to dense mangrove forest on the landward margins of Eden Lassie Creek. Exposure of archaeological material covers an area of about one square metre. Some in situ archaeological material may still be buried within the ridge. No stone artefacts were observed in this site. Shell species include *Saccostrea commercialis* and *Geloina coaxans*. Minimum number of individual shells is estimated at 10.

**<u>Preservation</u>**: Site preservation is poor. Site would be subject to tidal inundation during spring tides and storm surge. It is evident that this site has been truncated and probably reworked during high tides. Run-off from the slightly elevated landward terrain to the low lying mudflats is also evident and has contributed to erosion of this site.

**Potential Impacts from Development:** Site is located on the coastal margins outside the specific development area. Site is located more than 750 m from the proposed discharge channel on Eden Lassie Creek and should not be impacted by the development.