Due to the significance and conservation value of sea turtles, the assessment of the potential impacts on these species is considered separately in this section.

In particular the Draft EIS guidelines require comment about the possible impact of the proposed mining operations on the nesting populations of flatback (*Natator depressus*) and olive ridley (*Lepidochelys olivacea*) sea turtles.

URS commissioned Dr Michael Guinea of the School of Education, Health and Science at Charles Darwin University to undertake a sea turtle survey at Andranangoo and Lethbridge.

Initial surveys of the beaches were conducted on 19th and 20th February 2005 for baseline data as part of the NOI (Appendix E-1). An additional survey was conducted on 28th to 30th August 2005 to record the numbers of sea turtles nesting on the respective beaches; the distances travelled inland by each of the sea turtle species; and the density, height and width of the vegetation forming the proposed buffer zone (Appendix E-2). Plate 11.1 shows flatback turtle tracks at Andranangoo.

Plate 11.1: Flatback Sea Turtle tracks at Andranangoo Creek West

Source: Guinea 2005

As part of this survey a long-term sea turtle monitoring program was established, and Matilda employees were trained to monitor and record sea turtle nesting activities on the beaches adjacent to the proposed operations.

The results of these surveys are documented in two survey reports, which are included as Appendix E-1 and E-2. The second survey report also contains proposed sampling methodologies adopted during the

turtle surveys, a key to identifying individual species and data sampling sheets to be used by Matilda for the continued monitoring program.

11.1 Existing conditions

Northern Australia is home to six species of the world's marine turtles, and has globally significant nesting sites for four species (Kennett *et. al*., 1997). All six species of sea turtles are listed as either vulnerable or endangered under the *EPBC Act 1999*. All occur in the waters of the Northern Territory, and each differs in the conservation status that is awarded under International, National and Northern Territory legislation (Guinea 2005a). Table 11.1 summarises the turtle species and their conservation status under International, National and Northern Territory Legislation.

Flatback and olive ridley sea turtles nest in low to medium densities on the beaches of Andranangoo and Lethbridge (Guinea 2005b). They are known to feed along the shores of the mining leases and lay their eggs on the beaches that are either in or adjacent to the mining leases (Guinea 2005a). Collectively 75 sea turtle nests were examined, and all were within 10 m of the Spring High Water Mark (Guinea, 2005b).

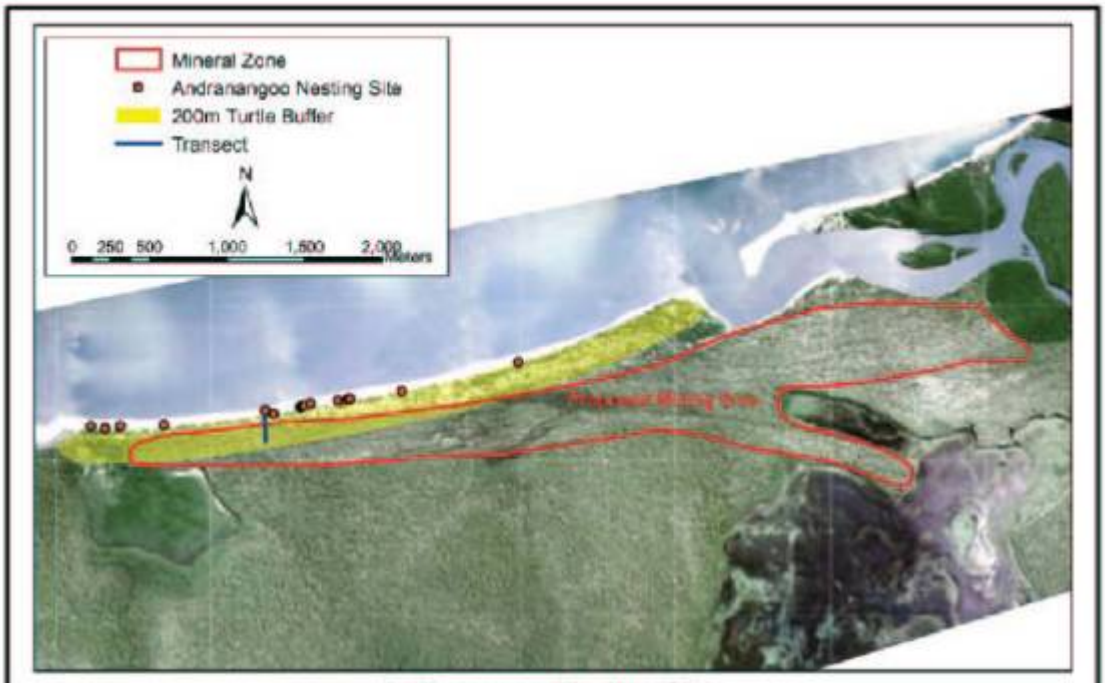
Table 11.1: Conservation Status at the International, National and Territory Levels of the Six Species of Sea Turtles Inhabiting Australian Waters

Sea Turtle Names		Conservation Status		
Common Name	**Scientific Name**	**International - Red List (2000)**	**National - EPBC Act 1999**	**NT Threatened Species 2002**
Flatback or Greenback	*Natator depressus*	Vulnerable	Vulnerable	Data Deficient
Green	*Chelonia mydas*	Endangered	Vulnerable	Least Concern
Hawksbill	*Eretmochelys imbricata*	Critically Endangered	Vulnerable	Data Deficient
Leatherback	*Dermochelys olivacea*	Critically Endangered	Vulnerable	Vulnerable
Loggerhead	*Caretta caretta*	Endangered	Endangered	Endangered
Olive Ridley	*Lepidochelys olivacea*	Endangered	Endangered	Data Deficient

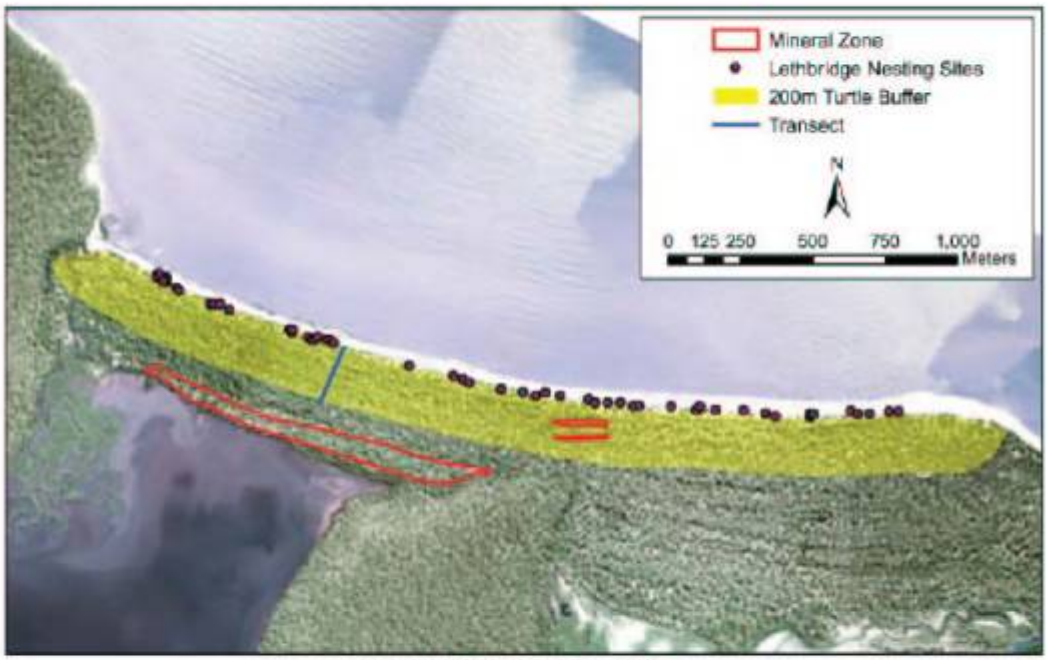
Source: Guinea (2005a)

Andranangoo

The beach at Andranangoo has a northern aspect and is exposed to onshore winds. Inland from the high water mark is a small seasonal sand dune or berm. Further inland, dunes to 10 m in height occur at the rear of the beach. Two flat back sea turtle nests were recorded during the February survey, and seventeen turtle nests were recorded along the Andranangoo beach during the August survey (Figure 11.1). Only one



Andranangoo Nesting Sites



Lethbridge Nesting Sites

Job	42213893	
Prep. By	JD	19 Oct 05
Chk.d By	JM	19 Oct 05
Revision No.		0

Matilda Minerals
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SEA TURTLE NESTING SITES

Figure 11.1

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flatback sea turtle nest remained intact out of both surveys, and the rest had been raided by either dogs or goannas (Guinea 2005 a & b).

A dead and decomposing hawksbill sea turtle was washed ashore on the Andranangoo beach during the survey (Guinea 2005a).

Nests were located throughout the length of the beach, with no obvious demarcation between flatback and olive ridley sea turtle nests. The distances from the Spring High Water Mark also revealed little difference between the species. The ten flatback sea turtle nests were on average 2.9 m above the Spring High Water Mark. The seven olive ridley sea turtle nests were on average 2.3 m above the Spring High Water Mark.

This pattern of dispersion from the Spring High Water Mark indicated that nesting olive ridley sea turtles on this beach were likely to move inland approximately as far as the flatback sea turtles. Sea turtle nests were seen only within 10 m of the Spring High Water Mark, even though the survey extended beyond the dune crest (Guinea 2005a).

The overall density of the coastal vegetation at Andranangoo was approximately 120 trees per ha. *Melaleucas* dominated the vegetation of the proposed buffer zone. The vegetation survey of the proposed 200 m buffer zone found the vegetation on the strand comprised trees that were relatively small (less than 5 m in height), thin (girth less than 20 cm), sparse (fewer than 100 trees per ha) and of large point to plant distances (6 to 16 m) (Guinea, 2005b).

Approximately 110 m from the Spring High Water Mark the vegetation and the topography changed. The trees became taller (height = 15 m), thicker (girth = 33cm) and closer together (density = 346 trees per ha). In this sector the transect line (Figure 11.1) crossed a vegetated sand dune with a height of approximately 10 m (Guinea, 2005b). This figure also shows the proposed 200 m buffer zone.

At 130 m the transect line crossed an ephemeral creek at the edge of the closed *Melaleuca* woodland. At this point the vegetation was at its most dense (1600 trees per ha). The canopy of the *Melaleucas* touched at a height of approximately 24 m, and the trees had a mean girth of 31 cm. *Melaleucas* dominated the remainder of the transect line. The mean canopy height varied from 14 to 22 m, and the mean girth varied from 23 to 37 cm. Densities in this closed *Melaleuca* woodland varied from 202 to 339 trees per ha (Guinea, 2005b).

Lethbridge

The Lethbridge beach has a north-easterly aspect and lacks the sparsely vegetated seasonal sand dune, as was evident on Andranangoo beach. Vegetation grows to the Spring High Water Mark, and in some places below it (Guinea 2005b).

The February survey recorded three olive ridley nests just above the strand line along the western section of the lease. All had been raided by goannas, and the empty eggshells were beside the hole that the goanna dug to gain entry to the nest. The entire clutch of each nest had been destroyed. The nests were

typical of olive ridley nests, in that the location was just above the strand line and there was very little evidence of the track (Guinea 2005a).

The August survey recorded 58 sea turtle nests or their remains along an estimated 4 km of beach (Figure 11.1). Of these only one nest was identified as being that of a flatback sea turtle. The remainder of the nests had small eggs and belonged either to olive ridley or to hawksbill sea turtles. No turtle tracks were found on this beach, and either dogs or goannas had raided all but one of the nests (Guinea 2005b)

The raided nests contained eggshells that in some cases were from eggs that had already hatched. This was evident by the near intact nature of the eggshells similar to those that are left in the nest after the hatchlings have emerged. Some eggs contained the remains of undeveloped yolks. Other nests contained eggshells that were judged to have been from freshly laid eggs (Guinea 2005b).

The nests were located along the beach without any obvious areas of intensive nesting. The single flatback sea turtle nest was laid at just over 1 m above the Spring High Water Mark. The other 57 nests belonged to either olive ridley or hawksbill sea turtles, or a mixture of both, and were on average laid 0.14 m above the Spring High Water Mark. The thick vegetation along the strand at Lethbridge either prevented sea turtles from moving inland or was sufficiently darkened at night to promote nesting within 10 m of the Spring High Water Mark (Guinea 2005b).

Of the 58 sea turtle nests located on this beach, 85 percent were laid within 2 m of the Spring High Water Mark. The furthest nest found above the Spring High Tide Mark was at 5 m, laid beneath a closed canopy of *Casuarina* trees. Four nests were below the high tide mark. These had been opened by dogs or goannas, and had been washed over by the last Spring High Tide (Guinea 2005b).

The shoreline at Lethbridge differed from that at Andranangoo in that the vegetation extended to the Spring High Water Mark, and the beach lacked a coastal sand dune along most of its length. In the eastern portion of the lease, a small seasonal berm fronted a seasonal *Melaleuca* swamp, which was dry at the time of the survey. The position of the transect line (Figure 11.1) was selected randomly, and was representative of most of the beach where sea turtle nests had been encountered. The overall tree density was estimated to be 270 trees per ha. The vegetation varied along the transect line as it passed through the coastal strand vegetation to an open *Melaleuca* and *Acacia* forest further inland (Guinea 2005b).

Vegetation was present at the Spring High Water Mark. Within the first 100 m the vegetation included coastal *Casuarina* trees. The mean tree height varied from 9 to 15 m, with girths ranging from 14 to 37 cm and point to plant distances from 4.5 to 11 m, giving mean densities of between 80 to 480 trees per ha (Guinea 2005b).

At 100 m from the Spring High Water Mark the vegetation changed as the transect line passed through the ecotone or transition between the beach vegetation and the *Melaleuca* and *Acacia*-dominated forest. In this area the trees were growing closer together, with a mean density of 1600 trees per ha, and were relatively smaller with mean heights of 7.5 m and girths of 21 cm.

Beyond this transition area, the tree heights were variable with patches where larger trees had fallen and smaller regrowth was under way. Progress along the transect line was impeded by numerous vines, logs

and shrubs that formed an understorey beneath a few emergent *Melaleucas* and *Acacias* with heights to 20 m. Mean tree densities varied from 118 to 1450 trees per ha, and mean heights ranged from 6.5 to 17.75 m with mean girths ranging from 9 to 52 cm (Guinea 2005b).

The topography was consistently flat throughout the length of the transect line, with only a small dry streambed that was a few centimetres deep at 100 m inland from the Spring High Water Mark. This pattern of thick vegetation with an almost impenetrable understorey of vines, fallen logs and regrowth was typical of the vegetation along the beach at Lethbridge. The *Casuarinas* that were so noticeable at the water's edge in the western part of the beach gradually gave way to *Melaleucas* backed by coastal seasonal swamps in the eastern regions near the creek mouth (Guinea 2005b).

11.2 Objectives and standards

As part of Matilda's commitment to the conservation of marine turtles, Matilda's objectives are to:

- Have no impact upon the population of nesting turtles that occur along the beaches of the mining areas.
- Provide a suitable buffer zone to provide a physical barrier between the proposed mining operations and the sea turtle nesting beach.
- Minimise the amount of light visible from the beaches where sea turtles nest.
- Monitor nesting turtles on both beaches while mining operations are being conducted, in order to demonstrate that the mining operations have no negative impacts on the nesting sea turtles.
- Provide data on turtle nesting activities to the TLC. It is noted that the TLC in conjunction with the World Wildlife Fund (WWF) are currently conducting a regional sea turtle monitoring program on the Tiwi Islands.

Relevant legislation, standards and policies

The relevant legislation, standards and policy are:

- Matilda's Environmental Policy
- *Environment Protection and Biodiversity Act 1999*
- *Territory Parks and Wildlife Conservation Act 2000*
- *National Strategy for the Conservation of Australia's Biological Diversity 1996*
- National Strategy for the Conservation of Australian Species and Communities Threatened with Extinction

- IUCN Red List of Threatened Species 2000.

11.3 Definition of issues and impacts

Nesting sea turtles are prone to disturbance by beach development in two major ways:

1. Adult sea turtles when approaching the beach to nest are disturbed by the presence of lights on the beach. This may cause them to move to a nesting location away from the lighted beach. After laying their eggs the female turtle will be attracted to lights visible from the beach. This attraction can disorient the turtles and lead them inland, where they become entangled in vegetation or die from exhaustion and dehydration.

2. Hatchling sea turtles after they leave the nest are attracted to lights visible from the beach. This disorientation leads to their death by dehydration and exhaustion and exposes the hatchlings to more predators (Guinea, 2005a).

Noise has been identified as a potential issue that may impact on nesting turtle populations. Additionally, other activities including human disturbance along the beach have also been identified as a potential issue that may affect nesting turtles. However, it is considered unlikely that noise (transmitted through the atmosphere) affects nesting turtles, as the make up of the turtle's ears allow them to hear low frequency sounds whilst underwater, and very little sound above water (Guinea 2005b).

11.4 Management

A Draft Sea Turtle Environmental Management Plan detailing management objective targets and actions for mitigation impacts on Sea Turtles is included in Section 25.3.

A minimum buffer distance of 200 m from the beach areas to the mining areas, and 50 m from inland water areas to mining areas will be provided. The 200 m buffer zone from the beach areas is specifically for turtle protection.

Mining operations will be undertaken during the day shift only. The only equipment that will operate during the night will be the feeder and a corresponding loader in the mining area, and the processing plant, which is to be located on the escarpment.

Access to turtle nesting beaches will be restricted to sea turtle monitoring activities only.

The proposed 200 m buffer zone will be adequate to provide a physical barrier between the proposed mining operations and the sea turtle nesting beaches. The tree density above the high water mark reached 1600 trees per hectare at both Andranangoo and Lethbridge, which will provide a strong visual barrier between the beaches and the mine sites. The integrity of the 200 m buffer zones will be maintained and monitored during mining operations, as recommended by Guinea (2005b).

Orange and red lights would be used wherever possible for external lighting, except where safety considerations require other coloured lights, to minimise potential light impacts. Yellow low pressure sodium vapour lamps are considered acceptable. Where white and other coloured lights, including fluorescent lights, are used, light spill would be reduced by either fitting shades or by orientation (Guinea, 2005b).

Lights would be mounted as low to the ground as practicable. Pathway lights would be less than one metre in height, and shaded to prevent upward illumination. The lighting system will enable selected parts of the mine site and the camp site to be illuminated separately (Guinea, 2005b).

High visibility jackets with reflective tape will be used by personnel on site, to reduce the amount of ambient light where the safety of personnel is not compromised (Guinea 2005b).

On-going monitoring of sea turtle nesting activities will be undertaken to demonstrate that the mining operation has no negative impact on the nesting sea turtles. In order to do this a monitoring protocol with associated field notes and data sheets has been developed by Dr Mick Guinea. Copies of these materials are included in Appendix E-2.

Matilda personnel have been trained in the techniques of monitoring the beaches for evidence of sea turtle nesting, and for systematic recording of such nesting. Monthly reports will be compiled using a standard monthly data sheet. Additionally, any incident involving sea turtles will be reported on the Sea Turtle Accident, Injury & Incident data (Guinea 2005b).

It is proposed that annual reports on the sea turtle monitoring program, based on the monthly data reports, will be supplied to:

- The Traditional Owners – Tiwi Land Council.
- Environmental Protection Agency (EPA).
- Biodiversity Conservation Division of the Department of Natural Resources, Environment and the Arts.
- The Commonwealth Government Department of Environment and Heritage (DEH).

11.5 Commitments

Matilda commits to providing a 200 m vegetative buffer zone from the spring high water mark specifically for protecting nesting sea turtles from potential effects of light spill and noise generation (Section 11.4).

Matilda commits to conducting pit excavations in daylight hours to reduce the potential effect of light spill on nesting turtling populations (Section 11.4).

Matilda is currently monitoring nesting sea turtle populations and commits to an on-going monitoring of sea turtle nesting activities during mining operations (Section 11.4).

Matilda commits to restricting access by personnel to the nesting beaches except for sea turtle monitoring activities only (Section 11.4).