Marine Turtle Management Plan for Cape Lambert
For Rio Tinto Iron Ore

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Disclaimer

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1 Introduction

The rapidly expanding character of seaborne iron ore freight requires the expansion of port facilities at Cape Lambert. The annual capacity will increase from 55 million tonnes to 80 million tonnes by the end of 2008. This improved expansion of infrastructure at Cape Lambert will allow concurrent berthing of four very large bulk carriers. The original ship loader will be replaced. An additional reclaimer will be added in the stock yard and yard and rail infrastructure will be improved. To accommodate the new configuration the wharf will be extended 256 metres. This upgrade of port and loading facilities will cater for the berthing of the new oversized carriers. The increased loading facilities will assist in satisfying the massive hunger for iron ore from the growing China market as well as maintaining supply to traditional consumers such as Korea and Japan (RioTinto 2007).

The proposed upgrades have minimal environmental risks as identified by ongoing environmental management commitments. The marine environment in the vicinity of the Cape Lambert lease is of particular interest and has attracted environmental risk assessment. Identified risks include impacts on corals, coral communities and habitats, benthic primary producer habitat, dredging and spoil disposal, water quality, marine turtle management, and the quality of the marine environment. The mitigation and monitoring requirements are outlined in the Minister of the Environment's Statement No. 743.

As a condition of approval for the expansion of port facilities and associated dredging, Robe River Iron Associates is required to develop and implement a sea turtle management plan to limit the possible environmental impacts on the marine environment. This requirement is set out in the Ministerial Statement No 743 condition 12 "Ongoing Marine Turtle Management" which states:

> *"12-1 The proponent shall within 6 months following the formal authority issued to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, in consultation with the Department of the Environment and Conservation (DEC) prepare a Marine Turtle Management Plan to the requirements of the Minister of the Environment.*
>
> *The objectives of this plan are to:*
>
> *• Provide a management framework to enable the proponent to manage the ongoing aspects of the project to detect and mitigate as necessary any impact upon the natural abundance, species diversity, geographical distribution, behaviour patterns, breeding success, predation levels, demographics and population viability of marine turtles that frequent and rely, wholly or in part on Cape Lambert or the waters adjacent to Cape Lambert;*
>
> *• Identify darkness strategies to reduce as far as practicable lights or light glow interfering with nesting female turtles and hatchlings and determining the impacts thereon; and*
>
> *• Identify the methodology to measure and detect any changes to affected marine turtle populations.*
>
> *The Plan shall:*
>
> *1. Identify project related stressors, causes of environmental impacts and potential consequences to marine turtles (including impact of noise, vibration, light overspill and glow, vessel strike and changes to coastal processes);*
>
> *2. Identify and demonstrate the effectiveness of proposed management measures to mitigate project-related impacts and consequences for marine turtles; and*
>
> *3. Identify a process for identifying, justifying and implementing additional management mitigatory measures in the event that monitoring (by the proponent*

or otherwise) identifies a change in the abundance, species diversity, geographical distribution, behaviour patterns breeding success, predation levels, demographics and population viability of marine turtles which, frequent and rely, wholly or in part, on Cape Lambert or the waters adjacent to Cape Lambert.

12-2 The proponent shall implement the Marine Turtle Management Plan required by condition 12-1.

The proponent shall make the Marine Turtle Management Plan required by condition 12-1 publicly available, in a manner approved by the CEO."

The Marine Turtle Management Plan (MTMP) (Appendix E of the DSDMP, 2007) identifies the actions needed in the short-term to address the impacts of the existing Cape Lambert operation and the long-term monitoring of marine turtle populations within the lease area at Cape Lambert and adjacent waters. Additional to this MTMP is the Memorandum of Understanding (MoU) between Pilbara Iron Pty Limited and the West Pilbara Community Turtle Program to monitor marine turtle nesting on beaches within the lease area at Cape Lambert and Bezout, Delambre and Dixon islands. The West Pilbara Community Turtle program has provided two valuable reports that describe the nesting and hatching success of marine turtles on the beaches of the Cape Lambert area. This report provides a review of marine turtle nesting on the beaches within the Cape Lambert lease.

Table 1 Identifications of sections of the Marine Turtle Management Plan (MTMP) that address the Ministerial Statement Condition 743 M12-1

Reference	Description	Reference to section where addressed in MTMP
Condition 743:M12-1.1	Identify project related stressors, causes of environmental impacts and potential consequences to marine turtles including impact of noise, vibration, light overspill and glow, vessel strike and changes to coastal processes.	Section 1.3
Condition 743:M12-1.2	Identify and demonstrate the effectiveness of proposed management measures to mitigate project-related impacts and consequences to marine turtles	Section 1.3 and Section 1.5 and Section 1.6
Condition 743:M12-1.3	Identify a process for identifying, justifying and implementing additional management mitigating measures in the event the monitoring (by the proponent or otherwise) identifies a change in the abundance, species diversity, geographical distribution, behaviour patterns breeding success, predation levels, demographics and population viability of marine turtles that frequent and rely, wholly or in part on Cape Lambert or the waters adjacent to Cape Lambert.	Section 1.8

2 Current Status

At least four species of sea turtle nest in the Cape Lambert region; another two species are present as either migratory or foraging species (

Table 2 Species likely to be influenced by Cape Lambert operation and adjacent waters (Prince 1993, 1994 a, b, c, d).). Two species (Flatbacks and Hawksbills) are the main nesting species on Bells Beach and Cooling Water Beach in the Cape Lambert lease (

Figure 1).

Figure to be inserted

Figure 1 Satellite image of Cape Lambert foreshore with sea turtle nesting beaches indicated and wharf with dredging area outlined (Google Earth image and GPS Visualiser).

Nesting season for turtles in this region starts in October and continues through to March with a maximum number of nesting turtles coming ashore in November and December (Norman et al. 1994; Prince 1994b; Blamires et al. 2003). The first hatched nests appear in December and continue through March with a peak of hatching in January and February (Salinovich 2006; 2007).

Feral dogs, introduced foxes and native goannas prey on the eggs of the sea turtles (Blamires et al. 2003; Salinovich 2006; 2007). Eradication and feral animal control measures are in place to remove the feral predators. Physical barriers can protect nests from goanna predation but have not been used at Cape Lambert (Blamires & Guinea 2003).

Preliminary studies indicate that Bells Beach with a length of 600 m is the major nesting area with about 150 nests laid each season by Flatback sea turtles (Figure 2). Cooling Water Beach at just 200 m supports far fewer yet still a significant number of nests. A large number of false crawls are recorded for both beaches and require closer scrutiny of the definition of the term and identification of such tracks.

Within the vicinity of the Dampier Archipelago a nationally significant number of Hawksbill sea turtles nest on Rosemary Island 50 km west of Cape Lambert (Figure 2). Major Green sea turtle nesting beaches occur on Barrow, Montebello and Muiron Islands (160 to 300 km to the south) and at the Lacepede Islands 125 km north of Broome. Major Flatback nesting

beaches occur on Barrow Island (190 km to the south) and at Mundabullangana Station (90 km to the north) and the Eighty Mile Beach 450 km to the north and 150 km south of Broome (Prince 1994b). Cape Lambert is considered to be a minor breeding site as are many of the mainland beaches in the Dampier region (Prince 1994a). As adult Flatback sea turtles lay approximately three clutches per breeding season (Limpus et al. 1984), each year about 50 individual Flatback and a couple of Hawksbill and a few Green sea turtles nest on the beaches within the Rio Tinto lease at Cape Lambert (Figure 2). This number is small compared with the several thousand individual sea turtles that nest on the beaches to the south and north of Cape Lambert. Possibly two hundred thousand sea turtles of all species are estimated to live in the coastal waters of the Pilbara. Many more thousands of sea turtles migrate annually into the region for breeding at the major rookeries. The nesting populations on the periphery of the major rookeries provide an indication of seasonal trends and fluctuations in the nesting sea turtle population. However the small number of nesting individuals on the periphery limits the robustness of any statistical analysis of population parameters and extrapolation of population size. However the ease of access to the beaches for monitoring enhances the suitability of the beaches for community-based conservation measures.

Table 2 Species likely to be influenced by Cape Lambert operation and adjacent waters (Prince 1993, 1994 a, b, c, d).

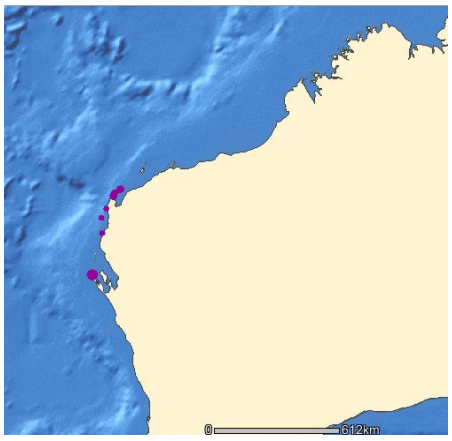
Species	Status (EPBC99)	Status in WA2	Presence at Cape Lambert		
			Nesting	Foraging	Migrating
Flatbacks (Natator depressus)	Marine Vulnerable	Rare	√	√	√
Greens (Chelonia mydas)	Marine Vulnerable	Rare	√	√	√
Hawksbills (Eretmochelys imbricata)	Marine Vulnerable	Rare	√	√	√
Loggerheads (Caretta caretta)	Marine Endangered	Rare	√	√	√
Leatherbacks (Dermochelys coriacea)	Marine Critically1 Endangered	Rare	-	√	√
Olive Ridley (Lepidochelys olivacea)	Marine Endangered	Rare	-	√	√

1 Leatherback turtles are undergoing nomination from Vulnerable to Critically Endangered under the EPBC99.

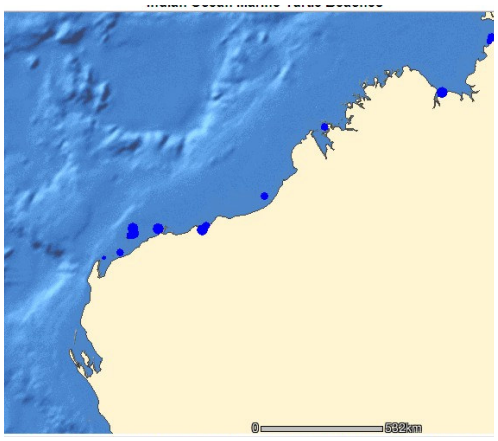
2 Rare or Likely to Become Extinct in Wildlife Conservation (Specially Protected Fauna) Notice 2006(2).

Table 3 Marine turtle nesting activity within the Cape Lambert Lease (Salinovich 2006, 2007)

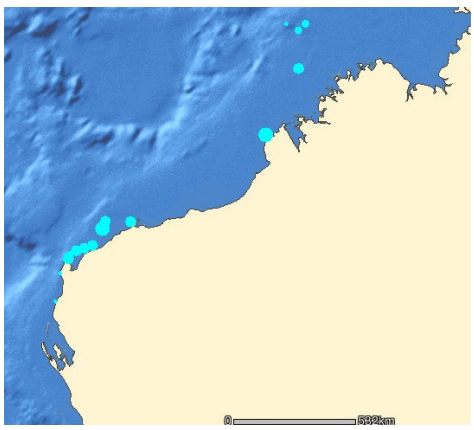
Locality	Marine Turtle Activity	2005/2006	2006/2007
Bells Beach	Flatback Nests (False Crawl)	185 (204)	149 (67)
	Hawksbill Nests (False Crawl)	5 (3)	1 (0)
	Green Nests (False Crawl)	1 (0)	0 (0)
Cooling Water Beach	Flatback Nests (False Crawl)	17 (21)	43 (60)
	Hawksbill Nests (False Crawl)	0 (0)	0 (0)
	Unidentified species	16	0 (0)



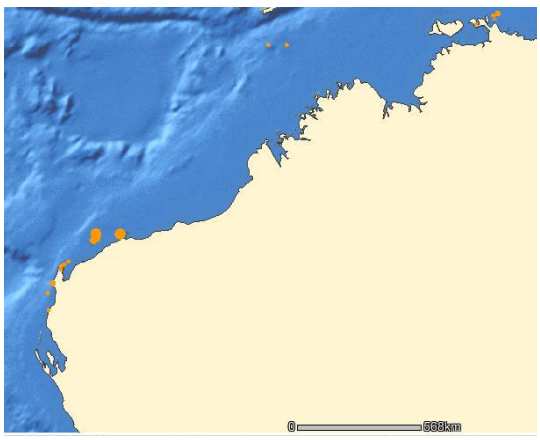
Loggerhead Nesting Beaches



Flatback Nesting Beaches



Green Nesting Beaches



Hawksbill Nesting Beaches

Figure 2 The major nesting beaches of Loggerhead, Flatback, Green and Hawksbill sea turtles in Western Australia (Indian Ocean South-East Asia marine Turle MoU website.

3 Potential Impacts

Discussions with DEC personnel and RTIO Environmental Management personnel identified several site specific activities that either exist at Cape Lambert or are likely to exist with the current port upgrade (Table 4).

Table 4 Summary of likely impacts on sea turtles during the dredging and wharf upgrade.

Impacts	Level of possible impact on sea turtles at Cape Lambert
Sand Movement	High (cyclones)
Food Sources	Low (below detection)
Predation	Moderate (monitoring and management)
Light	Low (monitoring and management)
Noise (terrestrial and marine)	Low (monitoring and management)
Vibration	Low (monitoring and management)
Boat Traffic (non-recreational)	Low (monitoring and management)
Turbidity (dredge spoil)	Low (management)
Physical Injury (dredging) (management procedures in place)	Low (monitoring and management)
Marine debris (entanglement and ingestion)	Reporting arrangements in place. Waste from shipping requires monitoring.

3.1.1 Turbidity

The Cape Lambert coastal province comprises hard rocky shore substrate, sandy beaches, mangroves and intertidal salt pan. Natural processes of wind, wave and tide produce turbid waters during spring tides and during the summer cyclone season. Increased turbidity and movement of sands from beaches are a direct result of cyclone activity. Dredging associated with capital or maintenance work programs will result in increased turbidity above normal conditions for that phase of the tide and time of the year. The impact of dredging is likely to be small and localised and may reduce the feeding habitat available to resident benthic feeding marine turtles for a short period of time . Surveys prior to dumping revealed that dredge spoil will have minimal impact on turtle feeding habitat.

3.1.2 Sand Movement

Sand movement from the beaches has a greater impact on nest site availability for female turtles. Sand removed from beaches during cyclones may take several years to recover by natural processes. Sand removed from Bells Beach and Cooling Water Beach during Cyclone Clare in January 2006 has started to return to the respective beaches. There is no

observable decrease in the numbers of sea turtles nesting but could be an explanation (Koch & Guinea 2006) for the high numbers of False Crawls in 2005-2006 and 2006-2007 nesting seasons (Salinovich 2006;2007).

3.1.3 Anthropogenic Light

The senses of sea turtles enable the animals to move from their place of hatching to the feeding area and return. Studies of these senses (Table 5) aim to reduce the impact of human activities on the survival of sea turtles. The responses by sea turtles to sensory stimuli such as light, are psychological rather than physical (Witherington & Martin 2000) in that the animal remains unharmed. Nesting females are photonegative when coming ashore to nest and photopositive when returning to the sea. Hatchlings are photopositive while moving to the water and as they swim from the beach.

Light from port structures have the potential to disrupt normal nesting behaviours by:

- Deterring female sea turtles from coming ashore,
- Misorientation of female turtles returning to the sea after nesting;
- Disorientation of hatchling sea turtles preventing them from finding the sea.
- Responses by sea turtles to light spill on to the beach include:
- Seasoned nesters continue to use the beach
- Neophyte (define term) nesters move to more darkened beaches in the area
- Hatchings have no avoidance response and may move several hundred metres towards the light until they find a darkened area and regain their correct sea finding behaviour.
- Hatchling sea turtles are attracted to the lights of vessels offshore and may swim towards the deck lights. The impact of this positive response to lights at sea depends on:
- Direction and speed of the ocean currents,
- Direction and height of the swell,
- Time interval from hatching to dawn.

The eye of a sea turtle is adapted in general for finding food in the marine habitat. Typically, sea turtles have a more curved but less pliable lens than is the case in freshwater turtles (Legler 1993; Bartol & Musick 2003). This spherical lens is ideal for underwater vision but behaves less favourably on land (Bartol & Musick 2003). The pigmented choroid contains the reflective layer, tapetum lucidum, that gives some animals a noticeable “eye-shine” when illuminated at night (Ollivier et al. 2004). Under low light condition the reflective tapetum lucidum enhances the sensitivity of the eye. The tapetum lucidum is poorly developed in the eyes of sea turtles.

The light sensitive cells of the eye respond to all wavelengths of visible light (Granda & Stirling 1965; Granda 1979; Bartol & Musick 2003). Stimulation of both rod and cone photoreceptor cells of the Green turtle to white light (400 to 700 nm) produced a peak of sensitivity at 520 nm with smaller peaks at 450-460 nm and 600 nm (Granda & Stirling 1965; Granda & O'Shea 1972; Granda 1979). This sensitivity to the shorter blue and ultra violet wavelengths is expected of a marine organism that uses vision to locate food (Granda 1979; Bartol & Musick 2003). An increase in density of rods and cones in the retina provide the visual acuity for Loggerhead turtles to find blue crabs underwater in low light conditions. In general, the eyes of a sea turtle respond to all wavelengths of visible light but are especially sensitive to the short wavelength (blue to ultraviolet) light that dominate in the marine environment.

3.1.4 Anthropogenic Light Action:

Reducing the impact of the light spill from the port facility requires:

- Maintaining a darkened buffer at the top of the beach at Bells and Cooling Water Beach,
- Use of white light when appropriate for safety reason
- Reducing direct light spill on to the beach by appropriate measures such as:
  - shields on the seaward side of lights,
  - non-reflective surfaces to buildings,
  - low-level lighting for walkways,
  - use of yellow sodium vapour lights of external lighting,
  - timer switches,
  - motion sensors as determined by a light audit.

Table 5 Summary of marine turtle sensory ability.

Sense	In water	In air	Authority
Smell	Acute due to water passing over the nostrils	Poor indicating little response to airborne particles	(Limpus 2006) (Vieyra & Vogt 2007)
Taste	Nil although some taste buds are present	Nil	(Wyneken 2001)
Vision	Sharp image Good vision in the blue to ultra violet wavelengths Rapid attenuation of red and yellow wavelengths in sea	Indistinct image Poor response to red and yellow wavelengths Hatchlings and post nesting females attracted to blue wavelengths	(Witherington & Martin 1996) (Eckert et al. 2006)
Hearing	Good response to low frequency sounds by modified auditory canal and possibly carapace	Poor response due to lack of external ears, fat filled auditory canal	(Wyneken 2001) (Moein Bartol & Ketten 2006)
Magnetic Field	Response to earth's magnetic field in reproductive migrations	Response to earth's magnetic field during incubation	(Irwin & Lohmann 2003; 2005)

3.1.5 Noise and Vibration

Sea turtles have no external ears. The ear canal contains fat and fluid (Ketten et al. 2006). Vibrations travel from the tympanic scale along the stapes to the cochlea (Wyneken 2001). In water, sea turtles respond to frequencies of 100 Hz to a maximum of 500 Hz. Most studies give values of between 200 Hz to 400 Hz in air (Moein Bartol & Ketten 2006). By contrast the human ear detects frequencies from 20 Hz to 20,000 Hz (Van Wynsberghe et al. 1995). Frequencies below 20 Hz are infrasound and sensory reception is by the bones and air

spaces rather than the ear. This sensory pathway is known as tactition. Such infrasounds include the low frequency sound of waves breaking on a beach.

The threshold volume for hearing frequencies at 400 Hz is 121 dB and at 200 Hz is 107 dB. These volumes are roughly equivalent to the sound of a jack hammer or a propeller driven aircraft (Van Wynsberghe et al. 1995). Sound attenuates with distance in water and it is unlikely that sea turtles will hear even loud noises at distance of 100 m (refer Figure 3). Sea turtles may be oblivious to the noise of machinery which reduces their responses to loud noise underwater but makes them prone to collisions with fast-moving boats (Hazel et al. 2007).

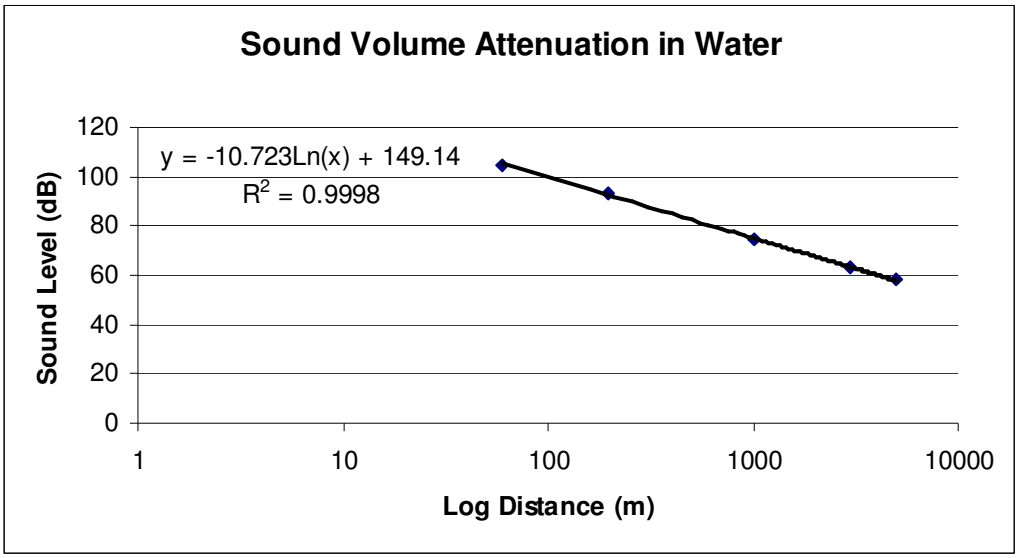


Figure 3 Attenuation of sound volume in water (Appendix E of the DSDMP, 2007).

The scientific literature contains little information on the impact of terrestrial vibrations on nesting sea turtles. There is an anecdotal suggestion that vibrations may influence the non-synchronous emergence of hatchlings, but this has not been tested. Unlike rock and water, sand is a poor conductor of vibration. It is likely that vibrations from the port facilities will be absorbed by the sand on both Bells Beach and Cooling Water Beach. However this needs to be monitored.

The sound of the Cape Lambert plant at present is inaudible to the human ear on Bells Beach due to the prevailing wind blowing from the west towards the plant. The wind blows during the turtle breeding season at a velocity that places the plant down-wind from the beach. Given the nature of the hearing of sea turtles and the direction of the wind, the sound is unlikely to be audible to sea turtles coming ashore at night during summer months.

3.1.6 Noise and Vibration Action:

It is recommended that the noise and vibration in the sands should be monitored on both Bells Beach and Cooling Water Beach. Records should also be kept on the frequency of hatchlings emerging from the nest at an immature stage of development and the non-synchronous emergence of hatchlings.

3.1.7 Habitat Protection

The dunes backing Bells Beach provides a visual screen and an environmental buffer between the beach with the greatest amount of sea turtles nesting on the lease and the port at Cape Lambert. It is important the dunes remain as a buffer. The dunes show signs of

human degradation in that blow-outs now promote human access to the beach. The height of the dunes has been reduced by wind erosion and lack of vegetation.

The dunes form from the westerly winds that blow onshore during the turtle breeding season. The winds during the non-breeding season are from the South-West and South-East which also build the dunes.

The dunes should be preserved, maintained and enhanced by:

- Establishing native vegetation, especially grasses, that will hold the dune together,
- Continue to restrict and prevent vehicle access to the beach,
- Establish foot access by hard surfaces such as board walks to the beach angled to the wind to prevent further erosion,
- Maintain a buffer zone of approximately 200 m inland from the high watermark,
- Link the buffer zone to the protected heritage sites.

The area available to nesting sea turtles at Cooling Water Beach requires maintenance and enhancement. The newly constructed pile lay down pad restricts the width of the dunes and nest-site options for female turtles. Beach replenishment with available sand or clean dredge spoil would provide a more stable nesting habitat. Non-reflective structures should be positioned on the pile lay down pad to provide a screen between the beach and the existing plant. This beach replenishment with clean dredge spoil and a darkened dune crest would add to the suitability of the beach as a nesting site. Clean dredge spoil placed beneath the existing wharfs would provide further nesting sites that may be suitable to some seasoned nesters.

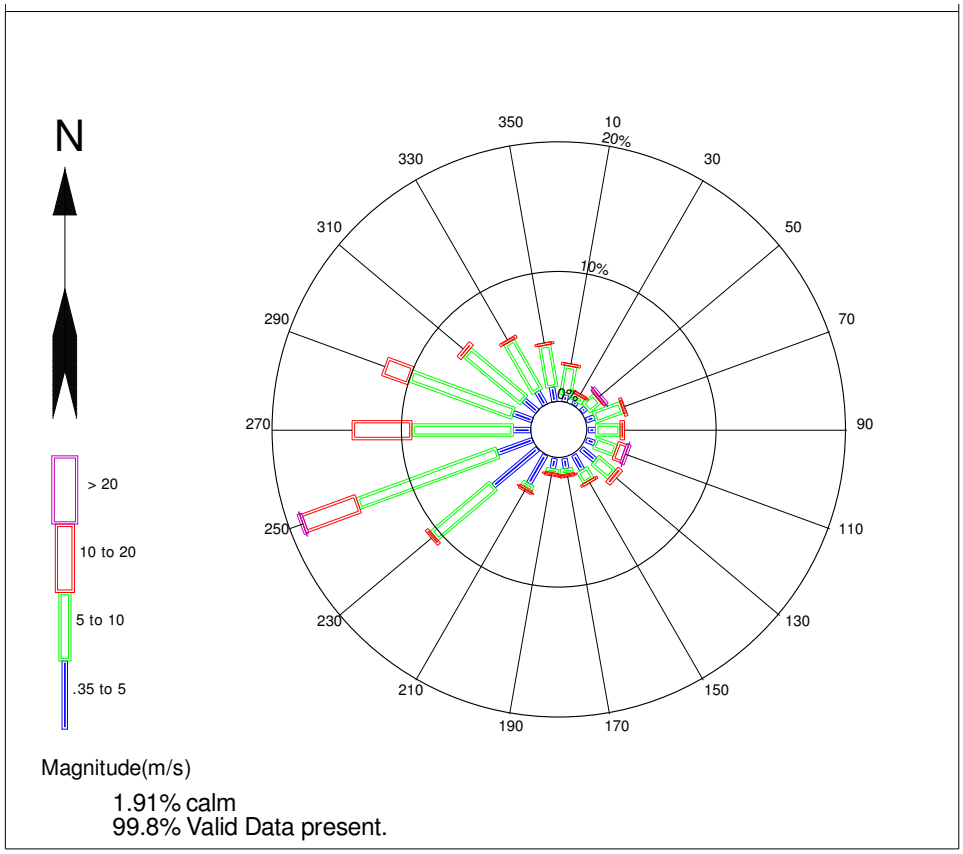


Figure 4 Composite wind rose for Pilbara Iron Met Station during the turtle breeding season (October 2006 to March 2007).

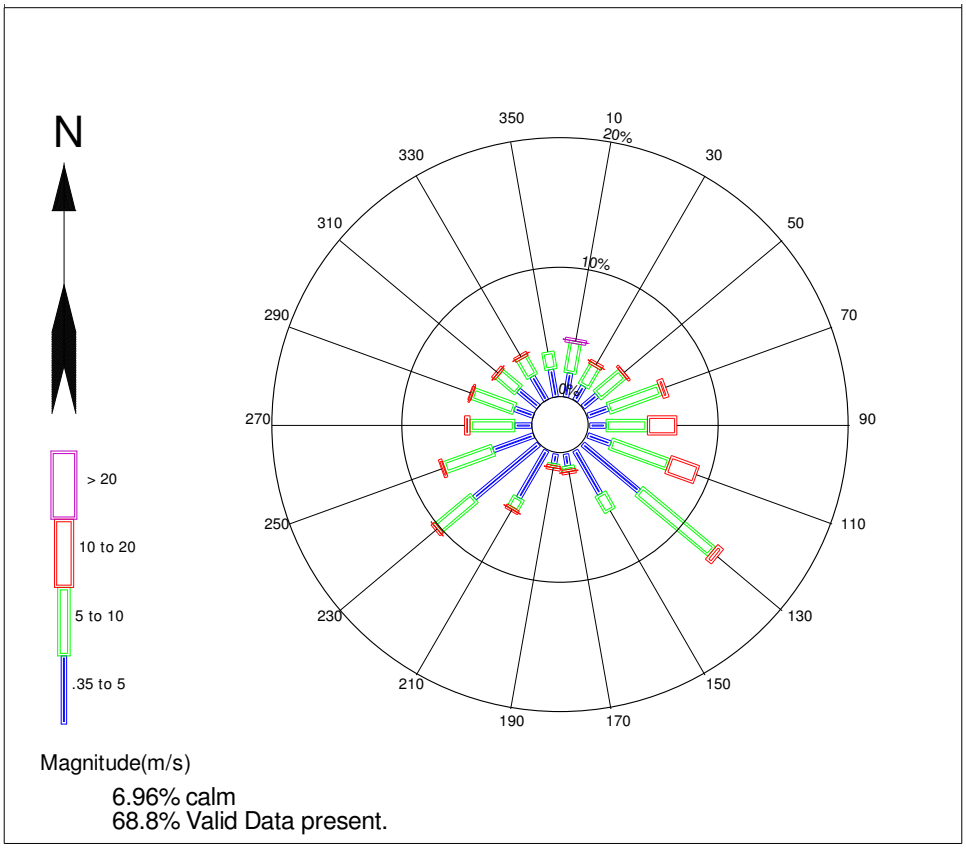


Figure 5 Composite wind rose for Pilbara Iron Met Station during the non breeding season for Flatback sea turtles at Cape Lambert (April 2007 to September 2007).

4 Environmental Objectives

The Marine Turtle Management Plan provides a management framework to enable RTIO to manage the ongoing aspects of the project to detect and mitigate as necessary any impact upon the natural abundance, species diversity, geographical distribution, behaviour patterns, breeding success, predation levels, demographics and population viability of marine turtles that frequent and rely, wholly or in part on Cape Lambert or the waters adjacent to Cape Lambert;

Identify darkness strategies to reduce as far as practicable lights or light glow interfering with nesting female turtles and hatchlings and determining the impacts thereon; and

Identify the methodology to measure and detect any changes to affected marine turtle populations.

4.1 Performance Indicators /Criteria

Table 6 Marine Turtle Attribute and Management Activities.

Marine Turtle Attribute	Management Activity
1 Natural abundance	Literature search for any measures of abundance. Assess current research and surveys at other regional localities. Assess existing data and input from volunteers for regional beaches. Monitor focus beaches within lease with appropriate staff allocation on rotation, if required. Include beach monitoring on the focus beaches in the lease during nesting season as normal operational procedures. Record numbers of nesting turtles to identify annual fluctuations. Complete the Daily Summary Sheet for each Beach (see Appendix).
2 Species diversity	Literature search for information of species of turtles nesting on the beaches and feeding in the waters around Cape Lambert. Identification nesting turtles by: tracks, visual inspection, nests, eggs, and hatchlings. Complete the Tag Data Sheet for each adult tagged and the Hatched Nest Data Sheet for each hatched nest (see Appendix).
3 Geographical distribution	Tagging nesting females and encouraging tag returns Satellite tracking of selected individuals from within the Cape Lambert lease to detect their movement to internesting areas and feeding areas.
4 Behaviour patterns	Record nesting behaviours from the time of coming ashore to re-entering the water to construct a database of normal behaviours. Complete the Tag Data Sheet (see Appendix) for each adult nesting turtle. Record movements of nesting females towards or away

	from lighted areas on the beaches. GPS the nests and assess in relation to possible light spill. Identify areas of hatchling misorientation or disorientation. Satellite tracking of adults to feeding areas
5 Breeding success	Record background temperature profiles of beach sands. Record number of successful nests Record number of unsuccessful nests Investigate hatched nests to record hatching success. Complete the Tag Data Sheet (see Appendix) for each adult and the Hatched Nest Data Sheet for each hatched nest (see Appendix).
6 Predation levels	In nest predation by crabs, flies, dogs, goannas, foxes etc complete the Hatched Nest Data Sheet for each hatched nest (see Appendix). Implement appropriate eradication or control programs Record any detectable predation e.g. birds, crocodiles
7 Demographics	Identification of animals of different life stages Identification of Adults – tagging, digital photographs of individuals Assessing the numbers of hatchlings produced per year. Compile the annual Hatching Success and Emergence Success for each beach (see Hatched Nest Data Sheet in Appendix). Identification of neophyte nesters by laparoscopic investigation of a sample of the nesting females over 2 - 5 nights per season. The appropriately trained personal will be required for laparoscopic examination of nesting females.
8 Population viability	Assessment of continuing nesting success and retain and enhance nesting habitat (dune stabilization). Ensure security in data collection. Adopt standard methodologies. Report data and summaries responsibily. Input to modelling the population at a regional level.

5 Implementation Strategy

The ministerial statement requires more information in the management plan than is collected currently by the West Pilbara Community Turtle Program volunteers. The Marine Turtle Management plan requires recognition of individual sea turtles by a tagging program. It also requires nightly surveys during the nesting and hatching seasons. Individual nests need identification and the contents of the nest examined after the hatchlings have left the beach. It requires baseline information and recording of physical parameters such as sand temperatures at nest depth, noise and vibrations, to assess the impact if any of the Cape Lambert port expansion against variables that may be attributed to climate change. The research methodologies in order of priority are outlined in Table 7.

Table 7 Research methodologies for long term sea turtle monitoring program within the lease area at Cape Lambert

Research Activity in Order of Priority	Marine Turtle Attribute Number	Personnel Responsible	Duration of Activity
Nesting adult track count	1, 2, 4, 5,	West Pilbara Community Turtle Program volunteers plus RTIO Marine Turtle Environment Personnel	October to April nightly on Cape Lambert lease
Hatched nest track count	1, 2, 3, 4, 5, 6, 7	West Pilbara Community Turtle Program volunteers plus RTIO Marine Turtle Environment Personnel	October to April nightly on Cape Lambert lease
Temperature data loggers	4, 5,	RTIO Marine Turtle Environment Personnel	Logger placed at 50 cm depth in sand and downloaded yearly prior to cyclone season
Tagging nesting females	1,2, 3, 4, 5, 6, 7, 8	RTIO Marine Turtle Environment Personnel	October to April nightly on Cape Lambert Lease
Excavating hatched nests	1, 2, 4, 5, 6, 7,	West Pilbara Community Turtle Program volunteers plus RTIO Marine Turtle Environment Personnel	October to April during the early mornings on Cape Lambert lease
Recording morphometrics of nesting females	1, 2, 3, 5,7,	RTIO Marine Turtle Environment Personnel	October to April nightly on Cape Lambert lease
Satellite tracking of nesting females within and at end of season.	3, 4,	RTIO Marine Turtle Environment Personnel.	Satellite tracking can be done within the nesting season and at the end of the season in February

5.1 Monitoring

Nightly monitoring of the nesting beaches during the summer months is fundamental to being able to identify individual nesting turtles. Monitoring should begin three hours before the night-time high tide and continue until three hours after the high tide. A successfully nesting Flatback turtle can take between 40 and 60 minutes to complete the nesting process. Hence RTIO staff and volunteers from the West Pilbara Community Turtle Program need to check the beach at least every 40 minutes. This will require coordination amongst the people on the beach.

Individual turtles should be tagged and data recorded on the Tag Data Sheet and the Daily Summary Sheet for each Beach (see Appendix). It is important that data be collated within 24 hours of collection to ensure the quality of the data and remove errors associated with lapses of memory. This is an important aspect of the MTMP in that the monitoring of the turtles is accompanied by monitoring of the database. RTIO Marine Turtle Environmental personnel will need to monitor the data and report to DEC any sick, injured or dead sea turtles. Sick, injured and dead sea turtles should be reported immediately to DEC on the appropriate after-hours phone number

5.2 Contingencies

Table 8 Environmental Triggers and Mitigation actions

Marine turtle Attribute	Environmental Trigger	Mitigation Action
Natural abundance	A decrease in the number of sea nesting turtles during the summer nesting period for three successive years.	Review Marine Turtle Management Plan. Assess nesting activity on other beaches in the Cape Lambert area through the MoU with West Pilbara Community Turtle Program. Assess change in nesting numbers on previously unutilized beaches. Identify likely causes for the loss of nesting turtle numbers. Address the likely cause for the decline in nesting turtles.
Species diversity	Decrease in the numbers of each species of nesting sea turtle on the beaches within the Cape Lambert lease.	Public awareness and education campaign to alert the public and industry to the increased likelihood of negative impact on sea turtles by activities outside of the Cape Lambert lease.
Geographical distribution	Tag returns identify areas of intense mortality. Internesting females moving into areas with increased danger.	Public awareness and education campaign to alert the public and industry to the increased likelihood of negative impact on sea turtles by activities outside of the Cape Lambert lease.
Behaviour patterns	Repeated aberrant behaviour of individuals to the presence of light spill, vehicle movement	Identify the causative factors. Implement mitigation measures to reduce light spill by shading, buffer zones, light audit and subsequent rectification.

	or changes in beach topography.	
Breeding success	Elevated numbers of unsuccessful clutches laid per season over three consecutive years. Temperature profiles at 50 cm depth reach lethal temperatures during the summer months. Increased numbers of late embryonic deaths or deformed hatchlings in clutches above normal parameters.	Implement environmental manipulative measures to either reduce or increase hatching temperatures to normal levels by relocating clutches to either shade or sunny positions.
Predation levels	Any incidence of feral animal predation. Increased numbers of nest raided by goannas.	Implement a feral animal eradication program through the appropriate channels. Implement appropriate nest protection strategies using mesh exclusion barriers.
Demographics	Decrease in the number of turtles nesting on the beaches with a corresponding increase in the number of turtles nesting on other beaches. Decrease in the number of neophyte nesters on the beaches.	Identify the causative factors. Take appropriate mitigation measures to reduce the light spill, light audit, Screen nesting beaches, beach replenishment, dune stabilisation or re-vegetation.
Population viability	Decrease in nesting and or hatching success over three consecutive years.	Identify the causative factors. Review historical records and annual reports. Assess the situation in the region to identify the scale of any decline. Annual Environmental Report (AER) to DEC by RTIO Marine Turtle Environment Personnel. Using appropriate data base model the sea turtle population of the Dampier Region.

6 Stakeholder Consultation

The requirements of the Ministerial Statement were discussed with Rio Tinto Representatives (Peter Royce, Steve Abbott, Phil Beddoes, Anthony Radici, Todd Jess, Roy Teale, Dennis Kelly, Bronwyn Bell, Sam Samaraweera) on 24 September before a visit to the Cape Lambert site that night. Meetings the following day (25 September 2007) with the Environmental Unit (Damon Newling, Andrew Johnston, Jarrad Sherborne) at Cape Lambert proved positive and constructive as did subsequent meetings with DEC personnel (Marissa Spears, Allan Kendrick and Haley Valentine) and interested members of the public (Anna Vitenbergs and Bob Vitenbergs) at Point Samson.

7 Auditing

Auditing should be conducted on an annual basis by the RTIO Marine Turtle Environment personnel and the Environmental Unit of RTIO.

8 Review and Revision

The Marine Turtle Management Plan should be reviewed after three years from it implementation. The review should address the outcomes of the management plan. This would be an appropriate time to undertake a revision of the MTMP should the review identify such action.

8.1 Public availability of MTMP

Once approved, and before implementation of the activities covered in the plan, the MTMP will be made publicly available in the manner outlined in the 2006 procedure developed by the DEC.

Making the MTMP publicly available will be achieved by:

- Two copies of the MTMP will be provided to the Shire of Roebourne libraries (including those at Wickham, Roebourne, Karratha and Dampier) as well as the JS Battye (State) Library and the DEC Library in Perth for a period of 2-3 months. These libraries will be requested to put the approved MTMP on display so that it can be readily viewed by interested members of the community.
- A copy of the approved MTMP will be placed on the Rio Tinto website.
- An advertisement will be placed in the Pilbara News in the format specified by the DEC advising readers of the availability of the MTMP for review at the mentioned libraries and Rio Tinto website.

Documentary evidence of the above actions will then be provided to the Compliance Monitoring Section of the DEC for clearance of the Condition 743:M12-3.

8.2 Key Management Actions Table

Table 9 Key Management Actions and Objectives.

Ref #	Key Management Action	Objective	DoE Reporting	Status
Condition 743:M12-1.1	Identify project related stressors	Mitigation of stressors	Ensure that the project complies with the Ministerial Conditions 743:M12-1.	Ongoing
Condition 743:M12-1.2	Mitigation of stressors	Identify means of limiting impact by identification of key habitats and features of those habitats that support successful sea turtle nesting.	Reporting to DEC by way of AER.	Annual Environmental Report usually in the non nesting period of the year.
Condition 743:M12-1.3	Identifying processes to manage or mitigate changes in sea turtle attributes in the vicinity of Cape Lambert	Provide a data set capable of interrogation to identify changes in the nesting environment and the success of nesting sea turtles.	Reporting to DEC by way of AER.	Review of the MTMP after three years to identify revision of the MTMP if needed.

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